OFFSHORE RENEWABLE ENERGY ACTION PLAN

SEA Environmental Report

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ABBREVIATIONS

AA	Appropriate Assessment
ADD	Acoustic Deterrent Devices
AEOSI	Adverse Effects on Site Integrity
AFBI	Agri-Food and Biosciences Institute
AfL	Agreement for Lease
AGA	Air-ground-air Communications
AIS	Auto Identification Systems
AMSL	Above Mean Sea Level
AoHSV	Areas of High Scenic Value
AONB	Areas of Outstanding Natural Beauty
AQMA	Air Quality Management Area
AQS	Air Quality Strategy
ASACS	Air Surveillance and Control System
ASAI	Areas of Significant Archaeological Interest
ASSI	Areas of Special Scientific Interest
BGMCF	Bottom Grown Mussel Consultative Forum
BGS	British Geological Society
BoCCI4	Birds of Conservation Concern in Ireland 4
CAA	Civil Aviation Authority
CBUK	Charter Boats UK
CCC	Climate Change Committee
CCRA	Climate Change Risk Assessment
CEFAS	Centre for Environment, Fisheries and Aquaculture Science
CEMP	Construction Environmental Management Plan
CJEU	Court of Justice of the European Union
CNS	Communications, Navigation and Surveillance
CO	Carbon monoxide
CO_2	Carbon dioxide
COLREG	Convention on the International Regulations for Preventing Collisions at SEA
COWRIE	Collaborative Offshore Wind Research Into the Environment
CTR	Control Zone
DAERA	Department of Agriculture, Environment and Rural Affairs
DAFM	Department of Agriculture, Food and the Marine
DECC	Department of the Environment, Climate and Communications
DEFRA	Department for Environment, Food and Rural Affairs
DETI	Department of Enterprise, Trade and Investment
DfC	Department for Communities

DfE	Department for the Economy
DfI	Department for Infrastructure
DHLGH	Department of Housing, Local Government and Heritage
DoH	Department of Health
DTM	Digital Terrain Model
EA	Environment Agency
EEZ	Exclusive Economic Zone
EIA	Environmental Impact Assessment
EMF	Electromagnetic Field
ENP	European Neighbourhood Policy
EPA	Environmental Protection Agency
EPO	Environmental Protection Objective
EQS	Environmental Quality Standards
ERCoP	Emergency Response Co-Operational Plan
ESCP	Erosion and Sedimentation Control Plan
ETS	Emissions Trading System
EU	European Union
FCS	Favourable Conservation Status
FEPA	Food and Environment Protection Act (1985)
FishRAMP	Fisheries Resource Access Mapping Project
FMP	Fisheries Management Plans
FRMP	Flood Risk Management Plan
FSA	Food Standards Agency
FU	Functional Unit
GBF	Global Biodiversity Framework
GES	Good Environmental Status
GHG	Greenhouse Gas
GIS	Geographical Information System
GPS	Global Positioning Systems
GSNI	Geological Survey of Northern Ireland
GVA	Gross Value Added
HARNI	Heritage at Risk in Northern Ireland
HATT	Horizontal Axis Tidal Turbines
HAWT	Horizontal Axis Wind Turbines
HED	Historic Environment Division
HERoNI	Historic Environment Record of Northern Ireland
HES	Historic Environment Scotland
HMAOO	Historic Monuments and Archaeological Objects (NI) Order 1995
HPAI	Highly Pathogenic Avian Influenza
HRA	Habitats Regulations Assessment
IAMMWG	Inter-Agency Marine Mammal Working Group

IBA	Important Bird Areas
ICES	International Council for the Exploration of the Sea
IFP	Instrument Flight Procedures
IMO	International Maritime Organisation
IMP	Integrated Maritime Policy
INTOG	Innovation and Targeted Oil and Gas
IPCC	Intergovernmental Panel on Climate Change
IUCN	International Union for Conservation of Nature
IWDG	Irish Whale and Dolphin Group
JFS	Joint Fisheries Statement
JNCC	Joint Nature Conservation Committee
LACMW	Local Authority Collected Municipal Waste
LAQM	Local Air Quality Management
LBAP	Local Biodiversity Action Plan
LCA	Landscape Character Areas
LCREE	Low Carbon and Renewable Energy Economy
LDP	Local Development Plan
LFS	Low Flying System
MARP	Marine Archaeology Reporting Plan
MCAA	Marine and Coastal Access Act
MCZ	Marine Conservation Zones
MEHRA	Marine Environmental High Risk Area
MGN	Marine Guidance Note
MMO	Marine Management Organisation
MNR	Marine Nature Reserves
MoD	Ministry of Defence
MPA	Marine Protected Area
MS	Marine Strategy
MSFD	Marine Strategy Framework Directive
MSU	Marine Strategy Unit
MSY	Maximum Sustainable Yield
MU	Management Units
NAEI	National Atmospheric Emission Inventory
NATS	National Air Traffic Services
NBAP	National Biodiversity Action Plan
NEAFC	North East Atlantic Fisheries Commission
NERC	Natural Environment Research Council
NERL	NATS En-Route plc
NH_3	Ammonia
NHA	Natural Heritage Area
NI	Northern Ireland

NICCAP2	NI Climate Change Adaption Programme 2019-2024
NIE	NI Electricity Networks
NIEA	Northern Ireland Environment Agency
NIFHA	Northern Ireland Fishery Harbour Authority
NILCA	Northern Ireland Landscape Character Assessment
NIRLCA	Northern Ireland Regional Landscape Character Assessment
NIRSCA	Northern Ireland Regional Seascape Character Assessment
NIS	Non-Indigenous species
NISCS	Northern Ireland Seabird Conservation Strategy
NISRA	Northern Ireland Statistics and Research Agency
NMVOCS	Non-Methane Volatile Organic Compounds
NNR	National Nature Reserve
NO	Nitric monoxide
NO_2	Nitrogen dioxide
NO_x	Nitrogen oxides
NOTAM	Notice to Airmen
NPWS	National Parks and Wildlife Service
NRW	Natural Resource Wales
NSA	National Scenic Area
O_3	Ozone
OESEA3	UK Offshore Energy Plan and SEA 3
OESEA4	UK Offshore Energy Plan and SEA 4
OLS	Obstacle Limitation Surfaces
ORE	Offshore Renewable Energy
OREAP	Offshore Renewable Energy Action Plan
OREDP	Offshore Renewable Energy Development Plan
OREF	Offshore Renewable Energy Forum
ORESAP	Offshore Renewable Energy Strategic Action Plan
OSPAR	Oslo and Paris Conventions
PAD	Protocol for Archaeological Discoveries
PAHs	Polycyclic Aromatic Hydrocarbons
PAM	Passive Acoustic Monitoring
PEXA	Practice and Exercise Areas
PfG	Programme for Government
PM	Particulate Matter
pMCZ	Proposed Marine Conversation Zone
PMF	Priority Marine Features
pNHA	Proposed Natural Heritage Area
POP	Persistent Organic Pollutants
pSPA	Proposed Special Protection Area
QIF	Qualifying Interest Feature

QUB	Queens University Belfast
RBD	River Basin District
RBMP	River Basin Management Plans
RCA	Regional Character Area
RDS	Regional Development Strategy
RIAA	Report to Inform Appropriate Assessment
RoI	Republic of Ireland
RSCA	Regional Seascape Character Area
RSPB	Royal Society for the Protection of Birds
RYA	Royal Yachting Association
RZ	Resource Zone
S	Sulphur
SAC	Special Areas of Conservation
SAR	Search and Rescue
SCA	Seascape Character Areas
SCI	Statement of Community Involvement
SCOS	Special Committee on Seals
SEA	Strategic Environmental Assessment
SEO	Strategic Environmental Objective
SEPA	Scottish Environmental Protection Agency
SLNCI	Sites of Local Nature Conservation Importance
SNIP	Scotland to Northern Ireland Pipeline
SO_2	Sulphur dioxide
SONI	System Operator for Northern Ireland
SOPEP	Shipboard Oil Pollution Emergency Planning
SOPHIE	Seas, Oceans and Public Health in Europe
SOV	Site-Operated Vehicles
SPA	Special Protection Area
SPLASHCOS	Submerged Prehistoric Archaeology and Landscapes of the Continental Shelf
SRP	Soluble Reactive Phosphorus
SSSI	Site of Special Scientific Interest
SVIA	Seascape and Visual Impact Assessment
SWPA	Shellfish Water Protected Area
TCE	The Crown Estate
TDPNI	Transmission Development Plan for Northern Ireland
TSS	Traffic Separation Schemes
TTA	Tactical Training Areas
TV	Television
UK	United Kingdom
UKCP	United Kingdom Climate Prediction

UKHO	UK Hydrographic Office
UNCLOS	UN Convention on the Law of the Sea
UNESCO	United Nations Educational, Scientific and Cultural Organization
UR	Utility Regulator
UXO	Unexploded Ordnance
VAT	Vertical Axis Turbine
VATT	Vertical Axis Tidal Turbine
VHF	Very High Frequency
VMS	Vessel Monitoring System
VTS	Vessel Traffic System
WEEE	Waste Electrical and Electronic Equipment
WFD	Water Framework Directive
WHS	World Heritage Site
WMP	Waste Management Plan
WWT	Wastewater Treatment

UNITS TABLE

Term	Definition
%	Percent
£	Great British Pounds
°	Degrees
$\mu g/m^3$	Microgrammes per cubic metre
µm	Micrometre or Micron
cm	Centimetre
dB	Decibel
ft	Feet
g CO_2 eq/kWh	Grams of Carbon Dioxide equivalent per kilowatt-hour
g/KWh	Grams per kilowatt-hour
GW	Gigawatts
GW/km^2	Gigawatts per square kilometre
ha	Hectares
Hz	Hertz
km	Kilometres
km^2	Square kilometres
kt	Thousands of tonnes
kV	Kilovolts
kW/m	Kilowatts per metre
m	Metres
m/s	Metres per second

NON-TECHNICAL SUMMARY

Introduction

The Offshore Renewable Energy Action Plan (OREAP) is being developed by the Department for the Economy (DfE) to deliver on the targets set out in the Energy Strategy for Northern Ireland (NI) – The Path to Net Zero Energy 2021. It will present the objectives and actions considered necessary to deliver on the targets of the Energy Strategy for offshore renewable energy (ORE) in the NI marine area, in particular the ambition to deliver at least 1GW of offshore wind from 2030. It sets out the direction for planning, licensing, and consenting the development of offshore renewable energy in NI.

The purpose of this Strategic Environmental Assessment (SEA) Environmental Report is to provide a formal and transparent assessment of the likely significant effects on the environment arising from implementation of the Offshore Renewable Energy Action Plan (OREAP) for NI, including consideration of reasonable alternatives. It has been prepared in accordance with the SEA Directive, and the Environmental Assessment of Plans and Programmes Regulations (NI).

Description of the Plan

Description of the OREAP

An early-stage draft OREAP was published for stakeholder consultation purposes in December 2022, with recognition that this should be a living and evolving document. This was developed around five themes: sustainability and co-existence, enabling frameworks, electricity networks, economic growth, and legislation and regulation; and has set out the following 12 Key Objectives:

1. Update the 2012 SEA and Habitats Regulations Assessment (HRA) for Offshore Renewable Energy in the NI Marine Area.
2. Align offshore renewable energy policy with marine-related environmental policy.
3. Deliver a wide stakeholder engagement forum.
4. Establish a decommissioning regime for NI.
5. Prioritise and streamline the process for licensing and consenting.
6. Deliver an offshore wind leasing round for NI.
7. Facilitate current and planned work and consider strategic network requirements to deliver the NI offshore wind ambition.
8. Implement a cost effective and efficient offshore transmission connection and operation framework.
9. Provide a visible route to market.
10. Support development of a skilled workforce for offshore wind and related areas.
11. Enable NI's businesses and economy to maximise the benefits of offshore wind.
12. Bring forward necessary legislative and subsequent appropriate regulatory changes to enable the sustainable deployment of offshore renewable energy projects in NI waters.

Included in these objectives are early actions to establish the resource availability in NI waters and to undertake environmental assessments (an SEA and HRA), including spatial characterisation work to establish the potential exploitable resource.

Geographic and Temporal Scope

The draft OREAP is a plan for the NI marine area. The Study Area for the OREAP comprises the entire NI marine area, i.e., the inshore region (up to the 12nm limit) and the NI offshore region, which extends into the UK EEZ. A SEA Study Area was defined, comprising the OREAP Study Area (NI inshore and offshore areas), and a 15km buffer around this area. Within this SEA Study Area, the potential for positive or negative effects on SEA environmental topic areas has been determined, with reference, where relevant, to the potential for effects at a greater distance (e.g., for mobile species, visual effects).

The draft OREAP initially covers the period from 2022 onwards, with a specific target for deployment of at least 1GW of offshore wind energy from 2030. It will be reviewed every year to reflect changes in the baseline environment, energy requirements, technological advances, and legislative changes. Any future amendments to the OREAP will be reviewed in line with requirements for an SEA.

The temporal scope of the SEA considers the potential for short-term (construction phase), medium-term (re-establishment and initial operational phase, considered as 0-5 years post-construction), and long-term (operational phase, 5 years post-construction onwards), as well as decommissioning impacts (considered as equivalent to construction phase) from implementing renewable energy projects that could arise from implementation of the OREAP.

Plan Development

The OREAP is an environmentally led plan, and its further development has been undertaken in an iterative manner in conjunction with the associated SEA and HRA processes, involving several stages and taking on board stakeholder views and recommendations. As part of this iterative process, and in line with Action 7 of the draft plan, RPS has undertaken spatial characterisation work in parallel with DfE work to update the SEA and HRA. Within the plan area, the OREAP indicates areas of potential technical feasibility and lower environmental and social constraint for the development of offshore renewable energy (fixed wind, floating wind and tidal).

Environmental Baseline

An environmental baseline was produced by SEA environmental topic as presented in **Section 3** of this report. The purpose of **Section 3** is to demonstrate the level of baseline environmental information used in the assessment of potential effects of ORE technologies.

Biodiversity, Flora and Fauna

There are a wide variety of natural habitats and species found within the overall SEA Study Area, protected by a range of designations. Sites have been designated to provide protection to those habitats and species considered to be of particular conservation value. There are 34 Special Areas of Conservation (SACs), 20 Special Protection Areas (SPAs), and seven Ramsar sites within the SEA Study Area. NI has 49 habitats listed in Annex I of the Habitats Directive, of which 18 are coastal or marine, and 18 species listed in Annex II of the Directive, of which 8 are coastal or marine for at least some part of their life. There are 394 Areas of Special Scientific Interest (ASSI) within NI, of which 160 are within, or partially within, the SEA Study Area, along with one Scottish Site of Special Scientific Interest (SSSI), and four Republic of Ireland (RoI) Natural Heritage Areas (NHAs), that are partially within the SEA Study Area. There are five Marine Conservation Zones (MCZs) in the inshore region of NI, two further MCZs situated in offshore UK waters, and one nature conservation Marine Protected Area (MPA) in Scottish waters, which are within, or partially within, the SEA Study Area. There are 12 National Nature Reserves (NNRs), and 402 Sites of Local Nature Conservation Importance (SLNCIs), along with six RSPB Nature Reserves and 13 Ulster Wildlife Nature Reserves, which are within, or partially within, the SEA Study Area. There are 51 NI Priority Habitats, and 594 Priority Species. Of these, 22 Priority Habitats are found in the marine or coastal environment, some of which are also listed as OSPAR threatened or declining habitats.

NI's coastal waters are home to approximately 100 species of regularly occurring marine fish, and there are 31 species of marine, or freshwater and marine, fish species, four species of marine crustaceans and 16 species of marine molluscs listed as NI Priority Species; some of these species also receive legislative protection.

The NI coastline and marine area supports nationally and internationally important populations of a large number of seabird species. Protection is provided to certain species of breeding, migrating and wintering birds through the establishment of SPAs and MCZs, while 13 Important Bird Areas (IBAs) have been identified that are considered important for the long-term viability of bird populations (these do not have any statutory protection, however, they may overlap with statutory designations). There are 32 species of birds listed as NI Priority Species whose broad habitat type either includes marine habitats or is solely marine.

Many species of marine mammal are known to occur in NI waters, including cetaceans (whales, dolphins, and porpoises), seals and otter. All species of cetaceans and marine turtles, as well as harbour and grey seals, are European Protected Species under the Habitats Directive and are thereby protected from killing, injury or disturbance. Harbour porpoise, bottlenose dolphin, grey and harbour seal are species for which the designation of SACs is required, and there are currently five SACs in NI designated wholly or partly for the protection of marine mammals.

Population and Human Health

In 2021, there were approximately 1.903 million people living in NI, with a predicted increase to 1.99 million people by 2043. Just under four-fifths (78.7%) of NI residents reported themselves to be of good or very good general health in the 2021 Census. Over two-thirds of all residents in NI aged 16 to 64 years were economically active in the 2021 census (70.2%). The renewables sector generated around £1.5 billion in turnover and provided 6,700 full-time equivalent jobs in 2021.

The NI marine area is used for a variety of recreational and leisure activities. Recreational sailing is popular, with 12 marinas and areas used for sailing and racing within the SEA Study Area. Other activities include diving (particularly to historic wreck sites), water sports such as canoeing and kayaking, paddleboarding, boating, surfing, and kitesurfing, beach use (with 26 areas designated as Bathing Waters), wildlife watching and sea angling. Many of these activities also represent tourist attractions for the region.

Geology, Soils and Land use

NI is bordered by the Irish Sea to the east, by the North Channel to the north-east, and by the Malin Sea to the north. The local seabed is predominantly under shallow water, with approximately two thirds of the area having water less than 100m deep, while in the centre of the North Channel there are isolated deeps of up to 284m. Most of the offshore area is underlain by less resistant sedimentary rocks, while in areas off the north coast there are locally significant rocky outcrops of basaltic rocks. The distribution and thickness of superficial deposits are very variable, ranging from areas of exposed bedrock to narrow glacially eroded basins infilled with up to 300m of glacial sediment. The seabed around NI's coastline can be divided into three roughly equal areas of mixed coarse sediment, sand and mud. The seabed type is often reflective of the strength of the tides, with coarse sediments occurring in strong tidal conditions and mud in more sheltered areas.

The one UNESCO World Heritage Site (WHS) in NI, the Giant's Causeway, is designated for its unique geological heritage. The Mourne, Gullion, Strangford UNESCO Global Geopark is situated along the south-east border of NI. There are 77 ASSIs that are designated, at least in part for their earth science features, which are within, or partially within, the SEA Study Area, of which 21 have a coastal component, or are situated immediately adjacent to the coast. In addition, there is one MCZ designated in NI waters to date, Rathlin Island MCZ, in part for its geological/geomorphological interest features.

Water

The UK Marine Strategy (MS) applies an ecosystem–based approach to the management of human activities, and considers the following 11 quality Descriptors: D1 – Biological diversity (cetaceans, seals, birds, fish, pelagic habitats and benthic habitats), D2 – Non-indigenous species, D3 – Commercially-exploited fish and shellfish, D4 – Food webs (cetaceans seals, birds, fish and pelagic habitats), D5 – Eutrophication, D6 – Sea-floor integrity (benthic habitats), D7 – Hydrographical conditions D8 – Contaminants, D9 – Contaminants in fish and other seafood, D10 – Marine litter, and D11 – Underwater noise. The most recent status assessment of Descriptors for the UK indicates that Good Environmental Status (GES) has not yet been achieved for birds, fish, benthic habitats, non-indigenous species, commercial fish or marine litter, and has only partly been achieved for cetaceans, seals, pelagic habitats, food webs and underwater noise.

There are 496 Water Framework Directive (WFD) surface water bodies in NI, including 25 transitional and/or coastal water bodies that are within, or partially within, the SEA Study Area. In 2021, no water bodies achieved good or high overall status, in part due to the introduction of new priority substances (ubiquitous, persistent, bioaccumulative, toxic (uPBT) substances) into the monitoring programme. Considering ecological status, 40% of transitional and coastal water bodies achieved good ecological status in 2021. WFD protected areas that are within the SEA Study Area include ten Shellfish Water and 26 Bathing Water sites.

Air

There are 21 air quality monitoring stations across NI, at which levels of pollutants are monitored with regard to air quality standards, and any exceedances recorded. Standards were met for PM_{10} and $PM_{2.5}$ particulate matter, NO_2, O_3, CO, benzene, SO_2 and polluting elements in 2021, but exceeded for the three sites monitored for Polycyclic Aromatic Hydrocarbons (PAHs) (likely due to solid fuel burning). Emissions for the priority air pollutants: ammonia (NH_3), carbon monoxide (CO), nitrogen oxides (NO_x

as NO_2), non-methane volatile organic compounds (NMVOCs), particulate matter less than 10 micrometres (PM_{10}), particulate matter less than 2.5 micrometres ($PM_{2.5}$), sulphur dioxide (SO_2) and lead (Pb) were mostly lower in 2020 than they were in 2005, with reduced SO_2 levels related to a switch in energy generation due to the development of the natural gas network in NI, which has allowed for fuel switching away from oil and coal-fired generation.

Pollutants such as sulphur and nitrogen oxides emitted by the combustion of fossil fuels (e.g., power generation) can lead to acid deposition – a deposit of air pollutants from the atmosphere leading to acidification of soils and freshwaters. Construction, maintenance and decommissioning of offshore renewable energy (ORE) projects have the potential to lead to temporary, localised, increases in air pollution, including ambient PM_{10} and nitrogen dioxide emissions, resulting in short-term negative impacts upon air quality. However, implementation of the OREAP also has the potential to lead to positive effects on air quality in the medium and long-term, with the potential for connection of new renewable energy generators, such as wind, wave, and tidal turbines, to the national grid expected to support a reduced dependence on fossil fuels.

Climatic Factors

In 2021, NI accounted for 5.3% of the UK total greenhouse gas (GHG) emissions. Regarding the long-term trend, NI's total GHG emissions have decreased by 23.2% since 1990. In 2021, the energy supply sector was responsible for 13.7% of GHG emissions, comprised entirely of CO_2; since 1990, there has been a 42% decrease in emissions from this sector. The UK Climate Change Projections anticipate a greater chance of hotter, drier summers and warmer, wetter winters with more extreme weather and rising sea levels. The emphasis for marine projections is on changes in coastal sea levels, including extreme water levels that arise from storm surges and surface waves. These effects of climate change are likely to increase coastal flooding and will require future development to be adaptable or resilient to future climatic changes and its associated impacts.

Carbon sequestration (or Blue Carbon) is the carbon captured by ocean and coastal ecosystems and is typically stored in ocean plants and sediments. Blue carbon habitats include mangroves, coastal wetlands, seagrass, and saltmarsh areas; NI has several blue carbon habitats (saltmarshes, seagrass beds, shellfish beds, kelp forests, maerl beds, and biogenic reefs). Renewable energy can produce electricity without direct carbon emissions, however, there is an up-front carbon cost associated with the extraction of raw materials and the production of infrastructure. Lifecycle assessments for electricity generation indicate that GHG emissions from renewable energy technologies are generally significantly lower than those associated with fossil fuel options.

Material Assets

Given the geographic scope of the OREAP, there is the potential for ORE development and operation to impact upon or be impacted by existing material assets, including other users of the marine area. There are several commercial ports in NI ranging from large port facilities to numerous smaller ports that are essential for ferry traffic, and local trade and supplies. The majority of tonnage is currently through Belfast Port and Larne, followed by Warrenpoint and Derry / Londonderry (operating as Foyle Port). There are areas of relatively higher shipping route density within the SEA Study Area. Cargo vessels tend to pass through the Plan area in a north-south direction, with high density from Belfast Lough south, as well as east to Morecambe Bay, between the north coast of Rathlin Island and Scotland, and approaching Derry / Londonderry. Tankers show a similar concentration from north to south, with the highest vessel density approaching Belfast Lough, and between Rathlin Island and Scotland. Fishing vessel density appears highest in the south-east of the region, close to the ports of Portavogie, Ardglass and Kilkeel, as well as within Belfast Lough. Passenger vessels (or ferries) provide transport from NI to Scotland, England and the Isle of Man, with major ferry ports located in Belfast, Larne, and Warrenpoint.

There are four major sub-sea electricity interconnectors within the SEA Study Area, the Moyle Interconnector, which runs across the North Channel between Islandmagee and Ayrshire, and the Rathlin interconnector that connects Rathin Island to the main NI electricity grid. The remaining two include the Western Link Ardneill to Wirral 1 cable which runs from Ardneill Bay in North Ayrshire (Scotland) to the Wirral peninsula in northwest England, and the East West Interconnector which runs from Shotton in Wales to Portan in Ireland. These power cables are operated by National Grid and Scottish Power, and Eirgrid Interconnector Ltd, respectively. There are also several major telecommunication cables linking NI with the UK and the Isle of Man, as well as three subsea gas pipelines, the Scotland to NI Pipeline (SNIP) and two further gas pipelines linking Scotland and the RoI within the SEA Study Area. There is limited offshore renewable energy infrastructure within NI waters at this time.

Commercial fishing is a significant industry in NI and is based largely around the three east coast ports of Ardglass, Kilkeel and Portavogie, from which the bulk of the fleet of vessels in excess of 10m length operates. These vessels depend mainly on fishing opportunities in the Irish Sea and the North Channel. In 2021, there were 332 NI registered fishing vessels, which employed 632 full-time workers and 184 part-time workers, and the fleet landed a total of 46,000 tonnes of fish worth approximately £55.5 million into UK ports and abroad, comprising £26.1 million for shellfish, £23.1 million for pelagic fish and £3.3 million for demersal fish. The highest landed weights and value of species from fishing vessel landings into NI ports include Nephrops, mackerel, horse mackerel, crabs, scallops and haddock. Areas of relatively higher fishing activity are primarily around the south-east coast. In NI, marine aquaculture mainly involves small enterprises and is largely for shellfish although there is commercial salmon farming activity within the Study Area off the east Antrim coast.

Tourism represents an important source of income for NI's economy, and the quality of NI's environment, heritage and culture has strong national and international appeal hence tourism is therefore an important activity in the SEA Study Area. Six of the top ten most visited tourist attractions in NI in 2020 were in coastal or marine locations.

Military activity occurs extensively throughout the SEA Study Area, with almost the entire area utilised for practice and exercise areas (PEXAs). Much of this is dominated by the Navy who use the PEXAs for submarine, general surface fleet and aircraft exercises. Two weapons ranges are located in the Study Area, the Magilligan and Ballykinler ranges, which are controlled by the Army.

NI has three main airports: George Best Belfast City Airport, Belfast International Airport, and City of Derry Airport. The safety of aviation operations has the potential to be a concern for offshore wind developments within the SEA Study Area (through physical obstruction, effects on communications, navigation and surveillance (CNS) systems (including radar), or through turbulence), and the UK airport safeguarding zone is 30km for wind turbines to ensure no adverse effects on the airport's operation.

There are areas of known marine disposal within the SEA Study Area; the deposit of substances is strictly controlled and licenced by Department of Agriculture, Environment and Rural Affairs (DAERA), and most sites receive chemically unmodified geological material derived from the adjacent coastline.

Cultural, Architectural and Archaeological Heritage

There are 51,820 recorded heritage assets within NI that have been included in the Historic Environment Record of NI (HERoNI). This includes 17,855 entries on the Sites and Monuments Record, 15,383 recorded historic buildings, 15,704 Industrial Heritage Record sites, 738 Defence Heritage Record sites, 738 Battlefield sites, 663 Historic Parks and Gardens Record sites, 382 identified aircraft wrecks and shipwreck, and 399 Historic Nucleated Urban Settlements. There are also over 12,000 designated heritage assets in NI. This includes 190 Monuments in State Care (of which 54 are within the SEA Study Area), 2,014 Scheduled Historic Monuments (of which 843 are within the SEA Study Area), as well as 49 that are Scheduled and in State Care, 12 protected wrecks, 8,976 Listed Buildings (of which 8,949 are within the SEA Study Area), and 58 Conservation Areas. There are 300 Historic Parks, Gardens and Demesnes of Special Historic Interest forming part of the HERoNI, of which 128 are within the SEA Study Area. Local Landscape Policy Areas (547 no.), Areas of Significant Archaeological Interest (ASAI) (10 no., representing distinctive areas of the historic landscape in NI), and Areas of Townscape / Village Character (177 no.) are LDP designations which may include assets recorded by HERoNI. There is also one coastal UNESCO WHS in NI; the Giant's Causeway, designated for its unique geological heritage. Wreck sites are generally defined as sunken ships and aircraft, and any material associated with such vessels. There are many thousands of shipwrecks that lie off the coastline of NI. There is relatively little known regarding submerged archaeological sites in NI evidencing drowned landscapes and settlements. There are a considerable number of known intertidal sites, such as fish traps and quays, associated with settlement dating from the Mesolithic to the historic period; a number of these are also scheduled.

Landscape, Seascape and Visual Amenity

The value of NI landscape is recognised through the designation of eight areas as Areas of Outstanding Natural Beauty (AONB), making up c.20% of the total land area (of these sites, seven include the coastline). The Giant's Causeway UNESCO WHS is designated for its unique geological heritage. There are eight Northern Ireland Environment Agency (NIEA) Country Parks and 56 National Trust Sites in NI (of which six and 43, respectively, are within, or partially within, the SEA Study Area). In addition, the NI Landscape Character Assessment (NILCA) 2000 identified special landscapes as Areas of Scenic Quality; some of these areas have been included in Local Area Plans, where they may be designated as Areas of High Scenic Value (AoHSV). The overall landscape of NI has been designated into 130 Landscape Character Areas (LCAs) and into 24 Seascape Character Areas (SCAs). The NI Landscape Character Assessment 2000 (NILCA) identifies six distinctive landscapes. Within these areas, and throughout NI, there are a wide variety of Tourism Conservation Zones, Local Landscape Policy Areas, Areas of Scenic Quality / Areas of High Scenic Value and Areas of Village Character. The NI Regional Landscape Character Assessment (NIRLCA), developed in 2016, aimed to complement the NILCA by subdividing the countryside into 26 Regional Character Areas (RCAs), with the aim to provide information on which to base plans at a more local level that might affect landscape character. The NI Regional Seascape Character Assessment identified 24 (SCAs) along the NI coast, describing the key features and characteristics of each area, and relating these to neighbouring terrestrial LCAs. These SCAs were identified as distinct areas with a unique sense of place, with boundaries tending to represent indicative lines of gentle transition rather than an abrupt change in seascape character.

Review of Relevant Plans, Programmes and Policies

A review of the Plans, Policies and Programmes relevant to the OREAP at International, European, National, Regional and Sub-Regional scales is reported in **Section 4**. This exercise was carried out with a view to establish the context of the OREAP, with regard to other Plans and Programmes. In particular, the environmental protection objectives (EPO's) and standards included within these Plans and Programmes that will directly influence, or be influenced by, the OREAP require consideration.

Review of Offshore Renewable Energy Technology Types

A variety of devices can be used to extract and convert different offshore energy sources: offshore wind, tidal energy, and wave energy, into electrical energy. These offshore energy forms can have several different types of renewable devices installed to generate electrical energy. Various factors influence the suitability of devices, including constraints on their location, required installation and maintenance processes, environmental interactions, and the size and energy density of the device arrays.

Offshore Wind Energy

Offshore wind energy takes advantage of the wind forces that are produced on the high seas, where the wind speed is relatively constant through the lack of topographic barriers. Electricity is generated through wind turbines that are usually within wind farm arrays. The same turbine technology platforms are likely to be used for fixed foundation and floating wind.

Bottom-fixed wind turbines are composed of a support tower and rotor blade installed onto a fixed foundation structure. Fixed offshore wind turbines occupy the entire water column; the horizontal extent occupied in the atmosphere depends on the rotor blade diameter, which is the only moving part in contact with air, with no moving parts in contact with water. Fixed wind devices can be located in water depths up to 70m. They are usually sited up to 30km offshore, however, can potentially be sited up to 100km from shore. Continual advancements in turbine design have led to increasing energy outputs. A device array of 100 turbines will typically cover an area of 50km^2 but, depending on device numbers, the arrays could vary in size from 5-250km^2. The specific installation methods used will depend largely on the seabed type and water depths, but usually involve the use of monopile structures for water depths of 10-45m, or jacket foundations for water depths of 45-70m. Other installation methods can include gravity foundations consisting of concrete, and the use of 'suction caissons'.

Floating wind turbines are wind turbines situated offshore that are mounted on a floating structure; this enables the use of wind turbines in deeper waters that may not be technically or economically feasible for fixed-bottom turbine devices (the current practical limit is around 250m). They are a relatively new device type, currently still in the early stages of development. These devices consist of similar turbine characteristics to fixed wind devices, which are typically installed on moored buoy platforms and can adapt to different seabed types and depths. Structures can be classified into three types: Spar-buoy, Semi-submersible and Tension Leg Platform.

Tidal Energy

Tidal energy provides a regular and predictable source. Typically, an average current speed across the tidal cycle of >1.5m/s is needed for viable energy generation with a general limit in water depth of between 20-100m. There are a wide variety of generic tidal devices available to harness energy, such as horizontal axis turbines, vertical axis turbines, venturi effect devices, and hydroplanes and oscillating hydrofoils; these use a range of attachment methods to the seabed, including gravity bases, moored tethered foundations and piled foundations. To date, there has been a limited commercial scale deployment of offshore tidal technologies, with deployment primarily consisting of single devices or small, demonstration-scale arrays, consisting of 1-10 devices.

Wave Energy

Wave devices convert either the potential (wave height) or the kinetic (wave-induced motion) energy of a wave into mechanical energy (through a turbine/rotor) which is then converted into electrical energy. Wave energy extraction can be difficult as the motion of forces is multidirectional, and the wave power is available in low-speed and high forces, which the device must be able to withstand. Wave energy devices are currently still in development and are not yet widely employed for commercial use; as such, a range of infrastructure designs are in development, such as oscillating water column, point absorber, overtopping/collectors, attenuators and terminators, and wave rotors/turbines. Depending on the design of the device, these may be installed on the shoreline, nearshore, or offshore. Typically, a >20kW/m wave crest is needed for viable energy generation by wave devices, with water depths for installation ranging from 10-200m. Device arrays can be variable in size ranging from only a few devices up to large arrays of over 200 devices. These typically cover smaller areas than tidal or wind devices.

Assessment Methodology

Identification and Assessment of Resource Zones

The OREAP is an environmentally led plan; development of the plan was undertaken in an iterative manner in conjunction with the SEA and HRA comprising several stages and taking on board stakeholder views and recommendations. These stages are illustrated in **Figure 0-1.**

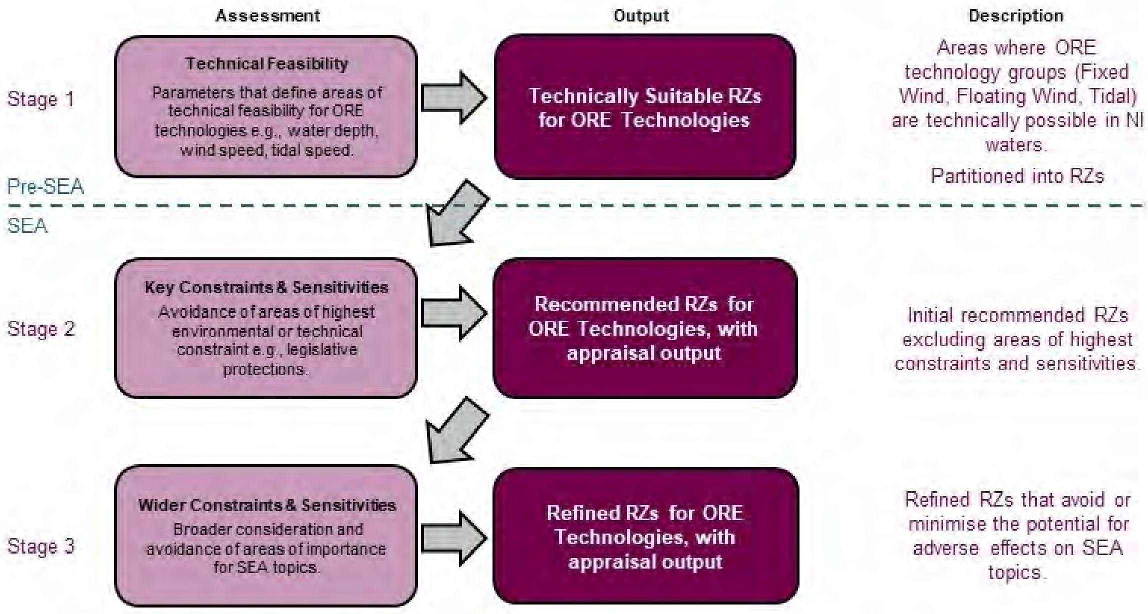


Figure 0-1 Stages in the Identification and Assessment of Resource Zones for ORE Technology Types

Stage 1 comprised an initial identification of areas that are suitable for the development and operation of ORE technology types (fixed wind, floating wind, tidal and wave) and division into Technically Suitable Resource Zones (RZs). The following criteria were applied for the ORE devices based on the current technological capabilities of ORE infrastructure:

- Fixed wind resource: Water depth of 10m – 80m; Annual Mean Wind Speed of >9m/s at 110m height.
- Floating wind resource: Water depth of 50m – 250m; Annual Mean Wind Speed of >9m/s at 110m height.

- Tidal resource: Water depth of 5m – 130m; Average Current Speed across the Tidal Cycle >1.5m/s.
- Wave resource: Water depth of 10m – 200m; Average Wave Height >1.2m; Average Wave Energy >20kW/m.

Stage 2 considered the key constraints and sensitivities within these Technically Suitable RZs, to provide an initial refinement that excluded those areas of highest constraints and sensitivities. Stage 3 considered a wider set of environmental constraints and sensitivities, to recommend refined RZs that can avoid or minimise the potential for adverse effects on the environment identified within the appraisals.

Assessment Approach and Strategic Environmental Objectives (SEOs)

Assessment of the OREAP comprised an assessment of the baseline environmental information available against the high-level objectives and potential issues. This method involved an assessment of each option available in the enactment of the OREAP against the following SEA topics:

- Biodiversity, Flora and Fauna (BFF);
- Population and Human Health (PHH);
- Geology, Soils and Land Use (GSL);
- Water (W);
- Air (A);
- Climatic Factors (CF);
- Material Assets and Infrastructure (MA);
- Cultural, Architectural and Archaeological Heritage (CH); and
- Landscape, Seascape and Visual Amenity (L).

The purpose of this was to predict and evaluate, as far as possible, the environmental effects of the OREAP, highlighting any significant environmental problems and/or benefits that were likely to arise from its implementation.

The proposals of the OREAP were assessed in terms of their potential effects, and the significance of these effects, on the environment against a set of Strategic Environmental Objectives (SEOs). These SEOs have been developed in the context of broader environmental protection objectives set at both international and national levels. The SEOs, Sub-Objectives, Indicators and Targets used are given in **Table 0-1**. The assessment examined the likely significant effects of the proposals set out by the OREAP, and how their implementation could contribute to achieving these SEOs.

Table 0-1 Strategic Environmental Objectives

SEA Topic	Objective	Objective Description	Indicators	Targets
Biodiversity, Flora and Fauna	Avoid damage to, and where possible enhance, biodiversity, flora and fauna.	Preserve, protect, maintain and, where possible, enhance biodiversity and ecosystems within the NI marine area, including internationally, nationally, and locally protected sites, habitats and species, and other known species of conservation concern.	• Conservation status of designated habitats and species within International, European and national designated sites (SACs, SPAs, Ramsar sites, MCZs, ASSIs). • Status of protected and priority habitats and species (Annex I habitats, Annex II species and Annex IV species, NI Priority Habitats and Species, OSPAR Threatened or	• No negative change, or a positive change, in the conservation status of designated habitats and species within International, European and National designated sites. • No negative change, or a positive change, in the status of protected or priority species and habitats outside designated sites, or to areas of known importance. • No negative change, or a positive change, in the Environmental status of MS Descriptors.

SEA Topic	Objective	Objective Description	Indicators	Targets
			Declining Habitats and Species). • MS Environmental status of marine area (e.g., Descriptor 1, 2, 4).	
Population and Human Health	Avoid disruption to the local population, while maximizing potential benefit to the population.	Minimise disruption to the local population, and displacement of recreational and leisure use of the area while providing a new secure renewable energy supply for the NI population, with potential employment and other benefit opportunities.	• Population centres in proximity to RZs. • Use of the area by recreational and leisure users (e.g., RYA areas, diving). • Capacity for new renewable energy supply for the NI population, with potential employment and other benefit opportunities.	• Delivery of offshore energy arrays with minimal adverse nuisance to communities. • Minimise the risk to, or displacement of, recreational and leisure users of the area. • Delivery of offshore energy arrays that maximise the potential benefits to the population.
Geology, Soils and Land use	Avoid damage to the function and quality of the seabed, and effects on hydrodynamics, sediment transport, or coastal processes.	Preserve, protect, maintain and, where possible, enhance, sites designated for geological or geomorphological features, and minimize direct and indirect damage to the function and quality of the seabed or changes to sediment transport, hydrodynamics or coastal processes.	• Site condition/status of protected geological or geomorphological features within designated sites (WHSs, MCZs, ASSIs, UNESCO Geoparks). • Potential scale of loss or alteration to seabed geology and sediments. • Potential to alter hydrodynamics, sediment dynamics, or coastal processes (tidal excursion and sediment type). • Interaction with known areas of potential contamination (Ministry of Defence (MoD) live firing areas, munition disposal areas, Unexploded Ordnance (UXO), dumping grounds)	• No negative change, or a positive change, in the condition of protected geological or geomorphological features within designated sites. • Minimise potential loss or alteration to seabed geology and sediments. • Minimise the potential for alteration of hydrodynamics, sediment dynamics, or coastal processes. • Minimise potential interaction with areas of potentially contaminated sediments.
Water	Avoid impacts on, and where possible enhance, the status or quality of water bodies.	Support the objectives of the WFD and MS by avoiding damage to or deterioration of water status, quality and resource.	• Status of WFD coastal water bodies (ecological, chemical, hydromorphological) • Status of WFD Protected Areas	• Potential to contribute to a change in the status of WFD coastal water bodies, and protected areas.

SEA Topic	Objective	Objective Description	Indicators	Targets
			(Bathing waters, Shellfish waters, Designated sites). • MS Environmental status of marine area (e.g., Descriptor 5, 8, 9, 10, 11). • Interaction with known areas of potential contamination (MoD live firing areas, munition disposal areas, UXO, dumping grounds)	• Potential to contribute to a change in the Environmental status of MS Descriptors. • Minimise potential interaction with areas of potentially contaminated sediments.
Air	Minimise risk to local air quality and contribute to improving regional emissions.	Minimise risk to local air quality and contribute to improving regional pollutant emissions.	• Sensitive receptors in proximity to RZs. • Capacity for new renewable energy connection, with potential effects on pollutant reduction.	• Minimise the potential for negative effects on air quality from vessel emissions. • Delivery of offshore energy arrays that maximise the potential for a reduction in air pollutant emissions.
Climatic Factors	Contribute to a reduction in GHG emissions.	Minimise loss of carbon sequestering seabed while contributing to a reduction in GHG emissions from the energy supply sector in line with national commitments.	• Capacity for new renewable energy connection, with potential effects on GHG reduction. • Interaction with areas of known or potential blue carbon habitats.	• Delivery of offshore energy arrays that maximise the potential for a reduction of GHG emissions. • Minimise the potential for loss of known blue carbon habitat (in line with objectives of the Blue Carbon Action Plan).
Material Assets and Infrastructure	Provide new, robust offshore renewable energy infrastructure with minimal disruption to other assets and infrastructure.	Provide new, robust offshore renewable energy infrastructure with minimal disruption to other assets and infrastructure.	• Potential capacity of new offshore renewable energy. • Presence of marine infrastructure (cables, pipelines). • Interaction with other users of the marine area (shipping, fisheries, military, aviation, dredging sites).	• Delivery of offshore energy arrays that maximise the potential energy output. • Minimise the potential for loss or damage to other marine infrastructure. • Minimise the risk to, or displacement of, other users of the area (fisheries and aquaculture, shipping, military activities, aviation, dredging sites).
Cultural, Architectural and Archaeological Heritage	Protect, conserve, and enhance designated and non-designated heritage assets and their settings.	Protect International, National and Local Heritage Designations, and their settings.	• Interaction with known marine heritage features. • Interaction with known designated coastal archaeological or architectural heritage features	• Minimise the potential for effects on known heritage features. • Minimise the potential for indirect effects on the setting of heritage features.

SEA Topic	Objective	Objective Description	Indicators	Targets
			(including their setting). • Potential for discovery of previously unknown archaeological heritage features.	
Landscape, Seascape and Visual Amenity	Protect, and where possible enhance, the landscape and seascape character and visual amenity of the NI shoreline.	Protect and where possible enhance the landscape and seascape character and visual amenity of the NI shoreline.	• Potential for effects on visually sensitive designated areas (e.g., AONBs, WHS). • Seascape sensitivity to offshore infrastructure development. • Population centres in proximity to RZs.	• No long-term negative change, or a positive change, to areas designated for landscape (AONBs, WHS). • No negative change, or a positive change, in visual amenity or landscape/seascape character. • Delivery of offshore energy arrays with minimal adverse visual effects to communities.

Assumptions Regarding ORE for Assessment

A variety of devices can be used to extract and convert offshore energy into electrical energy across the range of energy sources: offshore wind (both fixed and floating), tidal energy, and wave energy. These offshore energy forms can have several different types of renewable devices installed to generate electrical energy. For assessment purposes, some general assumptions were made regarding ORE technologies.

Non-Spatial Assessment of ORE Technologies

To simplify the RZ assessment process, avoid repetition during the assessment of each proposal, and recognise effects that are likely to be present across all areas, high-level impacts that the types of ORE devices and associated infrastructure (i.e., fixed wind turbines, floating wind turbines, submerged or floating tidal stream devices, wave devices and cables) can have on sensitive features within each SEA topic were considered.

Assessment of Key Objectives and Actions of the OREAP

In addition to the consideration of high-level non-spatial effects of ORE developments on SEA topics, and the potential for effects within RZs, the Key Objectives and Actions of the OREAP were also considered with regard to their compatibility or potential for effects on SEOs.

Difficulties and Data Gaps

Difficulties encountered during the SEA process are discussed and any data gaps highlighted.

Consideration of Alternatives

Three strategic-level alternatives to the OREAP were considered and assessed in **Section 7**:

Alternative 1 – Strategy option: no new Plan but reference to provisions of the existing ORESAP.

With no new OREAP, the existing Offshore Renewable Energy Strategic Action Plan (ORESAP) 2012-2020 would remain in place. There would be no consideration of the objectives and renewable energy targets of the Energy Strategy for NI – The Path to Net Zero Energy 2021 and its Action Plan 2023.

There would also be no consideration of the technological advancements in ORE infrastructure from 2012 as the potential RZs will remain as those outlined in the ORESAP. There will be no changes in the baseline environment taken into consideration, with potential for medium and long-term negative impacts on the SEOs for Biodiversity, Flora and Fauna, Geology, Soils and Land Use, Air, Climatic Factors and Material Assets. There is potential for detrimental impacts upon Air and Climatic Factors within NI and the SEOs for these with adherence to the objectives and targets of the 2012 ORESAP potentially leading to less connection of renewable energy sources to the electricity network resulting in continued use of fossil fuels and emissions of GHGs, with population growth and increased demands for electricity this will accelerate climate change with a potential worsening of the impacts of climate change in the medium to long-term. There is also potential for adverse effects on Material Assets in the medium to long-term with a lack of strategic planning of renewable energy targets impacting the ability to meet increased demand from economic and population growth.

Alternative 2 – Unconstrained option: adherence to the objectives and actions as set out in the OREAP, based on areas of potential technical suitability for ORE technologies, with no consideration of constraints refinement into RZs.

In this option, there will be adherence to the specific actions and objectives as set out in the OREAP based on areas of potential technical suitability for ORE devices but there will be no consideration of environmental or social constraints refinement of the RZs.

There is potential for significant adverse effects on the SEOs for Biodiversity, Flora, and Fauna as areas of importance would not be avoided. There is likely to be slight to moderate greater potential for adverse effects on the SEOs for Geology, Soils and Land use, as areas of importance would not be avoided. There is likely to be slight to moderate greater potential for adverse effects on the SEOs for Water in the short-term construction and decommissioning phases, as known areas of potential contamination would not be avoided at a strategic planning stage. Regarding Population and Human Health, the level of disturbance to coastal populations is likely to be slight, as the technical suitability constraints on location would still apply. There is potential for moderate to significant effects on leisure and recreational users, in inshore waters, as high-use areas for activities would not be avoided at a strategic planning stage. There is potential for greater adverse effects on the SEOs for Material Assets, as existing infrastructure such as cables and pipelines, and areas of known importance for other users of the marine area would not be considered and avoided at a strategic planning stage but would need to be considered during project planning. The potential for positive effects through the development and provision of a new secure renewable energy supply to the population and to reduce emissions of GHG and reliance on fossil fuels for Air and Climate Factors, are likely to vary from slight to significant, depending on the potential capacity of development areas. There is likely to be greater potential for adverse effects on the SEOs for Cultural Heritage on the setting of coastal heritage features and on coastal landscape designations, as those areas closer to the coastline would not be avoided at a strategic stage owing to the potential for visual impacts on sensitive receptors.

Alternative 3 – Preparation and adherence to the specific objectives and actions as set out in the OREAP, based on areas of potential technical suitability for ORE technologies refined into RZs through consideration of environmental and social constraints.

The assessment of implementing the OREAP, i.e., Strategic Alternative No.3, has been undertaken in **Section 9**. There is the potential for short to long-term adverse or positive effects across all SEOs from the implementation of the draft OREAP. However, the consideration of environmental and social constraints in the refinement of potential technically suitable areas for ORE technologies into potential RZs for fixed wind, floating wind and tidal stream technologies, would provide protection against the most potentially significant effects across many SEA topic areas. Furthermore, the future implementation of projects arising from the OREAP would have regard for the assessment outcomes from the SEA process, and the mitigation measures outlined, in ensuring that the environment is protected during project-level planning and development.

Non-Spatial Environmental Assessment of ORE Technologies

Section 8 provides a description of the potential high-level effects that ORE devices (i.e., fixed wind turbines, floating wind turbines, submerged or floating tidal devices, wave devices), and associated infrastructure and cabling (inter-array and export cables) can have on sensitive features within each SEA topic, including during installation, operation and decommissioning.

For Biodiversity, Flora and Fauna, the main effects identified at a strategic level are described under the following sub-topics: designated sites; benthic habitats and species; fish and shellfish; marine mammals and reptiles; and birds and bats.

For Population and Human Health, the main effects identified at a strategic level are described under the sub-topics of human health, and energy supply.

For Geology, Soils and Land use, the main effects identified at a strategic level are described under the sub-topics of geology, geomorphology and sediment processes.

For Water, the main effects identified at a strategic level are described under the sub-topic of water quality.

For Air, the main effects identified at a strategic level are described under the sub-topic of air quality.

For Climatic Factors, the main effects identified at a strategic level are described under the following sub-topics: GHG emissions and carbon storage; and climate change effects.

For Material Assets, the main effects identified at a strategic level are described under the following sub-topics: Existing infrastructure - cables and pipelines; other users - commercial fisheries and aquaculture; shipping and navigation; military activities; disposal areas; aggregate extraction; tourism; and aviation.

For Cultural Heritage, the main effects identified at a strategic level are described under the following sub-topics: archaeology and wrecks; and coastal heritage.

Environmental Assessment of Resource Zones

The potential for effects of ORE development on the environment within potential RZs was assessed in a series of stages, illustrated in **Figure 0-1.**

Technically Suitable Resource Zones for ORE Technologies

Stage 1 involved identifying suitable RZs for fixed wind, floating wind, and tidal resources based on technical constraints. No suitable areas for wave energy resources were identified within NI waters.

For fixed wind, seven potential RZs were identified:

- Atlantic – 1.10GW
- Rathlin Torr Head – 0.37GW
- Ards Peninsula – 1.84GW
- Mourne Lecale – 2.82GW
- Irish Sea Inshore – 3.17GW
- Irish Sea Offshore 1 – 1.52GW
- Irish Sea Offshore 2 – 0.06GW

For floating wind, five potential RZs were identified:

- Atlantic – 3.34GW
- Rathlin Torr Head – 1.01GW
- North Channel – 4.98GW
- Irish Sea Inshore – 4.55GW
- Irish Sea Offshore – 7.42GW

For tidal energy, two potential RZs were identified:

- Atlantic – 1.62GW
- Rathlin Torr Head – 0.89GW

These Technically Suitable RZs are shown in **Figure 0-2**.

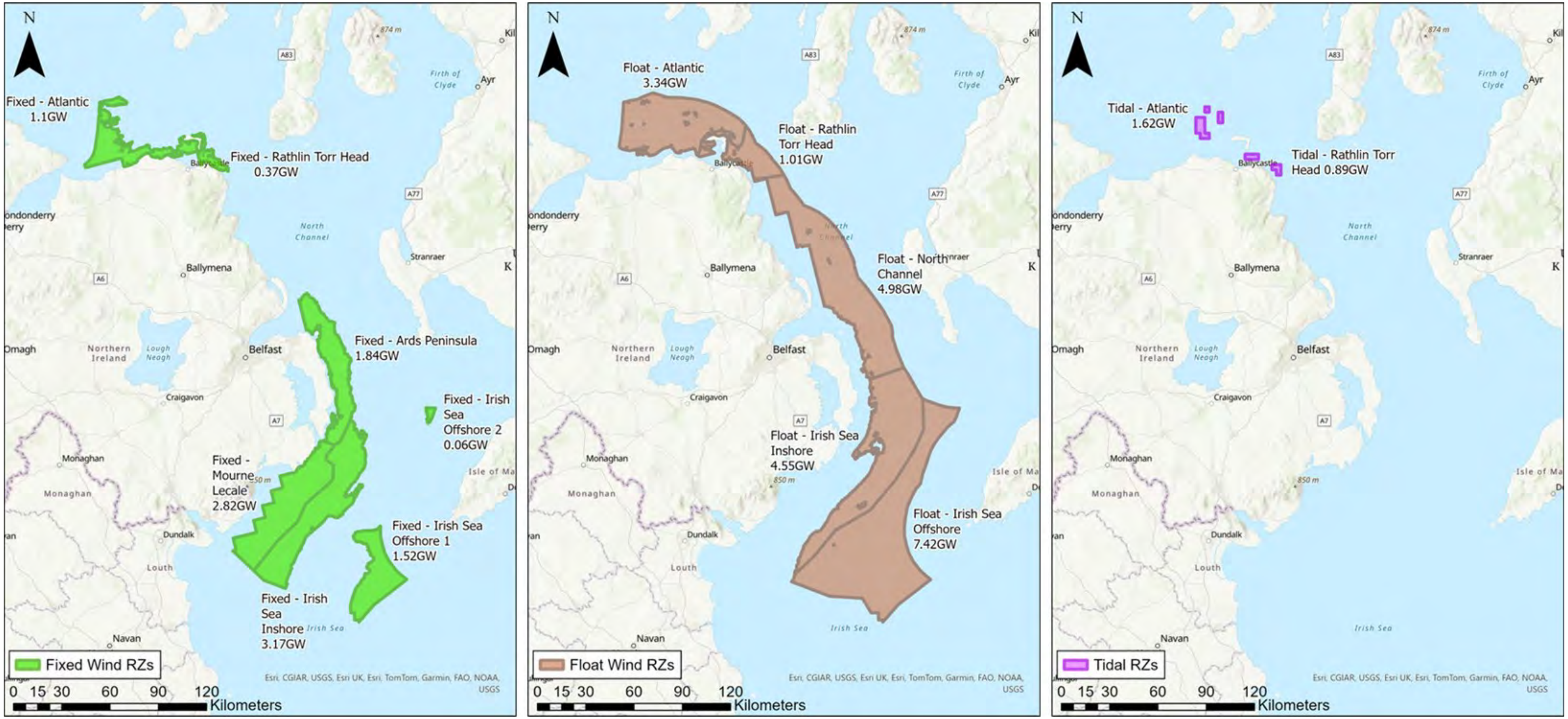


Figure 0-2 Technically Suitable Resource Zones for ORE Technologies

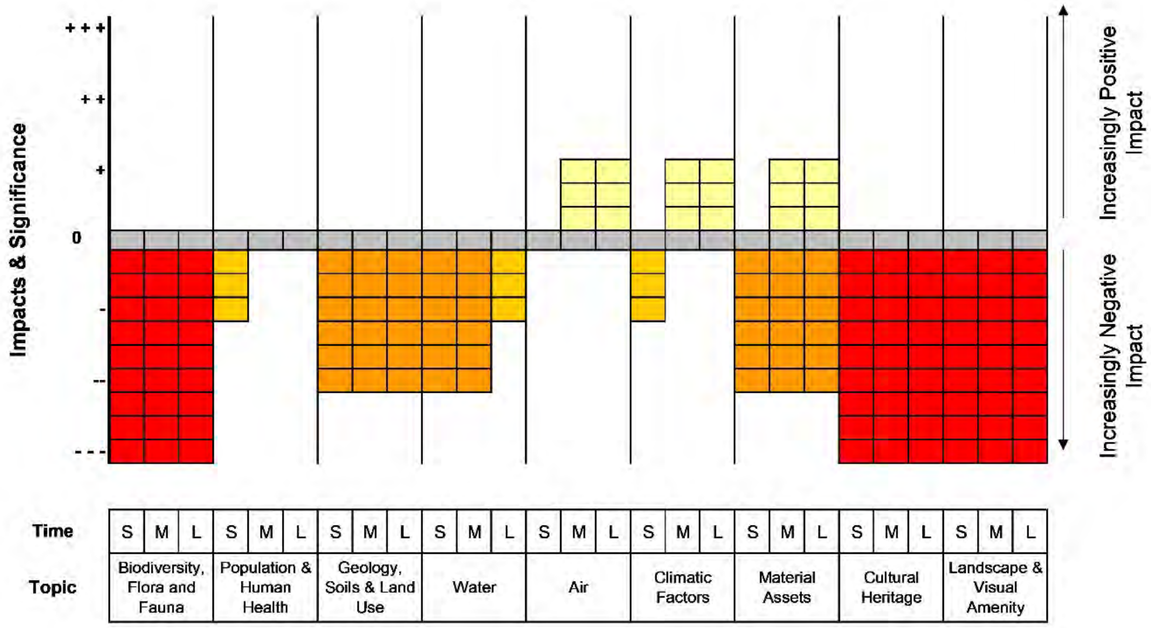
Screening, Refinement and Assessment of Potential Resource Zones

Stage 2 involved an initial constraints screening of the Technically Suitable RZs for development of each ORE technology type (fixed wind, floating wind and tidal), to identify areas of higher risk, informed by key constraints and sensitivities data (**Appendix C**). Where it was not considered possible to spatially refine these RZs to avoid key areas of potentially significant environmental effects, it was recommended to 'screen out' the RZ for further consideration in the plan development process. Where areas of a Technically Suitable RZ were considered to be of higher risk, these were refined to avoid areas considered as having the most potential for significant environmental risk based on key constraints and sensitivities. At this stage, the following Technically Suitable RZs were screened out: Fixed Wind Rathlin Torr Head, Fixed Wind Ards Peninsula, Fixed Wind Irish Sea Offshore 2. Refinement of the Tidal Atlantic and Tidal Rathlin Torr Head RZs was not deemed necessary as the original areas were not significantly constrained. All other Technically suitable RZs were spatially refined to avoid key constraints and sensitivities.

A further assessment was undertaken of the screened in recommended RZs for fixed wind, floating wind, and tidal energy in Stage 3, which was informed by wider constraints and sensitivities data (**Appendix D**). This appraisal included a description of the baseline environment and key issues within the recommended RZ, and an assessment in the short, medium, and long-term for likely effects, the significance of the effects, and whether they are positive or negative effects. Other impacts that were assessed for significance are secondary effects, cumulative effects, synergistic effects, temporary and permanent effects, and the inter-relationship of effects. The options were scored against SEOs, with a wider commentary on potential impacts by environmental topic area, included as **Appendix G**. Recommendations for further aspirational refinement were provided for some RZs, where this may reduce the potential for significant effects on environmental indicators. These recommendations will feed into the OREAP plan development process with the acknowledgement that further consideration of other factors, such as economics and deliverability will need to be taken into consideration in the further assessment and refinement of the resource zones offered for lease to enable the delivery of the most sustainable ORE Resource Zones possible within NI waters. This assessment is summarised below for each RZ.

1. Fixed Wind recommended Resource Zone: Atlantic

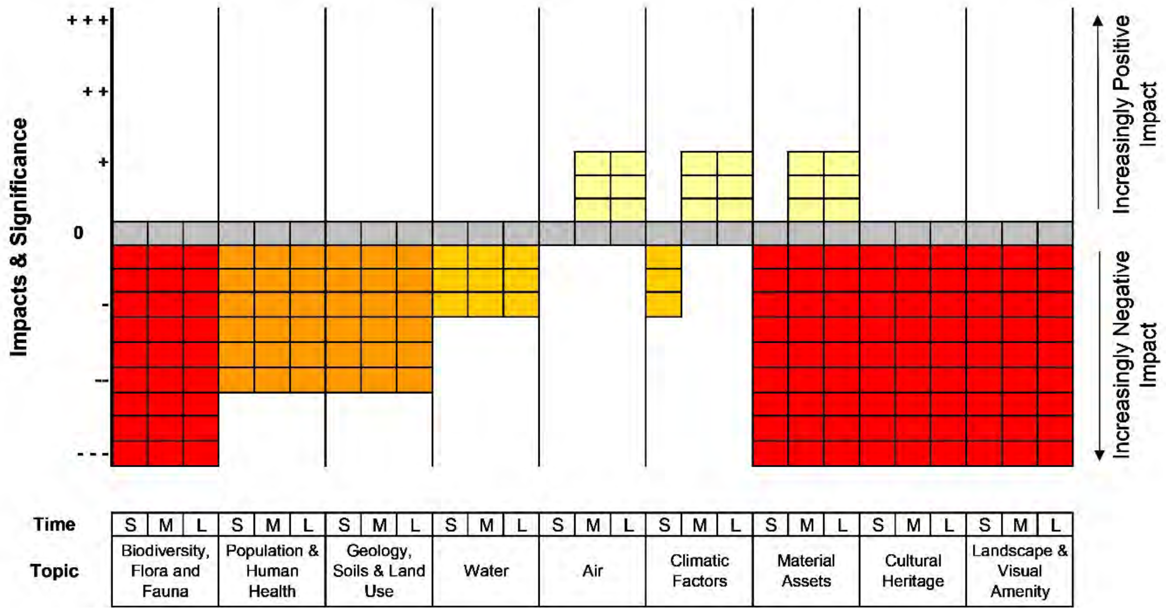
The potential capacity of the recommended RZ is 0.43GW. The assessment identified the potential for significant adverse effects on Biodiversity, Flora, and Fauna owing to the potential for indirect effects on designated sites, as well as effects on benthic habitats and species, fish and shellfish, marine mammals, and birds. The potential for significant adverse effects on Landscape, Seascape, and Visual Amenity and Cultural Heritage was also identified owing to the high sensitivity of landscape areas and coastal heritage features that could be affected and the distance of the recommended RZ offshore. The potential for slight to moderate adverse effects was identified for all other SEA topics. The potential for slight positive effects during operation of offshore wind farms was identified for Material Assets owing to the potential capacity of the recommended RZ, as well as slight positive effects on Air and Climatic Factors as a net reduction of air pollutant and GHG emissions is expected due to a move away from the use of fossil fuels to renewable energy.



Further refinement of the Fixed Wind Atlantic recommended RZ was recommended at Stage 3 to avoid or minimise the potential for significant adverse effects identified in the Stage 2 assessment. The potential capacity of the refined RZ is 0.26GW.

2. Fixed Wind recommended Resource Zone: Mourne Lecale

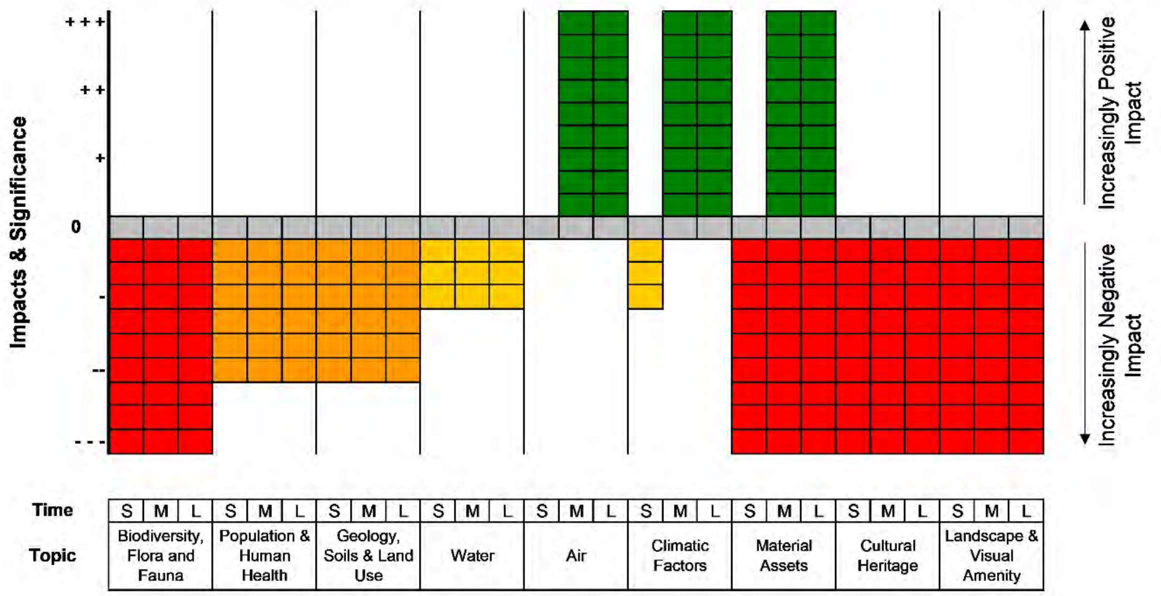
The potential capacity of the recommended RZ is 0.45GW. The assessment identified the potential for significant adverse effects on Biodiversity, Flora, and Fauna owing to the potential for effects on supporting habitats for many fish species, as well as effects on benthic habitats, marine mammals, and birds. The potential for significant adverse effects on Material Assets was identified owing to the potential displacement and increased collision risk for shipping and navigation, and commercial fisheries. The potential for significant adverse effects on Landscape, Seascape, and Visual Amenity, and Cultural Heritage was also identified owing to the high sensitivity of landscape areas and coastal heritage features that could be affected and the distance of the recommended RZ offshore. The potential for slight to moderate adverse effects was identified for all other SEA topics. The potential for slight positive effects during operation of offshore wind farms was identified for Material Assets owing to the potential capacity of the recommended RZ, as well as slight positive effects on Air and Climatic Factors, as a net reduction of air pollutant and GHG emissions is expected due to a move away from the use of fossil fuels to renewable energy.



Further refinement of the Fixed Wind Mourne Lecale recommended RZ was recommended at Stage 3 to avoid or minimise the potential for significant adverse effects identified in the Stage 2 assessment. The potential capacity of the refined RZ is 0.17GW.

3. Fixed Wind recommended Resource Zone: Irish Sea Inshore

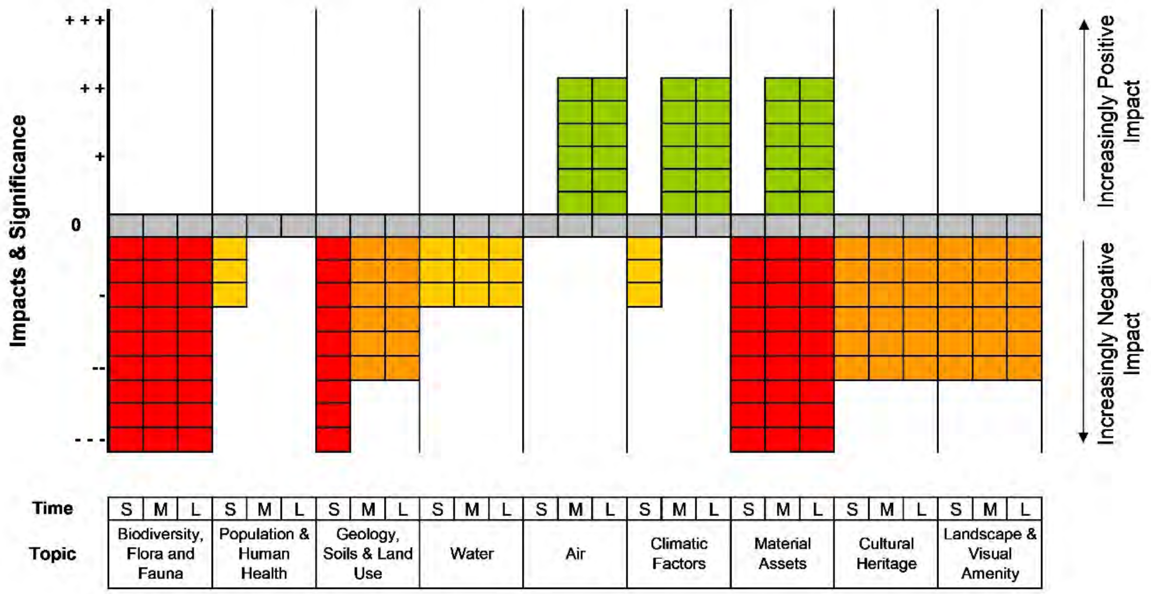
The potential capacity of the recommended RZ is 1.76GW. The assessment identified the potential for significant adverse effects on Biodiversity, Flora, and Fauna owing to the potential for indirect effects on designated sites and for effects on supporting habitats for many fish species, as well as effects on benthic habitats, marine mammals, and birds. The potential for significant adverse effects on Material Assets was identified owing to the potential displacement and increased collision risk for shipping and navigation, and commercial fisheries. The potential for significant adverse effects on Landscape, Seascape, and Visual Amenity, and Cultural Heritage was also identified owing to the high sensitivity of landscape areas and coastal heritage features that could be affected and the distance of the recommended RZ offshore. The potential for slight to moderate adverse effects was identified for all other SEA topics. The potential for significant positive effects during operation of offshore wind farms was identified for Material Assets owing to the potential capacity of the recommended RZ, as well as significant positive effects on Air and Climatic Factors, as a net reduction of air pollutant and GHG emissions is expected due to a move away from the use of fossil fuels to renewable energy. It is important to note that the south east of the recommended RZ crosses into NI offshore waters, which may give rise to jurisdictional and consenting issues that may complicate governance and approval of the projects.



Further refinement of the Fixed Wind Irish Sea Inshore recommended RZ was recommended at Stage 3 to avoid or minimise the potential for significant adverse effects identified in the Stage 2 assessment. The potential capacity of the refined RZ is 0.52GW.

4. Fixed Wind recommended Resource Zone: Irish Sea Offshore 1

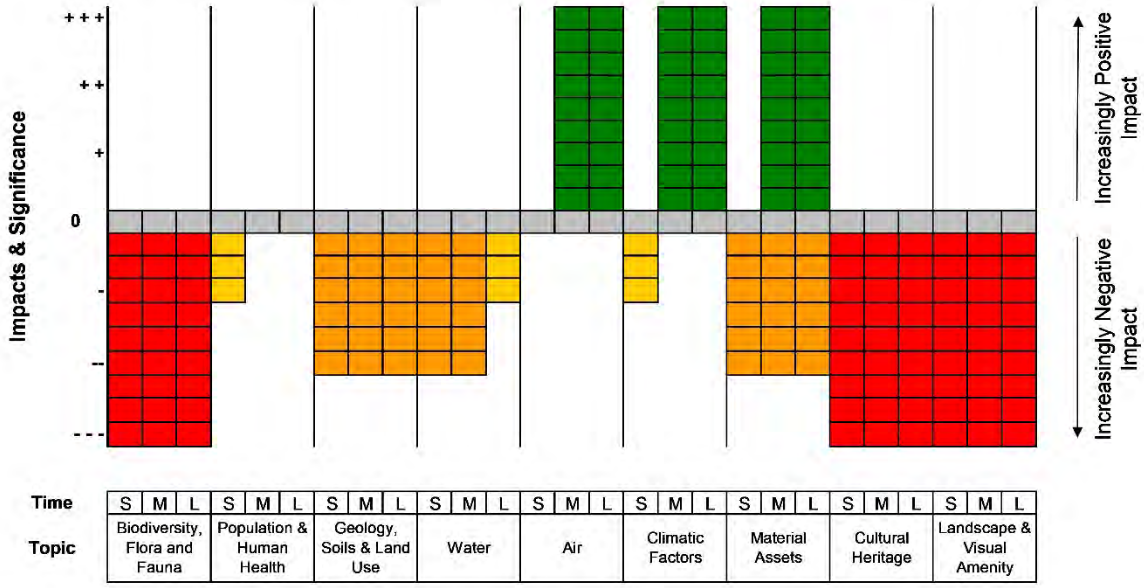
The potential capacity of the recommended RZ is 0.79GW. The assessment identified the potential for significant adverse effects on Biodiversity, Flora, and Fauna owing to the potential for indirect effects on designated sites, Annex I habitat and supporting habitats for many fish species, as well as effects on birds, and marine mammals. The potential for significant adverse effects on Geology, Soils and Land Use was identified during construction and decommissioning owing to the potential for indirect effects on a designated site. The potential for significant adverse effects on Material Assets was identified owing to the potential displacement and increased collision risk for shipping and navigation, and commercial fisheries. The potential for slight to moderate adverse effects was identified for all other SEA topics. The potential for moderate positive effects during operation of offshore wind farms was identified for Material Assets owing to the potential capacity of the recommended RZ, as well as moderate positive effects on Air and Climatic Factors, as a net reduction of air pollutant and GHG emissions is expected due to a move away from the use of fossil fuels to renewable energy. The development of wind energy sites further offshore in NI waters face increased technical challenges due to distance from ports, deeper waters and less sheltered conditions, as such construction and maintenance is more difficult and associated with higher costs requiring complex engineering solutions, specialised vessels and increased vessel trip distances. Additionally, the recommended RZ is located beyond 12nm, within NI offshore waters, which may give rise to jurisdictional and consenting issues that may complicate governance and approval of the projects.



Further refinement of the Fixed Wind Irish Sea Offshore 1 recommended RZ was recommended at Stage 3 to avoid or minimise the potential for significant adverse effects identified in the Stage 2 assessment. The potential capacity of the refined RZ is 0.56GW.

5. Floating Wind recommended Resource Zone: Atlantic

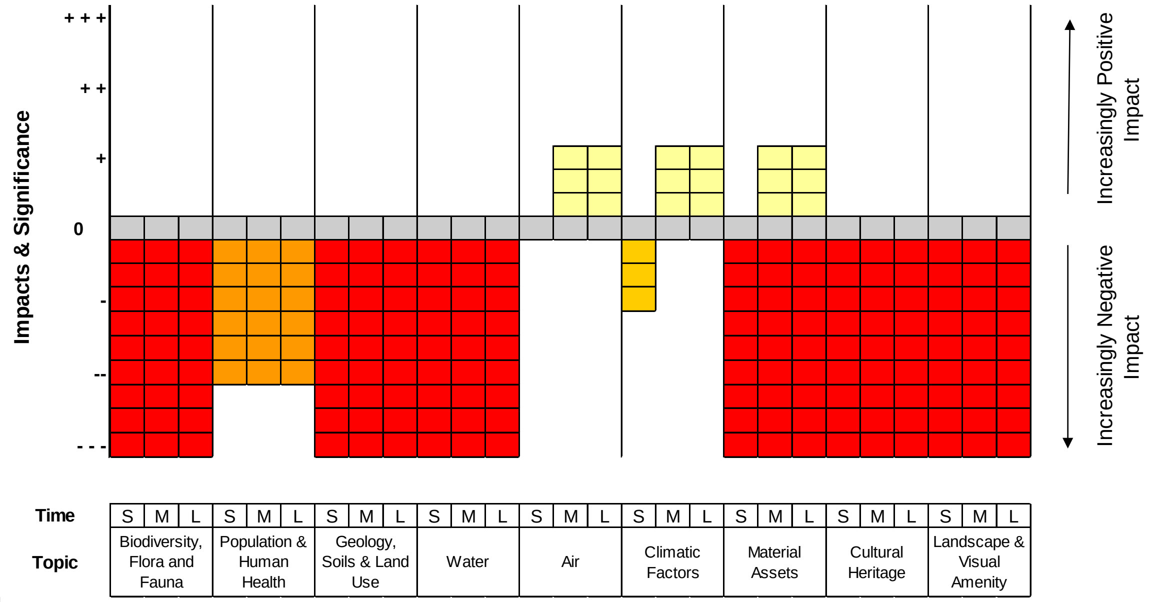
The potential capacity of the recommended RZ is 2.22GW. The assessment identified the potential for significant adverse effects on Biodiversity, Flora, and Fauna owing to the potential for indirect effects on designated sites, as well as effects on benthic habitats and species, fish and shellfish, marine mammals, and birds. The potential for significant adverse effects on Landscape, Seascape, and Visual Amenity, and Cultural Heritage was also identified owing to the very high sensitivity of landscape areas and coastal heritage features that could be affected and the distance of the recommended RZ offshore. The potential for slight to moderate adverse effects was identified for all other SEA topics. The potential for significant positive effects during operation of offshore wind farms was identified for Material Assets owing to the potential capacity of the recommended RZ, as well as significant positive effects on Air and Climatic Factors as a net reduction of air pollutant and GHG emissions is expected due to a move away from the use of fossil fuels to renewable energy.



Further refinement of the Floating Wind Atlantic recommended RZ was recommended at Stage 3 to avoid or minimise the potential for significant adverse effects identified in the Stage 2 assessment. The potential capacity of the refined RZ is 1.06GW.

6. Floating Wind recommended Resource Zone: Rathlin Torr Head

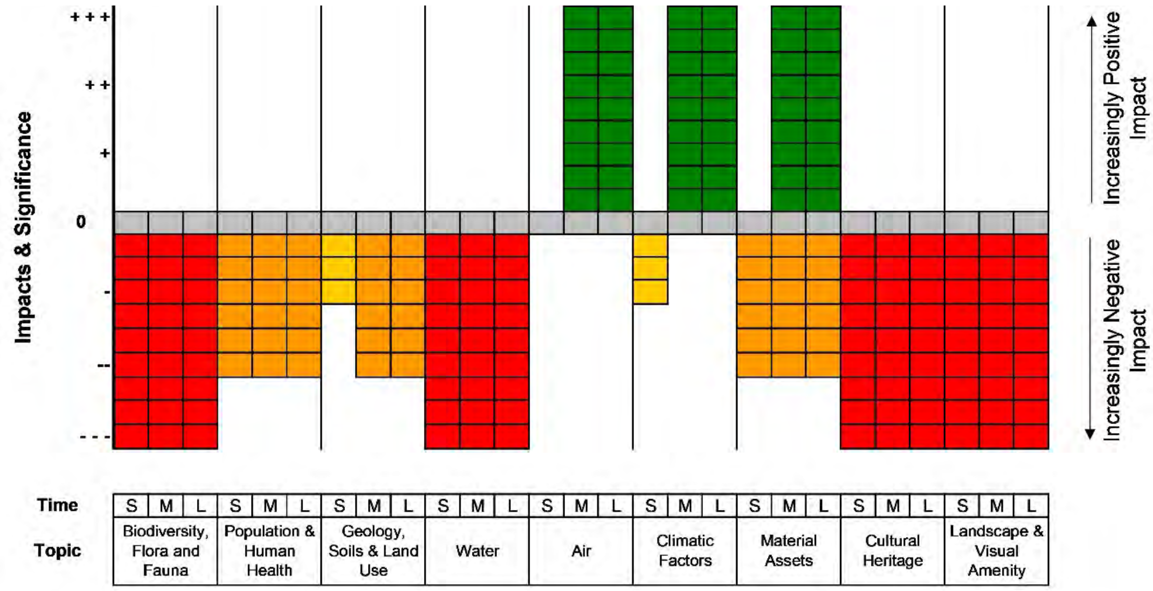
The potential capacity of the recommended RZ is 0.43GW. The assessment identified the potential for significant adverse effects on Biodiversity, Flora, and Fauna owing to the potential for indirect effects on designated sites, as well as effects on benthic habitats and species, fish and shellfish, marine mammals, and birds. The potential for significant adverse effects on Geology, Soils and Land Use was identified during construction and decommissioning owing to the potential for indirect effects on a designated site, and for significant adverse effects on Water owing to overlap with WFD water bodies. The potential or significant adverse effects on Material Assets was identified, which was mainly attributed to the potential for moderate adverse effects on Commercial Fisheries, and significant adverse effects on Shipping and Navigation due to high use of the area and proximity to the North Channel TSS. The potential for significant adverse effects on Landscape, Seascape, and Visual Amenity, and Cultural Heritage was also identified owing to the very high sensitivity of landscape areas and coastal heritage features that could be affected and the distance of the recommended RZ offshore. The potential for slight to moderate adverse effects was identified for all other SEA topics. The potential for slight positive effects during operation of offshore wind farms was identified for Material Assets owing to the potential capacity of the recommended RZ, as well as slight positive effects on Air and Climatic Factors as a net reduction of air pollutant and GHG emissions is expected due to a move away from the use of fossil fuels to renewable energy.



No further refinement of the Floating Wind Rathlin Torr Head recommended RZ was identified at Stage 3. The potential capacity of the RZ remains as 0.43GW.

7. Floating Wind recommended Resource Zone: North Channel

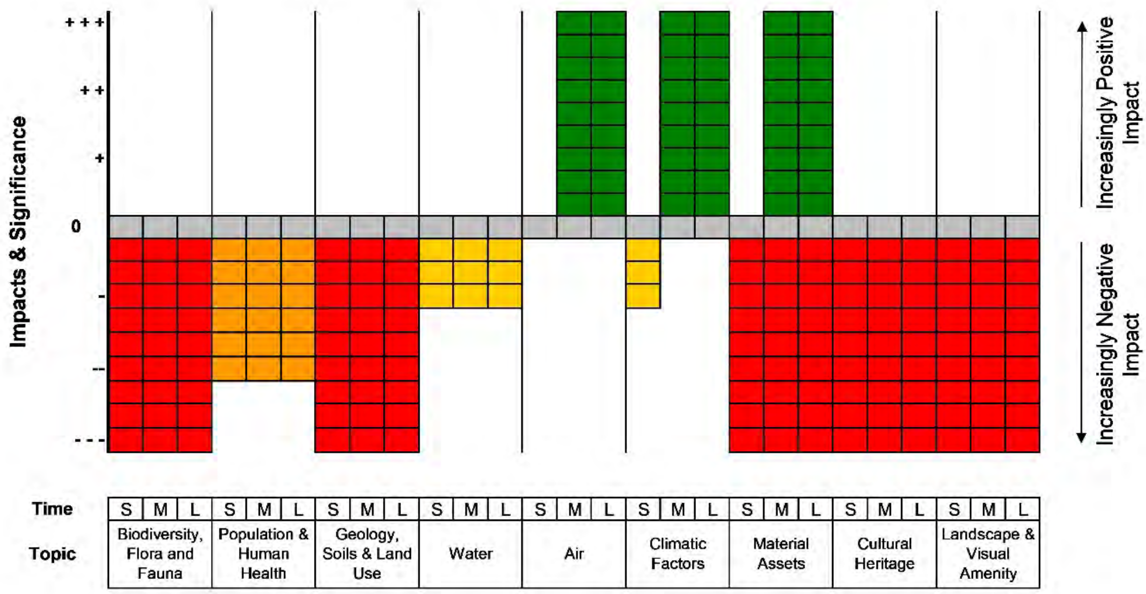
The potential capacity of the recommended RZ is 1.81GW. The assessment identified the potential for significant adverse effects on Biodiversity, Flora, and Fauna owing to the potential for indirect effects on designated sites, as well as effects on benthic habitats and species, fish and shellfish, marine mammals, birds, and fish. The potential for significant adverse effects on Water was identified owing to overlap with WFD water bodies and an explosives dumping ground. The potential for significant adverse effects on Landscape, Seascape, and Visual Amenity, and Cultural Heritage was also identified owing to the very high sensitivity of landscape areas and coastal heritage features that could be affected and the distance of the recommended RZ offshore. The potential for slight to moderate adverse effects was identified for all other SEA topics. The potential for significant positive effects during operation of offshore wind farms was identified for Material Assets owing to the potential capacity of the recommended RZ, as well as significant positive effects on Air and Climatic Factors as a net reduction of air pollutant and GHG emissions is expected due to a move away from the use of fossil fuels to renewable energy.



Further refinement of the Floating Wind North Channel recommended RZ was recommended at Stage 3 to avoid or minimise the potential for significant adverse effects identified in the Stage 2 assessment. The potential capacity of the refined RZ is 0.54GW.

8. Floating Wind recommended Resource Zone: Irish Sea Inshore

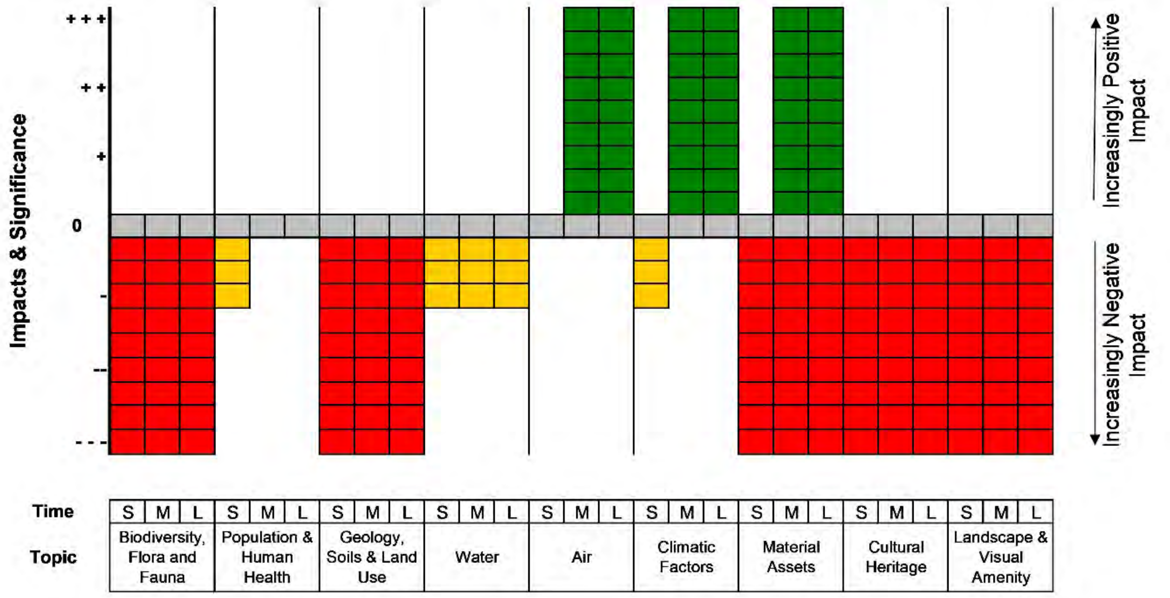
The potential capacity of the recommended RZ is 1.48GW. The assessment identified the potential for significant adverse effects on Biodiversity, Flora, and Fauna owing to the potential for indirect effects on designated sites and supporting habitats for many fish species, as well as effects on benthic habitats and species, marine mammals, and birds. The potential for significant adverse effects on Material Assets was identified owing to the potential displacement and increased collision risk for shipping and navigation, and commercial fisheries. The potential for significant adverse effects on Landscape, Seascape, and Visual Amenity, and Cultural Heritage was also identified owing to the very high sensitivity of landscape areas and coastal heritage features that could be affected and the distance of the recommended RZ offshore. The potential for slight to moderate adverse effects was identified for all other SEA topics. The potential for significant positive effects during operation of offshore wind farms was identified for Material Assets owing to the potential capacity of the recommended RZ, as well as significant positive effects on Air and Climatic Factors as a net reduction of air pollutant and GHG emissions is expected due to a move away from the use of fossil fuels to renewable energy.



Further refinement of the Floating Wind Irish Sea Inshore recommended RZ was recommended at Stage 3 to avoid or minimise the potential for significant adverse effects identified in the Stage 2 assessment. The potential capacity of the refined RZ is 0.5GW.

9. Floating Wind recommended Resource Zone: Irish Sea Offshore

The potential capacity of the recommended RZ is 5.7GW. The assessment identified the potential for significant adverse effects on Biodiversity, Flora, and Fauna owing to the potential for indirect effects on designated sites and supporting habitats for many fish species, as well as effects on benthic habitats and species, marine mammals, and birds. The potential for significant adverse effects on Geology, Soils and Land Use was identified during construction and decommissioning owing to the potential for indirect effects on a designated site. The potential for significant adverse effects on Material Assets was identified owing to the potential displacement and increased collision risk for shipping and navigation, and commercial fisheries. The potential for significant adverse effects on Landscape, Seascape, and Visual Amenity, and Cultural Heritage was also identified owing to the very high sensitivity of landscape areas and coastal heritage features that could be affected and the distance of the recommended RZ offshore. The potential for slight to moderate adverse effects was identified for all other SEA topics. The potential for significant positive effects during operation of offshore wind farms was identified for Material Assets owing to the potential capacity of the recommended RZ, as well as significant positive effects on Air and Climatic Factors as a net reduction of air pollutant and GHG emissions is expected due to a move away from the use of fossil fuels to renewable energy. The development of wind energy sites further offshore in NI waters face increased technical challenges due to distance from ports, deeper waters and less sheltered conditions, as such construction and maintenance is more difficult and associated with higher costs requiring complex engineering solutions, specialised vessels and increased vessel trip distances. Additionally, the recommended RZ is located beyond 12nm, within NI offshore waters, which may give rise to jurisdictional and consenting issues that may complicate governance and approval of the projects.

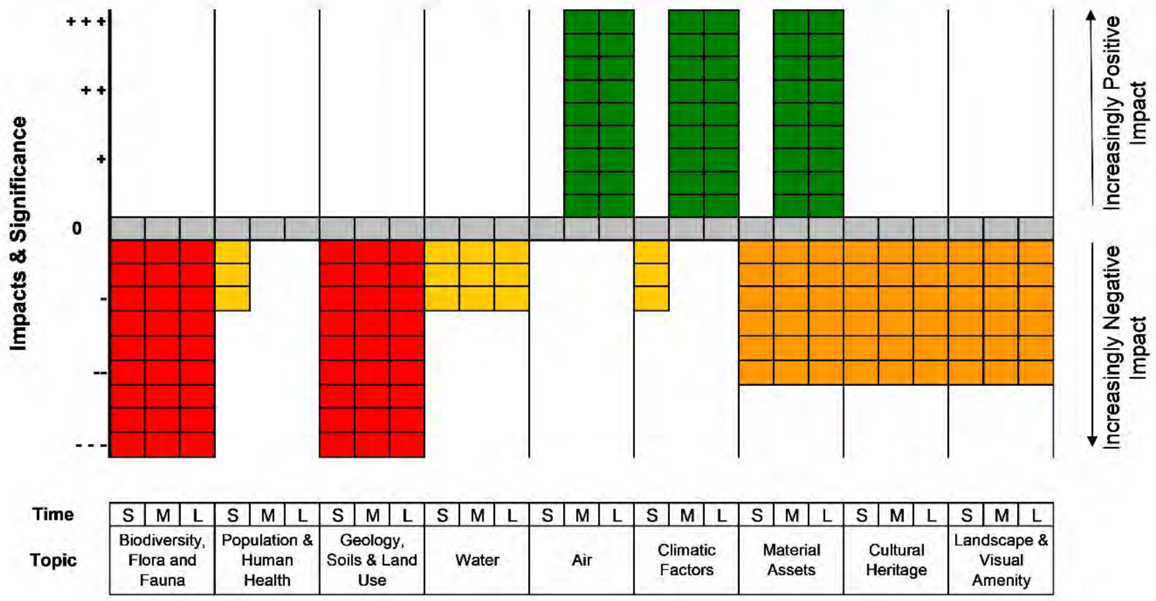


Further refinement of the Floating Wind Irish Sea Offshore recommended RZ was recommended at Stage 3 to avoid or minimise the potential for significant adverse effects identified in the Stage 2 assessment. The potential capacity of the refined RZ is 1.72GW.

10. Tidal recommended Resource Zone: Atlantic

The potential capacity of the recommended RZ is 1.62GW[1]. The assessment identified the potential for significant adverse effects on Biodiversity, Flora, and Fauna owing to the potential for indirect effects on designated sites, as well as effects on benthic habitats and species, fish and shellfish, marine mammals, and birds. The potential for significant adverse effects on Geology, Soils and Land Use was identified during construction and decommissioning owing to the potential for indirect effects on a designated site. The potential for slight to moderate adverse effects was identified for all other SEA topics. The potential for significant positive effects during operation of offshore wind farms was identified for Material Assets owing to the potential capacity of the recommended RZ, as well as significant positive effects on Air and Climatic Factors as a net reduction of air pollutant and GHG emissions is expected due to a move away from the use of fossil fuels to renewable energy.

[1]Theoretical capacity, not considering physical constraints and losses from multiple devices.

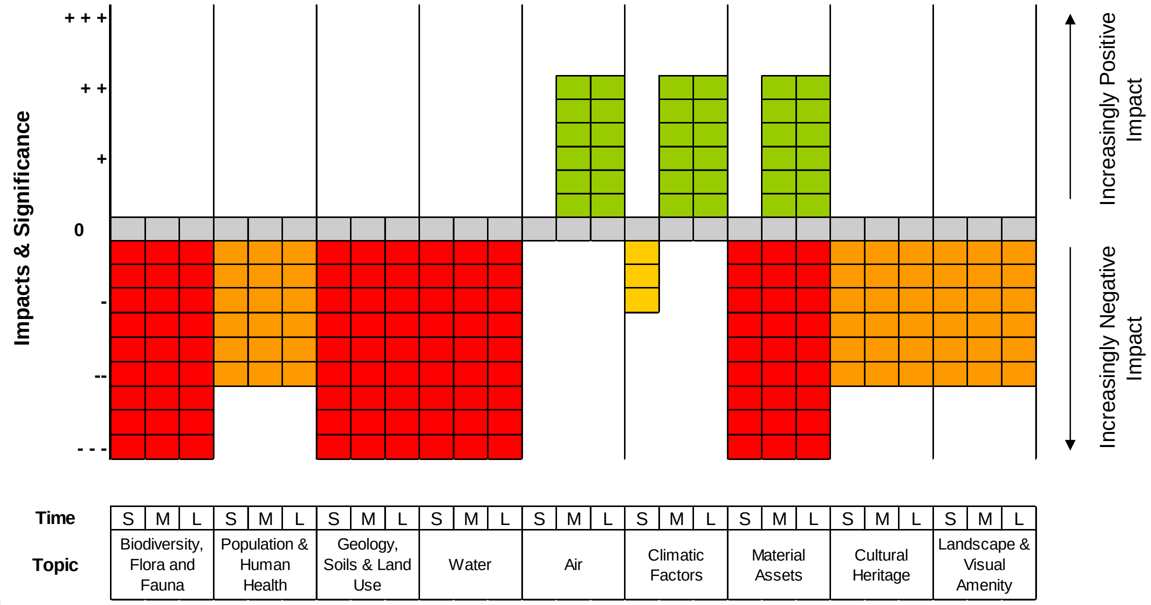


Refinement of the Tidal Atlantic RZ was recommended at Stage 3 to avoid or minimise the potential for significant adverse effects identified in the Stage 2 assessment. The potential capacity of the refined RZ is 0.99GW.

11. Tidal recommended Resource Zone: Rathlin Torr Head

The potential capacity of the recommended RZ is 0.89GW[2]. The assessment identified the potential for significant adverse effects on Biodiversity, Flora, and Fauna owing to the potential for indirect effects on designated sites, as well as effects on benthic habitats and species, fish and shellfish, marine mammals, and birds. The potential for significant adverse effects on Geology, Soils and Land Use was identified during construction and decommissioning owing to the potential for indirect effects on a designated site, and for significant adverse effects on Water owing to overlap with WFD water bodies. The potential or significant adverse effects on Material Assets was identified, which was mainly attributed to the potential for significant adverse effects on Shipping and Navigation due to high use of parts of the area and proximity to the North Channel TSS, and moderate effects on Commercial Fisheries. The potential for slight to moderate adverse effects was identified for all other SEA topics. The potential for moderate positive effects during operation of offshore wind farms was identified for Material Assets owing to the potential capacity of the recommended RZ, as well as moderate positive effects on Air and Climatic Factors as a net reduction of air pollutant and GHG emissions is expected due to a move away from the use of fossil fuels to renewable energy.

[2] Theoretical capacity, not considering physical constraints and losses from multiple devices.



Refinement of the Tidal Rathlin Torr Head RZ was recommended at Stage 3 to avoid or minimise the potential for significant adverse effects identified in the Stage 2 assessment. The potential capacity of the refined RZ is 0.15GW.

Cumulative/In-Combination Development Effects

Areas were identified where independent projects could interact at construction stage and/or in the long-term operational stage, and where there is the greater potential for in-combination or cumulative adverse effects, which would need to be taken into consideration at the detailed project planning and design stage.

1. Atlantic Area

Tidal technologies within the Tidal Atlantic RZ could occur alongside fixed and floating wind technologies in adjacent areas, with potential for increased displacement and collision/injury risk for marine mammals and fish if leasing areas are granted for ORE development. There is also potential for in-combination or cumulative effects of ORE development with the planned Malin Sea Wind Project within Scottish waters off NI's North coast if leasing is granted within the Fixed or Floating Atlantic Wind RZs affecting marine mammals, birds, and fish. There is potential for an increased displacement of commercial fishing activities and shipping, and there is also potential for temporary increased adverse effects on sensitive landscape areas and the setting of coastal heritage features should construction work occur concurrently, and potential for increased adverse effects on landscape and visual amenity along the northern coastline during wind farm operation.

2. Torr Head/North Channel Area

There is the potential for a range of cumulative and in-combination impacts to arise if leasing areas are granted within the Floating Rathlin Torr Head, Tidal Rathlin Torr Head, and Floating North Channel recommended RZs. These include adverse effects on designated sites within the tidal excursion zones, increased displacement and/or adverse effects on supporting habitats of fish and shellfish, increased disturbance, displacement and collision/injury risk for marine mammals, fish and seabirds, and an increased risk of invasive species introduction/spread. There is also an increased potential of navigational risk and displacement of commercial shipping and fishing vessels, as well as recreational and leisure vessels during construction and operation. There is potential for temporary increased adverse effects on sensitive landscape areas should construction works occur concurrently within these RZs, and potential for increased adverse effects on landscape and visual amenity, during operation of ORE projects within these RZs. There is also potential for a localised increase in air emissions and effects on water quality during construction and decommissioning. Regarding other emerging plans/projects in this general area, the LirIC Interconnector Project plans to develop a new HVDC subsea electricity connector between the Belfast region in NI and the Ayrshire region in Scotland. There is the potential for a range of cumulative and in-combination impacts to arise locally if leasing areas are granted within the North Channel Fixed Wind recommended RZ and works occur concurrently with this project.

3. **Irish Sea Area**

There is the potential for a range of cumulative and in-combination impacts to arise if leasing areas are granted within the Fixed Mourne Lecale, Fixed Irish Sea Inshore, Fixed Irish Sea Offshore, Floating Irish Sea Inshore, or Floating Irish Sea Offshore recommended RZs. There is potential for adverse effects on designated sites within the tidal excursion zones (for Fixed Irish Sea Inshore and Floating Irish Sea Offshore RZs), an increased displacement and/or adverse effects on supporting habitats of fish and shellfish and areas of importance as spawning and nursery grounds, increased disturbance, displacement and collision/injury risk for marine mammals, fish and birds, and an increased risk of invasive species introduction/spread. There is an increased potential of navigational risk and displacement of commercial fisheries. There is also an increased potential of navigational risk and displacement of vessels from areas of relatively high density for commercial shipping, and for recreational and leisure vessels in the inshore area between the Fixed Mourne Lecale and Fixed/Floating Irish Sea Inshore RZs. There is potential for temporary increased adverse effects on sensitive landscape areas and the setting of coastal heritage features should construction works occur concurrently within these RZs, and potential for increased adverse effects on landscape and visual amenity, and the setting of coastal heritage features, during operation of ORE projects within these RZs. There is also potential for a localised increase in air emissions and effects on water quality in the short-term construction and decommissioning phases.

There are several early planning stage offshore wind projects in adjacent RoI territorial waters in the south-east off the Louth and Dublin coasts, including Oriel, Clogherhead, and North East Wind and, further south, the North Irish Sea Array. There is the potential for a range of cumulative and in-combination effects to arise locally if leasing areas are granted within the Fixed Mourne Lecale, Irish Sea Inshore, or Irish Sea Offshore, or Floating Irish Sea Inshore or Irish Sea Offshore recommended RZs and works occur concurrently.

Mitigation and Monitoring

Mitigation

Mitigation measures have been recommended where potential adverse effects on environmental topic areas have been identified from developing potential ORE projects through implementation of the OREAP. These mitigation measures aim to prevent, reduce and as fully as possible offset any significant adverse effects on the environment due to implementation of ORE projects.

Table 10-1 demonstrates environmental impact-specific mitigation measures that should be adopted when implementing the OREAP to minimise the potential for any negative effects on the wider environment of developing any of the proposals assessed. These mitigation measures should be implemented and further developed at the next detailed design stage and project level study stage.

In addition to the proposed SEA mitigation, **Table 10-2** details the mitigation measures detailed in the RIAA that should be adopted within the OREAP to minimise the potential for any negative effects on European sites arising from implementation of the potential projects. These mitigation measures will be included in the OREAP and will be undertaken in the course of its adoption, pending the outcome of a 12-week public consultation period.

Monitoring

The SEA Directive requires that the significant environmental effects of the implementation of the OREAP are monitored in order to identify, at an early stage, unforeseen adverse effects and in order to undertake appropriate remedial action. The proposed monitoring programme in **Table 10-3** is based on the Targets and Indicators established in the SEOs. Following a 12-week public consultation period, this monitoring will be outlined in the OREAP. It will be undertaken in advance of planned review periods to enable the outcomes to influence the ongoing development of the OREAP.

Summary and Conclusions

Technically suitable areas for the operation of ORE types were determined, accounting for typical requirements in terms of water depths, wind speeds, wave height and energy, and current speed across the tidal cycle, and these areas were partitioned into RZs. Seven Technically Suitable RZs were identified for fixed offshore wind, five for floating offshore wind, and two for tidal energy. No technically suitable areas were found for wave energy development.

An initial environmental assessment was undertaken that considered the key environmental constraints and sensitivities within each Technically Suitable RZ across the SEA topics of Biodiversity, Flora and Fauna; Population and Human Health; Geology, Soils and Land Use; Water; Air; Climatic Factors; Material Assets; Cultural, Architectural, and Archaeological Heritage; and Landscape, Seascape, and Visual Amenity. This included the seven Fixed Wind RZs of Atlantic, Rathlin Torr Head, Ards Peninsula, Mourne Lecale, Irish Sea Inshore, Irish Sea Offshore 1, and Irish Sea Offshore 2; the five Floating Wind RZs of Atlantic, Rathlin Torr Head, North Channel, Irish Sea Inshore, and Irish Sea Offshore; and the two Tidal RZs of Atlantic and Rathlin Torr Head. Following this assessment, it was concluded that several RZs were significantly constrained for ORE development, and these were therefore not considered further; these were: Rathlin Torr Head Fixed Wind RZ, Ards Peninsula Fixed Wind RZ, and Irish Sea Offshore 2 Fixed Wind RZ. The remaining Fixed Wind and Floating Wind RZs were refined in area to avoid areas of key environmental constraint and sensitivity. No refinement of the Tidal RZs was deemed necessary based on the key environmental constraints and sensitivities data.

A further environmental assessment was undertaken, that considered a wider range of available strategic level data within each recommended RZ across the SEA topics. This assessment indicated the potential for significant adverse effects on Biodiversity, Flora and Fauna in each of the recommended RZs. This was due to the potential for direct adverse effects on designated sites (Irish Sea Inshore Floating Wind recommended RZ and Irish Sea Offshore Floating Wind recommended RZ), indirect effects on designated sites, and/or overlap with spawning and nursery grounds for many fish species. The potential for significant adverse effects was identified for Material Assets for the Mourne Lecale Fixed Wind, Irish Sea Inshore Fixed Wind, Irish Sea Offshore 1 Fixed Wind, Irish Sea Inshore Floating Wind, and Irish Sea Offshore Floating Wind recommended RZs. This was primarily due to the potential for adverse effects on Shipping and Navigation, and Commercial Fisheries. The potential for significant adverse effects was identified for Geology, Soils, and Land Use for the Irish Sea Offshore 1 Fixed Wind, Rathlin Torr Head Floating Wind, Irish Sea Inshore Floating Wind, Irish Sea Offshore Floating Wind, Atlantic Tidal, and Rathlin Torr Head Tidal recommended RZs, owing to the potential for indirect effects on designated sites for geology/geomorphology, while the potential for significant adverse effects on Water was identified for the North Channel Floating Wind, and Rathlin Torr Head Tidal recommended RZs, owing to overlap with WFD coastal water bodies. The assessment also indicated the potential for significant adverse effects on Cultural, Architectural, and Archaeological Heritage, and Landscape, Seascape, and Visual Amenity for the Atlantic Fixed Wind, Mourne Lecale Fixed Wind, Irish Sea Inshore Fixed Wind, Atlantic Floating Wind, Rathlin Torr Head Floating Wind, North Channel Floating Wind, Irish Sea Inshore Floating Wind, and Irish Sea Offshore Floating Wind recommended RZs. This was due to the high sensitivity of landscape areas and coastal heritage receptors whose setting could be affected. Several slight to moderate, adverse effects were also identified from the development, operation, and decommissioning of ORE projects within the recommended RZs. Best practice mitigation was outlined in the assessments for the avoidance or minimisation of identified adverse effects.

The potential for positive effects was also identified by the assessment of recommended RZs. The potential for significant medium to long-term positive effects on Material Assets was identified for the Irish Sea Inshore Fixed Wind, Atlantic Floating Wind, North Channel Floating Wind, Irish Sea Inshore Floating Wind, Irish Sea Offshore Floating Wind, and Atlantic Tidal recommended RZs, owing to the relatively high potential capacity of the RZs. Significant positive indirect effects on Air and Climatic Factors were also identified, as the operation of renewable energy devices can support a transition away from fossil fuel use and its associated air emissions and can contribute to a net reduction in GHG emissions and the meeting of climate change emission reduction targets. Slight to moderate positive effects on Material Assets, Air and Climatic Factors were also recognised for the remaining recommended RZs.

Following the assessment of the recommended RZs, aspirational environmentally refined RZs were identified, which excluded areas that contributed to the potential for significant adverse effects identified. Further consideration of other factors, such as economics and deliverability will need to be taken into consideration in the further assessment and refinement of the resource zones offered for lease to enable the delivery of the most sustainable ORE Resource Zones possible within NI waters. No further recommendations were identified for refinement of the Rathlin Torr Head Floating recommended RZ, and it remains highly constrained for the development of floating wind technologies. Where the potential for significant adverse effects for Landscape, Seascape and Visual Amenity, and Cultural, Architectural, and Archaeological Heritage was identified for recommended RZs, this remained for the refined RZs, owing to the high sensitivity of landscape and coastal heritage receptors and the distance to shore. This should be further considered prior to project development.

Further environmental studies based on the more detailed designs and construction methodologies should be undertaken as appropriate and may include, for instance, surveys of various biotic groups, Seascape, Landscape and Visual Impact Assessments, or heritage assessments, with any recommended avoidance or mitigation measures applied to ensure that there are no significant adverse environmental effects during construction, operation, and decommissioning of the ORE developments. Further Appropriate Assessment, to meet the requirements of the Habitats Directive, of the detailed designs and construction methodologies will be required at the project level, where potential impacts have been identified in this SEA and accompanying RIAA for the OREAP. At the project implementation stage, all works and planning of works should be undertaken with regard to all relevant legislation, licensing and consent requirements, and recommended best practice guidelines. Areas that may be more sensitive to these developments have also been highlighted, to help inform DfE of the areas that should be avoided to minimise potential environmental impacts.

In the medium and long-term, the development of potential ORE projects within the identified RZs has the potential for slight to significant positive impacts, including facilitating the connection and supply of more renewable energy, and support of economic growth. These positive impacts in turn will help to ensure that electricity supply is able to meet future demand, and that there is less reliance on fossil fuels into the future, resulting in better air quality and less GHG emissions. Furthermore, the further development of ORE through the OREAP could play a key role in shaping a reliable and sustainable energy future for NI.

The RIAA included a Screening Assessment and subsequently, Appropriate Assessment (AA) to consider the potential for Likely Significant Effects, and subsequently Adverse Effects on Site Integrity of identified European sites, with regard to their Qualifying Interest Features and associated Conservation Objectives.

The Screening Assessment concluded that the possibility of Likely Significant Effects of developing fixed offshore wind, floating offshore wind and tidal energy within the identified recommended RZs of the NI Marine Area could not be excluded, alone and in combination with other plans and projects.

The RIAA, having conducted further investigation and analysis, and having applied appropriate plan-level measures including applying the mitigation hierarchy intended to avoid or reduce harmful effects on European sites and taking into consideration the safeguarding regime of lower level HRA at a project-level, for each of the projects brought forward from the OREAP and as part of the relevant development consent procedures in the NI Marine Area; it is concluded that adoption of the OREAP will not adversely affect the integrity of any European site.

Next Steps

Consultations on the OREAP consultation document (Offshore Renewable Energy Action Plan: Consultation on the Strategic Environmental Assessment (SEA) Environmental Report and Report to Inform Appropriate Assessment (RIAA)), SEA Environmental Report and RIAA are anticipated to commence in February 2025 and run for 12 weeks. These documents will be made available for viewing digitally via the DfE website:

https://www.economy-ni.gov.uk/consultations/consultation-sea-environmental-report-and-riaa.

Following completion of the consultation period, all comments will be collated and the OREAP, SEA Environmental Report and RIAA will be reviewed and revised as necessary. Provided there are no objections or comments that will significantly alter the OREAP, the final version of the OREAP can be drafted and adopted. This is anticipated to be in July - August 2025. Following release of the adopted OREAP, an SEA Statement will be drafted to summarise the process undertaken and identify the manner by which environmental considerations and consultations were integrated into the OREAP. Following adoption of the OREAP, the next stage for any of the potential options is further technical assessment by TCE prior to the leasing of any areas for development. Detailed design and further detailed study, incorporating the advice and mitigation measures proposed in these environmental reports will be required by developers.

The contact details for any information regarding the OREAP or its environmental assessment is as follows:

By post	RPS 74 Boucher Road Belfast BT12 6RZ Northern Ireland
By email	oreap_ni@rps.tetratech.com

1 INTRODUCTION

1.1 Background

This Strategic Environmental Assessment (SEA) Environmental Report has been prepared in accordance with the European Communities Directive 2001/42/EC on the assessment of the effects of certain plans and programmes on the environment (SEA Directive), and in accordance with the Environmental Assessment of Plans and Programmes Regulations (NI) 2004 (S.R. 280/2004).

The purpose of this Environmental Report is to provide a formal and transparent assessment of the likely significant effects on the environment arising from implementation of the Offshore Renewable Energy Action Plan (OREAP) for NI, including consideration of reasonable alternatives.

The SEA of the OREAP is being completed on behalf of the Department for the Economy (DfE).

1.2 Strategic Environmental Assessment and purpose of this Scoping Report

The SEA Directive requires that certain Plans and Programmes, prepared by statutory bodies, which are likely to have a significant impact on the environment, are subject to the SEA process. The SEA process is broadly comprised of the steps shown in **Figure 1-1**. The main stages in the SEA process are given a summary description in **Table 1-1**.

Table 1-1 Summary Descriptions of Main Stages in the SEA Process

Stage	Description	Status
Screening	Determines whether SEA is required for a Plan or Programme, in consultation with the designated statutory consultees.	Completed
Scoping	Determines the scope and level of detail of the assessment for the SEA, in consultation with the designated statutory consultees.	Completed June - September 2023
Environmental Assessment	Formal and transparent assessment of the likely significant effects on the environment arising from the implementation of the OREAP, including all reasonable alternatives. The output from this is an Environmental Report which must go on public display along with the OREAP.	Current Stage
SEA Statement	Summarises the process undertaken and identifies how environmental considerations and consultations have been integrated into the final OREAP.	July-August 2025

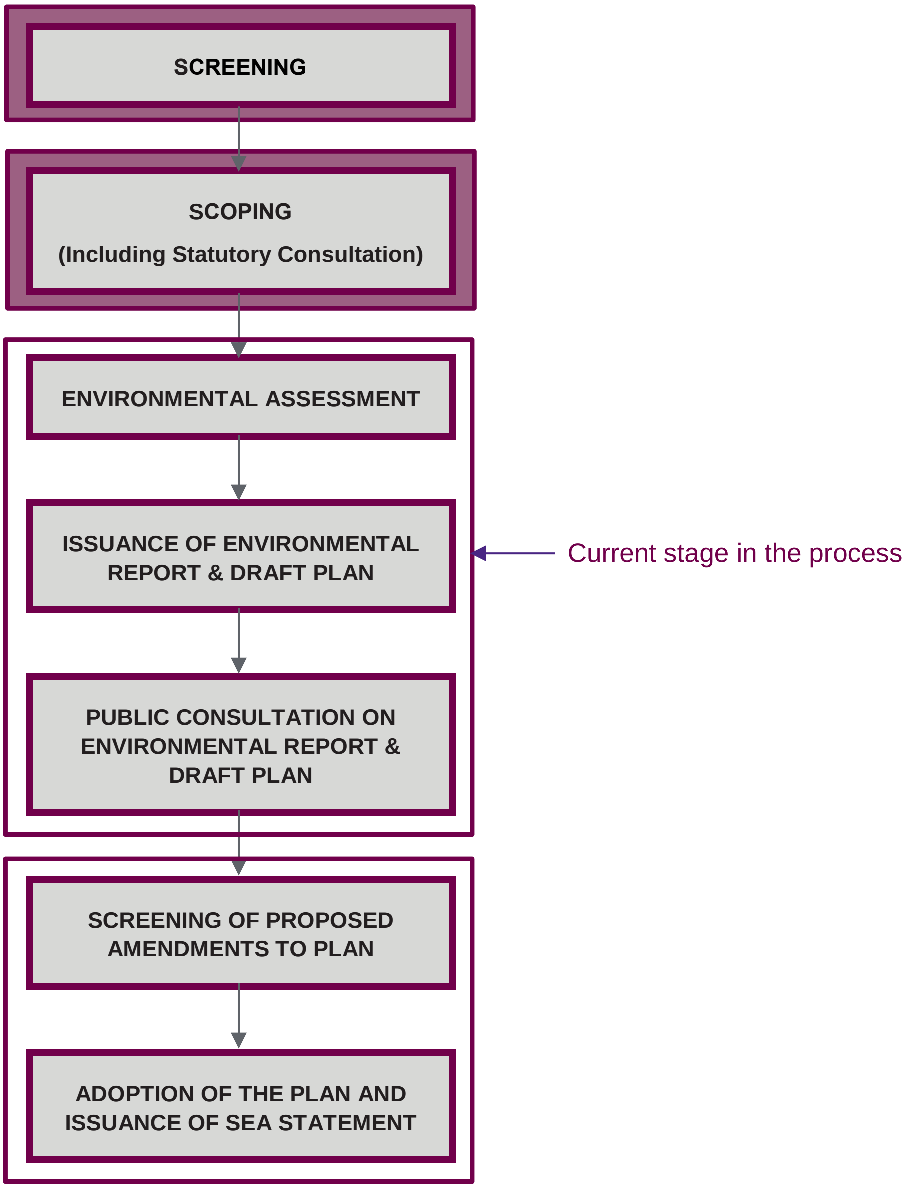


Figure 1-1 Overview of the SEA Process

1.3 Screening for SEA

Under Article 2 (2) of the SEA Directive, energy plans require a mandatory SEA. DfE therefore concluded that it was appropriate to update the SEA assessment for the OREAP.

1.4 Scoping for SEA

The SEA Scoping for the OREAP took place from June to September 2023. A Scoping Report was prepared to provide sufficient information on the OREAP to enable the consultees to form an opinion on the appropriateness of the scope, format, level of detail, and methodology for assessment and the consultation period proposed for the Environmental Report.

The provision of a Scoping Report to consultees is recommended as good practice as it can inform stakeholders about the key environmental issues and the key elements of the Plan or Programme. In addition, the Scoping Report can be used as a tool to generate comments from stakeholders on the scope and approach of the SEA. Responses received from consultees to the SEA Scoping consultation were taken into account in the Environmental Report, where possible.

Table 1-2 was created to generate discussion during the scoping process and consultation in relation to the SEA receptors and was subsequently amended as required following receipt of scoping responses.

Table 1-2 Potential Environmental Issues by SEA Topic

SEA Topic	Scoped In/Out	Potential Environmental Issues
Biodiversity, Flora and Fauna	**In**	• Potential for direct permanent loss of habitat and species, including protected or priority habitats and species, in the footprint of new infrastructure. • Potential for construction phase disturbance of habitat and species, or indirect changes in habitat type post construction e.g., through changes in sediment dynamics or smothering effects, effects on water quality/temperature, or cable protection. • Potential for infrastructure to create new habitat e.g., for epifauna colonisation. • Potential disturbance effects from underwater sound on marine mammals, fish and seabirds during construction and operation. • Potential collision risk for marine mammals, fish, seabirds (above and below the water surface), and other marine fauna with vessels during the construction phase, and with infrastructure during operation. • Potential barrier effects/habitat exclusion from the presence of infrastructure during operation. • Potential effects of EMF from transmission cables on fauna such as marine mammals and electrosensitive fish. • Potential for introduction or spread of non-native species during construction.
Population and Human Health	**In**	• Potential for disturbance of the local population during construction (e.g., noise) and impacts on residential amenity. • Potential for conflict with other users of the coastal and marine environment (e.g., fishing and leisure), or indirect effects on leisure activities (e.g., through alteration of hydrodynamics). • Potential positive or negative effects on employment and the local economy (e.g., local community employment, fisheries, and skilled technical workers, potential for increased capital investment in the local area). • Potential for long-term indirect health effects on the local population. • Potential for long-term positive effects on air quality (reduced emissions).
Geology, Soils and Land Use	**In**	• Potential for physical damage to the seabed from new infrastructure. • Potential for indirect physical effects on the seabed or subsurface from new infrastructure e.g., through alteration of the sediment regime, changes to seabed morphology, depositing of dredged material. • Potential for alteration of hydrodynamics or coastal processes.
Water	**In**	• Potential for the accidental release of contaminants or disturbance of historic sediment contaminants during construction, or release of contaminants from vessels during construction and operation. • Potential for the disturbance and mobilisation of marine sediments and effects on turbidity. • Potential for indirect effects on the water column e.g., temperature, turbidity, salinity. • Potential for the introduction of temporary or permanent sound sources into the marine environment. • Potential for the introduction of non-natural EMF into the marine environment • Potential for the introduction of marine litter and seabed debris into the marine environment. • Potential to adversely affect the status and/or the potential to achieve Good Environmental Status (GES) of MS Descriptors. • Potential to adversely affect the status and/or the potential to achieve Good Status of WFD transitional and coastal water bodies, and WFD Protected Areas (Bathing and Shellfish Waters).
Air/Climate	**In**	• Potential for localised effects of air pollutants during the construction phase and/or operational support/maintenance (plant emissions).

SEA Topic	Scoped In/Out	Potential Environmental Issues
		• Potential for localised noise effects during construction and operation. • Potential for indirect positive effects on air quality in the long-term through reduction in emissions from power stations owing to new renewable energy connections. • Potential for marine renewable energy to contribute to a net reduction in GHG emissions. • Potential for a permanent loss of blue carbon resources. • Potential for marine renewable infrastructure to be resilient to the effects of climate change.
Material Assets	**In**	• Potential for disruption effects on ports, shipping and navigation during construction. • Potential for interaction with areas of marine infrastructure (cables and pipelines, existing or planned renewable energy infrastructure). • Potential for temporary or permanent disturbance or displacement from areas of importance for commercial fisheries and aquaculture. • Potential for indirect effects on tourism. • Potential for temporary or permanent disruption effects on areas of known military/defence activity. • Potential for temporary or permanent disruption of aviation operations, including navigational radar and telecommunications. • Potential for disturbance of areas used for disposal or for aggregate extraction.
Cultural Heritage	**In**	• Potential for direct or indirect effects on marine archaeological features (including protected features) such as wrecks and submerged landscapes during construction. • Potential for indirect effects on the setting of coastal archaeological or architectural features. • Potential for the discovery of new cultural heritage features during construction.
Landscape/Seascape and Visual Amenity	**In**	• Potential for effects on areas of designated landscape quality and scenic views (AONBs, AoHSV). • Potential for effects on the general landscape and seascape and its sensitivity to development (potential compatibility with landscape and seascape character types). • Potential visibility of offshore structures and/or onshore support structures by human receptors.

1.5 SEA Guidance

Key guidance documents that have been used in the preparation of the SEA for the OREAP are listed in **Appendix A** of this SEA Environmental Report.

1.6 Statutory Consultees for SEA

Under Article 6 of the SEA Directive, the competent authority (in this case DfE) preparing the plan or programme is required to consult with specific “environmental authorities” (statutory consultees) on the scope and level of detail of the information to be included in the Environmental Report.

The statutory consultee established within the SEA legislation for NI is:

- The Department of Agriculture, Environment and Rural Affairs (DAERA).

In addition, the Department for Communities (DfC) Historic Environment Division (HED) has a Service Level Agreement with DAERA to provide advice regarding to potential effects on cultural heritage through the SEA process.

There is the potential for transboundary impacts from the implementation of the OREAP. For this reason, there is a requirement to undertake transboundary consultations as part of this SEA process.

The statutory consultees are established within the Irish national legislation, European Communities (Environmental Assessment of Certain Plans and Programmes) Regulations 2004 [S.I. 435/2004] and the Planning and Development (Strategic Environmental Assessment) Regulations 2004 [S.I. 436/2004], and their recent amendments of European Communities (Environmental Assessment of Certain Plans and Programmes) (Amendment) Regulations 2011 [S.I. 200/2011] and the Planning and Development (Strategic Environmental Assessment) (Amendment) Regulations 2011 [S.I. 201/2011], as being:

- Environmental Protection Agency (EPA);
- Department of Housing, Local Government and Heritage (DHLGH);
- Department of the Environment, Climate and Communications (DECC);
- Department of Agriculture, Food and the Marine (DAFM); and,
- Any adjoining planning authority whose area is contiguous to the area of the planning authority.

The Scottish statutory consultees, as established in the Environmental Assessment (Scotland) Act 2005, are:

- NatureScot;
- Scottish Environmental Protection Agency (SEPA); and
- Historic Environment Scotland (HES).

The English statutory consultees, as established in The Environmental Assessment of Plans and Programmes Regulations 2004, are:

- Environment Agency (EA);
- Historic England; and
- Natural England.

The Welsh statutory consultees, as established in the Environmental Assessment of Plans and Programmes (Wales) Regulations 2004, are:

- Cadw; and
- Natural Resources Wales (NRW).

1.7 Appropriate Assessment

The Habitats Directive (Council Directive 92/43/EEC) on the conservation of natural habitats and of wild fauna and flora obliges Member States to designate, protect and conserve habitats and species of importance in a European Union context. Article 6(3) of the Habitats Directive requires that "*Any plan or project not directly connected with or necessary to the conservation of a site but likely to have a significant effect thereon, either individually or in combination with other plans or projects, shall be subject to appropriate assessment of its implications for the site in view of the site's conservation objectives*." The Directive was transposed into NI legislation through the Conservation (Natural Habitats, etc.) Regulations (NI) 1995. Any proposed plan or project that has potential to result in a likely significant effect on a designated European site will require an Appropriate Assessment (AA). Case law has determined that the likelihood need not be great, merely possible, and that the precautionary principle must apply as set out in European Commission Guidance and as required by Court of Justice of the European Union (CJEU) case law (i.e., C 127/02 '*Waddenzee*').

The output of this is a Report to Inform Appropriate Assessment (RIAA), which has been prepared to influence the OREAP and to establish whether or not the OREAP is likely to have a significant negative effect upon the integrity of any European sites. The findings of the RIAA have been integrated into this Environmental Report and subsequently into the OREAP. The RIAA will be used to inform the conclusions of the HRA undertaken by the competent authority. The scope of the RIAA covered the OREAP for NI. The RIAA assessed offshore marine development within a specified number of recommended Resource Zones for fixed and floating wind farm arrays and tidal energy arrays and made an assessment of the potential for Adverse Effects on Site Integrity from these activities where there was sufficient information available to do so. One of the key intentions of adopting the OREAP is to support the future processes of leasing of ORE development areas by TCE and streamlined consenting of ORE projects by the relevant competent authorities in the NI marine area.

2 DESCRIPTION OF THE OREAP FOR NI

2.1 The Offshore Renewable Energy Strategic Action Plan 2012

The Offshore Renewable Energy Strategic Action Plan (ORESAP) was developed by the then Department of Enterprise, Trade and Investment (DETI), and was published in 2012[3]. This presented the Department's vision for the delivery of offshore renewable energy in NI waters, and the possible scenarios whereby offshore renewables could contribute to a target of 40% renewable electricity by 2020. The draft ORESAP was subject to the SEA and AA processes, and key recommendations and mitigation measures from this work were built into the final plan. This process reviewed earlier studies and developer interest, identified resource potential for marine renewable technologies in NI waters and potential RZs suitable for offshore wind, wave and tidal technologies. The SEA proposed that between 900MW and 1200MW of electricity could be generated from offshore wind and tidal energy without significant effects on the environment or other users.

As part of the subsequent offshore leasing round by The Crown Estate (TCE), one 600MW fixed offshore wind site off the coast of County Down (First Flight Wind) and two 100MW tidal energy sites off the north coast (Torr Head and Fair Head) received Agreements for Lease. Planning for the offshore wind farm was abandoned in 2014, and the Torr Head project was abandoned following the liquidation of the company in 2019. Fairhead Tidal do not currently have a marine licence. In the future should the company wish to resubmit a revised or modified application, this will again be put out to public consultation under the requirements of the marine licensing process and the Marine Works (Environmental Impact Assessment) Regulations 2007 (as amended). In addition, other consents are required from both the Department for Infrastructure (DfI) (strategic planning) and from DfE (energy generation). There has therefore been no additional commercial offshore energy developed since the ORESAP was published.

2.2 The Energy Strategy for NI and Renewable Energy Targets

The Energy Strategy for NI – The Path to Net Zero Energy was published by DfE in 2021[4] and set out a roadmap for energy to 2030 that will 'mobilise the skills, technologies and behaviours needed to take us towards our vision of net zero carbon and affordable energy by 2050'.

The Energy Strategy is centred around the delivery of five key principles:

1. **Placing you at the heart of our energy future:** We will make energy as simple as possible for everyone in society and develop policies that enable and protect consumers through the energy transition. Affordability and fairness will be key considerations in all our policy decisions.
2. **Grow the green economy:** We will create new jobs and grow a skills base for the low carbon economy through innovation, support and focusing on our competitive strengths.
3. **Do more with less:** We will set clear targets, standards and regulations that drive improvements in energy efficiency, provide support to invest in improvements to buildings and help consumers make changes that reduce their energy use.
4. **Replace fossil fuels with renewable energy:** We will phase out fossil fuels by growing our indigenous renewable base, supported by sustainable renewable imports and use these to decarbonise power, heat and transport.
5. **Create a flexible, resilient and integrated energy system:** We will create a flexible, smart and digitised energy system that integrates renewables across heat, power and transport, creates value for consumers and enhances security of supply.

[3] Department of Enterprise, Trade and Investment (DETI). 2012. Offshore Renewable Energy Strategic Action Plan (ORESAP) 2012-2020. Available at: https://www.economy-ni.gov.uk/sites/default/files/publications/deti/Offshore%20Renewable%20Energy%20Strategic%20Action%20Plan%20%28ORESAP%29%202012-2020.pdf

[4] Department for the Economy (DfE). 2021. Energy Strategy for Northern Ireland – Path to Net Zero Energy. Available at: https://www.economy-ni.gov.uk/sites/default/files/publications/economy/Energy-Strategy-for-Northern-Ireland-path-to-net-zero.pdf

The overall goal of the Energy Strategy is to achieve net zero carbon and affordable energy for all. It sets out three high-level targets:

1. Energy Efficiency: Deliver energy savings of 25% from buildings and industry by 2030.
2. Renewables: Meet at least 70% of electricity consumption from a diverse mix of renewable sources by 2030.
3. Green Economy: Double the size of our low carbon and renewable energy economy to a turnover of more than £2 billion by 2030 (supporting the 10X Economic Vision).

Energy-related sectors (business, energy supply, industrial process, public, residential and transport) together account for almost 60% of NI's GHG emissions. The aim is to reduce energy-related emissions by 56% by 2030 relative to 1990 levels, with at least 70% of electricity consumption from a diverse mix of renewable resources, and a 100% reduction in energy-related emissions by 2050. Successful implementation of the Strategy, and the pathway to decarbonise the power supply, form an important part of NI's overall plan to address climate change, supporting the Climate Change Committee's (CCC) pathway to net zero carbon by 2050 and the NI Green Growth Strategy, which emphasises that addressing climate change is essential for international competitiveness and attractiveness.

The Strategy states that, given the need to diversify the renewable technology mix, there will be a renewed focus on marine technologies, as DfE are committed to offshore wind forming a part of the future renewable electricity generation mix. The energy strategy is supported by the Energy Strategy Action Plan[5], setting out the key supporting actions to progress and deliver on the Energy Strategy: Under the Key Principle 5 of the Energy Strategy 'Replace Fossil Fuels with Renewable Energy', the Action Plan includes the following Action:

- Action 14 - DfE to "Develop an action plan to deliver 1GW of offshore wind from 2030". Reach agreement with TCE for leasing. Establish plan for implementing regulatory approvals. Develop competition process.

DfE and TCE have agreed a Statement of Intent to express their commitment towards establishing offshore wind leasing for NI.

Subsequent to the publishing of the Energy Strategy, the Climate Change Act (NI) was introduced in 2022. This introduced more ambitious emissions targets for NI, as follows:

- Net zero emissions by 2050, with at least 48% reduction in net emissions by 2030.
- 80% renewable electricity by 2030 (i.e., raised from the 70% target of the Strategy).

2.3 Review and Update of the OREAP

Offshore wind is currently the fastest-growing sector in renewable energy[6]; in the UK, offshore wind generation overtook that of onshore generation in 2019 and accounted for 55% of all wind generation in 2021[7]. The UK has become one of the world leaders in offshore wind energy deployment, with 13GW of offshore wind capacity and a target set out in the UK Energy Strategy of 50GW by 2030 of which 5GW will be floating wind. In the Republic of Ireland (RoI), one project has been connected to date (Arklow Bank), while there are a significant number of projects in development, and a target to produce 7GW by 2030. A report by BVG Associates for RenewableNI[8] estimates that the addition of 1.5GW of offshore wind in NI would result in enough clean electricity to power 1.6 million homes; £2.4 billion of Gross Value Added (GVA); up to 1,500 additional jobs at peak construction; and 49MtCO_2e savings.

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[5] Department for the Economy (DfE). 2022. Energy Strategy for Northern Ireland – The Path to Net Zero Action Plan. Available from: https://www.economy-ni.gov.uk/sites/default/files/publications/economy/energy-strategy-path-to-net-zero-action-plan.pdf

[6] Invest NI. 2023. Off-Shore Wind: The Fastest Growing Sector in Renewable Energy. Available at: https://www.investni.com/media-centre/features/shore-wind-fastest-growing-sector-renewable-energy

[7] Department for Energy Security and Net Zero (DESNZ). 2023. Digest of UK Energy Statistics (DUKES): renewable sources of energy. Available at: https://assets.publishing.service.gov.uk/media/64c1322c90b54500143e83c6/DUKES_2023_Chapter_6.pdf

[8] BVG Associates. 2022. 'Building Northern Ireland's offshore wind industry'. Available from: https://renewableni.com/wp-content/uploads/2022/09/The-Clean-Revolution-%E2%80%93-Building-Northern-Irelands-Offshore-Wind-Industry.pdf

The OREAP will be the first Action Plan subsequent to the 2021 Energy Strategy and the targets that it sets, which are strengthened by the Climate Change Act of 2022. To deliver on the Energy Strategy and the intention to develop an action plan to deliver at least 1GW of offshore wind as set out in the Energy Strategy Action Plan, DfE led the development of the OREAP during 2022. DfE established an OREAP Steering Group to guide its development and to bring together key delivery partners: DAERA, DfI, the Utility Regulator for NI (UR), TCE, the System Operator for NI (SONI), NI Electricity (NIE) Networks, and RenewableNI. Four expert stakeholder working groups were established to identify key actions required to deliver the deployment of offshore wind in NI waters, as follows: Planning, Licensing and Consenting; Network Development; Legislative Powers; and Sectoral Growth. An Offshore Renewable Energy Forum (OREF) was also established, comprising of bodies that live close to, work in, or use the marine environment, to ensure that their views are fully considered; this included the fishing industry, local Government, maritime safety, environmental protection, maritime and marine economic development, ports and harbours, and marine heritage.

An early-stage draft OREAP, considered as a living and evolving document, was published for stakeholder consultation purposes in December 2022, with the aim of taking the first steps towards delivering on these commitments. It proposed principles and actions to take forward the Energy Strategy's ambition and was designed to accelerate this ambition through deployment of offshore wind in advance of 2030, if feasible.

The OREAP has been developed with ***three principles*** to guide the implementation of the action plan:

1. **Sustainable development in the marine environment**

   The draft Marine Plan and the Energy Strategy support the growth of the low carbon economy in NI. Ensuring that this occurs in the most appropriate locations, with co-existence of compatible marine users where possible, and balancing all competing factors in a sustainable, environmentally positive way. Sustainable development also means maximising the long-term economic benefits that the offshore renewable energy sector can offer communities and businesses in NI.

2. **Adaptive approach**

   Delivery will be managed through an adaptive approach which will allow the OREAP to be adjusted, if necessary, based on what is learned and as new data and insights become available. As such, the OREAP is an evolving, flexible document, which will address uncertainties and improve understanding of the processes of developing offshore renewable energy in NI.

3. **Collaboration and partnership**

   Offshore renewable energy development involves several government departments, and multiple stakeholders. Therefore, pivotal to success will be the ability to work collaboratively and to regularly engage with key delivery partners including other government departments, regulators and other relevant bodies, the energy industry, and wider stakeholders who live close to, work in, or otherwise use the marine environment. The OREAP process will be delivered through a multidisciplinary and cross-sectoral approach.

The OREAP has been developed around ***five themes***, capturing the overarching strategic priorities that must be coordinated to enable offshore renewable energy deployment in NI waters:

- **Theme A: Sustainability and Co-existence**

  Offshore renewable energy development in the marine environment will work within the framework of DAERA's draft Marine Plan for NI, and once adopted, the Marine Plan for NI. The highest standards of environmental, social, and economic sustainability, and where possible, innovative approaches to co-location and co-existence in the marine environment, will be practiced. Three actions have been identified under Theme 1.

- **Theme B: Enabling Frameworks**

  A coherent and coordinated process for developers to establish offshore renewable energy developments in NI's marine area will be established. This process will involve a combination of marine licensing, development consent, planning permission, and generation and transmission licences. Government departments, regulators and relevant bodies will work in a coordinated and aligned way to deliver this. Five actions have been identified under Theme 2.

- **Theme C: Electricity Networks**

  Government departments, regulators, electricity networks and relevant bodies will work in coordination and collaboration to establish a joint approach to deliver the Energy Strategy for NI's long-term ambitions for offshore renewable energy. Coordinated research and analysis activities will be aligned with and drive policy and inform decision making. Three actions have been identified under Theme 3.

- **Theme D: Economic Growth**

  Certainty and assurance on the route to market for offshore renewable energy projects will be established. Public, private and education sector collaboration will bring forward the necessary skills and workforce to meet the requirements of the energy sector in the future. Ensuring NI maximises the economic benefits of offshore renewable energy projects in NI will be prioritised by government departments and agencies, and industry partners. Eight actions have been identified under Theme 4.

- **Theme E: Legislation and Regulation**

  Legislation and regulation will be reviewed as necessary to be fit for purpose to deliver on the Energy Strategy for NI's offshore renewable energy and low carbon technology ambitions. Three actions have been identified under Theme 5.

Within the framework of these themes, 12 key objectives have been identified and a total of 22 actions scheduled as far as 2025, have been set out, as shown in **Table 2-1**. These include the initial delivery steps necessary towards ensuring policy direction is established, necessary legislation is brought forward, and the regulatory requirements needed for offshore renewable energy deployment in NI waters are implemented, while also identifying actions to coordinate the work of key delivery partners, develop insight and data through research and bringing the right people together to steer sustainable development of the industry. Included in these are early actions to establish the resources available in NI waters and to update the SEA undertaken in 2012. Action 1 is to "Procure external consultants to conduct SEA/HRA update of offshore renewable energy in the NI marine area", and Action 7 is to "Undertake spatial characterisation work in parallel with DfE work to update SEA/HRA". Included in the OREAP will be the identification of potential areas for Offshore Renewable Energy, which are being put forward for further consideration.

Table 2-1 Key Objectives and Actions of the OREAP

Key Objective	Actions
Theme A: Sustainability and Co-existence	
Update the 2012 SEA and HRA of Offshore Renewable Energy in the NI Marine Area.	A1 Procure external consultants to conduct SEA/HRA update of offshore renewable energy in the NI marine area.
Align offshore renewable energy policy with marine-related environmental policy.	A2 On an ongoing basis, DfE will liaise with DAERA and TCE to ensure that offshore renewable energy policy remains aligned with marine-related environmental policy including, but not exclusively, the developing NI Marine Plan, Biodiversity Strategy and Blue Carbon Action Plan.
Deliver a wide stakeholder engagement forum.	A3 Establish and regularly engage with a group of wider stakeholders representing those that live close to, work in or otherwise use the marine environment.
Theme B: Enabling Frameworks	
Establish a decommissioning regime for NI.	B1 Consult on policy options for a decommissioning regime for offshore renewable energy installations in NI.
Prioritise and streamline the process for licensing and consenting.	B2 Establish a Memorandum of Understanding between DfI/DAERA/DfE to ensure that offshore renewable energy projects are prioritised and where possible, departments coordinate and communicate to progress applications expeditiously.
	B3 Publish guidance on consenting regimes and marine boundaries for offshore wind projects in NI.
Deliver an offshore wind leasing round for NI.	B4 Undertake spatial characterisation work in parallel with DfE work to update SEA/HRA.
	B5 Commence design of future leasing for offshore wind.
Theme C: Electricity Network	

Facilitate current and planned work, and consider strategic network requirements to deliver the NI offshore wind ambition.	C1 Establish a working group to consider offshore transmission arrangements and related grid development, including options for offshore connections under existing processes and the options out to 2050 to inform policy direction.
	C2 Determine the quantity of offshore capacity that will be targeted in the short, medium and long term.
Implement a cost effective and efficient offshore transmission connection and operation framework.	C3 SEA/HRA commissioning to incorporate strategic environmental considerations of offshore infrastructure.
Theme D: Economic Growth	
Provide a visible route to market.	D1 Consult on a renewable electricity support scheme for NI.
	D2 Publish a Statement of Intent with TCE.
Support development of a skilled workforce for offshore wind and related areas.	D3 Develop policy around schemes and awareness campaigns to bring forward the skills and workforce for offshore wind.
	D4 Establish linkages between colleges, universities, and industry to train a workforce and address skills shortages.
Enable NI's businesses and economy to maximise the benefits of offshore wind.	D5 Determine policy approach to maximise local content in the offshore wind supply chain.
	D6 Facilitate greater collaboration within the NI supply chain that benefits everyone.
	D7 Develop policy to bring forward public and private sector collaboration with the purpose of achieving NI and UK offshore wind targets and maximising the benefits for NI.
	D8 Establish a working group to identify policy necessary to maximise potential use of offshore wind energy with low carbon technologies, including green hydrogen.
Theme E: Legislation and Regulation	
Bring forward necessary legislative and subsequent appropriate regulatory changes to enable the sustainable deployment of offshore renewable energy projects in NI.	E1 Establish any regulatory change necessary for offshore transmission arrangements.
	E2 Consider any regulatory changes necessary to enable the use of offshore wind energy with low carbon technologies, including green hydrogen.
	E3 Regularly review the legislative and regulatory framework to establish any gaps in provision.

2.4 Scope of the OREAP and SEA

2.4.1 Geographic Extent of the OREAP and SEA

The OREAP is a plan for the NI marine area. The Study Area for the OREAP, shown in **Figure 2-1**, comprises this marine area, i.e., the inshore region (up to the 12nm limit) and the NI offshore region, which extends into the UK Exclusive Economic Zone (EEZ). Within this, potential RZs currently anticipated to have potential to accommodate each of the technology types considered by the plan have been identified, taking into account significant environmental and social constraints.

For the purpose of SEA assessment, a SEA Study Area, shown in **Figure 2-1**, has been defined comprising the OREAP Study Area (NI inshore and offshore areas), and a 15km buffer around this area. Within this SEA Study Area, the potential for positive or negative effects on SEA environmental topic areas will be determined, with reference, where relevant, to the potential for effects at a greater distance (e.g., for mobile species).

The RIAA for the OREAP investigates the potential impacts on the European sites (National Site Network Sites) and covers a wider Study Area and zones of influence to address ex situ impacts to habitats and species.

Consideration of export cable routes and development of onshore infrastructure is not within the scope of the OREAP and is therefore not included in any detail within the SEA and RIAA assessments. However, the RZ assessments provided in **Section 9** acknowledge the potential difficulties associated with connecting to the electricity grid in NI.

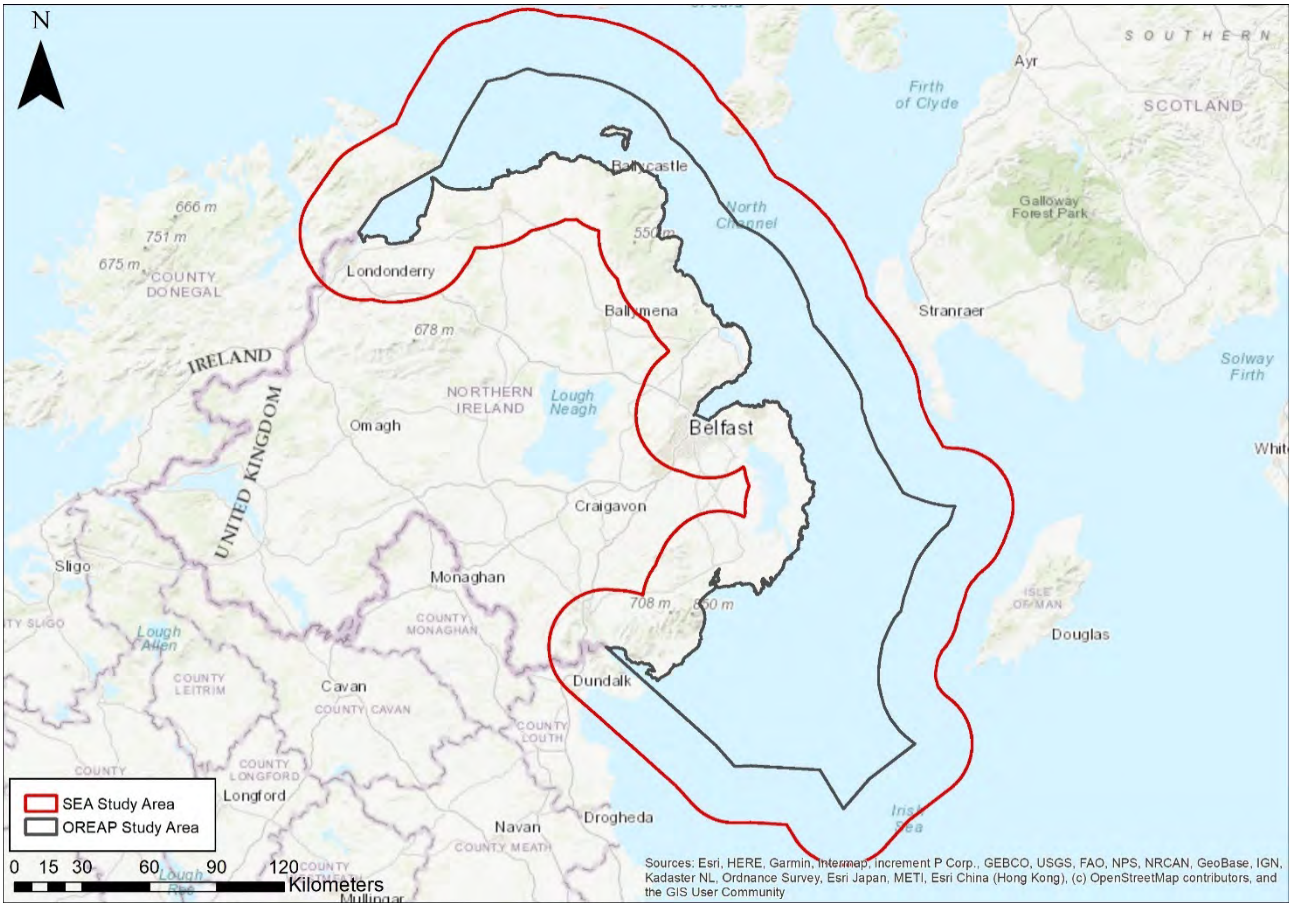

Figure 2-1 OREAP and SEA Study Area

2.4.2 Temporal Extent of the OREAP and SEA

The OREAP initially covers the period from 2022 onwards, with an initial target of at least 1GW of offshore wind energy from 2030.

The OREAP will be subject to review following completion of the SEA and HRA. It will be reviewed every five years to reflect changes in the baseline environment, energy requirements, technological advances, and legislative changes. Any future updates to the OREAP will be reviewed for the purpose of undertaking a new SEA, if required.

The temporal scope of the SEA will consider the potential for short-term (construction phase), medium-term (re-establishment and initial operational phase, considered as 0-5 years post-construction), and long-term (operational phase, 5 years post-construction onwards), as well as decommissioning impacts from implementing the potential renewable energy projects that could arise from implementation of the OREAP (including reference to secondary, cumulative, synergistic, permanent and temporary, positive and negative effects), in line with the requirements of the SEA Directive.

2.5 Plan Development

As described in **Section 2.3**, an early-stage draft OREAP was published for stakeholder consultation purposes in December 2022. The OREAP is an environmentally led plan, and its further development is being undertaken in an iterative manner in conjunction with the SEA and HRA, comprised of several stages and taking on board stakeholder views and recommendations. These steps are shown in **Table 2-2,** and the process is illustrated in **Figure 2-2**.

Table 2-2 Flow steps in the development of the OREAP, SEA and HRA

Step	Description	Action	Outcome	Timeframe
1	Data collection, collation and cleansing	Gathering of all relevant technical, environmental and social geospatial data which can represent constraints to offshore renewable infrastructure development. Data coverage must be across the entire Study Area and not spatially constrained to site-specific studies. Ranking of constraints (Black/Red/Amber/Green (BRAG) and score) as to the level of constraint they would place upon the proposed offshore infrastructure. Note that BRAG and scoring includes for technical operational envelopes for the offshore infrastructure and for environmental and social sensitivities. Constraints also connect with the baseline data collection for the SEA and RIAA, and to environmental indicators in SEA assessment. Geographic cleansing and transformation of data to ensure efficient working in web mapping and models.	Constraints data to be used in technical, environmental and social assessment of proposed offshore renewable energy development in NI waters.	June – August 2023
2	Stakeholder Review 1	Tiered stakeholder review of proposed constraint information and ranking/scoring. Stakeholders to propose and provide additional constraint data/sensitivities, of adequate quality and coverage. If applicable RPS will collate into database and/or amend constraint rankings/scores.	Stakeholder agreement on constraints data and ranking/scoring to be used in resource assessment and within SEA and RIAA.	June – July 2023
3	Constraint Mapping and Modelling	Mapping of agreed constraints data and development of web mapping for stakeholder access. Mapping by BRAG ranking and by cumulative constraints scoring.	Detailed mapping system for assessment purposes and summary mapping system for stakeholder interaction.	August – October 2023
4	SEA Scoping	Development of SEA Scoping Report. The purpose of the SEA Scoping Report was to provide sufficient information on the OREAP to enable the consultees to form an opinion on the appropriateness of the scope, format, level of detail, methodology for assessment and the consultation period proposed for the SEA Environmental Report.	Draft SEA Scoping Report for client review.	June – September 2023
5	SEA Scoping Consultation	5-week consultation on SEA Scoping Report to environmental consultees, including transboundary and stakeholders.	SEA Scoping completion.	September – October 2023
6	Stakeholder Review 2	Tiered stakeholder review of all constraints data collated and mapped. RPS review feedback and undertake required updates.	Stakeholder agreement on constraints mapping, ranking, scoring and modelling.	October 2023
7	Resource Identification	Two step approach to identification of suitable RZs. - Areas within the SEA Study Area that are within the technical operational envelopes for the various renewable energy infrastructure. - Constraints screening of RZs to identify areas of lower constraint and reduced risk.	Technical opportunity zones for each type of infrastructure. Areas of lower environmental and social constraint for offshore renewable development.	November – December 2023
8	Resource Quantification	Quantification of renewables potential within technically suitable areas of lower environmental and social constraint. High level, theoretical quantification, based on technology footprints. Not	Potential generating capacities of RZs. Provides indication of resource potential within lower constraint	December 2023

Step	Description	Action	Outcome	Timeframe
		detailed assessment or commitment. All assessment based on data collected in step 1.	areas, for DfE/TCE/DAERA to consider further.	
9	Stakeholder Review 3	Tiered stakeholder review of RZs and potential capacities. RPS review feedback and undertake required updates.	Stakeholder agreement on identified zones and capacities.	January – April 2024
10	Environmental Assessment	Environmental assessment of proposals based on SEA Objectives, Targets and Indicators, which are linked to the constraints data. Identification of wider environmental issues and opportunities.	Wider environmental issues and opportunities to feedback into RZ refinement.	October 2023 – June 2024
11	RIAA Stage 1 - Screening	Screening for Appropriate Assessment. Potential for effects of the Plan on designated European sites/National Site Network.	RIAA Screening Report.	December 2023 – June 2024
12	RZ Refinement	Feedback from SEA and RIAA Screening into refinement of RZs.	Agreed RZs.	December 2023 – June 2024
13	OREAP Development	OREAP development based on the RZ identification and quantification.	Draft revised OREAP.	October 2023 – June 2024
14	SEA Environmental Report	Development of SEA Environmental Report.	SEA Environmental Report.	June 2024
15	RIAA Stage 2 - Assessment	Plan level Appropriate Assessment of proposals for potential effects on designated European sites/National Site Network.	Report to Inform Appropriate Assessment.	January – June 2024
16	Public and Stakeholder Consultation	12-week public and stakeholder consultation. OREAP consultation document (Offshore Renewable Energy Action Plan: Consultation on the Strategic Environmental Assessment (SEA) Environmental Report and Report to Inform Appropriate Assessment (RIAA)), SEA Environmental Report and Report to Inform Appropriate Assessment available for public viewing and feedback.	Public consultation.	February – May 2025
17	Consultation Review	Review and collation of all feedback received on the OREAP consultation document, SEA Environmental Report and Report to Inform Appropriate Assessment.	Consultation feedback log and actions developed.	June – July 2025
18	Stakeholder Review 4	Tiered stakeholder review of proposed amendments to the OREAP based on consultation responses.	Stakeholder agreement on revised OREAP.	July 2025
19	Plan Finalisation and Adoption	Finalisation of the revised OREAP based on consultation feedback.	Final revised OREAP.	July – August 2025
20	SEA Statement	Update and finalisation of SEA Environmental Report. Development of SEA Statement to demonstrate how the OREAP has considered the environment in its development, how the public and stakeholder have been consulted upon, and the reason for choosing the final Plan.	SEA Statement.	July – August 2025
21	Final Report to Inform Appropriate Assessment	Post consultation Final Report to Inform Appropriate Assessment. Competent authority completes HRA.	Final Report to inform Appropriate Assessment.	July – August 2025

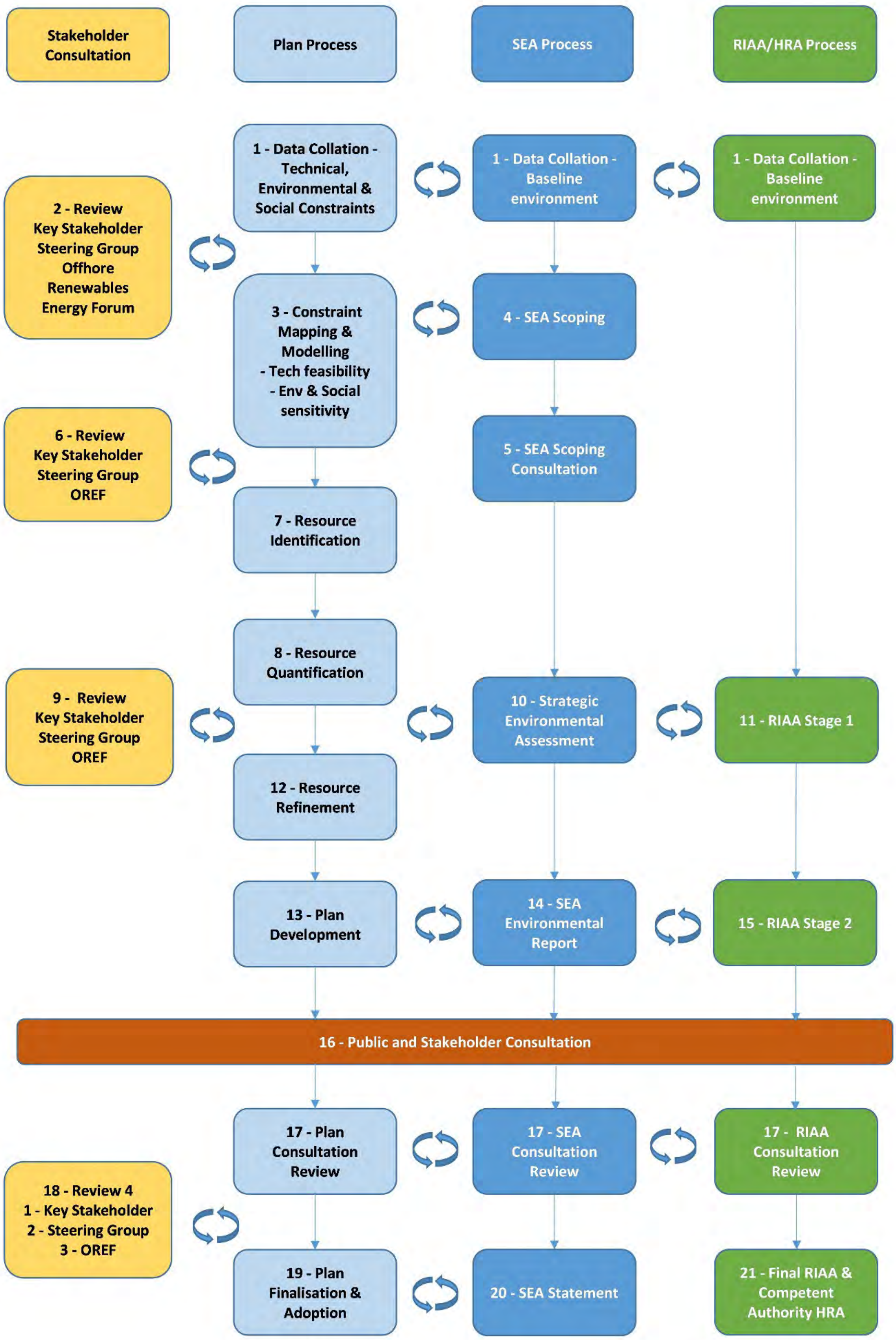

Figure 2-2 Flowchart for the iterative development of the OREAP, SEA and HRA

3 BASELINE AND ENVIRONMENTAL PROBLEMS

In line with the SEA Directive, this section describes the environmental baseline for the OREAP SEA Study Area. This includes: a description of the state of the environment at present; a discussion of the key problems/issues currently being faced in the area; and a description of the expected evolution of the environment should the OREAP not be implemented, i.e., in the absence of the Plan.

3.1 Current State of the Environment in NI

This section summarises the state of the environment in NI, as reported by DAERA state of the environment reports and annual statistical updates. Detailed further information is then presented regarding the environmental characteristics of the baseline environment in NI (and of transboundary consideration) of key relevance to the OREAP by SEA topic area in **Section 3.2**.

NI's most recent state of the environment review (2013)[9] found the situation to be variable. Air quality showed continuing improvement, while water quality had benefitted significantly from improved control of effluents, and rates of municipal waste recycling had been steadily increasing. Significant challenges remained, however, in reversing biodiversity declines and meeting EU objectives for water bodies, landscapes, habitats and heritage.

The main threats identified in the previous 2008 review, namely climate change, land use, and socio-economic growth, continued to create pressures on the environment in NI. These key challenges are outlined below:

- Economic downturn – The most significant change since 2008 with regards to socio-economic growth has been the economic downturn, which has had impacts on housing, development, energy and resource use, and on waste production. The 2008 recession had intensified the need to stimulate growth and to use our resources, such as agricultural lands, more efficiently whilst protecting and enhancing our natural environment.
- Living within our limits – Living within our limits relates to the impact of ever-increasing populations on the environment in terms of food production, imports, energy use, and water security. There was an increasing realisation that living within our limits, both economically and environmentally, locally, and globally, is now a major challenge.
- Sustainable rural land use – It had been identified that the marine environment, from biodiversity indicators and the status of our waters are under threat. The 2013 State of the Environment report noted the relationship between rural land practices and the water environment and identified that a fully integrated approach to the management of the land and water environment was needed.
- Climate change – Climate change remained an important issue for NI and indeed globally. However recent legislation such as the UK Climate Change Act along with renewable energy policies and increasing energy costs are likely to contribute to already positive advancements.

Following on from the key challenges identified, three key principles underpinning the way forward were also listed, and comprise the following:

- Working to achieve **resilient, diverse ecosystems** capable of providing vital services while absorbing pressures and responding to change;
- Valuing and **managing natural resources** to support economic and social prosperity; and
- Protecting the quality of life by **reducing pollution, protecting heritage** and promoting **sustainable land use**.

[9] DAERA NI. 2013. From Evidence to Opportunity A Second Assessment of the State of NI's Environment. Available at: https://www.daera-ni.gov.uk/sites/default/files/publications/doe/corporate-report-from-evidence-to-opportunity-second-assessment-of-state-of-ni-environment-2013.pdf.

A summary of the relevant aspects of the current state of the environment in NI, as presented in the most recent state of the environment review (2013) and updated, where possible, by taking into account the most recent NI Environmental Statistics Report (2024)[10], has been provided in **Table 3-1**.

The RoI[11], Scotland[12], England[13], and Wales[14] also have versions of the State of the Environment report that set out key issues and challenges of national relevance.

Table 3-1 Summary of Current State of the Environment in NI[15]

Theme	Key Findings
Air Quality	There are 21 air quality monitoring stations in NI. Air quality in NI has shown substantial improvement in recent years. The average annual mean concentration of NO_2 across NI's urban background sites remained relatively stable between 2011 and 2016, varying between 20 and 23µg/m^3. The average annual mean concentration of NO_2 reduced to a low in 2020 and, from 2021, levels have remained around 14.0µg/m^3 across NI's urban background sites. In 2023, there was no breach of the UK Strategy Objective or EU Limit Values of 40µg/m^3 for the annual mean concentration of particle matter (PM_{10}). The annual mean PM_{10} concentration across NI's urban monitoring sites reached a maximum of 22µg/m^3 (in 2010) but has shown a gradual decline since that time, with an annual mean value of 13µg/m^3 in 2023. The agriculture sector accounted for the majority of ammonia emissions in NI in 2021. Other sources include transport, commercial and domestic combustion and industrial processes. Overall, ammonia emissions have increased, by 11.1%, from 28.8kt in 2005 to 32.0kt in 2021.
Climate	Since the start of the 20th century records show that the climate in NI is changing. In 2021, NI's GHG emissions were estimated to be 22.5MtCO_2e, a reduction of 23% since baseline levels in 1990. Agriculture (28%), transport (17%) and business (14%) were the largest contributing sectors to GHG emissions in NI in 2021. The UK Climate Change Act commits the UK to reducing emissions by 100% by 2050 from 1990 baseline levels. The same 100% emission reduction target is now true of NI, due to the Climate Change Act NI, as of June 2022. In 2021, NI's total GHG emissions accounted for 5% of the UK total, higher than its population share of 3%. For the period January to December 2023, 46% of the total electricity consumption in NI was generated from renewable sources based in NI.
Water	Eutrophication, or the enrichment of water by nutrients, especially compounds of nitrogen and/or phosphorus is recognised in the State of the Environment Report 2013 as a widespread major threat to water quality in the freshwater environment. The report stated that the overall status of water bodies in NI had not significantly changed from that recorded in 2012, but improvements had been identified in water utility discharges and drinking water quality. Long-term seasonal trend analysis reported in the State of the Environment Report 2013 showed that the monthly trends in average nitrate concentrations in rivers in NI were predominantly

[10] NISRA. 2024. Northern Ireland Environmental Statistics Report. May 2024. Available at: https://www.daera-ni.gov.uk/sites/default/files/publications/daera/NI%20Environmental%20Statistics%20Report%202024_0.pdf

[11] Environmental Protection Agency (EPA). 2020. Ireland's Environment: An Integrated Assessment. Available at: https://www.epa.ie/publications/monitoring--assessment/assessment/state-of-the-environment/EPA_Irelands_Environment_2020.pdf.

[12] Scotland's Environment Web. 2016. State of the environment - previous reports. Available at: https://www.environment.gov.scot/our-environment/state-of-the-environment-previous-reports/

[13] Environment Agency. 2023. State of the Environment. Available at: https://www.gov.uk/government/publications/state-of-the-environment

[14] Natural Resources Wales. 2020. State of natural resources reports. Available at: https://naturalresources.wales/evidence-and-data/research-and-reports/?lang=en.

[15] As presented in 'From Evidence to Opportunity: Second assessment of State of NI Environment 2013' and updated by the 'NI Environmental Statistics Report 2024'

Theme	Key Findings
	decreasing or stable over the 28-year period, 1992-2019, which may be attributed to the measures implemented through the Nitrates Action Programme. However, DAERA issued a consultation document on Significant Water Management Issues[16] to inform the development of the third cycle River Basin Management Plan (2021-2027). This showed that the most significant pressure on water quality in NI is from the release of the nutrients not only nitrogen but also from phosphorus, from agricultural and other sources. Between 2015 and 2018, Soluble Reactive Phosphorus (SRP) was the cause of decline in status for 100 river water bodies across NI. It should also be noted that The Programme for Government (PfG) Outcome 2 indicator includes SRP concentrations in rivers. In 2023, there were 1,851 water incidents reported to NIEA or discovered by NIEA during inspections. Of these incidents, 44% were confirmed as having an impact on the water quality of the receiving waterway, with 20% of these considered as high or medium severity. Blue green algal bloom events accounted for an increase in reported substantiated and unsubstantiated incidents, including in Lough Neagh, Lower Bann and the North Coast during 2023.
Marine	The majority of NI's 650km of coastline is protected for its special interest, and a number of our coastal species and habitats are recognised as internationally important. Of the 25 inshore coastal waterbodies in NI, 13 were reported as good or better ecological conditions. No improvement was observed since 2021. High nutrient levels, particularly in inshore estuarine waters and sea loughs, are identified as a key element responsible for coastal water bodies not attaining good ecological condition. In January 2014, the Shellfish Waters Directive was subsumed into the WFD, resulting in more stringent *E. coli* standards. One out of nine (11%) designated shellfish water protected areas (SWPAs) complied with the WFD guideline *E. Coli* standard in Shellfish Flesh in 2023, a decrease from a percentage compliance of 22% in 2022 and 56% in 2021. The first assessment of UK seas under the UK MS was published in 2012[17], and set objectives, targets and indicators for achieving Good Environmental Status (GES). This was updated in 2019[18], and indicated that GES had been achieved for some MS Descriptors, but had not been achieved for birds, fish, commercial fish, benthic habitats, non-indigenous species, and marine litter, and had been only partially achieved for seals, pelagic habitats, food webs, and underwater noise.
Land and Landscape	Agri-environment schemes encourage farmers and landowners to manage their land to benefit the environment. At the end of 2023, 62,000ha of land in NI were under an agri-environment scheme agreement. In NI, over 52% of forests and woodlands are state-owned or managed. The NI Environmental Statistics Report 2024, reported that in 2023/24, 433 hectares of new woodland (41ha conifer and 392ha broadleaf) were planted by NI Forest Service and private landowners supported by grant aid.
Biodiversity	The NI Environmental Statistics Report 2024 reported that in 2023/24, the area of terrestrial protected sites under favourable management in NI was recorded as at least 29,962ha. In 2022/23, 55% of features within marine and terrestrial protected

[16] Department of Housing, Planning and Local Government. 2021. Significant Water Management Issues in Ireland. Available at: https://www.gov.ie/pdf/?file=https://assets.gov.ie/78373/30d96d3b-a09c-431c-a3ee-790668e35e57.pdf#page=null

[17] Department for Environment, Food and Rural Affairs (DEFRA). 2012. Marine Strategy Part One: UK Initial Assessment and Good Environmental Status. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/69632/pb13860-marine-strategy-part1-20121220.pdf

[18] Department for Environment, Food and Rural Affairs (DEFRA). 2019. Marine Strategy Part One: UK updated assessment and Good Environmental Status. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/921262/marine-strategy-part1-october19.pdf.

Theme	Key Findings
	sites were in Favourable condition while 36% were in Unfavourable condition. Approximately 3% were in Unfavourable-Recovering condition with less than 1% Destroyed. The wild bird population indicator, using 56 bird species, shows decreased levels in 2022 compared to 1996. Bird populations peaked in 2005 and have been in decline since, driven principally by bird species found in farmland habitats. The most severely declining breeding and wintering population groups in Ireland have been identified as breeding farmland and upland birds and seabirds and wintering waterfowl[19].
Built Heritage	In 2022/23, there were a total of 2,035 scheduled historic monuments protected under Article 3 of the Historic Monuments and Archaeological Objects (NI) Order 1995. Overall, there has been a 35% increase in the number of scheduled monuments since 2001/02, reflecting ongoing survey, designation and assessment. In addition, there has been a modest increase in the number of buildings listed in recent years with a total of 9,072 statutory listings in 2022/23, compared with 8,191 in 2003/04. The figures provide an indication of this aspect of the rich cultural and built heritage of NI, an increasingly important source of "soft power" and an important contributor to the NI economy, through attracting tourism and filming. In 2022/23, 1,037 historic buildings and structures were recorded on the Heritage at Risk in NI (HARNI) register as 'at risk', an increase of 145 compared to 2021/22. The Defence Heritage Project records archaeological sites and monuments that have had a defensive function, publicising existing assets and encouraging public recording of new information. A map-based web application is available at http://go.qub.ac.uk/DefenceHeritageNI, showing previously recorded defence heritage features, as well as new submissions; many defence heritage features are in coastal locations.
Waste and Resources	Waste is produced by households, by industrial processes, by the construction and demolition industry, through commercial activities and agricultural practices, and by public services and utilities. Waste can affect the environment through its visual impact or by emissions to the air, groundwater and surface water as well as the contamination of land. The NI Environmental Statistics Report 2024 notes that The Local Authority Municipal Waste Management Statistics show that the amount of waste sent for energy recovery via incineration has grown exponentially since 2006-07, whilst the proportion of waste sent to landfill has more than halved in the same timescale. Recycling of waste is becoming much more common in NI. The revised NI Waste Management Strategy (Delivering Resource Efficiency, 2013) proposed to achieve a 50% recycling rate by 2020 for local authority collected municipal waste. For municipal waste in 2022/2023 the recycling rate was 50.7%, with a 0.6% increase compared to 2021/22. The recycling rate for all waste collected was 49.7% in 2022/23, which was similar to the recycling rate recorded in 2021/22.

3.2 Environmental Characteristics

This section describes the environmental baseline for NI of relevance to the OREAP. The baseline has been divided by topic into the issues requiring assessment under SEA legislation. The purpose of this section is to demonstrate the level of baseline environmental information used when assessing the potential impacts of implementing the OREAP. This baseline information forms the indicators which potential offshore renewable infrastructure will have the potential to impact upon. Future variations in these indicators owing to the implementation of the OREAP will be monitored as part of the OREAP and SEA review.

[19] Gilbert, G., Stanbury, A. and Lewis, L. 2021. Birds of conservation concern in Ireland 4: 2020–2026. Irish Birds, 43, pp.1-22. Available at: https://birdwatchireland.ie/app/uploads/2021/04/Irish-Birds-2021-BOCCI-for-web.pdf.

3.2.1 Biodiversity, Flora and Fauna

Biodiversity is the variety of all plants and animals, and the communities that they form. The conservation of biodiversity is important in its own right. Humans are also dependent on biodiversity for the provision of ecosystem services such as clean air and water, food, and shelter, as well as for the health and amenity value that the natural environment can provide. NI's marine waters cover an area of over 6,000km^2 and contain over 50% of the region's biodiversity, along with a coastline that stretches for over 650km, more than 75% of which falls within some form of conservation designation[20].

The importance of preserving biodiversity has increasingly been recognised from an international to a local level, and NI has legal obligations under International and EU commitments and legislation. The UN Convention on Biological Diversity (1992) is an international legally binding treaty with three main goals: conservation of biodiversity; sustainable use of biodiversity; and the fair and equitable sharing of the benefits arising from the use of genetic resources. It requires the development of national strategies for the conservation and sustainable use of biological diversity. The most recent Biodiversity Strategy for NI, "Valuing Nature", was published by DAERA in 2015 and covered the period up to 2020. This set out how NI planned to meet its international obligations and local targets to protect biodiversity, and to ensure that the environment can continue to support the population and economy of NI. Its overall mission was "To make progress towards halting overall biodiversity loss, establish an ecosystem approach and help business and society in general have a greater understanding of the benefits that nature can bring to everyday life in NI". Following the UN Biodiversity Conference in December 2022 (COP15), a Global Biodiversity Framework (GBF) was agreed that aims to see 30% of land protected globally by 2030. A new Biodiversity Strategy for NI is currently in production, which will reflect the targets set out by the GBF. The OREAP must also have regard for the Habitats Directive and the Birds Directive, as transposed through the Conservation (Natural Habitats, etc.) Regulations (NI) 1995, which require that any plan or project not directly connected with or necessary to the management of a European site but likely to have a significant effect on such a site, must undergo an AA in view of best scientific knowledge and in view of the conservation objectives of the site. The OREAP falls under this remit, and an AA was undertaken in parallel to the SEA process, to assess the potential implications of the Plan for European Sites.

It is considered that the key issues associated with the implementation of the OREAP and Biodiversity, Flora and Fauna comprise:

- Potential for direct permanent loss of habitat and species, including protected or priority habitats and species, in the footprint of new infrastructure.
- Potential for construction phase disturbance of habitats and species, or indirect changes in habitat type post-construction e.g., through changes in sediment dynamics/smothering effects, effects on water quality/temperature or cable protection.
- Potential for infrastructure to create new habitat e.g., for epifauna colonisation.
- Potential disturbance effects from underwater sound on marine mammals, fish, and seabirds during construction and operation.
- Potential collision risk for marine mammals, fish, seabirds (above and below the water surface) and other marine fauna with vessels during the construction phase and with infrastructure during operation.
- Potential barrier effects/habitat exclusion from the presence of infrastructure during operation.
- Potential effects of EMF from transmission cables on fauna such as marine mammals and electrosensitive fish.

[20] DAERA NI. 2018. Draft Marine Plan for Northern Ireland. Available at: https://www.daera-ni.gov.uk/sites/default/files/consultations/daera/Marine%20Plan%20for%20NI%20final%2016%2004%2018.PDF

3.2.1.1 Designated Sites

3.2.1.1.1 Overview of Designated Sites

There are a wide variety of natural habitats and species within NI. Sites have been designated to provide protection to those habitats and species considered to be of particular conservation value. These include features whose conservation is of importance at an international level, for which 20 Ramsar Sites, 58 Special Areas of Conservation (SACs), and 16 Special Protection Areas (SPAs) have been designated in NI to date. Sites have also been designated for nature conservation importance at an international level within the RoI, Scotland and the UK offshore region. There are 34 SACs (of which 16 are designated for the protection of marine or coastal habitats or species), 20 SPAs, and seven Ramsar Sites that are within the SEA Study Area. Appropriate steps must be taken to avoid the deterioration of habitats, and habitats of species, as well as significant disturbance of the species for which these sites have been designated. The Conservation Objectives safeguard the habitats of the site, the range, numbers and supporting habitats of the qualifying species. NI has 49 habitats listed in Annex I of the Habitats Directive[21], of which 18 are coastal/marine, and 18 species listed in Annex II of the Directive, of which 8 are coastal/marine for at least some part of their life [22]. Annex II marine and coastal species such as common seal and harbour porpoise are included within SAC designations while, in recent years, sites have also been designated solely for the protection of marine features: North Channel (harbour porpoise), Red Bay (sandbanks), Skerries and Causeway (reefs, sandbanks, sea caves, harbour porpoise), and The Maidens (reef, sandbanks, grey seal). Marine and intertidal habitats and species of significance within NI's waters are further discussed in the following sections.

At a national level, 394 Areas of Special Scientific Interest (ASSIs) have been designated to provide statutory protection for the best examples of the UK's flora, fauna, geological or physiographical features, of which there are 160 ASSIs that are within the SEA Study Area. There is also one Site of Special Scientific Interest (SSSI), an equivalent Scottish national designation, and four Natural Heritage Areas (NHAs), an equivalent RoI national designation, which are within the SEA Study Area. There are five Marine Conservation Zones (MCZs) designated under the Marine Act (NI) 2013 to safeguard vulnerable or unique marine species and habitats of national importance in the inshore region of NI, and one nature conservation Marine Protected Area (MPA) in Scottish waters, which are within the SEA Study Area. For the RoI part of the western Irish Sea, which borders NI waters, an ecological sensitivity analysis has recently been completed[23] to inform future designation of MPAs, with forty potential biological and environmental features considered (species and habitats classified as threatened or declining on national and/or international lists, species and habitats of recognised ecological importance, areas of high biodiversity and a feature with high potential for restoration), and areas of high and low priority for protection identified, considering current and proposed future sectoral activities. MPAs will be established in the RoI under the forthcoming MPA Bill. In Wales, the Government launched the MPA network completion programme in November 2022[24], which highlighted the Areas of Search from within which possible MCZs will be identified. None of these areas are within the SEA Study Area. All of these sites are for the protection of benthic sediments. It is anticipated that, once possible sites have gone out to public consultation, they will become a material consideration under Section 126 of the Marine and Coastal Access act (2009), meaning that any public authority when determining applications has to take into consideration the impact on the protected features of the site (e.g., Marine licensing). There are 91 MCZs in English waters, designated under the Marine and Coastal Access Act

[21] The Annex 1 habitat 'Submarine structures made by leaking gases' is not located in NI waters but is found offshore in NI adjacent waters outside the territorial limit.

[22] DAERA NI. 2013. Habitats Directive Annexes of Habitats and Species. Available at: https://www.daera-ni.gov.uk/sites/default/files/publications/doe/natural-information-ni-habitats-and-species-2013.pdf

[23] Marine Protected Area Advisory Group. 2023. Ecological sensitivity analysis of the western Irish Sea to inform future designation of Marine Protected Areas (MPAs). Report for the Department of Housing, Local Government and Heritage, Ireland. Available at: https://www.gov.ie/pdf/?file=https://assets.gov.ie/261015/35f09f23-5a32-4492-b470-d9d26ed9eb16.pdf#page=null

[24] Welsh Government. 2022. Written Statement: Announcement of the commencement of the Welsh Marine Conservation Zone (MCZ) designation pre-consultation engagement process. Available at: https://www.gov.wales/written-statement-announcement-commencement-welsh-marine-conservation-zone-mcz-designation-pre

(2009); none of these areas are within the SEA Study Area. In the Isle of Man, Marine Nature Reserves (MNR) are designated under the Wildlife Act 1990 for the protection of marine flora, fauna, geological or physical features of special interest, or providing opportunities to study or research such features. There are currently 10 MNRs within the Isle of Man territorial area. There is also one SPA and one Ramsar site on the Isle of Man. None of these designated sites are within the SEA Study Area.

There are 50 statutory Nature Reserves, designated to provide protection to features considered to be of national importance in NI, while 940 sites have been designated for their importance at a more local level (Sites of Local Nature Conservation Importance or SLNCIs); of these, 12 and 402, respectively are within the SEA Study Area. In addition, there are 10 sites in NI protected as RSPB (Royal Society for the Protection of Birds) nature reserves, and 18 sites protected as Ulster Wildlife nature reserves, of which 6 and 13, respectively, are situated adjacent to the coastline and intercept the SEA Study Area.

These designated sites are further detailed in **Table 3-2** and their locations are shown in **Figure 3-1**.

Table 3-2 Number and type of sites designated for conservation of Biodiversity, Flora and Fauna that are within the SEA Study Area

Site Designation	Description	Number
Special Areas of Conservation (SACs), including candidate SACs (cSACs)	Existing SACs in NI were designated in accordance with the Habitats Directive (92/43/EEC) for the conservation of certain habitats and species while SPAs were designated under the EU Directive on the Conservation of Wild Birds (EC/79/409), “The Birds Directive”, as areas that are important for breeding, feeding, wintering or migration of rare and vulnerable bird species. Together this formed part of the Natura 2000 network of protected sites. Following the UK’s exit from the EU, there is now a UK National Site Network of European sites, comprising existing designated sites and any further sites designated under the Habitats Regulations. Sites in UK offshore waters are designated by The Conservation of Offshore Marine Habitats and Species Regulations 2017. SACs and SPAs in the RoI remain part of the Natura 2000 site network.	34
Special Protection Areas (SPAs), including proposed SPAs (pSPAs)		20
Ramsar Sites	Ramsar sites are designated under the “Ramsar Convention” (Ramsar Convention on Wetlands of International Importance especially as Waterfowl Habitat, Iran 1971), an international treaty for the conservation and sustainable use of wetlands.	7
Areas of Special Scientific Interest (ASSIs)	ASSIs are protected under the Environment (NI) Order 2002. This requires NIEA to designate land as an ASSI that it considers to be of special scientific interest, owing to the flora or fauna present, or the presence of geological features.	160
Sites of Special Scientific Interest (SSSIs)	Sites designated in Scotland under the Nature Conservation (Scotland) Act 2004. An equivalent national designation to ASSIs in NI.	1
Natural Heritage Areas (NHAs)	Sites designated in the RoI under the Wildlife (Amendment) Act 2000. An equivalent national designation to ASSIs in NI.	4
Marine Conservation Zones (MCZs)	MCZs protect nationally important marine species, habitats and features of geological or geomorphological interest. Priority Marine Features (PMF) is a collective term for the features considered to be of conservation importance in the NI inshore region and form the basis of MCZ designation under the Marine Act (NI) 2013 and the UK Marine and Coastal Access Act 2009 for inshore and offshore regions, respectively. These sites should complement the marine components of sites designated under the	5

Site Designation	Description	Number
	Birds and Habitats Directives, coastal ASSIs and Ramsar sites, together forming a network of MPAs.	
Nature Conservation Marine Protected Areas (MPAs)	MPAs protect a wide range of habitats, species, geology and undersea landforms in Scottish waters, and are designated under The Marine (Scotland) Act 2010. An equivalent national designation to MCZs in NI.	1
National Nature Reserves	Statutory Nature Reserves are areas of importance for flora, fauna, geological or other special features for conservation purposes and to provide the opportunity for research. They are designated under the Nature Conservation and Amenity Lands (NI) Order 1985.	12
Sites of Local Nature Conservation Importance (SLNCIs)	Each council area in NI reports on locally important sensitive or valued habitats through the production of Local Biodiversity Action Plans (LBAPs). These Plans outline the areas of importance for natural heritage reasons within the council area, guiding development policy and potential enhancement of local biodiversity. These are known as SLNCIs.	402

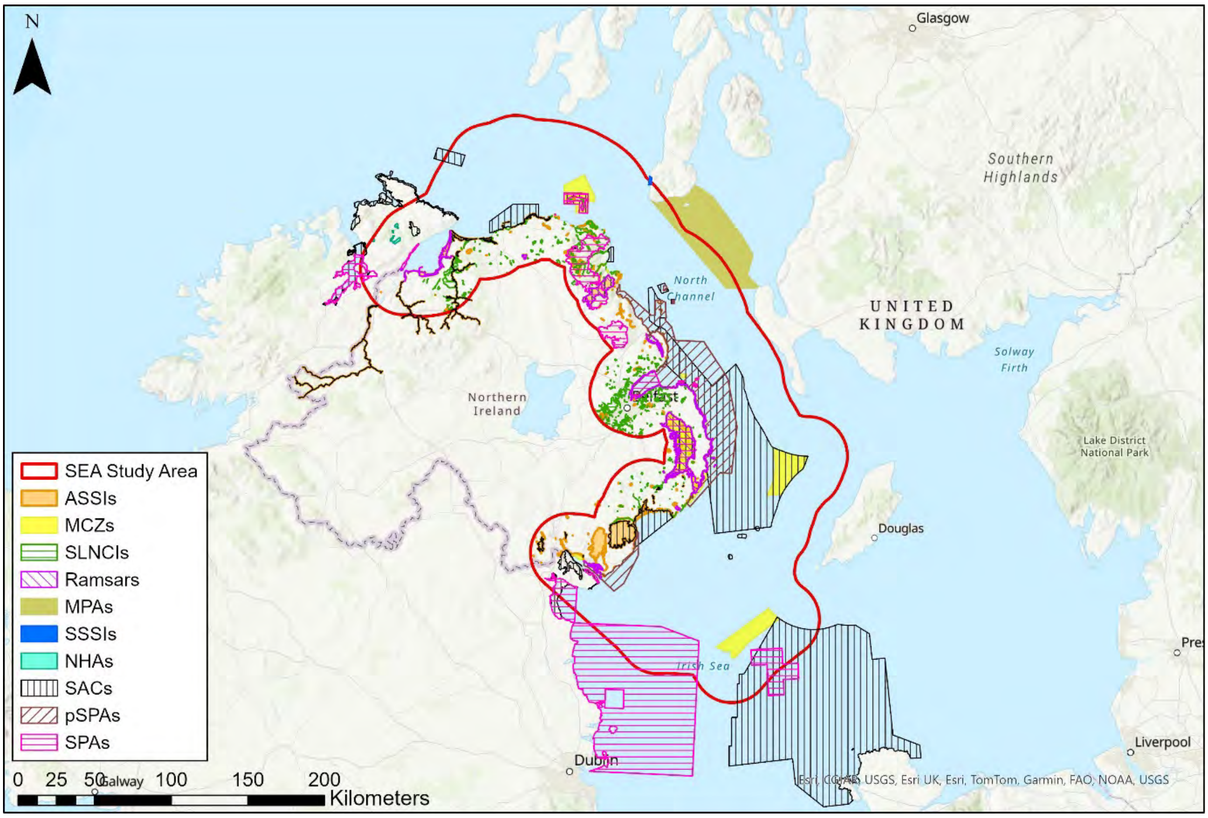

Figure 3-1 Designated sites that are within the SEA Study Area

3.2.1.1.2 Status and Trends for Sites Important at an International Level (SACs and SPAs)

Article 17 of the Habitats Directive requires that, every six years, all EU Member States report on the implementation of the Directive, including on the conservation status of habitats and species (informally known as the Article 17 report). The 4th UK Habitats Directive Report was submitted to the European Commission in August 2019, and included a General Implementation Report, Habitat Reports and Species Reports. These outlined any changes in designated habitats and species, for the UK as a whole, in the period 2013-2018[25]. Only six habitats were given an overall conservation status of 'Favourable', with eight habitats classified as 'Inadequate', 62 as 'Bad' and one classified as 'Unknown' conservation status. Of these, 22 habitats showed improvement in overall conservation status, 29 habitats showed no change, 22 habitats showed a decline, and 4 were uncertain in comparison with the results of the 3rd UK Habitats Directive Report. Of the designated species reported, 33 were given an overall conservation status of 'Favourable', 24 a status of 'Inadequate', 16 a status of 'Bad' and 20 a status of 'Unknown'. Of these, 9 species showed improvement in overall conservation status, 47 showed no change, 12 showed decline and 25 were uncertain in comparison with the results of the 3rd UK Habitats Directive Report.

Article 12 of the Birds Directive requires that, every six years, all EU Member States report on the implementation of the Directive. The 11th UK Report for Article 12 of the EU Birds Directive was submitted to the European Commission in October 2019. The report format includes both a General Report on the implementation of the Directive (Annex A), and a Bird Species Status and Trends Report containing individual assessments for all relevant bird species (Annex B). Of the 319 birds included in this assessment (including in some cases both breeding and wintering populations separately), 131 showed a short-term decreasing population trend, while 108 showed a long-term decreasing population trend.

Following the UK's exit from the EU, reporting to the European Commission will no longer be required, however, DAERA will report periodically every 6 years following exit from the EU. The first of these reports is due in 2026.

3.2.1.1.3 Status and Trends for Sites important at a National Level (ASSIs)

NI launched its first State of the Environment Report in 2008, containing 30 indicators that were designed to assist future comparison and measurement of the changing environment. The last full State of the Environment Report for NI was published in 2013 and, in the interim period, the NIEA has published an annual NI Environmental Statistics Report on a range of environmental indicators. The most recent report is for 2024[26], and Section 5 provides key information regarding the current status of biodiversity indicators in NI.

For the first time in 2022, and continued in 2024, a combined feature condition standard for all network features on land and sea in NI was produced. This is a new metric collated for the country which helps align with UK reporting.

The 2024 report indicated that:

- 55% of all features were in a Favourable condition;
- 36% of all features were in an Unfavourable condition;
- 3% of all features were in an Unfavourable Recovering condition;
- Less than 1% of all features were destroyed; and
- 5% of all features had an undetermined condition due to a lack of formal assessment.

When this is partitioned into the biological and earth science features assessed, 38% of habitats and 57% of species features were in Favourable condition, compared to 94% of earth science features in Favourable condition, reflecting the greater pressures on the natural environment.

These results remain very similar to the previous 10 years of reporting. NIEA is aiming to achieve Favourable condition for a much higher proportion of the ASSI network, and there is now a focus on improving the overall condition of sites towards "favourable conservation status (FCS)" through effective

[25] JNCC. 2019. Article 17 Habitats Directive Report 2019: Habitat Conservation Status Assessments. Available at: https://jncc.gov.uk/our-work/article-17-habitats-directive-report-2019-habitats/

[26] NISRA. 2024. Northern Ireland Environmental Statistics Report. May 2024. Available at: https://www.daera-ni.gov.uk/sites/default/files/publications/daera/NI%20Environmental%20Statistics%20Report%202024_0.pdf

land management to support recovery of the special features within the site. The Environmental Statistics Report 2024 states that, in 2023/2024, the area of terrestrial protected sites under management in NI was recorded as at least 299.62km^2, a significant increase since the baseline year for reporting (2015/2016) when just 2.63km^2 of terrestrial sites were under favourable management.

In the marine area, NI has international obligations which focus on nature positive conservation and management actions, including the Conservation on Biological Diversity Global Biodiversity Framework Targets. In 2024, NI had exceeded the aim to designate 30% of its marine area for protection by 2030, with 38% within the MPA network; the need for additional designation is recognised to achieve ecological coherence of the network. During 2023/2024, DAERA worked on a range of initiatives with stakeholders to develop effective management for marine MPAs, including: fishing regulations, Blue Carbon Action Plan, strategies for the conservation and management of seabirds and elasmobranchs, and cross-border MPA management plans.

3.2.1.2 Benthic and Intertidal Habitats

Benthic ecology is the flora and fauna living in, on, or closely associated with the seabed. The benthic environment of NI's coastal and offshore waters is rich and varied. Intertidal habitats comprise muddy habitats on sheltered coasts and sea loughs, exposed and sheltered rocky shores characterised by a very diverse community, and sandy shingle and gravel shores. Subtidal habitats comprise sheltered mud occurring mainly in sea loughs, subtidal sand habitats offshore of the north coast, subtidal mixed sediment gravel and cobble habitat found mainly in Strangford Lough and the Ards Peninsula, Lecale and the Mourne Coast, and rocky habitat characterised by bedrock or boulders colonised by kelp beds. Extensive offshore circalittoral mud habitat is present off the south-east coast, while areas of offshore circalittoral coarse sediment are extensive elsewhere.

The main benthic marine habitat types found within the SEA Study Area are shown in **Figure 3-2**.

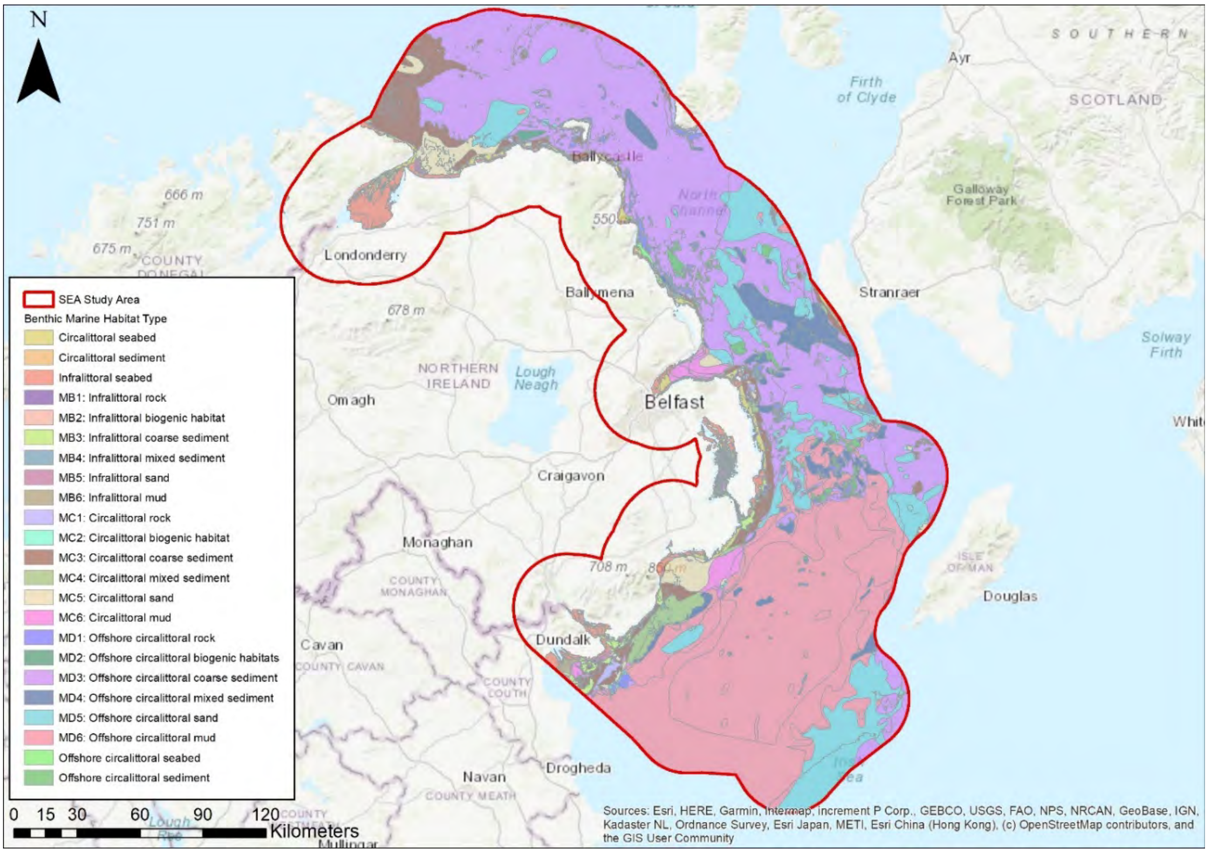

Figure 3-2 Benthic marine habitat types within the SEA Study Area

3.2.1.2.1 Protected and Priority Habitats

The NI Environment Agency (NIEA) has compiled a list of those habitats and species considered to be priority, based on their listing as a UK Priority Habitat[27]/Species[28] or importance in an all-Ireland context, and current downward trends; the most recent lists comprise 51 NI Priority Habitats, and 594 species. Of these, 22 Priority Habitats are found in the marine or coastal environment:

- Blue mussel beds;
- Coastal and floodplain grazing marsh;
- Coastal saltmarsh;
- Coastal sand dunes;
- Coastal vegetated shingle;
- Estuarine rocky habitats;
- Fragile sponge and anthozoan communities on subtidal rocky habitats;
- Horse mussel beds;
- Intertidal chalk;
- Intertidal mudflats;
- Intertidal underboulder communities;
- Maerl beds;
- Maritime cliff and slopes;
- Mud habitats in deep water;
- Peat and clay exposures;
- *Sabellaria alveolata* reefs;
- Saline lagoons;
- Seagrass beds;
- Sheltered muddy gravels;
- Subtidal chalk;
- Subtidal sands and gravels; and
- Tide-swept channels.

Some of these benthic habitats are also OSPAR threatened or declining habitats of the North East Atlantic, with areas of known locations mapped[29]. Those mapped around the NI coastline include Zostera (seagrass) beds (Strangford Lough; Dundrum Bay; Carlingford Lough; Lough Foyle; Skerries and Causeway; Waterfoot; Old Church Bay; and Rathlin Island), intertidal mudflats (Strangford Lough; Dundrum Bay; Carlingford Lough; Larne Lough; Lough Foyle; and Bann Estuary), littoral chalk communities (several locations along the north east coast; Strangford Lough, Dundrum and Newcastle), maerl beds (Strangford Lough; Carlingford Lough; off Glenarm; the north-east Antrim coast; and Rathlin island), modiolus (horse mussel) beds (primarily within, and to the east of, Strangford Lough; Belfast Lough; Carlingford Lough; and Skerries off the north coast), Sabellaria reef (off the north coast at the Giant's Causeway), sea-pen and burrowing megafauna (significant sub-tidal area off the south-east coast; and Strangford Lough).

The following Annex I marine and coastal habitat types are known to be present in NI's waters and are included within the SAC designations in NI's coastline and waters:

- **Sublittoral Habitats**
  - Sandbanks which are slightly covered by seawater at all times;
  - Large shallow inlets and bays;
  - Estuaries; and
  - Reefs.
- **Intertidal and Coastal Habitats**
  - Coastal Lagoons;

[27] DAERA NI. 2015. Northern Ireland list of priority habitats. Available at: https://www.daera-ni.gov.uk/publications/northern-ireland-list-priority-habitats

[28] DAERA NI. 2023. Northern Ireland list of priority species. Available at: https://www.daera-ni.gov.uk/publications/list-northern-ireland-priority-species-2023

[29] EMODnet. 2024. EMODnet Map Viewer. Available at: https://emodnet.ec.europa.eu/geoviewer/

- o Mudflats and sandflats not covered by seawater at low tide;
- o Submerged or partially submerged sea caves;
- o Annual vegetation of drift lines;
- o Perennial vegetation of stony banks;
- o Salicornia and other annuals colonising mud and sand;
- o Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*);
- o Sand dunes (Fixed dunes with herbaceous vegetation "grey dunes"; shifting dunes along the shoreline with *Ammophila arenaria* "white dunes"; Atlantic decalcified fixed dunes (*Calluno-Ulicetea*); dunes with *Salix repens ssp.*, argentea (*Salicion arenariae*); embryonic shifting dunes; humid dune slacks); and
- o Vegetated sea cliffs of the Atlantic and Baltic coasts.

Within the SEA Study Area, there are currently six SACs in NI and five SACs in RoI for which benthic ecology is either the primary reason for designation or is a qualifying feature, as detailed in **Table 3-3**. In addition, the Pisces Reef SAC is situated in offshore UK waters and is located within the SEA Study Area and is designated for the protection of reef habitat.

Table 3-3 SACs designated for benthic habitats within the SEA Study Area

SACs	Annex 1 Habitat
Rathlin Island	Sandbanks which are slightly covered by sea water all the time Submerged or partially submerged sea caves Annual vegetation of drift lines Vegetated sea cliffs of the Atlantic and Baltic coasts
Murlough	Sandbanks which are slightly covered by sea water all the time Dune habitats (five types) Atlantic salt meadows Mudflats and sandflats not covered by seawater at low tide
Strangford Lough	Reefs Coastal lagoons Large shallow inlets and bays Annual vegetation of drift lines Atlantic salt meadows Mudflats and sandflats not covered by seawater at low tide Perennial vegetation of stony banks Salicornia and other annuals colonising mud and sand
Red Bay	Sandbanks which are slightly covered by sea water all the time
Skerries and Causeway	Reefs Sandbanks which are slightly covered by sea water all the time Submerged or partially submerged sea caves
The Maidens	Reefs Sandbanks which are slightly covered by sea water all the time
Pisces Reef (UK Offshore SAC)	Reefs
Lough Swilly (RoI)	Atlantic Salt Meadows Coastal Lagoons Estuaries
Hempton's Turbot Bank (RoI)	Sandbanks which are slightly covered by sea water all the time
Dundalk Bay (RoI)	Estuaries Mudflats and sandflats not covered by seawater at low tide Perennial vegetation of stony banks Salicornia and other annuals colonising mud and sand Atlantic salt meadows

	Mediterranean salt meadows
Carlingford Shore (RoI)	Annual vegetation of drift lines Perennial vegetation of stony banks
North Inishowen Coast (RoI)	Mudflats and sandflats not covered by seawater at low tide Perennial vegetation of stony banks Vegetated sea cliffs of the Atlantic and Baltic coasts Fixed coastal dunes with herbaceous vegetation (grey dunes)

There are currently five MCZs in the NI inshore region (designated under the Marine Act (NI) 2013) that provide protection to a range of representative and threatened rare or declining habitats and species. The habitat features that are proposed MCZ (pMCZ) features of these sites are as follows:

- Deep-sea bed: Rathlin Island MCZ is the only known location of this broad scale habitat. This habitat is particularly unique in NI inshore waters due to the steep drop-off in depth (>200m), close proximity to land and a range of deep subtidal sands, mixed sediments and rock.
- Seagrass bed (*Zostera marina*) on subtidal (sublittoral) sand: Waterfoot MCZ (located in a small embayment offshore from the village of Waterfoot, within the Red Bay area on the east coast of Co. Antrim) has been designated for this habitat type. Seagrass density is declining in UK waters, and although present throughout NI, the subtidal bed in this MCZ is extensive and in good condition.
- Subtidal (sublittoral) sand: Outer Belfast Lough MCZ has been designated for this habitat type. This heterogeneous habitat incorporates occasional small patches of gravelly muddy sand. The masked crab (*Corystes cassivelaunus*), king scallop (*Pecten maximus*) and sand burrowing brittlestar (*Amphiura brachiata*) have been recorded within the MCZ; these are representative species associated with the seabed type.
- Subtidal (sublittoral) mud: Carlingford Lough MCZ has been designated for this habitat type, which includes white lobe shell (*Philine aperta*) and sea-pen (*Virgularia mirabilis*) in soft stable infralittoral mud.

In addition, the South Rigg and Queenie Corner MCZs are situated in offshore UK waters between NI and the Isle of Man and Wales, respectively. South Rigg MCZ is designated for benthic subtidal habitat features, such as mud, sand, coarse and mixed sediments, sea-pen and burrowing megafaunal communities, and circalittoral rock. Queenie Corner MCZ is designated for sea-pen and burrowing megafaunal communities and subtidal mud. An equivalent designation in Scottish territorial waters is also in proximity to the SEA Study Area, the Clyde Sea Sill Nature Conservation MPA, designated under the Marine (Scotland) Act 2010. This site is situated to the north-east of Antrim Plateau between NI and Scotland and is designated for the protection of marine geological and geomorphological features, benthic habitats, and black guillemot.

3.2.1.3 Fish and Shellfish

NI's coastal waters are home to approximately 100 species of regularly occurring marine fish. There are two main categories of fish: pelagic and demersal. Pelagic fish are those that live in the mid-water, often occurring in shoals, such as herring and mackerel. Demersal fish are those that live at, or close to, the sea floor. Of these, some have a greater association with the seabed e.g., flatfish and ray, while others forage in a layer that can be several tens of metres above the seabed e.g., cod-like fishes. Both pelagic and demersal species can make extensive migrations between spawning and feeding grounds. Migrations are usually revealed by tag, release, and recapture experiments; although these can indicate broad-scale movements, they do not provide information on migration pathways. Pelagic fish species also undertake diurnal vertical migrations, so that they may occupy all water column depths at some point during the day; herring and mackerel for example, can both descend to 100m, where depth allows. Demersal fish species identified that are likely to be found in NI waters include sandeel *Ammodytidae spp.,* whiting *Merlangius merlangu*, lemon sole *Microstomus kitt*, ling *Molva molva*, plaice *Pleuronectes platessa*, cod *Gadus morhua* and European hake *Merluccius merlucciu*s (hereafter referred to as hake). Pelagic species include herring *Clupea harengus*, mackerel *Scomber scombrus*, sprat *Sprattus sprattus* and European sea bass *Dicentrarchus labrax*.

Skates, sharks and rays (elasmobranchs) are an important part of the NI marine ecosystem, however there is relatively limited knowledge about their abundance and distribution. There is evidence of 17 species of elasmobranch fish (cartilaginous fish, comprising sharks, rays and skates) in NI waters; 6 species of ray and 11 species of shark. Shark species recorded in the area include basking shark *Cetorhinus maximus*, spurdog *Squalus acanthias*, tope shark *Galeorhinus galeus*, porbeagle shark *Lamna nasus*, small-spotted catshark *Scyliorhinus canicula*, and nursehound *Scyliorhinus stellaris*, while skate and ray species include thornback ray *Raja clavata*, spotted ray *Raja montagui*, blonde ray *Raja brachyura*, cuckoo ray *Leucoraja naevus*, common skate *Dipturus batis* and undulate ray *Raja undulata* [30]. The slow growth rates, late maturity and small litter characteristics of many elasmobranchs render them among the most vulnerable of marine fish. Consequently, a number of elasmobranch species present in NI waters are considered endangered and included on the International Union for Conservation of Nature (IUCN) (the World Conservation Union) Red List. This species group is therefore one of particular sensitivity to the impacts of marine development. High sensitivity species present in NI's waters include common skate, white skate, spotted ray and spurdog. The main areas where basking sharks have been seen are Rathlin Island, Co. Antrim; Portrush, Co. Antrim; St. Johns Point, Co. Down; and Belfast Lough and Strangford Lough, Co. Down; three sightings of this species have been recorded in the past year, and there is evidence of migration through the Irish Sea[31]. DAERA are currently developing an Elasmobranch Strategy for NI; objectives from this upcoming Strategy will need to be considered when undertaking developments within NI's marine environment.

Shellfish comprise exoskeleton-bearing aquatic invertebrates used as food, including various species of commercial molluscs and crustaceans; shellfish also includes cephalopods.

3.2.1.3.1 Protected and Priority Fish and Shellfish Species

Several of the species that may be found within the Plan area are listed on the IUCN Red List of Threatened Species (e.g., common skate, cod and haddock), and some are also Priority Species in NI (e.g., basking shark). In total, there are 31 species of marine or freshwater/marine fish species listed as NI Priority Species. These Priority Species require conservation action because of their decline, rarity, and importance in an all-Ireland and UK context, and public bodies in NI must take these species into consideration and further their conservation as far as is reasonably practical as part of their biodiversity duty. Further information on the legislation and agreements protecting these species is provided in **Table 3-4**[32].

Table 3-4 Protected and Priority Fish species within the SEA Study Area

Name	IUCN[1]	Habitats Directive	OSPAR	Bern	Bonn	Conservation Regs	Wildlife Order	Fisheries Acts	Irish Red List[1]
Bony Fish									
Allis shad *Alosa alosa*	LC	Annex II	✓	✓		✓		✓	V
Twaite shad *Alosa fallax*		Annex V		✓		✓			V
Lesser/Raitt's sandeel *Ammodytes marinus*									
Lesser sandeel									

[30]NBN Atlas - UK's largest collection of biodiversity information National Biodiversity Network Trust (NBN Trust). 2024. NBN Atlas. Available at: https://nbnatlas.org/

[31] Doherty, P.D., Baxter, J.M., Gell, F.R., Godley, B.J., Graham, R.T., Hall, G., Hall, J., Hawkes, L.A., Henderson, S.M., Johnson, L. and Speedie, C. 2017. Long-term satellite tracking reveals variable seasonal migration strategies of basking sharks in the north-east Atlantic. Scientific reports, 7(1), pp.42837. Available at: https://pubmed.ncbi.nlm.nih.gov/28216646/

[32] Habitas. 2010. Northern Ireland Priority Species. Available at: https://www.habitas.org.uk/priority/types.asp

Name	IUCN[1]	Habitats Directive	OSPAR	Bern	Bonn	Conservation Regs	Wildlife Order	Fisheries Acts	Irish Red List[1]
Ammodytes tobianus									
Greater sandeel *Hyperoplus lanceolatus*	CR								
European eel *Anguilla Anguilla*			✓					✓	CR
Herring *Clupea harengus*	LC								
Pollan *Coregonus autumalis*	E	Annex V						✓	V
Atlantic cod *Gadus morhua*	T		✓						
Whiting *Merlangius merlangus*									
European hake *Merluccius merluccius*									
Smelt *Osmerus eperlanus*									V
Atlantic salmon *Salmo salar*	LC	Annex II and V (fw)	✓	Y (fw)		✓		✓	V
Brown/sea trout *Salmo trutta*	LC							✓	LC
Turbot *Scophthalmus maximus*	D (Eur) V (Glo)								
Atlantic blue-fin tuna *Thunnus thynnus*			✓						
Elasmobranch									
Basking shark *Cetorhinus maximus*	E (Eur) V (Glo)		✓	✓	✓		✓		E
Common (blue) skate *Dipturus batis*	CR (Eur) E (Glo)		✓				✓		CR
Common (flapper) skate *Dipturus intermedia*	CR		✓						CR
Tope *Galeorhinus galeus*	V								V

Name	IUCN[1]	Habitats Directive	OSPAR	Bern	Bonn	Conservation Regs	Wildlife Order	Fisheries Acts	Irish Red List[1]
Porbeagle *Lamna nasus*	CR (Eur) E (Glo)		✓						CR
Cuckoo ray *Leucoraja naevus*	LC								V
Blonde ray *Raja brachyura*	NT								NT
Thornback ray *Raja clavata*	NT		✓						LC
Spotted ray *Raja monagui*	LC		✓						LC
Undulate ray *Raja undulata*	NT (Eur) E (Glo)								E
White skate *Rostroraja alba*	CR (Eur) E (Glo)		✓						CR
Spiny dogfish (spurdog) *Squalus acanthias*	E (Eur) V (Glo)		✓						E
Angel shark (monkfish) *Squatina squatina*	CR		✓				✓		CR
Jawless fish									
Sea lamprey *Petromyzon marinus*	LC	Annex II	✓					✓	NT
River lamprey *Lampetra fluviatilis*	LC	Annex II and V (fw)						✓	LC

[1]LC=Least Concern; D=Declining; V=Vulnerable; NT=Near Threatened; E=Endangered; CR=Critical; Eur=European Status; Glo=Global Status

Under Article 10 of the Wildlife (NI) Order 1985 (as amended) it is an offence to intentionally or recklessly, injure or kill a wild animal included in Schedule 5 of this Order. This includes angel shark and common skate (in respect to Article 10 (1) only and within 6 nautical miles (nm) of coastal water only).

In addition, there are four species of marine crustaceans and 16 species of marine molluscs included as NI Priority Species. Three of the four species of crustaceans are not legally protected while the fourth, the European spiny lobster is protected under the Wildlife (NI) Order, the Wildlife and Natural Environment Act (NI) 2011, and fisheries protection measures. Of the priority species of marine mollusc, the fan mussel is protected under the Wildlife (NI) Order, whilst the ocean quahog is protected under MCZ designation. The spiny lobster, fan mussel, short snouted seahorse, and spiny seahorse are protected under Article 10 of the Wildlife (NI) Order 1985 (as amended), which make it is an offence to intentionally or recklessly, injure or kill these species. It is also an offence intentionally or recklessly disturb any such animal while it is occupying a structure or place which it uses for shelter or protection; damage or destroy, or obstruct access to, any structure or place which any such animal uses for shelter or protection; damage or destroy anything which conceals or protects any such structure; or to have in possession or control any live or dead wild animal included in Schedule 5 or any part of, or anything derived from, such an animal. The Outer Belfast Lough MCZ has been designated for its well-established population of ocean quahog, a long-lived suspension feeding marine mollusc that lives buried within the sediment. This species is distributed throughout NI, in a range of sediments from coarse sand to muddy sand, and over a wide depth range from 4m to 400m+. In Outer Belfast Lough, it is restricted to a small area of predominantly sublittoral firm sediments at 20-25m depth at the mouth of the Lough in a dense aggregation (densities of 4.5 individuals/m^2). The ocean quahog is an important food source for several species of fish, including cod. Four scallop enhancement sites have been established by DAERA, at Ballyquintin, Drumfad Bay, Roaring Rock and Whitehead, with protection in the form of management measures prohibiting fishing by demersal mobile fishing gear and diving for scallops at these locations through The Scallop Enhancement Sites (Prohibited Methods of Fishing) Regulations (NI) 2022[33].

There are currently no coastal or marine SACs in NI that are designated for the protection of marine fish or shellfish, however, species of diadromous migratory species such as Atlantic salmon (*Salmo salar*), sea trout (*Salmo trutta*), allis shad (*Alosa alosa*), twaite shad (*Alosa fallax*) and European eel (*Anguilla Anguilla*) are designated within freshwater SACs as they spend part of their lifecycle in freshwater and part at sea. Salmon and sea trout spawn in freshwater and then migrate to sea to mature, while eel mature in freshwater and reproduce at sea. These species occur within the SEA Study Area as there are a number of rivers that flow out to sea and are known to contain populations, including:

- The Foyle, Faughan, Roe, Lower Bann, Bush and Glensheak rivers along the North Coast;
- The Glendun, Glenariff and Glenarm rivers along the north-east coast;
- The River Lagan, which flows into Belfast Lough;
- The Moneycarragh, Shimna, Annalong and Kilkeel rivers along the south-east coast;
- The White Water, Cassy Water and Newry rivers which flow into Carlingford Lough.

The degree to which these areas are sensitive to interaction with renewable energy development will vary according to the species and the time of year. Shad, for instance, feed in estuaries before moving upstream to spawn (April – July). Salmon, however, leave their river homes in spring and early summer, and migrate towards feeding areas in the Nordic Seas and West Greenland. In contrast, sea trout are more likely to remain in nearshore waters rather than undergoing extensive migrations. For eels, peak migration takes place on the increasing tides in April and May.

3.2.1.3.2 Spawning and Nursery Grounds

Habitats of ecological importance for marine fish include those important for breeding (mating sites, spawning grounds where fish aggregate to spawn, and parturition grounds), those important for recruitment and early-stage growth (nursery grounds) and those important for feeding and migration. The eggs of most finfish are pelagic; on hatching they pass through larval and post-larval stages before metamorphosing into their adult form. The eggs and larval stages drift with the currents, with their ultimate destination dependent on factors such as the location of the spawning area, the currents, and the duration of the larval stage. The metamorphosed juveniles may remain dispersed, or they may aggregate on nursery grounds; the latter includes herring, sprat and whiting in sea loughs or sheltered coastal areas, and plaice in the intertidal zone of sandy beaches. Owing to these characteristics any assessment of the effects of offshore renewable devices on fish needs to consider all stages of life history, which may differ quite considerably between species. The mobility of species at different stages of their life history may also influence their ability to avoid potentially harmful devices.

The Draft Marine Plan for NI identified that a natural gyre circulatory system is present in the south-east, which creates ideal spawning and breeding grounds for a wide range of commercial fish species[34].

[33] The Scallop Enhancement Sites (Prohibited Methods of Fishing) Regulations (Northern Ireland) 2022 No. 272. Available at: https://www.legislation.gov.uk/nisr/2022/272/contents

[34] DAERA NI. 2018. Draft Marine Plan for Northern Ireland. Available at: https://www.daera-ni.gov.uk/sites/default/files/consultations/daera/Marine%20Plan%20for%20NI%20final%2016%2004%2018.PDF

Coull *et al*. (1998)[35], and Ellis *et al*. (2012)[36], have described and mapped known spawning and nursery grounds for selected fish species in UK waters, including species of commercial and conservation importance. Within NI waters, the species shown in **Table 3-5** were identified as having spawning and/or nursery grounds. Areas of known mapped spawning grounds within the SEA Study Area are shown in **Figure 3-3**, and areas of known mapped nursery grounds are shown in **Figure 3-4** (Coull *et al*., 1998 and Ellis *et al*., 2012). In addition, AFBI and Cefas have conducted egg production surveys which can provide an indication on the location of spawning areas, and AFBI undertook an early Summer (May/June) NIMIK (NI Methot-Isaacs-Kidd) survey which can provide an indication of potential juvenile nursery area locations for the following species: cod, haddock, whiting and plaice. Spawning grounds for the majority of species are concentrated in the south-east of the SEA Study Area, while nursery grounds for many species are also within this region.

Table 3-5: Species with spawning and/or nursery grounds within NI waters (Coull *et al*. 1998; Ellis *et al*. 2012)

Common Name	Species	Spawning	Nursery
Anglerfish	*Lophius piscatorius*	N/A	High and low intensity
Cod	*Gadus morhua*	High and low intensity	High and low intensity
Haddock	*Melanogrammus aeglefinus*	N/A	Undefined intensity
Hake	*Merluccius merluccius*	N/A	Low intensity
Herring	*Clupea harengus*	Undefined intensity	High and low intensity
Horse mackerel	*Trachurus trachurus*	Low intensity	N/A
Ling	*Molva molva*	Low intensity	Low intensity
Mackerel	*Scomber scombrus*	Low intensity	High and low intensity
Plaice	*Pleuronectes platessa*	High and low intensity	Low intensity
Saithe	*Pollachius virens*	N/A	Undefined intensity
Sandeel	Ammodytidae spp.	Low intensity	Low intensity
Sole	*Solea solea*	Low intensity	N/A
Sprat	*Sprattus sprattus*	Undefined intensity	N/A
Whiting	*Merlangius merlangus*	Low intensity	High and low intensity
Common skate	*Dipturus batis*	N/A	Low intensity
Spotted ray	*Raja montagui*	N/A	Low intensity
Spurdog	*Squalus acanthias*	N/A	High intensity
Thornback ray	*Raja clavate*	N/A	Low intensity
Tope shark	*Galeorhinus galeus*	N/A	Low intensity
Nephrops	*Nephrops norvegicus*	Undefined and high intensity	Undefined intensity

[35] Coull, K.A., Johnstone, R., and S.I. Rogers. 1998. Fisheries Sensitivity Maps in British Waters. UKOOA Ltd. Available at: https://www.cefas.co.uk/media/o0fgfobd/sensi_maps.pdf

[36] Ellis, J.R., Milligan, S.P., Readdy, L., Taylor, N. and Brown, M.J. 2012. Spawning and nursery grounds of selected fish species in UK waters. Sci. Ser. Tech. Rep. 147. Cefas Lowestoft, pp.56. Available at: https://tethys.pnnl.gov/sites/default/files/publications/Ellisetal2012.pdf

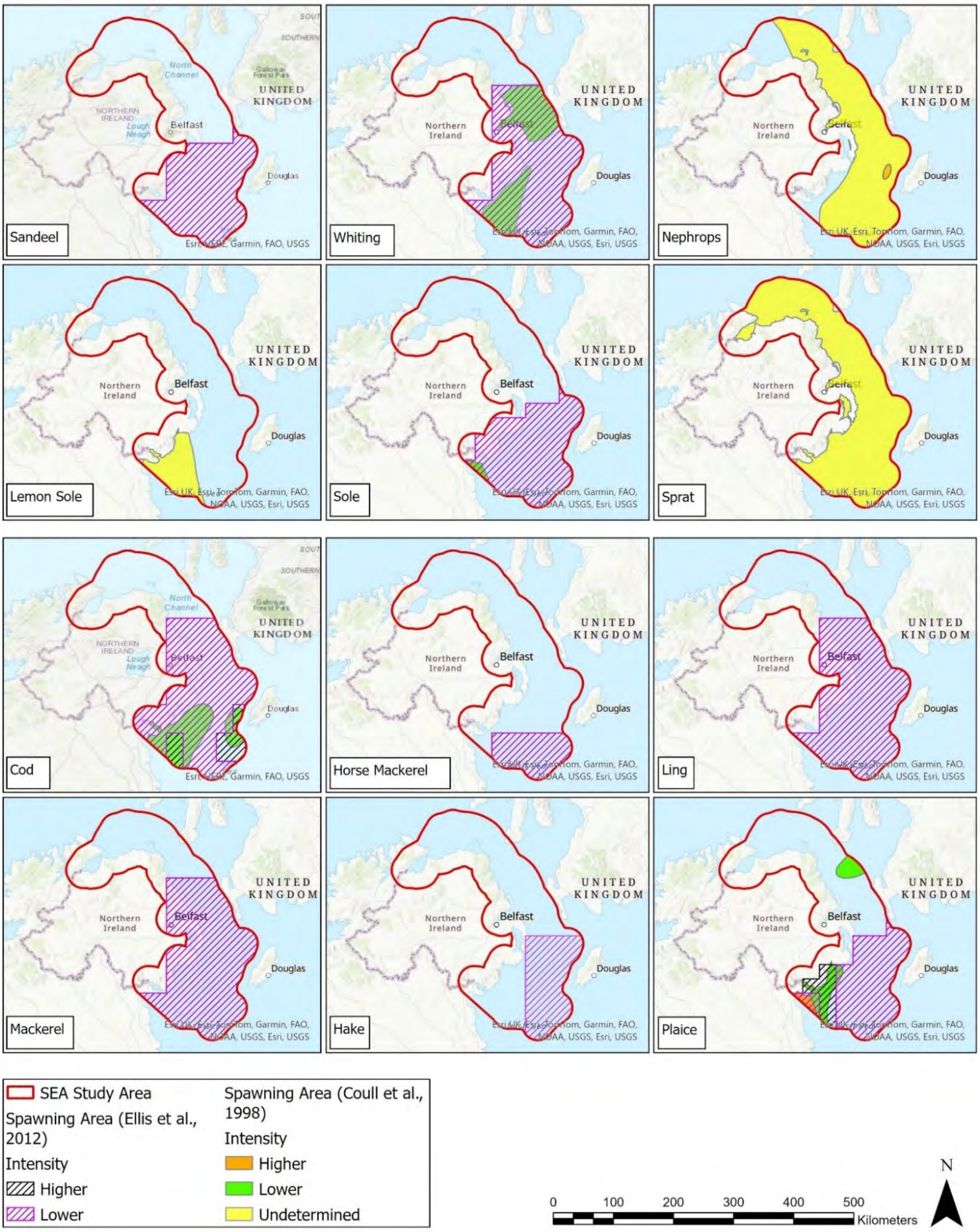

Figure 3-3 Fish Spawning Grounds within the SEA Study Area (Coull *et al*. 1998; Ellis *et al*. 2012).

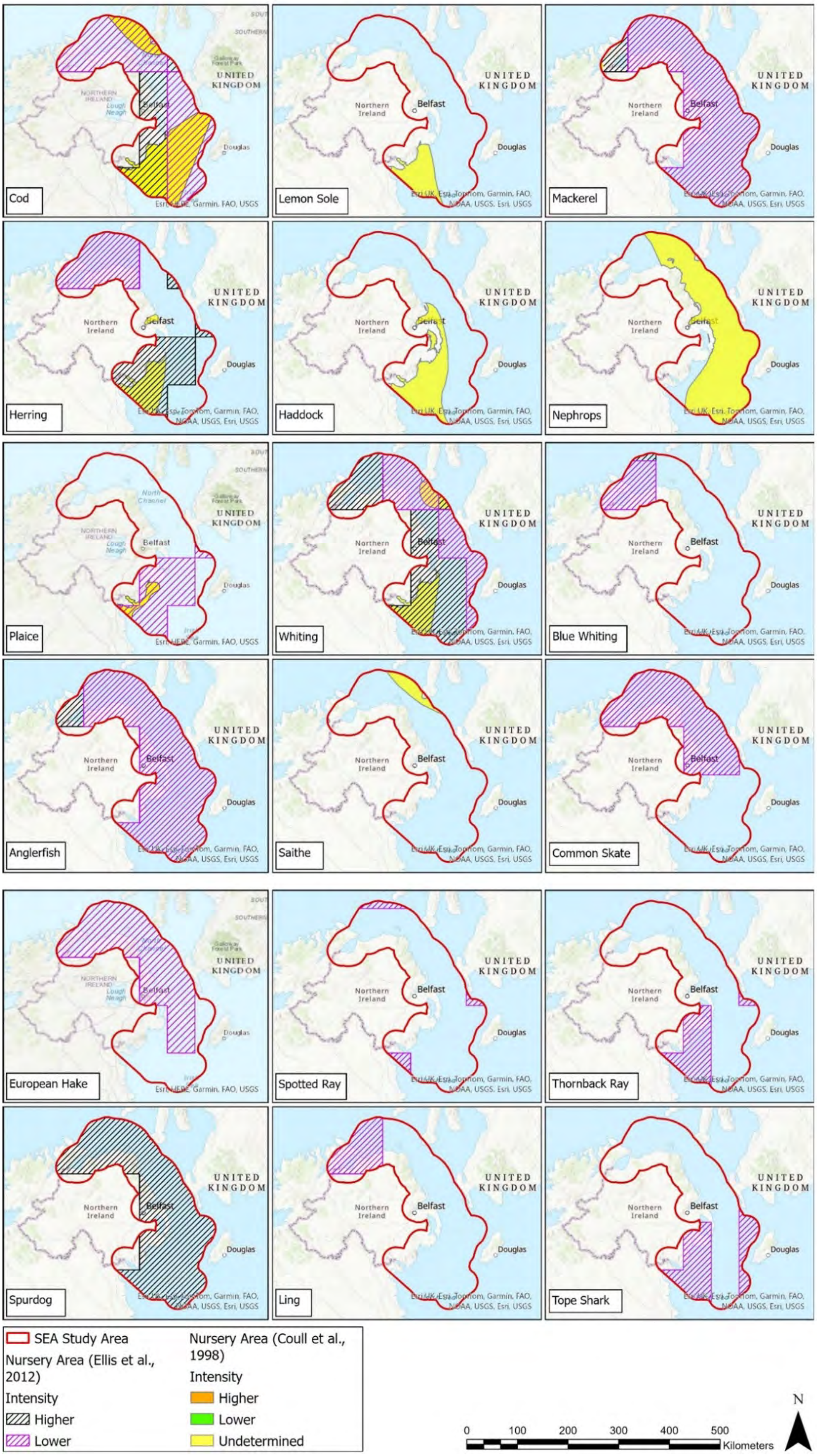

Figure 3-4 Fish Nursery Grounds within the SEA Study Area (Coull *et al*. 1998; Ellis *et al*. 2012)

3.2.1.3.3 Fisheries

Analysis of fisheries statistics can provide a good indication of the type of species present in the SEA Study Area. It should be noted that this does not provide a definitive guide to the finfish and shellfish in the area and the levels of catch do not correspond directly to community structure. However, as many of the species found in the waters of NI are commercially exploitable, it does serve as a useful indicator. **Section 3.2.7.3** describes the commercial species most commonly caught by the NI fleet.

3.2.1.3.4 Status and Vulnerabilities of Fish

The UK assessment of environmental status for the MS (2019) indicates that demersal fish communities are recovering from past over-exploitation in the UK, but that GES has not yet been achieved in the Greater North Sea or Celtic Seas, while a partial assessment of pelagic fish did not provide a clear result.

Offshore wind farms have the potential to adversely affect fish and shellfish in a number of ways during construction and operation, including via underwater noise during construction, electromagnetic fields (EMF) emitted from cables during operation, collision risk and changes to ground conditions and supporting habitat.

3.2.1.4 Birds

3.2.1.4.1 Areas of importance to seabirds

The NI coastline and marine area supports nationally and internationally important populations of a large number of seabird species. It can be difficult to make accurate assessments of the temporal and spatial distribution of bird species, owing to their highly mobile nature, particularly in offshore environments. Information available on SPAs and Important Bird Areas (IBAs) provides an indication of the areas of greatest importance for seabird populations, including important breeding grounds, and for wintering or migratory populations.

Protection is provided to certain species of breeding migrating and wintering birds through the establishment of SPAs under the Birds Directive and the Conservation (Natural Habitats, etc.) Regulations (NI) within NI territory, and under the European Communities (Birds and Habitats) Regulations 2011 for transboundary sites within RoI. The location of these SPAs within the SEA Study Area is shown in **Figure 3-1**, and details of the bird species for which these sites were designated are provided in **Table 3-6**.

Table 3-6 Coastal/marine SPAs and their designated species within the SEA Study Area

Site	Designated Species
Carlingford Lough	Sandwich tern *Sterna sandvicensis* (breeding) Common tern *Sterna hirundo* (breeding) Light-bellied brent goose *Branta bernicla hrota* (wintering) Wetland and waterbirds
Carlingford Marine proposed SPA (extension of existing Carlingford Lough SPA)	Sandwich tern *Sterna sandvicensis* (breeding) Common tern *Sterna hirundo* (breeding) Light-bellied brent goose *Branta bernicla hrota* (wintering)
Killough Bay	Light-bellied brent goose *Branta bernicla hrota* (wintering)
Strangford Lough	Sandwich tern *Sterna sandvicensis* (breeding) Common tern *Sterna hirundo* (breeding) Arctic tern *Sterna paradisaea* (breeding) Light-bellied brent goose *Branta bernicla hrota* (wintering) Redshank *Tringa tetanus* (wintering) Knot *Calidris canutus* (wintering) Waterbird assemblage

Site	Designated Species
Outer Ards	Turnstone *Arenaria interpres* (wintering) Light-bellied brent goose *Branta bernicla hrota* (wintering) Ringed plover *Charadrius hiaticula* (wintering) Golden plover *Pluvialis apricaria* (wintering) Arctic tern *Sterna paradisaea* (breeding)
Copeland Islands	Arctic tern *Sterna paradisaea* (breeding) Manx shearwater *Puffinus puffinus* (breeding)
Belfast Lough Open Water	Great crested grebe *Podiceps cristatus* (wintering)
Belfast Lough	Redshank *Tringa tetanus* (wintering) Bar-tailed godwit *Limosa lapponica* (wintering) Black-tailed godwit *Limosa limosa* (wintering) Common tern *Sterna hirundo* (breeding) Arctic tern *Sterna paradisaea* (breeding)
Larne Lough	Light-bellied brent goose *Branta bernicla hrota* (wintering) Mediterranean gull *Larus melanocephalus* (breeding) Roseate tern *Sterna dougallii* (breeding) Common tern *Sterna hirundo* (breeding) Sandwich tern *Sterna sandvicensis* (breeding)
Rathlin Island	Razorbill *Alca torda* (breeding) Black-legged kittiwake *Rissa tridactlya* (breeding) Common guillemot *Uria aalge* (breeding) Seabird assemblage
Sheep Island	Cormorant *Phalacrocorax carbo* (breeding)
Lough Foyle	Light-bellied brent goose *Branta bernicla hrota* (wintering) Bar-tailed godwit *Limosa lapponica* (wintering) Waterbird assemblage
East Coast Marine proposed SPA	Great Crested grebe *Podiceps cristatus* (wintering) Red-throated diver *Gavia stellata* (wintering) Sandwich tern *Sterna sandvicensis* (breeding) Common tern *Sterna hirundo* (breeding) Arctic tern *Sterna paradisaea* (breeding) Manx shearwater *Puffinus puffinus* (breeding) Eider duck *Somateria mollissima* (wintering)
Irish Sea Front (UK Offshore)	Manx shearwater *Puffinus puffinus* (breeding)
North-West Irish Sea (RoI)	Red-throated Diver *Gavia stellata* (wintering) Great Northern Diver *Gavia immer* (wintering) Fulmar *Fulmarus glacialis* (breeding) Manx Shearwater *Puffinus puffinus* (breeding) Cormorant *Phalacrocorax carbo* (breeding) Shag *Phalacrocorax aristotelis* (breeding) Common Scoter *Melanitta nigra* (wintering) Little Gull *Larus minutus* (wintering) Black-headed Gull *Chroicocephalus ridibundus* (wintering) Common Gull *Larus canus* (wintering) Lesser Black-backed Gull *Larus fuscus* (breeding) Herring Gull *Larus argentatus* (breeding) Great Black-backed *Gull Larus marinus* (wintering) Kittiwake *Rissa tridactyla* (breeding) Roseate Tern *Sterna dougallii* (breeding) Common Tern *Sterna hirundo* (breeding)

Site	Designated Species
	Arctic Tern *Sterna paradisaea* (breeding) Little Tern *Sterna albifrons* (breeding) Guillemot *Uria aalge* (breeding) Razorbill *Alca torda* (breeding) Puffin *Fratercula arctica* (breeding)
Carlingford Lough (RoI)	Light-bellied Brent Goose *Branta bernicla hrota* (wintering) Wetland and Waterbirds
Lough Foyle (RoI)	Red-throated Diver *Gavia stellata* (wintering) Great Crested Grebe *Podiceps cristatus* (wintering) Bewick's Swan *Cygnus columbianus bewickii* (wintering) Whooper Swan *Cygnus cygnus* (wintering) Greylag Goose *Anser anser* (wintering) Light-bellied Brent Goose *Branta bernicla hrota* (wintering) Shelduck *Tadorna tadorna* (wintering) Wigeon *Anas Penelope* (wintering) Teal *Anas crecca* (wintering) Mallard *Anas platyrhynchos* (wintering) Eider *Somateria mollissima* (wintering) Red-breasted *Merganser Mergus serrator* (wintering) Oystercatcher *Haematopus ostralegus* (wintering) Golden Plover *Pluvialis apricaria* (wintering) Lapwing *Vanellus vanellus* (wintering) Knot *Calidris canutus* (wintering) Dunlin *Calidris alpina* (wintering) Bar-tailed Godwit *Limosa lapponica* (wintering) Curlew *Numenius arquata* (wintering) Redshank *Tringa tetanus* (wintering) Black-headed Gull *Chroicocephalus ridibundus* (wintering) Common Gull *Larus canus* (wintering) Herring Gull *Larus argentatus* (wintering) Wetland and Waterbirds
Dundalk Bay (RoI)	Great Crested Grebe *Podiceps cristatus* (wintering) Greylag Goose *Anser anser* (wintering) Light-bellied Brent Goose *Branta bernicla hrota* (wintering) Shelduck *Tadorna tadorna* (wintering) Teal *Anas crecca* (wintering) Mallard *Anas platyrhynchos* (wintering) Pintail *Anas acuta* (wintering) Common Scoter *Melanitta nigra* (wintering) Red-breasted Merganser *Mergus serrator* (wintering) Oystercatcher *Haematopus ostralegus* (wintering) Ringed Plover *Charadrius hiaticula* (wintering) Golden Plover *Pluvialis apricaria* (wintering) Grey Plover *Pluvialis squatarola* (wintering) Lapwing *Vanellus vanellus* (wintering) Knot *Calidris canutus* (wintering) Dunlin *Calidris alpina* (wintering) Black-tailed Godwit *Limosa limosa* (wintering) Bar-tailed Godwit *Limosa lapponica* (wintering) Curlew *Numenius arquata* (wintering) Redshank *Tringa tetanus* (wintering) Black-headed Gull *Chroicocephalus ridibundus* (wintering) Common Gull *Larus canus* (wintering)

Site	Designated Species
	Herring Gull *Larus argentatus* (wintering) Wetland and Waterbirds
Lough Swilly (RoI)	Great Crested Grebe *Podiceps cristatus* (wintering) Grey Heron *Ardea cinerea* (wintering) Whooper Swan *Cygnus cygnus* (wintering) Greylag Goose *Anser anser* (wintering) Shelduck *Tadorna tadorna* (wintering) Wigeon *Anas penelope* (wintering Teal *Anas crecca* (wintering) Mallard *Anas platyrhynchos* (wintering) Shoveler *Anas clypeata* (wintering) Scaup *Aythya marila* (wintering) Goldeneye *Bucephala clangula* (wintering) Red-breasted Merganser *Mergus serrator* (wintering) Coot *Fulica atra* (wintering) Oystercatcher *Haematopus ostralegus* (wintering) Knot *Calidris canutus* (wintering) Dunlin *Calidris alpina* (wintering) Curlew *Numenius arquata* (wintering) Redshank *Tringa totanus* (wintering) Greenshank *Tringa nebularia* (wintering) Black-headed Gull *Chroicocephalus ridibundus* (breeding) Common Gull *Larus canus* (wintering) Sandwich Tern *Sterna sandvicensis* (breeding) Common Tern *Sterna hirundo* (breeding) Greenland White-fronted goose *Anser albifrons flavirostris* (wintering) Wetlands and Waterbirds

Rathlin Island MCZ has also been designated for its importance in supporting a large population of black guillemots (*Cepphus grylle*) (in addition to deep-sea bed and geological/geomorphological features), which nest within the island's cliffs. This species has a wide distribution in NI, however, the breeding and nesting population at Rathlin Island is significant, with the reproductive success likely associated with the highly productive waters and rich feeding grounds within the MCZ. This population is also afforded indirect protection through the SAC (Annex I Habitat is Vegetated sea cliffs) and SPA (Annex II breeding seabird population which also nest on the cliffs) designations for Rathlin Island.

Seabirds for which sites have been designated outside of NI may also have potential to be affected by the implementation of the OREAP. Many seabirds, such as northern gannet (*Morus bassanus*), fulmar (*Fulmarus glacialis*), and Manx shearwater (*Puffinus puffinus*), have extensive foraging ranges, extending for several hundred kilometres from their breeding colonies[37]. SPAs in Scotland in proximity to the SEA Study Area, and which include seabird species as qualifying species, include Ailsa Craig SPA, and Loch of Inch and Torrs Warren SPA. The Clyde Sea Sill Nature Conservation MPA, designated under the Marine (Scotland) Act 2010, is designated in part for the protection of black guillemot.

Several of the species that may be found within the SEA Study Area are listed as Priority Species in NI. In total, there are 85 species of birds listed as NI Priority Species. Of these, there are 32 species whose broad habitat type either includes marine habitats or is solely marine. These include seabird species for which SPAs have been designated, as described previously, as well as species classified as vulnerable or endangered by the IUCN (e.g., dunlin, purple sandpiper, black-headed gull, long-tailed duck, puffin, shag).

[37] Woodward, I., Thaxter, C.B., Owen, E. and Cook, A.S.C.P. 2019. Desk-Based Revision of Seabird Foraging Ranges Used for HRA Screening. BTO Research Report No. 724, British Trust for Ornithology, Thetford. ISBN 978-1-912642-12-0.

In addition to designated SPAs and MCZs, a network of sites known as Important Bird Areas (IBAs) have been identified by BirdLife International as critical for the long-term viability of bird populations. These sites are not afforded any statutory protection but provide an indication of those areas of UK waters of particular importance to seabirds and may overlap with statutory designations. IBAs are selected due to the numbers and species of birds that they hold and are of particular significance for those species that congregate in large numbers. There are 13 IBAs with a coastal component that overlap with the SEA Study Area; these are described in **Table 3-7** and their locations are shown in **Figure 3-5**.

Table 3-7 Important Bird Areas that overlap with the SEA Study Area

Site Name	Species supported	Current Condition
Antrim Hills	Typical assemblage of upland bird species.	Not assessed
Belfast Lough	Important for wintering waders and wildfowl, with man-made lagoons in the Inner Harbour holding the main wader roost.	Unfavourable
Carlingford Lough	Important for breeding terns and wintering waterbirds. Brent geese are from the Canadian / Greenland breeding population of the *hrota* subspecies.	Unfavourable
Copeland Islands	Important for breeding seabirds and waders.	Favourable
Dundrum Inner Bay	Important for wintering wildfowl and waders. Wintering brent geese are from the Canadian / Greenland breeding population of the *hrota* subspecies.	Favourable
Killough Bay	Important for wintering waterbirds. Wintering brent geese are from the Canadian / Greenland breeding population of the *hrota* subspecies.	Favourable
Larne Lough	The mudflats are important for wintering brent geese (*hrota*) from the Canadian / Greenland breeding population, while Swan / Blue Circle Islands support an important mixed tern colony.	Near favourable
Lough Foyle and River Foyle	Internationally important for wintering wildfowl and waders. Brent geese are from the Canadian / Greenland breeding population of the *hrota* subspecies.	Very unfavourable
Outer Ards	Important for wintering waders and geese, wintering and breeding cormorants and breeding terns. Most brent geese are from the Canadian / Greenland breeding population of the *hrota* subspecies.	Unfavourable
Rathlin Island	Important for breeding seabirds.	Favourable
Sheep Island	Important for breeding seabirds.	Near favourable
South Down Coast	Important for wintering waders and waterbirds.	Not assessed
Strangford Lough and Islands	NI's most important coastal site for wintering wildfowl and is also of importance for breeding terns.	Favourable

*As recorded by BirdLife International Data Zone at https://www.birdlife.org, accessed in May 2023

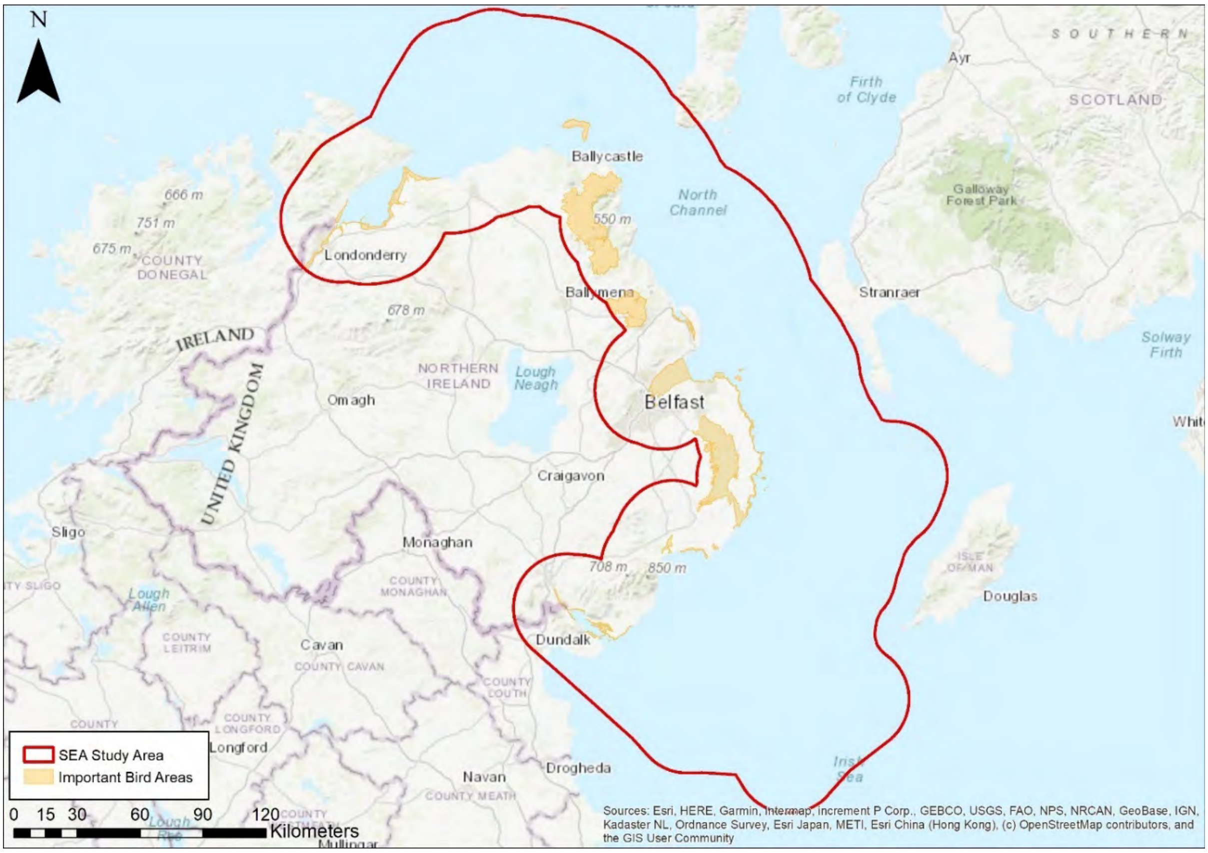

Figure 3-5 Location of Important Bird Areas within the SEA Study Area

The distribution of 12 seabird species in the North-East Atlantic was studied by Waggitt et al. (2019)[38], who amalgamated and standardised survey data to produce distribution maps. These show the spatial variation in predicted densities of the following seabird species in January and July: Atlantic puffin, black-legged kittiwake, herring gull, lesser black-backed gull, common guillemot, European shag, Manx shearwater, Northern fulmar, European storm petrel, great skua, Northern gannet and razorbill. High densities of black-legged kittiwake, common guillemot, Northern fulmar, Northern gannet, and razorbill are predicted around NI waters in both January and July, whilst higher densities are predicted in January for herring gull, and higher densities are predicted in July for Atlantic puffin, lesser black-backed gull, Manx shearwater, European storm petrel, and great skua. High-density seabird areas in UK waters have also been identified by Cleasby *et al*. (2018)[39] for black-legged kittiwake, common guillemot, razorbill, and European shag. For black-legged kittiwake, areas around the coast of NI were identified as important, particularly in the north-east. For common guillemot, a hotspot was identified around Rathlin Island, with areas of importance around the north and north-east NI coast. Hotspots were also identified around the NI coast for razorbill, around Rathlin Island and in the north-east and east.

Sandeels, comprising *Ammodytes* species, are a key component in marine food webs and an important food source for many species of seabirds. There is a known spawning ground of low intensity for sandeel off the south-east coast (Ellis *et al.* 2012; see **Figure 3-3**). AFBI have also mapped areas of

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[38] Waggitt, J.J., Evans, P.G., Andrade, J., Banks, A.N., Boisseau, O., Bolton, M., Bradbury, G., Brereton, T., Camphuysen, C.J., Durinck, J. and Felce, T., 2020. Distribution maps of cetacean and seabird populations in the North-East Atlantic. Journal of Applied Ecology, 57(2), pp.253-269. Available at: https://besjournals.onlinelibrary.wiley.com/doi/pdf/10.1111/1365-2664.13525

[39] Cleasby, I.R., Owen, E., Wilson, L. and Bolton, M., 2018. Combining habitat modelling and hotspot analysis to reveal the location of high density seabird areas across the UK: Technical report (No. 63). RSPB Research Report. Available at: https://www.researchgate.net/publication/332298694_Combining_habitat_modelling_and_hotspot_analysis_to_reveal_the_location_of_high_density_seabird_areas_across_the_UK_Technical_Report_A_UK-wide_report_covering

potential modelled sandeel habitats within the NI inshore region[40], which could aid in the identification of important foraging areas for seabird species within and outside of designated areas.

3.2.1.4.2 Status and Vulnerabilities of Seabirds

The UK population of breeding seabirds has shown an overall decline of almost 25% since the 1980s[41], while, for Scotland, this decline is as much as 49%[42]. Results of the Seabirds Count[43], which is the fourth census of Britain and Ireland's internationally important populations of breeding seabirds, were published in 2023. While these showed mixed results in the direction and extent of population change, they indicated an overall decline, with 11 of the 21 species (those for which there was confidence in their trends), having declined by over 10% since the previous census; these species are little tern, European shag, Atlantic puffin, black-headed gull, arctic tern, northern fulmar, black-legged kittiwake, great black-backed gull, common gull, arctic skua and Leach's storm petrel.

The NI Seabird Report 2022[44] provides an update on the status of seabird species known to breed in NI, namely fulmar, Manx shearwater, storm petrel, cormorant, shag, great skua, kittiwake, black-headed gull, Mediterranean gull, common gull, lesser black-backed gull, herring gull, great black-backed gull, little tern, sandwich tern, common tern, roseate tern, arctic tern, guillemot, razorbill, black guillemot and puffin. Highlighted in this report is that fulmar populations continue to be lower than in the past in NI, with numbers at most monitored sites in 2022 stable or slightly declining. At monitored sites, kittiwake numbers continue to increase, while common tern populations appear to have recovered from a significant population decline of the coastal NI population seen in 2020. According to the Birds of Conservation Concern in Ireland 4 (BoCCI4) report 2020-2026[45], 70% of all seabirds (total number of 38) and 23 out of 24 of all breeding seabirds are now Red (highest priorities for action at a global scale) or Amber listed (unfavourable conservation status in Europe). Those at Red status in BoCCI4 include kittiwake, razorbill and puffin, while those at Amber status include Manx shearwater, storm petrol, cormorant, shag, great skua, black-headed gull, Mediterranean gull, common gull, lesser black-backed gull, herring gull, little tern, sandwich tern, common tern, roseate tern, Arctic tern, guillemot, razorbill, and black guillemot.

A NI Seabird Conservation Strategy (NISCS) is being developed by DAERA, which will review and report on the current status of seabird populations and identify and assess their sensitivity to threats and pressures, informing management recommendations to maintain and improve conservation status. This is included as a proposed measure for the Descriptor for Birds in the MS Part Three: UK Programme of Measures. The UK assessment of the environmental status of birds for the MS (2019) indicates that GES has not yet been achieved for non-breeding waterbirds in the Celtic Sea, or for breeding seabirds and non-breeding waterbirds in the Greater North Sea.

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[40] AFBI, 2022. Mapping of potential sandeel habitat within the Northern Irish inshore region. Report to the Department of Agriculture, Environment and Rural Affairs (DAERA). Available at: https://www.daera-ni.gov.uk/sites/default/files/publications/daera/DAERA%20E%2BI%20Project_18.04.07_Mapping%20sandeel%20habitats%20_Final%20report.pdf

[41] Department for Environment, Food and Rural Affairs, UK. 2021. UK Biodiversity Indicators 2021. UKBI - C5. Birds of the wider countryside and at sea. Available at: https://webarchive.nationalarchives.gov.uk/ukgwa/20220901105259/https://jncc.gov.uk/our-work/ukbi-c5-birds-of-the-wider-countryside-and-at-sea/

[42] NatureScot. 2020. Scottish biodiversity indicator – The numbers and breeding success of seabirds (1986 – 2019). Available at: https://www.nature.scot/doc/scottish-biodiversity-indicator-numbers-and-breeding-success-seabirds-1986-2019

[43] https://jncc.gov.uk/our-work/seabirds-count/#results

[44] Booth Jones, K. (ed.) 2023. The Northern Ireland Seabird Report 2022. British Trust for Ornithology, Thetford. Available at: https://www.bto.org/sites/default/files/publications/ni_seabird_report_final_web.pdf

[45] Gilbert, G., Stanbury, A. and Lewis, L. 2021. Birds of conservation concern in Ireland 4: 2020–2026. Irish Birds, 43, pp.1-22. Available at: https://birdwatchireland.ie/app/uploads/2021/04/Irish-Birds-2021-BOCCI-for-web.pdf.

The RSPB's Powering Healthy Seas report[46] highlights the variety of ways in which offshore wind farms can impact seabirds during construction and operation. These include the risk of direct collision with turbine blades (e.g., for kittiwake and northern gannet, which fly at around the same height as turbines); disturbance (such as noise and visual disturbance from construction, maintenance and boat activity), which can result in additional energy expenditure (e.g., red-throated divers, which are sensitive to human activity); a loss of access/displacement from important foraging areas; and a risk of interrupting important feeding and migration pathways (barrier effect). Seabirds may also be affected indirectly through habitat loss and seabed alteration, affecting food sources and coastal habitats.

3.2.1.5 Marine Mammals

3.2.1.5.1 Background and Distribution

Many species of marine mammal are known to occur in NI waters, including cetaceans (whales, dolphins, and porpoises) and pinnipeds (seals). The Irish Cetacean Review 2000-2009[47] of the Irish Whale and Dolphin Group (IWDG) set out all cetacean sighting and stranding records made during this period for the island of Ireland. Sightings and/or strandings were recorded off the NI coastline for the following species:

- Humpback whale (*Megaptera novaengliae*);
- Minke whale (*Balaenoptera acutorostrata*);
- Sei whale (*Balaenoptera borealis*);
- Fin whale (*Balaenoptera physalus*);
- Blue whale (*Balaenoptera musculus*);
- Sperm whale (*Physeter macrocephalus*);
- Cuvier's beaked whale (*Ziphius cavirostris*);
- Northern bottlenose whale (*Hyperoodon ampullatus*);
- Bottlenose dolphin (*Tursiops truncatus*);
- Striped dolphin (*Stenella coeruleoalba*);
- Short-beaked common dolphin (*Delphinus delphis*);
- White-beaked dolphin (*Lagenorhynchus albirostris*);
- Atlantic white-sided dolphin (*Lagenorhynchus acutus*);
- Risso's dolphin (*Grampus griseus*);
- Killer whale (*Orcinus orca*);
- Long-finned pilot whale (*Globicephala melas*); and
- Harbour porpoise (*Phocoena phocoena*).

Harbour porpoise and bottlenose dolphin have consistently been the most commonly reported cetacean species in waters surrounding NI. Berrow (2008)[48] reviewed cetacean sightings for NI and identified the key sites for cetaceans as being: Portrush and Portballintrae, Co. Antrim; Rathlin Island, Co. Antrim; and Portmuck, Islandmagee, Co. Antrim, and Whitehead, Co. Antrim. In the past year (June 2022 to June 2023) there were 300 sightings of marine mammals off the coast of NI registered with the IWDG. The majority of these sightings were of bottlenose dolphin and harbour porpoise, with 110 sightings and 116 sightings respectively. A greater proportion of sightings of bottlenose dolphin were off the north coast, particularly from off the coast of Coleraine to Rathlin Island. On the east coast, sightings were mainly from Glenarm to Larne, Bangor to Donaghadee, and Strangford to Portaferry. Sightings of harbour porpoise were at similar locations, in particular off the coast of Coleraine, Rathlin and Larne, as well as Killough and Newcastle. There were 17 sightings of common dolphin recorded, comprising

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[46] Royal Society for the Protection of Birds. 2022. Powering Healthy Seas: Accelerating Nature Positive Offshore Wind. A RSPB commissioned report. Available at: https://offshore-coalition.eu/documents/powering-healthy-seas-report_rspb_august-2022.pdf

[47] Berrow, S.D., Whooley, P., O'Connell, M. and Wall, D. 2010. Irish Cetacean Review (2000-2009). Irish Whale and Dolphin Group. pp 60. Available at: https://www.iwdg.ie/downloads/IWDG%20Cetacean%20Sightings%20Review_lr.pdf

[48] Berrow, S.D. 2008. Review of cetacean sightings and strandings data from Northern Ireland, with recommendations for the designation of Special Areas of Conservation. Unpublished Report to the Environment and Heritage Service. Irish Whale and Dolphin Group, pp.30.

245 individuals, with many large groups of over ten individuals. Records on the north coast occurred from off Coleraine to Torr Head, with records off the east coast from Larne to Bangor. There were 34 records of minke whale, comprising 70 individuals, from Coleraine to Causeway Coast, off Rathlin Island, and in the Irish Sea from off Kircubbin to Annalong. There were two recorded sightings of killer whale, comprising two individuals off Rathlin Island, and one individual off Annalong. At present, there is limited information available on seasonal patterns of occurrence, site fidelity and annual variability in abundance of cetacean species within NI waters[49]. Current research suggests that there is a potential migratory corridor for north Atlantic humpback whales off the coast of NI, with whale song detected off the north coast at Skerries and Causeway SAC and Malin Head in County Donegal[50].

The Inter-Agency Marine Mammal Working Group (IAMMWG) defines Management Units (MUs) for the seven most common cetacean species found in UK waters: harbour porpoise, bottlenose dolphin, short-beaked common dolphin, white-beaked dolphin, Atlantic white-sided dolphin, Risso's dolphin and minke whale. In terms of wider distributions within the Celtic Seas Ecoregion, harbour porpoises are commonly observed with high densities in the Irish Sea and its northern and southern channels (Wall *et al*., 2013)[51], predominantly along the West Scotland coastline, and Celtic and Irish Sea MUs (IAMMWG, 2021)[52]. Bottlenose dolphins are also common with high concentrations in the Cardigan Bay area to the south, the Irish Sea, and off the North Wales Coast and the Coastal West of Scotland and Hebrides MUs with migrations following feeding patterns on benthic and pelagic fish species. The short-beaked common dolphin has a large offshore distribution, found towards the southern end of the Irish Sea, and the Celtic and Greater North Seas MUs, and undergoes strong seasonal shifts in distribution during the winter with movement onto the Celtic Shelf, the western English Channel, and St. George's Channel. The Risso's dolphin is distributed in the nearshore waters off the south-west of Ireland, the NI Sea around Shetland and Orkney, southern Irish Sea, Isle of Man, north Anglesey, north-west coast of Wales, and the Celtic and Greater North Seas MUs. Less common dolphin species include the Atlantic white-sided, striped, and white-beaked dolphins. The Atlantic white-sided dolphin is restricted to the cool waters of the North Atlantic and has been rarely recorded in the Irish Sea[29]. The striped dolphin has rarely been sighted in inshore waters of the Irish Sea, largely distributed along south and west Ireland. The white-beaked dolphin has no sightings recorded for the Irish Sea; one stranding incident has been recorded.

Minke whales have a large offshore distribution, predominantly in Celtic Deep and the Celtic and Greater North Seas MUs and will enter the western Irish Sea during the summer months with seasonal distribution alterations due to oceanographic conditions and prey availability. They move east within waters during the September and November periods. Humpback whales are commonly seen on the south and south-west coast of Ireland, occasionally seen on the east coast of Ireland. Fin whales are found on the south coast of Ireland and along the west coast and are rarely recorded within the Irish Sea. Killer whales have occasionally been sighted in the Irish Sea, typically to the southwest, west, and north of Ireland. Sperm whales are largely distributed off the west coast of Scotland and Ireland, all sightings have been recorded in deep waters beyond the edge of the Irish Shelf e.g., 1000m depth[29]. Blue whales undergo migration along the western seaboard of Ireland. Rarer whale species include the northern bottlenose, with whale sightings in inshore waters very rare, with no strandings on the east coast of Ireland since 1954, and the Sowerby's beaked whale, which is rarely recorded in Irish Seas, and for which some records of strandings on the southeast coast of Ireland have occurred.

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[49] Beck, S. 2021. Developing a cost-effective monitoring strategy for coastal cetaceans. PhD Thesis. Available at: https://pureadmin.qub.ac.uk/ws/portalfiles/portal/242721907/Thesis_BECK.PDF

[50] AFBI. 2023. Humpback whales migrate through UK Waters. Available at: https://www.afbini.gov.uk/news/humpback-whales-migrate-through-uk-waters

[51] Wall, D., Murray C., O'Brien, J., Kavanagh, L., Wilson, C., Ryan, C., Glanville, B., Williams, D., Enlander, I., O'Connor, I., McGrath, D., Whooley, P. and Berrow, S. 2013. Atlas of the Distribution and Relative Abundance of Marine Mammals in Irish Offshore Waters, 2005-2011. Irish Whale and Dolphin Group, Merchants Quay, Kilrush, Co. Clare. Available at: https://www.researchgate.net/publication/335504684_Atlas_of_the_Distribution_and_Relative_Abundance_of_Marine_Mammals_in_Irish_Offshore_Waters_Atlas_of_the_Distribution_and_Relative_Abundance_of_Marine_Mammals_in_Irish_Offshore_Waters_2005_-2011

[52] IAMMWG. 2022. Updated abundance estimates for cetacean Management Units in UK waters. JNCC Report No. 680 (Revised March 2022), JNCC Peterborough, ISSN 0963-8091. Available at: https://data.jncc.gov.uk/data/3a401204-aa46-43c8-85b8-5ae42cdd7ff3/jncc-report-680-revised-202203.pdf

Harbour porpoise, bottlenose dolphin, short-beaked common dolphin, and Risso's dolphin are considered likely to occur year-round, and minke whale is considered likely to occur in the summer months within NI waters (Reid *et al.* 2003; Baines and Evans 2012; Wall *et al.* 2013; Waggitt *et al.* 2020). Abundance estimates for each species within their respective MUs are given in IAMMWG (2022). **Table 3-8** shows the IAMMWG population estimates for each MU, and for the UK portion of each MU, for each species likely to be present in NI waters, as well as species-specific density estimates, based on the Small Cetaceans in European Atlantic Waters and the North Sea (SCANS) IV density estimates[53] from SCANS-IV block 'CS-D and CS-F' (covering NI waters).

For pinnipeds, harbour seals are widely distributed (covering the North Atlantic and North Pacific Seas) and cover several SACs, largely found in Scotland on the West coast, Inner and Outer Hebrides, Orkney, and Shetland. Grey seals are also a commonly observed species, and a designated feature for The Maidens SAC; a number of small breeding colonies occur off NI, the Isle of Man, and North Wales coastlines. Around 84% of the UK population breeds in Scotland in the Hebrides and Orkney[29]. Grey seals regularly forage in the open sea at depths of up to 100m and return to haul-out sites where they rest, moult and breed. The species generally prefers isolated habitats, away from the presence of humans and other terrestrial predators (SCOS, 2021).

The Natural Environment Research Council Special Committee on Seals (SCOS) published advice regarding the status and management of seal populations in the UK in 2021[54]. Population trends of grey seals are assessed from pup counts during the breeding season, converted to an estimate of total population size. Pup production of grey seals in NI in 2019 was estimated as 250 individuals (the overall UK total was given as 67,850), while the total population was estimated as 600 individuals (the overall UK population was estimated as 157,300 individuals). Harbour seal populations were estimated through counts on land during August moulting; the most recent count data for NI (2016-2021) estimated 1,000 individuals, while population estimates were given as 1,400 individuals. The harbour seal population in NI appeared to have declined slowly after 2002, however, it appears to have remained stable since 2011.

DAERA coordinates seal counts in NI; a review of seal count data for 1992-2017[55] indicated that a significant number of surveys were undertaken at locations within Strangford Lough (6,522) and Murlough (382), where harbour seals are qualifying features under the SAC and ASSI designations. Other areas surveyed included The Maidens, North Antrim and Skerries, Carlingford Lough, Rathlin Islands, Lough Foyle, Larne Lough, South and North Belfast Lough, Copelands, Dundrum and test haul-out sites.

Estimated at-sea distribution maps from Carter et al. (2022) indicate the areas of higher density for grey seal (**Figure 3-6**) and harbour seal (**Figure 3-7)** within the SEA Study Area.

[53] Gilles, A., Authier, M., Ramirez-Martinez, N.C., Araújo, H., Blanchard, A., Carlström, J., Eira, C., Dorémus, G., Fernández-Maldonado, C., Geelhoed, S.C.V., Kyhn, L., Laran, S., Nachtsheim, D., Panigada, S., Pigeault, R., Sequeira, M., Sveegaard, S., Taylor, N.L., Owen, K., Saavedra, C., Vázquez-Bonales, J.A., Unger, B. and Hammond, P.S. 2023. Estimates of cetacean abundance in European Atlantic waters in summer 2022 from the SCANS-IV aerial and shipboard surveys. Final report published 29 September 2023. pp. 64. Available at: https://www.tiho-hannover.de/fileadmin/57_79_terr_aqua_Wildtierforschung/79_Buesum/downloads/Berichte/20230928_SCANS-IV_Report_FINAL.pdf

[54] Natural Environment Research Council (NERC) Special Committee on Seals. 2022. Scientific Advice on Matters Related to the Management of Seal Populations: 2021. Available at: https://www.smru.st-andrews.ac.uk/files/2022/08/SCOS-2021.pdf

[55] Culloch, R., Horne, N. and Kregting, L. 2018. A review of Northern Ireland seal count data 1992-2017: Investigating population trends and recommendations for future monitoring. Available at: https://www.daera-ni.gov.uk/sites/default/files/publications/daera/AE1%2018%20772548%20%20NI%20Seal%20Report%20Final%20-%202017.pdf

Table 3-8 Density (from Gilles *et al.* 2023) and abundance estimates for relevant management units from IAMMWG (2022)

Species	Density (animals per km^2) within SCANS-IV Block CS-D[1] and CS-F[2]	MU	Abundance of animals in MU (CV)	95% confidence interval	Abundance of animals in the UK portion of MU (CV)	95% Confidence interval for UK portion of MU
Harbour porpoise	0.2803[1] 0.2010[2]	West Scotland (WS)	28,936 (0.16)	21,140 – 39,608	24,305 (0.18)	17,121 –34,505
		Celtic and Irish Sea (CIS)	62,517 (0.13)	48,324 – 80,877	16,777 (0.2)	11,216 – 25,096
Bottlenose dolphin	0.2352[1] 0.0425[2]	Coastal West Scotland and the Hebrides (CWSH)	-	-	45*	33-66
		Irish Sea (IS)	293 (0.54)	108 - 793	186 (0.52)	70 - 492
Short-beaked common dolphin	0.0272[1] 0.0544[2]	Celtic and Greater North Seas (CGNS)	102,656 (0.29)	58,932 – 178,822	57,417 (0.32)	30,850 – 106,863
Risso's dolphin	0.0022[1] 0.0027[2]		12,262 (0.46)	5,227 – 28,764	8,687 (0.63)	2,810 – 26,852
Minke whale	0.0137[1] 0.0137[2]		20,118 (0.18)	14,061 – 28,786	10,288 (0.26)	6,210 – 17,042

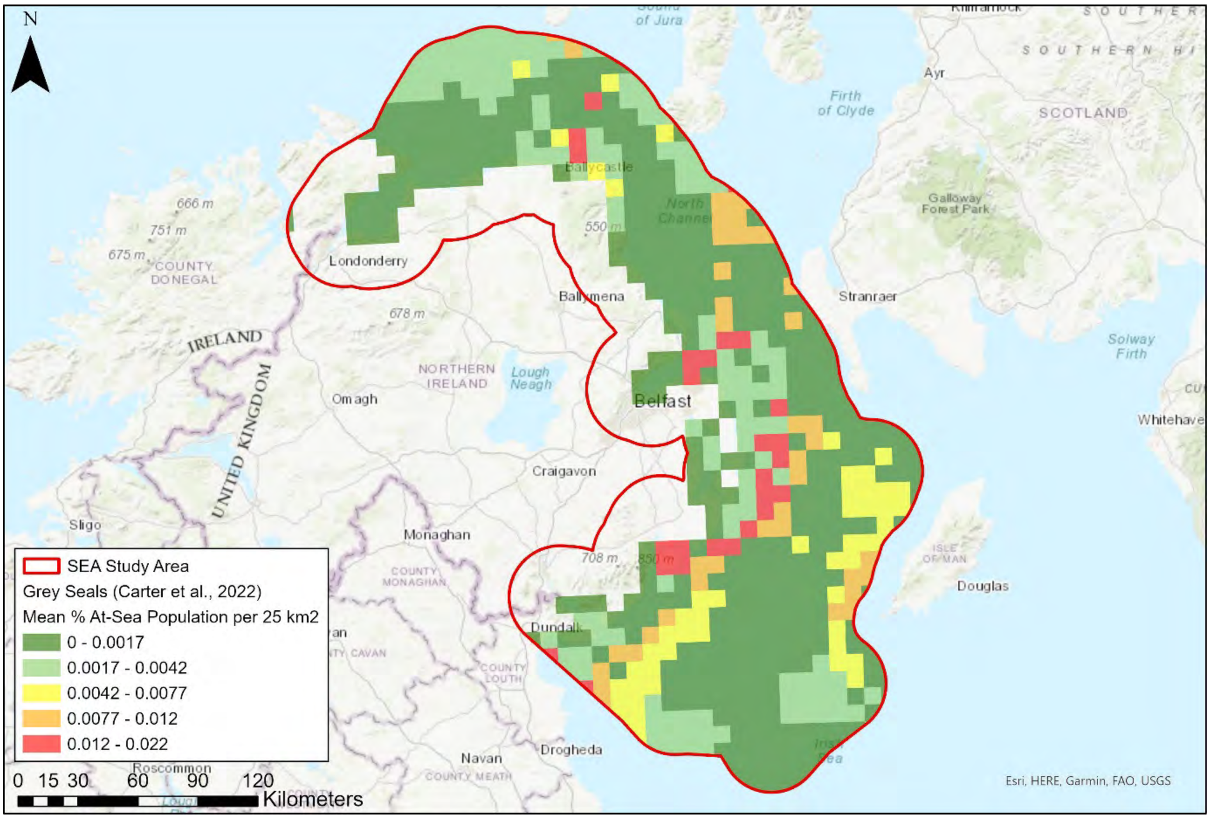

Figure 3-6 Estimated at-sea density for grey seal within the SEA Study Area (Carter *et al*. 2022)

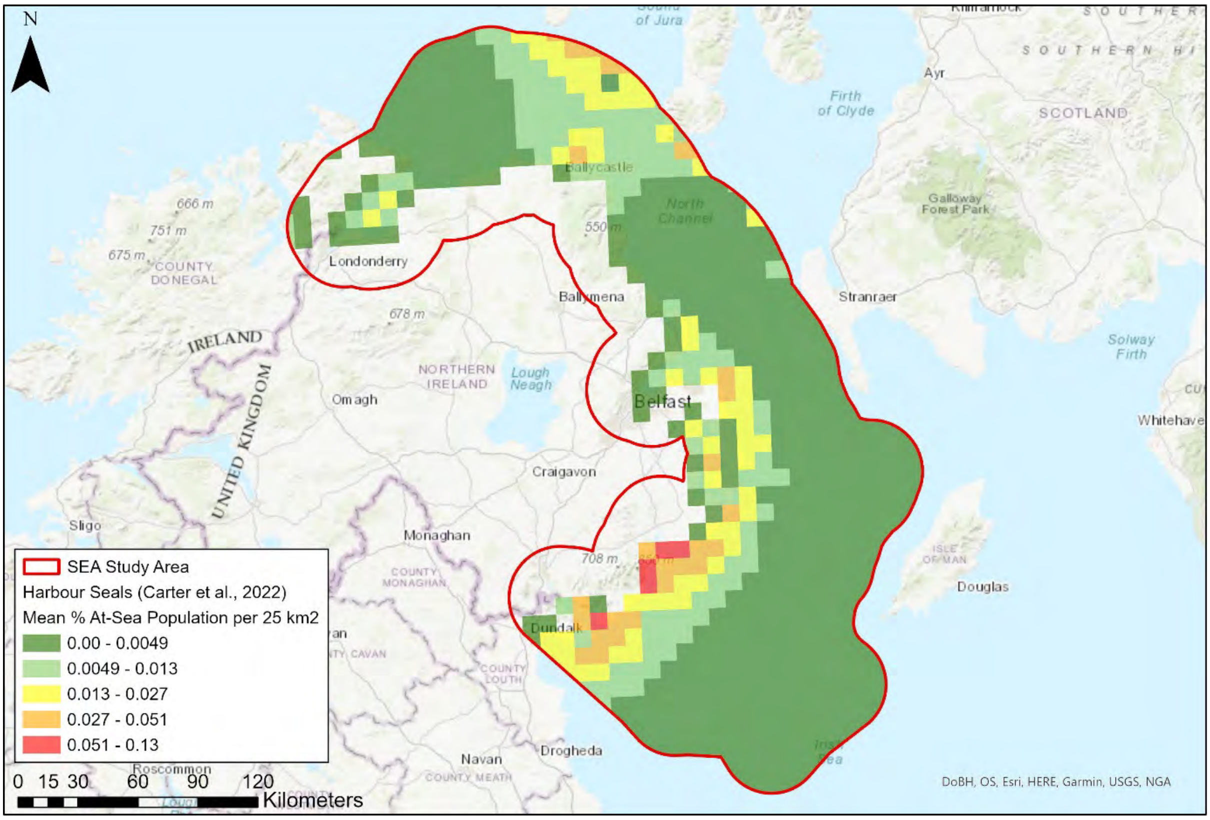

Figure 3-7 Estimated at-sea density for harbour seal within the SEA Study Area (Carter *et al*. 2022)

3.2.1.5.2 Protected and Priority Marine Mammals

All species of cetaceans and marine turtles are European Protected Species, as they are listed in Annex IV of the Habitats Directive and are thereby protected from killing, injury or disturbance in NI inshore waters through the Conservation Regulations (NI) 2009 (as amended) and in UK offshore waters by The Conservation of Offshore Marine Habitats and Species Regulations 2017. Under Article 10 of the Wildlife (NI) Order 1985 (as amended) it is an offence to intentionally or recklessly disturb, capture, or injure a harbour seal (*Phoca vitulina*) or grey seal (*Halichoerus grypus*). It is also an offence to intentionally or recklessly: disturb any such animal while it is occupying a structure or place which it uses for shelter or protection; damage or destroy, or obstruct access to, any structure or place which any such animal uses for shelter or protection; damage or destroy anything which conceals or protects any such structure; or to have in possession or control any live or dead wild animal included in Schedule 5 or any part of, or anything derived from, such an animal. Where impact cannot be avoided or mitigated, a licence may be required for operations and DAERA Marine Wildlife Team should be consulted.

In addition, harbour porpoise, bottlenose dolphin, grey and harbour seal are species for which the designation of SACs is required owing to their listing in Annex II of the Habitats Directive. There are currently five SACs in NI designated wholly or partly for the protection of marine mammals:

- Murlough SAC: Common seal (not a primary feature). The beach area at Ballykinler is important as a haul-out for Common seal;
- Strangford Lough SAC: Common seal (not a primary feature). Although not currently a qualifying species, Strangford Lough is now the most important site for grey seals in NI;
- North Channel SAC: Harbour porpoise;
- Skerries and Causeway SAC: Harbour porpoise are residents of the site throughout the year. The site also contains non-qualifying populations of grey seal, common seal and bottlenose dolphin;
- The Maidens SAC: Grey seal (not a primary feature). The relatively remote rocks, islands and the waters that surround them in the North Channel are important for providing haul-out sites, resting sites and foraging areas for grey seals.

Marine mammals for which sites have been designated outside of NI may also have potential to be affected by the implementation of the OREAP. DAERA recommend that all SACs within 100km of a project should be screened for grey seals; all SACs within 50km should be screened for harbour seals; and all SACs within 100km should be screened for harbour porpoise. In RoI, Horn Head and Rinclevan SAC (designated for grey seal), Rockabill to Dalkey Island SAC (designated for harbour porpoise), Lambay Island SAC (designated for harbour porpoise, grey seal, and harbour seal), Codling Fault Zone SAC (designated for harbour porpoise), and Lough Swilly SAC (designated for harbour porpoise) are within these distances. In addition, in UK inshore and offshore waters, the North Anglesey Marine / Gogledd Môn Forol (designated for harbour porpoise), South-east Islay Skerries SAC (designated for harbour seal), West Wales Marine SAC (designated for harbour porpoise), and Pen Llŷn a`r Sarnau/ Lleyn Peninsula and the Sarnau SAC (designated for grey seal and bottlenose dolphin) are within these distances. Several Isle of Man Marine Nature Reserves (MNRs) also protect these species: Calf of Man and Wart Bank (grey seal), Langness (common seal, grey seal, and harbour porpoise), Niarbl Bay (grey seal, harbour porpoise), West Coast (grey seal, harbour porpoise), while other cetacean species that are provided protection from Isle of Man MNRs include Risso's dolphin, bottlenose dolphin and minke whale.

Although otters (*Lutra lutra*) are widely distributed throughout NI, there are currently no coastal SACs in NI with otters as a qualifying feature; however, otters are a qualifying feature of Lough Swilly SAC in RoI, which is within the SEA Study Area. In general, otter distribution in NI is concentrated inland with a relatively low occurrence at coastal sites[56].

Of the marine mammals that may be found within the SEA Study Area, several species are listed as Priority Species in NI, namely minke whale, common dolphin, Risso's dolphin, grey seal, harbour seal,

[56] Preston, J., Prodohl, P., Portig, A. and Montgomery, I. 2006. Reassessing Otter Lutra lutra distribution in NI. Environment and Heritage Service Research and Development Series. No. 06/24.

killer whale, common porpoise, bottle-nosed dolphin and otter. These Priority Species and the protection measures that are afforded to them are outlined in **Table 3-9.**

Table 3-9 Priority Marine Mammal species in NI and their Protection

Name	Bern Convention	IUCN	Habitats Directive	Conservation Regs.	Wildlife (NI) Order
Minke whale *Balaenoptera acutorostrata*	Appendix 3		Annex IV	Schedule 4	
Common dolphin *Delphinus delphis*	Appendix 2		Annex IV	Schedule 4	
Risso's dolphin *Grampus griseus*	Appendix 2		Annex IV		
Grey seal *Halichoerus grypus*	Appendix 3		Annex V	Schedule 3	Schedule 5 and 6
Killer whale *Orcinus orca*	Appendix 2		Annex IV	Schedule 2	
Harbour seal *Phoca vitulina*	Appendix 3		Annex II and V	Schedule 3	Part 1 Schedule 5, 6 and 7
Common porpoise *Phocoena phocoena*	Appendix 2		Annex II and IV	Schedule 2	
Bottle-nosed dolphin *Tursiops truncatus*	Appendix 2		Annex II and IV	Schedule 2	
Otter *Lutra lutra*		NT	Annex II and IV		Part 1 Schedule 6 and 6A

3.2.1.5.3 Status and Vulnerabilities of Marine Mammals

The UK assessment of environmental status for the MS (2019) indicates that for cetaceans in the UK, the achievement of GES is uncertain. For grey seals, GES has been achieved for grey seals in the Celtic Seas, while, for harbour seals in the Celtic Seas, there has been a significant increase in West Scotland, but the status is uncertain elsewhere.

Cetaceans and seals can be affected by bycatch (fish or other marine species caught unintentionally while fishing for specific species) from marine commercial fisheries, with the most recent estimated bycatch of seals in UK fisheries of 488 individuals[16]. Offshore marine renewable devices have potential to adversely affect marine mammals in a number of ways during construction and operation, including potential collision risk with vessels and underwater devices, noise effects that may vary from avoidance behaviour to physical damage, EMF (emitted from cables during operation) effects on behaviour, barrier effects of devices leading to habitat exclusion, and indirect impacts affecting water quality, supporting habitats and food sources. A review of the impacts of wind farms on biodiversity[57] found that acoustic impacts during construction are likely to be greater in the marine environment than the terrestrial environment owing to the conductivity of sound in water and the sensitivity of marine mammals and their prey species. For marine mammals, this review found that literature indicated effects of operational noise on cetaceans and pinnipeds (seals) for up to a few hundred metres; Joint Nature Conservation Committee (JNCC) recommend a minimum 500m exclusion zone to mitigate for noise disturbance

[57] Ruddock, M., Reid, N. and Montgomery, W. 2010. Review of windfarms and their impact on biodiversity: Guidance for developments in Northern Ireland. Northern Ireland Environment Agency. Available at: https://pureadmin.qub.ac.uk/ws/files/675744/Ruddock%20&%20Reid%20(2010)%20Impact%20of%20windfarms%20on%20biodiversity.pdf

during piling activities[58], however, species will have different hearing abilities and varying sensitivities to noise.

3.2.1.6 Bats

There are eight species of bat known to commonly occur in NI (of the nine species found in Ireland); these are common pipistrelle, soprano pipistrelle, Nathusius' pipistrelle, Leisler's bat, brown long-eared bat, whiskered bat, Natterer's bat and Daubenton's bat. These are all strictly protected under the Habitats Regulations (NI) 1995 (as amended) and are known as European protected species. Their protection includes deliberate capture, injury killing and disturbance, as well as protection of their breeding and resting places (roosts).

Wind farms have potential to adversely affect bats, with extensive evidence from onshore wind farms in the UK and worldwide that significant casualties can arise through the following means:

- Direct mortality through collisions with turbine blades, barotrauma and other injuries;
- Loss of, damage to, or fragmentation of commuting and foraging habitat through installation of wind turbines and associated infrastructure, such as access roads;
- Loss of, damage to, or disturbance to roosts; and
- Displacement from foraging and commuting habitats.

New 'Guidance on Bat Surveys, Assessment and Mitigation for Onshore Wind Turbine Developments' in NI was published by NIEA in 2021[59] to ensure that bats are appropriately taken into account when planning for onshore wind energy developments.

Bats are subject to a number of threats onshore, primarily relating to the loss of important roosting and foraging areas and the removal of flight corridors. However, there is limited understanding of the potential issues affecting bats in offshore locations. It has been recognised that there is potential for bats to interact with offshore wind farms, as discussed in a 2014 article published by Bat Surveys Ireland[60], with the EUROBATS Guidance document 'Guidance for consideration of bats in wind farm projects Revision 2014' recommending that "a pre-survey assessment should be undertaken for all new onshore and offshore wind turbine proposals". The potential interactions of bats with offshore wind turbines include interactions during migration or during offshore foraging. While limited information exists on bat migration across the sea in Europe, there is evidence of bat migration across the sea between the UK and mainland Europe (a 596km migration of a Nathusius' pipistrelle from the UK to the Netherlands[61]), and of the presence of bats at Dutch offshore wind farms[62]. Non-migratory bats may also be found offshore when foraging on insects that have been blown out to sea and may interact with offshore turbines[63]. There is currently no evidence of significant bat migrations, or migrations over sea from Ireland, or evidence that bats in Ireland utilise offshore areas for foraging.

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[58] JNCC. 2010. Statutory nature conservation agency protocol for minimising the risk of injury to marine mammals from piling noise. Available at: https://data.jncc.gov.uk/data/31662b6a-19ed-4918-9fab-8fbcff752046/JNCC-CNCB-Piling-protocol-August2010-Web.pdf

[59] NIEA, Natural Environment Division. 2021. Guidance on Bat Surveys, Assessment and Mitigation for Onshore Wind Turbine Developments in Northern Ireland. Available at: https://cieem.net/wp-content/uploads/2021/08/NIEA-Guidance-on-Bat-Surveys-for-Wind-Turbine-Proposals-Final-August-1....pdf

[60] Bat Surveys Ireland. 2014. Could bats be an issue for offshore wind farms? Available at: https://batsurveysireland.com/2014/01/25/bats-and-offshore-wind-farms/

[61] The Guardian. 2014. Thumb-sized bat crosses English Channel. Available at: https://www.theguardian.com/environment/2014/jan/20/thumb-sized-bat-crosses-english-channel

[62] Ahlén, I., Bach, L., Baagøe, H.J. and Pettersson, J., 2007. Bats and offshore wind turbines studied in southern Scandinavia. Naturvårdsverket. Available at: https://www.bach-freilandforschung.de/images/download/Ahlen_etal_2007_offshore.pdf

[63] Ahlén, I., Baagøe, H.J. and Bach, L., 2009. Behavior of Scandinavian bats during migration and foraging at sea. Journal of Mammalogy, 90(6), pp.1318-1323. Available at: https://bioone.org/journals/journal-of-mammalogy/volume-90/issue-6/09-MAMM-S-223R.1/Behavior-of-Scandinavian-Bats-during-Migration-and-Foraging-at-Sea/10.1644/09-MAMM-S-223R.1.short

3.2.1.7 Reptiles

Two species of turtle have been observed in NI waters: leatherback turtles (*Dermochelys coriacea*) and loggerhead turtles (*Caretta caretta*). Leatherback turtles are the largest of all marine turtles and migrate huge distances between their feeding grounds and where they lay their eggs. The loggerhead is a wide-ranging turtle, occurring throughout the temperate subtropical and tropical regions of the Atlantic, Pacific and Indian Oceans. The most frequently sighted are leatherback turtles, which are located along the UK coastline and Isle of Man coastline, distribution patterns relate to the migration of jellyfish during summer seasons[29].

All marine turtles are legally protected: they are listed on Appendix I of the Convention on the International Trade in Endangered Species of Flora and Fauna (CITES), Appendices I and II of the Bonn Convention on Migratory Species and Appendix II of the Bern Convention, and on Annex IV of the EU Habitats Directive, with the loggerhead turtle also listed as a priority species on Annex II. Globally, the leatherback turtle is listed as ‘Vulnerable’ on the IUCN Red List of Threatened Species, while the sub-population of the north-west Atlantic (one of seven sub-populations assessed) is ‘Least Concern’[64]. Globally, the loggerhead turtle is now also listed as ‘Vulnerable’, while the sub-population of the north-east Atlantic (one of ten sub-populations assessed) is ‘Endangered’[65]. The leatherback turtle is also listed as a Priority Species for NI.

There were 41 records of sightings or strandings of turtles in NI waters between 1748-2021[66], the majority of which were leatherback turtles. Although there are annual records within NI, there is no information on site fidelity. Similar to marine mammals, marine reptiles have potential to be affected by collision risk with vessels and with devices underwater, noise, exclusion from habitat, as well as indirectly via effects on water quality or marine litter. JNCC recommend that, whilst the appropriate mitigation may require further investigation, the protocols recommended for minimising the risk of injury to marine mammals from piling noise[23] would also be appropriate for marine turtles.

3.2.1.8 Non-indigenous Species

Non-indigenous species (NIS) comprise those species that have been introduced outside of their natural range, intentionally or unintentionally. Some of these species have the potential to thrive within their introduced environment and can out-compete native species of flora and fauna and pose a significant threat to native biodiversity. Once established, invasive species are extremely difficult and costly to control and eradicate and can have far-reaching impacts. NIS can enter UK waters from ballast water and the accumulation of organisms on ships’ hulls via shipping, and through the introduction of commercial species into the wild in aquaculture. Under Article 15 of the Wildlife (NI) Order 1985 (as amended) it is an offence to release or allow to escape into the wild any plant or animal which; a) is of a kind which is not ordinarily resident in and is not a regular visitor to NI in a wild state (or is a hybrid of any animal of that kind), or b) is included in Part I of Schedule 9 (or is a hybrid of any plant or animal included in that Part).

The UK assessment of environmental status for the MS (2019) indicates that for NIS in the UK, GES has not yet been achieved but the ability to detect new NIS has improved, however there was no significant change in the number of new records of NIS between 2003 and 2014 in either the Greater North Sea or the Celtic Seas. As part of the actions set out under the MS, NIS monitoring has started to be integrated into biodiversity monitoring since 2016, while Species Action Plans are being developed for key species by the UK working non-native group, with an Action Plan produced for *Didemnum*

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[64] Wallace, B.P., Tiwari, M. and Girondot, M. 2013. Dermochelys coriacea. The IUCN Red List of Threatened Species 2013: e.T6494A43526147. Available at: https://dx.doi.org/10.2305/IUCN.UK.2013-2.RLTS.T6494A43526147.en.

[65] Casale, P. and Tucker, A.D. 2017. Caretta caretta (amended version of 2015 assessment). The IUCN Red List of Threatened Species 2017: e.T3897A119333622. https://dx.doi.org/10.2305/IUCN.UK.2017-2.RLTS.T3897A119333622.en. Available at: https://www.iucnredlist.org/species/3897/119333622

[66] Penrose, R.S., Westfield, M.J. and Gander, L.R., 2022. British & Irish Marine Turtle Strandings & Sightings Annual Report 2021. Technical report, Marine Environmental Monitoring, Wales, 2022. Available at: https://media.mcsuk.org/documents/2021_Turtle_Strandings_Report_2.pdf

vexillum (carpet sea squirt) in 2020[67]. In collaboration with the aquaculture industry, this Action Plan aims to reduce negative impacts of this species by improving the capacity to detect, report and prevent its spread.

The Invasive Alien Species Strategy for NI provides an overarching framework to minimise the risk and negative impacts posed by these species, while the draft Marine Plan for NI sets out policy in relation to invasive alien species. The Great Britain Invasive Non-Native Species Strategy[68] sets out the government strategy for the management of all non-native species of flora and fauna, particularly those known to be, or with the potential to be, invasive. As part of addressing transportation pathways for the introduction or spread of these species, operators are encouraged to follow the International Maritime Organisation's (IMO) voluntary guidelines for the control and management of ships' biofouling. In addition, the UK acceded to the Ballast Water Management Convention in 2022 and introduced domestic legislation[69] that aims to regulate discharges of ballast water and reduce the risk of non-native species introduction.

3.2.1.9 Summary of Existing Pressures and Issues for Biodiversity, Flora and Fauna

The latest State of Nature report for NI has estimated that 12% of species are threatened with extinction (based on species assessed using the IUCN Regional Red List criteria)[70]. Marine habitats within the SEA Study Area are subject to existing pressures, including loss or disturbance through destructive fishing methods, and extractive activities such as dredging. Marine fauna may be subject to direct loss through fishing (commercial fish and shellfish species), including bycatch (marine mammals), collision or behavioural avoidance due to vessel movements, and noise or visual damage, disturbance or displacement from numerous developments and activities within the marine and coastal environment. Seabird colonies have also been affected by Highly Pathogenic Avian Influenza (HPAI) in recent years, and almost all seabird species that were included in the Birds of Conservation Concern in Ireland report and that breed in NI are Red or Amber listed[71]. The multiple stressors that may affect marine habitats and species influences their ability to recover from disturbance and can lead to ecosystems that are less resilient to invasive species, and that may have less ability to adapt to potential climate change impacts.

Implementation of the OREAP, and the construction, maintenance and decommissioning activities associated with the potential offshore renewable energy projects that may arise as a result, has the potential to lead to direct and indirect effects on habitats and species within the SEA Study Area, including protected and priority species, within and outside designated sites.

3.2.1.10 Evolution of the baseline in the absence of the plan

In the short-term, the future baseline for biodiversity, flora and fauna is likely to be driven by the current trends, as discussed.

In the longer-term, the main drivers of change from the current baseline are likely to include continuing pressures from marine development, human activities and climate change. This includes fishing

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[67] British-Irish Council. 2021. Invasive Non-Native Species Action Plan, Didemnum vexillum, Carpet Sea Squirt. Available at: https://invasivespeciesni.co.uk/wp-content/uploads/2021/11/British-Irish-Council-Didemnum-vexillum-Invasive-Species-Action-Plan.pdf

[68] DEFRA, The Scottish Government, and Welsh Government. 2023. The Great Britain Invasive Non-Native Species Strategy: 2023 to 2030. Available at: https://www.nonnativespecies.org/about/gb-strategy/the-great-britain-invasive-non-native-species-strategy/#_Toc128036380

[69] The Merchant Shipping (Control and Management of Ships' Ballast Water and Sediments) Regulations 2022 No. 737. Available at: https://www.legislation.gov.uk/uksi/2022/737/body/made

[70] State of Nature. 2023. State of Nature Northern Ireland Summary Report. Available at: TP26055-SoN-N_Ireland-summary-report-v4-1.pdf (stateofnature.org.uk)

[71] Gilbert, G., Stanbury, A. and Lewis, L. 2021. Birds of conservation concern in Ireland 4: 2020–2026. Irish Birds, 43, pp.1-22. Available at: https://birdwatchireland.ie/app/uploads/2021/04/Irish-Birds-2021-BOCCI-for-web.pdf.

activities, marine and coastal developments, and other activities such as dredging, shipping and recreation, which could affect biodiversity, flora, and fauna through a variety of pathways such as direct or indirect damage to benthic habitats, pollution events, collision, bycatch, or via effects on prey species. Seabird populations are likely to continue to be affected by HPAI, and seal populations may be further affected by phocine distemper virus.

Climate change has the potential to be a key issue influencing the future baseline for flora and fauna. Predicted further warming of sea temperatures is likely to influence the distribution of species, and the spread northwards of warmer water species. Alterations in the distributions of prey species could affect fish, bird, marine mammal and turtle populations and their distribution, and they may also be affected by a predicted increase in extreme weather events and changes in sea levels.

Marine biodiversity, flora and fauna may be provided with increased protection in the future, including through the designation of further sites e.g., the designation of offshore SACs, marine SPAs or MCZs, thus reducing the potential for marine development and activities to adversely impact their ecology within these areas. Knowledge and understanding of the baseline are likely to improve, including marine mammal and seabird distribution, abundance and habitat use.

3.2.2 Population and Human Health

Population and human health considers the presence and wellbeing of people, and their activities and use of receiving environments. Population size, growth predictions and distribution within an area can indicate both the potential pressures that people may exert on resources and infrastructure, and the potential to which they may be exposed to pollution, disturbance, or other risks. The health of a population can be adversely affected through several direct and indirect pathways, including through emissions to water and air, health and safety risks, noise and other disturbances.

It is considered that the key issues associated with the implementation of the OREAP and Population and Human Health comprise:

- Potential for disturbance of the local population during construction (e.g., noise) and impacts on residential amenity.
- Potential for direct conflict with other users of the coastal and marine environment (e.g., fishing, recreation and leisure), or indirect effects on recreation and leisure activities (e.g., through alteration of hydrodynamics).
- Potential positive or negative effects on employment and the local economy (e.g., local community employment, fisheries, and skilled technical workers, potential for increased capital investment in the local area).
- Potential for long-term indirect health effects on the local population.
- Potential for long-term positive effects on air quality (reduced emissions).

3.2.2.1 Population Demographics and Health

The total population of NI in 2021 was approximately 1.903 million people[72], and is predicted to increase to approximately 1.99 million individuals by 2043[73].

[72] NISRA. 2022. Census 2021 Main statistics for Northern Ireland Phase 1. Available at: https://www.nisra.gov.uk/system/files/statistics/census-2021-main-statistics-for-northern-ireland-phase-1-report.pdf

[73] NISRA. 2023. Registrar General Northern Ireland Annual Report 2022. Available at: https://www.nisra.gov.uk/system/files/statistics/RG%20Annual%20Report%202022.pdf

In 2019-2021, life expectancy at birth was 78.4 years for men and 82.2 for women living in NI[74], an increase from 69 and 76, respectively, since the base reporting period of 1980-1982. NI has an ageing population, with 17.2% aged over 65 years, and it is projected that the over 65-year population will be larger than the number of children (0-15 years) from mid-2028 onwards[75]. The primary causes of death for people in NI in 2021 were cancer (26.1%, most commonly bronchus or lung) and circulatory disease (21.1%), followed by Covid-19 (10.5%), respiratory (8.8%), other causes (17.5%) and Alzheimer's/dementias (10.7%)[76].

In the NI census in 2021, just under four-fifths (78.7%) of NI residents reported themselves to be of good or very good general health. Over one in five of the resident population (24.3%) had a long-term health problem or disability, which limited their day-to-day activities. The most common long-term conditions among the resident population were long-term pain or discomfort (11.6%) and a mobility or dexterity problem (10.9%)[77].

Seas, Oceans and Public Health in Europe (SOPHIE) is a pan-European initiative to coordinate research into the impacts that environments such as 'blue spaces' can have on human health and wellbeing, with recent research providing evidence that the marine environment and human health are inextricably linked (including through sustainable seafood, marine medicine and biotechnology, tourism and wellbeing)[78]. Many major population centres are situated along, or in proximity to, the coastline of NI. These include Belfast, Derry / Londonderry, Bangor, Carrickfergus, Larne, Portrush and Portstewart and these are shown in **Figure 3-8**.

[74] Atcheson, R., Carson, M. and Laverty, C. 2023. Life Expectancy in Northern Ireland 2019-21. Information Analysis Directorate. Available at: https://www.health-ni.gov.uk/sites/default/files/publications/health/hscims-life-expectancy-ni-2019-21.pdf

[75] NISRA. 2021. NISRA Statistical Bulletin - 2020 Mid-year Population Estimates for Northern Ireland. Available at: https://www.nisra.gov.uk/sites/nisra.gov.uk/files/publications/MYE20-Bulletin.PDF

[76] NISRA. 2022. Registrar General Northern Ireland Annual Report 2021. Available at: https://www.nisra.gov.uk/system/files/statistics/RG%20Annual%20Report%202021.pdf

[77] NISRA. 2022. Census 2021 Main statistics for Northern Ireland Phase 2. Available at: https://www.nisra.gov.uk/system/files/statistics/census-2021-main-statistics-for-northern-ireland-phase-2-report.pdf

[78] Seas, Oceans and Public Health in Europe (SOPHIE). 2020. Available at: https://sophie2020.eu/

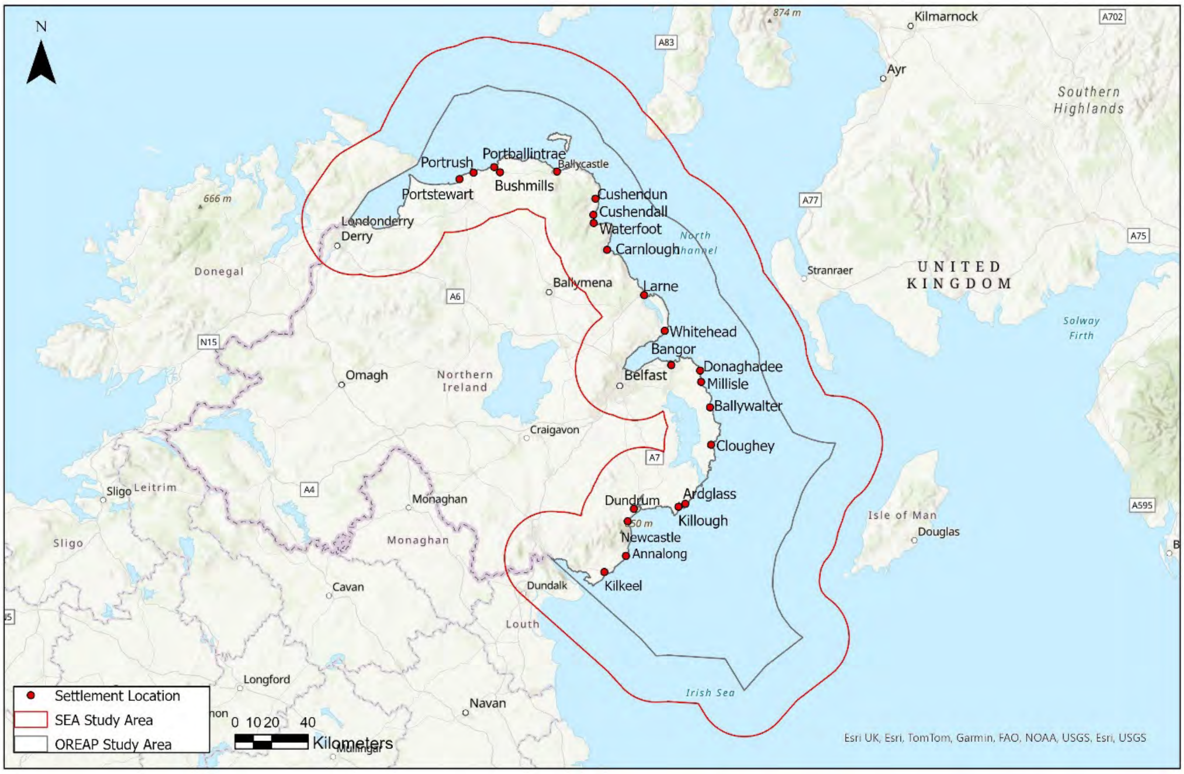

Figure 3-8 Main coastal settlements within the SEA Study Area.

3.2.2.2 Employment

Over two-thirds of all residents in NI aged 16 to 64 years were economically active in the 2021 census (70.2%); these were primarily composed of full-time and part-time employees. In 2021, most district council areas in NI saw an increase in employee jobs[79].

Total employment in NI in September 2021 including employees and working owners was 823,672[80]. Services was the headline industry with greatest employment (at 666,235 individuals), followed by Manufacturing (89,024 individuals), Construction (43,269 individuals) and Other (25,145 individuals). The Other industry category, accounting for 3.1% of all jobs in NI, were predominantly in 'Agriculture, forestry and fishing' (53%); and 'Water, sewage, waste management and remediation' (31%). Data from the NI Business Register and Employment Survey 2021 includes 205 individuals directly employed in fishing and 106 in aquaculture, 406 individuals employed in the 'processing and preserving of fish, crustaceans and molluscs', 33,494 individuals employed in 'retail sale in non-specialised stores with food, beverages or tobacco predominating', and 32 individuals employed in the 'retail sale of fish, crustaceans and molluscs in specialised stores'. There were 528 individuals noted as employed in water transport, including 101 individuals in 'sea and coastal freight water transport'. There were also 585 individuals employed in 'service activities incidental to water transportation'.

Regarding employment in the renewables sector, estimates of the size of the UK's Low Carbon and Renewable Energy Economy (LCREE) indicate that, for NI, the sector generated around £1.5 billion in

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[79] NISRA. 2024. Business Register and Employment Survey. Available at: https://www.nisra.gov.uk/statistics/annual-employee-jobs-surveys/business-register-and-employment-survey

[80] NISRA. 2022. Business Register and Employment Survey 2021. Available at: https://www.nisra.gov.uk/system/files/statistics/BRES-2021-Publication_1.pdf

turnover and provided 6,700 full-time equivalent jobs in 2021[81]. The Energy Strategy for NI aims to at least double the size of this sector by generating local market opportunities, in place of importing fossil fuels, and by ensuring that NI companies can compete successfully for the UK and global opportunities in low carbon energy and technologies that are becoming available.

3.2.2.3 Coastal and Marine Recreation and leisure

Yachting is popular in the more sheltered coastal waters, bays and sea loughs of NI, while particular routes are followed to traverse the coast, and travel between islands. Strangford Lough is a very popular location, with 12 clubs located on its shores. In total, there are 12 marinas within the SEA Study Area. The east coast, from south of Carlingford Lough northwards to Ballygalley, and taking in Carlingford Lough, Strangford Lough and Belfast Lough, is identified as a general sailing area by RYA. Carlingford Lough, Strangford Lough, Belfast Lough, Larne Lough and Lough Foyle are also identified as RYA Boating (Sailing/Racing) Areas. The location of marinas and Sailing and Racing Areas within the SEA Study Area is shown in **Figure 3-9**.

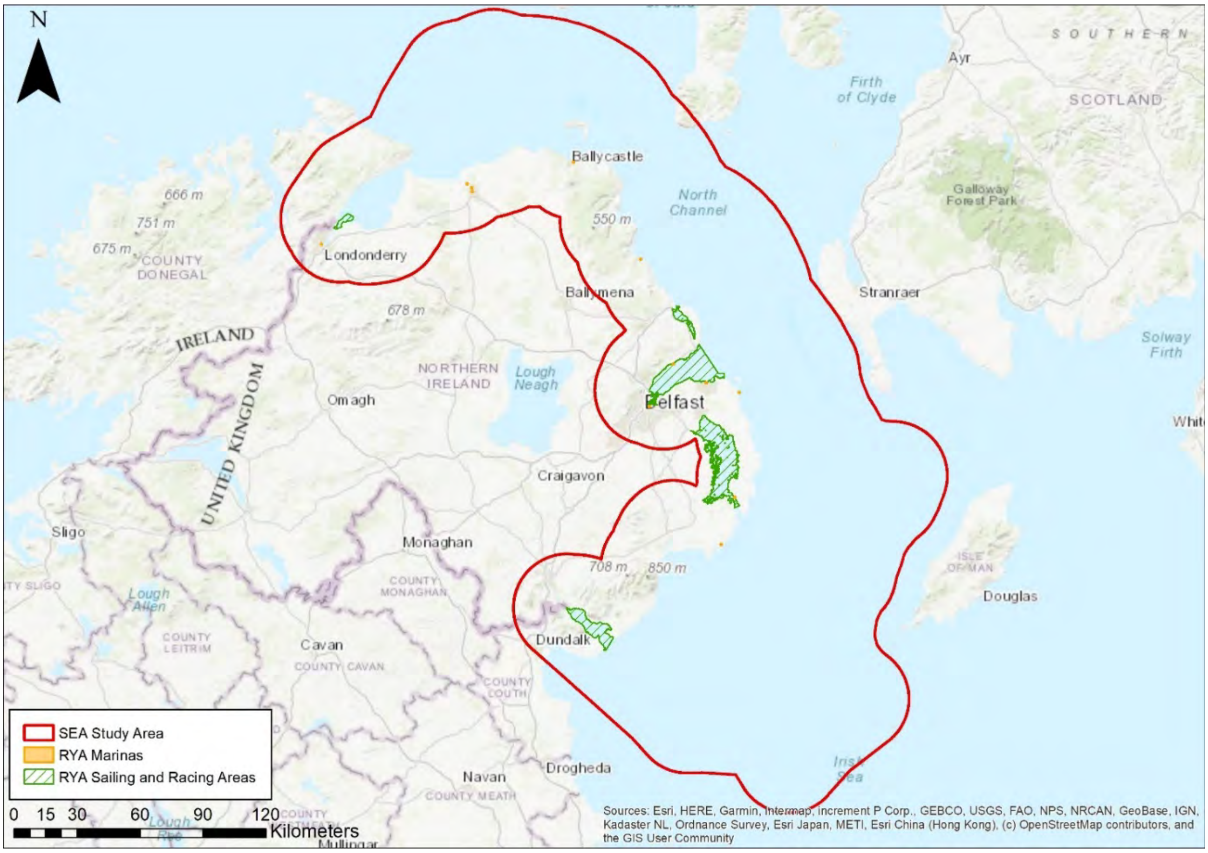

Figure 3-9 RYA areas within the SEA Study Area – Marinas, Sailing and Racing Areas

The SEA Study Area is known for its clear waters and diverse marine life. Diving attractions within the SEA Study Area include both wrecks and marine wildlife. There is localised diving around the population centres in the region, and some dive boat charters to more remote areas. Particular areas of interest include the historic wrecks of HMS Drake, MV Alastor and Girona, and the areas of Portstewart, Portmuck, Causeway coast, Whitehead and Rathlin Island.

Water sports, including canoeing and kayaking, paddleboarding, boating, surfing, kitesurfing, caving and coasteering occur around at many coastal locations, including Strangford Lough, Belfast Lough,

[81] ONS. 2023. Low carbon and renewable energy economy, UK: 2021. Available at: https://www.ons.gov.uk/economy/environmentalaccounts/bulletins/finalestimates/2021

Carlingford Lough, Portrush, Portstewart, Ballintoy, Derry / Londonderry, Portaferry, and Coleraine[82]. The majority of coastal surf shops and outdoor activity operators within the SEA Study Area are located on the north coast in the vicinity of Portrush, or along the coast of Belfast Lough. These centres offer a range of marine related activities including surfing, wind surfing, kayaking and angling. The coastline of NI receives swell waves from the Atlantic Ocean. The main surfing areas are situated along the stretch of coast between Magilligan in the west to Ballycastle in the east, with the most popular surfing location around Portrush.

Sea angling is an important recreation and leisure activity, as well as a contributor to coastal tourism. Key areas for angling in the UK include the south and northeast coasts of England and Wales. The Directory of Charter Boats UK (CBUK)[83] holds records on 4184 charter boats in the UK, of which two are registered in NI (one operating out of County Down, and one out of County Antrim).

Beaches in NI, which are mostly rural in nature, are primarily used in summer months. There are 26 beaches designated as bathing waters in NI under the Quality of Bathing Water (NI) Regulations 2013 that are used for recreation and leisure predominantly during the tourist season. These designated bathing waters are detailed in **Table 3-14,** and their locations shown in **Figure 3-14** of **Section 3.2.4** Water. Several seaside resorts, such as Newcastle, Bangor, Portrush and Portstewart have a strong traditional accommodation base due to their historic popularity for tourism. Portstewart, with car parking on the beach, attracts high numbers of visitors in good weather and has one of the most popular beaches. Good railway connections to Belfast also contribute to the popularity of the beaches at Portrush and Portstewart. There are currently 18 Blue Flag sites in NI, which have met a series of stringent environmental, educational, safety-related and access-related criteria; these comprise nine beaches (Benone Beach, Castlerock Beach, Cranfield Bay, Downhill Beach, Murlough Beach, Portrush East Strand Beach, Portrush West Strand Beach, Tyrella Beach, and Whiterocks Beach) and nine marinas (Ballycastle Marina, Ballyronan Marina, Bangor Marina, Carrickfergus Marina, Coleraine Marina, Glenarm Marina, Portglenone Marina, Portrush Harbour and Marina, and Rathlin Marina)[84]. The top ten beaches in NI, as listed on The Beach Guide UK are Whiterocks Beach, Ballygally, Whitepark Bay, Brown’s Bay, Downhill Strand, The Strand Portstewart, Benone Beach, Murlough, Tyrella Beach (Clough) and Helen’s Bay[85].

The generally unspoilt and undeveloped nature of much of NI’s coastline makes it ideal for wildlife-related recreation, leisure and tourism. Notable sites include Rathlin Island, which is popular with birdwatchers for its extensive bird populations and undeveloped landscapes, and Strangford Lough, where watching for many types of wildlife, including grey and common seals, otters, porpoises, and aggregations of wintering cormorants and terns, takes place.

Sightings of whales off the coast of NI have increased over recent years as whale watching becomes more popular. The best places for whale watching are headlands, islands and bays when the sea is calm. Whale watching and angling vessels can also be chartered from a range of locations off the northern coast of NI.

3.2.2.4 Summary of Existing Pressures and Issues for Population and Human Health

NI’s marine area supports many facets of employment directly and indirectly, such as fishing (including aquaculture), processing and sales, and water transport; these sectors have been disrupted in recent years by the Covid-19 pandemic and by Britain’s exit from the EU. Coastal communities are likely to be increasingly subject to coastal hazards associated with extreme weather events due to climate change

[82] Discover NI. 2024. Water Sports. Available at: https://discovernorthernireland.com/things-to-do/outdoors-nature-and-wildlife/water-activities/watersports?p=2

[83] Charterboats UK (CBUK). 2024. Charter Boats: Northern Ireland. Available at: https://www.charterboats-uk.co.uk/northernireland/

[84] Keep Northern Ireland Beautiful. 2024. Blue Flag Award. Available at: https://www.keepnorthernirelandbeautiful.org/cgi-bin/generic?instanceID=29#:~:text=Blue%20Flag%20Beaches,%2C%20Tyrella%20Beach%2C%20Whiterocks%20Beach.

[85] The Beach Guide. 2024. Northern Ireland beaches. Available at: https://www.thebeachguide.co.uk/northern-ireland/

and may be subject to pressures such as coastal development, noise and, in some areas, water pollution.

Implementation of the OREAP, and the construction, maintenance and decommissioning activities associated with the potential offshore renewable energy projects that may arise as a result, has the potential to lead to positive or negative effects on employment; employment relating to fisheries and marine transport could be adversely affected through disruption or displacement during installation of infrastructure, to exclusion from areas of operational infrastructure; however, renewable energy projects have potential for positive effects on employment, both locally and more widely. Coastal communities and leisure activities have the potential to be disrupted, primarily during the installation of renewable infrastructure, or associated with onshore cabling.

3.2.2.5 Evolution of the baseline in the absence of the plan

The future baseline for population and human health in the SEA Study Area is likely to be driven by the current trends and pressures as discussed above. The population is expected to continue to increase into the future, with an increase in the older cohort of the population. The area is likely to continue to be used for leisure and recreational activities such as sailing, angling, swimming and beach use, diving and water sports, as well as wildlife watching, and these activities may be influenced by the predicted and planned increase in tourism. Coastal and marine-related employment, such as in fisheries, aquaculture, and water transport will be influenced by commercial factors, demand, level of fish stocks and policy and legislative changes.

3.2.3 Geology, Soils and Land Use

Bathymetry is a key factor when selecting appropriate sites for marine devices, as these have optimal water depth ranges within which they can operate. The bedrock and the nature of the Quaternary deposits is relevant to the design and siting of seabed installations and, where rocks occur close to the seabed, they may also exert control over sedimentary processes and affect both physical and biological habitats at the seabed. Seabed sediments, and the marine sedimentary processes of erosion, transport and deposition that control their distribution, character and thickness, are also relevant to the design and siting of seabed/near-seabed renewable energy installations. Seabed installations can have potentially significant effects on these marine sedimentary processes.

It is considered that the key issues associated with the implementation of the OREAP and Geology, Soils and Land Use comprise:

- Potential for physical damage to the seabed from new infrastructure.
- Potential for indirect physical effects on the seabed or subsurface from new infrastructure e.g., through alteration of the sediment regime, changes to seabed morphology, depositing of dredged material.
- Potential for alteration of hydrodynamics or coastal processes.

3.2.3.1 Bathymetry and Seabed Features

NI is bordered by the Irish Sea to the east, by the North Channel to the north-east, and by the Malin Sea to the north. Off the north-east coast of NI, the bathymetry is dominated by the North Channel, a strait that separates eastern NI and the south-west of Scotland. The Irish Sea is a relatively small regional sea, covering an area of approximately 58,000km^2. It generally takes the form of a relatively shallow basin, with considerable areas where the depth ranges from 20-100m. In the western part of the Irish Sea, a deeper channel of over 100m in depth extends from north to south, reaching a maximum depth of 315m in the North Channel; this deeper channel links with the Celtic Sea in the south via St George's Channel, and with the Malin Sea to the north via the North Channel.

Surrounding the NI coastline, the local seabed is predominantly under shallow water, with approximately two thirds of the area having water less than 100m deep[86]. Off the south-eastern coast of County Down, the seabed slopes relatively gently, with overall gradients of approximately 0.17° to the south-east and water depths of approximately 100m at the 12nm limit. Off the north-eastern coast of NI, the seabed gradients are higher in the vicinity of the North Channel, with overall gradients of approximately 0.45° towards the north-east. The centre of the North Channel lies roughly at the 12nm limit, where isolated deeps of up to 284m occur. The axis of the North Channel runs approximately 5km to the north of Rathlin Island: in this area the seabed shelves steeply with overall gradients of 3° and a maximum depth of approximately 240m. Off the north-east coast of County Donegal, to the west of Rathlin Island, the overall seabed gradient is relatively gentle at approximately 0.29°. An overview of the bathymetry of the SEA Study Area is shown in **Figure 3-10**.

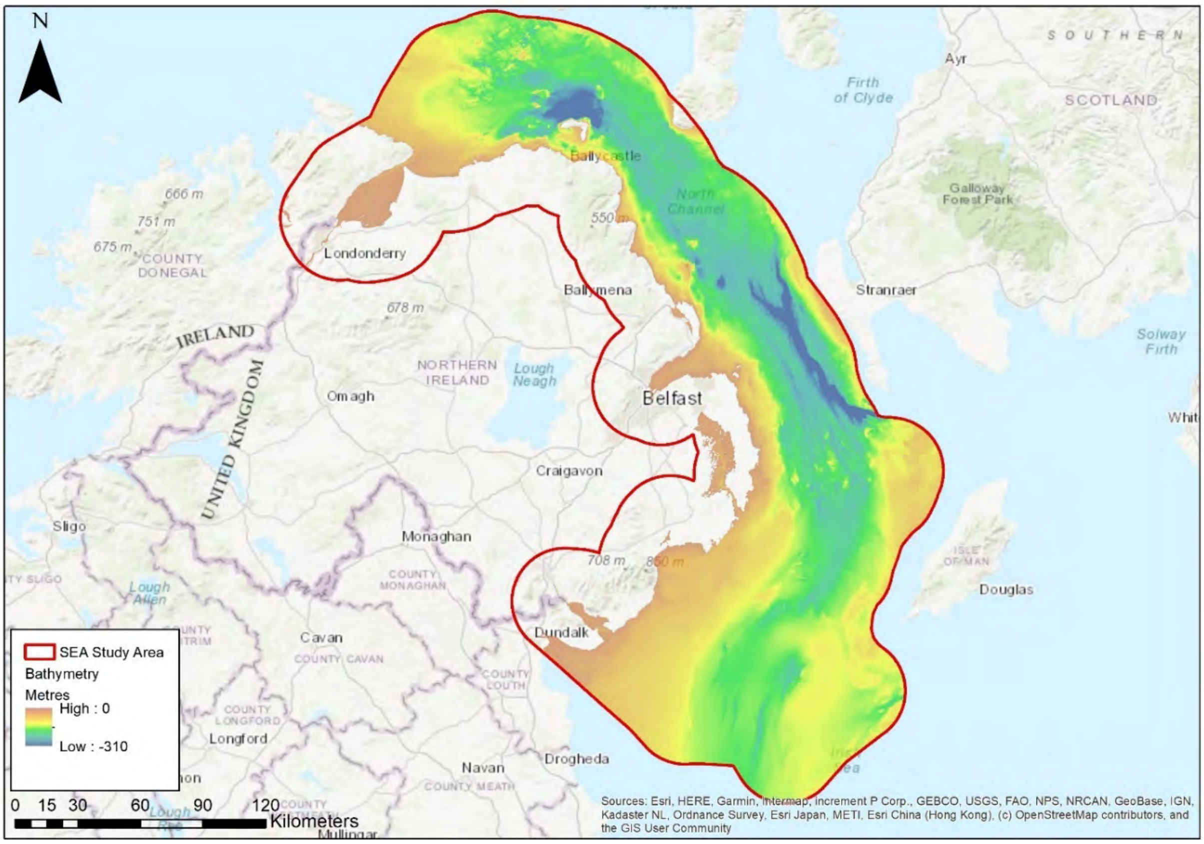

Figure 3-10 Bathymetry of the Study Area

3.2.3.2 Marine and Coastal Geology and Sediments

3.2.3.2.1 Bedrock and Quaternary Geology

The geological landscape of NI is remarkably varied considering its relatively small area of about 14,000km^2 and reflects the diverse geology on which it has been shaped. The older rocks can be broadly split into two distinct types: sedimentary bedrock and basement bedrock. Sedimentary bedrock geology consists of younger sequences, including limestones, sandstones and clays and older sequences, including sandstones, siltstones and mudstones. Basement geology (which underlies the sediment geology) consists of rocks that formed from the solidification of molten rock below volcanoes (igneous rocks) and sediments or intrusions that have changed as a result of high temperatures and

[86] AFBI. 2015. Northern Ireland State of The Seas Report – Seabed Integrity. Available at: https://www.afbini.gov.uk/sites/afbini.gov.uk/files/publications/%5Bcurrent-domain%3Amachine-name%5D/contents%20ministers%20forewords%20and%20executive%20summary.pdf

pressures (metamorphic rocks). Onshore, the upland areas of NI are dominated by hard rocks that are relatively resistant to erosion – the older Dalradian metamorphic basement rocks in the Sperrin Mountains, the basalts of the Antrim Plateau and the granites of the Mourne Mountains.

Onshore rock units may extend several kilometres offshore from the coastal areas, and many of the rock units found onshore are also present offshore, however the distribution of rock types differs. Most of the offshore area of NI is underlain by less resistant sedimentary rocks – mostly Permo-Triassic mudstones and sandstones. In areas off the north coast of NI (Malin Sea and North Channel) rocky outcrops of basaltic rocks occur, which are locally significant.

Overlaying the bedrock geology, NI has widespread geological deposits of relatively recent origin, known as superficial deposits, which formed during the last 2-3 million years of the Earth's history, spanning the Ice Ages and Interglacial periods. The Quaternary Period, with its dramatic changes in climatic conditions leading to rapid changes in sea level and episodes of extreme glacial erosion and deposition, acted on the existing bedrock and superficial sediments and largely shaped the gross bathymetry of the offshore area of NI. The distribution and thickness of glacial and glaciomarine deposits are very variable, ranging from areas of exposed bedrock to narrow glacially eroded basins infilled with up to 300m of glacial sediment. These offshore glacial deposits can also have great variability both in the size and composition of material. In certain areas the near-surface parts of these deposits have been reworked during the Holocene.

3.2.3.2.2 Sediment Characteristics, Transport and Processes

The seabed around NI's coastline can be divided into three roughly equal areas of mixed coarse sediment, sand and mud[47]. The seabed type is often reflective of the strength of the tides, with coarse sediments occurring in strong tidal conditions and mud in more sheltered areas. The seabed around NI can be divided into areas of net erosion and deposition. In areas of net erosion, where the sediments overlay Quaternary sediments or older bedrock, the thickness of the active seabed sediment layer is usually less than 2m, and there may be relict inactive bedforms formed at times of lower sea level. In areas of net deposition, banks of sand waves and megaripples can reach 30 to 40m in height.

Off the north coastline the tides tend to be moderate in nature, and the seabed is comprised of mobile sand. Around Rathlin Island, the bedrock and strong currents present provide a rocky reef habitat. Stronger tides occur in the North Channel, with extensive areas of sand with large ripples and coarse sediment, while rocky outcrops are present at the Maidens. There are large areas of muddy sand close to the coast off County Down, with soft mud present in deeper waters. A variety of productive seabed habitats occur within the sea loughs. An overview of the seabed sediments within the SEA Study Area is shown in **Figure 3-11**.

The shape and nature of the seabed can affect waves and currents, processes that shape the coastline through coastal erosion and deposition. The Coastal Erosion Risk Management Report[87] used available data to undertake a high-level assessment of the vulnerability of NI's coastline to coastal erosion. This preliminary assessment did identify areas at potential risk of erosion; however, it also identified a lack of coastal erosion-specific data on which to base a reliable risk ranking.

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[87] DAERA NI and DfI. 2018. Baseline Study and Gap Analysis of Coastal Erosion Risk Management NI. Available at: https://www.infrastructure-ni.gov.uk/sites/default/files/publications/infrastructure/coastal-erosion-risk-management-report-2019.pdf

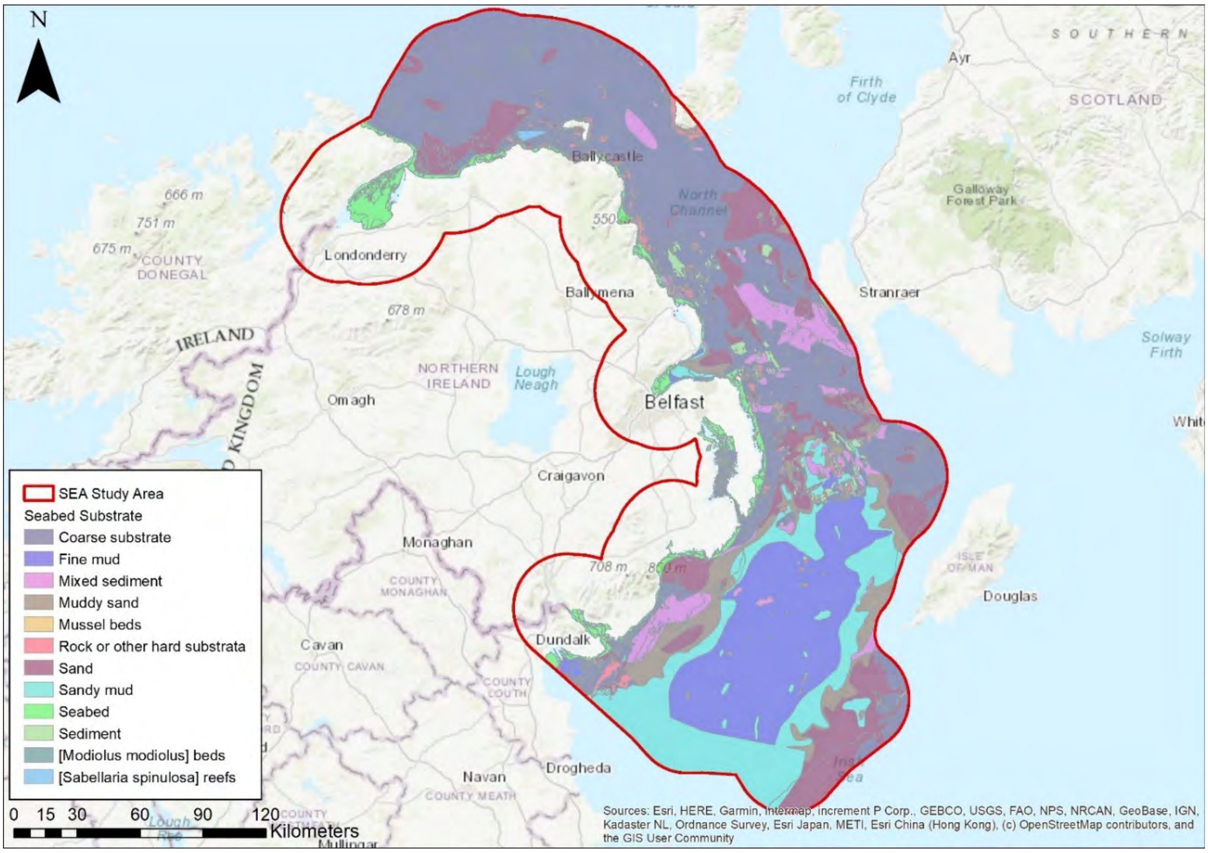

Figure 3-11 Seabed sediments within the SEA Study Area

3.2.3.2.3 Designated Sites for Earth Science Features

There is one UNESCO World Heritage Site (WHS) in NI, the Giant's Causeway and Causeway Coast WHS, which is designated for its unique geological heritage. This site lies at the foot of basalt cliffs along the sea coast on the edge of the Antrim Plateau and includes approximately 40,000 massive black basalt columns that project from the sea. The Mourne, Gullion, Strangford UNESCO Global Geopark is situated along the south-east border of NI, encompassing three Areas of Outstanding Natural Beauty (AONBs) and covering an area of 1,932km^2 including a marine area of 94km^2; this Geopark protects areas of internationally important rocks and landscapes, all of which must be managed responsibly for conservation, education, and sustainable development.

As described in **Section 3.2.1.1**, ASSIs have been developed as a national suite of sites that provide statutory protection for the best examples of the UK's flora, fauna, geological or physiographical features. They are also used to underpin other national and international nature conservation designations. There are 148 ASSIs in NI that are designated for, or partially for, their Earth Science interest. There are 77 ASSIs that are designated, at least in part for their earth science features, which are within the SEA Study Area; of these, 21 sites have a coastal component, or are situated immediately adjacent to the coast. Details of these sites are provided in **Table 3-10**.

Table 3-10 Summary of ASSIs protected for earth science interest in the SEA Study Area

Site Name	Location	Description of earth science/physiographic interest
Ballycastle Coalfield ASSI	Co. Antrim	Best exposure of a coalfield sequence in Ireland. The area also contains important evidence of early industrial activity.
Carrickarade ASSI	Co. Antrim	A section through an explosive volcano, an important feature in the interpretation of the earliest stages of Tertiary volcanic activity in the region. The limestone cliffs also contain one exceptional raised sea cave.

Site Name	Location	Description of earth science/physiographic interest
Giants Causeway and Dunseverick ASSI	Co. Antrim	Important geological site, with volcanic rocks that show the three main eruption phases and rocks containing important minerals. Geological feature of a lava feeder tube also occurs near Portmoon.
Larne Lough ASSI	Co. Antrim	A sea lough of approximately 9km length whose form was mainly determined in relation to the Larne Lough Fault, which runs in a north-north-west direction. Fossiliferous Jurassic rocks occur as well as an estuarine clay series containing fossil remnants.
Portmuck ASSI	Co. Antrim	Contains the best exposure of the Cretaceous Hibernian formation in NI, the only occurrence of the mineral sodalite in Ireland and the international type locality of Gobbinsite. A range of other minerals and basalt related features are also present.
Portrush West Strand ASSI	Co. Antrim	Important site for geological history. The area is underlain by layers of peat and dune sand that reflect the pattern of coastal changes over 7000 years.
Ramore Head and the Skerries ASSI	Co. Antrim	Important site regarding the origin of basaltic rocks. An unusually complex layered intrusion of Tertiary dolerite into shales of Jurassic age producing hornfels rock with abundant fossils.
Rathlin Island Coast ASSI	Co. Antrim	Formations include vertical cliffs, shores of both boulder and shingle, and wave cut platforms on chalk and basalt. The geological exposures and rock formations associated with these coastal conditions are also important.
Runkerry ASSI	Co. Antrim	A beach system of international importance that shows beach states from dissipative to reflective. A wide range of rhythmic morphological features are also present.
Torr Head ASSI	Co. Antrim	Best exposure of metamorphosed Limestone of Dalradian age in NI, of international importance in understanding relationships between rock sequences elsewhere.
White Park Bay ASSI	Co. Antrim	The bay comprises a massive land-slipped area backed by high chalk cliffs, and several exposures are well represented, with sea stacks and natural arches present.
Outer Belfast Lough ASSI	Co Antrim / Co. Down	Important for the Ordovician series of spilitic lavas, black shales and greywackes. The Carboniferous series of the Holywood group are also of significance and the Permian rocks are the best exposed series of rocks of this age in Ireland.
Carlingford Lough ASSI	Co. Armagh / Co. Down	Limestones that were deposited in a shallow sea basin during the Carboniferous period and which contain numerous fossils. Moraines and deposited sediments provide evidence of ice sheet and glacier movement.
Copeland Islands ASSI	Co. Down	Rocks date from some 400 million years ago to the closure of the Iapetus Ocean during the Silurian period. They contain among the best examples in NI of intruded volcanic rocks of this age, where the form of the intrusions is controlled by structural alteration of the country rock.
Killard ASSI	Co. Down	The glaciomarine sediment sequence within the site represents part of a unique moraine deposited in a tidewater setting. This feature fronts and is associated with the formation of the drumlin swarms to the west and dates from the Late Midlandian, some 17,000 years ago.
Murlough ASSI	Co. Down	Exhibits a range of gravel ridges, re-curved spit, dune systems, palaeosols and contemporary beach processes dating from between late glacial and modern times.
Outer Ards ASSI	Co. Down	The peninsula is of interest due to the structure, palaeontology and stratigraphy at Orlock Bridge, Coalpit Bay and Kearney Point. The seashore at Ballymacormick Point is composed of a number of Ordovician rock ridges running parallel to the waterline.
Strangford Lough ASSI	Co. Down	The sea inlet is made up of a drowned drumlin field, with raised beach terraces shaped by Quaternary glaciation. The drumlins display stages of wave erosion, with a number reduced to rocky islands or 'pladdies'. The Lough is an Earth Science Conservation Review Site (ESCR) because of its coastal processes (contemporary processes at Bar Hall Bay, Gransha Point, Youran, Narrows, Dorn and Northern Mudflats).

Site Name	Location	Description of earth science/physiographic interest
Bann Estuary ASSI	Co. Derry / Londonderry	The site incorporates a series of sand dune systems which together with the lowest section of the River Bann, are part of the same physiological unit that has evolved over the last 6,000 years. The study of the dune sediments provides information critical to understanding sea-level history in the area and the development stages and processes in the evolution of temperate dune soils.
Lough Foyle ASSI	Co. Derry / Londonderry	The physiographical interest of the site relates to various active coastal processes that occur on both the intertidal and upper beach areas of the shore, in the river and in the saltmarsh environments. These include development of shell and gravel ridges, saltmarsh pans, drainage creeks and sand pits.
Magilligan ASSI	Co. Derry / Londonderry	Represents one of the best sand dune systems in NI. The system extends along a substantial portion of the north coast and is an internationally recognised classical beach-ridge cuspate foreland with active prograding dunes (which also presents a detailed record of Holocene sea-level changes). It is the largest and most intensively studied coastal accumulation site in Ireland and amongst the top such localities in Europe.

In addition, five MCZs have been designated to protect nationally important marine species, habitats and features of geological or geomorphological interest in the NI inshore region. The geological and/or geomorphological features considered for protection in MCZ development were listed as the following[88]:

- Glacial process features;
- Marine process features;
- Mass movement features;
- Features indicating past change in relative sea level;
- Geological process features; and
- Seaward extension features.

Sites identified for geological and/or geomorphological features will, in most cases, be multi-feature sites where these occur alongside PMF habitats or species. Of the MCZs designated in NI's waters to date, Rathlin Island MCZ was designated, in part for its geological/geomorphological interest features. This site encompasses an area of 90.6km^2 off the coast of Co. Antrim. It includes a range of subtidal geological and geomorphological features that have been recorded along the north coast of the Island, including a submerged coastline, underwater caves, sea arches and lagoons. These are important indicators of global sea-level change.

The locations of these sites designated for geological, geomorphological or other earth science features are shown in **Figure 3-12**.

[88]DAERA NI. 2014. Guidance on selection and designation of Marine Conservation Zones (MCZs) in the Northern Ireland Inshore Region. Available at: https://www.daera-ni.gov.uk/sites/default/files/publications/doe/marine-report-guidance-on-selection-designation-of-mczs-in-ni-inshore-region-2014.PDF

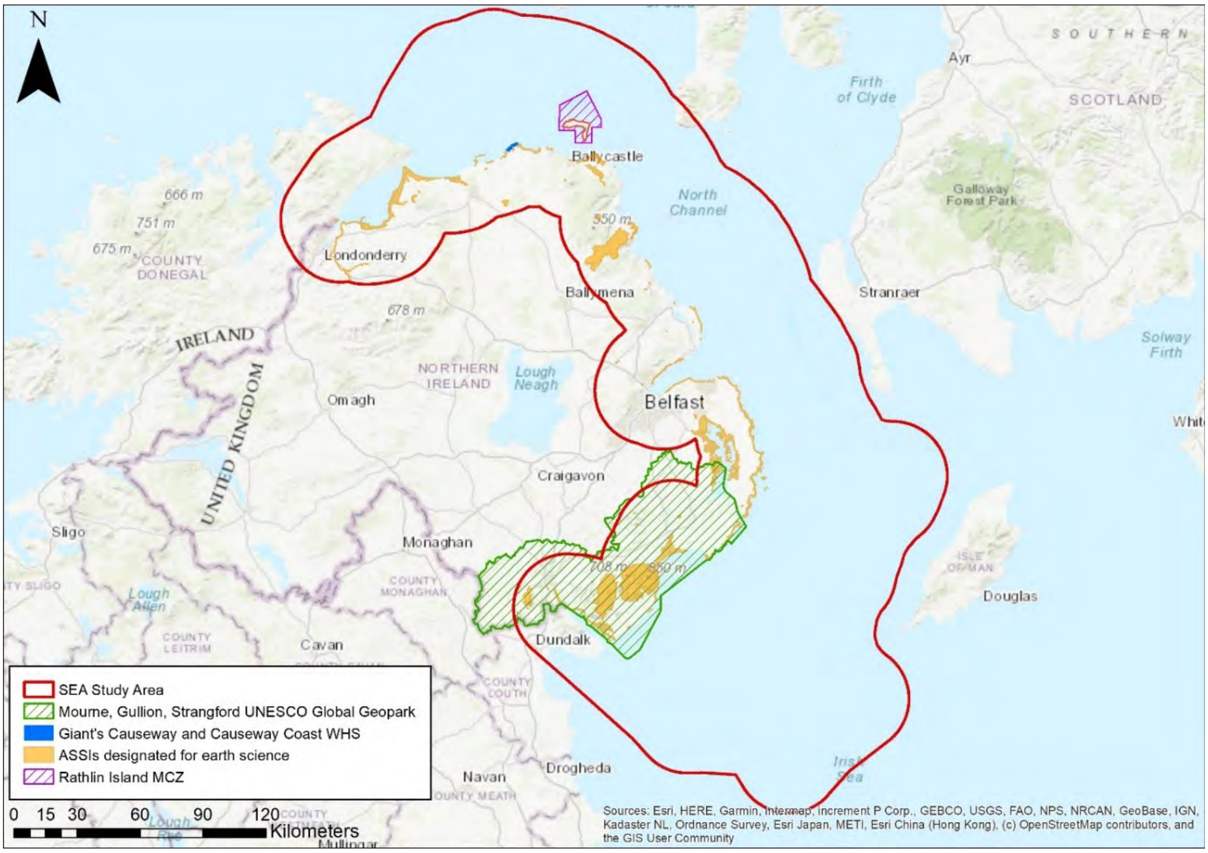

Figure 3-12 Sites designated for geological, geomorphological, or other earth science features within the SEA Study Area

3.2.3.3 Summary of Existing Pressures and Issues for Geology, Soils and Land Use

Activities occurring at the seabed, such as capital and maintenance dredging, marine explorations and installations, and destructive fishing methods can lead to localised changes in seabed sediments and marine sedimentary processes.

Implementation of the OREAP, and the construction, maintenance and decommissioning activities associated with potential offshore renewable energy projects that may arise as a result, has the potential to cause a loss of marine sediments, and to affect marine sedimentary processes through the addition of infrastructure at or near to the seabed. Geological or geomorphological features, including those within designated sites, have the potential to be directly or indirectly damaged by invasive construction methods such as piling or cable trenching. Bathymetry, as well as the nature of the seabed geology and deposits, directly influence the siting and design of marine renewable installations.

3.2.3.4 Evolution of the baseline in the absence of the plan

Whilst certain types of seabed development such as capital and maintenance dredging, and marine installations may result in localised changes to marine sedimentary processes and seabed sediments, there is no evidence to suggest any general long-term trends in marine geology.

The main issues affecting geomorphology are related to the interaction between the energy within coastal seas and the processes of erosion, transport and deposition. Climate change could cause an increase in frequency of extreme weather events. The intensity of storm events could impact associated wave heights and the energy within coastal seas, which in turn would affect erosion rates, particularly of vulnerable coastlines.

Marine or coastal development or other marine activities could affect the geological and geomorphological features within MCZs or ASSIs. There may be increased protection of marine and coastal geological and geomorphological features in the future through designation of further areas e.g., as MCZs or ASSIs.

3.2.4 Water

Water is essential for the maintenance of biodiversity, supports the population through the provision of drinking water, and supports many of our core activities[89]. Assessment of the UK status of marine waters under the MS indicates that, for several Descriptors, the achievement of good status is uncertain or has not yet been achieved, while assessments of transitional and coastal waters under the Water Framework Directive highlight that none have achieved a good or high overall status (note the overall failure for any water bodies to achieve a good or high status relates to an update in the monitoring of persistent chemicals, as discussed below)[90]. It is considered that the key issues associated with the implementation of the OREAP and Water comprise:

- Potential for the accidental release of contaminants or disturbance of historic sediment contaminants during construction, or release of contaminants from vessels during construction and operation.
- Potential for the disturbance and mobilisation of marine sediments and effects on turbidity.
- Potential for indirect effects on the water column e.g., temperature, turbidity, salinity.
- Potential for the introduction of temporary or permanent sound sources into the marine environment.
- Potential for the introduction of non-natural EMF into the marine environment.
- Potential for the introduction of marine litter and seabed debris into the marine environment.
- Potential to adversely affect the status and/or the potential to achieve GES of Marine Strategy Descriptors.
- Potential to adversely affect the status and/or the potential to achieve Good Status of WFD transitional and coastal water bodies, and WFD Protected Areas (Bathing and Shellfish Waters).

3.2.4.1 Marine and Coastal Water Quality

3.2.4.1.1 The Marine Strategy and Status of Descriptors

The MS Regulations 2010, which transposed the EU MS Framework Directive (Directive 2008/56/EC), required action to be taken to achieve or maintain GES marine waters within the MS area by 2020. GES is defined in the Regulations as “the environmental status of marine waters where these provide ecologically diverse and dynamic oceans and seas which are clean, healthy and productive within their intrinsic conditions, and the use of the marine environment is at a level that is sustainable, thus safeguarding the potential for uses and activities by current and future generations”.

The Regulations required the production of a MS for UK waters, coordinated across the four UK Administrations. The Strategy aims to help in the delivery of international obligations and commitments such as those under the UN Convention on the Law of the Sea (UNCLOS), UN Sustainable Development Goal 14, OSPAR Strategy and Convention on Biological Diversity, and the OSPAR North-

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[89] DAERA NI. 2013. From Evidence to Opportunity A Second Assessment of the State of NI's Environment. Available at: https://www.daera-ni.gov.uk/sites/default/files/publications/doe/corporate-report-from-evidence-to-opportunity-second-assessment-of-state-of-ni-environment-2013.pdf.

[90] DAERA NI. 2021. Water Framework Directive Statistics Report 2021. Available at: https://www.daera-ni.gov.uk/sites/default/files/publications/daera/NI%20Water%20Framework%20Directive%20Statistics%202021_0.pdf

East Atlantic Environment Strategy (NEAES) 2030. The UK MS applies an ecosystem–based approach to the management of human activities, and considers the following 11 quality Descriptors:

- D1 – Biological diversity (cetaceans, seals, birds, fish, pelagic habitats and benthic habitats);
- D2 – Non-indigenous species;
- D3 – Commercially-exploited fish and shellfish;
- D4 – Food webs (cetaceans seals, birds, fish and pelagic habitats);
- D5 – Eutrophication;
- D6 – Sea-floor integrity (benthic habitats);
- D7 – Hydrographical conditions;
- D8 – Contaminants;
- D9 – Contaminants in fish and other seafood;
- D10 – Marine litter; and
- D11 – Underwater noise.

The UK MS comprises three parts, to be updated every six years: assessment, monitoring programmes and a programme of measures. The first UK assessment of our seas was published in 2012[91], and set objectives, targets and indicators for achieving GES; this was updated in 2019[92], and the summary status of Descriptors for the UK is summarised in **Table 3-11**. MS Descriptors that relate to habitats and species are discussed further within **Section 3.2.1** Biodiversity, Flora and Fauna.

Table 3-11 Summary of UK Assessment of Environmental Status for the MSFD

Descriptor	GES Achieved	Trend	Description
D1 and D4 Cetaceans	Partially	Stable/mixed	Achievement of GES uncertain. Status of coastal bottlenose dolphin and minke whale consistent with GES in the Greater North Sea, but unknown/uncertain elsewhere. Unknown if GES achieved for other species. Fisheries bycatch is an ongoing pressure; the target for cetacean bycatch (indicated by harbour porpoise bycatch) has been met in the North Sea, but in the Celtic Seas it is likely to have exceeded the precautionary threshold.
D1 and D4 Seals	Partially	Improving	GES achieved for grey seals in the Greater North Sea and Celtic Seas. Harbour seals have not achieved GES in the Greater North Sea; in the Celtic Sea, significant increase in West Scotland but status uncertain in other areas.
D1 and D4 Birds	No	Declining	GES achieved for non-breeding waterbirds in the Greater North Sea but not the

[91] Department for Environment, Food and Rural Affairs (DEFRA). 2012. Marine Strategy Part One: UK Initial Assessment and Good Environmental Status. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/69632/pb13860-marine-strategy-part1-20121220.pdf

[92] Department for Environment, Food and Rural Affairs (DEFRA). 2019. Marine Strategy Part One: UK updated assessment and Good Environmental Status. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/921262/marine-strategy-part1-october19.pdf.

Descriptor	GES Achieved	Trend	Description
			Celtic Sea. Breeding seabirds have not achieved GES.
D1 and D4 Fish	No	Improving	Demersal fish communities recovering from past over-exploitation, but GES not yet achieved in the Greater North Sea or Celtic Seas. Partial assessment of pelagic shelf fish did not provide a clear result.
D1 and D4 Pelagic Habitats	Partially	Stable/mixed	Achievement of GES uncertain; prevailing environmental conditions likely driving changes in plankton communities but influence of human activities not certain.
D1 and D6 Benthic habitats	No	Stable/mixed	GES achievement uncertain for intertidal and soft sediment habitats; for soft sediments, the levels of physical damage are considered consistent with GES in UK waters to the west of the Celtic Seas but not in the Celtic Seas or the Greater North Sea. GES not achieved for sublittoral rock and biogenic habitats.
D2 Non-indigenous species (NIS)	No	Stable/mixed	GES not achieved. Ability to detect new NIS has improved but no significant change in the number of new records of NIS between 2003 and 2014.
D3 Commercial fish	No	Improving	GES achieved for some commercially exploited fish. In 2015, 53% of marine fish (quota) stocks fished below maximum sustainable yield (MSY) and has increased significantly since 1990. Most national shellfish stocks have not achieved GES, or their status is uncertain.
D4 Food webs	Partially	Improving	Extent to which GES has been achieved is uncertain, components of the marine food web are changing but it is not clear how they are affecting each other.
D5 Eutrophication	Yes	Stable/mixed	GES largely achieved. A small number of problems remain in coastal and estuarine waters, representing 0.03% of the UK EEZ and 0.41% of estuarine and coastal waters.
D7 Hydrographical conditions	Yes	Stable/mixed	GES continuing to be achieved.
D8 Contaminants	Yes	Improving	GES largely achieved. Concentration of hazardous substances and their biological effects generally meeting agreed target thresholds.

Descriptor	GES Achieved	Trend	Description
			Highly persistent legacy chemicals such as Polychlorinated biphenyls (PCBs) cause of few failures, mainly in coastal waters close to polluted sources.
D9 Contaminants in seafood	Yes	Improving	GES achieved, high level of compliance with agreed safety levels.
D10 Marine litter	No	Stable/mixed	GES not achieved. Beach litter levels in the Celtic Seas largely stable since assessment in 2012, whilst levels in the Greater North Sea have slightly increased.
D11 Underwater noise	Partially	Stable/mixed	Achievement of GES is uncertain, but research and monitoring programmes are improving understanding.

3.2.4.1.2 WFD Status of coastal and transitional water bodies

The EU Water Framework Directive (WFD) (2000/60/EC), transposed in NI through 'The Water Environment (Water Framework Directive) Regulations (NI) 2017' the "WFD Regulations", established a new legal framework for the protection, improvement and sustainable use of rivers, lakes, transitional waters, coastal waters, and groundwater across Europe. This was undertaken to prevent deterioration and to enhance the status of aquatic ecosystems, promote sustainable water use and reduce pollution. The WFD is implemented through River Basin Management Plans (RBMPs), with the Regulations requiring the production and implementation of a RBMP for NI in six yearly cycles. The most recent is the draft third cycle RBMP (2021), which runs from 2021-2027. This classifies the status of all WFD surface water bodies according to chemical, biological and hydromorphological parameters, providing an overall status of either 'High', 'Good', 'Moderate', 'Poor' or 'Bad' for each surface water body (if the surface water bodies have been designated as artificial or heavily modified, they are classified using ecological 'potential' rather than ecological 'status'). 'Water Bodies' are the basic management units for reporting and assessing compliance with the environmental objectives of the WFD Regulations. There are 496 WFD surface water bodies in NI, including 25 transitional and/or coastal water bodies that are within the SEA Study Area.

The third cycle RBMP for NI 2021-2027 will identify those water bodies which can be classified as being at 'good or better' status and set objectives and a programme of measures for the next six-year cycle to help improve those water bodies which are classified as below 'good' status. This is currently at a draft stage, however, an updated classification for water bodies was published in December 2021 in the WFD Statistics Report prior to the production of the third cycle RBMP 2021-2027[93]. This report highlights that there have been significant changes in the monitoring and overall classification for rivers, lakes, and transitional and coastal water bodies. New priority substances were introduced into the monitoring programme in 2018, and the 'chemical status assessment' now includes the presence of ubiquitous, persistent, bioaccumulative, toxic (uPBT) substances. Although a number of these substances are now banned or have restricted use, their widespread past use has resulted in accumulation in the aquatic environment and breaching of Environmental Quality Standards (EQS). These substances were found at all monitoring stations, and uPBT failures were extrapolated to all surface water bodies across NI; as the 'Overall Surface Water Status' from 2021 will incorporate the chemical classification including uPBT substances, as well as cypermethrin failures, this has resulted

[93] DAERA NI. 2021. Water Framework Directive Statistics Report 2021. Available at: https://www.daera-ni.gov.uk/sites/default/files/publications/daera/NI%20Water%20Framework%20Directive%20Statistics%202021_0.pdf

in no water bodies meeting a good or high ‘Overall Surface Water Status’. **Figure 3-13** illustrates the most recent digitally available (2021) status of WFD transitional and coastal water bodies.

Table 3-12 compares the number and percentage of transitional and coastal WFD water bodies at good or high status in 2015, 2018 and 2021. In 2015, 36% of the 25 transitional and coastal water bodies were classified as good or high overall status. In 2018, 40% were classified as good or high overall status. In 2021, no water bodies achieved good or high overall status. Considering ecological status, 36% of water bodies achieved good ecological status in 2021, in comparison to 40% in 2018 and 3% good and 6% high status in 2015. In addition, when the chemical status of water bodies is considered excluding uPBT substances and cypermethrin for comparative purposes, 88% achieved good chemical status in 2021, compared to 44% in 2018 (of 16 assessed water bodies) and 20% in 2015 (of 16 assessed water bodies).

The results of the draft third cycle RBMP classification mean that NI will not achieve the objective to have 70% of its water bodies at ‘good or better’ status.

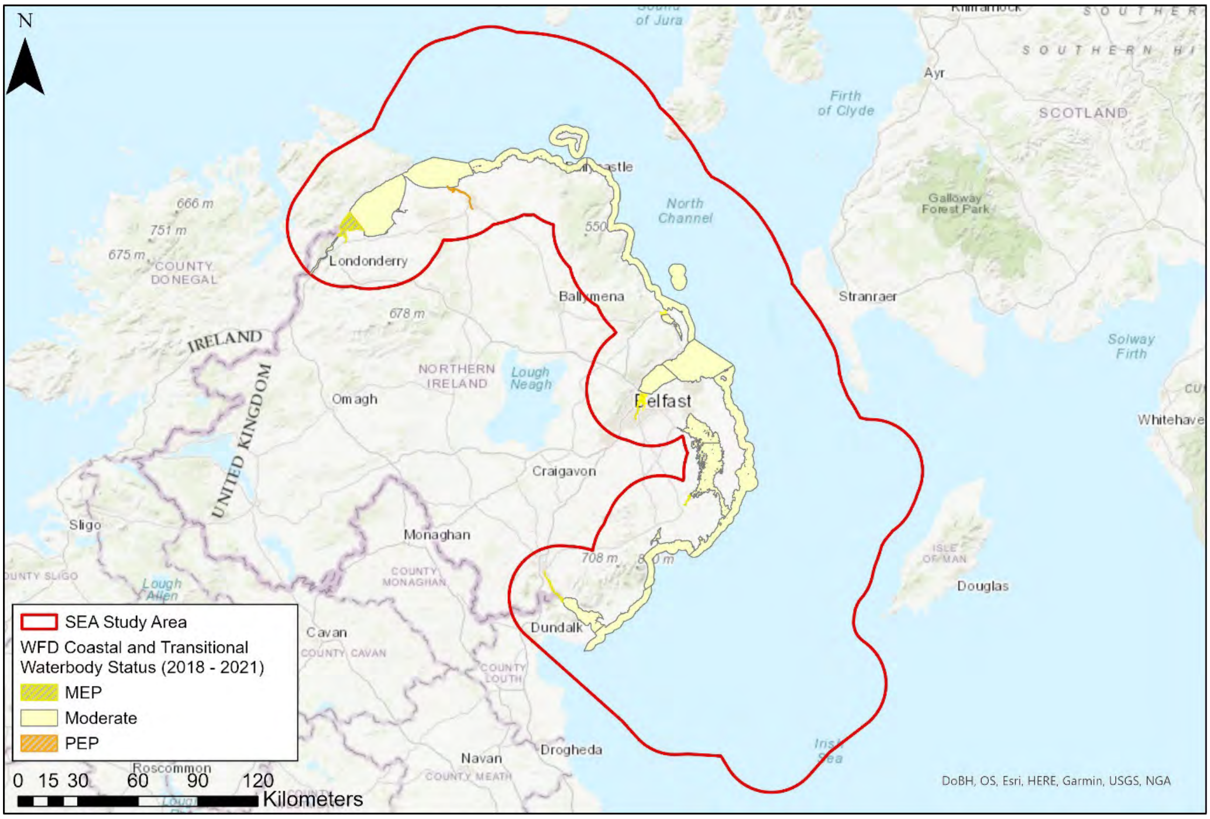

Figure 3-13 WFD status of transitional and coastal water bodies

Table 3-12 Comparison of WFD Transitional and Coastal Water Bodies at ‘Good or Better’ Status for 2015, 2018 and 2021

	Ecological Status	Chemical Status	Overall Status	No.	%
Transitional and coastal 2015	9%	20%	36%	9	36
Transitional and coastal 2018	40%	44%	40%	10	40
Transitional and coastal 2021	36%	0%	0%	0	0

The WFD Regulations also required the establishment of a register of protected areas for NI, for water bodies, or parts thereof, that require additional water quality protection owing to their importance to people or wildlife. This is outlined in Article 10 of the WFD Regulations. The register includes the following protected areas of relevance to the OREAP:

- An area or body of water requiring special protection in accordance with any EU instrument protecting surface water, groundwater or conservation of habitats and species, including:
  - (i) Areas designated for the protection of economically significant aquatic species (including shellfish water protected areas).
  - (ii) Bodies of water designated as recreational waters (Bathing waters).

The location of areas designated for shellfish and bathing waters within NI is shown in **Figure 3-14**.

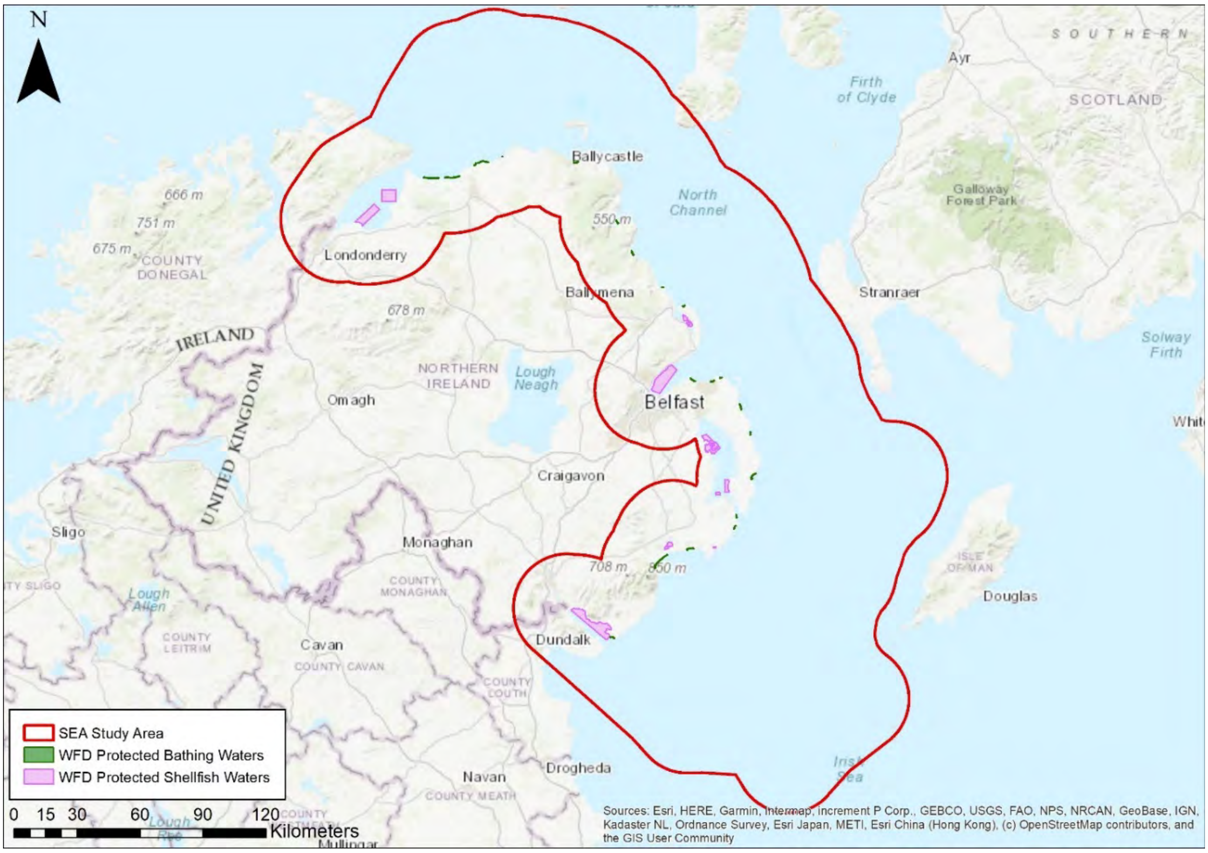

Figure 3-14 WFD Protected Shellfish Waters and Bathing Waters in NI

Shellfish Areas

Shellfish water protected areas (SWPAs) are areas designated for the protection of shellfish growth and production. Good water quality within these areas is important for the production of high-quality shellfish. Both the Shellfish Directive (79/923/EEC) and Freshwater Fish Directive (78/659/EEC) were revoked in 2013 and subsumed into the WFD. Areas previously designated under these Directives are now areas designated for the protection of economically significant aquatic species under the WFD and listed on the Protected Areas register. All SWPAs must be managed to ensure that they meet ecological and chemical objectives under the WFD. They must also meet at least Class B status classification by the Food Standards Agency (FSA) under the Food Hygiene Regulations, to ensure that the quality of shellfish harvested is sufficient to protect public health. SWPAs must also make progress to meet a

WFD microbiological guideline standard of ≥75% of samples containing ≤230 *E. coli* in the shellfish flesh and intervalvular liquid[94].

There are currently 10 SWPAs in NI, shown in **Figure 3-14**. Shellfish Action Plans have been established for these sites and will be reviewed in line with the third river basin cycle under the WFD. SWPAs are managed by DAERA's Marine and Fisheries Division to ensure no deterioration in water quality, and that progress is made towards compliance with guideline standards. **Table 3-13** outlines the most recent status of these sites, as given in the NI Environmental Statistics Report 2024[95]. A total of one out of nine (11%) designated shellfish waters complied with the guideline *E. coli* standard in 2023 (no data was available for Marlfield SWPA in Strangford Lough for several years as shellfish harvesting has not recently occurred here). Only one site has consistently met the guideline standard over the past six years (Skate Rock), while five sites have met the guideline standard at least once, and four sites have not met this standard in any year. The draft 3rd cycle RBMP for 2021-2027 indicates the status of surface water bodies associated with these sites; according to the surface water classification for 2021, all ten surface water bodies were at 'moderate' surface water status. There has been a continued significant statistical deterioration observed at some Belfast Lough shellfish beds (B2, B4 and B5) and both Dundrum Inner South mussels and Inner North oysters. The observed deterioration in Dundrum has been linked to several agricultural practices within the catchment and a pilot scheme is being developed to help identify and resolve agricultural issues in the area.

Table 3-13 Location and Status of Shellfish Water Protected Areas in NI

Site Name	WFD Status 2021	WFD Target 2027	FSA Classification 2021	WFD *E. Coli* Guideline 2023
Larne Lough	Moderate	Good	B	Did not meet guideline
Belfast Lough	Moderate	Good	B/C*	Did not meet guideline
Strangford Lough – Paddy's Point and Reagh Bay	Moderate	Good	A	Did not meet guideline
Strangford Lough – Skate Rock	Moderate	Good	B	Met guideline
Strangford Lough – Marlfield Bay	Moderate	Good	N/P	Not Designated or Not in Production
Killough Harbour	Moderate	Good	B	Did not meet guideline
Dundrum Bay	Moderate	Good	B/C**	Did not meet guideline
Lough Foyle, Longfield Bank	Moderate	Good	B	Did not meet guideline
Lough Foyle, Balls Point	Moderate	Good	B	Did not meet guideline

[94] The Water Framework Directive (Classification, Priority Substances and Shellfish Waters) Regulations (Northern Ireland) 2015 No. 351. Available at: https://www.legislation.gov.uk/nisr/2015/351/contents/made

[95] NISRA. 2024. Northern Ireland Environmental Statistics Report. May 2024. Available at: https://www.daera-ni.gov.uk/sites/default/files/publications/daera/NI%20Environmental%20Statistics%20Report%202024_0.pdf

Site Name	WFD Status 2021	WFD Target 2027	FSA Classification 2021	WFD *E. Coli* Guideline 2023
Carlingford Lough	Moderate	Good	B***	Did not meet guideline

*B status for all sites in Belfast Lough with the exception of a B/C status for Dougold and Henning sites (seasonal classification)

**B Status for Inner North Mussels and C Status for Inner South Mussels

***B Status for all sites in Carlingford Lough with the exception of a B/C Status at Narrow Water Wild Fishery (seasonal classification)

Bathing Waters

The Bathing Water Directive (Directive 2006/7/EC concerning the management of bathing water quality and repealing Directive 76/160/EEC) required member states to identify their most popular bathing waters for regular testing in order to ensure that a minimum quality standard is reached; this is implemented in NI by The Quality of Bathing Water (NI) Regulations 2013. There are 26 designated bathing waters in NI (**Figure 3-14**), as detailed in **Table 3-14**. These are monitored weekly from May to September, and classified into one of four categories:

- Excellent;
- Good;
- Satisfactory; or
- Temporary advice issued against bathing.

Classifications are based on the presence of *E. coli* in water samples. Individual sample results below 250 *E. coli* (EC)/100ml and 100 Intestinal Enterococci (IE)/100ml are typical of an 'Excellent' classification. Results below these values, and up to 500 EC/100ml and 200 IE/100ml are typical of a 'Good' or 'Sufficient' classification. When *E. coli* levels exceed 1250 EC/100ml, temporary advice against bathing is issued. Temporary advice against bathing is also provided with respect to the levels of blue-green algae present based on the World Health Organisation's guidelines on the safe thresholds of blue-green algae. The most recent assessment of bathing water quality compliance at these sites from 2023 classified 18 as 'Excellent' quality, six as 'Good' quality, one as 'Sufficient' quality, and one as 'Poor' quality for bathing[96]. According to the draft 3rd cycle RBMP, over the assessment period of 2014-2019, 25 of the 26 bathing water sites consistently met the minimum standard (sufficient). Of these, ten sites consistently met the 'excellent' standard, seven sites consistently met 'excellent' or 'good' standard, and five sites consistently met 'good' or 'sufficient' standard. One site, Ballyholme, consistently met the 'sufficient' standard over this period. Investigations by DAERA have shown that this site is situated in a complex catchment, vulnerable to pressures from agricultural run-off and overflows from the wastewater treatment (WWT) network. Management measures that should be considered to prevent pollution and physical disturbance to these sites are included in DAERA's Bathing Water Profiles[97].

Table 3-14 Location and Status of Bathing Water Sites in NI

Bathing Water	2023 Compliance Level
Ballycastle	Excellent
Ballygally	Excellent
Ballyhornan	Excellent

[96] DAERA NI. 2024. About bathing water quality. Available at: https://www.daera-ni.gov.uk/articles/bathing-water-quality

[97] DAERA NI. 2023. 2023 Bathing Water Profiles. Available at: https://www.daera-ni.gov.uk/publications/2023-bathing-water-profiles

Bathing Water	2023 Compliance Level
Brown’s Bay	Excellent
Castlerock	Excellent
Cloughey	Excellent
Cranfield	Excellent
Groomsport	Excellent
Kilclief	Excellent
Magilligan (Benone)	Excellent
Magilligan (Downhill)	Excellent
Murlough (Co Down)	Excellent
Portballintrae Salmon Rock	Excellent
Portrush Curran (East Strand)	Excellent
Portrush Mill (West Strand)	Excellent
Portrush Whiterocks	Excellent
Portstewart	Excellent
Tyrella	Excellent
Ballywalter	Good
Carnlough	Good
Crawfordsburn	Good
Helen’s Bay	Good
Millisle	Good
Waterfoot	Good
Newcastle	Sufficient
Ballyholme	Poor

In addition, under the recently published DAERA Report of the 2022/23 Bathing Water Review[98], seven candidate bathing water sites have been proposed as meeting the requirement for identification under The Quality of Bathing Water Regulations (NI) 2008. If formally identified under these Regulations, these sites will be further identified as Protected Areas under the WFD Regulations. These candidate sites and their 2023 classification are as follows:

- Cushendall- Excellent;
- Drain’s Bay- Good;
- Portmuck- Good;
- Brompton- Poor;

[98] DAERA NI. 2023. Report of The 2022/23 Bathing Water Review. Available at: https://www.daera-ni.gov.uk/sites/default/files/publications/daera/202223%20Bathing%20Waters%20Review%20report.pdf

- Donaghadee- Poor;
- Warrenpoint- Poor; and
- Rea’s Wood (Inland)- Poor.

3.2.4.2 Summary of Existing Pressures and Issues for Water

The most recent State of the environment report for NI states that industry, power generation, agriculture and forestry, development, transport and infrastructure pressures all potentially impact on NI’s water environment[99]. Under the WFD, pressures on the quality of the water environment have been assessed according to two types, as follows:

- Point source pollution pressures on water quality – e.g., effluent discharges arising from industry and wastewater treatment works; sewer overflows during heavy rainfall events; and
- Diffuse source pollution pressures on water quality – e.g., contaminated surface run-off from roads, construction sites, fuel storage areas; septic tank discharges; acid and nutrient deposition from the air; run-off of pesticides, soils and nutrients from agriculture and forestry, and migration of these to groundwaters and surface waters.

Abstractions and impoundments of water for drinking water supply, industry, agriculture, recreation, and hydropower can lead to pressures on water quantity and flow and can exacerbate existing water quality issues. The introduction and spread of invasive non-indigenous species can impact upon native aquatic biodiversity and can adversely affect water-based recreation and leisure activities.

The most recent UK MS assessment indicated that some Descriptors have not yet met GES (e.g., breeding seabirds, fish, some benthic habitats, non-indigenous species, marine litter), or there is uncertainty or a lack of data to enable their status to be confidently determined. Part three of the MS has established a UK Programme of Measures with the aim of achieving GES.

Implementation of the OREAP, and the construction, maintenance and decommissioning activities associated with potential offshore renewable energy projects that may arise as a result, has the potential to lead to negative effects on the quality of marine and coastal water bodies in NI (as well as to cross-border water bodies in the RoI) alone, or in combination with, these existing pressures. Consideration should be given to the potential for impacts on marine Descriptors when planning for infrastructure in coastal or marine environments. Construction-phase effects on water quality could occur, for instance, through the release of contaminants or from the mobilisation of sediments, while during operation effects could include the introduction of sound or EMF into the marine environment.

3.2.4.3 Evolution of the baseline in the absence of the plan

Water quality around the coastline of NI is affected primarily by marine industry and associated effects, as well as land use, and similar pressures are likely to affect the baseline into the future. DAERA is currently managing estuarine and coastal waters through RBMPs to achieve GES, as required under the WFD, and to ensure no deterioration in water quality, and managing marine waters through programmes of measures to achieve GES for Descriptors, as required by the MS. The continued management of water quality has the potential to improve the status of coastal, transitional, and marine water bodies in the long-term. Knowledge and understanding of the baseline for MS Descriptors where there is uncertainty or a lack of data to enable their status to be confidently determined is likely to improve.

3.2.5 Air

Good air quality is vital for human health and wellbeing, for our climate, habitats and built environment. Air pollution is the result of a range of substances that are introduced into the atmosphere from a variety of different sources. On the whole, air quality in NI has improved significantly over the past few decades;

[99] DAERA NI. 2013. From Evidence to Opportunity A Second Assessment of the State of NI's Environment. Available at: https://www.daera-ni.gov.uk/sites/default/files/publications/doe/corporate-report-from-evidence-to-opportunity-second-assessment-of-state-of-ni-environment-2013.pdf.

in particular, concentrations of sulphur dioxide, originating from the combustion of coal and oil, have reduced. However, some pollutants are continuing to exceed air quality objectives. This has consequences on both human health and on some of our most important habitats that are sensitive to the effects of atmospheric pollutant deposition.

It is considered that the key issues associated with the implementation of the OREAP and Air comprise:

- Potential for localised effects of air pollutants during the construction phase and/or operational support/maintenance (plant emissions).
- Potential for indirect positive effects on air quality in the long-term through reduction in emissions from power stations owing to new renewable energy connections.

3.2.5.1 Air Quality in NI

Air quality in NI is reported annually by DAERA, the most recent report in 2021[100], and is compiled from data supplied by the 21 air quality monitoring stations. At each of these locations, levels of pollutants are monitored, and measured with regard to EU Air Quality Directives, the 2007 UK Air Quality Strategy (AQS) objectives, and The Air Quality Standards Regulations (NI) 2010. This highlights any exceedances of air quality objectives and highlights any emerging air quality trends. The most significant air pollutants for NI and their sources are the following:

- Nitrogen oxides (NO_x, including nitric monoxide NO and nitrogen dioxide NO_2), arising from fuel combustion in transport and energy generation;
- Sulphur dioxide (SO_2), arising from combustion of fuels that contain sulphur, from power generation, industry and domestic solid fuel combustion;
- Particulate matter (PM_{10} and $PM_{2.5}$), arising from road transport and domestic solid fuel combustion, and as a secondary pollutant from ammonia;
- Ground-level ozone (O_3), arising from the interaction of various air pollutants with sunlight;
- Ammonia (NH_3), arising from agricultural activities and handling of manure. NH_3 reacts with other pollutants (NO_x, S), producing fine particles of ammonium nitrate and ammonium sulphate; and
- Polycyclic aromatic hydrocarbons (PAHs), arising from incomplete combustion primarily from domestic sources.

The following pollutants were monitored in NI during 2021: carbon monoxide (CO), oxides of nitrogen (NO_x) comprising nitric oxide (NO) and nitrogen dioxide (NO_2), sulphur dioxide (SO_2), particles (as PM_{10}, $PM_{2.5}$ and black carbon), ozone (O_3), benzene, polluting elements (including lead, arsenic, cadmium, nickel, and mercury) and polycyclic aromatic hydrocarbons (PAHs). The Regulations limit values, target values and AQS objectives were met for the following pollutants in NI in 2021: PM_{10} and $PM_{2.5}$ particulate matter, NO_2, O_3, CO, benzene, SO_2 and polluting elements. The three sites monitored for PAHs exceeded AQS objectives; these are likely due to solid fuel burning. This has potential to decrease, however, as NI's new Energy Strategy - Path to Net Zero Energy[101], published in 2021, details restrictions on burning fossil fuels for home heating.

Local Air Quality Management (LAQM) provides the framework under the Environment Order (NI) 2002 within which air quality is managed by NI's local authorities (District Councils). LAQM requires the District Councils to review and assess a range of air pollutants against the objectives set by the AQS, using a range of monitoring, modelling, and other methods. For locations where objectives are not

[100] DAERA NI. 2022. Air pollution in NI 2021. Available at: https://www.daera-ni.gov.uk/publications/air-pollution-northern-ireland-2021

[101] Department for the Economy (DfE). 2021. Energy Strategy for Northern Ireland – Path to Net Zero Energy. Available from: https://www.economy-ni.gov.uk/sites/default/files/publications/economy/Energy-Strategy-for-Northern-Ireland-path-to-net-zero.pdf

expected to be met by the relevant target date, District Councils are required to declare an Air Quality Management Area (AQMA), and to develop an Action Plan to address the problem. There are 19 active AQMAs in NI, set for one or more of the pollutants PM_{10}, NO_2, or SO_2.

The UK National Atmospheric Emission Inventory (NAEI) is the standard reference air emissions inventory for the UK, and includes emission estimates for England, Scotland, Wales and NI for a wide range of important pollutants including GHGs, regional pollutants leading to acid deposition and photochemical pollution, persistent organic pollutants (POPs) and other toxic pollutants such as heavy metals. The NAEI is compiled annually, when the latest set of data is added, and the full-time series updated and reported internationally. The latest report was published in October 2022 and covers the period 2005-2020[102]. This summarises emissions in NI for the eight priority air pollutants: ammonia (NH_3), carbon monoxide (CO), nitrogen oxides (NO_x as NO_2), non-methane volatile organic compounds (NMVOCs), particulate matter less than 10 micrometres (PM_{10}), particulate matter less than 2.5 micrometres ($PM_{2.5}$), SO_2 and lead (Pb). Most pollutant emission levels were lower in 2020 than they were in 2005. A switch in energy generation has created a reduction in SO_2 levels in NI due to the development of a natural gas pipeline to NI, this has allowed for fuel switching away from oil and coal-fired generation.

Pollutants such as sulphur and nitrogen oxides emitted by the combustion of fossil fuels (e.g., power generation) can lead to acid deposition – a deposit of air pollutants from the atmosphere leading to acidification of soils and freshwaters through dry deposition of acidifying gases or wet deposition in rainfall[103]. Oxidised and reduced nitrogen currently dominate the gases involved in acid deposition. Effects on soils from acidification include chemical changes leading to reduced fertility and nutrient deficiencies; release of toxic metal ions; and changes in microbial transformations. Effects from acidification of freshwaters include reduced viability of a range of aquatic plants from algae to macrophytes, and a loss of acid-sensitive species at all trophic levels, including primary producers, macrophytes and top predators, e.g., fish and waterfowl. Regarding vegetation, the susceptibility of an ecosystem to acid deposition is influenced by geology and soil chemistry, with those growing on acid soils with high aluminium at most risk; low pH (<4.5) results in aluminium in the form of AL^{3+}, which can have high toxicity. pH influences chlorophyll stability, and acidification can lead to reduced light capture and carbon assimilation.

3.2.5.2 Summary of Existing Pressures and Issues for Air and Climatic Factors

According to NI's most recent State of the Environment review (2013), air pollution from domestic combustion and from road transport remain as challenges in the improvement of air quality for the protection of human health[104], while pollutants can also lead to secondary effects on sensitive habitats. However, air quality has improved significantly over the past few decades, and the most recent air quality monitoring report shows that all pollutants, except for PAHs, met the EU limit and target values and AQS objectives. NI's new Energy Strategy - Path to Net Zero Energy is expected to support further improvements in air quality.

Implementation of the OREAP, and the construction, maintenance and decommissioning activities associated with the potential offshore renewable energy projects that may arise as a result, has the potential to lead to temporary, localised, increases in air pollution, including ambient PM_{10} and nitrogen dioxide emissions, resulting in short-term negative impacts upon air quality. However, implementation of the OREAP also has the potential to lead to positive effects on air quality in the medium and long-term, with the potential for connection of new renewable energy generators, such as wind, wave, and

[102] Aether. 2022. Air Pollution Inventories for England, Scotland, Wales and NI: 2005-2020. Available at: https://uk-air.defra.gov.uk/assets/documents/reports/cat09/2210251052_DA_Air_Pollutant_Inventories_2005-2020_FINAL_v1.2.pdf

[103] Air Pollution Information System (APIS). 2016. Acid deposition. Available at: https://www.apis.ac.uk/overview/pollutants/acid-deposition.

[104] DAERA NI. 2013. From Evidence to Opportunity A Second Assessment of the State of NI's Environment. Available at: https://www.daera-ni.gov.uk/sites/default/files/publications/doe/corporate-report-from-evidence-to-opportunity-second-assessment-of-state-of-ni-environment-2013.pdf.

tidal turbines, to the national grid expected to support a reduced dependence on fossil fuels and a net reduction in the quantity of pollutants released into the atmosphere, including from the three major power plants in NI (Ballylumford, Kilroot, and Coolkeeragh).

3.2.5.3 Evolution of the baseline in the absence of the plan

In the short-term, the future baseline for air quality in NI is likely to be driven by the current trends and pressures as discussed above. In the longer-term, targets for the decarbonisation of the energy sector have potential for reducing associated emissions to air, with potential to lessen secondary effects on human health and ecology. Changes in the baseline of other air pollutants such as ammonia will be largely driven by UK and NI agricultural policy.

3.2.6 Climatic Factors

Climate change represents one of the most important threats to our environment, and to our economy, and projections indicate that hotter, drier summers and warmer wetter winters will occur over the next century because of climate change. The Paris Agreement, signed in 2015, committed to strengthening the global response to the threats of climate change, by holding the global temperature rise to no more than 2°C and preferably below 1.5°C. Key to this agreement is the reduction of GHG emissions fast enough to achieve this temperature goal.

The recent European Green Deal 2019 aims to make significant advances in climate action, providing a more sustainable low-carbon economy for the EU. It plans to boost the efficient use of resources by moving to a clean circular economy, and to restore biodiversity and cut pollution. The Deal has set a goal of net zero carbon emissions by 2050, and a 50-55% reduction in emissions by 2030. The UK Climate Change Act 2008 introduced a legally binding target for the reduction of GHG emissions in the UK by at least 80% below 1990 baseline levels by 2050. The target for the current 2018-2022 period is a reduction in emissions by 37% by 2020 and, for the next period (2025) to reduce emissions by 51%. The Act was amended in 2019, and now commits the UK to reducing emissions by 100% by 2050 from 1990 baseline levels (in line with the EU's 'net zero 2050 target'). The first climate change legislation was passed by the NI Assembly in 2022; the Climate Change Act (NI) 2022 sets out the legal framework for tackling climate change by reducing GHG emissions in NI, with a net zero target by 2050 from baseline levels.

It is considered that the key issues associated with the implementation of the OREAP and Climatic Factors comprise:

- Potential for marine renewable energy to contribute to a net reduction in GHG emissions.
- Potential for a permanent loss of blue carbon resources.
- Potential for marine renewable infrastructure to be resilient to the effects of climate change.

3.2.6.1 GHG Emissions

The NI GHG Inventory includes data on GHG emissions in NI, forming part of the UK GHG Inventory reported at an international level in line with UK commitments under the Kyoto Protocol. The Inventory is updated annually, the latest available covers the period 1990-2021[105].

In 2021, NI accounted for 5.3% of the UK total GHG emissions, which stood at 426.5MtCO_2e. The net emissions of 22.5MtCO_2e in 2021 represent an increase of 5% compared to 2020, and a 1% increase in emissions from pre COVID-19 pandemic 2019 figures. Regarding the long-term trend, NI's total GHG emissions have decreased by 23.2% since the base year (1990), in comparison to an emission reduction of 47.7% for the UK as a whole.

[105] NISRA. 2023. Northern Ireland Greenhouse Gas Emissions 2021. Available at: https://www.daera-ni.gov.uk/sites/default/files/publications/daera/NI%20Greenhouse%20Gas%20Statistics%201990-2021-Report.PDF

Agriculture was the sector responsible for the greatest amount of GHG emissions in 2021 (27.6%), followed by transport (16.7%), business (14.0%), energy supply (13.7%), and residential (12.4%) sectors. The energy supply sector experienced an increase in emissions of 0.2MtCO_2e from 2020 to 2021, due to increased coal-fired power generation driven by less favourable weather conditions for renewable sources, particularly wind. Since the base year, however, there has been a 42% decrease in emissions from this sector.

The composition of GHG emissions for NI in 2021 was as follows:

- 67% Carbon dioxide (UK 80%)
- 25% Methane (UK 13%)
- 7% Nitrous oxide (UK 4%)
- 1% Fluorinated and other gases (UK 3%)

Across all sectors other than agriculture and waste management, carbon dioxide was the most common emitted GHG. Within the energy supply sector, CO_2 comprised the total amount of GHG emissions.

The energy supply sector is currently responsible for 13.7% of GHG emissions in NI, comprised entirely of CO_2. Energy-related sectors (business, energy supply, industrial process, public, residential and transport) together account for almost 60% of NI's GHG emissions and, to target changes in the overall energy sector, the Energy Strategy for NI – Path to Net Zero Energy was published in 2021[106]. The primary targets of this strategy are:

1. Energy Efficiency: Deliver energy savings of 25% from buildings and industry by 2030.
2. Renewables: Meet at least 70% of electricity consumption from a diverse mix of renewable sources by 2030.
3. Green Economy: Double the size of our low carbon and renewable energy economy to a turnover of more than £2 billion by 2030.

GHG emissions are an indicator in the draft 2016-2021 PfG, based on a criterion for change set at +/-1.0 percentage points annually since the baseline of 21.9MtCO_2e in 2014. The decrease of 7.7% from 2014 to 2020 is considered as 'no change' for PfG reporting. On the whole, the UK has reduced emissions by 47.7% between the base year and 2020, however, the different parts of the UK vary in their reduction, with NI achieving the lowest reduction of 23.2% in emissions to date (Scotland 49.3%; England 50.2%; Wales 35.0%).

3.2.6.2 Climate Change

3.2.6.2.1 Climate Change Projections

The UK Climate Change Projections (UKCP18)[107] anticipate a greater chance of hotter, drier summers and warmer, wetter, winters with more extreme weather and rising sea levels. The high emission scenario for NI indicates that by 2070 winters could be up to 3.9°C warmer and 25% wetter, and summers could be up to 4.9°C hotter and 38% drier.

The emphasis of the UKCP18 marine projections is on changes in coastal sea levels, including extreme water levels that arise from storm surges and surface waves[108]. Global sea level has risen over the 20th century and will continue to rise over the coming centuries, which could affect tidal characteristics,

[106] Department for the Economy (DfE). 2021. Energy Strategy for Northern Ireland – Path to Net Zero Energy. Available from: https://www.economy-ni.gov.uk/sites/default/files/publications/economy/Energy-Strategy-for-Northern-Ireland-path-to-net-zero.pdf

[107] DAERA NI. 2018. UK Climate Change Projections. Available at: https://www.daera-ni.gov.uk/articles/uk-climate-change-projections

[108] Palmer, M., Howard, T., Tinker, J., Lowe, J., Bricheno, L., Calvert, D., Edwards, T., Gregory, J., Harris, G., Krijnen, J. and Pickering, M., 2018. UKCP18 Marine Report. Available at: https://www.metoffice.gov.uk/binaries/content/assets/metofficegovuk/pdf/research/ukcp/ukcp18-marine-report-updated.pdf

including tidal range. The amount of sea level rise projected depends on the location around the UK and the emission scenario; under the high emission scenario, it is predicted that sea levels at Belfast could rise by up to 94cm by 2100. No evidence has been found for significant changes in future storm surges. The UKCP09 multi-level temperature and salinity marine data were not updated for UKCP18. Around the UK, the sea surface temperature generally shows a significant warming trend of around 0.3°C per decade over the last 40 years, with warming greatest across the southern North Sea, and a predicted warming trend in the future[109]. Research to date suggests that it is unlikely that multi-year annual mean wind speeds will change by more than a maximum of ±25% over most of Europe and North America during the present century[110].

These effects of climate change are likely to increase coastal flooding and will require future development to be adaptable or resilient to future climatic changes and associated impacts. Sea level and storm surge projections, in combination with local information on coastline structure and existing coastal defences can enable coastal vulnerability assessment.

According to the UK Climate Change Risk Assessment (CCRA) 2017, infrastructure in NI in general is exposed to a range of climate hazards; flooding poses the greatest long-term risk to infrastructure from climate change, however, there are growing risks from heat, water scarcity and slope instability caused by severe weather[111]. Risks to offshore infrastructure are identified from storms and high waves; the CCRA considered this not to be a high priority risk for NI, as the majority of offshore infrastructure in the UK at the time was in the North Sea, but that this risk would need to be assessed should there be an increase in offshore infrastructure in the area in the future. The Evidence Report for the Third UK Climate Change Risk Assessment CCRA3 (Summary for NI)[112] assessed the risks to offshore infrastructure from the impacts of climate change, including equipment used by the oil and gas industry, wind, tidal and wave energy, and gas pipelines and power cables on or under the seabed. The vulnerabilities of these infrastructure types due to storms and high waves were considered to include the destabilisation or degradation of mechanical structures, reduced energy output and operating periods, damage to cabling systems during storms and prevention of access for maintenance and inspection activities. The current level of risk was deemed to be low, however, the future risk was allocated as medium magnitude due in part to increasing offshore renewable energy infrastructure and the presence of a large fleet of oil and gas platforms that may be repurposed for carbon capture and storage.

3.2.6.2.2 Carbon Sequestration Potential (Blue Carbon)

Carbon sequestration (or Blue Carbon) is the carbon captured by ocean and coastal ecosystems and is typically stored in ocean plants and sediments. Blue carbon habitats include mangroves, coastal wetlands, seagrass, and saltmarsh areas, which are frequently in severe decline. Boosting carbon sequestration rates (and reducing GHG levels within the atmosphere) is an area of increased research and need, given that it is estimated that UK blue carbon ecosystems sequester an estimated 11 million tonnes of carbon dioxide (CO_2) annually, representing 30% of all CO_2 sequestration by UK

[109] The Impacts of Climate Change on Sea Temperatures around the UK and Ireland Cornes, R.C., Tinker, J., Hermanson, L., Oltmanns, M., Hunter, W.R., LloydHartley, H., Kent, E.C., Rabe, B. and Renshaw, R. 2023. Climate change impacts on temperature around the UK and Ireland. MCCIP Science Review 2023, pp.18. Available at: https://nora.nerc.ac.uk/id/eprint/534103/1/The%20Impacts%20of%20Climate%20Change%20on%20Sea%20Temperature%20around%20the%20UK%20and%20Ireland_1.pdf

[110] Edenhofer, O., Pichs-Madruga, R., Sokona, Y., Seyboth, K., Kadner, S., Zwickel, T., Eickemeier, P., Hansen, G., Schlömer, S., von Stechow, C. and Matschoss, P. 2011. Renewable energy sources and climate change mitigation: Special report of the intergovernmental panel on climate change. Cambridge University Press. Available at: https://archive.ipcc.ch/pdf/special-reports/srren/SRREN_FD_SPM_final.pdf

[111] ASC. 2016. UK Climate Change Risk Assessment 2017 Evidence Report – Summary for Northern Ireland. Adaptation Sub-Committee of the Committee on Climate Change, London. Available at: https://www.theccc.org.uk/wp-content/uploads/2016/07/UK-CCRA-2017-Northern-Ireland-National-Summary.pdf

[112] Climate Northern Ireland. 2021. Evidence for the third UK Climate Change Risk Assessment (CCRA3) - Summary for Northern Ireland. Available at: https://www.ukclimaterisk.org/wp-content/uploads/2021/06/CCRA-Evidence-Report-Northern-Ireland-Summary-Final.pdf

ecosystems[113]. Restoring habitats such as saltmarsh (a hectare of saltmarsh can capture two tonnes of carbon per year), and seagrass (a hectare of seagrass can store a tonne of carbon per year) can have significant potential to further sequester carbon, while the development of kelp forests can also help to increase carbon sequestration rates.

Ulster Wildlife's Blue Carbon Habitat Restoration Feasibility Study[114] identified that NI has several blue carbon habitats (saltmarshes, seagrass beds, shellfish beds, kelp forests, maerl beds, and biogenic reefs). This study estimated that the current extent of coastal blue carbon habitats in NI is 658km^2, with approximately half of this area occurring within the inshore MPA network. The effective protection of these areas of carbon sinks can contribute to climate change mitigation and adaptation.

Activities that are damaging or disruptive to seabed habitats (e.g., trawling and dredging) can cause the resuspension of stored sediment carbon. Planned offshore renewable infrastructure should consider the potential damage to these habitats and release of carbon and/or reduction in carbon sequestration potential, and factor this into the consideration of overall CO_2 emission reductions that may be achieved. DAERA is currently developing a Blue Carbon Action Plan to protect and restore NI's blue carbon habitats; objectives from the upcoming Action Plan will need to be considered when undertaking developments within NI's marine environment.

3.2.6.3 Carbon Impacts (Carbon Cost) of Offshore Renewables

Renewable energy can produce electricity without direct carbon emissions, however, there is an up-front carbon cost associated with the extraction of raw materials and the production of infrastructure.

The Intergovernmental Panel on Climate Change (IPCC) published a Special Report on Renewable Energy Sources and Climate Change Mitigation in 2012[66], taking account of costs and GHG emissions across various technologies and scenarios, and their current and potential role in the mitigation of GHG emissions. Six renewable energy sources were considered: bioenergy, direct solar energy, geothermal energy, hydropower, ocean energy (including wave and tidal devices) and wind energy (onshore and offshore). Lifecycle assessments for electricity generation indicated that GHG emissions from renewable energy technologies are generally significantly lower than those associated with fossil fuel options (median values for all renewable energy types ranged from 4-46g CO_2 eq/kWh, while those for fossil fuels ranged from 469-1,001g CO_2 eq/kWh).

A review of literature for this Special Report demonstrated that the energy used and GHG emissions produced from the manufacture, transport, installation, operation and decommissioning of wind turbines are small in comparison to the energy generated and emissions avoided over the lifetime of wind power devices – estimates for the GHG emissions intensity of wind energy ranged from 8-20g CO_2 eq/kWh, while energy payback times were 3.4-8.5 months. Management of the variability that can be associated with energy output from wind power was found to not significantly detract from these GHG benefits. Regarding ocean energy (including wave and tidal devices), CO_2 is not directly emitted during operation, but GHG emissions can arise from raw material extraction, manufacturing, construction, maintenance and decommissioning. A review of lifecycle assessment studies indicates that GHG emissions from wave and tidal systems are less than 23g CO_2 eq/kWh, with a median estimate of 8g CO_2 eq/kWh for wave energy.

A report by Bernstein Research on the carbon cost of renewables[115] determined that the biggest contributors to the carbon footprint of wind turbines are steel, aluminium and the epoxy resins that are

[113] Norris, C., Roberts, C., Epstein, G., Crockett, D., Natarajan, S., Barisa, K. and Locke, S. 2021. Blue Carbon in the United Kingdom: Understanding and developing the opportunity. Available at: https://www.bluemarinefoundation.com/wp-content/uploads/2022/08/Blue-Carbon-UK-Report_Final-1.pdf

[114] Strong, J.A., Mazik, K., Piechaud, N., Bryant., L., Wardell., C., Hull, S., Tickle, M., Norrie, E-M., McIlvenny, H. and Clements, A. 2021. Blue Carbon Restoration in Northern Ireland – Feasibility Study. Available at: https://www.ulsterwildlife.org/sites/default/files/2021-05/Blue%20Carbon%20Habitat%20Restoration%20in%20Northern%20Ireland%20-%20A%20Feasibility%20Study.pdf

[115] Forbes. 2021. How Green is Wind Power Really? Available at: https://www.forbes.com/sites/christopherhelman/2021/04/28/how-green-is-wind-power-really-a-new-report-tallies-up-the-carbon-cost-of-renewables/?sh=4adda3db73cd

used to hold components together, the steel tower of the turbine comprising 30% of the associated carbon impact, the concrete foundation comprising 17% and the carbon fibre and fibreglass blades comprising 12%. In terms of the lifecycle cost, this report estimated that wind power has a carbon footprint that is 99% lower than coal-fired power plants, 98% lower than natural gas, and 75% lower than solar power (11g CO_2/kWh for wind compared to 44g/KWh for solar, 450g/KWh for natural gas, and 1000g/KWh for coal).

3.2.6.4 Summary of Existing Pressures and Issues for Climatic Factors

Climate change represents a significant challenge internationally. GHG emissions in NI have decreased by 24% since 1990, owing to improvements in energy efficiency, switching from coal to natural gas as a fuel source, and improvements in the management of landfills. The energy supply sector has lower emissions of GHGs currently than it had in 1990. The UK has committed to a target of a 37% reduction in GHGs by 2020 and, through the Climate Change Act (NI) 2022, NI has committed to a target of 100% reduction by 2050; although in 2020 the UK, as a whole, had a 49.9% reduction, in NI GHG reduction stood at only 23.9%. This has implications for successfully contributing to the UK and NI targets for ‘net zero emissions’ by 2050.

Implementation of the OREAP, and the construction, maintenance and decommissioning activities associated with the potential offshore renewable energy projects that may arise as a result, has the potential to lead to temporary, localised, increases in GHG emissions. There is also an upfront carbon cost and GHG emissions associated with the extraction of raw materials and the manufacture of renewable infrastructure. However, implementation of the OREAP also has the potential to lead to positive effects on GHG emissions in the medium and long-term, with the potential for connection of new renewable energy generators, such as wind, wave, and tidal turbines, to the national grid expected to support a reduced dependence on fossil fuels and a net reduction in the quantity of GHG released into the atmosphere. This could have far-reaching positive consequences upon other factors such biodiversity and human health.

3.2.6.5 Evolution of the baseline in the absence of the plan

Climate change predictions indicate that several changes will occur in the marine environment. These include a rise in sea surface temperature, rising sea levels, an increase in acidity and an increase in extreme weather and storminess. Predicted climate change effects, such as sea level rise, are likely to affect blue carbon ecosystems, with vulnerability a function of exposure, sensitivity and adaptive capacity[116]. Continued disturbance of seabed sediments, through marine industry and activities, and potentially through increased storminess resulting from climate change, has the potential to release sequestered carbon. Decarbonisation of the energy sector has potential for reduced emissions in the long-term and can support the UK and NI targets to limit GHG emissions and moderate the progression of climate change and its effects.

[116]Lovelock, C.E. and Reef, R. 2020. Variable Impacts of Climate Change on Blue Carbon, One Earth, 3(2), pp. 195-211. Available at: https://www.sciencedirect.com/science/article/pii/S2590332220303547#bib27

3.2.7 Material Assets

The term 'Material Assets' can be considered very broadly within the SEA process, encompassing for example infrastructure, settlements, transport and utilities. Given the geographic scope of the OREAP and the large-scale nature of projects that may arise from its implementation, there is potential for offshore renewable infrastructure development and operation to impact upon, or be impacted by, existing material assets. It is considered that the key issues associated with the implementation of the OREAP, and material assets comprise:

- Potential for disruption effects on ports, shipping, and navigation during construction.
- Potential for interaction with areas of marine infrastructure (cables and pipelines, existing or planned renewable energy infrastructure).
- Potential for temporary or permanent disturbance or displacement from areas of importance for commercial fisheries and aquaculture.
- Potential for indirect effects on tourism.
- Potential for temporary or permanent disruption effects on areas of known military/defence activity.
- Potential for temporary or permanent disruption effects on aviation operations, including navigational radar and telecommunications.
- Potential for interaction with or disturbance of areas used for disposal or for aggregate extraction.

3.2.7.1 Ports, Shipping and Navigation

There are several commercial ports in NI ranging from large port facilities to numerous smaller ports that are essential for ferry traffic and local trade and supplies (

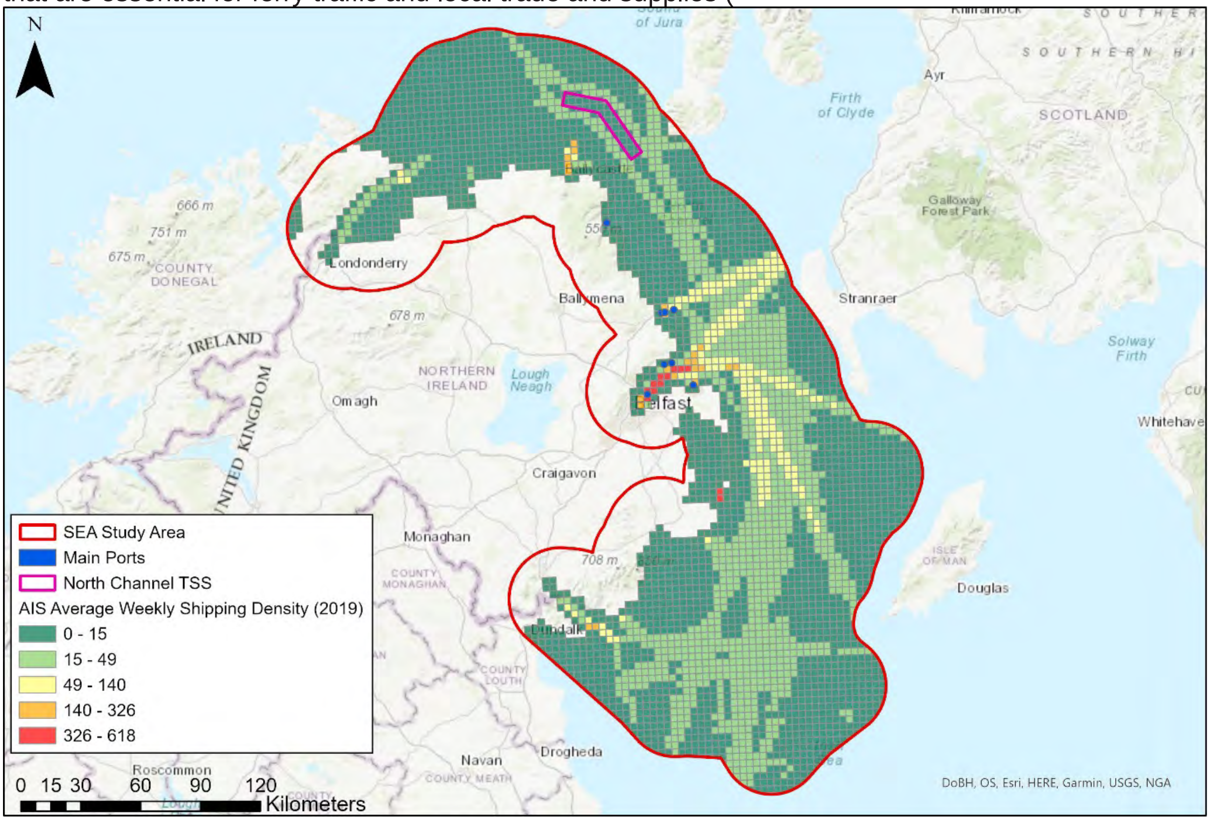

Figure 3-15). The estimated total tonnage through NI's major ports in 2022 was 27.5 million tonnes, comprising 6.1% of the total tonnage handled at major UK ports (448.6 million tonnes)[117]. The majority of tonnage (66.5%) came through Belfast Port, while Larne was the second busiest (accounting for 13.4%), followed by Warrenpoint (11.6%). Londonderry (now operating as Foyle Port) is also considered as a major port, handing approximately 6% of NI's tonnage in 2021. There were 12,476 commercial shipping movements recorded at Belfast Harbour in 2022, with a total tonnage amounting to 128,000,000 Gross Registered Tonnage (GRT)[118]. Bulk trade included liquid bulk of kerosene and other refined oils, while dry bulk included aggregates, fertiliser, grain and animal feeds. Roll on Roll off (RoRo) freight recorded almost 600,000 freight units passing through the port, while the Stena Line Belfast – Birkenhead passenger route carried more than 130,000 cars and 450,000 passengers in 2022. The Port of Larne records over 200,394 freight units, and over 521,205 passengers annually[119]. For Warrenpoint Port[120], the tonnage in 2022 was 3.3 million tonnes. In addition to RoRo and LoLo (lift-on/lift-off) container services, Warrenpoint Port specialises in break bulk, bulk, recyclables and project consignments; commodities regularly handled include timber, steel, animal feed, cement, CO_2 and refuse-derived fuel. The 2022 Annual Report noted it as a port of choice for 'project cargo' or specialist loads in addition to general cargo, with expertise to handle special project cargo including wind turbines and concrete piles. There is a twice daily RoRo service to Heysham, while there were three cruise ship visits in 2022. For Foyle Port, the latest report for the tax year ending 31st March 2023[121] states that 1.8 million tonnes were handled; vessel types include bulk carriers, coasters, oil tankers and cruise vessels, with trade enhanced through services including towage, pilotage, dredging and estate rents, and with cruise tourism recognised as an opportunity for further growth. The use of ports in the SEA Study Area by commercial vessels can be seen in the shipping route density data displayed in **Figure 3-15**.

The NI licensed sea fishing industry is concentrated at the fishing ports of Ardglass, Kilkeel and Portavogie, located on the East coast, while many smaller ports around the coastline are frequently used by local fishing boats. According to the most recent UK Sea Fisheries statistics[122], the most used fishing port in NI in 2021 (based on the quantity of landings in kt) was Belfast (8.7kt), followed by Derry / Londonderry (4.4kt), Ardglass (3.9kt) and Kilkeel (3.4kt). Landings at Belfast were solely pelagic fish, while in Derry / Londonderry and Ardglass they were primarily pelagic, with some shellfish and a small percent of demersal fish. Landings at Kilkeel were primarily shellfish and demersal species, with a smaller percent of pelagic species.

The recent National Ports Study for Wind Energy Ireland[123] investigated the potential suitability of ports on the island of Ireland for the offshore renewable industry, recognising the key role of ports and suitable port infrastructure to the successful delivery of offshore wind projects, in terms of transportation of turbine components and foundations as well as their role as a link between marine and landside activities and supply chains. The locations considered within NI were Belfast D1, Harland and Wolff and Larne. The D1 facility in Belfast Harbour was concluded to be the only facility that could currently accommodate staging and marshalling of fixed-bottom projects of the scale anticipated soon, while Harland and Wolff and Larne appeared to have some suitability to be used as staging ports. No existing facilities were considered suitable to facilitate manufacturing and staging of floating wind projects; D1

[117] NISRA Ports traffic NISRA. 2023. Ports Traffic. Available at: https://www.nisra.gov.uk/statistics/other-surveys/ports-traffic

[118] Belfast Harbour. 2023. Annual Report 2022. Available at: https://www.belfast-harbour.co.uk/wp-content/uploads/2023/06/00965-02-Belfast-Harbour-AR-2023-Online-Spreads.pdf

[119] Port of Larne. 2024. Port Information. Available at: https://www.portoflarne.co.uk/marine-information/port-information/

[120] Warrenpoint Port. 2024. Facilities and Capability. Available at: https://warrenpointport.com/port/facilities-capability/

[121] Londonderry Port & Harbour Commissioners. 2023. Annual Report & Financial Statements for the ended March 2023. Available at: https://www.foyleport.com/_files/ugd/c4e44a_84c8aeab46ed440db3b0a70ccaaf286e.pdf

[122] MMO. 2021. UK Fisheries Statistics 2021. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1107359/UK_Sea_Fisheries_Statistics_2021.pdf

[123] Wind Energy Ireland. 2022. National Port Study. Available at: https://windenergyireland.com/images/files/final-national-ports-study.pdf

and Harland and Wolff could provide some capacity for assembly, however, several new facilities were deemed to be required to meet the demand for staging at ports.

Shipping route density within the SEA Study Area can be seen in **Figure 3-15.** The route density for various vessel types (cargo, fishing, passenger, tanker, other) can be seen within the DAERA NI Marine Map Viewer[124]. Cargo vessels tend to pass through the Plan area in a north-south direction, with high density from Belfast Lough south, as well as east to Morecambe Bay, between the north coast of Rathlin Island and Scotland, and approaching Derry / Londonderry. Tankers show a similar concentration from north to south, with the highest vessel density approaching Belfast Lough, and between Rathlin Island and Scotland. Fishing vessel density appears highest in the south-east of the region, between the ports of Portavogie, Ardglass and Kilkeel, as well as within Belfast Lough. Passenger vessels (or ferries) provide transport from NI to Scotland, England and the Isle of Man, with major ferry ports located in Belfast and Larne. A ferry service also runs between Campbeltown (Scotland), Ballycastle and the Isle of Islay. Ferries are also an important mode of transport within Loughs, including Strangford Lough, Lough Foyle and Carlingford Lough, and between Rathlin Island and the mainland of NI. These routes are represented in **Figure 3-15**, with the highest route density between Belfast / Larne and Cairnryan (Scotland) and between Rathlin Island and the mainland. Ferries tend to take very distinct routes and in certain areas (e.g., Rathlin Sound) due to bathymetry and other characteristics there is no, or limited, scope for adjustment of routes.

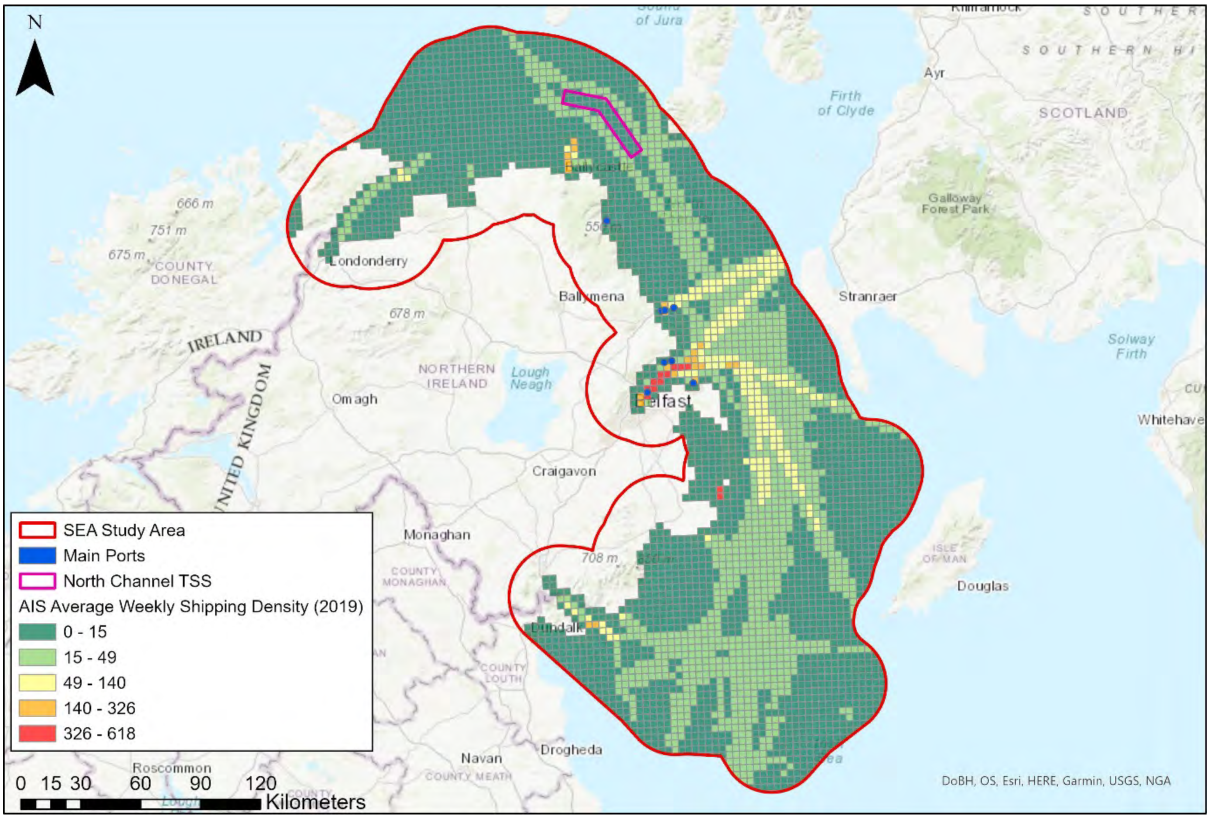

Figure 3-15 Location of Major Ports and Shipping Route Density within the SEA Study Area

The North Channel is recognised as a 'strait used for international navigation' under the UN Convention on the Law of the Sea; as such, development consent cannot be granted where installations would be likely to interfere with the shipping lane. The International Maritime Organisation (IMO) is an international body that adopts routeing measures for international shipping to aid navigation of certain ships or ships with certain cargoes. Traffic Separation Schemes (TSS) are areas where navigation of ships is highly regulated owing to large numbers of ship movements in different directions or where there is a high risk of collision. Given the importance of the North Channel to international shipping

[124] DAERA NI. 2024. NI Marine Map Viewer. Available at: https://gis.daera-ni.gov.uk/arcgis/apps/webappviewer/index.html?id=e44a8e27333241bfa2faf4a387fd99d7

there is a TSS in place between Rathlin Island and the Mull of Kintyre. There are no other IMO measures in the SEA Study Area. Marine Environmental High Risk Areas (MEHRAs) have been established for the protection of environmentally sensitive marine areas that are considered to be at risk from shipping. The sole MEHRA within the SEA Study Area is Island Magee, situated on the northern edge of Belfast Lough and with adjacent shipping routes to and from the nearby ports of Belfast and Larne. Several ports within the SEA Study Area use shore-based radar systems for navigational purposes; wind turbines have the potential to interfere with marine radar, including shore-based radar systems.

3.2.7.2 Marine Infrastructure

3.2.7.2.1 Cables and Pipelines

Submarine telecommunications and electricity interconnectors are located within the SEA Study Area, as are several pipelines.

There are four major sub-sea electricity interconnectors within the Study Area. NI's electrical system is connected to the Scottish system via the 0.5GW Moyle Interconnector, which runs across the North Channel between Islandmagee (NI) and Ayrshire (Scotland), while the Rathlin interconnector connects Rathin Island to the main NI electricity grid. Both electricity interconnectors are operated by NIE. The remaining two include the 2.2GW Western Link Ardneill to Wirral 1 cable which runs from Ardneill Bay in North Ayrshire (Scotland) to the Wirral peninsula in northwest England, and the 500MW East West Interconnector which runs from Shotton in Wales to Portan in Ireland. These power cables are operated by National Grid and Scottish Power, and Eirgrid Interconnector Ltd, respectively.

There are several major telecommunication cables linking NI with the UK and the Isle of Man; these cables make landfall on the east coast of NI, owing to the shorter crossing distances. The Hibernia 'A' telecommunication cable, which is a transatlantic cable connecting Europe and the USA, also passes through the Study Area, following the territorial limit. The NI branch of the Hibernia 'A' cable connects Portrush on the north coast to the Hibernia 'A' cable, 22 miles off the north coast.

There is one major pipeline within the Study Area: the Scotland to NI Pipeline (SNIP), owned by Premier Transmission Limited is a 135km long pipeline that runs across the North Channel from Twynholm in Scotland to Ballylumford in NI. In addition, there are two sub-sea gas pipelines that cross coastal loughs; these comprise a 9km pipeline across Belfast Lough and a 3km pipeline across Larne Lough. There are also several local outfall pipes located along the coastline.

The major cable systems in the SEA Study Area are detailed in **Table 3-15** and the location of major cables and pipelines are shown in **Figure 3-16.**

Table 3-15 Major cable systems within the SEA Study Area

Cable	Type	Operator
Moyle Interconnector	Power	NIE
Rathlin Interconnector	Power	NIE
Western Link Ardneill to Wirral 1	Power	National Grid and Scottish Power
East West Interconnector	Power	Eirgrid Interconnector Ltd
Scotland – NI 1	Telecommunications	BT
Scotland – NI 2	Telecommunications	BT
Scotland – NI 3	Telecommunications	BT
Scotland – NI 4	Telecommunications	BT
Manx – NI	Telecommunications	BT
Lanis 2	Telecommunications	C&W
Lanis 3	Telecommunications	C&W

Sirius North	Telecommunications	Virgin Media
Hibernia 'A'	Telecommunications	Hibernia Atlantic
Hibernia 'A' NI Branch	Telecommunications	Hibernia Atlantic
Hibernia 'C'	Telecommunications	Hibernia Atlantic
ESAT 2	Telecommunications	BT
CeltixConnect-2 (CC-2)/Havhingsten	Telecommunications	Aqua Comms
Rockabill	Telecommunications	EU Networks

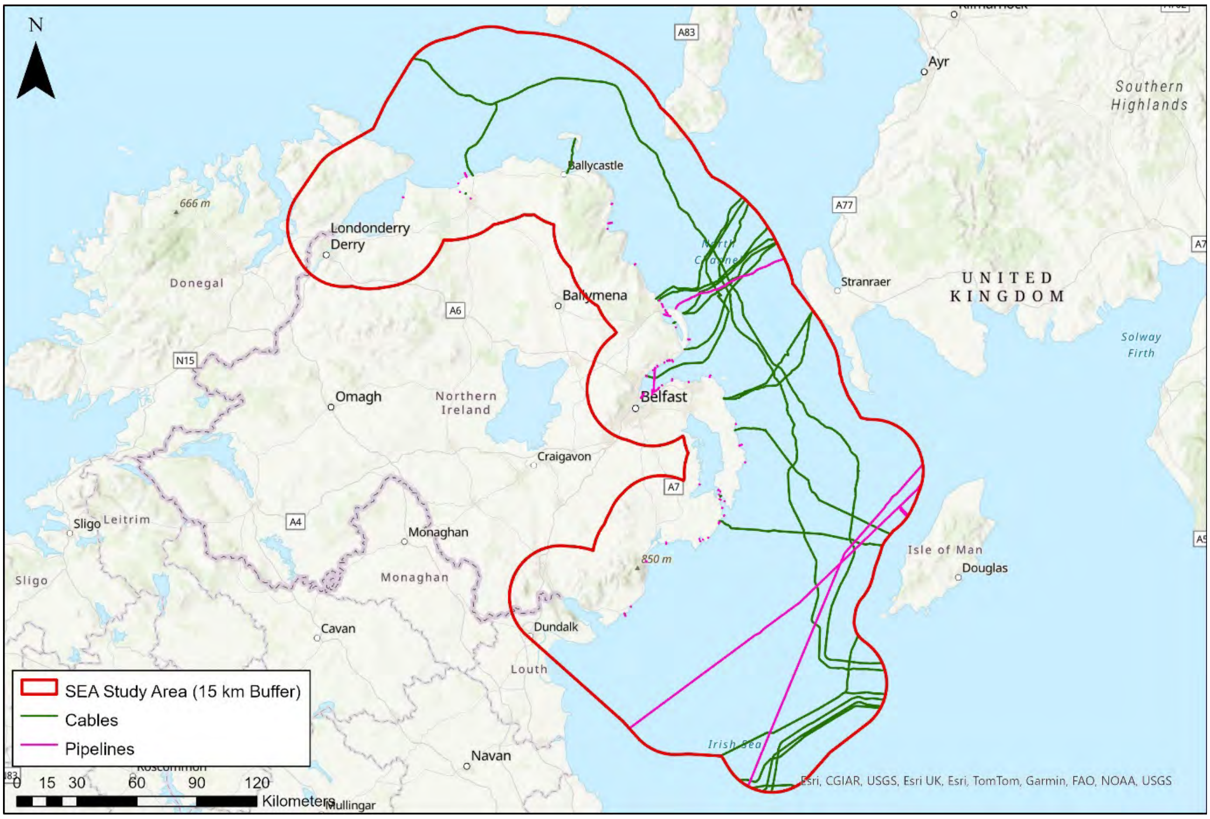

Figure 3-16 Locations of major cables and pipelines within the SEA Study Area

3.2.7.2.2 Renewable energy infrastructure

There is limited offshore renewable energy infrastructure within NI waters at this time. There are currently no offshore wind facilities, with several proposed projects having been abandoned; this includes the First Flight Wind project, a 600MW fixed foundation wind project proposed off the south County Down coastline. DfE and TCE have agreed to a statement of intent toward establishing offshore wind leasing for NI. One prospective project is the SBM Offshore North Channel Wind[125], which is a floating offshore wind farm (consisting of North Channel Wind 1 and North Channel Wind 2) in the North Channel of the Irish Sea located 9-25km off the eastern coast (at a depth of approximately 120m), aimed for construction in 2029-2030. It is proposed that the turbines be sited in deep water, with a

[125] North Channel Wind Ltd. 2024. North Channel Wind. Available at: https://northchannelwind.com/

design envelope that includes a tension leg platform as one of the possible foundation solutions, with key project infrastructure to include wind turbine generators, floating platforms, mooring infrastructure, inter-array cables, offshore substations, and offshore export cables. Combined, North Channel 1 and 2 have a potential capacity of over 1.4GW. A second proposed offshore commercial wind facility is the Simply Blue Group Olympic Offshore Wind project[126]; this is a floating wind farm with a potential capacity of 1.3GW located in the Irish Sea off the County Down coast. It aims to enter into commercial operation by 2028.

Regarding tidal energy infrastructure, sites were leased by TCE for projects at Torr Head and Fair Head off the north coast, and for Marine Current Turbines SeaGen, Minesto, and a Queen's University Belfast Test Site within Strangford Lough following the ORESAP 2012-2020. SeaGen, the world's first tidal power station was installed in Strangford Narrows between Strangford and Portaferry, and connected to the grid in 2008; this was a horizontal twin turbine system with an infrastructure of buried seafloor cables and above sea/water column turbine components. It was decommissioned by 2019. Strangford Lough has also been used for other tidal energy forms including testing since 2010 for Minesto's[127] novel subsea tidal kite, the Deep Green, and the H2020 Powerkite, Flex Marine Power 2020. More recent turbines, installed in 2022 (operational for 2 years), included 10kW vertical axis turbines, known as the Vertical Axis Tidal Turbines in Strangford (VATTS)[128], which feature battery-based energy storage and aim to deliver energy to the network in an adaptable manner rather than relying on cabling infrastructure and associated costs. The Torr Head project was abandoned following the liquidation of the company in 2019. The Fair Head Tidal Project proposed a 10MW demonstration array phase to connect to the existing grid system at Ballycastle, before advancing to a proposed 100MW array of turbines; however, the Fair Head Tidal Agreement for Lease (AfL) has lapsed, and the project is no longer in development.

Wave renewable devices, whilst at an earlier stage of commercial development compared to tidal devices, are also in development, namely the Pure Marine Gen machine as a wave energy converter of 2MW capacity with deployment aimed at large arrays generating up to 500MW[129].

3.2.7.2.3 Onshore Transmission Infrastructure

Northern Ireland Electricity Networks (NIE Networks) owns the electricity transmission and distribution network in NI. The existing electricity transmission infrastructure in NI comprises 2,300km of transmission network, and includes 713km of 275kV overhead line and 1km of cable, 934km of 110kV overhead line, and 112km of 110 kV cable, as well as major and minor substations. Offshore renewable energy that is generated will need to be connected to this network. This infrastructure is shown in **Figure 3-17**.

[126] Simply Blue Group. 2024. Olympic Offshore Wind. Available at: https://simplybluegroup.com/project/olympic-offshore-wind/

[127] Offshore Energy. 2018. Minesto engages Northern Ireland tidal testing support. Available at: https://www.offshore-energy.biz/minesto-engages-northern-ireland-testing-support/

[128] Ges Group. 2022. The new tidal turbine technology from the VATTS project. Available at: https://ges-group.com/2022/03/the-new-tidal-turbine-technology-from-the-vatts-project/

[129] Pure Marine. 2020. Duo Wave Energy Technology. Available at: https://puremarinegen.com/wave-energy/

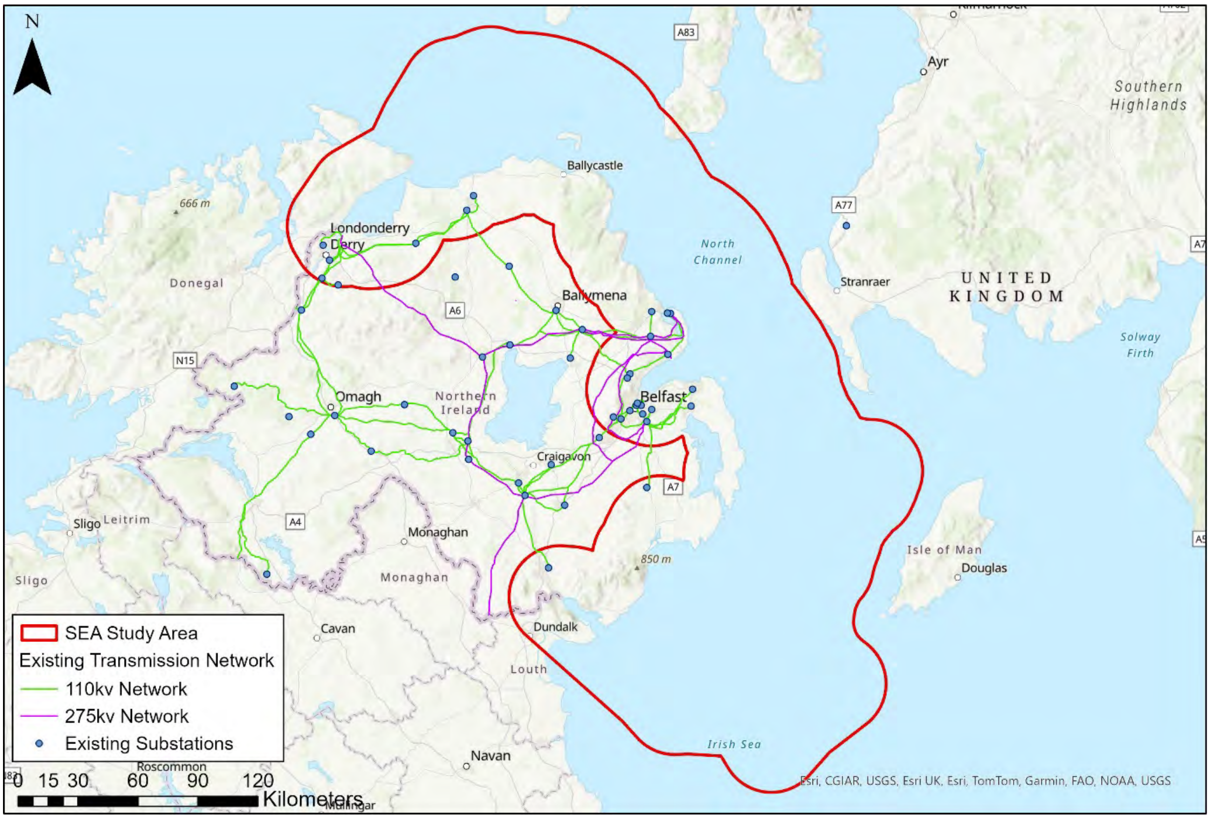

Figure 3-17 Transmission Infrastructure in NI

3.2.7.3 Commercial Fishing and Aquaculture

Commercial fishing is a significant industry in NI and is based largely around the three south-east coast NI Fishery Harbour Authority (NIFHA) ports of Ardglass, Kilkeel and Portavogie. The NI fishing fleet is currently comprised of the demersal fleet of about 140 vessels over 10m (targeting Nephrops, whitefish and scallop on a seasonal basis), a modern pelagic fleet of three large vessels over 50m in length (targeting small pelagics, mainly mackerel and herring), and around 200 inshore vessels (targeting mainly crab and lobster)[130]. The NI fleet has the highest proportion of vessels over 10m within the UK.

3.2.7.3.1 Fisheries Landings and Value

The supply of seafood from NI vessels to the processing sector achieves an annual turnover of approximately £135 million (comprising c.£45 million from fishing and c.£90 million from processing), supporting 1,550 FTE jobs (905 in fishing and 645 in processing), with an estimated GVA of approximately £55.5 million per annum[125].

In 2022, the NI fleet landed a total of approximately 44.5Kt of fish worth approximately £62.1 million into UK ports and abroad, representing c.6% of the total value of fish landed by UK vessels. This comprised £34.5 million for shellfish (e.g., Nephrops, scallops, lobsters), £24.8 million for pelagic fish (e.g., herring, mackerel) and £2.8 million for demersal fish (e.g., haddock, cod)[131]. The total value of species landed into NI ports in 2022 was £31.6 million. The main reason for the difference in the total value into UK and NI ports relates to the pelagic fleet, as there are three large pelagic vessels that land much of their catch into Scotland, Ireland, Norway, and Denmark, while there are also landings by the demersal fleet

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[130] Cappell, R. 2021. Fishing & Seafood Development Programme Final Report. Strategic Investment Board. Available at: https://niopa.qub.ac.uk/bitstream/NIOPA/14577/1/FSDP%20final%20report%20April%202021%20-%20Final%20version%20for%20publication%2027%20April%202021.pdf

[131] MMO. 2023. UK sea fisheries annual statistics report 2022. Available at: https://www.gov.uk/government/statistics/uk-sea-fisheries-annual-statistics-report-2022

to ports outside of NI, depending on the areas that they are fishing[126]. The top ten landings by value into NI ports in 2022 are shown in **Table 3-16**[132]. Nephrops are significantly the highest value of species landed into NI ports. Demersal landings mainly comprise bycatch from the Nephrops fleet and are therefore influenced by the Nephrops fishery and catching opportunities for species of whitefish. Not including the pelagic fleet, landings by the NI fleet are primarily by mid-sized trawlers (length 16-22m), comprising around half the landed volume and value in the ten years prior to 2021. Landing statistics for major ports in NI in 2022 show that the majority of Nephrops were landed into the ports of Kilkeel, Ardglass and Portavogie, in similar volume and value, while for the other main shellfish landed (crabs, scallops, and lobsters) a higher amount was landed in Kilkeel. Haddock was the highest value of demersal fish landed into NI's ports, followed by cod, monkfish/anglerfish and hake; the higher amount of these species was landed into Kilkeel, with smaller amounts in Ardglass and Portavogie and (for hake and monkfish/anglerfish) a small amount in Derry / Londonderry. Herring and mackerel were the only two pelagic species landed into NI, the majority of which were landed into Belfast, with some herring landed into Kikeel, Derry / Londonderry and other NI ports, and a very small amount of mackerel landed into Kilkeel and other NI ports.

Table 3-16 Total landings of fish and shellfish into all NI ports in 2022

Species	Live Weight (Tonnes)	Value (£)
Nephrops (Norway lobster)	6,266	17,192,043
Mackerel	5,291	4,335,604
Crabs (C.P. mixed sexes)	966	2,518,712
Herring	8,151	2,466,632
Scallops	697	1,590,673
Lobsters	63	812,810
Haddock	691	744,199
Crabs – velvet (swim)	195	461,404
Hake	171	355,872
Cod	71	243,188

Data was extracted from the UK Sea Fisheries Annual Statistics 2022 and was interrogated for four International Council for the Exploration of the Sea (ICES) rectangles across the NI marine area; these rectangles are 37E4, 38E4, 39E3, and 39E4 and account for potential trawling and active gear movements across the area. The value and volume of species estimated as captured within the EEZ of NI within these ICES rectangles by vessels of all nationalities (including NI, Scotland, Isle of Man, and Ireland) is shown in **Table 3-17** and **Table 3-18**, respectively.

Table 3-17 Value (£)* of fisheries landings from ICES rectangles in the NI marine area (year 2022; estimated EEZ of capture NI; MMO 2023)

Species	Scientific name	37E4	38E4	39E3	39E4	Total
Blonde ray	*Raja brachyura*	235	85	0	0	**320**
Brill	*Scophthalmus rhombus*	27,754	195	0	74	**28,023**
Brown shrimps	*Crangon crangon*	39,485	0	0	0	**39,485**

[132] DAERA NI. 2022. Fish landings into Northern Ireland. Available at: https://www.gov.uk/government/statistics/uk-sea-fisheries-annual-statistics-report-2022

Species	Scientific name	37E4	38E4	39E3	39E4	Total
Cod	*Gadus morhua*	25,802	44,028	3	466	**70,299**
Conger eels	*Conger conger*	176	1,693	0	20	**1,889**
Crabs - velvet	*Necora puber*	467,082	49,983	0	5,199	**522,264**
Crabs	*Cancer pagurus*	809,970	64,749	173,804	39,983	**1,048,523**
Green crab	*Carcinus maenas*	0	724	0	0	**724**
Gurnard and latchet	*Pterygotrigla polyommata*	1035	6	0	0	**1041**
Haddock	*Melanogrammus aeglefinus*	47,412	21,716	0	41	**69,169**
Hake	*Merluccius merluccius*	25,187	161,522	0	1,191	**187,900**
Herring	*Clupea harengus*	1,060,555	200,782	9,284	0	**1,270,621**
John dory	*Zeus faber*	213	331	0	0	**544**
Lemon sole	*Microstomus kitt*	282	4	0	<1	**286**
Lesser spotted dog	*Scyliorhinus canicula*	68,120	152	0	28	**68,297**
Ling	*Molva*	455	198	0	2	**655**
Lobsters	*Homarus gammarus*	496,275	137,561	219,684	35,163	**888,683**
Mackerel	*Scomber scombrus*	45	548	604	212	**1,219**
Megrim	*Lepidorhombos whiffiagonis*	739	21	0	0	**760**
Monks or anglers	*Lophius piscatorius*	85,175	1,152	16	150	**86,493**
Nephrops	*Nephrops norvegicus*	7,937,366	85,938	37,926	627,768	**8,688,998**
Plaice	*Pleuronectes platessa*	2,333	23	0	3	**2,359**
Pollack	*Pollachius*	1,528	1,410	0	0	**2,938**
Queen scallops	*Aequipecten opercularis*	1,197	0	361,678	846	**363,721**
Saithe	*Pollachius virens*	53	731	0	1	**785**
Scallops	*Pecten maximus*	217,865	290,952	96,461	41,749	**647,027**
Skates and rays	(mixed species)	201	0	0	0	**201**
Sole	*Solea solea*	37,731	1,117	191	45	**39,084**
Sprats	*Sprattus spp.*	0	177	0	0	**177**
Squid	(mixed species)	3,761	81	0	8	**3,850**
Thornback ray	*Raja clavata*	20,802	3,382	0	26	**24,210**
Turbot	*Scophthalmus maximus*	14,400	156	0	72	**14,628**
Unidentified dogfish	(unknown)	671	0	0	0	**671**
Whelks	*Buccinum undatum*	14,352	5,006	4,546	29	**23,933**
Whiting	*Merlangius merlangus*	508	890	0	0	**1,398**
Total (£)		**8,835,457**	**1,075,136**	**904,197**	**753,072**	**11,567,862**

*Including all values of >£100

The highest value and volume of total catch occurred within 37E4. Within this rectangle demersal trawls (catching a variety of species) caught a value of c.£8.2 million, pots and traps (catching crabs and lobsters) c.£1.9 million, pelagic trawls (catching mainly haddock and herring) c.£1 million, dredge fishing (for scallops) c.£200,000, with drift and fixed nets (for herring), beam trawl (for cod and herring), and longlines (for pollack) also catching small amounts of <£15,000. The highest values of catch were taken from March to September.

Within ICES rectangle 38E4 demersal trawls (catching a variety of species, mainly Nephrops and hake) caught a value of c.£311,000, pots and traps (catching crabs and lobsters) c.£258,000, dredge (for scallops) c.£279,000, and pelagic trawls (catching a variety of species, including herring, hake and haddock) c.£227,000, with a small value also caught by handlines. The highest values of catch were taken in August-September, and November-December.

Within 39E3 dredge (for scallops, primarily queen scallops) caught a value of c.£445,000, pots and traps (for crabs and lobsters) a value of c.£398,000, demersal trawls (for Nephrops and queen scallops) c.£51,000, and pelagic trawls c.£9,000, with a small value also caught by handlines. The highest values of catch were taken from August-October.

Within 39E4 demersal trawls (mixed species with the predominant value from Nephrops) caught a value of c.£621,000, pots and traps (for crabs and lobsters) c.£90,000, and dredge c.£42,000, while a small value was also caught by handlines and other passive gears. The highest values of catch were taken from May-September, particularly in June and August.

Table 3-18 Volume (t)* of fisheries landings from ICES rectangles in the NI marine area (year 2022[133]; estimated EEZ of capture NI; MMO 2023)

Species	Scientific name	37E4 Volume (t)	38E4 Volume (t)	39E3 Volume (t)	39E4 Volume (t)	Total Volume (t)
Brill	*Scophthalmus rhombus*	4.99	0.07	0	0.02	**5.08**
Brown shrimps	*Crangon crangon*	2.37	0	0	0	**2.37**
Cod	*Gadus morhua*	7.89	10.93	0	0.23	**19.05**
Conger eels	*Conger conger*	0.37	3.62	0	0.04	**4.03**
Crabs - velvet	*Necora puber*	190.66	23.75	0	1.85	**216.26**
Crabs	*Cancer pagurus*	366.92	29.72	63.58	14.33	**474.55**
Green crab	*Carcinus maenas*	0	1.34	0	0	**1.34**
Gurnard and latchet	*Pterygotrigla polyommata*	1.62	0.01	0	0	**1.63**
Haddock	*Melanogrammus aeglefinus*	56.47	13.49	0	0.04	**70.0**
Hake	*Merluccius merluccius*	13.34	62.17	0	0.97	**76.48**
Herring	*Clupea harengus*	1968.33	456.76	16.88	0	**2,441.97**
Lesser spotted dog	*Scyliorhinus canicula*	280.15	0.68	0	0.14	**280.97**
Lobsters	*Homarus gammarus*	38.48	9.96	14.19	2.32	**64.95**
Mackerel	*Scomber scombrus*	0.09	0.78	1.09	0.18	**2.14**
Monks or anglers	*Lophius piscatorius*	31.12	0.40	0.01	0.07	**31.60**
Nephrops	*Nephrops norvegicus*	1,335.81	14.18	6.16	113.30	**1,469.45**
Plaice	*Pleuronectes platessa*	2.29	0.02	0	0	**2.31**
Queen scallops	*Aequipecten opercularis*	1.71	0	717.69	1.69	**721.09**
Scallops	*Pecten maximus*	90.95	119.59	54.25	18.89	**283.68**
Sole	*Solea solea*	5.71	0.21	0.03	0.01	**5.96**
Sprats	*Sprattus spp.*	0	1.06	0	0	**1.06**
Squid	(mixed species)	1.08	0.02	0	0	**1.10**
Thornback ray	*Raja clavata*	23.26	2.81	0	0.04	**26.11**
Turbot	*Scophthalmus maximus*	1.84	0.02	0	0.01	**1.87**
Unidentified dogfish	(unknown)	1.53	0	0	0	**1.53**
Whelks	*Buccinum undatum*	11.97	3.68	4.69	0.03	**20.37**
Total		**4,438.95**	**755.27**	**878.57**	**154.16**	**6,226.95**

*Including all values of >1 tonne

133 Recorded tonnage of >1 t for a species

3.2.7.3.2 Spatial Distribution of the NI Fishing Fleet

Most activity of the NI fleet occurs in UK offshore waters and NI inshore waters (up to 12nm), with some fishing also occurring in RoI waters and in other EU Member State waters (pelagic fleet)[134]; it predominantly operates within the ICES Celtic Seas ecoregion within divisions 7.a (Irish Sea) and 6.a[135]. The demersal fleet represents the majority of the vessels over 10m in the NI fleet and has changed, over the past 50 years, from a fleet that targets whitefish to predominantly Nephrops (representing over 75% of the landed value). The fleet operate bottom trawls, with some diversifying to dredging for king and queen scallops on a seasonal basis. The Irish Sea fisheries has shifted from mainly cod, whiting, sole, and herring in the 1960s to one dominated by Nephrops and other shellfish. The majority of demersal catches, as well as all inshore catches, and around 20% of pelagic landings by the NI fleet come from the Irish Sea.

Nephrops burrow in soft, muddy seabed, and there are defined fishing grounds for the species, with stock assessed as ‘functional units’ (FUs). For Nephrops, the population density of the Western Irish Sea (ICES FU15) is the highest of all stocks compared to other Nephrops fisheries in the ICES area[136]. High production of larvae is coupled with a strong retention mechanism and depositional environment owing to the western Irish Sea gyre, which ensures continued good recruitment[137], while the fishery occurs throughout the year. The Nephrops FUs of most importance to the NI fleet (FU15 Irish Sea West, FU14 Irish Sea East and FU13 Firth of Clyde) are considered to be in good condition and fished at sustainable levels. There are also a small number of vessels in the NI fleet that trawl for haddock, and hake (historically also for cod, however there is currently no permitted commercial targeted fishery for cod). Regarding finfish caught by the fleet, cod and whiting are not considered to be in good condition, while Irish Sea haddock and plaice are in better condition. Inshore vessels target shellfish using pots or dredging (e.g., for king scallop) within divisions 6.a and 7.a., while queen scallops are caught using trawl nets and dredge gear in the Irish Sea and north of Rathlin Island in division 6.a[129].

The most important resources to the pelagic fleet are mackerel and herring, accounting for over 90% of the value of pelagic landings[128]. Other pelagic species caught include horse mackerel, blue whiting, sprat and sandeel. Mackerel are assessed as a single north-east Atlantic stock, generally considered to be in good condition. Herring targeted are from several stocks including Irish Sea, Celtic Sea, North Sea and West of Scotland, with Irish Sea and North Sea stocks accounting for the greatest proportions. NI’s pelagic fleet lands, on average, just under 32Kt of pelagic species annually, with around 30% of mackerel and herring estimated to go to NI processors. The fisheries are highly seasonal, with Irish Sea herring landed into NI ports from August to October. Catching efficiency for the pelagic fleet is high; shoals are targeted mid-water with little bycatch and no contact with the seabed.

The main stocks targeted by the inshore fleet are brown crabs and lobster, with velvet crab, whelk, palaemon prawn, Nephrops (Strangford Lough), herring (seasonal netting), and mackerel and other finfish (very small amounts caught on a seasonal basis) targeted at a lower level. Brown crab stocks appear to be in poor condition due to overfishing, while lobster generally appear in good condition[128]. The inshore fleet comprises the Down fleet (the majority), and the fleet of the North Coast (widely dispersed); much of the fleet operates from a few ports including Kilkeel and Ardglass[128].

Sea fishing boats registered in the RoI may also hold a licence issued by the UK authorities to fish both in UK waters in the NI 0-6nm Zone, and in UK waters in the UK EEZ 12-200nm. The Voisinage (or “neighbourhood”) arrangements between Ireland and NI have provided reciprocal fishing access for more than 50 years in coastal waters. Key target stocks for the Irish inshore sector include non-quota

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[134] Cappell, R. 2019. Fishing & Seafood Development Programme Stage 1: Fishing. Final Report. Strategic Investment Board. Available at: https://niopa.qub.ac.uk/bitstream/NIOPA/12922/1/FSDP%20stage%201%20final%20report.pdf.

[135] ICES. 2022. Celtic Seas ecoregion – fisheries overview. ICES Advice: Fisheries Overviews. Report. Available at: https://ices-library.figshare.com/articles/report/Celtic_Seas_ecoregion_fisheries_overview/21641312?file=38379152

[136] AFBI. 2016. Nephrops Factsheet. Available at: https://www.afbini.gov.uk/sites/afbini.gov.uk/files/publications/FAEB%20fact%20sheets%20NEPHROPS.pdf

[137] Hill, A.E., Brown, J. and Fernand, L. 1997. The summer gyre in the Western Irish Sea: Shelf sea paradigms and management implications, Estuarine, Coastal and Shelf Science, 44(1), pp. 83-95. Available at: https://www.sciencedirect.com/science/article/abs/pii/S0272771497800108

species such as shellfish/crustaceans caught by pots (lobster, crab) or by dredges (cockle, clam), turbot or bait fish and some crawfish (by nets). Inshore boats also have access to some quota stocks (e.g., mackerel and herring).

Spatial activity data is available for vessels over 12m through Vessel Monitoring System (VMS) records of position. The distribution and intensity of fishing activity within the SEA Study Area are shown in **Figure 3-18.** Smaller vessels have not historically had the same reporting and vessel tracking requirements, and there is a general lack of spatial activity data for these smaller vessels. AFBI have mapped locations of known pot fishing, where observers have been present on pot boats, which indicates some of the spatial effort for pot fishing in NI waters, shown in **Figure 3-19**. Most potting effort occurs within six miles of shore and there is some delineation between grounds that are regularly trawled and locations where pots are set, however there may be some overlap between trawl and potting fisheries owing to seasonal variations[138]. Localised impacts can be significant for individual potting vessels owing to the nature and limited range of potting fleets. AFBI have also surveyed for scallops, including within inshore areas and further offshore of the north coast and south-east coast, and for queen scallops off the north coast, including a high-density area north of Rathlin Island, which is a priority ground for queen scallops in NI waters.

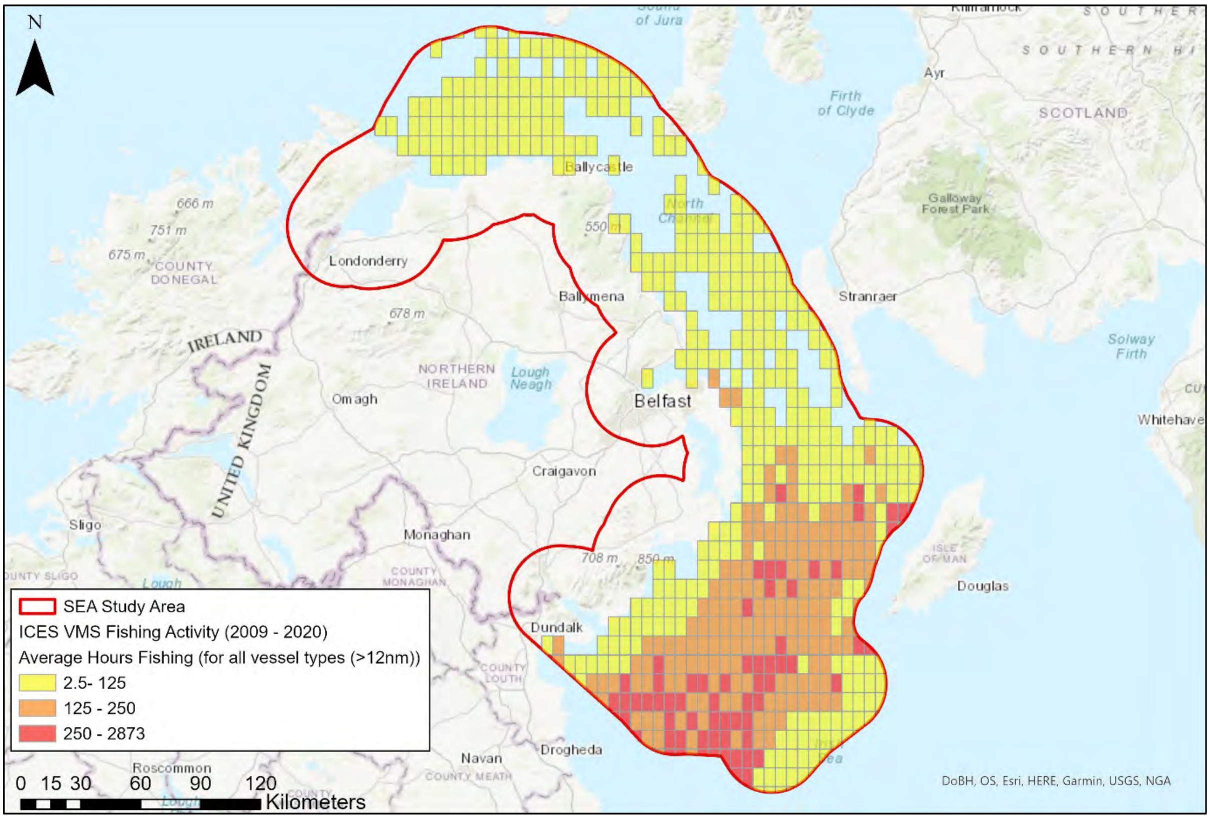

Figure 3-18 ICES VMS data showing average hours spent fishing

[138] Poseidon. 2015. Fish Resource Access Mapping Project (Fish Ramp) Economic Analysis and Literature Review. Available at: https://www.seafish.org/document?id=4268d1ff-c514-4cc0-a9e8-d41ed0ef4566

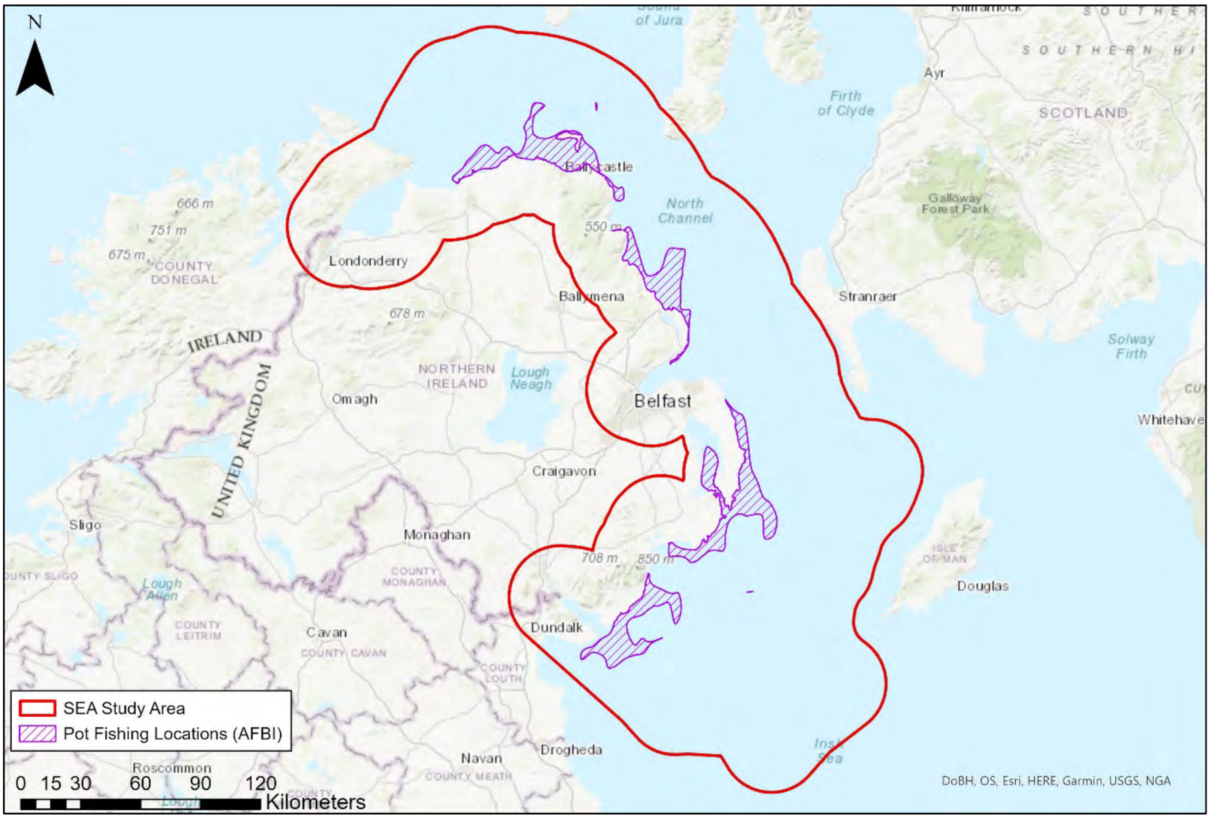

Figure 3-19 Areas of Known Pot Fishing Activity (data provided by AFBI)

The spatial access priorities of the NI fishing fleet were examined by Yates (2012)[139], who consulted 103 skippers and owners (approximately half of the NI fleet) and the areas of priority in NI waters for both the whole fleet and for each of the main fisheries: Nephrops, scallop, white fish and pot fleets. Regarding the whole fleet, areas of greatest significance were seen in the inshore area of the east coast around the Ards Peninsula and north-east coast, followed by the inshore and offshore south-east marine area. Significant priority areas for the Nephrops fleet were in the south-east; for the scallop fleet the inshore areas around the Ards Peninsula; for the pot fleet outer Belfast Lough; and for the white fish fleet offshore of the north coast. To gain an updated perspective of the access priorities of the NI commercial fishing fleet, as part of the stakeholder consultation process RPS provided survey charts to the NI fisheries representative bodies for distribution among their members, who had the opportunity to identify areas of greatest importance. Responses to this engagement were digitised and considered during the assessment of RZs detailed in **Section 9.2**.

3.2.7.3.3 Aquaculture

In the UK as a whole, aquaculture is dominated by farming for Atlantic salmon by a few large companies in Scotland; in NI, England, and Wales, marine aquaculture mainly involves small enterprises and is largely for shellfish[140]. The combined aquaculture industry in NI in 2018 was valued at approximately €13.1 million, with the salmon sector contributing 42%, the oyster sector 26%, the trout sector 17% and the mussel sector 16%. Aquaculture licences are granted by the Marine and Fisheries Division of DAERA under the Fisheries Act (NI) 1966 and are of three types: a fish culture licence, a shellfishery licence and a marine fishery licence. Fish culture licences are compulsory for all fish and shellfish farms,

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[139] Yates, K. 2012. Mapping the spatial access priorities of the NI fishing fleet. PhD, UU. Available at: https://www.researchgate.net/publication/248394585_Yates_K_2012_Mapping_the_spatial_access_priorities_of_the_Northern_Irish_fishing_fleet_The_Diverse_Seas_Project_University_of_Ulster

[140] ICES. 2022. Celtic Seas ecoregion – Aquaculture Overview. Aquaculture Overviews. Report. Available at: https://ices-library.figshare.com/articles/report/Celtic_Seas_ecoregion_Aquaculture_Overview/21252294

while shellfishery or marine fishery licences are additional licences that give the licence holder the exclusive right to cultivate a particular species within a specified area and legislative protection for their operations. Shellfish aquaculture sites are present within two transboundary sea loughs that border NI and the RoI, Lough Foyle in the north-west, and Carlingford Lough in the south-east; these include farming of Pacific oysters and blue mussels. Eligible RoI-registered fishing boats also access coastal waters in NI to fish for mussel seed. The mussel seed fishery is managed on an all-island basis, between DAERA, DAFM and the cross-border Loughs Agency. The Bottom Grown Mussel Consultative Forum (BGMCF) provides a structure where these bodies can consult with industry representatives on management of the fishery.

The location of marine fish farms for fish, crustaceans and oysters/mussels within the SEA Study Area is shown in **Figure 3-20**.

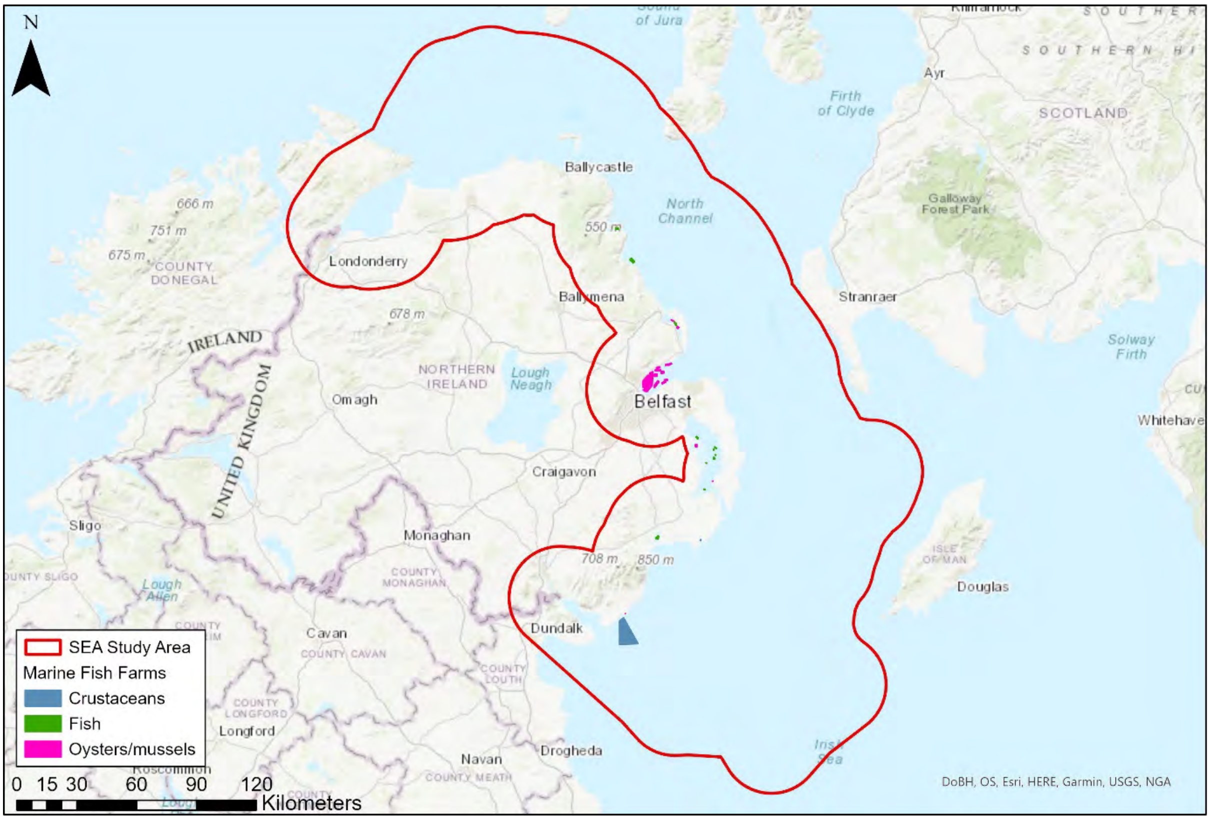

Figure 3-20 Location of Marine Fish Farms within the SEA Study Area

3.2.7.3.4 Status and Protection

Under the MS, the assessment of the status of commercial fish is based on two indicators, commercial fishing pressure, and reproductive capacity; these are measured for the commercially exploited stocks of UK interest that have maximum sustainable yield (MSY) assessments. The 2019 assessment for the UK (see **Section 3.2.4**) indicates that GES has been achieved for some commercially exploited fish (Descriptor D3 Commercial fish). In 2015, 53% of marine fish (quota) stocks were fished below MSY and had increased significantly since 1990. Most national shellfish stocks had not achieved GES, or their status was uncertain.

Prior to the UK’s exit from the EU, commercially valued fish species were subject to catch limits set by the EU for the protection of fish stocks. Shellfish, excluding Nephrops which were not subject to EU catch limits, are also financially significant to the local fishing fleet. Following the withdrawal of the UK from the EU, fisheries policy is being replaced by UK fisheries policy. Eight high-level policy objectives have been set out in the UK Fisheries Act 2020, and a Joint Fisheries Statement (JFS)[141] has been developed and adopted that sets out the policies for achieving these objectives. Fisheries Management Plans (FMPs)[142] are being developed for key stocks and fisheries; these include the following FMPs coordinated by DAERA:

- Irish Sea Pelagic FMP;
- Irish Sea Demersal FMP; and
- NI Inshore FMP.

In addition, DAERA is a joint authority for a number of FMPs for individual species coordinated by Marine Scotland, including cod, haddock, whiting, hake, saithe, monkfish/anglerfish, megrim, ling, Nephrops, mackerel, herring, greater silver smelt, and blue whiting.

Two new fisheries regulations were introduced in January 2023 to protect sensitive habitats from destructive fishing methods. The Marine Protected Areas (Prohibited Methods of Fishing) Regulations[143] specify fishing method restrictions (demersal mobile gear or static gear) within nine MPAs: Carlingford Lough MCZ, Murlough SAC, Outer Belfast Lough MCZ, Rathlin Island SAC and MCZ, Red Bay SAC, Skerries and Causeway SAC, Strangford Lough MCZ, The Maidens SAC, and Waterfoot MCZ. The Scallop Enhancement Sites (Prohibited Methods of Fishing) Regulations (NI)[144], intending to further the Conservation Objectives of MPAs and support fishing at sustainable levels, define a number of locations as scallop enhancement sites. These regulations protect 55,660ha of seabed from bottom towed fishing gear, which represents 10% of the NI inshore region. The regulations also protect 950ha of highly sensitive marine habitats, such as seagrass, from all types of fishing.

3.2.7.4 Tourism

Tourism represents an important source of income for NI's economy, with the most recent 2019 annual statistics for tourism[145] indicating the following:

- There were an estimated 5.3 million overnight trips in NI. Expenditure associated with these trips was estimated as £1.0 billion.
- Three million of these trips were from external visitors, with associated expenditure estimated at £731 million. This was an increase of 7% from the previous year.
- 167 cruise ships docked at ports in NI in 2019, a marked increase from 62 ships in 2013; the total number of passengers and crew has nearly trebled since 2013 (from 103,000 to 290,000).
- Tourism statistics show an upward trend in overall tourism activity between 2013 and 2019, and statistics regarding trips and spends have increased significantly since 2017.
- It is estimated that 70,803 individuals were employed in tourism-related industries in 2019, with the majority employed in food and beverage serving activities (59%), followed by

[141] Department for Environment, Food & Rural Affairs, Department of Agriculture, Environment and Rural Affairs (Northern Ireland), The Scottish Government and Welsh Government. 2022. Joint Fisheries Statement. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1119399/Joint_Fisheries_Statement_JFS_2022_Final.pdf

[142] Department for Environment, Food & Rural Affairs, Department of Agriculture, Environment and Rural Affairs (Northern Ireland), The Scottish Government and Welsh Government. 2022. List of Fisheries Management Plans (FMPs). Available at: https://www.gov.uk/government/publications/joint-fisheries-statement-jfs/list-of-fisheries-management-plans

[143] The Marine Protected Areas (Prohibited Methods of Fishing) Regulations (Northern Ireland) 2022 No. 292. Regulation 3. Available at: https://www.legislation.gov.uk/nisr/2022/292/regulation/3

[144] The Scallop Enhancement Sites (Prohibited Methods of Fishing) Regulations (Northern Ireland) 2022 No. 272. Available at: https://www.legislation.gov.uk/nisr/2022/272/contents

[145] NISRA. 2020. Northern Ireland Annual Tourism Statistics 2019. Available at: https://www.nisra.gov.uk/sites/nisra.gov.uk/files/publications/Tourism-Statistics-Annual-Publication-2019_0.pdf

accommodation for visitors (15%), sporting and recreational activities (12%) and transport (7%).

The quality of NI's environment, heritage and culture has strong national and international appeal and tourism is therefore an important activity in the SEA Study Area. The north coast of NI has a developed tourist infrastructure and a number of coastal attractions. The Causeway Coast Way, for example, takes in attractions like the Giant's Causeway, Dunluce Castle ruins, and the Carrick-a-rede Rope Bridge. Access to the coast is relatively easy, with good infrastructure in place, although car parking facilities are in short supply in some areas. Long distance footpaths, notably the 16km long North Antrim Cliff Path, allows exploration of less accessible sites. NI Statistics and Research Agency (NISRA) run an annual survey to collect information on visits to all visitor attractions. Of the top ten most visited tourist attractions in NI in 2020[146], shown in **Table 3-19**, six (highlighted in bold text) are in coastal or marine locations.

Table 3-19 Top ten visitor attractions in NI in 2020

Attraction	Visitor Numbers (thousands)
Dundonald International Ice Bowl	202
Ballyronan Marina	174
Blackhead Path	151
Titanic Belfast	150
Pickie Fun Park	148
Giants Causeway World Heritage Site	139
Mount Stewart House and Gardens	132
Slemish Mountain	77
Castle Ward	72
An Creagán Visitor Centre	65

There are four AONBs that overlap the coastline of NI, as described in **Section 3.2.9**, and a number of National Trails and long-distance walking routes, that often coincide with National Parks or AONBs, offering significant attraction for outdoor tourism and leisure; these include Antrim Hills Way, Lecale Way, Mourne Way and Moyle Way. Coastal and marine recreation and leisure, including water sports, sea angling, beach use and wildlife watching within the SEA Study Area, as described in **Section 3.2.2**, are also popular with tourists.

3.2.7.5 Aviation, Military, and Communications

NI has three main airports: George Best Belfast City Airport, Belfast International Airport, and City of Derry Airport. Of the 221.8 million passengers passing through UK airports in 2022, 6.6 million used the main NI airports[147].

The physical characteristics of wind turbines, coupled with the size and siting of the developments, can result in effects that can have a negative impact on aviation. The safety of aviation operations has the

[146] NISRA. 2021. Visitor attraction survey publications. Available at: https://www.nisra.gov.uk/publications/visitor-attraction-survey-publications

[147] Civil Aviation Authority (CAA). 2022. Terminal and Transit Passengers 2022. Available at: https://www.caa.co.uk/Documents/Download/9116/47a460b2-0592-4ef7-b24b-aa5e27ccfce4/5636

potential to be a concern for offshore wind developments within the SEA Study Area. Aviation operations may be affected by wind farm development in the following ways:

- Through the physical obstruction caused by a tall structure;
- Through effects that the supporting structure and rotating turbine blades may have on communications, navigation and surveillance (CNS) systems (including radar); and
- Through turbulence.

Authority for policy and regulation of aviation services in the UK rests with the Department for Transport and the Civil Aviation Authority (CAA). The CAA has produced CAP764 Policy and Guidelines on Wind Turbines[148] and are a statutory consultee for offshore developments in excess of 100MW. The UK airport safeguarding zone is 30km for wind turbines to ensure no adverse effects on the airport's operation; all potential wind turbine developments within 30km of the airport must apply to the CAA. Obstacle Limitation Surfaces (OLS) ensure that no buildings or structures penetrate the OLS e.g., approach surface, runway, and take-off surface within the 30km radius (this value can vary between airports - for George Best Belfast City Airport and Belfast International Airport it is 30km). The impact areas for flight pathways are much larger and cover generally a "triangular" shaped area expanding outwards from the relevant runaways for incoming/outgoing aircraft; for George Best Belfast City Airport this extends outwards for 15km for all approach directions. Wind turbines developed near these areas must undergo certain lighting conditions for visibility. This includes potential impacts on Instrument Flight Procedures (IFP), whereby wind turbines can impact primary radar leading to clutter and false aircraft tracks on radar, and secondary radar can be impacted as turbines cause misplaced aircraft returns. They may also generate turbulence and cause issues for incoming/outgoing aircraft.

Belfast City Airport's Control Zone (CTR) is active from surface level up to 2,000 feet (ft) above mean sea level (amsl). To the east, the base of the Belfast CTR rises to 1,500ft amsl below which is uncontrolled Class G airspace down to surface level. Further north and east between NI and Scotland, the base of controlled airspace rises to 3,500ft amsl until the boundary of Danger Area 509 within Scottish territorial waters, which is protected for Military operations from surface level up to 55,000ft amsl.

Military activity occurs extensively throughout the SEA Study Area, with almost the entire coast utilised for practice and exercise areas (PEXAs). Much of this is dominated by the Navy who use the PEXA areas for submarine, general surface fleet and aircraft exercises; no ammunition firing occurs in these areas. There are no Air force training areas located within the SEA Study Area. Air Surveillance and Control System (ASACS) are critical to air defence systems in the UK and as such the MoD submits holding objections to all wind energy proposals within 74km and in line of sight of air defence radars. Two weapons ranges are located in the Study Area, the Magilligan and Ballykinler ranges, which are controlled by the Army. Both Magilligan and Ballykinler ranges are byelawed areas that are due to be reviewed by the Defence Estates as part of their review of all existing MoD byelaws[149]. Byelaws are a form of delegated legislation, used mostly by local authorities and government departments; they cover a defined geographical area, normally regulating certain activities in the interests of safety and security[150]. In the two byelawed areas within the SEA Study Area certain civilian activities are restricted and therefore these areas would not be considered suitable for offshore renewable energy development. The MoD is currently undertaking a review of the practice and exercise areas under byelaw and is also considering proposing new byelawed areas. No information is yet available on the location of proposed new byelawed sites. In recognition of the move towards a net zero carbon economy and the deployment of offshore wind, which could potentially have adverse impacts on the UK's air defence radars, the UK government have published a strategy 'Air defence and offshore wind – working

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[148] Civil Aviation Authority (CAA). 2016. CAA Policy and Guidelines on Wind Turbines - CAP 764. Available at: https://www.caa.co.uk/publication/download/14561

[149] Ministry of Defence (MoD). 2018. MOD byelaws: Northern Ireland. Available at: https://www.gov.uk/government/publications/northern-ireland-byelaws

[150] Ministry of Defence (MoD). 2019. Ministry of Defence: byelaws review. Available at: https://www.gov.uk/guidance/ministry-of-defence-byelaws

together towards Net Zero'[151] outlining how the government will manage the effective coexistence of air defence and offshore wind.

The UK low flying system (LFS) allows training within the whole of the UK airspace and surrounding seas, to 3nm, from the surface to 2,000 feet above the ground or mean sea level; NI is in LFA19. Installation and presence of obstacles can pose a physical obstruction to Aviation operations and can be difficult to see from the air, particularly in poor meteorological conditions, leading to a potential increase in obstacle collision risk. Low flying is unlikely to significantly impact upon offshore wind farms as no designated Tactical Training Areas (TTAs) are present over the sea, and any possible interference can be resolved through consultation, charting and lighting of developments[152]. Search and Rescue (SAR) helicopters are not constrained during operational missions by the standard airspace rules and operate in accordance with their Aircraft Operator Certificate, which allows them flexibility to manoeuvre, as required, for the particular mission being carried out. Any permanent or temporary obstacles that are of greater than 91.4m (300ft) in height must be informed to aircrews by means of the Notice to Airmen (NOTAM) system or by inclusion on Aviation charts. The CAA, the MoD, and the National Air Traffic Services (NATS) have a statutory duty to safeguard certain sites and airspace from radar interference in the interests of national security and for the safe operation of passenger and military aviation. NATS has produced, and made publicly available, GIS-based maps designed as an aid to developers in understanding where interference with NERL (NATS En Route plc) infrastructure is likely[153], which can facilitate an assessment of the impact of wind turbines on the electronic infrastructure required to operate an air traffic service. For each of the 54 air-ground-air (AGA) communication stations, 55 navigation aids and 20 secondary surveillance radar operated by NERL, a consultation zone has been provided; 10km for the air-ground-air communication stations and navigation aids and, in line with CAA publication CAP764, 15nm for the secondary surveillance radar.

3.2.7.6 Disposal Areas

The deposit of substances or articles in the sea or under the seabed within NI's territorial waters or controlled waters is regulated by DAERA, under Part II of the Food and Environment Protection Act 1985 (FEPA) (as amended). Most sites receive chemically unmodified geological material derived from the adjacent coastline. The disposal of waste at sea is strictly controlled through the Marine and Coastal Access Act (MCAA) 2009 licensing system through the Marine and Fisheries Division of DAERA. Statutory changes have occurred over recent years governing the types of waste that may be disposed of at sea. Since the end of 1998, most forms of waste disposal at sea have been prohibited including disposal of radioactive waste (since 1982); disposal of industrial waste (since 1992: and disposal of sewage sludge (since 1998).

The main types of disposal activity that remain licenced by the Marine and Fisheries Division[154] are as follows:

- Disposal of dredged material at sea (e.g., capital dredged material or maintenance dredged material);
- Miscellaneous disposal (e.g., explosives and munitions, tracers, others); and

[151] Ministry of Defence, Department for Energy Security and Net Zero, The Crown Estate and Department for Business, Energy & Industrial Strategy. 2021. Air defence and offshore wind - working together towards Net Zero. Available at: https://www.gov.uk/government/publications/air-defence-and-offshore-wind-working-together-towards-net-zero

[152] DTI. 2002. A Strategic Framework for the Offshore Wind Industry. Available at: https://tethys.pnnl.gov/sites/default/files/publications/A_Strategic_Framework_for_the_Offshore_Wind_Industry.pdf

[153] NATS. 2024. Self-assessment maps. Available at: https://www.nats.aero/services-products/catalogue/n/wind-farms-self-assessment-maps/

[154] DAERA NI. 2016. Northern Ireland Guidance on Marine Licensing - Dredging, Disposal and Aggregate Dredging, under Part 4 of the Marine and Coastal Access Act 2009. Available at: https://www.daera-ni.gov.uk/sites/default/files/publications/doe/marine-licensing-guidance-dredging-disposal-and-aggregate-dredging-under-part-4-marine-and-coastal-access-act-2009-may-2016.pdf

- Alternative use (e.g., habitat creation/feeding (saltmarsh and mudflat), beach nourishment).

The location of known disposal sites within the SEA Study Area is shown in **Figure 3-21**.

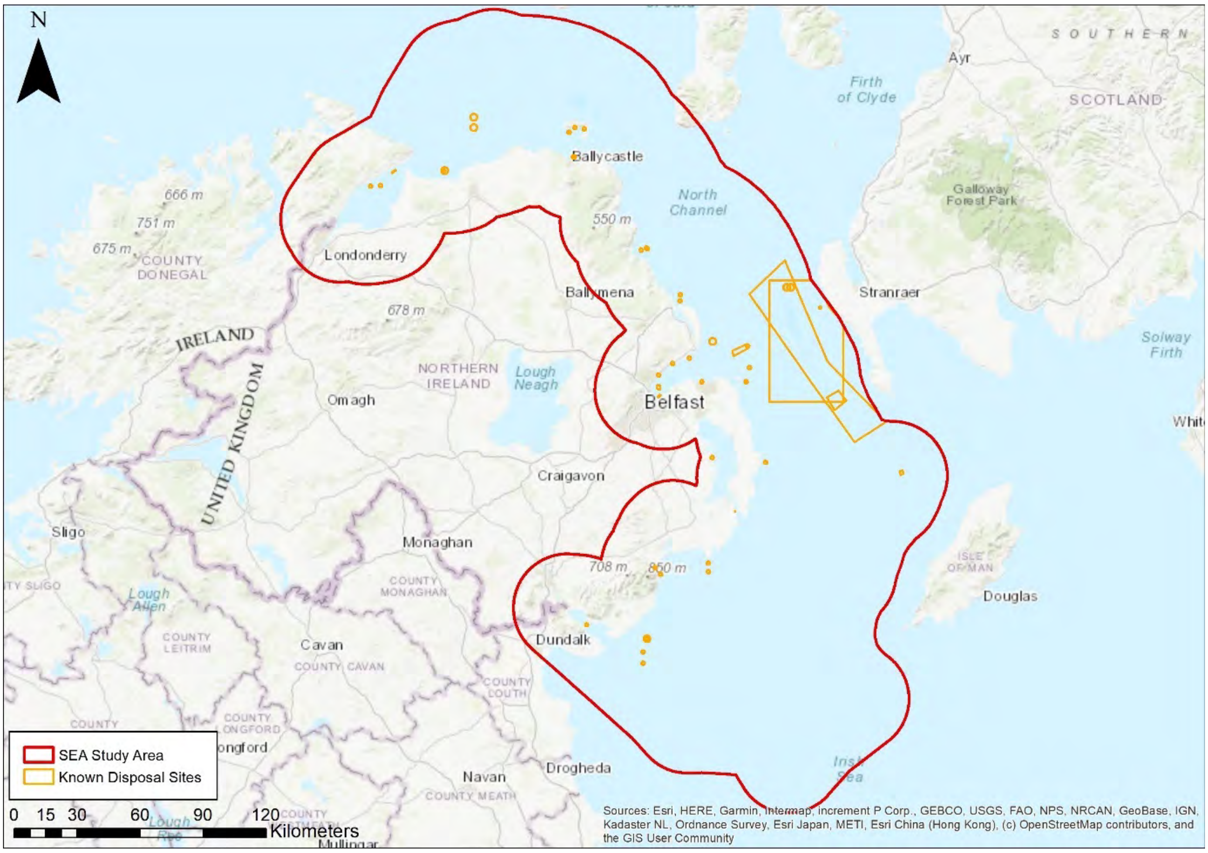

Figure 3-21 Location of Known Disposal Sites within the SEA Study Area

3.2.7.7 Marine Aggregate Extraction

Marine aggregates can be defined as sedimentary material comprised of sand or gravel of various grain and class sizes (grades). This material can be a valuable contributor to infrastructure development, including for buildings and roads, and may also be used for beach nourishment and coastal defences. The extraction of marine aggregates typically involves dredging of the deposit to remove it from the seabed. Screening of aggregate material may occur at sea prior to its transportation to land for further processing[155].

The (non-energy) mineral rights to the seabed, extending from the edge of the UK continental shelf, are owned by TCE, who issues consents for non-exclusive sampling, and licences for commercial aggregate extraction. Aggregate dredging is regulated in NI under Part 4 of the Marine and Coastal Access Act (MCAA) 2009 (marine licensing). Prior to the commencement of extraction, the operator must obtain consent from the government, as administered in NI through a marine licence from the

[155] Sutton, G. 2008. Irish Sea Marine Aggregate Initiative (IMAGIN) Project Synthesis Report Including: Geological Assessment, Environmental Assessment, Morphodynamic Modelling Web-based GIS System, Cost Benefit Analysis, Aggregate Resources and Markets-Wales. Marine Environment and Health Series, 36. Available at: https://oar.marine.ie/bitstream/handle/10793/277/No%2036%20Marine%20Environment%20and%20Health%20Series.pdf;jsessionid=83226168702B8114897FA6BDA38E68DF?sequence=1

Marine and Fisheries Division. There is currently no licensed marine aggregate extraction in NI and no prospective licence areas have been defined[156].

3.2.7.8 Summary of Existing Pressures and Issues for Material Assets

Population growth and development are placing increasing pressure on many infrastructure assets in NI, particularly in urban areas. Annual population growth has been positive for the past 25 years in NI, and the total population is predicted to increase from approximately 1.9 million in 2021 to approximately 1.99 million by 2043. Population growth is likely to increase the demand for infrastructure and the consumption of energy. Commercial fisheries and shipping have been disrupted in recent years by the Covid-19 pandemic and by Britain's exit from the EU (Brexit). There has been a slower growth in tourism than in previous years, affected by uncertainty surrounding Brexit, geopolitical and trade tensions, and the global economic slowdown.

The complexity in management of multiple activities and users in the marine region is recognised by recent plans and legislation, including the UK Marine Policy Statement, the Marine and Coastal Access Act and the draft Marine Plan for NI. Implementation of the OREAP, and the construction, maintenance and decommissioning activities associated with the potential offshore renewable energy projects that may arise as a result, have the potential to result in short to long-term disruption or displacement of other users (e.g., from fishing grounds or shipping routes). The location of existing, or indeed planned, infrastructure will influence the siting of offshore renewable devices, as will the level of constraint associated with areas where there is significant conflict with other users and the location of ports and potential onshore location of supporting infrastructure.

3.2.7.9 Evolution of the baseline in the absence of the plan

Population growth is likely to increase the demand for infrastructure and the consumption of energy. In the long-term it is likely that there will be an increased need or sub-sea cabling in the SEA Study Area, to support increased telecommunications and connectivity e.g., between NI, North America, and Europe, and to upgrade and provide for increased renewable electricity connection and transmission. Vessel traffic volume and routes are driven by commercial factors. Shipping movements such as ferries, fishing, commercial shipping and recreation are largely independent of renewable energy plans. Commercial fishing will be affected by the level of stocks (which may be affected by climate change and sea temperature rise and effects on species distribution), exploitation at a sustainable level and UK and NI fisheries policy. There may be changes in fishing activity and the species being targeted resulting from future changes to fisheries legislation, displacement of fishing activities due to legislation (such as closed areas) and fisheries management measures. Designation of marine habitats may restrict fishing activity in specific areas or for specific types of fishing gear. The tourism industry has largely recovered from the effects of the Covid-19 pandemic and is predicted to grow[157].

3.2.8 Cultural, Architectural and Archaeological Heritage

Cultural heritage, including archaeological heritage and architectural heritage, are places and objects of beauty, cultural, historic, scientific, social, or spiritual value. They include archaeological monuments, world heritage sites, protected structures, designed landscapes, place names, language, and inherited traditions. NI is rich in cultural, archaeological and architectural heritage, with many important archaeological sites, monuments and heritage buildings. Marine cultural heritage in NI is rich, and includes features such as submerged landscapes, harbours and jetties, fish traps and quays, and wrecks.

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[156] The Crown Estate (TCE). 2022. Marine Aggregates Annual Review 2022. Available at: https://downloads.ctfassets.net/nv65su7t80y5/6EF1PrZKZ2BoQzoWlYjCC3/bd7b9e99abfdc38f24f6d69fc5e30198/marine-aggregates-annual-review-2022.pdf

[157] Department for the Economy (DfE). 2023. Tourism Strategy for Northern Ireland. Available at: https://consultations.nidirect.gov.uk/dfe/tourism-strategy-public-consultation/supporting_documents/Draft%20Tourism%20Strategy%20for%20Northern%20Ireland%20%2010%20Year%20Plan.pdf

It is considered that the key issues associated with the implementation of the OREAP and Cultural Heritage comprise:

- Potential for direct or indirect effects on marine archaeological features (including protected features) such as wrecks and submerged landscapes during construction.
- Potential for direct and indirect impacts on the setting of coastal designated and non-designated heritage assets, including archaeological and architectural features.
- Potential for the discovery of new cultural heritage features during construction.

3.2.8.1 Protected Sites

There are 51,820 recorded heritage assets within NI that have been included in the Historic Environment Record of Northern Ireland (HERoNI). This includes:

- 17,855 entries on the Sites and Monuments Record;
- 15,383 recorded historic buildings;
- 15,704 Industrial Heritage Record sites;
- 738 Defence Heritage Record sites;
- 738 Battlefield sites;
- 663 Historic Parks and Gardens Record sites;
- 382 identified aircraft wrecks and shipwrecks; and
- 399 Historic Nucleated Urban Settlements (including those with identified areas of archaeological potential).

There are also over 12,000 designated heritage assets in NI. This includes:

- 190 Monuments in State Care. Of these, 54 are within the SEA Study Area;
- 2,014 Scheduled Historic Monuments. Of these, 843 are within the SEA Study Area, as well as 49 that are Scheduled and in State Care);
- 12 protected wrecks (3 shipwrecks which are scheduled under the Historic Monuments and Archaeological Objects (NI) Order 1995 (HMAOO) (HMS Drake, Lochgarry and Devereux), 1 Shipwreck (La Girona) which is protected under the Protection of Wrecks Act 1973 and 8 military aircraft protected under the Protection of Military Remains Act 1986) (see Section 4.3.7.2);
- 8,976 Listed Buildings (Listed Buildings are those designated through listing as being of 'special architectural or historic interest' under Section 80 of the Planning Act (NI) 2011). Of these, 8949 are within the SEA Study Area; and
- 58 Conservation Areas.

Historic Parks, Gardens and Demesnes of Special Historic Interest form part of the HERoNI and are identified on the basis of these records for protection through policy in the Local Development Plan (LDP) process. There are 300 of these sites included in the HERoNI, of which 128 are within the SEA Study Area. Local Landscape Policy Areas (547 no.), Areas of Significant Archaeological Interest (ASAIs) (10 no. representing distinctive areas of the historic landscape in NI), and Areas of Townscape / Village Character (177 no.) are LDP designations which may include assets recorded by HERoNI.

There is also one coastal UNESCO WHS in NI; the Giant's Causeway, designated for its unique geological heritage. This site is situated at the foot of basalt cliffs along the coast on the edge of the Antrim Plateau and is comprised of some 40,000 massive black basal columns that protrude from the sea. Geological study of these formations has shown that they were formed by volcanic activity during the Tertiary period some 50-60 million years ago and have contributed greatly to the understanding of earth science.

It is important to note that the HERoNI archive is still growing, with new assets added as new information is provided.

The locations of designated heritage assets within the SEA Study Area are shown in **Figure 3-22**.

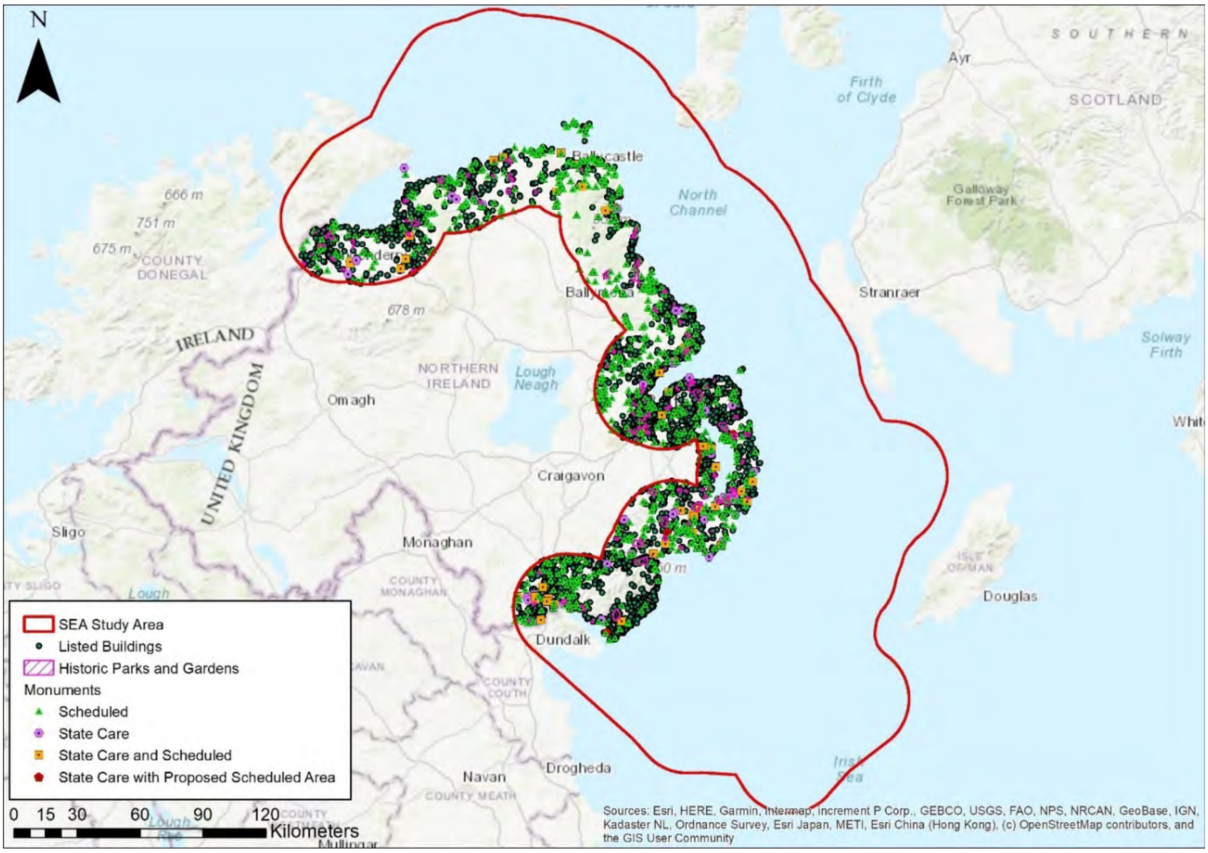

Figure 3-22 Location of designated heritage assets within the SEA Study Area

3.2.8.2 Wrecks

Wreck sites are generally defined as sunken ships and aircraft, and any material associated with such vessels. This includes vessels ranging from prehistoric logboats to modern metal ships and aircraft. There are many thousands of shipwrecks that lie off the coastline of NI, with designated wreck zones, historic wrecks and a density map of documented marine losses available for viewing on the Department for Communities' Historic Environment Map Viewer[158]. This shows a high concentration of marine losses along the eastern coastline of NI from Larne to Strangford, with the highest concentration within Belfast Lough. Known wreck sites in the SEA Study Area range from single isolated items to virtually complete vessels and cargoes. It is highly probable that more 'undiscovered' wrecks and their associated material culture exist in the waters off NI.

There are twelve protected wrecks within NI's territorial waters. The wreck site of the Spanish Armada vessel, La Girona, which sank at Lacada Point on the north Antrim coast in 1588 is designated under The Protection of Wrecks Act 1973. There is a 300m exclusion zone around the wreck, and diving is prohibited without a licence from the NIEA. The 19th Century barque Devereux, the First World War armoured cruiser HMS Drake and the Second World War transport ship Loghgarry are scheduled for protection under the HMAOO. This makes it an offence to execute, cause or permit to be executed any works that affect a scheduled monument without consent. All military aircraft are automatically protected under the Protection of Military Remains Act 1986, it is an offence to interact with any of these vessels

[158] Department for Communities. 2019. Historic Environment Map Viewer. Available at: https://experience.arcgis.com/experience/8bb16b64f0994385a5c141027ae9d33e/

in absence of a licence from the Ministry of Defence. There are currently 8 known military aircraft within NI waters.

Significant numbers of shipwrecks have also been recorded around the coast of the RoI including a dense cluster on the north coastline in proximity to the NI coastline. All wrecks within the RoI's territorial waters that are over 100 years old are protected under Section 3 of the National Monuments (Amendment) Act 1987, while those less than 100 years old, as well as potential wreck locations, may be protected under this Act if considered to be of significance. **Figure 3-23** shows the presence of known wrecks around the coastline.

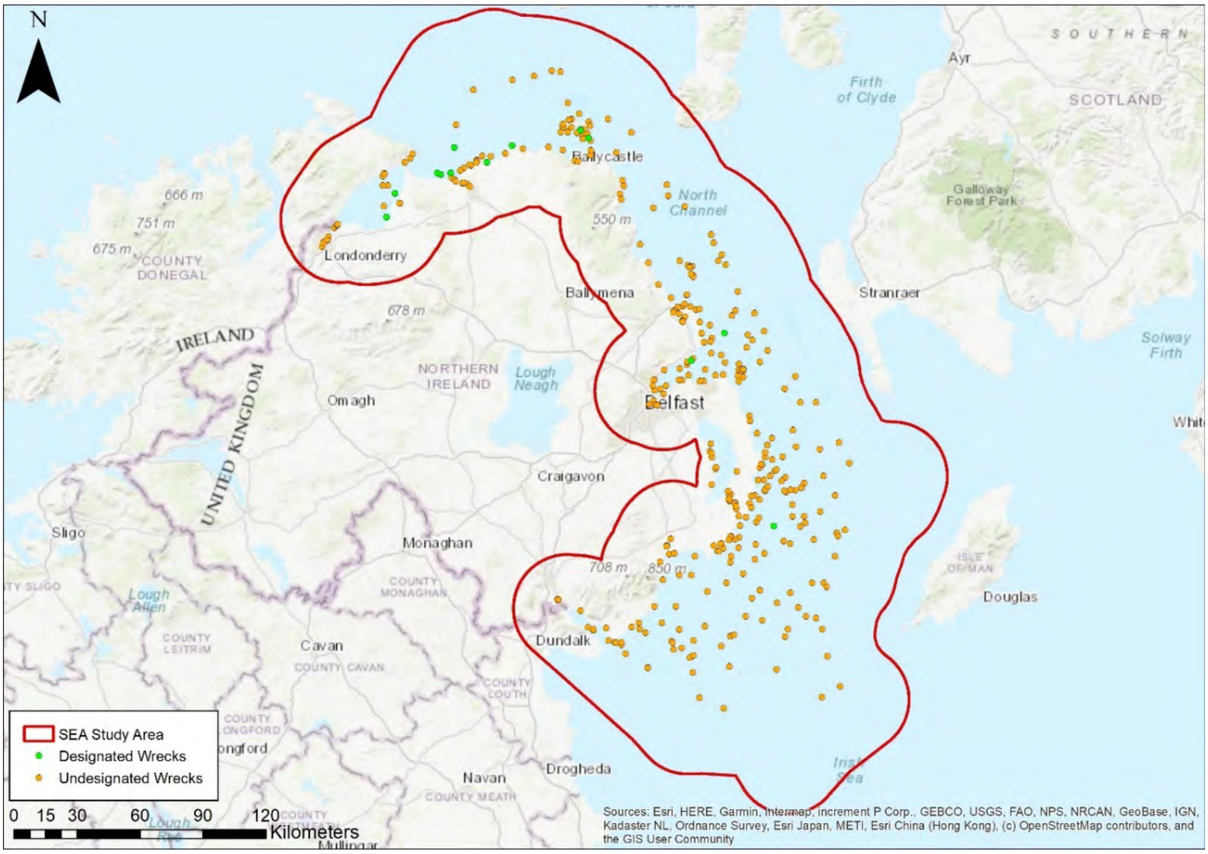

Figure 3-23 Known Wreck (Designated and Undesignated) Locations within the SEA Study Area

3.2.8.3 Submerged Landscapes

The earliest known human occupation of NI is dated to about 10,000-9,000 before present (BP) (the site of Mount Sandel, Co. Derry). As is the case with much of the northern part of the British Isles the possibility of early habitation of the NI coastal zone is related to the extent of past glaciation and sea level. Almost all of Ireland was glaciated at the height of the last Ice Age, some 20,000 years ago. Large-scale ice retreat occurred from about 16,000 years BP, exposing land along the NI coastline. As the ice continued to retreat, the land rebounded such that sea-levels between 14000-10000 BP were lowered by up to 30m, moving the coastline seaward of its present position[159]. Sea-levels then rose again reaching present levels by 5000-6000 BP. There is therefore a possibility of early (i.e., 14000-6000 BP) settlement sites being found offshore. Later (i.e., post-6000 BP) sites are restricted to the intertidal and coastal zone.

[159] Brooks, A., Bradley, S., Edwards, R., Milne, G., Horton, B. and Shennan, I. 2008. Post-Glacial relative sea-level observations from Ireland and their role in Glacial Rebound Modelling, Journal of Quaternary Science, 23, pp. 175 - 192. Available at: https://www.researchgate.net/publication/227657880_Post-Glacial_relative_sea-level_observations_from_Ireland_and_their_role_in_Glacial_Rebound_Modelling

The HMAOO acts to provide protection for scheduled monuments both on land and within UK territorial waters adjacent to the coastline of NI. It also obliges the finder of archaeological objects to report them, and (if portable) to deposit them with the authorities.

There is relatively little known regarding submerged archaeological sites in NI evidencing drowned landscapes and settlements. There are a considerable number of known intertidal sites, such as fish traps and quays, which are associated with settlement dating from the Mesolithic to the historic period; a number of these are also scheduled. A database of all known subtidal and intertidal assemblages with prehistoric evidence was compiled from published and grey literature for the Submerged Prehistoric Archaeology and Landscapes of the Continental Shelf (SPLASHCOS) project for the entire coastline island of Ireland[160]. There are currently 50 sites recorded on this database, of which 11 are fully subtidal, 38 are intertidal and one is deeply buried below sea level beneath reclaimed land[161]. Spatially, the distribution of these sites is concentrated in the north and north-east coasts (35 of the 50 sites), mirroring the distribution of terrestrial Mesolithic sites on the island. Of the 11 recorded sites, those found within NI waters comprise a single isolated find in Larne Lough, and a small number in Belfast Lough, both in nearshore waters. The intertidal locations primarily comprise archaeological evidence of flint tools, with the largest concentrations around Strangford and Belfast Loughs.

3.2.8.4 Summary of Existing Pressures and Issues for Cultural Heritage

Built heritage in NI has been adversely affected by population growth and expansion of the agricultural sector since the 18th century, with major landscape changes such as marginal land reclamation and removal of peatland occurring since the UK joined the EU in the 1970s[162]. According to the most recent State of the Environment report for NI (2013), the archaeological resource is most at risk from agricultural land use practices, and from urban development. At present, there are over 800 entries on the Heritage at Risk database, while 3% of Scheduled Historic Monuments are considered to be in poor condition[163].

Implementation of the OREAP, and the construction, maintenance and decommissioning activities associated with the potential offshore renewable energy projects that may arise as a result, has the potential to lead to damage or disturbance of known or as yet undiscovered heritage features in the marine environment, including wrecks and archaeological features, while development of infrastructure in inshore areas, or inshore and coastal cabling associated with the export of energy from offshore renewables to land could have potential to directly impact on coastal architectural and archaeological features, or indirectly affect their setting.

3.2.8.5 Evolution of the baseline in the absence of the plan

Cultural heritage in the SEA Study Area is likely to be affected in the long-term by marine and coastal developments and climate change. Continuing pressures from human development will affect historic assets and their settings. The large number of visitors to heritage attractions may put increasing pressure on some sites. Pressures from climatic conditions and coastal erosion will continue to affect heritage features and be exacerbated by climate change. For coastal assets this is likely to include a greatly increased rate of loss of coastal assets e.g., through rising sea levels, impacts of adaptation schemes e.g., construction of coastal defences, and changes to salinity of groundwater affecting plant growth in historic landscapes, parks and gardens. For marine heritage this is likely to include changes to water chemistry leading to breakdown of marine heritage, and increased water temperatures leading

[160] SPLASCOS. 2020. SPLASHCOS Viewer. Available at: http://splashcos.maris2.nl/

[161] Westley, K. and Woodman, P. 2020. Ireland: Submerged Prehistoric Sites and Landscapes. In: Bailey, G., Galanidou, N., Peeters, H., Jöns, H. and Mennenga, M. (eds) The Archaeology of Europe’s Drowned Landscapes. Coastal Research Library, 35. Springer, Cham. Available at: https://link.springer.com/chapter/10.1007/978-3-030-37367-2_11

[162] DAERA NI. 2013. From Evidence to Opportunity A Second Assessment of the State of NI's Environment. Available at: https://www.daera-ni.gov.uk/sites/default/files/publications/doe/corporate-report-from-evidence-to-opportunity-second-assessment-of-state-of-ni-environment-2013.pdf.

[163] Department for Communities. 2020. NI Heritage Statistics. Available at: https://www.communities-ni.gov.uk/sites/default/files/publications/communities/ni-heritage-statistics-310319.pdf

to new pests affecting marine archaeology. There is a risk of coastal erosion along 19.5% of the NI coastline, and immediate vulnerability in Strangford Lough and the Foyle estuary[164].

3.2.9 Landscape, Seascape and Visual Amenity

'Landscape' is defined by the European Landscape Convention as 'an area as perceived by people whose character is the result of the action and interaction of natural and/or human factors' and 'it concerns landscapes that might be considered outstanding as well as everyday or degraded landscapes'. Landscape and seascape form an important part of NI's identity and culture and influence the economy and the wellbeing of the population.

It is considered that the key issues associated with the implementation of the OREAP and Landscape, Seascape and Visual Amenity comprise:

- Potential for effects on areas of designated landscape quality and scenic views (AONBs, AoHSV).
- Potential for effects on the general landscape and seascape and its sensitivity to development (potential compatibility with landscape and seascape character types).
- Potential visibility of offshore structures and/or onshore support structures by human receptors.

3.2.9.1 Designated Landscapes

The value of the landscape present in NI is recognised through the designation of eight AONBs, designated for their distinctive landscape character and high scenic value. These areas cover approximately 325,000ha, or c.20% of the total land area of NI. Of these sites, seven are within the coastline; these are described in **Table 3-20** and their locations are shown in **Figure 3-24**.

Table 3-20 AONBs within the SEA Study Area

AONB Name	Area covered	Description
Antrim Coast and Glens	The AONB includes the coastline of Co. Antrim from Ballycastle to Larne and the Glens of Antrim.	The area is dominated by a high undulating plateau cut by deep glens which open north and eastwards to the sea. It is an area of contrasts: gentle bays are separated by blunt headlands; exposed moorland gives way to sheltered valleys; wide-open expanses to enclosed farmland.
Binevenagh	The AONB covers the area between the Roe Estuary and Magilligan, the cliffs of Binevenagh, the Bann Estuary and Portstewart sand dunes.	Much of the landscape is characterised by long beaches and extensive dune systems. The Bann Estuary is also an important site in relation to the study of coastal physiography.
Causeway Coast	The AONB encompasses 18 miles of coastline and incorporates the Giant's Causeway.	This area is renowned internationally and boasts the only WHS in NI. The spectacular coastal scenery includes dramatic cliffs and headlands that are broken by sandy beaches backed by dunes. The dark volcanic rocks and white chalk form geological features including the Giant's Causeway and Carrick-a-Rede rope bridge.
Strangford and Lecale	This AONB follows the shores of Strangford Lough and extends inland	This coastal AONB and its lowland landforms illustrate NI's glacial past, with drumlin hilltops

[164] Climate Northern Ireland. 2021. Evidence for the third UK Climate Change Risk Assessment (CCRA3) - Summary for Northern Ireland. Available at: https://www.ukclimaterisk.org/wp-content/uploads/2021/06/CCRA-Evidence-Report-Northern-Ireland-Summary-Final.pdf

AONB Name	Area covered	Description
	up the Quoile River and south along the outward-facing shore of the Irish Sea.	poking from the sea to form hundreds of islets of Strangford Lough.
Mourne	This AONB includes the south-east coastline from the south of Dundrum Bay to the north of Carlingford Lough.	This AONB includes a picturesque mountain district, including twelve peaks such as Slieve Donard, NI's highest mountain. The mountain slopes descend through moorland, woodland, fields, and farms before meeting the coast.
Ring of Gullion	This AONB surrounds Slieve Gullion mountain in County Armagh.	Slieve Gullion mountain lies at the centre of this AONB, with an encircling ring of lower rugged hills. The Ring of Gullion is regarded as the finest expression of a ring dyke in the British Isles. The area has an extensive geology and is rich in natural, cultural and built heritage.
Lagan Valley	This AONB lies mostly within the Lagan Valley Regional Park, to the south of Belfast.	This AONB is focussed on the course of the River Lagan, and includes riverbank scenery, meadows, woods and pastoral valley land.

There is one UNESCO WHS that is within the SEA Study Area, the Giant's Causeway, as described in **Section 3.2.8**. There are eight NIEA Country Parks in NI; of these, six sites are within the SEA Study Area: Scrabo Country Park, Ness Wood Country Park, Crawfordsburn Country Park, Redburn Country Park, Roe Valley Country Park and Lagan Valley Regional Park. There are also 56 National Trust Sites within NI, of which 43 are within the SEA Study Area.

In addition, the NI Landscape Character Assessment 2000, described in **Section 3.2.9.2,** identified special landscapes that it termed Areas of Scenic Quality; some of these areas have been included in Local Area Plans, where they may be designated as Areas of High Scenic Value (AoHSV).

In the RoI, there are six areas designated as National Parks, as they are recognised as nationally important landscapes; none of these areas are in proximity to the border with NI.

The location of these designated landscape types is shown in **Figure 3-24**.

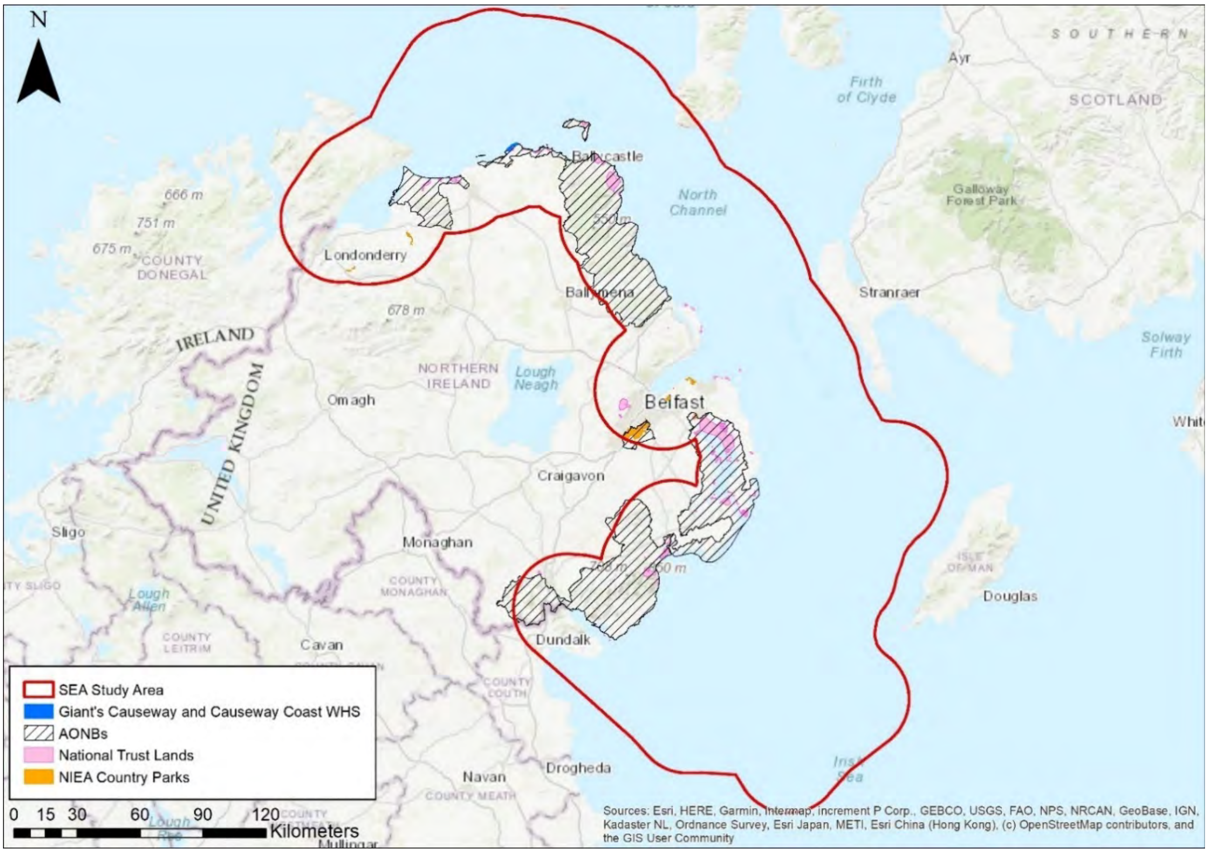

Figure 3-24 Areas Designated for Landscape that are within the SEA Study Area

3.2.9.2 Landscape and Seascape Character Assessment

Landscape character assessments are used as a tool to identify the landscape features that give a locality its 'sense of place'. The NI Landscape Character Assessment 2000[165] (NILCA) subdivided the countryside into 130 Landscape Character Areas (LCAs), each based upon local patterns of geology, landform, land use, cultural and ecological features. For each LCA, the key characteristics were described and an analysis of landscape condition and its sensitivity to change was made. The land use planning system will generally refer to the NILCA where development might affect the landscape character[166].

The NI Regional Landscape Character Assessment (NIRLCA), developed in 2016, aimed to complement the NILCA by providing a regional framework upon which more detailed local studies could be based. This subdivided the countryside into 26 Regional Character Areas (RCAs), based upon information relating to people and place and the combinations of nature, culture and perception that contribute to local uniqueness. These aim to provide information on which to base plans at a more local level that might affect landscape character.

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[165] NIEA. 2015. Landscape Character of Northern Ireland. DAERA NI. Available at: https://www.daera-ni.gov.uk/articles/landscape-character-northern-ireland#toc-1

[166] Smyth, E. 2015. Landscape Planning for Sustainable Development. Knowledge Exchange Seminar Series (KESS). Available at: https://www.niassembly.gov.uk/globalassets/documents/raise/knowledge_exchange/briefing_papers/series4/kess_es_policybriefing_landscape-planning-for-sustainable-development-.pdf

The NI Regional Seascape Character Assessment (NIRSCA)[167] identified 24 Seascape Character Areas (SCAs) along the NI coast, describing the key features and characteristics of each area, and relating these to neighbouring terrestrial LCAs. These SCAs were identified as distinct areas with a unique sense of place, with boundaries tending to represent indicative lines of gentle transition rather than an abrupt change in seascape character. These regional SCAs are shown in **Figure 3-25**, and their key characteristics are described in **Table 3-21**.

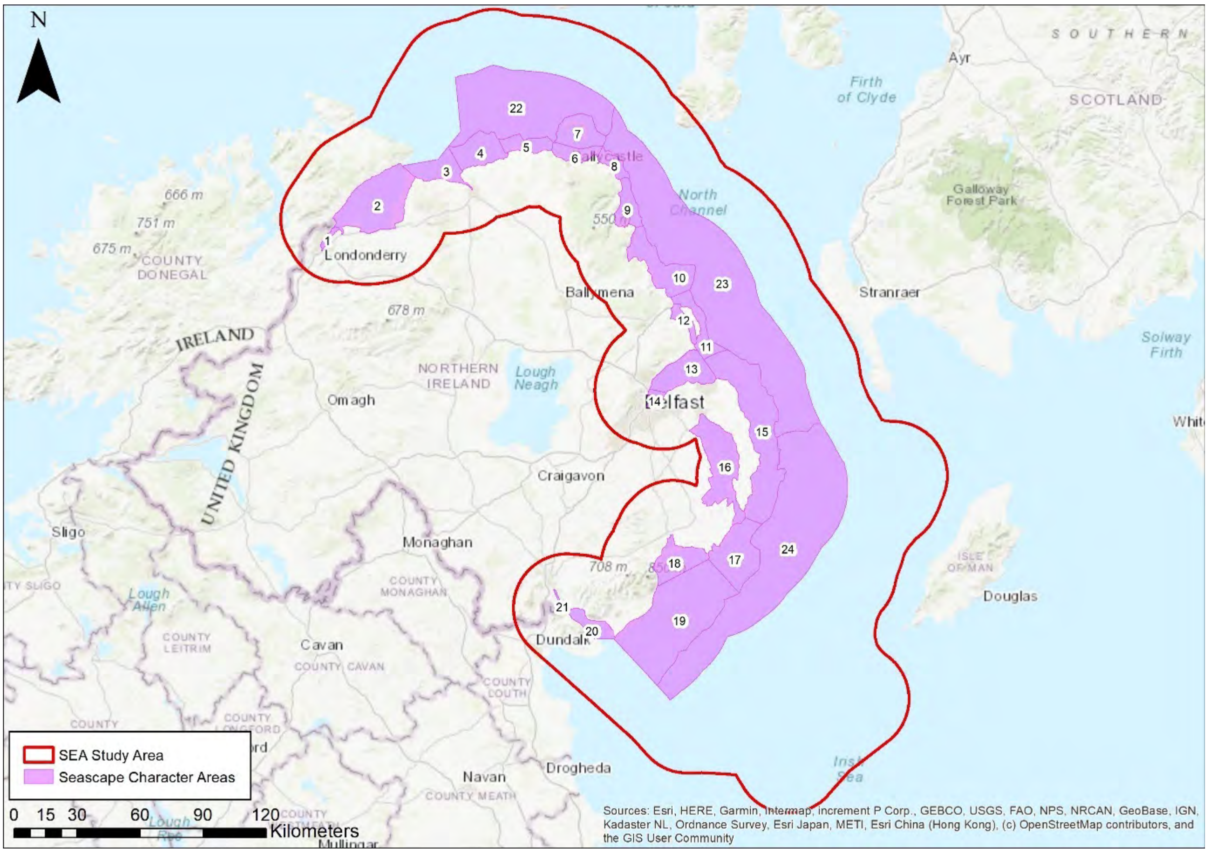

Figure 3-25 Location of Regional Seascape Character Areas in NI

Table 3-21 Description of Regional Seascape Character Areas in NI

No.	Seascape Character Area	Key Characteristics*
1	Foyle Estuary	Contained by valley sides, the gently meandering river is flanked by a series of historic navigational features with channel markers along its length. The constant flow of water and changing tides underpin a dynamic seascape, emphasised by occasional small boats and yachts moving up and down the river and commercial shipping activities at Lisahally, where large shipping containers import and export goods. The river valley sides to the north-east of Derry / Londonderry are heavily wooded which contrasts with large-scale industrial and commercial land uses towards Derry / Londonderry and around

[167] NIEA. 2014. Northern Ireland Regional Seascape Character Assessment. DAERA NI. Available at: https://www.daera-ni.gov.uk/publications/northern-ireland-regional-seascape-character-assessment

No.	Seascape Character Area	Key Characteristics*
		the port. The Peace Bridge is a striking feature across the River Foyle which, along with the Foyle and Craigavon bridges, provides strategic connections across the river. The SCA also forms an important recreational resource and setting for the city.
2	Lough Foyle	Lough Foyle is an extensive sea lough and has one of the largest catchments of all Irish sea loughs. At 3,700km^2, it is the largest sea lough in NI and several rivers run into it including the Foyle, Faughan and Roe. From the Donegal coast to the mudflats off Ballykelly, the Lough is approximately 10km at its widest point. There is a well-marked channel down the Donegal side which is used by large ships visiting Lisahally Port opposite Culmore Bay. The large expanse of water provides ever-changing patterns of currents, waves and reflections of the sky. At low tide, there are extensive textured patterns of mudflats that are important feeding grounds for wintering bird populations. Magilligan Strand forms an extensive, peaceful beach along the eastern shore. The Lough is also an important resource for shellfish fisheries, aquaculture and recreational activity.
3	North Coast Strands and Dunes	With panoramic open views of dramatic rolling waves, the SCA has a prevailing windswept and often wild appearance. The extensive flat sandy beaches of Benone Strand, Castlerock Strand, Downhill Strand and Portstewart Strand, all backed by large sand dune systems, are notable scenic features that define much of the coastline character and provide an important resource for a range of coastal recreational activities. The dynamic dune system at Magilligan is the largest accumulation of coastal sands in Ireland. At Portstewart and Castlerock, there are sections of basalt forming rocky headlands that contrast with the extensive swathes of sand. The sheltered River Bann punctuates the coastline and enters the sea between the coastal towns of Castlerock and Portstewart. Offshore, large rolling waves form in shallow waters above extensive areas of sandy seabed. Located on the cliff top, the iconic Mussenden Temple is visible from across much of the SCA.
4	The Skerries and Dunluce Coast	This dramatic section of exposed coastline is formed of rugged and intricate basalt and contrasting chalk cliffs with submerged sandbanks, sea caves and reefs. Ramore Head juts out to sea forming a very prominent headland and is composed of a hard dolerite sill that extends offshore to form the Skerries, a chain of nearby low-lying uninhabited rocky islands. Located on a rocky outcrop, the dramatic medieval ruin

No.	Seascape Character Area	Key Characteristics*
		of Dunluce Castle overlooks the rugged cliffs and wild sea beyond. There are three sections of scenic beach, Bushfoot Strand, Curran Strand and Portrush West Strand where high-energy rolling waves are popular for surfing. Portrush is a popular tourist resort, providing a good location to explore the coast and nearby visitor attractions.
5	Causeway Coast	The iconic and world-famous Giant's Causeway and Causeway Coast, (designated as a WHS) is a defining feature of this stunning SCA. The seascape is typified by rough seas crashing against a series of rocky headlands and surrounding high vertical cliffs with dramatic formations of Basalt and Chalk. There is also an impressive submerged palaeo-cliff shoreline off White Park Bay and the Giant's Causeway. There is an intricate pattern of sweeping bays, islets, rocky headlands and outcrops, punctuated by the sweeping sands at White Park Bay, backed by hummocky ground and low-rising, slumped Chalk cliffs. There are a number of small rocky islands near to the coastline including Sheep Island and Carrick-a-rede Island with a series of submerged sandbanks, sea caves and reefs towards the west of the SCA. The area has a strong undeveloped character with a remote and exposed experience that contrasts with the intimacy and shelter provided by the distinctive harbours at Ballintoy, Dunseverick, Portbradden and Portnaboe. Along the cliff tops, there are extensive swathes of semi-natural grasslands and patches of gorse.
6	Ballycastle Coast	The SCA is formed by a broad sweeping bay that partly encloses the dynamic waters of Rathlin Sound, notable for its extremes of currents, overfalls and eddies that make navigation very challenging. The character of the SCA is heavily influenced by the distinctive outline of Rathlin Island which forms a sense of visual containment and shelter from the wild Atlantic beyond. Along the coast, a series of mostly vertical and exposed cliffs of varying geology and landforms are punctuated by rocky headlands and small rocky outcrops. A distinctive series of large sea caves are located between Kinbane and Ballycastle and the sheltered bay at Ballycastle contains the town, harbour and a beach backed by sand dunes. Fair Head is a particularly prominent and exposed headland with a very distinctive profile that marks the eastern point of the SCA. The imposing open moorland summit of Knocklayd, Glentaisie and Glenshesk are important features that provide an important setting to the southern part of the SCA

No.	Seascape Character Area	Key Characteristics*
7	Rathlin	This stunning and dramatic seascape is typified by its remote and wild qualities, extreme exposure to the elements and panoramic views of extensive rough sea. A composition of rugged cliffs, a broad sweeping bay, an exposed inland plateau providing distant views towards Scotland and the nearby mainland, underpins an exhilarating coastal experience with an outstanding scenic quality. The island has a long history of settlement, invasion, industry and trade with a large number of notable maritime sites, including harbours, quays, slipways, landing places and lighthouses. Rathlin Sound is also notable for its extremes of currents, overfalls and eddies that make navigation very challenging, and a number of interesting submarine geological features are found around Rathlin Island, including a submerged partly-enclosed basin within the bedrock structure.
8	Torr Head Coast	The SCA includes some of the most unspoilt and dramatic coastal landscapes in NI. With its very exposed location, Torr Head juts out into open sea forming a prominent headland and focal point in the seascape. There are expansive views across the North Channel SCA where occasional large shipping movements add interest against a distant backdrop of Scotland. The coast is characterised by a series of large, vegetated landslips, small, sheltered bays and crashing waves against exposed headlands and rocky outcrops. Large sections of the coast are inaccessible which underpins a strong sense of remoteness and tranquillity.
9	Northern Glens Coast	The SCA is typified by a series of dramatic large sweeping bays backed by a series of distinctive glens and surrounding open moorland with panoramic views across the open expanse of the North Channel that, when travelling along the open coastal road, provide a constantly changing visual experience. The sweeping bays, enclosed by broad rocky headlands of varying geology and landforms with a series of vegetated slopes, have a prevailing exposed and undeveloped nature. Within the shelter of the bays, the traditional coastal towns of Cushendall, Waterfoot and Cushendun, with a concentration of cultural sites, are popular visitor attractions. The shoreline within the bays is typically lined with pebbles, boulders and sands, with rocky outcrops along the more exposed sections of the coastline.
10	Southern Glens Coast	Centred on the broad sweep of Carnlough Bay and backed by the Larne Glens, the SCA is heavily influenced by dramatic basalt cliffs and scarp slopes and further south, the prominent headland of Ballygally

No.	Seascape Character Area	Key Characteristics*
		Head. The bays provide shelter for the traditional coastal settlements of Carnlough, Ballygally and Glenarm that contrast with open and exposed headlands. On the seabed, there are extensive maerl beds and the Maidens' light towers amongst rocky outcrops are distinctive features in the open sea. The shoreline consists mostly of gravel with rocky outcrops with sandy beaches found at Ballygally Bay and Carnlough Bay. When travelling along the open coastal road, there is a dramatic and contrasting experience with extensive views across the open sea. The bays are also popular for sailing.
11	The Gobbins	Stunning views of dramatic basalt cliffs and extensive open sea, combined with exposure to the elements, underpin an exhilarating coastal experience. 'The Gobbins', a three-mile-long coast path that opened in 1902 (although now closed but to be restored again), in its heyday, was more popular than the Giant's Causeway. It consisted of a series of cliff staircases, suspension bridges, caves and tunnels. Further north, the small offshore Isle of Muck is important for nesting sea birds and the surrounding open sea often provide sightings of dolphins and whales. Black Head Lighthouse is situated on a prominent headland and further south, the sheltered town of Whitehead is located near to the mouth of Belfast Lough. Out to sea, ferries and commercial ships pass along busy shipping lanes to and from Larne and Belfast ports.
12	Larne Lough	The SCA is centred on Larne Lough, a shallow and relatively small and narrow sea lough contained by the wooded sides of the Larne Ridgeland to the west and the open farmlands of Islandmagee to the east. The Port of Larne is a very busy commercial harbour with a continuous flow of ferries and commercial traffic into and out of the Ro-Ro docks on the west side of the Lough entrance. The east side of the entrance to the Lough is dominated by Ballylumford Power Station. The wooded escarpments either side of the village of Glynn form a distinctive backdrop to the Lough, contrasting with lower-lying areas of development in Larne. The Lough is dotted with small boats and towards the southern quieter end, there are extensive mudflats and saltmarsh. A network of large pylons across the southern part of the Lough contributes to a visually cluttered appearance.
13	Belfast Lough	Belfast Lough is a large, shallow sea lough and busy gateway for Belfast Port. The Lough has three main channels that provide shipping routes for a large number

No.	Seascape Character Area	Key Characteristics*
		of ferries, container ships and occasional cruise liners. With a diversity of land and sea uses, the constant activity of boats and ships underpins a dynamic and vibrant seascape experience. The majority of the shore is characterised by rocky headlands, small sandy bays and intertidal rocky outcrops, with occasional lagoons and mudflats. Along the southern shore, a strong pattern of wooded estates contrasts with the more open and industrial character along the northern shore where Kilroot Power Station forms a prominent landmark. There are a number of busy towns with marinas scattered around the Lough that provide a base for water-based recreational activity. As the Lough is virtually free of strong tides, it is a very popular attraction for sailing and kayaking.
14	Belfast Harbour	Belfast Harbour is a compact SCA centred on three main shipping channels and docks with surrounding mixed, large scale land uses. The two yellow Harland and Wolff cranes form an iconic feature on the Belfast skyline. The origins of the port can be traced back to 1613 and it has played a central role in the evolution of Belfast. Today, it is a hub for maritime services, logistics, industry and urban regeneration, receiving over 6000 vessels each year. In addition to providing a major centre for importing and exporting with regular ferry links to Scotland and England, it is also a popular destination for cruise liners. The Titanic Belfast Visitor Centre is a striking new building that explores the history of its construction at the docks. The SCA also includes Belfast City Airport, an RSPB Reserve, Victoria Park, sewage works, landfill sites and industrial estates.
15	Ards Peninsula	Although still exposed to the elements, the eastern coast of the Ards Peninsula is the most sheltered stretch of open rocky coast in NI. Along the low-lying coastline, there is a simple pattern of rocky outcrops and curved sandy beaches, punctuated by occasional coastal settlements and harbours. Lighthouses and historic fishing harbours are a particular feature and Portavogie is an important commercial fishing centre. Offshore, there are a large number of reefs, islands and rocky outcrops. The Copeland Islands, important for seabirds and located near to the mouth of Belfast Lough, are separated from the mainland by strong currents racing through the Donaghadee Sound. Burial Island, off Burr Point near Ballyhalbert, is the easternmost point of Ireland.
16	Strangford Lough	Strangford Lough is a near-land-locked and sheltered marine inlet with a highly indented coastline that contains a highly distinctive and visually stunning

No.	Seascape Character Area	Key Characteristics*
		composition of numerous whale-backed islands produced from the drowning of countless drumlins by the sea. The drumlins are found mainly on the west coast with most of those on the east coast having been removed by marine erosion forming small islands and numerous rocky reefs known as 'pladdies'. Strangford Lough is of particular importance for its marine flora and fauna and is NI's only MCZ. The intimacy experienced along the seclusion of the western shore contrasts with the larger scale and more open appearance of the northern and eastern shores. The area has a long history of settlement with religion, industry and pleasure reflected in a large number of historical features associated with the Lough.
17	Lecale Coast	With a horizontal emphasis, the SCA is a low-lying, exposed and windswept coastline with extensive views out to sea. The coastline is predominantly formed of intricate rocks with sections of low-lying soft cliffs, punctured by two small, secluded inlets of Killough Bay and Ardglass Harbour which supports an important commercial fishing centre. There are many shipwrecks submerged in shallow water and a scattering of archaeological remains along the coast. There are sheltered fishing harbours at Killough and Ardglass and the open coast road is separated from the sea by a narrow section of open farmland with patches of gorse and stone walls.
18	Dundrum Bay	Dundrum Bay is the largest natural bay in NI and its sweeping formation provides a contained and sheltered setting for the busy coastal resort of Newcastle, which hosts a range of popular visitor attractions. A huge swath of sandy beach, popular for recreation, is backed by the extensive Murlough dunes. The dune system, dating back 6000 years, has an unusually intact and extensive transition including sand dunes, yellow and grey dunes, dune grassland, heath and scrub. Intertidal mudflats in Inner Dundrum Bay and sublittoral sands in Dundrum Bay are important for wintering birds. Dundrum derives its name from its Norman Castle, in Irish Dún Droma, meaning "fort of the ridge" which is located just outside the SCA boundary. The imposing outline of the Mourne Mountains is integral to the contained and instantly recognisable setting of the bay, particularly when viewed from the sea.
19	Mourne Coast	With an imposing and dramatic backdrop of the Mourne Mountains, the SCA has a prevailing open, exposed and windswept appearance with panoramic views of the extensive Irish Sea. The low-lying coast

No.	Seascape Character Area	Key Characteristics*
		bulges out into the sea and is exposed to the east and south-east to high energy waves. A series of rock platforms alternate with sand beaches with greywacke rock outcrops and gravel beaches further north. Maritime cliffs and slopes and coastal vegetated shingles occur at the northern end of the SCA. Kilkeel is an important commercial fishing centre and there are a large number of shipwrecks scattered across the seabed.
20	Carlingford Lough	Carlingford Lough is a shallow and relatively broad sea lough sheltered from the rough waters of the Irish Sea and is particularly noted for its glacial fjord or sea inlet form. The surrounding summits of the stunning Mourne and Cooley Mountains, with large areas of wooded slopes, are integral features to its contained setting. It is a particularly dynamic and busy seascape with a diversity of land and sea uses and busy shipping lanes leading out to sea. The Newry River and the Newry Canal link the Lough to the nearby city of Newry. There is an extensive shellfish culture, and the Lough is also a very popular visitor attraction, offering a wide range of recreational activities. There are extensive mudflats and areas of saltmarsh supporting large numbers of wintering water birds.
21	Newry Estuary	With a long association of maritime trade, the SCA is centred on the narrow lower reaches of the Newry River set within a dramatic, steep-sided narrow valley. Running alongside the river, the Newry Canal links the Lough to the nearby city of Newry. The gently meandering river is flanked by a series of historic navigational features with channel markers along its length. Newry Canal, with its impressive archaeological features including pump houses, quays, locks and lock houses, contribute to a strong sense of place. The seclusion of the wooded valley sides contrasts with areas of busy large-scale land use of port infrastructure, industrial and commercial development.
22	Atlantic	The Atlantic SCA adjoins the outer marine extents of several SCAs located along the north coast. It includes extensive areas of often rough open sea with turbulent tides, difficult to navigate. Sea depth is generally up to 100m and to the north of Rathlin Island, the seabed drops steeply away to over 200m. At this distance, features along the north coast are difficult to distinguish but the formations of vertical cliffs and moorland hills above Ballycastle, form an important skyline to the expanse of open sea. The outline of Rathlin Island is a distinctive feature and in close proximity, the rugged cliffs and seabird colonies

No.	Seascape Character Area	Key Characteristics*
		become apparent. To the south-west, there are views of the outline of the hills of Inishowen and distant views of the Kintyre Peninsula, Islay and Jura to the east.
23	North Channel	With relatively busy commercial shipping lanes, the deep North Channel SCA adjoins the outer marine extents of several SCAs located along the north-east coast. It extends from the eastern side of Rathlin Island, past the entrance of Belfast Lough, where it meets the Irish Sea (South Down) SCA. Formed above the deep circalittoral zone, sea depth extends to approximately 200m along the outer reaches, becoming shallower towards the coast. Habitats are diverse and are likely to mainly consist of deep circalittoral sediment and sand, faunal communities on circalittoral rock and deep circalittoral mixed sediments. Along the northern part of the SCA, the outline of the Moyle Glens and basalt escarpments, backed by rolling moorland summits and the Garron plateau, form a distinctive skyline. Further south, the low-lying coastline is difficult to distinguish. To the north-east, there are distant views of the Kintyre Peninsula, Ailsa Craig, Arran and the Rhins of Galloway
24	Irish Sea (South Down)	The Irish Sea (South Down) SCA is located off the south-east coast and adjoins the outer marine extents of several SCAs located along the coast. Formed above the deep circalittoral zone, sea depth extends to approximately 200m along the outer northern boundary, becoming progressively shallower to the south and towards the coast where depth is up to approximately 50m. Habitats are predominantly deep circalittoral mud with smaller areas of deep circalittoral sand, faunal communities on circalittoral rock, with deep circalittoral course and mixed sediments to the north of the SCA. At this distance, features along the low-lying coastline would be hardly discernible although the dramatic outline of the Mourne Mountains and the Cooley Mountains form a distinctive skyline. To the east, there are distant views of the Rhins of Galloway, the Isle of Man and the north-west coast of England beyond. The SCA is notable for its important prawn grounds.

*As described in the NIRSCA

Coastal Character Assessment[168] and Landscape Character Assessment[169] have also been undertaken for Scotland. Thirteen National Coastal Character Types have been identified at a very broad scale:

- Type 1 - Remote High Cliffs;
- Type 2 - Rocky Coastline / Open Sea Views;
- Type 3 - Deposition Coastline, Open Views;
- Type 4 - Outer Firths;
- Type 5 - Developed Inner Firths;
- Type 6 - Narrow Coastal Shelf;
- Type 7 - Kyles and Sea Lochs;
- Type 8 – Enclosed Bays, Islands and Headlands;
- Type 9 – Sounds, Narrows and Islands;
- Type 10 – Outer Firth with Islands;
- Type 11 – Less Developed Inner Firths; and
- Type 12 – Low Rocky Island Coasts.

National Scenic Areas (NSAs) are those areas in Scotland designated for their outstanding scenery, and broadly comparable to AONB designations. In total, there are 40 NSAs covering 13% of the land cover.

3.2.9.2.1 Visibility and Sensitivity to Offshore Renewables

The draft UK Offshore Energy SEA (OSEA4) for the future leasing/licencing for offshore renewable energy offshore oil and gas and gas storage and associated infrastructure [170] determined that an assessment of the likely impacts of offshore energy activity on the seascape/landscape of UK waters and coastlines should have three principal considerations:

- The limit of visual perception from the coast (i.e., are the devices or installations visible, and what influences their visibility).
- The individual characteristics of the coast, which affect its capacity to contain a given development.
- How people perceive and interact with the seascape, and what changes in character may be introduced by certain developments, including in a non-visual way.

UK guidance on the landscape/seascape and visual effects of offshore wind farms recommends that a study area of a 50km radius is considered for wind turbines of height 150m to blade tip and above[171].

[168] NatureScot. 2023. Coastal Character Assessment. Available at: https://www.nature.scot/professional-advice/landscape/coastal-character-assessment

[169] NatureScot. 2023. Scottish Landscape Character Types Map and Descriptions. Available at: https://www.nature.scot/professional-advice/landscape/landscape-character-assessment/scottish-landscape-character-types-map-and-descriptions

[170] Department for Business, Energy, and Industrial Strategy. 2022. UK Offshore Energy Strategic Environmental Assessment (OESEA4). Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1061670/OESEA4_Environmental_Report.pdf

[171] Scottish Natural Heritage. 2017. Visual Representation of Wind Farms Guidance. Available at: https://www.nature.scot/sites/default/files/2019-09/Guidance%20-%20Visual%20representation%20of%20wind%20farms%20-%20Feb%202017.pdf

NI was excluded from TCE Offshore Wind Leasing Round 4, primarily due to potential landscape/seascape effects[172], with 'Visibility from sensitive receptors' given a red rating as a 'Significant/insurmountable issue that would be challenging to mitigate within the area of influence of a receptor'. This visual assessment was based on bands of significant visual impacts from medium and high sensitivity receptors (National Parks, AONBs, Heritage Coasts and WHSs) as established in the UK's Offshore Energy Strategic Environmental Assessment (OSEA3), which determined that 99% of the potential area for offshore wind in the region was within 13km of the coast and that visual impacts would therefore be a significant issue. The draft OSEA4 does not include consideration of the territorial and offshore waters of NI for the leasing of offshore renewable energy.

In NI, local planning authorities are responsible for controlling development in an AONB; they have a duty to ensure that any proposed development in the AONB is in line with the statutory purpose of conserving and enhancing the natural beauty of the area and will often have policies or guidelines in place that are specific to the AONB. Onshore wind farms have been developed within AONBs, and further planning applications have been put forward within these areas; however there has been significant opposition in some cases relating to the landscape sensitivity and potential adverse impacts on visual amenity and landscape character. In terms of potential landscape and visual impacts, DAERA usually only provides advice on the impacts of wind energy developments located within the boundary of the Giant's Causeway WHS or its landscape setting, or for major or regionally significant wind farm development proposals located within the boundary of an AONB[173].

3.2.9.3 Summary of Existing Pressures and Issues for Landscape/Seascape and Visual Amenity

Around 20% of the total land area of NI is designated as within an AONB, and a significant length of the coastline of the region is designated for its landscape value. In particular, the Antrim Coast and Glens AONB overlaps much of the north-east coast, while together the Strangford Lough and Mourne AONBs cover much of the south-east coastline. Landscape and seascape character types have been defined that can provide information on which to base plans at a more local level that might affect landscape/seascape character.

Implementation of the OREAP, and the construction, maintenance and decommissioning activities associated with the potential offshore renewable energy projects that may arise as a result, has the potential to lead to temporary (during construction), to permanent effects on visual amenity and/or seascape character (operation of renewable devices at sea), including in some areas the potential for transboundary effects in the RoI or Scotland.

3.2.9.4 Evolution of the baseline in the absence of the plan

In the long-term, the coastal landscape and seascape of NI is likely to be changed by human development, coastal processes, and climate change. These landscapes and seascapes will be altered by coastal processes such as coastal erosion and accretion. These processes are likely to be exacerbated by climate change, such as increased erosion of more vulnerable coastlines, with an identified risk of coastal erosion along 19.5% of the NI coastline[174], as well as sea level rise and increased storminess. A predicted continuing increase in the population is likely to drive further pressure for development, including within coastal areas and sensitive, designated, or valued landscapes.

[172] The Crown Estate (TCE). 2019. Offshore Wind Leasing Round 4 Regions Refinement Report. Available at: https://www.thecrownestate.co.uk/media/3330/tce-r4-regions-refinement-report.pdf

[173] DAERA NI. n.d. Wind energy installations. Available at: https://www.daera-ni.gov.uk/articles/wind-energy-installations

[174] Climate Northern Ireland. 2021. Evidence for the third UK Climate Change Risk Assessment (CCRA3) - Summary for Northern Ireland. Available at: https://www.ukclimaterisk.org/wp-content/uploads/2021/06/CCRA-Evidence-Report-Northern-Ireland-Summary-Final.pdf

4 REVIEW OF RELEVANT PLANS, PROGRAMMES AND POLICIES

4.1 Interaction with other relevant Plans and Programmes

As part of the SEA process, the context of the OREAP must be established with regard to other Plans and Programmes that have been adopted at International, National and Regional levels. In particular, the environmental protection objectives (EPOs) and standards included within these Plans and Programmes that will directly influence, or be influenced by, the OREAP requires consideration. These EPOs have been used to create the Strategic Environmental Objectives (SEOs) that have been used for assessment of the OREAP.

Table 4-1 identifies the main significant environmental plans, programmes and legislation, adopted at International/European level, National/Regional level or Sub-Regional level, which would be expected to influence, or be influenced by, the OREAP. While it is recognised that there are many Plans, Programmes and legislation that could relate to the OREAP it is considered appropriate to only deal with those significant texts in order keep the assessment at a strategic level. More information on these Plans, Programmes and legislation, along with their potential interaction with the OREAP is given in **Appendix B**.

The OREAP is intrinsically linked to the Energy Strategy for NI and the Energy Strategy Action Plan, as discussed previously. Significantly, the OREAP will operate within a new marine planning system for NI, underpinned by the draft Marine Plan for NI 2018[175], the NI Marine Act 2013, the UK Marine Policy Statement 2011, and the Marine and Coastal Access Act (MCAA) 2009. The draft Marine Plan will inform and guide the regulation, management, use, and protection of the NI marine area, and the MCCA and Marine Act require that public authorities, in taking authorisation or enforcement decisions that might affect the marine area, must do so in accordance with the draft Marine Plan. Core policies of the draft Marine Plan relate to Stakeholder engagement, Air Quality, Climate Change, Coastal Processes, Co-Existence, Cumulative Impacts, Heritage Assets, Invasive Alien Species, Land and Sea Interaction, Marine Litter, Marine Noise, Natural Heritage, Seascape, Use of Evidence, and Water Quality. Objective 2 (of 8 objectives set out in the draft Marine Plan) is 'to help realise the potential of energy resources and energy storage within the marine area, while fully considering the requirements of other marine interests'. The following renewable energy policy is of direct relevance to the OREAP:

"There is a presumption in favour of energy proposals that improve the security and diversity of energy supply, where it can be demonstrated:

a) there will be no unacceptable adverse impact throughout the lifetime of the proposal on marine activities, uses and/or the marine area and any potential adverse impact is, in order of preference, avoided, minimised and/or mitigated; and

b) restoration/decommissioning measures have been agreed, where necessary"

When assessing energy proposals, public authorities must consider the contribution that the proposal would make to the security and diversity of energy supply in NI and the wider economy and society. Public authorities should only authorise a proposal if they are satisfied that it will not have any unacceptable adverse impacts on the marine area, its ecosystem services, and other marine users; and that the decision is consistent with requirements under UK and EU legislation and the UK's obligations under international law.

[175] DAERA NI. 2022. Marine Plan for Northern Ireland. Available at: https://www.daera-ni.gov.uk/articles/marine-plan-northern-ireland

Table 4-1 Summary of Key Plans, Programmes and Legislation Relevant to the OREAP

Level	Plan/Programme/Policy/Legislation
International/EU Level	*Biodiversity* • UN Convention on Biological Diversity (1992) • Kunming-Montreal Global Biodiversity Framework (GBF) • Ramsar Convention on Wetlands of International Importance (1971 and amendments) • Bern Convention (Convention on European Wildlife and Natural Habitats) (1982) • The Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR) (1992) • Bonn Convention (Convention on the Conservation of Migratory Species of Wild Animals) (1983) • EU Biodiversity Strategy to 2030 • EU Birds Directive (Directive on the conservation of wild birds) [2009/147/EC] • EU Habitats Directive (Directive on the conservation of natural habitats and of wild fauna and flora) [92/43/EEC] • Convention for the Conservation of Salmon in the North Atlantic • EU Common Fisheries Policy *Climate Change* • Paris Agreement (UNFCCC, 2015) • UN Kyoto Protocol, The United Nations Framework Convention on Climate Change (UNFCC, 1997) • EU 20-20-20 Climate and Energy Package Agreement (2007) • The European Green Deal 2019 • Renewable Energy Directive [2009/28/EC] and revision [Directive EU/2018/2001] • EU Strategy on Adaptation to Climate Change 2013 • Forging a climate-resilient Europe – the new EU Strategy on Adaptation to Climate Change 2021[COM(2021)82] • Second European Climate Change Programme (ECCP II) 2005 • EU Green Infrastructure Strategy (COM(2013) 249 final) *Air quality* • Stockholm Convention (2004) • WHO Air Quality Guidelines – global update (2005) • The Gothenburg Protocol (1999) • Ambient Air Quality and Cleaner Air for Europe (CAFE) Directive [2008/50/EC] and 4th Daughter Directive of the Air Quality Framework Directive [2004/107/EC] • Industrial Emissions Directive [2010/75/EU] • National Emissions reduction Commitments (NEC) Directive [2016/2284/EU] • Geneva Convention (1979) *Sustainable Development and Energy* • Eight Environmental Action Programme (2021-2030) of the European Community • EUROPE 2020 A strategy for smart, sustainable and inclusive growth (COM/2010/2020) • Roadmap to a Resource Efficient Europe (COM(2011) 571) • SEA Directive [2001/42/EC] • UN Convention on Environmental Impact Assessment (ESPOO Convention) and Kyiv (SEA) Protocol • EIA Directive [85/337/EEC] [2014/52/EU] • Energy Efficiency Directive [2012/27/EU] • UN 2030 Agenda for Sustainable Development *Water* • The MARPOL Convention (preventing pollution from shipping) • UNCLOS (United Nations Convention on the Law of the Sea) 1982

Level	Plan/Programme/Policy/Legislation
	• European Integrated Maritime Policy 2007 • Water Framework Directive [2000/60/EC] and amendments • Marine Strategy Framework Directive [2008/56/EC] • Floods Directive [2007/60/EC] • Bathing Water Directive [2006/7/EC] • Environmental Quality Standards Directive [2008/105/EC] (also known as the Priority Substances Directive), as amended by Directive 2013/39/EU. • Environmental Liability Directive [2004/35/EC] *Waste* • Waste Electrical and Electronic Equipment Directive [2002/96/EC], as recast by [201219/EU] • Waste Framework Directive [2008/98/EC] *Cultural Heritage* • Valetta Treaty (1992) • Granada Treaty (1985) • World Heritage Convention [WHC-2005/WS/02] *Landscape* • European Landscape Convention [ETS No. 176]
National/Regional Level	*Biodiversity* • Biodiversity Strategy for NI to 2020 • UK Post-2020 Biodiversity Framework • Conservation (Natural Habitats, etc.) Regulations (NI) 1995 • The Wildlife (NI) Order 1985 • Wildlife and Natural Environment Act (NI) 2011 • The Environment (NI) Order 2002 • DAERA Conservation Management Plans for SACs (in prep.) • UK National Ecosystem Assessment (2011) • NI Species and Habitat Action Plans • Marine Protected Areas (Prohibited Methods of Fishing) Regulations (NI) 2022 • The Scallop Enhancement Sites (Prohibited Methods of Fishing) Regulations (NI) 2022 • UK Fisheries Act 2020 • NI Blue Carbon Action Plan (draft for public consultation) • Review of the MPA Strategy for the NI Inshore Area 2024-2030 (draft for public consultation) • Draft MPA Management Plans • NI Seabird Conservation Strategy (in preparation) • NI Elasmobranch Strategy (in preparation) • (ROI) National Biodiversity Action Plan 2017-2022 and Ireland's 4th National Biodiversity Action Plan (draft, 2022) *Climate Change/Air Quality* • NI's second Climate Change Adaptation Programme (NICCAP2) 2019 – 2024 • UK Climate Change Act 2008 • Change Act 2008 (2050 Target Amendment) Order 2019 • Climate Change (NI) Act 2022 • UK Climate Change Risk Assessment 2022 • (RoI) National Adaptation Framework 2018 • (RoI) Climate Action Plan 2023 • The National Emissions Ceiling Regulations 2018 • UK National Air Pollution Control Programme (NAPCP) 2023 • The Environment Act 2021 and The Environment (2021 Act) (Commencement and Saving Provision) Order (NI) 2022

Level	Plan/Programme/Policy/Legislation
	• Air Quality Strategy for England, Scotland, Wales and NI 2007 (due to be amended May 2023) • Air Quality Standards Regulations (NI) 2010 • Clean Air Strategy for NI – A Public Discussion Document, 2020 *Sustainable Development and Energy* • NI Energy Strategy – the Path to Net Zero (2021) • Energy Strategy for NI – the Path to Net Zero Energy. Action Plan (2022). • Energy Strategy Action Plan 2023 • Electricity (NI) Order 1992 (Article 39) • Food and Environment Protection Act 1985 • Environmental Assessment of Plans and Programmes Regulations (NI) 2004 • (RoI) European Communities (Environmental Assessment of Certain Plans and Programmes) Regulations 2004, as amended • (Scotland) Environmental Assessment (Scotland) Act 2005 • (England) The Environmental Assessment of Plans and Programmes Regulations 2004 • (Wales) Environmental Assessment of Plans and Programmes (Wales) Regulations 2004 • (RoI) Offshore Renewable Energy Development Plan (OREDP) 2014, and draft OREDP II • UK Offshore Energy Plan and SEA 3 (OESEA3). Department of Energy and Climate Change 2016 • Offshore Wind Leasing Round 4 (Regions Refinement Report). The Crown Estate 2019 • Broad Horizons: Key Resource areas for offshore wind. Everoze Report, commissioned by The Crown Estate 2020 • Draft Marine Plan for NI 2018 • Marine Act (NI) 2013 • Marine and Coastal Access Act 2009 • UK Marine Policy Statement 2011 • Integrated Coastal Zone Management Strategy for NI 2006-2026 • (Scotland) National Marine Plan 2015 • (Scotland) Marine (Scotland) Act 2010 • (Scotland) ScotWind Offshore Wind Leasing Round (The Crown Estate) • (RoI) National Marine Planning Framework • (RoI) The Maritime Area Planning Act 2021 (all-encompassing Act that covers both on-shore and off-shore planning) • The Planning (Environmental Impact Assessment) Regulations (NI) 2017 • Draft Transmission Development Plan for NI 2023-2032 • (ROI) Grid Implementation Plan 2017-2022 for the Electricity Transmission System in Ireland • Air defence and offshore wind – working together towards Net Zero 2021 • NI Executive Programme for Government 2016-2021 • Programme for Government Draft Outcomes Framework 2021 • Strategic Planning Policy Statement for NI 2015 • Planning Policy Statements 1 – 23 • The Regional Development Strategy 2035 – Shaping Our Future • (RoI) National Planning Framework (Project Ireland 2040) • UK Sustainable Development Strategy • 10X Economy – An Economic Vision for a Decade of Innovation 2021 • Draft Environment Strategy for NI 2019 • Draft Green Growth Strategy for NI – Balancing our Climate, Environment and Economy 2021

Level	Plan/Programme/Policy/Legislation
	Water • The Marine Strategy Regulations 2010 • The Water Environment (Water Framework Directive) Regulations (NI) 2017 • Draft 3rd cycle River Basin Management Plan (RBMP) for NI 2021-2027 • (RoI) Draft River Basin Management Plan for Ireland 2022- 2027 • Water Framework Directive (Classification, Priority Substances and Shellfish Waters) Regulations (NI) 2015 • The Quality of Bathing Water Regulations (NI) 2008 • Water Environment (Floods Directive) (Amendment) Regulations (NI) 2018 • NI Flood Risk Management Plan, 2021-2027 • Environmental Liability (Prevention and Remediation) Regulations 2009 and amendment • Pollution Control and Local Government (NI) Order 1978 *Waste* • NI Waste Management Strategy, 2012 (new Strategy under development 2023) • Draft Waste Management Plan for NI 2019 *Cultural Heritage* • Archaeology 2030 – A Strategic Approach for NI • Historic Monuments and Archaeological Objects (NI) Order 1995 • Planning Act (NI) 2011 • The Regional Development Strategy 2035 – RG11 • The Protection of Wrecks Act 1973 • The Protection of Military Remains Act 1986 • (RoI) National Monuments (Amendment) Act 1987 *Landscape* • Nature conservation and Amenity Lands Order (NI) 1985 • (ROI) National Landscape Strategy for Ireland 2015-2025
Sub-Regional Level	• Local Biodiversity Action Plans (LBAPs) • Local Development Plans / Draft Plan Strategies

5 REVIEW OF OFFSHORE RENEWABLE ENERGY TECHNOLOGY TYPES

5.1 Introduction

A variety of devices can be used to extract and convert the different offshore energy sources, wind, tidal energy, and wave energy into electrical energy. These offshore energy forms can have several different types of ORE devices installed to generate electrical energy. These devices have various factors influencing their suitability for use, including constraints on their location, required installation and maintenance processes, environmental interactions, and the size and energy density of the device arrays.

Section 5.2 discusses each renewable energy source in terms of the various device types which can be used to harness offshore energy, the device characteristics, and the factors influencing the siting of these devices. This review was based on the information provided in EIA reports for renewable energy projects in UK waters, considering those listed on the following websites that were past the early planning stage:

- Offshore wind projects: https://map.4coffshore.com/offshorewind/;
- Offshore wave and tidal projects: https://www.renewableuk.com/page/UKMED2.

The information on device types and characteristics provided in the following reports was also reviewed and considered:

- SEA for the first iteration of the NI ORESAP;
- UK Offshore Energy Strategic Environmental Assessment 3 (OSEA3);
- UK Offshore Energy Strategic Environmental Assessment 4 (OSEA4);
- Scottish Draft Sectoral Marine Plan for Offshore Wind Energy SEA (2019);
- Planning Scotland's Seas: SEA of Plans for Wind, Wave and Tidal Power in Scottish Marine Waters (2013);
- Broad Horizons: Key resource areas for offshore wind (Everoze report, commissioned by TCE, 2020).

This information provides background information on potential ORE devices and their application. Evaluation of the potential effects that these offshore energy types may pose to the environment in NI waters within the OREAP and this SEA Environmental Report is technology neutral, i.e., the size of turbine or individual array is not predefined; rather, it examines the types of interactions that these devices may have with the environment and the potential effects of these interactions.

5.2 Device Types

This section describes the characteristics of ORE devices and their typical installation. The schematic in **Figure 5-1** illustrates some examples of fixed wind and floating wind ORE devices and their attachment to the seabed.

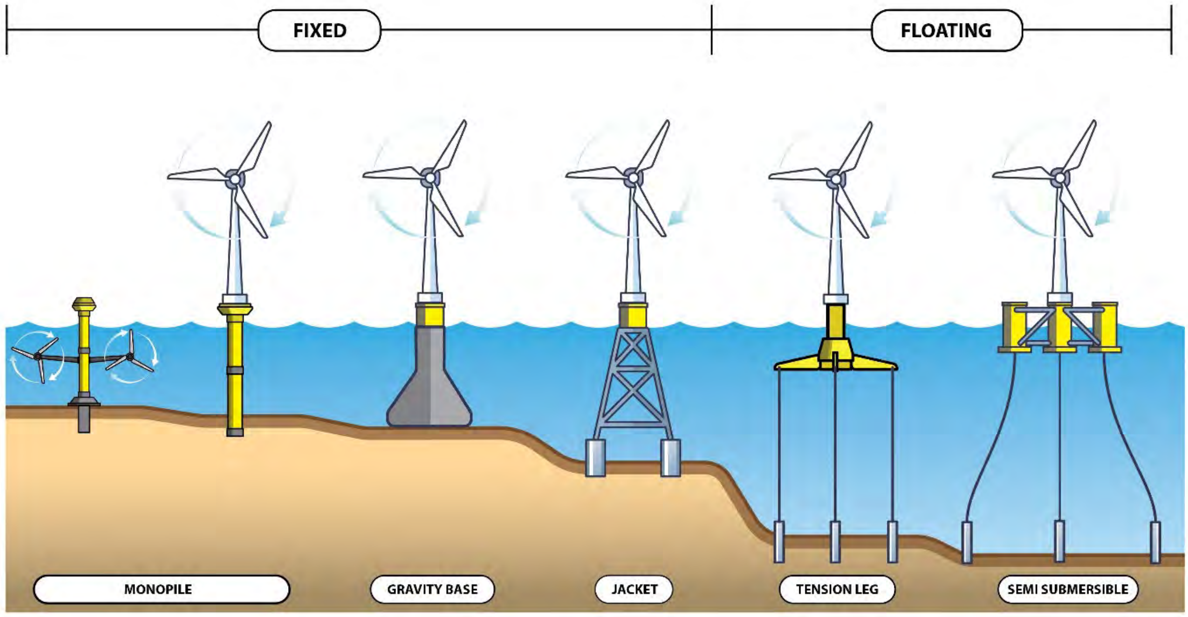

Figure 5-1 Schematic of ORE devices and attachment to the seabed

5.2.1 Offshore Wind Energy

Offshore wind energy takes advantage of the wind forces that are produced on the high seas, where the wind speed is relatively constant through the lack of topographic barriers. Offshore wind energy can be variable in its occurrence and magnitude depending on the geographic location and governing meteorological and climatological conditions. Electricity is generated through wind turbines that are usually within wind farm arrays.

With developing technologies, the proportion of the seabed where it is possible to build wind farms is increasing significantly; according to Everoze (2020), 'turbines will continue to get larger, fixed foundation designs and installation methods will improve, and floating substructures (currently in the demonstration phase) will become a commercial reality'. The same turbine technology platforms are likely to be used for fixed foundation and floating wind.

5.2.1.1 Bottom-Fixed Offshore Wind

Bottom-fixed wind turbines are composed of a support tower and rotor blade installed onto a fixed foundation structure (**Figure 5-2**). Fixed offshore wind turbines occupy the entire water column; the horizontal extent occupied in the atmosphere depends on the rotor blade diameter, which is the only moving part in contact with air, with no moving parts in contact with water.

Commercial scale fixed offshore wind farms are commonly composed of horizontal axis wind turbines (HAWT), usually generating more than 8MW of energy; 12MW turbines have become commercially available since 2020 (Everoze, 2020[176]). Typically, these turbines have an overall height of 80-120m, comprising a typical tower height of 60-80m, and a blade length of approximately 40m; however, some devices can now exceed a total height of 200m, and rotor diameter can be over 100m. Fixed wind devices can be located in water depths up to 70m. They are usually sited between 20-30km offshore, however, can potentially be sited up to 100km from shore.

Continual advancements in turbine design have led to increasing energy outputs. The generation of power is dependent on the wind speed. The British Wind Energy Association (now Renewable UK) states that turbine operation begins with wind speeds of 4-5m/s, with maximum power output at around

[176] Everoze. 2020. Broad Horizons: Key Resource Areas for Offshore Wind Summary Report. The Crown Estate (TCE). Available at: https://www.thecrownestate.co.uk/media/3642/broad-horizons-offshore-wind-key-resource-area-summary-report.pdf

15m/s (design point-optimum wind speed for maximum efficiency), the devices are shut down with very high wind speeds (25m/s) to prevent damage. Generally, device array sizes which are larger in area are more efficient for energy generation. Adequate spacing between turbines is required (typically a 1km distance between individual 5MW turbines, however spacing between turbine rows can be lower c.500-700m). A device array of 100 turbines will typically cover an area of 50km^2 but, depending on device numbers, the arrays could vary in size from 5-250km^2. The main components of a fixed-bottom offshore wind energy development are shown in **Figure 5-2**.

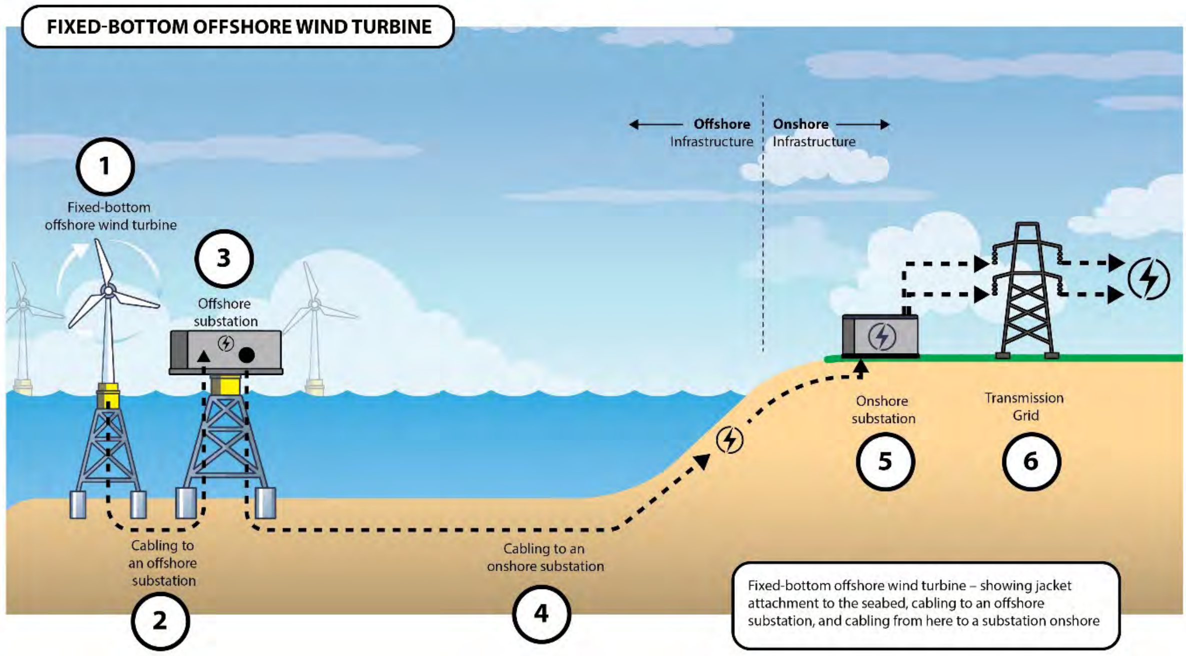

Figure 5-2 Main offshore and onshore components of fixed bottom offshore wind turbines.

The specific installation methods used will depend largely on the seabed type and water depths, but usually involve the use of monopile structures (c.4m long, steel tubes that are hammered, drilled, or vibrated into the seabed to around 20m depth - the piling depth can be variable depending on the overall turbine size) for water depths of 10-45m, with the platform and tower installation above, or jacket foundations (multi-legged platforms of steel which are anchored to the seabed via pile foundations before the turbine rests above) for water depths of 45-70m. Other installation methods can include gravity foundations consisting of large concrete structures, which settle and become stabilised by sand or water before the turbine tower is fitted above. Recent development methods for installation on previously difficult sediment substrates include the use of ‘suction caissons’ for water depths of 20-70m, whereby pumps draw hollows into the seabed of sandy sediment; this technique reduces installation cost and associated noise. Examples of the main foundation methods for fixed-bottom wind turbines are shown in **Figure 5-3**.

The timescale for installation is highly variable, depending on the complexity and number of devices involved. The amount of maintenance required by the devices depends on the complexity of the installation method. The internal turbine components require maintenance, and the external parts will undergo corrosion, which requires monitoring. Typically, scheduled maintenance occurs annually for approximately two weeks, however, unexpected faults and shutdowns may occur requiring additional work. Device decommissioning can also be complex and typically the removal of foundations is most problematic; piled structures may be cut at the sea-bed level and left in situ.

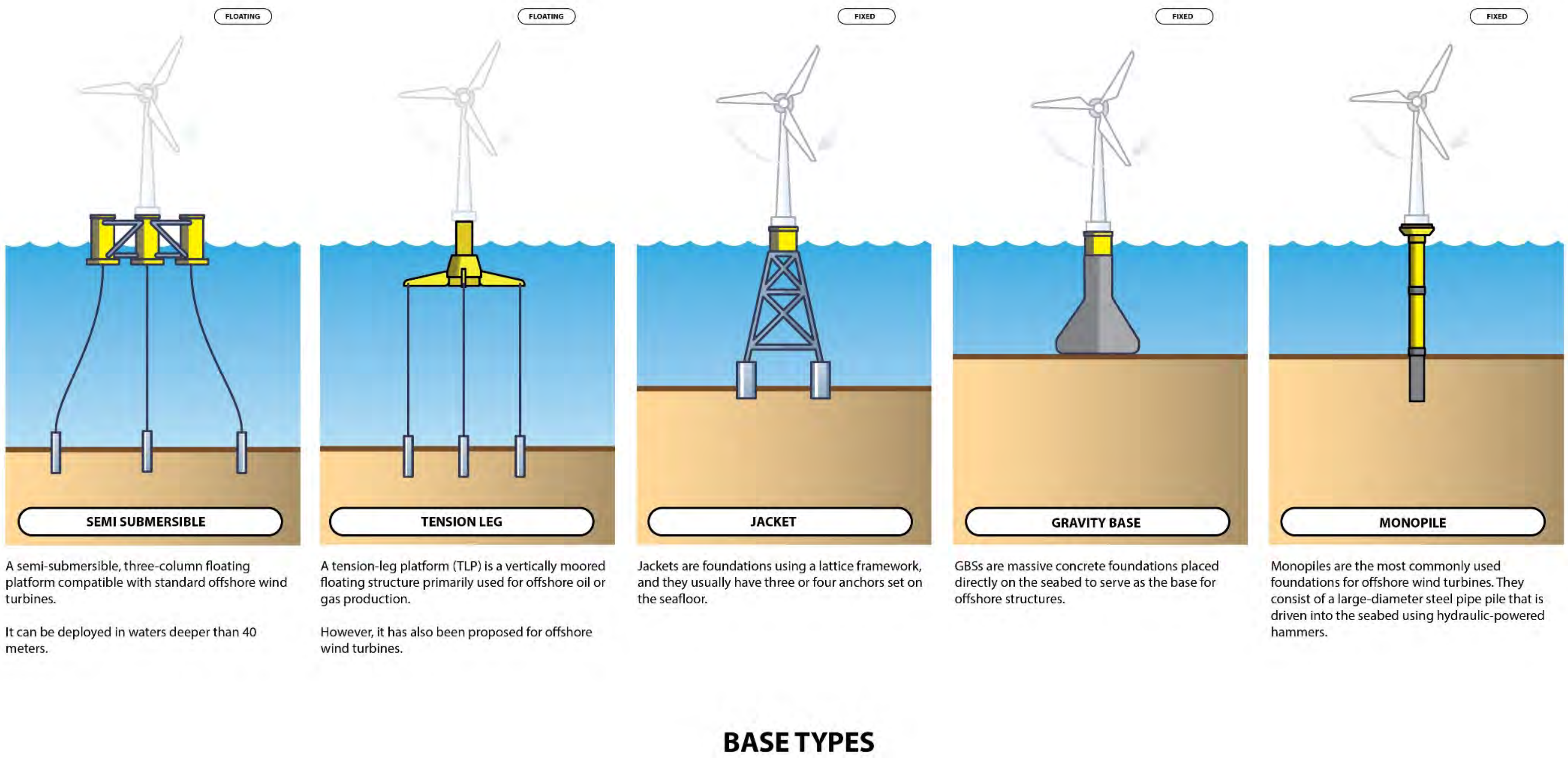

Figure 5-3 Typical base types for fixed and floating offshore wind turbines

5.2.1.2 Floating Offshore Wind

Floating wind turbines are wind turbines situated offshore that are mounted on a floating structure; this enables the use of wind turbines in deeper waters that may not be technically or economically feasible for fixed-bottom turbine devices. The main components of a floating offshore wind energy development are shown in **Figure 5-4**.

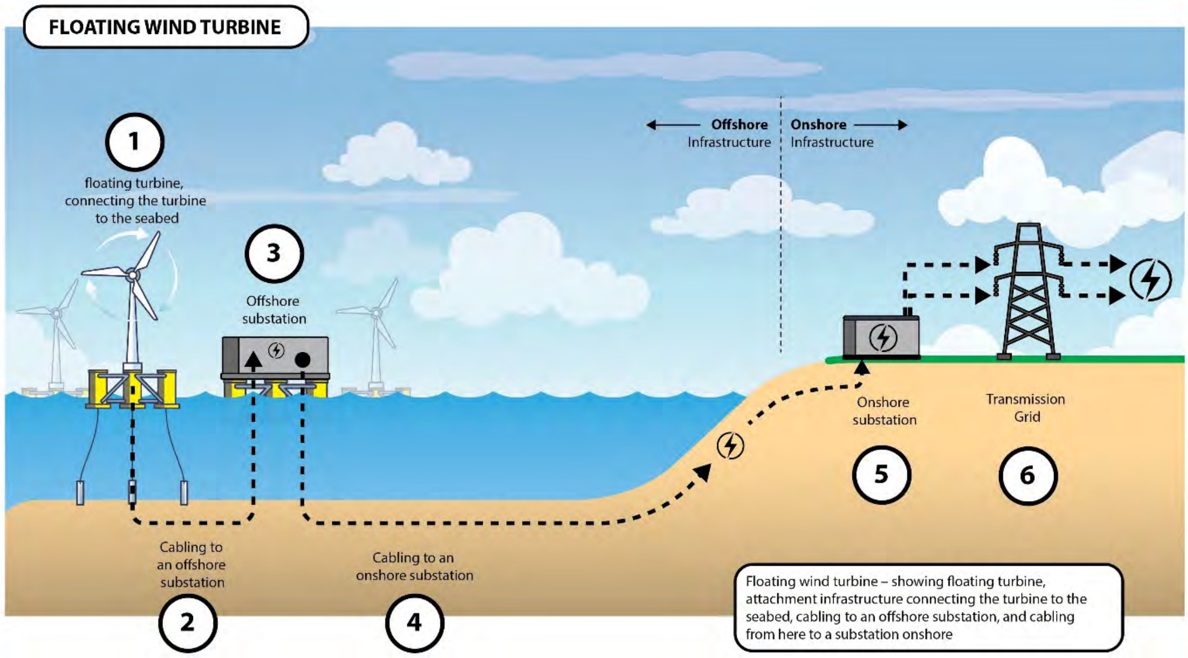

Figure 5-4 Main offshore and onshore components of floating offshore wind turbines

Floating wind turbine devices are a relatively new device type, currently still in the early stages of development. The structures can be classified into three types: Spar-buoy, Semi-submersible and Tension Leg Platform, with Semi-submersibles being the most advanced technology currently available. These allow device installation to deeper waters (proposed up to 1,000m with Semi-submersibles; the current practical limit is around 250m, although current scoping assessments have considered depths of up to 800m). They have potential to reduce the amount of water column occupied by the turbine structure, increase the seabed areas available for offshore energy generation, and reduce adverse visual effects through their installation further offshore. The devices consist of similar turbine characteristics to Fixed Wind devices**.** The devices are typically installed on moored buoy platforms and can adapt to different seabed types and depths. Prototype installation methods include ballast stabilised, mooring line stabilised, and buoyancy stabilised approaches; the main issue regarding their installation and operation relates to stabilisation, particularly in deeper, rougher waters. Complex anchoring systems (tension leg and catenary loose mooring systems) have also been developed to provide restorative moments during wave pitch and roll-induced periods for rougher wave conditions. New installation methods for these devices are forecasted to use suction or socketed piles[177] (Everoze, 2020). Examples of the main foundation methods for floating wind turbines are shown in **Figure 5-3**.

The degree of impact that these devices may have on the seabed in terms of geomorphology and sediment is dependent on the installation method used. With new developments in installation techniques, increased research on the potential impacts of these will be needed. These particular devices are currently assessed as being more economically viable compared to fixed wind devices (despite higher installation costs) as they can access deeper waters and stronger, more reliable wind

[177] Everoze. 2020. Broad Horizons: Key Resource Areas for Offshore Wind Summary Report. The Crown Estate (TCE). Available at: https://www.thecrownestate.co.uk/media/3642/broad-horizons-offshore-wind-key-resource-area-summary-report.pdff

energy sources. However, the associated maintenance of these devices may be more challenging compared to fixed wind given their more remote locations and the potential for rougher sea conditions restricting access. However, new developments in large capacity site-operated vehicles (SOVs) will help facilitate access to turbines in all weather conditions.

5.2.2 Tidal Energy

Tidal energy provides a regular and predictable source, which is advantageous over wind and wave resources. Typically, an average current speed across the tidal cycle of >1.5m/s is needed for viable energy generation with a general limit in water depth of between 20-100m. Areas of high elevation and strong tidal flows are often located in bathymetric constrictions, which are often located close to land and in areas of a quieter wind and wave climate, providing advantages when considering electric grid connection and device maintenance. There are a wide variety of generic tidal devices available to harness energy, such as such as horizontal axis turbines, vertical axis turbines, venturi effect devices, and hydroplanes and oscillating hydrofoils; these use a range of attachment methods to the seabed, including gravity bases, moored tethered foundations and piled foundations. Typically, the number of devices installed in tidal energy developments is limited to 1-10, however new consenting projects are aiming for much higher numbers e.g., West Islay Tidal Energy Farm of 390 devices to generate 400MW via a tidal stream. The main components of a tidal stream development are shown in **Figure 5-5**.

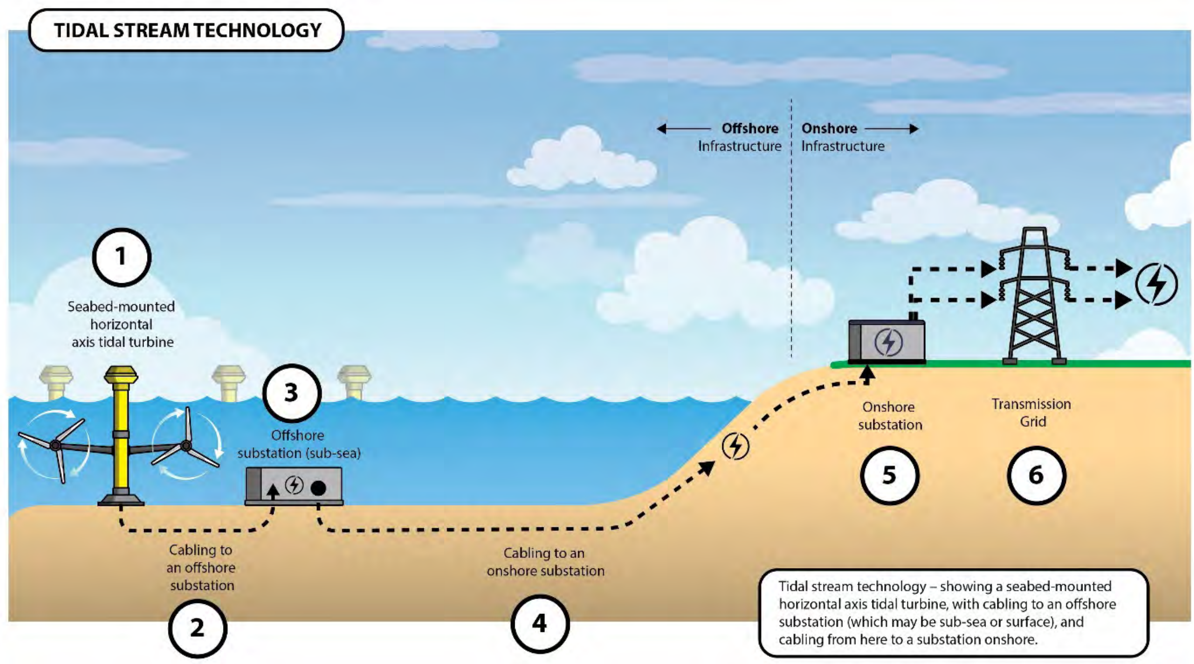

Figure 5-5 Main offshore and onshore components of tidal stream energy development

5.2.2.1 Horizontal Axis Turbines

These devices operate similarly to HAWT; however, they are exposed to much larger forces and moments (turning effects on turbine) than HAWT given the increased density of water (800 times greater) compared to air. Horizontal Axis Tidal Turbines (HATT) are therefore typically smaller in diameter with differently designed blades of shorter lengths e.g., 10-30m. Device dimensions may vary but are smaller than HAWT e.g., dimensions of 20m by 50m. Some devices may be shrouded to increase their energy generation efficiency through flow acceleration via constriction. The devices can generate up to 10MW of energy, providing a predictable energy source. They reach their maximum efficiency with current speeds of 2-3m/s, but can operate at up to 5-6m/s.

The installation of these devices typically relies on monopiling (to a seabed depth of 20m with 4m diameter steel piles) or gravity structures, but the installation technique used is dependent on the seabed type and water depth and may use anchors or clump weights (pre-fabricated steel blocks or baskets). Their current installation depth ranges between 10-80m. They will occupy the entire water column and a portion of the atmosphere if the device has a turbine that allows height changes e.g., SeaGen. In terms of maintenance the devices are typically located close to shore and given their more sheltered location, in-situ maintenance is expected to occur every 2-6 years lasting between 4-6 weeks. The maintenance will generally focus on essential device areas e.g., turbine, gearbox, or generator locations rather than the entire device and require maintenance systems to be able to either access or remove these specific areas. Device decommissioning can be complex and is dependent on the installation methods used. The devices can occupy a horizontal extent of up to $500m^2$ at the level of the turbine itself. The turbines commonly operate at between 20-30 revolutions per minute. The size of device arrays installed will likely depend on the geographic extent of available space. For example, if the SeaGen device installed at Strangford Lough was scaled up to an array of 50-100 devices (requiring 50m spacing perpendicular to flow and 200m along the flow), this would cover an area of $1.1\text{-}2.2km^2$ with a power density of $70MW/km^2$.

5.2.2.2 Vertical Axis Turbines

These devices operate in the same manner as HATT but rely on a vertical axis of rotation and are a less common device type; they can harness energy from tidal flows in any direction. The differences in terms of performance between HATT and Vertical Axis Turbines (VAT) are similar to the difference between HATT and HAWT devices. They are more efficient at harnessing energy from low flows, with greater efficiency and survivability in strong flows. The devices can start blade rotation at 0.3m/s. These devices are installed in water depths of 10-20m and can either occupy the entire water column or only the lower part of the water column. If such devices are bottom mounted, they can be varied in size in proportion to the water depth and tidal flow. Bottom-mounted devices allow deployment in deeper waters and will have fewer constraints on navigation, they may however require surface markers such as buoys or lights if they were to affect navigation. The diameter of these turbines can be variable from approximately 3m to 6m, can be up to 6m in height, and have moving blades in contact with water. The devices can be installed using mostly gravity structures, anchors, or clump weights. The devices may also be moored using chains and wires. The maintenance of these devices is not well documented but may be difficult given the underwater nature of the devices, potentially requiring remotely operated vehicles for access or divers. Device decommissioning can be complex and is dependent on the installation processes used; gravity structures will need reflotation which can involve heavy lifting equipment. The number of VAT devices used can be dependent on tidal flow conditions and the availability of the seabed area, however specific information on the sizes of the devices available is not well documented. Energy outputs from VAT have been found to reach an average power density of $34.7Wm^{-2}$ [178].

5.2.2.3 Venturi Devices

These devices are relatively recent emerging tidal stream technology where a turbine is enclosed in a venturi-shaped shroud or duct (ventuduct). It produces a sub-atmosphere of low pressure behind the turbine due to shrouding constriction. With the shrouded design, there are no moving blades or hinges in contact with water. Shrouding can increase water flow through a turbine. These turbines may have potential to operate at higher efficiencies as the shrouded turbine is not subjected to the Betz limit (a theoretical maximum efficiency for a wind turbine), which increases the volume of flow, with potential of 1.5-4 times more generation. The devices can operate in shallower areas and typically have smaller turbines; however, they must be installed at the correct locations to intercept current flow at the correct angle. The devices can be mounted directly onto the seabed, reducing the area of the water column affected. They cannot deal with flows in multiple directions, only operating in one direction. Prototypes have been developed that can generate 1MW.

[178] Ouro, P., Dené, P., Garcia-Novo, P, Stallard, T., Kyozuda, Y. and Stansby, P. 2023. Power density capacity of tidal stream turbine arrays with horizontal and vertical axis turbines. J. Ocean Eng. Mar. Energy 9, pp. 203–218. Available at: https://link.springer.com/article/10.1007/s40722-022-00257-8

5.2.2.4 Hydroplanes and Oscillating Hydrofoils

These devices extract energy from oscillations created from tidal flows and are installed on the seabed. The wing of the device oscillates in response to hydrodynamic lift, with this motion used to generate electricity. The angle of the hydroplane to flow can be optimised to increase efficiency. The amount of water column affected will depend on the height of the device. They are usually installed directly on the seabed, with the specific installation method dependent on the seabed itself and installation water depths. The prototype Stingray project[179] was installed on the seabed utilising its weight (180t). The operation of oscillating hydrofoils is similar to turbines, as the oscillating occurs around an axis of rotation, however, it occurs as an incomplete rotation between two angles. Similar to tidal turbines, oscillation can occur around either a vertical or horizontal axis. The Stingray project (150kW) with a 15m span hydroplane (lifted to a height of 24m during each 15-second oscillation cycle) was successfully deployed in depths of 30m, but research from this project has indicated that depths above this would be preferable, with installation proceeding on a seabed angle of <8.5°, with a current velocity >2m/s. Research has indicated that, as the devices extract energy from flow vortices, energy generation could occur with weak flows of around 1m/s. The Stingray hydroplane consists of several 3m long injection-moulded plastic sections which are sleeved onto a pair of tubular steel beams.

5.2.3 Wave Energy

Wave devices convert either the potential (wave height) or the kinetic (wave-induced motion) energy of a wave into mechanical energy (through a turbine/rotor) which is then converted into electrical energy. Wave energy extraction can be difficult as the motion of forces is multidirectional, and the power is available in low-speed and high forces, which the device must be able to withstand. Wave energy devices are currently still in development and are not yet widely employed for commercial use; as such, a range of infrastructure designs are in development, such as oscillating water column, point absorber, overtopping/collectors, attenuators and terminators, and wave rotors/turbines. Depending on the design of the device, these may be installed on the shoreline, nearshore, or offshore. Typically, a >20kW/m wave crest is needed for viable energy generation by wave devices, with water depths for installation ranging from 10-200m. Device arrays can be variable in size ranging from only a few devices up to large arrays of over 200 devices. These typically cover smaller areas than tidal or wind devices.

5.2.3.1 Oscillating Water Column

These devices use changes in the height of the wave/water surface, which alters air pressure in a semi-enclosed (typically concrete) chamber located above the water surface. The air is forced through an air turbine (Wells type) which rotates on the same axis irrespective of the directionality of air pressure changes. The device can produce significant noise. There are no moving parts in contact with water. These devices can be mounted either on the shoreline or float offshore. Recent developments have looked at the incorporation of device structures into coastal protection schemes such as sea walls to boost energy generation. Shoreline devices will affect the entire water column and are installed in shallow depths of at least 4m but require a sharp slope. They may be further secured using anchors, clump weights, or gravity structures, particularly when floated in the near and offshore areas. Devices installed in near and offshore areas are typically at depths of 10-50m and will not affect the entire water column, typically only the surface area and the seabed mooring area are affected (0.1km^2 footprint). The devices can range in size from 20 x 20m up to 200 x 200m. Maintenance occurs on-site, around 2-3 times per year, and can take between a few hours to two weeks. On a commercial scale basis, shoreline oscillating water column devices will likely be single structures joined together, which could consist of 100 turbines joined, covering an extent of 20m by 500m, with a power density of ~1GW/km^2. Near/offshore arrays could consist of 20 devices, with a power density of ~10MW/km^2.

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[179] DTI. 2005. Stingray Tidal Stream Energy Device – Phase 3. Available at: https://tethys.pnnl.gov/sites/default/files/publications/Stingray_Tidal_Stream_Energy_Device.pdf

5.2.3.2 Point Absorber

These devices (usually buoys, attached to the seabed via cables, anchors, clump weights, or gravity structures depending on the seabed type and water depth) float on the water surface, with the vertical motion of the water's surface moving a piston up and down (in contact with the water) with energy generation via linear generators. These devices can operate in a variety of water depths from 5-100m and cover smaller sea surface areas e.g., 20 x 20m. Potential commercial scale arrays may consist of 20–50 devices covering an extent of c.2km^2, and with a power density of 10-25MW/km^2. Maintenance occurs mostly offsite, requiring suitable access such as remotely controlled vehicles and suitable weather conditions, occurring 2-3 times per year for a duration of between a few hours to two weeks. These devices should be placed offshore as they may impact shoreline wave energy. An adaptation of these devices is submerged pressure differentials, which sit lower in the water column and move through pressure changes due to passing overhead waves. The pressure difference produces flow which drives a turbine and generator.

5.2.3.3 Overtopping/Collectors

These devices are submerged water reservoirs that float at the surface. Waves overtop the device to fill the reservoirs to store the potential energy of the wave. This reservoir then empties through a turbine outlet, with the turbine in contact with water. These devices are usually moored offshore at depths of 50-80m using anchors, clump weights, and gravity structures. These devices require certain wave heights for optimal functioning. Power density generation by these devices in commercial-scale arrays could be c.9MW/km^2, with approximately eight devices in an array covering an extent of c.6-8km^2. Maintenance takes place on-site, typically between 2-3 times per year lasting between a few hours to two weeks.

5.2.3.4 Attenuators and Terminators

These devices consist of multiple floating structures connected to one another. Energy is extracted via the relative motion along these parts. Attenuators extract energy along the axis of propagation of the wave, whilst terminators are located perpendicular to the axis of propagation. The devices are fixed to the seabed using anchors, clump weights, or gravity structures and occupy the top of the water column area, with moving hinges in contact with the water surface. Terminators can be located in depths of 30-100m with attenuators operating in depths of 50-80m. Some types of terminators, which use oscillating wave surge converters, also use wave-induced horizontal motion beneath the surface to extract energy. These consist of a vertical or inclined board perpendicular to the wave direction. Maintenance can depend on the device's location e.g., above or below the surface, occurring 2-3 times per year and lasting between a few hours to 2 weeks. Power density generation by these devices in commercial-scale arrays could be between 10-25MW/km^2, comprising 20-50 devices covering an extent of c.2km^2. These devices are sensitive to wave periods (roughly proportional to wave heights) peak periods are typically between 5-15 seconds.

5.2.3.5 Wave Rotors/Turbines

These are generally bottom-mounted devices located in the nearshore, which generate energy from the rotational motion generated by waves driving a turbine or rotor. Rotors typically have a diameter of 10-20m with a turbine height of c.30m. There is generally low space between the rotors of around 1m. Rotor types may be combined e.g., Darrieus rotor and Wells rotor, allowing the turbine to rotate in the same direction independent of flow. These devices operate in shallow waters of between 10-15m depth and are typically installed using monopiling on the seabed. They typically only affect the seabed area of the water column. Given their underwater location, divers or remotely operated vehicles may be required to access the devices for maintenance, typically occurring 2 to 3 times per year for a few hours to two weeks. These devices can require mesh to be installed to prevent fish and mammals from coming into contact and being injured by the turbine (in contact with the water) as the turbine blades rotate at approximately 25 revolutions per minute.

5.2.4 Interactions of devices with the environment

The manner and degree of interaction of offshore renewable energy devices with their environment is influenced by several factors such as:

- the space occupied within the air, water column or seabed;
- the method of attachment;
- whether there are moving parts in contact with the air or water;
- the potential for generation of noise;
- the potential for generation of EMF; and
- the use of chemicals.

The environmental impacts caused by a device on its environment partly depend on the space it occupies in the air and in the water column, affecting which aspects of the environment the device interacts with. Bottom-fixed offshore wind turbines occupy the entire water column, with the horizontal extent occupied in the atmosphere dependent on the rotor blade diameter. Floating wind devices occupy the upper water column; as for fixed offshore wind devices, the horizontal extent occupied in the atmosphere depends on the rotor blade diameter. The space occupied by tidal devices in the water column varies with the device type and may include the seabed only or the entire water column. Similarly, wave devices can vary in the amount of the water column that they occupy, with some device types mainly at the seabed (e.g., wave rotor), some occupying the entire water column (e.g., oscillating water column at the shoreline), while others are mainly at the surface with a mooring footprint at the seabed (e.g., overtopping, attenuator/terminator, point absorber, oscillating water column at the nearshore/offshore).

The degree of impact that these devices may have on the seabed, e.g., in terms of geomorphology and sediment, is dependent on the installation method used. Fixed wind devices require a seabed foundation, with the type dependent on the seabed type and water depth; primarily monopile foundations are used, while jacket foundations, gravity (concrete) foundations or suction caissons can also be applied. Floating wind device attachment depends on the seabed type and water depths; moored buoys, mooring lines, ballast stabilised, buoyancy stabilised, or complex anchoring may be used. For tidal devices the type of attachment is device dependent and depends on seabed type and water depth, but may include monopiles, gravity structures, anchors, or clump weights. Anchors are most widely used for wave devices, while clump weights and gravity structures are also widely used; monopiles may be used for wave rotor devices.

For fixed wind and floating wind devices, there are no moving parts in contact with the water. The rotor blade is the only moving part in contact with the air. Tidal devices may have turbines or oscillating boards in contact with the water, and some device types are shrouded; there are no moving parts in contact with the air. Some wave devices have no moving parts in contact with the water, whereas others have turbines, hinges, or pistons; there are no moving parts in contact with the air.

Fixed and floating wind devices can generate underwater noise, primarily during the installation and decommissioning processes. Underwater noise can be generated by tidal and wave devices during the operational phase, as well as during their installation and decommissioning processes.

Fixed wind, floating wind, wave and tidal devices can generate under sea EMFs. EMFs are produced as a result of power transmission in inter array cables and export cables to shore. Magnetic field strength generated during electricity cable operation is variable, and dependent on several factors including cable alignment and configuration. Electric fields can be produced in water passing through the magnetic field surrounding a cable. Electric fields can be almost completely blocked from emanating externally by the shielding effect of a cable’s structure. The devices themselves will also have an electrical signature, however, this will be specific to the individual devices. The strength of both magnetic and electric fields decreases with distance from the source.

Fixed and floating wind devices typically use non-toxic coatings and antifouling chemicals (to prevent algae and molluscs fouling, which can reduce device efficiency), as well as sacrificial anodes (readily corrodible metal, usually zinc or aluminium that are designed to protect metals by actively undergoing dissolution and release discharges to seawater of low concentrations which may impact water quality). Given that tidal devices are exposed to strong currents this generally limits the marine growth potential, reducing the need for antifouling materials, although these may still be used. Sacrificial anodes may also be employed to reduce the dissolution of protected metals. There may also be the use of hydraulic fluids (although some devices rely on water), which may leak and have water quality implications. Sacrificial anodes, antifouling components, and hydraulic fluids may also be present on some wave devices, depending on their design.

6 ASSESSMENT METHODOLOGY

6.1 Identification and Assessment of Resource Zones

As described in **Section 2.5**, the OREAP is an environmentally led plan; development of the plan was undertaken in an iterative manner in conjunction with the SEA and HRA, comprising several stages and taking on board stakeholder views and recommendations.

These stages are illustrated in **Figure 6-1**. Stage 1 comprised an initial identification of areas that are suitable for the development and operation of ORE technology types, and division into Technically Suitable Resource Zones (RZs). Stage 2 considered the key constraints and sensitivities within these RZs, to provide an initial refinement that excluded those areas of highest constraints and sensitivities. Stage 3 considered a wider set of environmental constraints and sensitivities, to recommend RZs that can avoid or minimise the potential for adverse effects on the environment identified within the appraisals.

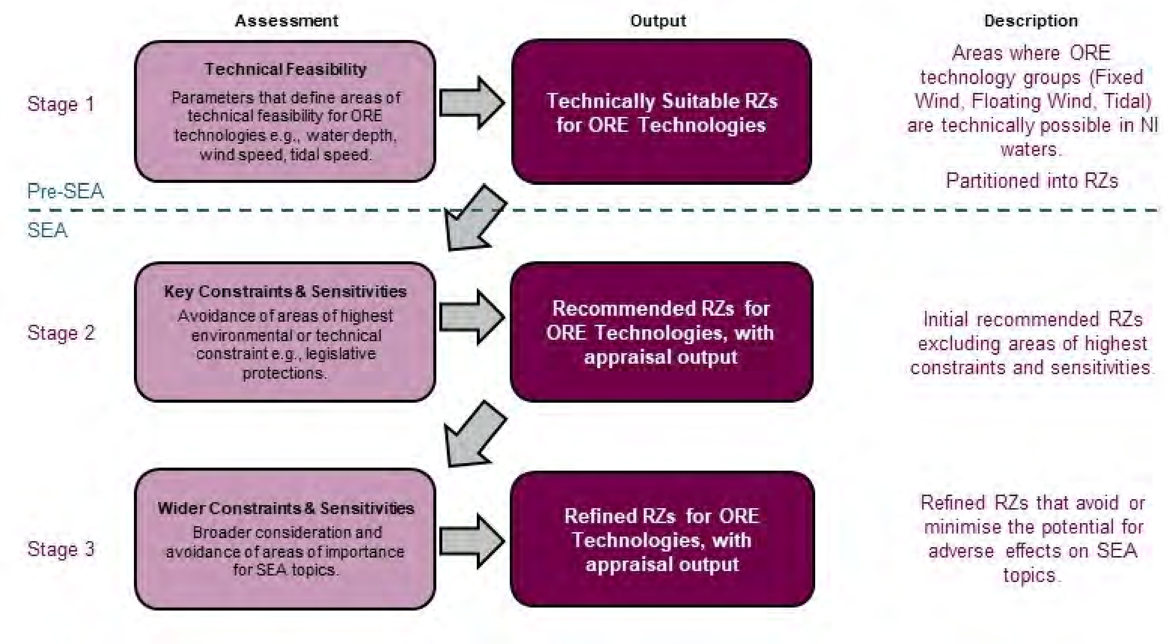

Figure 6-1 Stages in the Identification and Assessment of Resource Zones for ORE Technology Types

6.1.1 Identification of Technically Suitable Resource Zones

Stage 1 comprised the initial identification of areas within the SEA Study Area that are within the technical operational envelopes for the various ORE infrastructure. The types of ORE technology types included in this process are fixed-bottom wind, floating wind, wave, and tidal stream power. Further information on these renewable energy types and their operational parameters is given in **Section 5**. The technical operational envelopes for these device types were established through a thorough review of published Environmental Impact Assessments (EIAs) for ORE projects within the UK, and through feedback from stakeholders.

Technically suitable areas for the operation of ORE types were identified within the NI Marine area, as described in the following Sections.

6.1.1.1 Technically Suitable Resource Zones for Fixed Offshore Wind

For the identification of areas that are technically suitable for the operation of fixed-bottom offshore wind devices, the following essential criteria were applied by the model within NI's marine area:

- Water depth 10m – 80m; and

- Annual Mean Wind Speed at 110m height above mean sea level (amsl) >9m per second.

These criteria were based on a review of available technologies and their requirements, and feedback from stakeholders. On the basis of these criteria, GIS analysis was undertaken to define areas of technological suitability for the installation and operation of fixed wind turbines. Areas considered to be too small (<10km^2) or too discontinuous for commercial consideration were then screened out of further consideration. Seascape areas were used as a guide in partitioning the modelled fixed wind resource into potential Technically Suitable RZs for fixed offshore wind.

6.1.1.2 Technically Suitable Resource Zones for Floating Offshore Wind

For the identification of areas that are technically suitable for the operation of floating offshore wind devices, the following essential criteria were applied by the model within NI's marine area:

- Water Depth 50m – 250m; and
- Annual Mean Wind Speed at 110m height above mean sea level (amsl) >9m/s.

These criteria were based on a review of available technologies and their requirements, and feedback from stakeholders. On the basis of these criteria, potential areas were preliminarily identified as technologically suitable for the installation and operation of floating wind turbines. Areas considered to be too small (<10km^2) or too discontinuous for commercial consideration were then screened out. Seascape areas were used as a guide in partitioning the modelled floating wind resource into potential Technically Suitable RZs for floating offshore wind.

6.1.1.3 Technically Suitable Resource Zones for Tidal Energy

For the identification of areas that meet the technical requirements for the operation of tidal stream devices, the following essential criteria were applied by the model within NI's marine area:

- Water Depth 5m – 130m; and
- Average Current Speed across the Tidal Cycle >1.5m/s;

These criteria were based on a review of available technologies and their requirements, and feedback from stakeholders. On the basis of these criteria, potential areas were preliminarily identified as technologically suitable for the installation and operation of tidal energy. Areas considered to be too small (<10km^2) or too discontinuous for commercial consideration were then screened out. Seascape areas were used as a guide in partitioning the modelled tidal energy resource into potential Technically Suitable RZs for tidal stream energy,

6.1.1.4 Technical Resource Potential for Wave Energy

For the identification of areas that meet the technical criteria for the operation of wave energy devices, the following essential criteria were applied by the model within NI's marine area:

- Water Depth 10m – 200m;
- Average Wave Height >1.2m; and
- Average Wave Energy >20kW/m.

On the basis of these criteria, no suitable areas were identified as technologically suitable for the installation and operation of wave energy devices within NI waters.

6.1.2 Screening and Refinement of Resource Zones

This stage involved the mapping and modelling of constraints, including those of a technical, environmental and social nature. The modelling of environmental constraints is being used as part of the toolbox in focussing the plan through the identification of lower constrained resource areas that can avoid the areas of highest environmental risk and meet the right technical criteria for offshore renewable technologies.

In order to apply constraint mapping, a constraint had to meet all of the following requirements:

- Constraint had to represent a level of impedance to the project;
- There had to be reliable, published data available on the spatial distribution of the constraint; and
- There had to be consistent data availability across the entire Study Area.

Constraints were initially given a BRAG ranking – Black, Red, Amber, Green, based on the level of risk that impacting them would pose to the consenting of infrastructure within an area or across a feature or the level of risk posed to the establishment of an asset. These ratings were as detailed as possible, based on specific feature sensitivities, where identified by stakeholders. For example, SACs are given a Red rating, accounting for the sensitivity of designated features to direct and indirect impacts from infrastructure. The BRAG ratings that were used for this process are detailed alongside the constraints in **Appendix C**. The constraints analysis was informed by a series of principles, established in conjunction with the Project Team and stakeholders, covering issues such as allowable proximity, features to avoid etc., all of which were used ultimately to assign a weighting or rating to each constraint. The buffer distances applied to the constraints used for this process are detailed in **Appendix C**. The constraints data were also linked to one or more SEA topics and SEA indicators.

With the principles established, GIS techniques were used to generate a “heat map” or “cost surface” whereby the Study Area was mapped based on the consenting “cost” of establishing offshore renewable devices or routing a cable through each cell in a raster of constraints. In this context “cost” does not represent an actual monetary value, rather it represents the combined influence of multiple criteria that affect the feasibility of establishing an asset or laying a cable, under the broad headings of environmental, social and technical. Areas of environmental constraints arise due to there being environmentally sensitive habitats or species present and/or the areas being designated through international, European, national, or local planning legislation. Areas of social constraint are where there is likely to be disturbance to or risk to human activity or impacts on heritage features. Technical constraints are areas where it would be technically difficult or not technically feasible to construct and operate offshore renewable infrastructure and includes issues such as high shipping density or TSS areas.

The BRAG rating of data allowed for easy and quick identification of constraints and their relative sensitivities to offshore renewable infrastructure. The heat mapping allowed for easy and quick identification of cumulative constraints and sensitivities. By using heat mapping the BRAG-rated data could be mapped and assessed qualitatively, with heat mapping used to generate least cost/lower constrained areas, to assist in the refinement of potential RZs for offshore renewable energy development, and the ‘screening out’ of areas that have the potential for significant direct effects on key environmental areas. The output of this stage was a recognition of the key constraints and sensitivities within Technically Suitable RZs and avoidance through a refinement of the RZ area. At this stage it was also identified if any Technically Suitable RZ was considered too highly constrained for further consideration and appraisal. This screening and refinement of Technically Suitable RZs to produce recommended RZs is reported in **Section 9.2**.

6.1.3 Assessment of Recommended Resource Zones and Recommendations for further Refinement

This stage involved a strategic-level environmental assessment of the screened in and refined Recommended RZs for Fixed Wind, Floating Wind, and Tidal ORE technologies. This assessment was informed by a wider set of strategic-level constraints and sensitivities data, which are listed and described in **Appendix D**. This included datasets that informed the key constraints and sensitivities screening and refinement of RZs (**Appendix C**), as well as additional datasets that could provide spatially suitable information to inform the assessment of environmental topics. This includes a set of 'MPA risk layers' that are in development by NIRAS Group (UK) Ltd. for TCE through the Offshore Wind Evidence and Change Programme. These layers map the relative risk to designated features from pressures arising from offshore wind, extending the consideration beyond the spatial footprint of MPAs – for example by including wider foraging areas for seabirds that nest within a SPA. These inform areas of higher risk for breeding birds, non-breeding birds, marine mammals, fish and MCZ features, but it should be noted these layers are not intended to replace an assessment. Only areas considered as Level 5 (Moderate), Level 6 (High) or Level 7 (Very High) MPA risk will be included within the assessment of the recommended RZs as having likelihood, high likelihood and very high likelihood of significant effects, respectively. In the context of the assessment framework for this SEA, this has been taken to indicate the potential for significant effects for Level 7 MPA risk areas, and, alongside consideration of further evidence to support the assessment, the potential for moderate effects for Level 6 or 5 MPA risk areas. Tidal excursion data was considered to inform the zone of influence for physical processes, characterised as seabed and coastal areas that may be influenced by changes to physical processes due to the presence or construction of offshore infrastructure. This is defined as one tidal excursion, which is the distance suspended sediment is transported prior to being carried back on the returning tide.

For assessment of the potential for visual effects from development of ORE technologies within the recommended RZs, buffer distances were derived that are in line with those outlined in the study by White Consultants (2020)[180], which was published in support of the UK OESEA4; this study provides suggested significance buffers, based on the sensitivity of landscape and heritage receptors (from Medium to Very High sensitivity), and a range of offshore turbine heights. The sensitivities and suggested buffers set out in this study were also recommended by HED and DAERA Marine Historic Environment division, in their responses to the OREAP Scoping consultation, for the assessment of effects on the setting of coastal Cultural Heritage features. Very High seascape value and potential Very High sensitivity receptors were considered to equate to the coincidence of an AONB with a WHS. Very High seascape value and potential High sensitivity receptors were considered to equate to the presence of either an AONB or a WHS. Medium-High seascape value and potential Medium and Medium/High sensitivity receptors were considered to equate to local landscape designations, Registered Historic Parks, Gardens and Demesnes, Scheduled Monuments, and Listed Buildings. On this basis, significance buffers for use in the SEA assessment were set out, as shown in **Table 6-1**.

Table 6-1 Receptors and Buffer Distances for Visual Assessment

Landscape or heritage designation	Value to seascape	Potential Sensitivity	Buffer distance
Multiple landscape designations (AONB and WHS)	Very High	Very High	Fixed wind (turbine height 146-175m): potential for significant effects within 34km Floating wind (turbine height 225-300m): potential for significant effects within 40km
AONB WHS	Very high	High	Fixed wind (turbine height 146-175m): potential for significant effects within 22km Floating wind (turbine height 225-300m): potential for significant effects within 39km
Local landscape designations (e.g., AoHSV, National Trust Lands) Registered Historic Parks, Gardens and Demesnes Scheduled Monuments Listed Buildings	Medium - High	Medium and Medium/High	Fixed wind (turbine height 146-175m): potential for significant effects within 19km (intermediate between 16km and 22km) Floating wind (turbine height 225-300m): potential for significant effects within 33km (intermediate

[180] White Consultants. 2020. Offshore Energy Strategic Environmental Assessment: Review and Update of Seascape and Visual Buffer study for Offshore Wind Farms. Available at: https://assets.publishing.service.gov.uk/media/5ef9a3abd3bf7f769a4e7742/White_Consultants_2020_Seascape_and_visual_buffer_study_for_offshore_wind_farms.pdf

			between 27.5km and 39km)

To estimate the landscape and cultural heritage designations that have the potential to be affected, viewshed modelling was undertaken for each ORE technology from each of the recommended RZs. A combined Digital Terrain Model (DTM) was created of onshore and offshore data in a 100m grid and was clipped to the SEA Study Area. For fixed wind, a viewer (turbine) height of 165m was used, with a viewable distance of 40km; and for floating wind a viewer (turbine) height of 228m was used, with a viewable distance of 40km. For tidal stream technologies it was assumed that devices and/or array areas will require marking using buoys, therefore the viewshed modelling used a viewer (buoy) height of 3m, with a viewable distance of 10km. This enabled an approximation of the landscape and cultural heritage receptors from which ORE developments would likely be visible, which were then taken into account in the recommended RZ assessments under the 'Cultural, Archaeological and Architectural Heritage' and 'Landscape, Seascape and Visual Amenity' SEA topics. The Regional Seascape Character Areas within which ORE technologies could be viewable were also discussed, including the cultural heritage features of note within these areas.

The assessment of recommended RZs was informed by the non-spatial environmental assessment of ORE technologies, the methodology for which is described in **Section 6.4** and the outcomes reported in **Section 8** and **Appendix E**.

The potential for development within each recommended RZ to have effects on SEA topics and SEOs, which are described in **Section 6.2**, was assessed in the short, medium and long-term for likely effects, the significance of the effects, and whether they are positive or negative effects. Other impacts assessed for significance were secondary effects, cumulative effects, synergistic effects, temporary and permanent effects, and the inter-relationship of effects.

All potential positive and negative impacts are presented individually, with a text description, and then a summary graphic. In addition, a summary of the overall balanced potential effect is presented for each environmental issue area. Scores are assigned to impacts, ranging from +3 to -3 as demonstrated in **Table 6-2**. The purpose of adding numerical scores was to assist in the ranking of options and for potential incorporation of the environmental and social criteria into future decision making by the OREAP team, as this can easily be tied into a multi-criteria analysis of alternatives, if desired. Like the assessment, the scores demonstrate both the positives and the negatives and are not conveyed in terms of net benefit or net loss, which can sometimes be misleading. A guide to the scorings that have been used for this assessment is given in **Appendix F**; note that that this provides *examples* of the types of effects that may occur and their potential significance on environmental receptors. The scoring takes into account the sensitivity of receptors and professional opinion, and is linked to the potential high-level impacts identified, and the baseline environment.

Table 6-2 Description of SEA Environmental Impact Scores

Score	Description
+3	Significant positive environmental effects
+2	Moderate positive environmental effects
+1	Slight positive environmental effects
0	No environmental effects
-1	Slight negative environmental effects
-2	Moderate negative environmental effects
-3	Significant negative environmental effects

This assessment of RZs is provided in **Section 9.2** and **Appendix G**. Recommendations for further refinement are provided for some RZs, where this may reduce the potential for significant effects on environmental indicators. These Refined RZs represent aspirational areas of lower environmental constraint and sensitivity. Further consideration of other factors, such as economics and deliverability will need to be taken into consideration in the further assessment and refinement of the resource zones offered for lease to enable the delivery of the most sustainable ORE Resource Zones possible within NI waters. The potential export cable routes to shore are outlined, along with key constraints and sensitivities that should be considered during project planning.

An assessment of the potential for in-combination or cumulative effects on environmental topics and SEOs from development and operation of ORE technologies within the RZs is provided in **Section 9.3**.

The RIAA for the OREAP considers the potential impacts on the European sites (National Site Network Sites) and may cover a wider Study Area and zones of influence to address ex situ impacts to habitats and species. The identification of these potential RZs and the outcomes of the SEA and RIAA assessments will help to inform the next stage of screening and assessment to be undertaken at the project design stage.

6.2 Assessment Approach and SEOs

Assessment of the OREAP is relatively strategic, with the aim of reporting likely impacts at the national and regional level to reflect the scale at which the potential technically suitable areas and RZs are identified.

Assessment of the OREAP comprises an assessment of the baseline environmental information available against the high-level objectives and potential issues. This method involves an assessment of each option available in the enactment of the OREAP against the following SEA topics:

- Biodiversity, Flora and Fauna (BFF);
- Population and Human Health (PHH);
- Geology, Soils and Land Use (GSL);
- Water (W);
- Air (A);
- Climatic Factors (CF);
- Material Assets and Infrastructure (MA);
- Cultural, Architectural and Archaeological Heritage (CH);
- Landscape, Seascape and Visual Amenity (L).

The purpose of this is to predict and evaluate, as far as possible, the environmental effects of the OREAP, highlighting any significant environmental problems and/or benefits that are likely to arise from its implementation.

The proposals of the OREAP were assessed in terms of their potential effects, and the significance of these effects, on the environment against a set of SEOs. These SEOs were developed in the context of broader environmental protection objectives set at both international and national levels (outlined in **Section 4** and detailed in **Appendix B**), and also take into account the context of potential for impacts associated with the OREAP. Each of the environmental topics described in **Section 3** was assigned at least one high-level SEO, specifying a desired outcome, against which the potential proposals set out in the OREAP were assessed. Each high-level SEO was paired with a specific target(s), as well as indicator(s) that can be used to measure the progress towards achievement of these targets. These SEOs, Indicators and Targets are given in **Table 6-3**. The assessment examined the likely significant effects of the proposals set out by the OREAP, and how their implementation will contribute to achieving these SEOs.

Table 6-3 Strategic Environmental Objectives, Indicators and Targets.

SEA Topic	Objective	Objective Description	Indicators	Targets
Biodiversity, Flora and Fauna	Avoid damage to, and where possible enhance, biodiversity, flora and fauna.	Preserve, protect, maintain and, where possible, enhance biodiversity and ecosystems within the NI marine area, including internationally, nationally, and locally protected sites, habitats and species, and other known species of conservation concern.	• Conservation status of designated habitats and species within International/European and national designated sites (SACs, SPAs, Ramsar sites, MCZs, ASSIs). • Status of protected and priority habitats and species (Annex I habitats, Annex II species and Annex IV species, NI Priority Habitats and Species, OSPAR Threatened or Declining Habitats and Species). • MS Environmental status of marine area (e.g., Descriptor 1, 2, 4).	• No negative change, or a positive change, in the conservation status of designated habitats and species within International, European and National designated sites. • No negative change, or a positive change, in the status of protected or priority species and habitats outside designated sites, or to areas of known importance. • No negative change, or a positive change, in the Environmental status of MS Descriptors.
Population and Human Health	Avoid disruption to the local population, while maximizing potential benefit to the population.	Minimise disruption to the local population, and displacement of recreational and leisure use of the area while providing a new secure renewable energy supply for the NI population, with potential employment and other benefit opportunities.	• Population centres in proximity to RZs. • Use of the area by recreational and leisure users (e.g., RYA areas, diving). • Capacity for new renewable energy supply for the NI population, with potential employment and other benefit opportunities.	• Delivery of offshore energy arrays with minimal adverse nuisance to communities. • Minimise the risk to, or displacement of, recreational and leisure users of the area. • Delivery of offshore energy arrays that maximise the potential benefits to the population.
Geology, Soils and Land use	Avoid damage to the function and quality of the seabed, and effects on hydrodynamics, sediment transport, or coastal processes.	Preserve, protect, maintain and, where possible, enhance, sites designated for geological or geomorphological features, and minimize direct and indirect damage to the function and quality of the seabed or changes to sediment transport, hydrodynamics or coastal processes.	• Site condition/status of protected geological/geomorphological features within designated sites (WHSs, MCZs, ASSIs, UNESCO Geoparks). • Potential scale of loss or alteration to seabed geology and sediments. • Potential to alter hydrodynamics, sediment dynamics, or coastal processes (tidal excursion and sediment type). • Interaction with known areas of potential contamination (MoD live	• No negative change, or a positive change, in the condition of protected geological/geomorphological features within designated sites. • Minimise potential loss or alteration to seabed geology and sediments. • Minimise the potential for alteration of hydrodynamics, sediment dynamics, or coastal processes. • Minimise potential interaction with areas of potentially contaminated sediments.

SEA Topic	Objective	Objective Description	Indicators	Targets
			firing areas, munition disposal areas, UXO, dumping grounds)	
Water	Avoid impacts on, and where possible enhance, the status or quality of water bodies.	Support the objectives of the WFD and MS by avoiding damage to or deterioration of water status, quality and resource.	• Status of WFD coastal water bodies (ecological, chemical, hydromorphological) • Status of WFD Protected Areas (Bathing waters, Shellfish waters, Designated sites). • MS Environmental status of marine area (e.g., Descriptor 5, 8, 9, 10, 11). • Interaction with known areas of potential contamination (MoD live firing areas, munition disposal areas, UXO, dumping grounds).	• Potential to contribute to a change in the status of WFD coastal water bodies, and protected areas. • Potential to contribute to a change in the Environmental status of MS Descriptors. • Minimise potential interaction with areas of potentially contaminated sediments.
Air	Minimise risk to local air quality and contribute to improving regional emissions.	Minimise risk to local air quality and contribute to improving regional pollutant emissions.	• Sensitive receptors in proximity to RZs. • Capacity for new renewable energy connection, with potential effects on pollutant reduction.	• Minimise the potential for negative effects on air quality from vessel emissions. • Delivery of offshore energy arrays that maximise the potential for a reduction in air pollutant emissions.
Climatic Factors	Contribute to a reduction in GHG emissions.	Minimise loss of carbon sequestering seabed while contributing to a reduction in GHG emissions from the energy supply sector in line with national commitments.	• Capacity for new renewable energy connection, with potential effects on GHG reduction. • Interaction with areas of known or potential blue carbon habitats.	• Delivery of offshore energy arrays that maximise the potential for a reduction of GHG emissions. • Minimise the potential for loss of known blue carbon habitat (in line with objectives of the Blue Carbon Action Plan).
Material Assets and Infrastructure	Provide new, robust offshore renewable energy infrastructure with minimal disruption to other assets and infrastructure.	Provide new, robust offshore renewable energy infrastructure with minimal disruption to other assets and infrastructure.	• Potential capacity of new offshore renewable energy. • Presence of marine infrastructure (cables, pipelines). • Interaction with other users of the marine area (shipping, fisheries, military, aviation, dredging sites).	• Delivery of offshore energy arrays that maximise the potential energy output. • Minimise the potential for loss or damage to other marine infrastructure. • Minimise the risk to, or displacement of, other users of the area (fisheries and aquaculture, shipping, military activities, aviation, dredging sites).

SEA Topic	Objective	Objective Description	Indicators	Targets
Cultural, Architectural and Archaeological Heritage	Protect, conserve, and enhance designated and non- designated heritage assets and their settings.	Protect International, National and Local Heritage Designations, and their settings.	• Interaction with known marine heritage features. • Interaction with known designated coastal archaeological or architectural heritage features (including their setting). • Potential for discovery of previously unknown archaeological heritage features.	• Minimise the potential for effects on known heritage features. • Minimise the potential for indirect effects on the setting of heritage features.
Landscape, Seascape and Visual Amenity	Protect, and where possible enhance, the landscape and seascape character and visual amenity of the NI shoreline.	Protect and where possible enhance the landscape and seascape character and visual amenity of the NI shoreline.	• Potential for effects on visually sensitive designated areas (e.g., AONBs, WHSs). • Seascape sensitivity to offshore infrastructure development. • Population centres in proximity to RZs.	• No long-term negative change, or a positive change, to areas designated for landscape (AONBs, WHSs). • No negative change, or a positive change, in visual amenity or landscape/seascape character. • Delivery of offshore energy arrays with minimal adverse visual effects to communities.

6.3 Assumptions regarding ORE for Assessment

A variety of devices can be used to extract and convert offshore energy into electrical energy which uses different energy sources: offshore wind (both fixed and floating), tidal energy, and wave energy. These offshore energy forms can have several different types of renewable devices installed to generate electrical energy. These devices have various factors influencing their suitability for use, including constraints on their location, required installation and maintenance processes, environmental interactions, and the size and energy density of the device arrays. These devices are discussed in **Section 5**.

For assessment purposes, some general assumptions have been made:

The approximate turbine height for fixed wind turbines (maximum height to tip) has been taken as 165m (taking an average value from EIA reports and project websites for 37 projects that are within the maximum distance from shore that will apply for the OREAP; the range of heights was 80-291m). It is assumed that fixed wind turbines will have a requirement for some type of foundation into the seabed. The viewable distance for fixed wind turbines of this height has been taken as 40km.

The approximate turbine height for floating wind turbines (maximum height to tip) has been taken as 228m (taking an average value from EIA reports and project websites for five projects that are within the maximum distance from shore that will apply for the OREAP; the range of heights was 130-300m). It is assumed that floating wind turbines will have a requirement for some types of attachment infrastructure to the seabed. The viewable distance for floating wind turbines of this height has been taken as 40km.

It is assumed that tidal stream devices may have some requirement for devices or attachment infrastructure on the seabed, and within the water column, and that they may have submerged moving parts. It has been assumed that devices and/or array areas will require marking using buoys with an approximate height of 3m, with a viewable distance of 10km, and a requirement for lighting at night.

6.4 Non-Spatial Assessment of ORE Technologies

To simplify the RZ assessment process, avoid repetition during the assessment of each proposal, and recognise effects that are likely to be present across all areas, high-level impacts that the types of ORE devices and associated infrastructure (i.e., fixed wind turbines, floating wind turbines, submerged or floating tidal stream devices, wave devices and cables) can have on sensitive features within each SEA topic have been considered. These potential impacts have been described based on the experience of the SEA Team, and from a review of SEA reports from related plans, including the NI ORESAP SEA; OSEA4; OSEA3; the Scottish Draft Sectoral Marine Plan for Offshore Wind Energy SEA (2019), the Scottish draft Sectoral Marine Plans for wave and tidal energy (2013); Planning Scotland's Seas: SEA of Plans for Wind, Wave and Tidal Power in Scottish Marine Waters (2013); FishRAMP project Literature review); and a review of a significant number (approximately 165) EIA reports associated with ORE projects in UK waters. This non-spatial environmental assessment of ORE technologies is provided in **Section 8** and **Appendix E**.

6.5 Assessment of Key Objectives and Actions of the OREAP

In addition to the consideration of high-level non-spatial effects of ORE developments on SEA topics, and potential for effects within RZs, the Key Objectives and Actions of the OREAP have also been considered with regard to their compatibility or potential for effects on SEA Objectives. A positive score (+) reflects the potential for an Action to positively affect the Objective for that SEA topic, a negative score (-) reflects the potential for an Action to have a negative effect, and a neutral score (/) indicates a neutral effect or no expected potential for interaction. This assessment is provided in **Section 9.4**.

6.6 Difficulties and Data Gaps

The sourcing and compilation of data used within the opportunities and constraints modelling for the iterative development of the OREAP and SEA, and within the SEA assessment, proved to be difficult and time intensive. DfE, advised by RPS, stipulated that in order for data to be used in the constraints assessment, it should be reliable, published, spatial distribution data, freely available or available from steering group members, and there had to be consistent data availability across the entire SEA Study Area. For some topics it proved difficult to obtain high quality data with a sufficient geographical distribution across the NI marine area, such as for areas of higher density or known importance for mobile marine mammals and seabirds, and areas of importance for inshore and offshore fisheries. Stakeholders were consulted at several stages of the plan and SEA development, and constraints assessment, to ensure that key stakeholder opinions and recommended data could be fully considered, thus ensuring a balance in the consideration of data to be used for constraints modelling and screening. However, although the consultation and subsequent sourcing and review of recommended data sources was time intensive, data gaps remain for important fisheries areas. As part of the stakeholder consultation process RPS provided survey charts to the NI fisheries representative bodies for distribution among their members, who had the opportunity to identify areas of greatest importance. Responses to this engagement were digitised and considered during the assessment of RZs.

The Marine Plan for NI is currently at a draft stage. In its current form the draft Marine Plan for NI is not spatially descriptive in its consideration of the needs and precedence of users and/or sectors. However, choosing to refine areas of potential technical suitability for ORE technologies through the consideration of important environmental and social constraints the OREAP, and SEA assessment, is in line with the Key Activity policy of the draft Marine Plan that “There is a presumption in favour of energy proposals that improve the security and diversity of energy supply, where it can be demonstrated: a) there will be no unacceptable adverse impact throughout the lifetime of the proposal on marine activities, uses and/or the marine area and any potential adverse impact is, in order of preference, avoided, minimised and/or mitigated; and b) restoration/decommissioning measures have been agreed, where necessary”.

To date, there has been a limited scale of deployment of offshore tidal and wave technologies, with deployment primarily consisting of single devices or small, demonstration-scale arrays. As such, there is a greater variation in the characteristics of potential devices that could be deployed and their interaction with the environment, less information is available on environmental effects of devices on environmental receptors, and there is greater uncertainty regarding how environmental effects (such as displacement, entanglement, or changes to oceanographic systems[181]) will manifest at the array scale- information on environmental effects is primarily based on single devices/demonstration-scale, or modelling of potential array scenarios.

For some potential impacts of ORE technologies, effects on species have been documented, but there remains uncertainty as to what, if any, effect this could have at a population level. For example, knowledge of marine species’ sensitivities to EMF from subsea cables is patchy, and the knowledge base on effects, and how they could manifest at a population-level needs advancement[182]. Further available knowledge, from scientific and industry research, and projects under the TCE Offshore Wind Evidence and Change Programme should be taken on board by any projects arising from the OREAP, and in any future iteration of the Plan itself.

The NIEA has undertaken an assessment of the sensitivity of NI’s LCAs to wind farm development (NIEA, 2010[183]), which describes the sensitivity of LCAs to wind energy development, taking into account the different landscape components and attributes that influence sensitivity to wind energy developments. Landscape sensitivity to wind energy development was considered as the extent to which the inherent character and visual amenity of a landscape are vulnerable to change due to this development, primarily a function of landscape character sensitivity (i.e., the degree to which a LCA is vulnerable to change which will affect its character); and visual sensitivity (i.e., the degree to which a particular view or visual landscape experience is vulnerable to change). Landscape value, through

[181] Hasselman, D.J., Hemery, L.G., Copping, A.E., Fulton, E.A., Fox, J., Gill, A.B. and Polagye, B. 2023. ‘Scaling up’ our understanding of environmental effects of marine renewable energy development from single devices to large-scale commercial arrays, Science of The Total Environment, 904, pp. 166801. Available at: https://www.sciencedirect.com/science/article/pii/S0048969723054268?via%3Dihub

[182] Gill, A.B., Hutchison, Z.L. and Desender, M. 2023. Electromagnetic Fields (EMFs) from subsea power cables in the natural marine environment. Cefas Project Report for Crown Estate Offshore Wind Evidence and Change Programme, pp. 66. Available at: https://tethys.pnnl.gov/sites/default/files/publications/Gill-et-al-2023-CEFAS.pdf

[183]NIEA. 2010. Wind Energy Development in NI’s Landscapes: Supplementary Planning Guidance to accompany Planning Policy Statement 18 ‘Renewable Energy’. NIEA Research and Development Series No 10/01, Belfast.

designation or local recognition of importance was also considered. There is currently no comparable assessment of the sensitivity of NI’s SCAs to the development of offshore wind energy, or other offshore energy types, that would aid strategic-level assessment.

7 CONSIDERATION OF ALTERNATIVES

7.1 Consideration of Alternatives

The SEA process must include an evaluation of the likely environmental consequences of a range of reasonable alternative scenarios, which in this case are alternatives to the OREAP. The purpose of this section is to outline the reasons for choosing the OREAP as the preferred alternative in light of other reasonable alternatives being considered.

7.2 Consideration of Strategic-level Alternatives

The following strategic-level alternatives can be considered for the OREAP:

- Alternative 1 – Strategy option: no new Plan but reference to provisions of the existing ORESAP.
- Alternative 2 – Unconstrained option: adherence to the specific objectives and actions as set out in the OREAP, based on areas of potential technical suitability for ORE technologies, with no consideration of constraints refinement into RZs.
- Alternative 3 – Preparation and adherence to the specific objectives and actions as set out in the OREAP, based on areas of potential technical suitability for ORE technologies refined into RZs through consideration of environmental and social constraints.

7.2.1 Strategic Alternative 1

In the absence of a new OREAP, the existing ORESAP 2012-2020, published in 2012 would remain in place. The objectives and renewable energy targets of the Energy Strategy for NI – The Path to Net Zero Energy 2021 and its Action Plan 2023, strengthened by the Climate Change Act of 2022, would not be taken into consideration. There would be no regard for the technological developments that have taken place since the ORESAP was published in 2012 including, for instance, the increased size of wind turbines, developments in how devices can be attached to the seabed and, in particular, the evolution and potential of floating wind technologies. The potential RZs would remain as those outlined and assessed for the ORESAP, which would not take into account changes in potential technically suitable areas e.g. water depth in the ORESAP was considered for wind technologies up to 80m, to allow consideration of future fixed foundation technologies and floating wind structure in deeper waters, however the OREAP plan update allows for development potential for floating wind technologies in water depths of up to 250m. These RZs are therefore unlikely to be the most suitable with regard to updated technologies. Furthermore, they will not consider any changes in the baseline environment, such as the designation of additional MPAs.

Without an updated OREAP, there is the potential for medium and long-term negative impacts on the SEOs for Biodiversity, Flora and Fauna, Geology, Soils and Land Use, Air, Climatic Factors and Material Assets.

There is the potential for detrimental impacts upon Air quality and Climatic Factors within NI and the SEOs for these, adherence to the objectives and targets of the 2012 ORESAP moving forward may result in less connection of renewable energy sources to the electricity supply network. This is likely to result in the continued reliance upon finite fossil fuels and thus the ongoing, long-term emissions of pollutants into the atmosphere. With population growth and therefore increased electricity demands expected into the future, the severity of these impacts is likely to increase with time. The continued reliance upon fossil fuels to provide electricity in the medium and long-term will contribute to the further acceleration of climate change and the exacerbation of the impacts of climate change. The impacts of climate change would worsen going forward from the medium to the long-term as the volume of GHG in the atmosphere would continue to rise. A lack of updated strategic planning for renewable energy targets may leave some areas unable to meet increased demand resulting from economic and population growth, with potential for adverse effects on Material Assets in the medium to long-term.

There is slight potential for adverse effects on the SEOs for Biodiversity, Flora and Fauna, and Geology, Soils and Land Use in the short to long-term, as there would be no strategic-level consideration of more recent designations, including the MCZs and the East Coast Marine and Carlingford Marine proposed SPAs. These would, however, be a requirement for developers and planning authorities to consider these sites at the project level through Screening for AA/AA and MCZ Assessments.

7.2.2 Strategic Alternative 2

This strategic alternative considers adherence to the specific objectives and actions as set out in the OREAP, based on areas of potential technical suitability for ORE technologies, with no consideration of environmental or social constraints refinement of the RZs.

There is potential for significant adverse effects on the SEO for Biodiversity, Flora, and Fauna in the short, medium, and long-term in this scenario, as areas of importance for the protection of biodiversity, such as SACs, SPAs, and MCZs, would not be avoided. This would have the potential for significant adverse effects on designated and sensitive benthic habitats and species, marine mammals, birds, fish and shellfish, as described in **Section 8.1**.

Regarding Population and Human Health, the level of disturbance to coastal populations is likely to be slight, as the technical suitability constraints on location, such as water depths and wind speed conditions would still apply. There is potential for moderate to significant effects on leisure and recreational users, in inshore waters, as high-use areas for activities such as sailing and diving would not be avoided at a strategic stage.

There is likely to be slight to moderate greater potential for adverse effects on the SEO for Geology, Soils and Land use in the short, medium, and long-term in this scenario, as areas of importance for the protection of geology/geomorphology, such as MCZs, would not be avoided. At this time Rathlin MCZ is the sole marine site designated for these features, while coastal ASSIs could be adversely affected by the onshoring of export cables. In addition, known areas of potential contamination would not be avoided that could adversely affect seabed sediments within the area.

There is likely to be slight to moderate greater potential for adverse effects on the SEO for Water in the short-term construction and decommissioning phases, as known areas of potential contamination would not be avoided at a strategic stage that could lead to adverse effects on water quality within the tidal excursion zone. As the technical suitability constraints on location, such as water depths and wind speed conditions would still apply, the potential for effects within WFD water bodies, including coastal water bodies and protected areas such as Bathing and Shellfish Waters is likely to be limited, with the exception of tidal RZs in shallower waters, where the lack of consideration of these areas as constraints could result in greater impacts.

The potential for adverse effects on SEOs for Air and Climatic Factors due to emissions are likely to be slight. As the technical suitability constraints on location, such as water depths would still apply, the potential for interaction of array development areas with areas of known blue carbon habitat, is likely to be limited. However, inshore areas could be adversely affected by the onshoring of export cables. The potential for medium to long-term indirect positive effects on air and GHG emissions through the development and provision of a new secure renewable energy supply to the population, and potential lessening on the reliance on fossil fuels, would vary from slight to significant, depending on the potential capacity of the development areas.

There is potential for significant adverse effects on the SEO for Material Assets in the short, medium, and long-term in this scenario, as existing infrastructure such as cables and pipelines, and areas of known importance for other users of the marine area, such as fisheries, shipping, and military, would not be considered and avoided at a strategic planning stage. The potential for medium to long-term positive effects through the development and provision of a new secure renewable energy supply to the population, would vary from slight to significant, depending on the potential capacity of the development areas.

There is likely to be slight to moderate greater potential for adverse effects on the SEO for Cultural Heritage in the short, medium, and long-term, as known designated and unprotected wrecks would not be considered as constraints and avoided, where possible at a strategic planning stage. There is likely to be greater potential for adverse effects on the setting of coastal heritage features, as those areas closer to the coastline would not be avoided owing to the potential for visual impacts on sensitive heritage receptors. Similarly, there is likely to be greater potential for adverse effects on coastal landscape designations such as AONBs, as areas closer to shore would not be excluded owing to the potential for adverse visual effects.

7.2.3 Strategic Alternative 3

The assessment of implementing the OREAP, i.e., Strategic Alternative No.3, is reported in **Section 9.1**. In this scenario, potential RZs for fixed wind, floating wind and tidal stream technologies will be further assessed by TCE and areas may subsequently be made available for leasing to developers, under the overarching objectives, actions, and initial refinement based on areas of potential technical suitability for ORE technologies refined into RZs through consideration of environmental and social constraints, as set out in the OREAP.

There is the potential for short to long-term adverse or positive effects across all SEOs from the implementation of the OREAP. However, the consideration of environmental and social constraints in the refinement of potential technically suitable areas for ORE technologies into potential RZs for fixed wind, floating wind and tidal stream technologies, would provide protection against the most potentially significant effects across many SEA topic areas.

In addition, the future implementation of projects arising from the OREAP would have regard for the assessment outcomes from the SEA process, and the mitigation measures outlined, in ensuring that the environment is protected during further TCE strategic-level planning and subsequent project-level planning and development.

7.2.4 Consideration of Alternative Options during Development of the OREAP

In addition to consideration of the OREAP as a strategic-level alternative, each potential RZ can be considered as an alternative option available to the OREAP to meet its objectives and targets for NI. The various options refined for the OREAP have all been assessed in terms of their potential effects, and the significance of these effects, on the environment against the SEOs in **Section 8**. This will allow for a comparison between the relative merits and drawbacks of the RZs proposed by the OREAP.

8 NON-SPATIAL ENVIRONMENTAL ASSESSMENT OF ORE TECHNOLOGIES

This section provides a description of the potential high-level effects that ORE devices (i.e., fixed wind turbines, floating wind turbines, submerged or floating tidal devices, wave devices), and associated infrastructure and cabling (inter-array and export cables) can have on sensitive features within each SEA topic, including during installation, operation and decommissioning. Information on the ORE technology types and their interaction with the environment is given in **Section 5**. This high-level assessment is not area specific, and is technology neutral i.e., the size and type of device, or the size of device arrays are not pre-defined; rather, it examines the types of interactions that these devices and their associated infrastructure may have with the environment and the potential effects of these interactions. A subsequent assessment, that is specific to the potential RZs identified for offshore renewable energy technology types and sensitive receptors within these areas, is presented in **Section 9.2.**

The potential high-level effects have been described based on the experience of the SEA Team; a review of the assessment of environmental impacts provided in the following reports: SEA for the first iteration of the NI ORESAP, UK Offshore Energy Strategic Environmental Assessment 3 (OESEA3), UK Offshore Energy Strategic Environmental Assessment 4 (OESEA4), SEA of Sectoral Marine Plan for Offshore Wind Energy in Scotland (2019), Planning Scotland's Seas: SEA of Plans for Wind, Wave and Tidal Power in Scottish Marine Waters (2013), SEA for the Republic of Ireland Offshore Renewable Energy Development Plan (OREDP) II (2022), FishRAMP project Economic Analysis and Literature Review[184]; and a comprehensive review of the information provided in EIA reports for renewable energy projects in UK waters, listed for offshore wind projects[185] and offshore wave and tidal stream projects[186] that were past the early planning stage with publicly available project information (a total of 165 projects were reviewed).

8.1 Potential Effects on SEA topics

For Biodiversity, Flora and Fauna, the main effects identified at a strategic level are described under the following sub-topics: designated sites; benthic habitats and species; fish and shellfish; marine mammals and reptiles; and birds and bats.

For Population and Human Health, the main effects identified at a strategic level are described under the sub-topics of human health, and energy supply.

For Geology, Soils and Land use, the main effects identified at a strategic level are described under the sub-topics of geology, geomorphology and sediment processes.

For Water, the main effects identified at a strategic level are described under the sub-topic of water quality.

For Air, the main effects identified at a strategic level are described under the sub-topic of air quality.

For Climatic Factors, the main effects identified at a strategic level are described under the following sub-topics: GHG emissions and carbon storage; and climate change effects.

For Material Assets, the main effects identified at a strategic level are described under the following sub-topics: Existing infrastructure - cables and pipelines; other users - commercial fisheries and aquaculture; shipping and navigation; military activities; disposal areas; aggregate extraction; tourism; and aviation.

[184] Poseidon. 2015. Fish Resource Access Mapping Project (Fish Ramp) Economic Analysis and Literature Review. Available at: https://www.seafish.org/document?id=4268d1ff-c514-4cc0-a9e8-d41ed0ef4566

[185] TGS. 2024. 4c Offshore Wind Map. Available at: https://map.4coffshore.com/offshorewind/

[186] RenewableUK. 2015. UK Marine Energy Database (UKMED). Available at: https://www.renewableuk.com/page/UKMED2

For Cultural Heritage, the main effects identified at a strategic level are described under the following sub-topics: archaeology and wrecks; and coastal heritage.

For Landscape, Seascape and Visual Amenity, the main effects identified at a strategic level are described under the overall topic area of landscape, seascape and visual amenity.

These effects are summarised in **Table 8-1,** and are further detailed in **Appendix E**.

Table 8-1 Potential high-level effects on SEA topics from ORE technologies

SEA Topic	Devices (including substations)		Cabling (inter-array and export)	
	Pre-construction, Construction and Decommissioning	Operation and Maintenance	Pre-construction, Construction and Decommissioning	Operation and Maintenance
Biodiversity, Flora, and Fauna	**Designated sites** • Potential for device arrays to affect the integrity, quality, ecology, structure, and functions of protected sites, habitats, and species; these impacts will depend on the characteristics and sensitivity of the protected sites, habitats, and species.			
	Benthic Habitats and species • ***Direct damage from installation area preparation:*** Potential for direct short-term damage to benthic habitats and sedentary species from pre-construction clearance or levelling within the device installation area (*fixed wind; floating wind; wave; and tidal*). • ***Direct loss from device/foundations/attachments placement:*** Potential for direct long-term (device life) loss of benthic habitats and sedentary species in the footprint in of installed foundations and scour protection/attachments and associated infrastructure such as substations, and short-term loss in the working area for foundations/attachments and where machinery such as jack-up barges are used (*fixed wind: foundations and scour protection; floating wind: attachment infrastructure; wave: attachment infrastructure; tidal: attachment infrastructure or devices*). • ***Indirect loss or damage:*** Potential for indirect short-term adverse effects on sensitive benthic habitats and	**Benthic Habitats and species** • **Indirect habitat loss:** Potential for an indirect loss of substrate and loss/alteration of associated benthic habitats/species through scouring at the base of piled structures (e.g., monopiles for fixed wind devices and, on a smaller scale, certain tidal and wave devices), as well as other attachment methods such as anchoring, gravity bases, and clump weights, associated with floating wind, wave and tidal devices. • ***Direct community alteration from device/foundations/attachments presence:*** Potential for long-term (device life) to permanent (if structures remain in place after decommissioning) alteration of benthic community composition from natural conditions through colonisation of seabed-based device structures by benthic species (*fixed wind: foundations and scour protection; floating wind: attachment infrastructure; wave: attachment infrastructure; tidal: attachment infrastructure or devices*).	**Benthic Habitats and species** • ***Direct damage from cable route preparation:*** Potential for direct short-term damage to benthic habitats and species from pre-construction clearance or levelling within the inter-array areas and subsea export cabling area route (*fixed wind; floating wind; wave; and tidal*). • ***Direct loss or damage from cabling placement:*** Potential for direct short-term damage to, or loss of benthic habitats and species within cable routes, including potential for direct damage to intertidal and coastal habitats at cable landfall. Potential for direct loss of habitats and sedentary species where placement of hard cable protection is required (*fixed wind; floating wind; wave; and tidal*).	**Benthic Habitats and species** • ***EMF:*** Potential for long-term (device life) behavioural effects on benthic species from Electro-Magnetic Fields (EMF), produced via power transmission and devices. However, current research indicates that marine flora/macroinvertebrates are insensitive to EMF (*fixed wind; floating wind; wave; and tidal*). • ***Direct community alteration*** Potential for direct long-term effects on community composition through colonisation of hard cable protection by benthic species, should this be required (*fixed wind; floating wind; wave; and tidal*).

SEA Topic	Devices (including substations)		Cabling (inter-array and export)	
	Pre-construction, Construction and Decommissioning	Operation and Maintenance	Pre-construction, Construction and Decommissioning	Operation and Maintenance
	species (such as shellfish growing waters and fish spawning grounds) in the vicinity of the construction *and* decommissioning area from sediment dispersion and deposition, or the release of contaminated sediments. • ***Indirect community alteration due to non-native species:*** Potential for the introduction of non-native species to the area from vessels during construction/decommissioning activities, or from wet storage of renewables infrastructure. This has potential for indirect adverse effects on native species and community structure (*fixed wind; floating wind; wave; and tidal*). • ***Direct loss from removal of structures:*** Potential for a loss of benthic habitats and sedentary species colonising subsea structures following removal at the decommissioning stage *fixed wind: foundations and scour protection; floating wind: attachment infrastructure; wave: attachment infrastructure; tidal: attachment infrastructure or devices*).	• ***Indirect loss or damage from contamination:*** Potential for indirect long-term (device life) adverse effects on benthic habitats due to leakage of toxic compounds from devices; the degree of sensitivity of the benthic habitat to chemical contamination will influence recovery. Potential for operational and/or accidental marine discharges to impact on local plankton communities; depending on the food chain hierarchy this may result in indirect effects on other marine species (*fixed wind; floating wind; wave; and tidal*). • ***Indirect community alteration due to non-native species:*** Potential for the introduction of non-native species to the area from vessels during maintenance activities, with potential for indirect adverse effects on native species and community structure (*fixed wind; floating wind; wave; and tidal*). • ***Change/loss of habitats from alteration of hydrography or sedimentation:*** Potential for a decrease in water flow and wave exposure due to extraction of wave and tidal energy that could alter suspended sediment concentrations and turbidity, and indirectly affect those habitats/species sensitive to decreases in wave energy, changes to tidal flows or changes to		

SEA Topic	Devices (including substations)		Cabling (inter-array and export)	
	Pre-construction, Construction and Decommissioning	Operation and Maintenance	Pre-construction, Construction and Decommissioning	Operation and Maintenance
		suspended sediment levels (*wave; tidal*). • ***Reduced GHG emissions:*** Support for a net reduction of GHG emissions associated with energy generation has potential for indirect positive effects on native benthic habitats and species by limiting adverse effects of climate change on marine ecosystems (*fixed wind; floating wind; wave; and tidal*).		
	Fish and Shellfish • ***Behavioural and physiological effects from noise and vibration disturbance:*** Potential for temporary noise disruption to species via seismic surveys prior to construction. Potential for permanent (mortality) to short-term behavioural effects (displacement) should UXO removal be required. Potential for auditory injury, disturbance or displacement during device installation and decommissioning; technologies involving piling will have a greater noise and vibration effect. Potential for cumulative disturbance and displacement effects due to multiple noise sources and vessel disturbance during construction and decommissioning (*fixed wind; floating wind; wave; and tidal*). • ***Direct loss or damage from device/foundations/attachments placement:*** Potential direct long-term	**Fish and Shellfish** • ***Collision risk:*** The potential for collision with wind turbines is expected to be low owing to the narrow diameter (<5m) and wide spacing of turbines. Wave and tidal devices are expected to pose a greater collision risk; specific species at risk will depend on the device type, location, and fish behaviours. Risk of entanglement with mooring lines of floating devices (*fixed wind; floating wind; wave; and tidal*). • ***Habitat exclusion, displacement or barrier effects***: Potential for long-term habitat exclusion effects due to the presence of fixed submerged equipment; device arrays may prevent fish from accessing feeding habitats, which may impact long-term food resources and influence adjacent populations. Potential for the presence of turbines to impact migration and transit pathways,	**Fish and Shellfish** • ***Behavioural and physiological effects from noise and vibration disturbance:*** As for devices, potential for temporary noise disruption to species via seismic surveys prior to construction. Potential for permanent (mortality) to short-term behavioural effects (displacement) should UXO removal be required along cable routes, and for cumulative disturbance and displacement effects due to multiple noise sources and vessel disturbance during construction and decommissioning (*fixed wind; floating wind; wave; and tidal*). • ***Direct loss or damage from cabling placement:*** Potential for direct short-term damage to, or loss of shellfish habitat, and supporting habitat for fish	**Fish and Shellfish** • ***EMF:*** Potential for adverse effects on species from device EMF generation; EMF generation is expected to be small and within the variation range of the environment but may be detectable to electro/magneto-sensitive species. Cable burial can provide a potential barrier to EMF (*fixed wind; floating wind; wave; and tidal*). • ***Heat:*** Potential for adverse effects on marine species due to the heat generated by installed device cables (*fixed wind; floating wind; wave; and tidal*).

SEA Topic	Devices (including substations)		Cabling (inter-array and export)	
	Pre-construction, Construction and Decommissioning	Operation and Maintenance	Pre-construction, Construction and Decommissioning	Operation and Maintenance
	(device life) loss of shellfish habitat, and supporting habitat for fish species including spawning, nursery and foraging habitat in the footprint of installed foundations and scour protection/attachments and associated infrastructure such as substations, and short-term loss in the working area for foundations/attachments and where machinery such as jack-up barges are used (*fixed wind: foundations and scour protection; floating wind: attachment infrastructure; wave: attachment infrastructure; tidal: attachment infrastructure or devices*). • ***Indirect loss or damage:*** Potential for indirect short-term adverse effects on shellfish habitats and fish spawning grounds in the vicinity of the construction/decommissioning area from sediment dispersion and deposition, or the release of contaminated sediments. Potential for short-term smothering impacts on these habitats; shellfish are generally more sensitive than fish. Potential for increased suspended sediment and turbidity to adversely affect filter feeders or to influence foraging and social behaviours and prey/predator interactions (*fixed wind; floating wind; wave; and tidal*).	particularly in constrained areas (*fixed wind; floating wind; wave; and tidal*). • ***Behavioural and physiological effects from noise disturbance:*** Potential for hearing loss and/or increased collisions due to generated noise from devices (note that lower noise levels are expected for wave devices than for tidal devices). • ***Indirect habitat loss:*** Potential for long-term (device life) adverse effects on supporting habitat for shellfish and benthic spawners (e.g., sandeels, herring), with knock-on effects on other species from food source alteration, due to substratum and seabed loss through scouring at the base of piled structures (e.g., monopiles for fixed wind devices and, on a smaller scale, certain tidal and wave devices), as well as other attachment methods such as anchoring, gravity bases, and clump weights, associated with floating wind, wave and tidal devices. Potential for indirect adverse effects on species due to contamination of habitat from leaching toxic compounds (*fixed wind; floating wind; wave; and tidal*). • ***Device colonisation:*** Potential for the formation of new habitat or artificial reefs from colonisation of fixed submerged equipment	species including spawning, nursery and foraging habitat within cable routes, including potential for direct damage to intertidal habitats at cable landfall. Potential for direct loss of habitats and sedentary species where placement of hard cable protection is required (*fixed wind; floating wind; wave; and tidal*).	

SEA Topic	Devices (including substations)		Cabling (inter-array and export)	
	Pre-construction, Construction and Decommissioning	Operation and Maintenance	Pre-construction, Construction and Decommissioning	Operation and Maintenance
		(foundations, scour protection, or device infrastructure (tidal)), and aggregation of fish. Device presence may benefit spawning and nursery grounds and during operational lifetime should fishing activities such as trawling be excluded in proximity to devices (*fixed wind; floating wind; wave; and tidal*). • ***Hydraulic change due to devices:*** Potential for long-term (device life) indirect effects on sensitive species from a decrease in water flow and wave energy due to the extraction of tidal and wave energy (*wave; and tidal*). • ***Reduced GHG emissions:*** Potential to support a reduced dependence on fossil fuels and a net reduction in the quantity of pollutants and GHG released into the atmosphere in the long-term (device life), with potential for indirect positive effects on biodiversity.		
	Marine Mammals and Reptiles • ***Collision risk:*** Potential for short-term collision risk for seals, cetaceans, and turtles with vessels and machinery during pre-construction, installation and decommissioning of devices and infrastructure. Potential for injuries from vessel propeller systems (*fixed wind; floating wind; wave; and tidal*).	**Marine Mammals and Reptiles** • ***Collision/entanglement risk:*** Potential for long-term effects through collision risk with wave and tidal devices due to regular transit through the water column. Smaller features such as chains, cables, or power lines may not be readily detected by species (particularly depending on size, and	**Marine Mammals and Reptiles** • ***Collision risk:*** Potential for short-term collision risk for seals, cetaceans, and turtles with vessels and machinery during pre-construction, installation and decommissioning of cables (*fixed wind; floating wind; wave; and tidal*).	**Marine Mammals and Reptiles** • ***Noise and EMF:*** Potential for effects on species' behaviour from EMF (*fixed wind; floating wind; wave; and tidal*).

SEA Topic	Devices (including substations)		Cabling (inter-array and export)	
	Pre-construction, Construction and Decommissioning	Operation and Maintenance	Pre-construction, Construction and Decommissioning	Operation and Maintenance
	• ***Noise effects:*** Potential for short-term underwater noise and vibration prior to and during installation and decommissioning to affect sensitive marine mammals (including cetaceans and seals), particularly via seismic surveys, detonation of UXOs if present within the device installation area, installation of piled foundations. Potential for hearing injury or behavioural changes (*fixed wind; floating wind; wave; and tidal*). • ***Disturbance or displacement (physical, visual and noise):*** Potential for short-term physical, visual, and noise disturbance of species due to the physical presence of vessels and machinery, airborne and marine noise and vibration, visual and light intensity changes, habitat disturbance and water quality changes, which could lead to displacement from the area (*fixed wind; floating wind; wave; and tidal*).	environmental conditions) causing injury. • ***Noise effects:*** Potential for effects of species' behaviour from marine noise and EMF; generally, less noise is produced for wave and wind devices compared to tidal devices (*fixed wind; floating wind; wave; and tidal*). • ***Habitat exclusion and displacement:*** Potential for long-term (device life) indirect effects from habitat exclusion from foraging, migratory, breeding, or nursery areas due to barriers of device arrays.	• ***Noise effects:*** Potential for underwater noise and vibration prior to and during installation and decommissioning of cables to affect sensitive marine mammals (including cetaceans and seals), particularly via seismic surveys and detonation of UXOs if present within the cabling area (*fixed wind; floating wind; wave; and tidal*). • ***Disturbance or displacement (physical, visual and noise):*** Potential for short-term physical, visual, and noise disturbance of species due to the physical presence of vessels and machinery, airborne and marine noise and vibration, visual and light intensity changes, habitat disturbance and water quality changes, which could lead to displacement from the area (*fixed wind; floating wind; wave; and tidal*).	
	Birds and Bats • ***Collision risk:*** Potential for short-term adverse effects on species due to collision risk with machinery and vessels during pre-construction, installation, and decommissioning; potential for collision risk with birds in flight or rafting (*fixed wind; floating wind; wave; and tidal*).	**Birds and Bats** • ***Collision risk:*** Potential for long-term effects through collision risk with vessels and machinery during device maintenance, including for rafting birds. Potential for a long-term (device life) collision risk for birds with wind turbines. The degree of sensitivity of birds to this risk is influenced by species sensitivity,	**Birds and Bats** • ***Collision risk:*** Potential for short-term adverse effects on species due to collision risk with machinery and vessels during pre-construction, installation, and decommissioning; potential for collision risk with birds in flight or	**Birds and Bats** • ***Collision risk:*** Potential for long-term effects through collision risk with vessels and machinery during device maintenance (*fixed wind; floating wind; wave; and tidal*).

SEA Topic	Devices (including substations)		Cabling (inter-array and export)	
	Pre-construction, Construction and Decommissioning	Operation and Maintenance	Pre-construction, Construction and Decommissioning	Operation and Maintenance
	• ***Noise effects:*** Potential for short-term noise and vibration during pre-construction, installation and decommissioning to affect birds, particularly via seismic surveys, detonation of UXOs if present within the device installation area, installation of piled foundations. Potential for hearing injury or behavioural changes (*fixed wind; floating wind; wave; and tidal*). • ***Disturbance or displacement (physical, visual and noise):*** Potential for disturbance in the vicinity of pre-construction, installation and decommissioning works from noise, physical and visual presence of vessels and machinery, and the use of artificial lighting. Disturbance may lead to increased stress, disrupt breeding, and lead to site avoidance and displacement from the area, with potential effects on foraging and breeding and energy expenditure. • ***Habitat loss/alteration:*** Potential for seabed preparation, installation, and decommissioning activities to damage to the local benthic environment directly and indirectly, which may affect invertebrates and fish and reduce prey availability and foraging opportunities for birds. Installation and decommissioning also has the potential to temporarily increase turbidity, with implications for visibility and foraging and	flight behaviour, time of year, weather conditions/visibility, turbine design including spacing and lighting, location of bird populations relative to the array, and location of foraging and migration routes. The proportion of birds flying at collision risk height is an important factor in risk. Collision risk may be higher closer to shore owing to increased movements between areas. In addition, potential for long-term effects on bats from collision risk with wind turbines (*fixed wind; floating wind*). Potential for collision of diving birds with devices, including submerged tidal and wave devices, mooring cables, and anchors for floating technologies (*fixed wind; floating wind; wave; and tidal*). • ***Habitat exclusion, displacement, and barrier effects:*** Potential for habitat loss for birds, loss of prey species, and long-term exclusion or displacement from foraging areas during operation of offshore renewable devices. Devices may exclude birds from a suitable foraging habitat by providing a physical or perceptual barrier, or producing noise that results in avoidance behaviour, and lead to a net loss of foraging area, with potential for reduced foraging success, increased distance to foraging areas, and increased pressure on alternative foraging	rafting (*fixed wind; floating wind; wave; and tidal*). • ***Noise effects:*** Potential for short-term noise and vibration during pre-construction, installation and decommissioning to affect birds, particularly via seismic surveys, detonation of UXOs if present within the cable installation area. Potential for hearing injury or behavioural changes (*fixed wind; floating wind; wave; and tidal*). • ***Disturbance or displacement (physical, visual and noise):*** Potential for disturbance in the vicinity of pre-construction, installation, and decommissioning works from noise, physical and visual presence of vessels and machinery, and the use of artificial lighting. Disturbance may lead to increased stress, disrupt breeding, and lead to site avoidance and displacement from the area, with potential effects on foraging and breeding and energy expenditure. • ***Habitat loss/alteration:*** Potential for seabed preparation, cable installation and decommissioning activities to damage to the local benthic environment directly and indirectly, which may affect invertebrates and fish, and	

<table>
<tr><th rowspan="2">SEA Topic</th><th colspan="2">Devices (including substations)</th><th colspan="2">Cabling (inter-array and export)</th></tr>
<tr><th>Pre-construction, Construction and Decommissioning</th><th>Operation and Maintenance</th><th>Pre-construction, Construction and Decommissioning</th><th>Operation and Maintenance</th></tr>
<tr><td></td><td>predator/prey interactions, as well as to disturb contaminated sediments, which may affect sensitive species (fixed wind; floating wind; wave; and tidal).</td><td>grounds. Potential for long-term displacement of birds, leading to effective habitat loss, associated with exclusion from ecologically important areas (e.g., feeding, breeding), barrier effects and disturbance of regular movements (e.g., foraging, migration), potentially increasing flight energy demands and collision risk.</td><td>reduce prey availability and foraging opportunities for birds. Installation and decommissioning also has the potential to temporarily increase turbidity, with implications for visibility and foraging and predator/prey interactions, as well as to disturb contaminated sediments, which may affect sensitive species (fixed wind; floating wind; wave; and tidal).</td><td></td></tr>
<tr><td>Population and Human Health</td><td>Human Health
Population disturbance: Potential for temporary noise and visual disturbance effects on the local population, and leisure and recreational activities due to noise generated and visual impacts during pre-construction, installation, and decommissioning (fixed wind; floating wind; wave; and tidal).
Effects on marine and coastal leisure and recreation: Potential for short-term increased collision risk, access restrictions and displacement or water quality effects for leisure and recreational marine users (e.g., recreational sailing, fishing, water sports and beach/coastal use) during pre-construction, installation, and decommissioning (fixed wind; floating wind; wave; and tidal).</td><td>Human Health
Population disturbance: Potential for flicker and noise effects, particularly if devices are located near shore (fixed wind).
Effects on marine and coastal leisure and recreation: Potential for a long-term (device life) enhanced collision risk for recreational and leisure vessels with wind turbine blades and submerged, partially submerged and sub-aerial devices and cable protection materials. Potential for long-term (device life) displacement of recreational and leisure craft from the array area (fixed wind; wave; and tidal).</td><td>Human Health
Population disturbance: Potential for temporary noise and visual disturbance effects on the local population, and leisure and recreational activities due to noise generated and visual impacts during pre-construction, installation, and decommissioning (fixed wind; floating wind; wave; and tidal).
Effects on marine and coastal leisure and recreation: Potential for short-term increased collision risk and displacement for leisure and recreational marine users (e.g., recreational sailing, fishing, water sports and beach/coastal use) during pre-construction, installation, and decommissioning (fixed wind; floating wind; wave; and tidal).</td><td>Human Health
Population disturbance: None anticipated.
Effects on marine and coastal leisure and recreation: Potential for a long-term (device life) enhanced collision risk for recreational and leisure vessels with cable protection materials.</td></tr>
</table>

SEA Topic	Devices (including substations)		Cabling (inter-array and export)	
	Pre-construction, Construction and Decommissioning	Operation and Maintenance	Pre-construction, Construction and Decommissioning	Operation and Maintenance
	Energy Supply • **Development of a secure energy supply:** None anticipated during the pre-construction, installation, or decommissioning phases (*fixed wind; floating wind; wave; and tidal*). • **Employment opportunities:** Potential for employment opportunities (*fixed wind; floating wind; wave; and tidal*).	**Energy Supply** • **Development of a secure energy supply:** Potential for long-term (device life) positive effects for the population in the development of a new secure renewable energy supply (*fixed wind; floating wind; wave; and tidal*). • **Employment opportunities:** Potential for employment opportunities (*fixed wind; floating wind; wave; and tidal*).	**Energy Supply** • **Development of a secure energy supply:** None anticipated during the pre-construction, installation, or decommissioning phases (*fixed wind; floating wind; wave; and tidal*). • **Employment opportunities:** Potential for employment opportunities (*fixed wind; floating wind; wave; and tidal*).	**Energy Supply** • **Development of a secure energy supply:** Potential for long-term (device life) positive effects for the population in the development of a new secure renewable energy supply (*fixed wind; floating wind; wave; and tidal*).
Geology, Soils and Land use	**Geology, geomorphology, and sediment processes** • ***Designated sites:*** Potential for short-term direct or indirect disturbance or damage to features within sites designated for geology or geomorphology from device installation and decommissioning (*fixed wind; floating wind; wave; and tidal*). • ***Loss of seabed sediments and change in morphology:*** Potential for short-term direct adverse effects on the seabed from pre-construction clearance or levelling, installation of device (including piles, foundations, anchoring and machinery such as jack-up barges) within the device installation area. Potential for a short-term increase in suspended sediment	**Geology, geomorphology, and sediment processes** • ***Designated sites:*** Potential for long-term indirect effects on features within sites designated for geology or geomorphology by changes in coastal processes due to device presence and operation (*wave; and tidal*). • **Loss of *seabed sediments and change in morphology:*** Potential long-term (device life) indirect loss of sediments though scouring at the base of piled structures (e.g., monopiles for fixed wind devices and, on a smaller scale, certain tidal and wave devices), as well as other attachment methods such as anchoring, gravity bases, and clump	**Geology, geomorphology, and sediment processes** • ***Designated sites:*** Potential for short-term direct or indirect disturbance or damage to features within sites designated for geology or geomorphology from cable installation (including landfall of export cables) and decommissioning (*fixed wind; floating wind; wave; and tidal*). • **Loss of *seabed sediments and change in morphology:*** Potential for short-term direct adverse effects on the seabed from pre-construction clearance and cable trenching. Potential for a short-term increase in suspended sediment to occur during the trenching process	**Geology, geomorphology, and sediment processes** • ***Designated sites:*** None anticipated. • **Loss of *seabed sediments and change in morphology:*** None anticipated. • ***Sediment dynamics:*** Potential for long-term effects on the occurrence of longshore drift altering sediment transfer where the cables (and cable protection) sit on the seabed surface (*fixed wind; floating wind; wave; and tidal*).

SEA Topic	Devices (including substations)		Cabling (inter-array and export)	
	Pre-construction, Construction and Decommissioning	Operation and Maintenance	Pre-construction, Construction and Decommissioning	Operation and Maintenance
	during installation and decommissioning of devices. Potential for short-term release of additional sediment loads during drilling and grouting of foundations (*fixed wind; floating wind; wave; and tidal*). • ***Seabed contamination:*** Potential for short-term release of contaminants to seabed sediments during installation (e.g., drilling wastes, particulate discharges, use of dredged materials for foundations) (*fixed wind; floating wind; wave; and tidal*).	weights, associated with floating wind, wave and tidal devices. • ***Sediment dynamics:*** Potential for long-term effects on sediment transport pathways; the presence of devices may directly alter sediment transport pathways and contribute to sediment deposition or erosion on a long-term basis (*fixed wind; floating wind; wave; and tidal*). • ***Hydrodynamics and coastal processes:*** Potential for a long-term (device life) alteration of coastal processes of tidal currents and wave regimes from operation of wave and tidal devices (*wave; and tidal*).	(*fixed wind; floating wind; wave; and tidal*).	
Water	**Water Quality** • ***Sediment disturbance:*** Potential for short-term mobilisation of sediments during pre-construction seabed preparation activities, and installation of devices, foundations and structures, resulting in increased turbidity. Potential for release of substrate that may be contaminated during these activities, with short-term adverse effects on water quality. Potential for adverse effects on nearby designated shellfish and bathing waters, and increased weathering of newly exposed sediment during device installation	**Water Quality** • ***Contamination:*** Potential for adverse effects on water quality through accidental contaminant release. Potential for leakage of device hydraulic fluids and anti-fouling compounds, or corrosion of sacrificial anodes. Potential for accidental discharge of contaminants from vessels or machinery during device maintenance (*fixed wind; floating wind; wave; and tidal*).	**Water Quality** • ***Sediment disturbance:*** Potential for short-term mobilisation of sediments during pre-construction seabed preparation activities, and installation of cables, resulting in increased turbidity. Potential for release of substrate that may be contaminated during these activities, with short-term adverse effects on water quality. Potential for adverse effects on nearby designated shellfish and bathing waters, and increased weathering of newly exposed sediment during cable installation	**Water Quality** • ***Contamination:*** Potential for adverse effects on water quality through accidental discharge of contaminants from vessels or machinery during cable maintenance (*fixed wind; floating wind; wave; and tidal*).

SEA Topic	Devices (including substations)		Cabling (inter-array and export)	
	Pre-construction, Construction and Decommissioning	Operation and Maintenance	Pre-construction, Construction and Decommissioning	Operation and Maintenance
	and decommissioning (*fixed wind; floating wind; wave; and tidal*). • ***Contamination:*** Potential for adverse effects on water quality through construction discharges or accidental contaminant release from machinery and vessels during installation and decommissioning (*fixed wind; floating wind; wave; and tidal*).		(*fixed wind; floating wind; wave; and tidal*).	
Air Quality	**Air Quality** • ***Air emissions:*** Potential for a short-term, temporary, increase in air emissions from vessels and machinery, and adverse effects on local air quality, during pre-construction, installation, and decommissioning (*fixed wind; floating wind; wave; and tidal*).	**Air Quality** • ***Air emissions:*** Potential for a short-term, temporary, increase in air emissions from vessels and machinery during operation and maintenance. Potential for long-term (device life) positive effects on regional air quality as operation of renewable energy devices support a transition away from fossil fuels (*fixed wind; floating wind; wave; and tidal*).	**Air Quality** • ***Air emissions:*** Potential for a short-term, temporary, increase in air emissions from vessels and machinery, and adverse effects on local air quality, during pre-construction, installation, and decommissioning (*fixed wind; floating wind; wave; and tidal*).	**Air Quality** • ***Air emissions:*** None anticipated.
Climatic Factors	**GHG Emissions and Carbon Storage** • ***GHG emissions:*** Potential for short-term, temporary emissions from vessels and machinery during pre-construction, installation, and decommissioning of devices (*fixed wind; floating wind; wave; and tidal*). • ***Carbon storage:*** Potential for short-term release of CO_2 due to seabed	**GHG Emissions and Carbon Storage** • ***GHG emissions:*** Potential for short-term, temporary emissions from vessels and machinery from operation and maintenance of devices. Potential for devices to contribute to long-term positive effects through a net reduction in GHG emissions, decarbonisation of the energy sector, diversification of	**GHG Emissions and Carbon Storage** • ***GHG emissions:*** Potential for short-term, temporary emissions from vessels and machinery during pre-construction, installation, and decommissioning of cables (*fixed*	**GHG Emissions and Carbon Storage** • ***GHG emissions:*** None anticipated.

SEA Topic	Devices (including substations)		Cabling (inter-array and export)	
	Pre-construction, Construction and Decommissioning	Operation and Maintenance	Pre-construction, Construction and Decommissioning	Operation and Maintenance
	disturbance during pre-construction, installation, and decommissioning of devices, which may include potential for adverse effects on blue carbon habitats that are valuable carbon sinks (*fixed wind; floating wind; wave; and tidal*).	electricity supply and energy security, and meeting of energy objectives and climate change emission reduction targets. The extent of benefits would be influenced by the scale and duration of developments (*fixed wind; floating wind; wave; and tidal*).	*wind; floating wind; wave; and tidal*). • ***Carbon storage:*** Potential for short-term release of CO_2 due to seabed disturbance during pre-construction, installation, and decommissioning of cables, which may include potential for adverse effects on blue carbon habitats that are valuable carbon sinks (*fixed wind; floating wind; wave; and tidal*).	
	Climate Change Effects • ***Direct or indirect effects on devices:*** None anticipated.	**Climate Change Effects** • ***Direct or indirect effects on devices:*** Potential for the long-term operation of renewable energy devices to be affected by climate change either directly, such as through a change in output, or indirectly, through altering device interactions with the surrounding environment (*fixed wind; floating wind; wave; and tidal*).	**Climate Change Effects** • ***Direct or indirect effects on cables:*** None anticipated	**Climate Change Effects** • ***Direct or indirect effects on cables:*** Potential for the landfall of export cables to be affected by climate change influenced coastal change (*fixed wind; floating wind; wave; and tidal*).
Material Assets	**Existing Infrastructure: cables and pipelines** • ***Direct damage to infrastructure:*** Potential for short-term damage to cables and pipelines within the array area during installation processes by device foundations, anchors, or other support structures and their removal during decommissioning; this could disrupt telecommunications or	**Existing Infrastructure: cables and pipelines** • ***Direct damage to infrastructure:*** Potential for short-term damage to cables and pipelines within the array area during device maintenance, which may disrupt telecommunications or release	**Existing Infrastructure: cables and pipelines** • ***Direct damage to infrastructure:*** Potential for short-term damage to cables and pipelines within the array area and export cable route during array and export cable installation; this could disrupt telecommunications or release	**Existing Infrastructure: cables and pipelines** • ***Direct damage to infrastructure:*** Potential for short-term damage to cables and pipelines within the array area and export cable route during maintenance, which may disrupt telecommunications or

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<tr><th rowspan="2">SEA Topic</th><th colspan="2">Devices (including substations)</th><th colspan="2">Cabling (inter-array and export)</th></tr>
<tr><th>Pre-construction, Construction and Decommissioning</th><th>Operation and Maintenance</th><th>Pre-construction, Construction and Decommissioning</th><th>Operation and Maintenance</th></tr>
<tr><td></td><td>release hazardous substances (fixed wind; floating wind; wave; and tidal).
• Access: Potential for reduced access to existing pipelines and cables for maintenance during the installation phase (fixed wind; floating wind; wave; and tidal).</td><td>hazardous substances (fixed wind; floating wind; wave; and tidal).
• Access: Potential for long-term reduced access to existing cables and pipelines within the array area during operation (fixed wind; floating wind; wave; and tidal).</td><td>hazardous substances (fixed wind; floating wind; wave; and tidal).
• Access: Potential for reduced access to existing pipelines and cables for maintenance during the installation phase (fixed wind; floating wind; wave; and tidal).</td><td>release hazardous substances (fixed wind; floating wind; wave; and tidal).</td></tr>
<tr><td></td><td>Other Users: Commercial Fisheries and Aquaculture
• Direct and indirect effects on fish and shellfish: Potential for short-term direct and indirect construction and decommissioning effects on fish and shellfish, as outlined under Biodiversity, Flora, and Fauna, which could adversely affect fish and shellfish stocks (fixed wind; floating wind; wave; and tidal).
• Displacement from fishing grounds: Potential for temporary displacement from traditional fishing grounds during the pre-construction, installation, and decommissioning phases to facilitate safety (fixed wind; floating wind; wave; and tidal).</td><td>Other Users: Commercial Fisheries and Aquaculture
• Direct and indirect effects on fish and shellfish: Potential for long-term direct and indirect operational effects of offshore renewable energy devices and infrastructure on fish and shellfish, as outlined under Biodiversity, Flora, and Fauna, which could adversely affect fish and shellfish stocks, fishing and fish production (fixed wind; floating wind; wave; and tidal).
• Displacement from fishing grounds: Potential for long-term (device life) displacement from fishing grounds. Potential for a concentration of vessels into a smaller area for shipping and navigation routes to lead to interference with fishing activities. Potential for increased resource competition for fishing grounds. Displacement may directly affect other fish stocks through overfishing and a reduction in species availability via changes in</td><td>Other Users: Commercial Fisheries and Aquaculture
• Direct and indirect effects on fish and shellfish: Potential for short-term direct and indirect construction and decommissioning effects on fish and shellfish, as outlined under Biodiversity, Flora, and Fauna, which could adversely affect fish and shellfish stocks (fixed wind; floating wind; wave; and tidal).
• Displacement from fishing grounds: Potential for temporary displacement from traditional fishing grounds during the pre-construction, installation, and decommissioning phases to facilitate safety (fixed wind; floating wind; wave; and tidal).</td><td>Other Users: Commercial Fisheries and Aquaculture
• Direct and indirect effects on fish and shellfish: Potential for long-term operational effects of offshore renewable energy devices and infrastructure on EMF sensitive species, as outlined under Biodiversity, Flora, and Fauna, which could adversely affect fish stocks (fixed wind; floating wind; wave; and tidal).
• Effects on fishing activity along cable routes: Potential for risks to fishing gear along cable routes, e.g., from cable protection armouring where cables cannot be buried sufficiently (fixed wind; floating wind; wave; and tidal).</td></tr>
</table>

SEA Topic	Devices (including substations)		Cabling (inter-array and export)	
	Pre-construction, Construction and Decommissioning	Operation and Maintenance	Pre-construction, Construction and Decommissioning	Operation and Maintenance
		substratum extent, EMFs, marine noise, contamination effects, and sediment changes (*fixed wind; floating wind; wave; and tidal*). • ***Effects on fishing activity within array area:*** Potential for increased collision risk due to the presence of device maintenance vessels. Potential for enhanced allision risks with floating wind structures. Potential for collision or entanglement of fishing gear with offshore device infrastructure. Potential for spoil, construction, or decommissioning debris on the seabed to impact commercial fisheries using bottom-towed fishing gear and the forms of fishing able to take place (*fixed wind; floating wind; wave; and tidal*).		
	Other Users: Shipping and Navigation • ***Collision risk:*** Potential for short-term risk of collision with slow moving or stationary installation and decommissioning vessels and equipment, which could result in the spillage of oil and hazardous cargo (*fixed wind; floating wind; wave; and tidal*). • ***Displacement:*** Potential for temporary displacement of vessels from the construction area due to safety exclusion zones. Potential for increased journey times/distances,	**Other Users: Shipping and Navigation** • ***Collision risk:*** Potential for long-term (device life) risk of collision to occur with stationary wind, wave and tidal devices and maintenance vessels and equipment, with a risk of associated hazardous spills. Potential effects on safety for shipping and navigation vessels due to a reduction in the under-keel clearance with the presence of subsea structures. • ***Displacement:*** Potential for long-term (device life) displacement of	**Other Users: Shipping and Navigation** • ***Collision risk:*** Potential for short-term risk of collision with slow moving or stationary installation and decommissioning vessels and equipment (*fixed wind; floating wind; wave; and tidal*). • ***Displacement:*** Potential for temporary displacement of vessels from the construction area due to safety exclusion zones. Potential for increased journey times/distances, which	**Other Users: Shipping and Navigation** • ***Collision risk:*** Potential for short-term risk of collision with slow moving or stationary vessels and equipment during maintenance (*fixed wind; floating wind; wave; and tidal*).

SEA Topic	Devices (including substations)		Cabling (inter-array and export)	
	Pre-construction, Construction and Decommissioning	Operation and Maintenance	Pre-construction, Construction and Decommissioning	Operation and Maintenance
	which may impact shipping density. Potential trade reductions through temporary restriction of port and harbour access (*fixed wind; floating wind; wave; and tidal*). • ***Rescue operations access:*** Potential for effects on search and rescue operations that occur within the installation and decommissioning area; such activities must take into consideration the installation equipment (*fixed wind; floating wind; wave; and tidal*).	vessels from the array area. Potential for increased journey times/distances. There may be direct displacements in shipping density trends and trade, and impacts on supplies through reduced access to ports and harbours. The level of displacement is likely to be greater for wind and wave developments as these tend to occupy larger areas than tidal developments; wind and wave devices may also occupy the entire water column, whereas tidal devices may be fully submerged and allow for co-existence of shipping (*fixed wind; floating wind; wave; and tidal*). • ***Navigation and communication:*** Potential for direct effects on navigation by devices obstructing lights, buoys, or the coastline; there may be compass deviation through magnetic interference. Radar, communications, and positioning systems can be affected by wind farms interfering with radar responses (*fixed wind; floating wind; wave; and tidal*).	may impact shipping density. Potential trade reductions through temporary restriction of port and harbour access (*fixed wind; floating wind; wave; and tidal*). • ***Rescue operations access:*** Potential for effects on search and rescue operations that occur within the installation and decommissioning area; such activities must take into consideration the installation equipment (*fixed wind; floating wind; wave; and tidal*).	
	Other Users: Military Activities • ***UXO presence:*** Short-term potential for UXO (unexploded ordnance) to impact the development of device arrays during pre-construction seabed preparation and installation due to MoD and WWI and WWII	**Other Users: Military Activities** • ***Disruption or displacement:*** Potential for long-term (device life) disruption of military exercises and activities. Potential to cause military vessels to use alternate locations or	**Other Users: Military Activities** • ***UXO presence:*** Short-term potential for UXO (unexploded ordnance) to impact the development of inter-array and export cables during pre-construction seabed preparation and installation due to MoD and	**Other Users: Military Activities** • None anticipated.

SEA Topic	Devices (including substations)		Cabling (inter-array and export)	
	Pre-construction, Construction and Decommissioning	Operation and Maintenance	Pre-construction, Construction and Decommissioning	Operation and Maintenance
	history (*fixed wind; floating wind; wave; and tidal*). • ***Disruption or displacement:*** Potential for temporary disruption of military exercises and activities during pre-construction, installation, and decommissioning (*fixed wind; floating wind; wave; and tidal*).	take longer journeys (*fixed wind; floating wind; wave; and tidal*).	WWI and WWII history (*fixed wind; floating wind; wave; and tidal*). • ***Disruption or displacement:*** Potential for temporary disruption of military exercises and activities during pre-construction, installation, and decommissioning (*fixed wind; floating wind; wave; and tidal*).	
	Other Users: Disposal Areas • ***Disturbance of disposal materials:*** Potential for short-term risk of previously disposed material to be released during pre-construction, installation and decommissioning activities should device arrays be installed close to disposal areas, with potential for secondary adverse effects on ecosystems (*fixed wind; floating wind; wave; and tidal*). • ***Disruption or displacement:*** Potential for temporary disruption or displacement of vessels moving to and from disposal sites during pre-construction, installation, and decommissioning activities (*fixed wind; floating wind; wave; and tidal*).	**Other Users: Disposal Areas** • ***Disruption or displacement:*** Potential for long-term disruption or displacement from the array area and increased journey times/distances to access disposal sites (*fixed wind; floating wind; wave; and tidal*).	**Other Users: Disposal Areas** • ***Disturbance of disposal materials:*** Potential for short-term risk of previously disposed material to be released during pre-construction, installation and decommissioning activities should cables be installed close to disposal areas, with potential for secondary adverse effects on ecosystems (*fixed wind; floating wind; wave; and tidal*). • ***Disruption or displacement:*** Potential for temporary disruption or displacement of vessels moving to and from disposal sites during pre-construction, installation, and decommissioning activities (*fixed wind; floating wind; wave; and tidal*).	**Other Users: Disposal Areas** • None anticipated.
	Other Users: Aggregate Extraction	**Other Users: Aggregate Extraction**	**Other Users: Aggregate Extraction**	**Other Users: Aggregate Extraction**

SEA Topic	Devices (including substations)		Cabling (inter-array and export)	
	Pre-construction, Construction and Decommissioning	Operation and Maintenance	Pre-construction, Construction and Decommissioning	Operation and Maintenance
	• ***Disruption or displacement:*** No effects anticipated, as there is currently no licensed marine aggregate extraction in NI and no prospective licence areas have been defined (*fixed wind; floating wind; wave; and tidal*).	• ***Disruption or displacement:*** No effects anticipated, as there is currently no licensed marine aggregate extraction in NI and no prospective licence areas have been defined (*fixed wind; floating wind; wave; and tidal*). • ***Future resource exploitation:*** Potential for long-term (device life) sterilisation of unlicensed mineral resources due to the presence of device arrays, with locations being unavailable for exploitation of aggregate resources during the operational lifecycle (*fixed wind; floating wind; wave; and tidal*).	• ***Disruption or displacement:*** No effects anticipated, as there is currently no licensed marine aggregate extraction in NI and no prospective licence areas have been defined (*fixed wind; floating wind; wave; and tidal*).	• None anticipated.
	Other Users: Tourism • ***Disturbance and contamination:*** Potential for short-term effects on coastal tourism locations and recreational activities due to generated noise and visual impacts and the potential release of contaminants during pre-construction, installation, and decommissioning. As described under Population and Human Health and Water topics (*fixed wind; floating wind; wave; and tidal*). • ***Access:*** Potential for temporary effects on recreational activities due to short-term access restrictions during installation and decommissioning. As described	**Other Users: Tourism** • ***Collision risk:*** Potential for long-term (device life) collision risk for recreational vessels. As described under Population and Human Health topic (*fixed wind; floating wind; wave; and tidal*). • ***Seascape and visual amenity:*** Potential for the physical presence of devices to affect the seascape and visual amenity, and potential for secondary effects on tourism. As described for Landscape, Seascape and Visual Amenity topic (*fixed wind; floating wind; wave; and tidal, particularly fixed wind due to turbine height and distance from shore*).	**Other Users: Tourism** • ***Disturbance and contamination:*** Potential for short-term effects on coastal tourism locations and recreational activities due to generated noise and visual impacts and the potential release of contaminants during pre-construction, installation, and decommissioning. As described under Population and Human Health, and Water topics. • ***Access:*** Potential for temporary effects on recreational activities due to short-term access restrictions during installation and decommissioning. As described	**Other Users: Tourism** • ***Collision risk:*** Potential for a long-term (device life) enhanced collision risk for recreational and leisure vessels with cable protection materials. As described under Population and Human Health topic (*fixed wind; floating wind; wave; and tidal*).

SEA Topic	Devices (including substations)		Cabling (inter-array and export)	
	Pre-construction, Construction and Decommissioning	Operation and Maintenance	Pre-construction, Construction and Decommissioning	Operation and Maintenance
	under Population and Human Health topic (*fixed wind; floating wind; wave; and tidal*).	• ***Noise:*** Potential for long-term (device life) noise effects (mainly affecting the marine environment, but shoreline devices may generate noise with the potential to directly affect land-based receptors) that may have secondary adverse effects on tourism e.g., through effects on wildlife as described under the Biodiversity, Flora, and Fauna topic (*fixed wind; floating wind; wave; and tidal*).	under Population and Human Health.	
	Other Users: Aviation • None anticipated.	**Other Users: Aviation** • ***Physical obstruction:*** Potential for long-term (device life) direct effects by wind turbine obstruction to low-flying aircraft. Potential for collisions with helicopters and fixed-wing aircraft. • ***Communications, navigation, and surveillance:*** Potential for long-term (device life) effects of turbines on communications, navigation, and surveillance (*fixed wind; floating wind*).	**Other Users: Aviation** • None anticipated.	**Other Users: Aviation** • None anticipated.
Cultural Heritage	**Archaeology and Wrecks** • ***Direct or indirect destruction or damage to features:*** Potential for direct damage to, or destruction of, submerged archaeological artefacts, structures or wrecks during pre-construction surveys and seabed preparation, device installation and decommissioning. Direct impacts may be permanent. Potential for indirect	**Archaeology and Wrecks** • ***Indirect damage to features:*** Potential for scouring and exposure to occur around sites or features in the vicinity of devices, leading to indirect damage or degradation, sediment deposition and further burial of features in the long-term, and potential for loss of, or damage to, features during maintenance	**Archaeology and Wrecks** • ***Direct or indirect destruction or damage to features:*** Potential for direct damage to, or destruction of, submerged archaeological artefacts, structures or wrecks during pre-construction surveys and cable laying. Sediment displacement may damage artefacts or lead to	**Archaeology and Wrecks** • ***Indirect damage to features:*** Potential for scouring and exposure to occur around sites or features in the vicinity of cable protection, leading to indirect damage or degradation, sediment deposition and further burial

SEA Topic	Devices (including substations)		Cabling (inter-array and export)	
	Pre-construction, Construction and Decommissioning	Operation and Maintenance	Pre-construction, Construction and Decommissioning	Operation and Maintenance
	impacts through sediment displacement and deposition around sites or features in the vicinity of these activities (*fixed wind; floating wind; wave; and tidal*).	activities. There may also be potential for long-term positive effects on archaeological features that are exposed, and that may be protected through burial (*fixed wind; floating wind; wave; and tidal*).	the burial of sites *(fixed wind; floating wind; wave; and tidal*).	of features in the long-term, and potential for loss of, or damage to, features during maintenance activities. There may also be potential for long-term positive effects on archaeological features that are exposed, and that may be protected through burial (*fixed wind; floating wind; wave; and tidal*).
	Coastal Heritage • ***Direct damage to coastal heritage:*** None anticipated. • ***Setting of coastal heritage features:*** Potential for direct and indirect temporary effects on the setting of designated and non-designated coastal heritage sites and features due to the presence of vessels and machinery during pre-construction, installation, and decommissioning (*fixed wind; floating wind; wave; and tidal*).	**Coastal Heritage** • ***Direct damage to coastal heritage:*** None anticipated. • ***Setting of coastal heritage features:*** Potential for direct and indirect long-term (device life) effects on the setting of designated and non-designated coastal heritage sites and features from the presence of offshore renewable energy devices.	**Coastal Heritage** • ***Direct damage to coastal heritage:*** Potential for short-term direct or indirect damage to coastal archaeological and architectural heritage at export cable landfall. • ***Setting of coastal heritage features:*** Potential for indirect temporary effects on the setting of designated and non-designated coastal heritage sites and features due to the presence of vessels and machinery during re-construction, installation, and decommissioning.	**Coastal Heritage** • ***Direct damage to coastal heritage:*** None anticipated. • ***Setting of coastal heritage features:*** None anticipated.
Landscape, Seascape and Visual Amenity	**Landscape, Seascape and Visual Amenity** • **Effects on seascapes:** Potential for short-term, temporary, effects on seascapes and visual amenity, including protected landscapes, from activity of vessels and machinery and	**Landscape, Seascape and Visual Amenity** • **Effects on seascapes:** Potential for long-term (device life) effects on landscape and seascape; effects of arrays on seascapes will depend on the seascape character type and	**Landscape, Seascape and Visual Amenity** • **Effects on seascapes:** Potential for short-term, temporary, effects on seascapes and visual amenity, including protected landscapes, from activity of	**Landscape, Seascape and Visual Amenity** • **Effects on seascapes:** None anticipated.

SEA Topic	Devices (including substations)		Cabling (inter-array and export)	
	Pre-construction, Construction and Decommissioning	Operation and Maintenance	Pre-construction, Construction and Decommissioning	Operation and Maintenance
	the use of artificial lighting, during pre-construction, device installation, and decommissioning (*fixed wind; floating wind; wave; and tidal*).	sensitivity, the presence of protected landscapes, and the type and magnitude/scale of development (*fixed wind; floating wind; wave; and tidal*).	vessels and machinery, and the use of artificial lighting, during pre-construction, cable installation, and decommissioning (*fixed wind; floating wind; wave; and tidal*).	

9 ENVIRONMENTAL ASSESSMENT OF RESOURCE ZONES

The purpose of this section is to evaluate as far as is possible the environmental effects of implementing the OREAP. As described in **Section 6.1**, the potential for effects of ORE development on the environment within potential RZs has been assessed in a series of stages.

9.1 Technically Suitable Resource Zones for ORE Technologies

As described in **Section 6.1.1**, Technically Suitable RZs for the operation of ORE technology types were determined.

9.1.1 Technically Suitable Resource Zones for Fixed Offshore Wind

The modelled fixed wind resource was partitioned into seven potential RZs, which are shown in **Figure 9-1**. Using a theoretical energy potential of 5MW/km^2 the energy that can be supplied by these areas can be estimated.[187] These RZs and their potential energy output are as follows:

- Atlantic – 1.10GW;
- Rathlin Torr Head – 0.37GW;
- Ards Peninsula - 1.84GW;
- Mourne Lecale – 2.82GW;
- Irish Sea Inshore – 3.17GW;
- Irish Sea Offshore 1 – 1.52GW; and
- Irish Sea Offshore 2 – 0.06GW.

9.1.2 Technically Suitable Resource Zones for Floating Offshore Wind

The modelled floating wind resource was partitioned into five potential RZs, which are shown in **Figure 9-2**. Using a theoretical energy potential of 5MW/km^2, the energy that can be supplied by these areas can be estimated. These RZs and their potential energy output are as follows:

- Atlantic – 3.34GW;
- Rathlin Torr Head – 1.01GW;
- North Channel – 4.98GW;
- Irish Sea Inshore – 4.55GW; and
- Irish Sea Offshore – 7.42GW.

9.1.3 Technically Suitable Resource Zones for Tidal Energy

The modelled tidal energy resource was partitioned into two potential Technically Suitable RZs, which are shown in **Figure 9-3**. Using a theoretical energy potential of 50MW/km^2, the energy that can be supplied by these areas can be estimated[188]. These RZs and their potential energy output are as follows:

[187] Derived from various sources, including Scottish Marine Sectoral Plan (2020) and the BalticLINes Capacity Density Study (2018

[188] Based on the value stated as being achievable for commercial arrays in both the SEA of Offshore Wind and Marine Renewable Energy in Northern Ireland (AECOM & Metoc 2009), and SEA of OREDP in RoI (AECOM & Metoc, 2009). This

- Atlantic – 1.62GW; and
- Rathlin Torr Head – 0.89GW.

value was also used as the lowest range in estimating theoretical tidal energy in the OSEA4 (2022). Theoretical capacity, not considering physical constraints and losses from multiple devices.

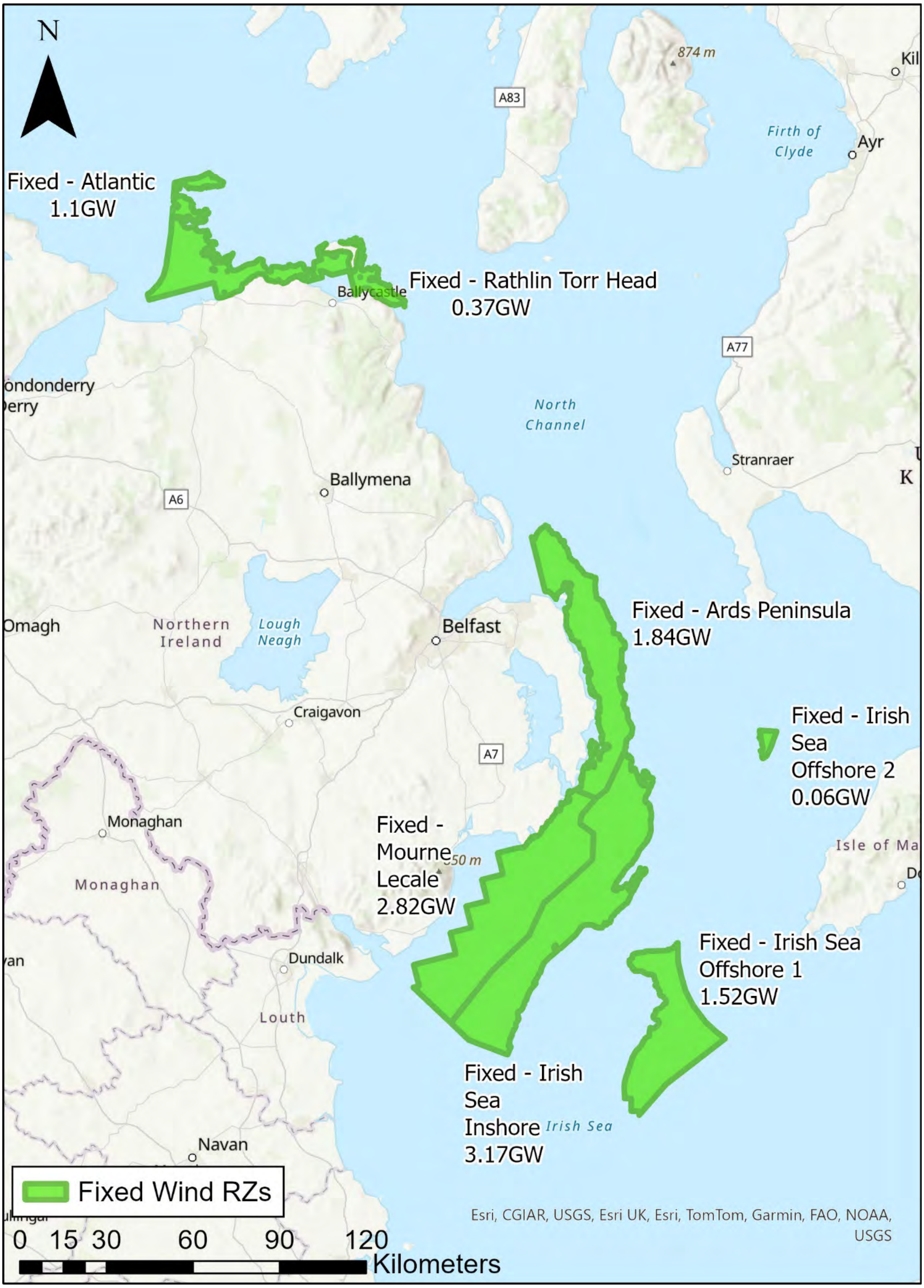


Figure 9-1 Technically Suitable RZs for Fixed Offshore Wind

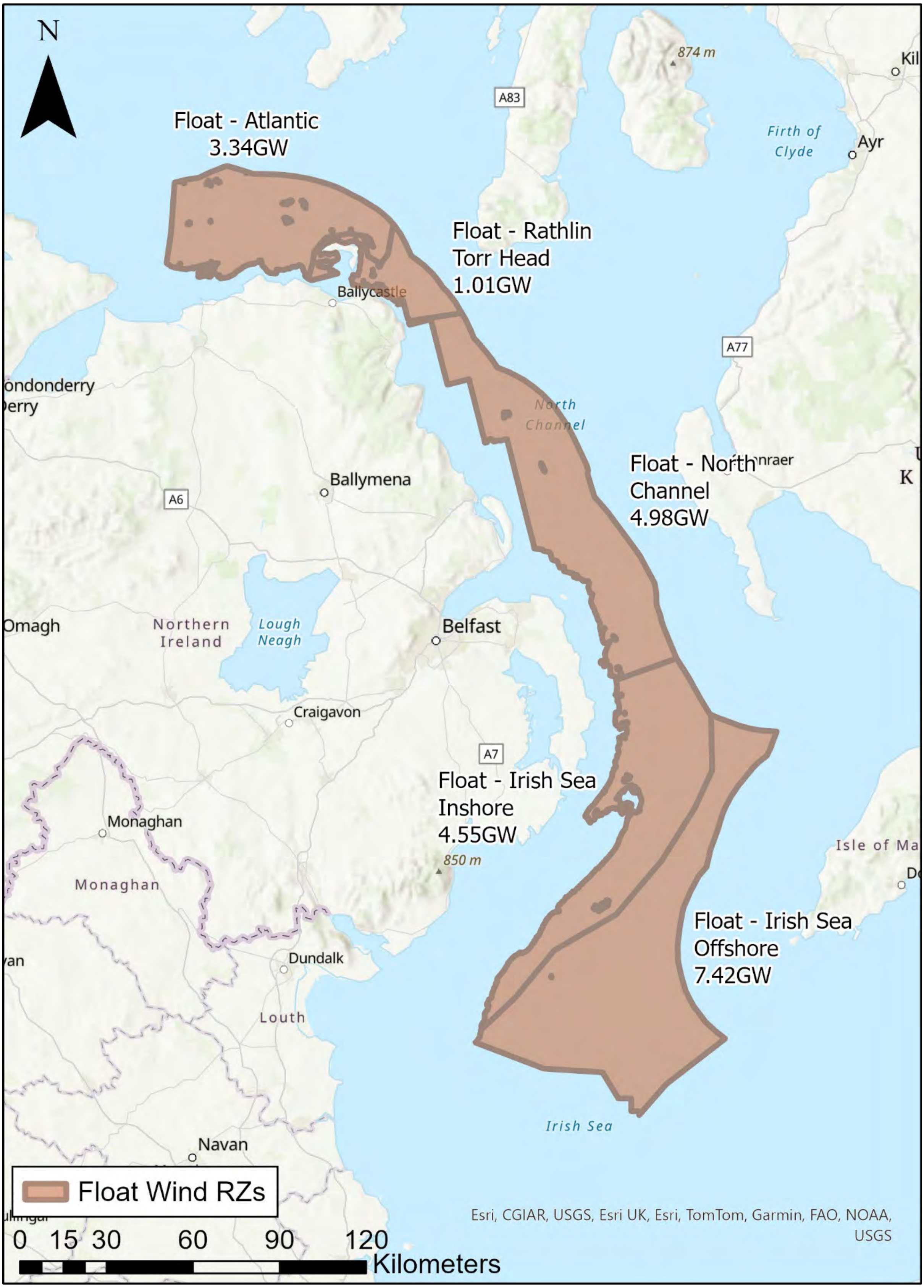


Figure 9-2 Technically Suitable RZs for Floating Offshore Wind

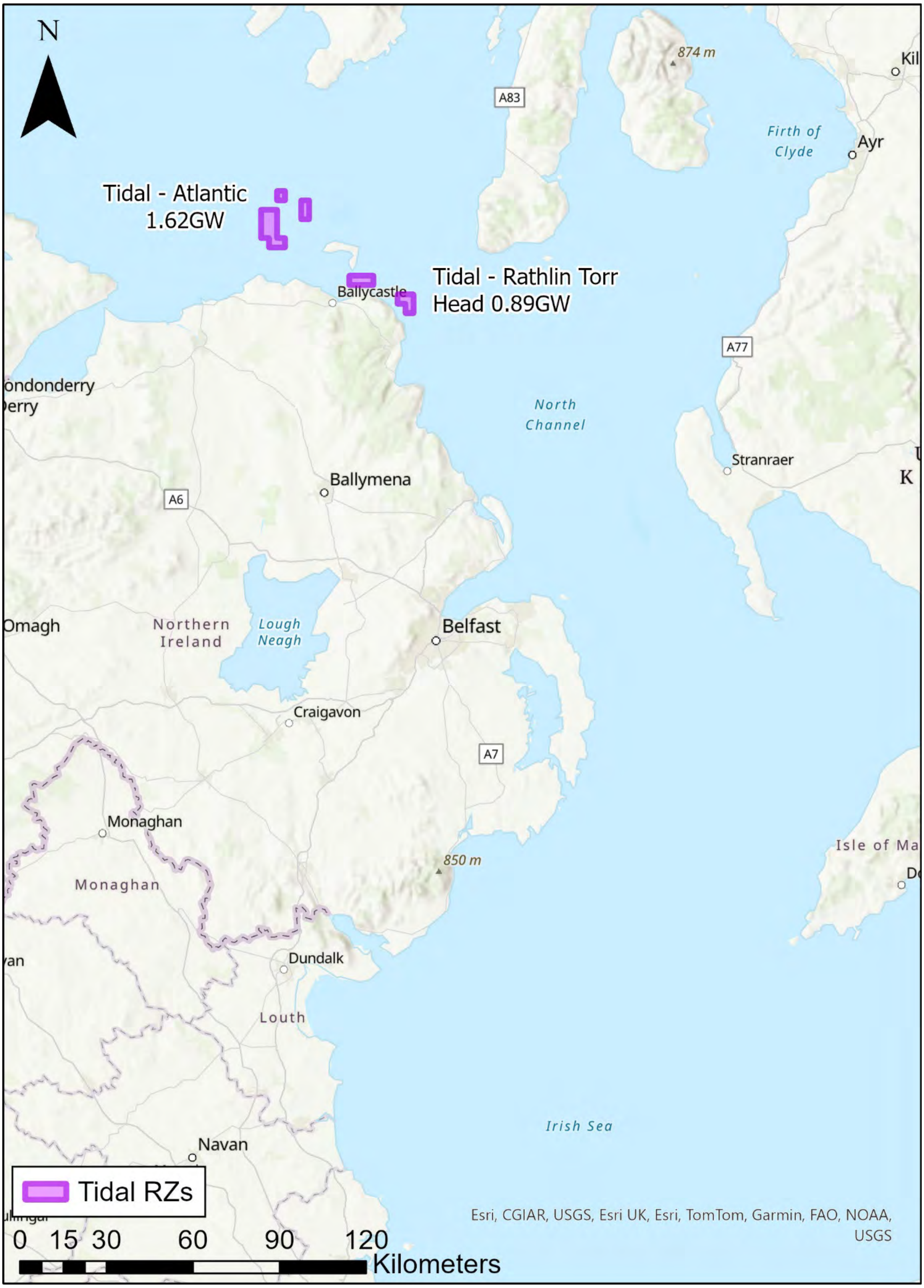


Figure 9-3 Technically Suitable RZs for tidal stream energy

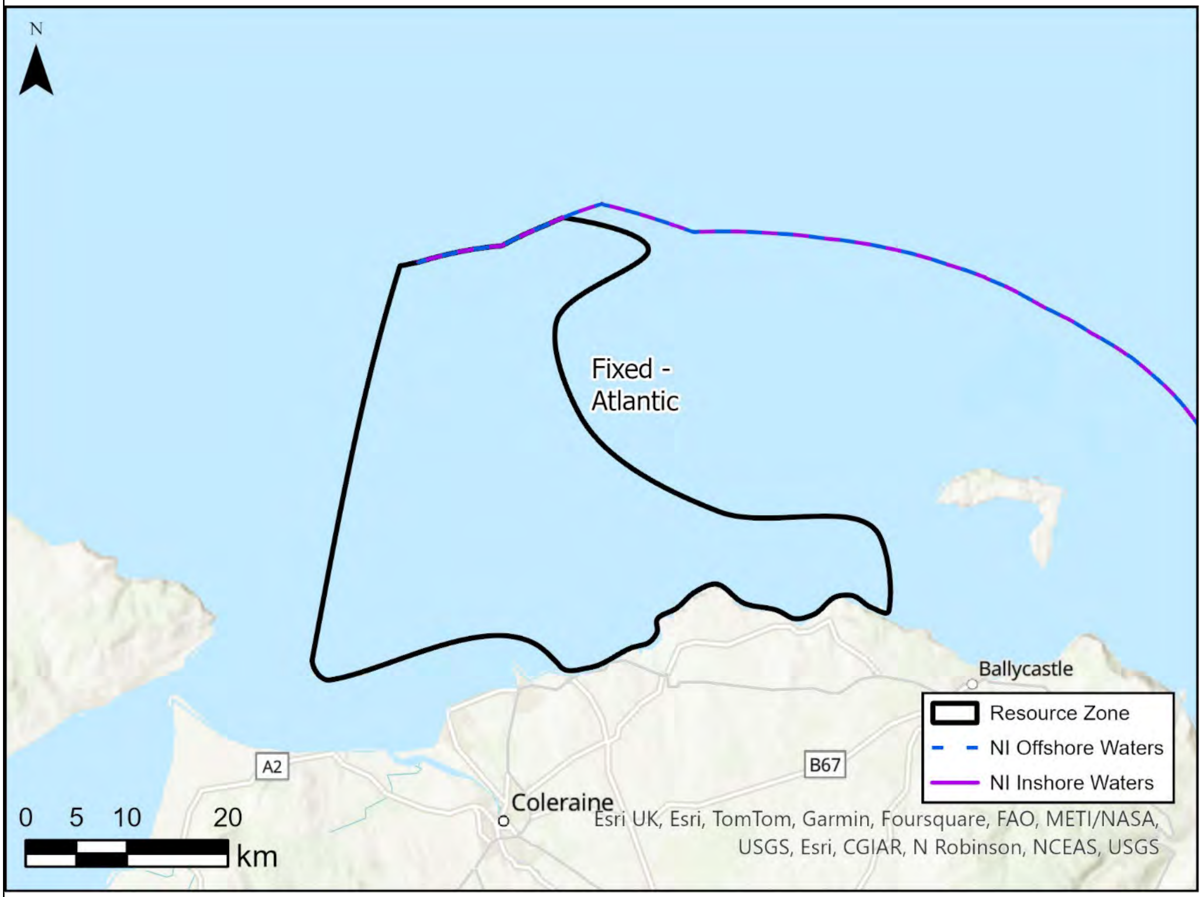
9.2 Screening, Refinement and Assessment of Potential Resource Zones

A constraints screening of the Technically Suitable RZs for development of each ORE technology type (fixed wind, floating wind and tidal) has initially been undertaken, to identify areas of higher risk, informed by key constraints and sensitivities data (**Appendix C**). Where it is not considered possible to spatially refine these RZs to avoid key areas of constraint or sensitivity, it has been recommended to ‘screen out’ the RZ from further consideration in the plan development process. Where areas of a Technically Suitable RZ are considered to be of higher risk, these have been refined to avoid areas of greatest potential for significant environmental risk based on key constraints and sensitivities to produce recommended RZs.

An assessment has then been undertaken of the recommended RZs for fixed wind, floating wind, and tidal energy, informed by wider constraints and sensitivities data (**Appendix D**). This appraisal includes a description of the baseline environment and key issues within the recommended RZ, and an assessment in the short, medium, and long-term for likely effects, the significance of the effects, and whether they are positive or negative effects. Other impacts that are assessed for significance are secondary effects, cumulative effects, synergistic effects, temporary and permanent effects, and the inter-relationship of effects. The options are scored against the SEOs given in **Table 6-3**. The scoring guidelines used for this assessment can be found in **Appendix F**. Following scoring of the option against these SEOs there is a wider commentary on potential impacts by environmental topic area, which is included as **Appendix G**.

Recommendations for further refinement are provided for RZs, where this may reduce the potential for significant effects on environmental indicators that have been identified. These recommendations will feed into the OREAP plan development process.

9.2.1 Fixed Wind Resource: Atlantic

Stage 1 - Fixed Wind Resource Zone - Atlantic
The Fixed Wind Atlantic RZ is located in the North Atlantic Ocean off the north coast of NI, approximately 200m offshore of Portballintrae and the Giant's Causeway. It encompasses an area of c.220km². The water depth of the RZ ranges from c.10m to c.80m. Whilst the average wind speeds range from c.9m/s to 10.27m/s. The predominant suitable TCE Technology Groups for the RZ include: - Technology Group 4A (Jacket Driven Low) - Technology Group 5A (Jacket 3D Low) - Technology Group 5B (Jacket 3D High) - Technology Group 7A (Jacket Socket Low) - Technology Group 7B (Jacket Socket High) The theoretical energy potential of this RZ is **1.10GW.**
Fixed Wind Resource Zone - Atlantic

Key Environmental Constraints and Sensitivities within the Resource Zone
Biodiversity, Flora and Fauna – Skerries and Causeway SAC is within the RZ. There are known areas of Annex I Sandbank and Reef habitats, and areas identified by TCE as being of High to Very High MPA Risk to Breeding Birds, Non-Breeding birds, Marine Mammals, and Habitats.

Population and Human Health – The RZ is in close proximity to the shoreline of the north coast (approximately 300m). The Portrush Whiterocks Bathing Water Site is within the RZ.

Geology, Soils and Land Use - There are areas of offshore rock within the RZ.

Water – The Portrush Whiterocks, Portrush Curran (East Strand), Portrush Mill (West Strand), and Magillian Downhill Bathing Water Sites are within the RZ.

Air – There are no key sensitivities within the RZ.

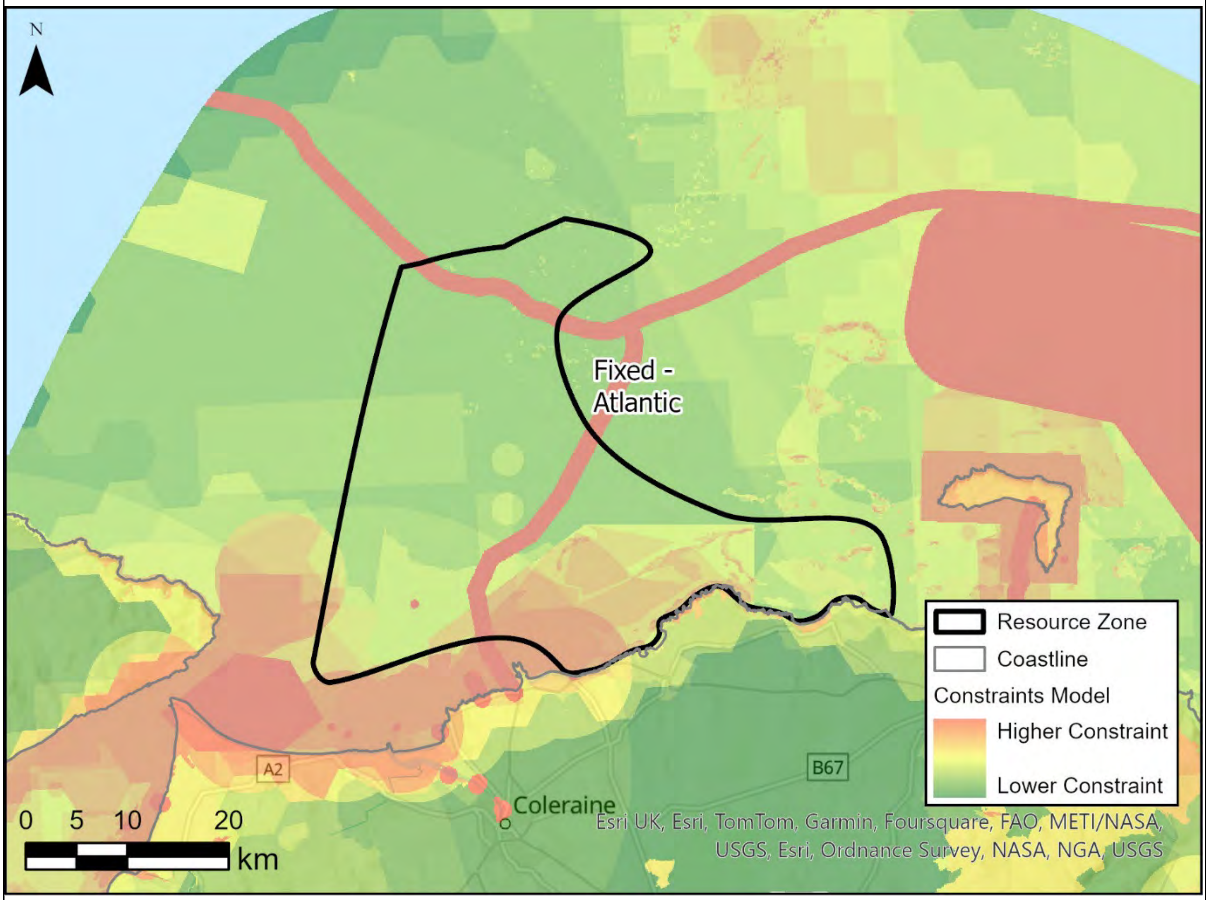
Climatic Factors – There are no key sensitivities within the RZ.

Material Assets – There is a telecommunication cable (Hibernia 'A' (including the NI Branch)) within the RZ. There are MPA Exempted Areas for fishing, Nephrops spawning and nursery grounds, and moderate (>70th percentile) fishing activity in the inshore area of the RZ. There two Military Practice Areas within the RZ, namely Skerries (X5537) and Rathlin (X5536). Three Aviation Safeguarding Zones (OLS) are within the RZ associated with City of Derry Airport, Ballarena Airfield and Castlerock Airstrip, respectively.

Cultural, Architectural and Archaeological Heritage – There is a protected wreck, and further unprotected wrecks within the RZ.

Landscape, Seascape and Visual Amenity - The RZ is in close proximity to the shoreline of the north coast (approximately 300m). It is offshore of the Causeway Coast and Binevenagh AONBs, and the Giants Causeway WHS, which are sensitive visual receptors.

Fixed Wind Resource Zone – Atlantic

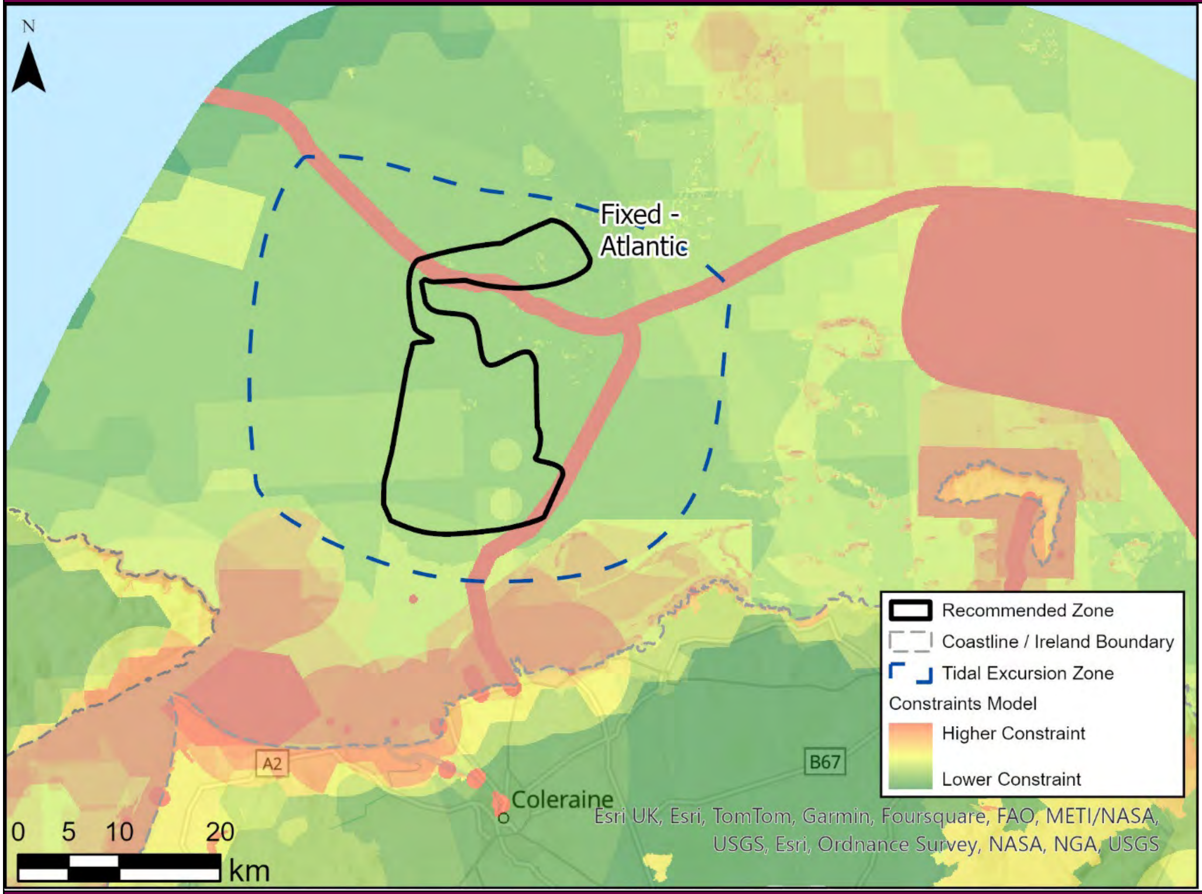


Stage 2 - Recommended Fixed Wind Resource Zone – Atlantic

To avoid the potential for direct impacts on identified key sensitivities within the Fixed Atlantic RZ, it was refined through the exclusion of the inshore area that was located within the Skerries and Causeway SAC, designated Bathing Water sites, and the closest areas to shore to limit effects on sensitive landscapes. Incidentally, this also avoided areas of Annex I habitat, a protected wreck and other unprotected wrecks.

The theoretical energy potential of the Stage 2 recommended Atlantic RZ is **0.43GW.**

Recommended Fixed Wind Resource Zone - Atlantic and Combined Constraints Model



Environmental Baseline and Key Issues within the Recommended RZ

Environmental baseline information relevant to this recommended RZ is given below, ordered by SEA environmental topic. These sensitivities and indicators have the potential to be impacted by and impact upon the development and/or operation of offshore fixed wind.

Biodiversity, Flora and Fauna

There are no designated sites (SACs, SPAs, Ramsar sites, MCZs, ASSIs) within the recommended RZ. Skerries and Causeway SAC, designated for Reef and Sandbank habitats and for Harbour porpoise, is situated c.1.5km inshore of the recommended RZ, and is within the tidal excursion zone. TCE High MPA risk areas for Breeding Birds and Marine Mammals are within the recommended RZ, while a Very High MPA risk area for Annex I habitats (owing to the proximity to Skerries and Causeway SAC), and a Moderate MPA risk area for Fish, are within the very south-easterly extent of the recommended RZ.

There are known areas of Annex I Reef habitat in the north of the recommended RZ, and within the tidal excursion zone to the south-east and east. The seabed habitats within the recommended RZ predominantly consist of coarse substrate, with a small area of sand.

Protected species (Wildlife Order) that have been recorded within the recommended RZ include the fan mussel, harbour porpoise, minke whale, short-beaked common dolphin, and basking shark. NI Priority Species that have been recorded include the starfish: purple sunstar; molluscs: horse mussel, ocean quahog and fan mussel; marine mammals: harbour porpoise, minke whale and short-beaked common dolphin; sea squirt *Pyura microcosmus*; and fish: spiny dogfish and basking shark. Priority Marine Features (PMFs) recorded within the recommended RZ include the starfish red cushion star and purple sunstar; molluscs: great scallop, queen scallop, ocean quahog, and fan mussel; sea slug *Embletonia pulchra*; marine mammals: harbour porpoise and short-beaked common dolphin; and fish: cuckoo ray, spotted ray, sole, anglerfish, thornback ray, small-spotted catshark, plaice, and spiny dogfish. There are also OSPAR records of the following mammals: harbour porpoise; invertebrate: ocean quahog; and fish: spotted ray, thornback ray, spiny dogfish, and basking shark.

There are areas of SCANs recorded relatively high density (>90th percentile) for white-beaked dolphin, pilot whale, and bottlenose dolphin, and areas of relatively moderate density (>70th percentile) for fin whale, pilot whale, and bottlenose dolphin. MU data also indicates that the cetaceans white-sided dolphin, white-beaked dolphin, Risso's dolphin, minke whale, harbour porpoise, common dolphin, and bottlenose dolphin may occur within the area. There are also areas of relatively moderate density for harbour seal within the recommended RZ.

There are areas of recorded relatively high and moderate density for seabirds at sea in the northerly part of the recommended RZ.

The entirety of the recommended RZ is encompassed within known sprat and herring spawning grounds, while there are Nephrops spawning and nursery grounds to the north-east of the recommended RZ, within the tidal excursion zone. There are fish nursery grounds for spurdog, whiting, anglerfish, blue whiting, cod, common skate, hake, herring, ling and mackerel within the recommended RZ and tidal excursion zone. There is a surveyed area for queen scallops of relatively low recorded density within the recommended RZ, and there are areas of moderate to high surveyed density for scallops, particularly in the north-east. There is a restricted fishing area for Scallops under the Conservation of Scallops Regulations.

There are records of invasive species in the south of the recommended RZ, including the polychaete *Goniadella gracilis* and the bryozoan *Bugula stolonifera*.

Population and Human Health

The recommended RZ is located offshore of the settlements of Portrush, Portstewart, Portballintrae, Castlerock and Coleraine. The inshore boundary of the recommended RZ is located approximately 7.6km, 10km and 13.6km to the north of Portrush, Portstewart and Coleraine, respectively. The inshore boundary of the recommended RZ also lies c.9.5km north-west of Portballintrae and c.13.2km north-east of Castlerock.

The recommended RZ is located offshore of the Castlerock, Magilligan Benone, Magilligan Downhill, Portrush Curran (East Strand), Portrush Mill (West Strand), Portrush Whiterocks and Portstewart Bathing Water sites, and the Benone, Castlerock, Downhill, Portrush East Strand, Portrush West Strand, Portstewart Strand and Whiterocks Blue Flag Beaches. However, none of these sites are located within the recommended RZ or tidal excursion zone.

Within the wider area there are areas of relatively high intensity RYA leisure boating activity within Lough Foyle, around Rathlin Island and from small craft travelling between these two areas. Within the recommended RZ there is relatively low vessel traffic intensity due to transient vessel traffic.

There are no known dive sites within the recommended RZ or tidal excursion zone.

Geology, Soils and Land Use

There are no WHSs, ASSIs, MCZs or UNESCO Geoparks designated for geological or geomorphological features within the recommended RZ or the tidal excursion zone. The recommended RZ is located c.8.5km from NI's only WHS of the Giant's Causeway and Causeway Coast.

The main seabed geology within the recommended RZ is British Geological Survey (BGS) Quaternary Undifferentiated rock, with areas of thickness between 5-50m. The main seabed sediments consist of coarse substrate and shallow circalittoral biozones of typically moderate energy. Some areas of deep circalittoral biozones are present, with one area of sand substrate. There are known areas of Annex I reef habitat in the north of the recommended RZ and within the tidal excursion zone to the south-east and east.

Two spoil dumping grounds are present within the recommended RZ towards the south-east of the area: Portstewart Bay B (silt and sand material of OSPAR code MA545), and Coleraine (material of OSPAR code MA540), both of which are not currently in use. There are no areas of explosives dumping grounds or MoD firing/danger areas within the recommended RZ.

TCE expected technology groups for the installation of fixed-bottom wind turbines within the recommended RZ are predominantly technology groups 2A (Monopile foundation structure, with driven piles and low ground risk) and 3B (Monopile foundation structure, with 3D complex piles and high ground risk), with some areas of the recommended RZ where technology groups 5A (Jacket foundation structure, with 3D piles and low ground risk), 5B (Jacket foundation structure, with driven piles and high ground risk), 6B (Monopile foundation structure, with socket installation on high ground risk), 7B (Jacket foundation structure, with socket installation and high ground risk), 1 (Jacket foundation structure, with suction installation) and 7A (Jacket foundation structure, with socket installation and low ground risk) may be appropriate.

Water

The water depths within the recommended RZ range from c.60-77m. Tidal speeds within the recommended RZ range from 1.00-1.25m/s.

Two spoil dumping grounds are present within the recommended RZ towards the south-east of the area: Portstewart Bay B (silt and sand material of OSPAR code MA545), and Coleraine (material of OSPAR code MA540), both of which are not currently in use. There are no areas of explosives dumping grounds or MoD firing/danger areas within the recommended RZ.

There are no WFD Shellfish Water or Bathing Water Protected Areas, or WFD coastal or transitional water bodies within the recommended RZ or tidal excursion zone.

The recommended RZ is located within the Celtic Seas sub-region for the MS (covering waters to the West of the UK and shared with Ireland and France).

Air

There are no known air quality issues within the recommended RZ, as there are no significant anthropogenic sources of air pollution in the vicinity. The recommended RZ is located offshore of the settlements of Portrush, Portstewart, Portballintrae, Castlerock and Coleraine. The inshore boundary of the recommended RZ is located approximately 7.6km, 10km and 13.6km north of Portrush, Portstewart and Coleraine, respectively. The inshore boundary of the recommended RZ also lies c.9.5km north-west of Portballintrae, and c.13.2km north-east of Castlerock.

There are areas of relatively high intensity RYA leisure boating activity within Lough Foyle and around Rathlin Island and from small craft travelling between these two areas. Within the recommended RZ there is relatively low vessel traffic intensity which may cause some minor, localised, air emissions.

Climatic Factors

There are no known blue carbon habitats (Annex I Saltmarsh, Annex I Maerl, Shellfish Waters, Subtidal and Intertidal Seagrass) within the recommended RZ. There are areas in the north of the recommended RZ that have been identified by Ulster Wildlife as areas of low potential for blue carbon importance. There are unlikely to be any sources of GHG emissions in the area, apart from vessels.

Material Assets

A c.0.56km length of one operational telecommunication cable, is within the recommended RZ; this is the Hibernia 'A' (including the NI Branch), a transatlantic cable connecting Europe and the USA. There are no pipelines or power cables within the recommended RZ.

There is, generally, a low shipping density within the recommended RZ. However, there is an area of relatively higher shipping density (>50th percentile for the SEA Study Area) in the south-west of the recommended RZ, possibly associated with vessels approaching Portrush Harbour, or cargo vessels and fishing vessels approaching Foyle Port. There are no TSSs within the recommended RZ, with the closest being located c.21km to the east. There are also no Harbour Areas or Ports within the recommended RZ.

The recommended RZ is used by commercial fisheries, however, there are no areas of relatively high (>90th percentile) or moderate (>70th percentile) fishing activity within the recommended RZ. Fleets which are known to operate within the recommended RZ include the scallop and pot fleets. Key fishing areas for king and queen scallops cover a large area of the recommended RZ, within which mobile fishing gear is used. There are relatively important herring stocks in the region, as well as recorded landings of commercial species such as herring, hake and monkfish/anglerfish at Foyle Port, located to the south-west of the recommended RZ in Lough Foyle. There are no marine fish farms or aquaculture sites within the recommended RZ. There is a known area of importance for inshore pot fisheries located to the south-east of the recommended RZ, within the tidal excursion zone. The entirety of the recommended RZ is encompassed within known sprat and herring spawning grounds, while there are Nephrops spawning and nursery grounds to the north-east of the recommended RZ, within the tidal excursion zone. There are fish nursery grounds for spurdog, whiting, anglerfish, blue whiting, cod, common skate, hake, herring, ling and mackerel within the recommended RZ and tidal excursion zone. Scallops are known to be present throughout the recommended RZ, with an area of relatively moderate to high surveyed density of scallops in the north-east, whilst queen scallops are found at a relatively low surveyed density throughout the recommended RZ. There is a restricted fishing area for scallops under the Conservation of Scallops Regulations within the recommended RZ.

The recommended RZ is used by the MoD, with nearly the entirety of the recommended RZ (c.82.6km^2) located within the Skerries Military Practice Area (X5537). This is utilised as a submarine exercise area and a surface fleet practice and exercise area. There are, however, no MoD danger areas within the recommended RZ.

The south-west of the recommended RZ is within an area (c.3km^2) of an aviation safeguarding zone (15km OLS) associated with Castlerock Airstrip, which is located c.14.5km to the south.

There are two spoil dumping grounds located within the south-east of the recommended RZ, neither of which are currently operational as discussed in the Geology, Soils and Land Use baseline.

The north coast of NI has a developed tourist infrastructure that includes a number of coastal attractions that are within the modelled viewshed for fixed wind turbines within the recommended RZ, including the Dunluce Castle ruins, located 16km to the south-east near Portballintrae. Potential tourist activities within the recommended RZ include boat tours, water sports, sailing and fishing, whilst significant long-distance walking routes such as the Causeway Coast Way within AONBs or National Parks, which offer significant attraction for tourism, are also located within the modelled viewshed for fixed wind turbines within the recommended RZ. Further information on landscape designations that may act as tourist attractions within the modelled viewshed of the area is provided in the Landscape, Seascape and Visual Amenity baseline.

The recommended RZ has a potential capacity of 0.43GW.

Cultural, Architectural and Archaeological Heritage

There are no protected wrecks within the recommended RZ. There is one recorded wreck within the recommended RZ, and four additional wrecks within the tidal excursion zone. The recommended RZ is situated between c.7.2km and c.22km distance from the coastline. The Giant's Causeway and Causeway Coast WHS is situated inshore of the recommended RZ and is within the modelled viewshed (based on a turbine height of 165m and a viewable distance of 40km). There are also 503 Listed Buildings, 336 Defence Heritage Record sites, 1053 Scheduled Monuments, 137 Scheduled Zones, and 20 Parks and Gardens (including Downhill, Cromore, Dunluce Castle, Dundarave) within the modelled viewshed.

Landscape, Seascape and Visual Amenity

The recommended RZ is situated between c.7.2km and c.22km distance from the coastline. There are 39 settlements situated inshore of the recommended RZ, which are within the modelled viewshed (based on a turbine height of 165m and a viewable distance of 40km). These include Portstewart, Portrush, Castlerock, Coleraine, Bushmills, Portballintrae, and Ballycastle.

There are three AONBs situated inshore of the recommended RZ, which are within the modelled viewshed; these are Causeway Coast AONB, Antrim Coast and Glens AONB, and Binevenagh AONB. The Giant's Causeway and Causeway Coast WHS is also situated inshore of the recommended RZ and within the modelled viewshed, as are 11 National Trust Lands (Avish, Barmouth Grangemore and Portstewart, Carrick a Rede, Cushleake Mountain, Downhill, Dunseverick, Fairhead and Murlough Bay, Giants Causeway, Hezlett House, Rathlin Island, and Whitepark Bay). There are also Areas of Especially High Scenic Amenity and High Scenic Amenity in County Donegal that are within the modelled viewshed.

The recommended RZ is within the Atlantic NI RSCA and the Republic of Ireland SCA of North Donegal Atlantic Headlands, Loughs and Beaches, and is immediately offshore of The Skerries and Dunluce Coast RSCA.

Environmental Assessment	Short-term	Medium-term	Long-term
Biodiversity, Flora and Fauna (BFF)	-3	-3	-3
Population and Human Health (PHH)	-1	0	0
Geology, Soils and Land Use (GSL)	-2	-2	-2
Water (W)	-2	-2	-1
Air (A)	0	+1	+1
Climatic Factors (CF)	-1	+1	+1
Material Assets and Infrastructure (MA)	-2	-2 / +1	-2 / +1
Cultural, Architectural and Archaeological Heritage (CH)	-3	-3	-3
Landscape / Seascape and Visual Amenity (L)	-3	-3	-3

Key Conclusions

Biodiversity, Flora and Fauna – There is potential for significant adverse effects on Biodiversity, Flora and Fauna in the short-term construction (and decommissioning) phase, and the medium to long-term operational phase (-3), owing to the proximity to Skerries and Causeway SAC within the tidal excursion zone, and the TCE Very High MPA risk area for Annex I habitats. There is also potential for moderate adverse effects in the short-term construction and decommissioning phases, and the medium to long-term operational phase (-2) for benthic habitats and species, fish and shellfish, marine mammals and birds, as there are TCE High MPA risk areas for marine mammals and breeding birds and Moderate risk areas for fish, recorded fish spawning and nursery grounds, areas of recorded relatively high and moderate density for marine mammals and seabirds at sea, and recorded presence of NI Protected and Priority species, within the recommended RZ.

Population and Human Health – There is potential for slight adverse temporary, direct and indirect, effects on leisure and recreational marine users due to an increased collision risk, access restrictions and displacement, or water quality effects, during the construction and decommissioning phases (-1). The potential for adverse direct or indirect effects on these users in the medium to long-term during the operational phase is likely to be negligible, as there is relatively low recreational boating use within the recommended RZ (0).

Geology, Soils and Land Use – There is potential for moderate adverse effects on Geology, Soils and Land use in the short-term construction and decommissioning phases, due to the potential to encounter complex geology requiring relatively complex installation technologies with potential for moderate adverse direct long-term permanent effects on the seabed geology and sediments through loss (-2). There is also potential for moderate direct temporary to permanent impacts on Annex I Reef habitats due to loss or damage during the construction and decommissioning phases (-2). Following the installation of fixed wind technologies there is potential for medium-term operational phase localised impacts on erosion and deposition patterns due to the presence of devices (-2). There is potential for influence on the MS Descriptor 6 sea floor integrity from the installation processes of fixed wind technologies in the recommended RZ, however, there is not anticipated to be potential for adverse effects on the achievement of GES. There is also potential for moderate adverse indirect short to medium-term effects in the construction and decommissioning phases due to the presence of two spoil dumping grounds within the recommended RZ, with the potential for mobilisation of contaminants to affect the seabed within the tidal excursion zone (-2). Generally, there is potential for direct short-term temporary sediment loss in the vicinity of the construction works during seabed preparation activities, construction and decommissioning activities (-1), and medium to long-term loss within the footprint of foundations and scour protection during device operation (-2).

Water – There is potential for moderate adverse effects on water quality in the short-term construction and decommissioning phases due to the presence of two spoil dumping grounds within the recommended RZ (-2). There is also potential for slight short-term effects on water quality elements that are considered by the MS (e.g., Descriptor 9 Concentrations of contaminants in fish and other seafood; Descriptor 8: Concentration of contaminants within marine environment; Descriptor 10 marine litter) during seabed preparation, construction, maintenance and decommissioning activities (-1), there is not anticipated to be potential for adverse effects on the achievement of GES with the application of standard best practice mitigation.

Air – There is potential for slight positive indirect effects on regional air quality in the medium to long-term operational phase, as the operation of renewable energy devices can support a transition away from fossil fuel use and its associated air emissions, with potential for a relatively low capacity in the recommended RZ (+1).

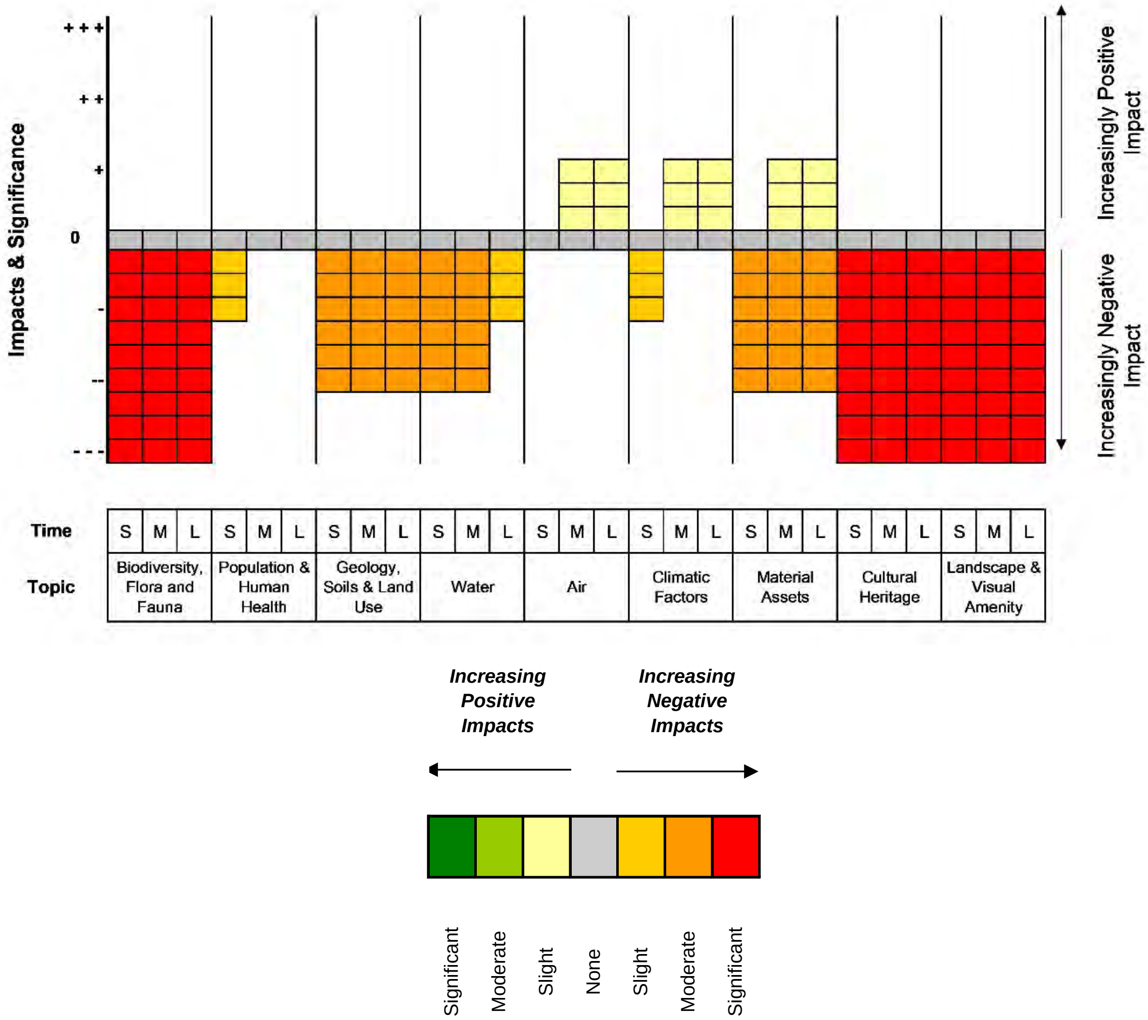
Climatic Factors – There is potential for slight adverse short-term effects on sediment carbon storage, due to a localised release of CO_2 from seabed disturbance during the construction and decommissioning phases (-1). There is potential for slight adverse, short-term, temporary effects on localised GHG concentrations, due to GHG emissions from vessels and machinery during the construction and decommissioning phases (-1), which should be minimised at the project level through adherence to standard best practise for the minimisation of air pollution, as set out in **Section 10.1**. There is potential for slight positive, medium to long-term effects during the operational phase, as the operation of renewable energy devices can contribute to a net reduction in GHG emissions, decarbonisation of the energy sector, diversification of electricity supply and energy security, and meeting of energy objectives and climate change emission reduction targets, with potential for a relatively low capacity in the recommended RZ (+1).

Material Assets – Overall, there is potential for moderate negative adverse effects in the short, medium and long-term on Material Assets (-2), following the consideration of best practice mitigation measures (**Section 10.1)**, mainly attributed to the potential for moderate adverse effects on Commercial Fisheries. Although the recommended RZ has relatively low fishing intensity and areas used by inshore fisheries, there is potential for moderate indirect effects on the profitability of commercial fishing in the short, medium, and long-term (-2), such as the potential for reduced quotas, increased resource competition for fishing, and reduced landings in both tonnage and economic value. This is owing to the combination of potential moderate adverse effects including: potential displacement from shipping grounds in the short, medium and long-term; potential for increased collision risk associated with the presence of construction or decommissioning vessels (short-term), and the presence of maintenance vessels and displacement from fishing grounds (medium to long-term); as well as effects on commercial fish species and their key habitats due to direct loss of supporting habitats, and indirect effects due to sediment mobilisation, which could indirectly affect fishing activity through an alteration of commercial fish stocks. There is potential for a slight positive effect in terms of the generation of a new renewable energy supply for the NI population in the medium to long term, as the recommended RZ has a potential capacity of 0.43GW (+1).

Cultural, Architectural and Archaeological Heritage – There is potential for significant adverse effects on Cultural Heritage in the short-term construction and decommissioning phases, and the medium to long-term operational phase (-3) owing to the very high sensitivity of coastal heritage receptors whose setting may be affected, including the Giant's Causeway and Causeway Coast WHS.

Landscape and Visual Amenity – There is potential for significant adverse effects on Landscape, Seascape and Visual Amenity in the short-term construction and decommissioning phases, and the medium to long-term operational phase (-3) owing to the distance of the recommended RZ offshore and the very high sensitivity of the landscape areas that may be affected, including the Giant's Causeway and Causeway Coast WHS, Causeway Coast AONB, Antrim Coast and Glens AONB and Binevenagh AONB, as well as a moderate population that may be affected by changes in visual amenity.

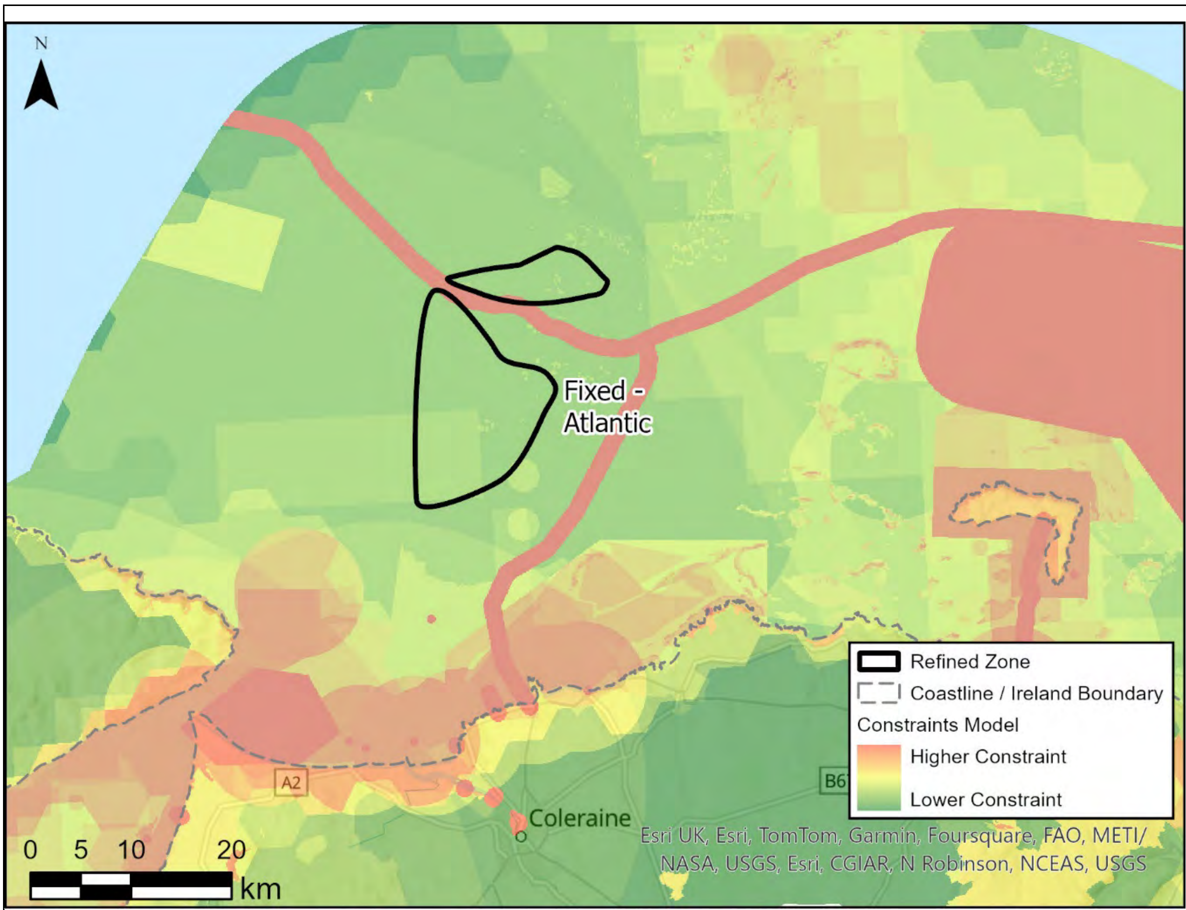
Summary Chart of Potential Effects



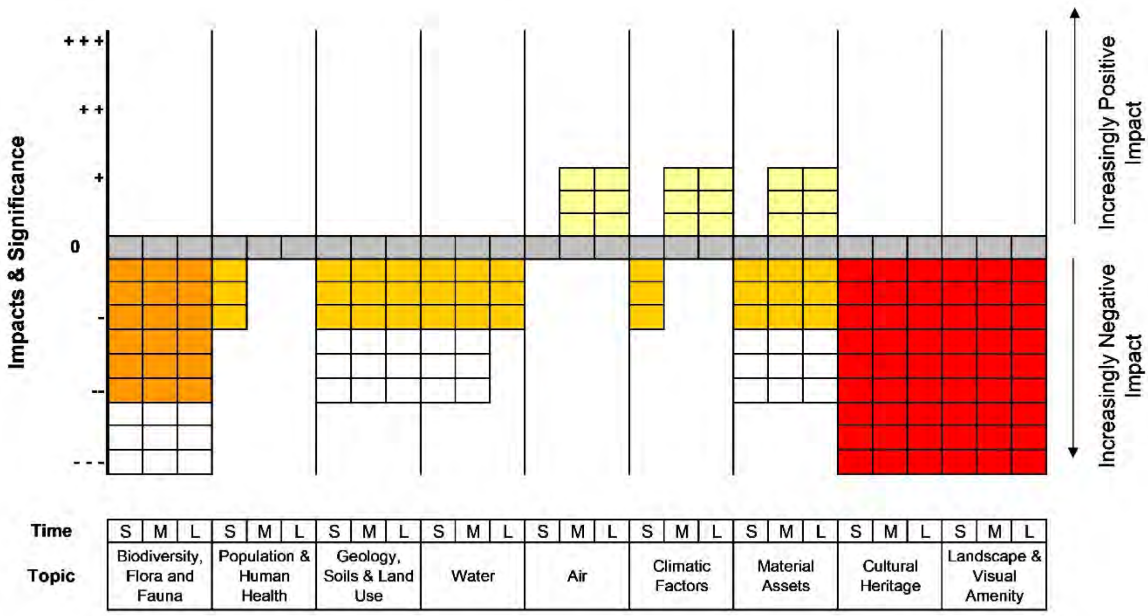
Stage 3 - Recommendations for Further Refinement

Further refinement of the Fixed Atlantic RZ is recommended to exclude the inshore area, to avoid Skerries and Causeway SAC being within the tidal excursion zone, and to avoid the TCE Very High MPA risk area associated with this site, which can reduce the overall score for Biodiversity, Flora, and Fauna to -2. This also avoids the closest areas to shore (within 13km), reducing the potential for significant visual effects, including on landscape designations and the setting of coastal heritage receptors, however the score for Cultural Heritage and Landscape, Seascape and Visual Amenity remains as -3 owing to the very high sensitivity of the landscape and heritage receptors (WHS, AONBs) that may still be adversely affected. Further refinement is also recommended to avoid the active disposal area in the south-east, the OLS associated with Castlerock Airstrip in the south-west, and a 500m safety zone around the Hibernia A cable, thereby reducing the potential for adverse effects on Material Assets and, in the case if the disposal area, on Geology, Soils and Land use, and Water.

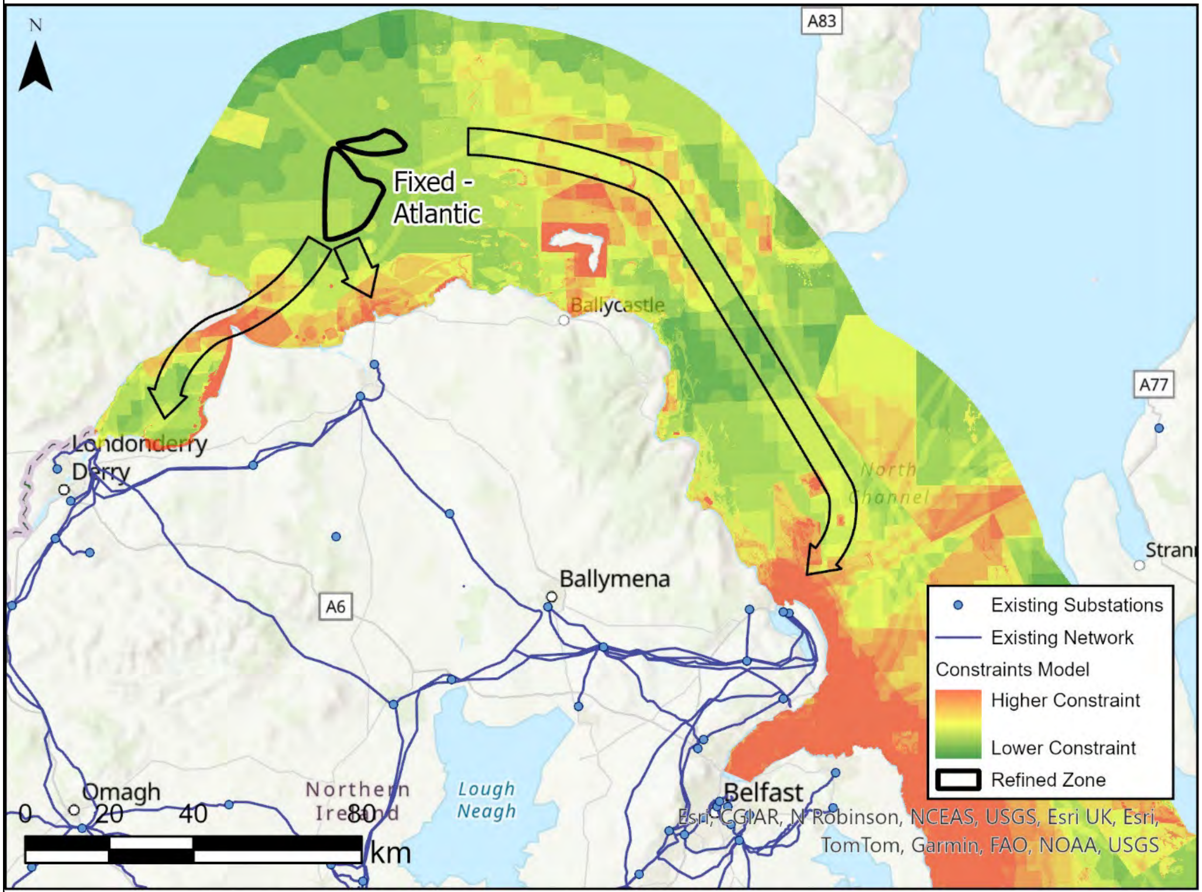
The theoretical energy potential of the refined Fixed Atlantic RZ is 0.26GW.



Comparative Chart



Potential Export Cable Routes



Connection into Larne area. 275kV/110kV existing network. Length approx. 101km. Significant likely constraints include the East Coast Marine pSPA, telecommunication cables, Brown's Bay Bathing Water Site, Portmuck Bathing Water Site, Offshore Rock, Annex I Reef, North Channel TSS and Port Lands around Larne. There are several designated sites within the vicinity including the North Channel SAC, The Maidens SAC, Rathlin Island SAC/SPA/IBA, Larne Lough SPA/Ramsar/IBA, Rathlin MCZ, and Portmuck ASSI, however these can all potentially be avoided.
Connection into Coleraine area. 110kV existing network. Length approx. 18km. Significant likely constraints include areas of Annex I Sandbanks. Other constraints which can potentially be avoided include protected wrecks, cliffs over 15m, urban areas, and environmental designations including Bann Estuary SAC, Skerries and Causeway SAC, Bann Estuary ASSI, Portrush West Strand ASSI, Ramore Head, Skerries ASSI, Binevenagh AONB and Causeway Coast AONB.
Connection into Derry/Londonderry area. 275kV/110kV existing network Length approx. 43km. Significant likely constraints include the Lough Foyle and River Foyle IBA and Pilot Boarding Stations. Other constraints which can potentially be avoided include Magilligan SAC/ASSI, Lough Foyle SPA/Ramsar/ASSI, Binevenagh AONB, Magilligan Military Area, Urban Areas, Derry Airport / Ballarena Airfield and Lough Foyle RSPB Reserve.

9.2.2 Fixed Wind Resource Zone: Rathlin Torr Head

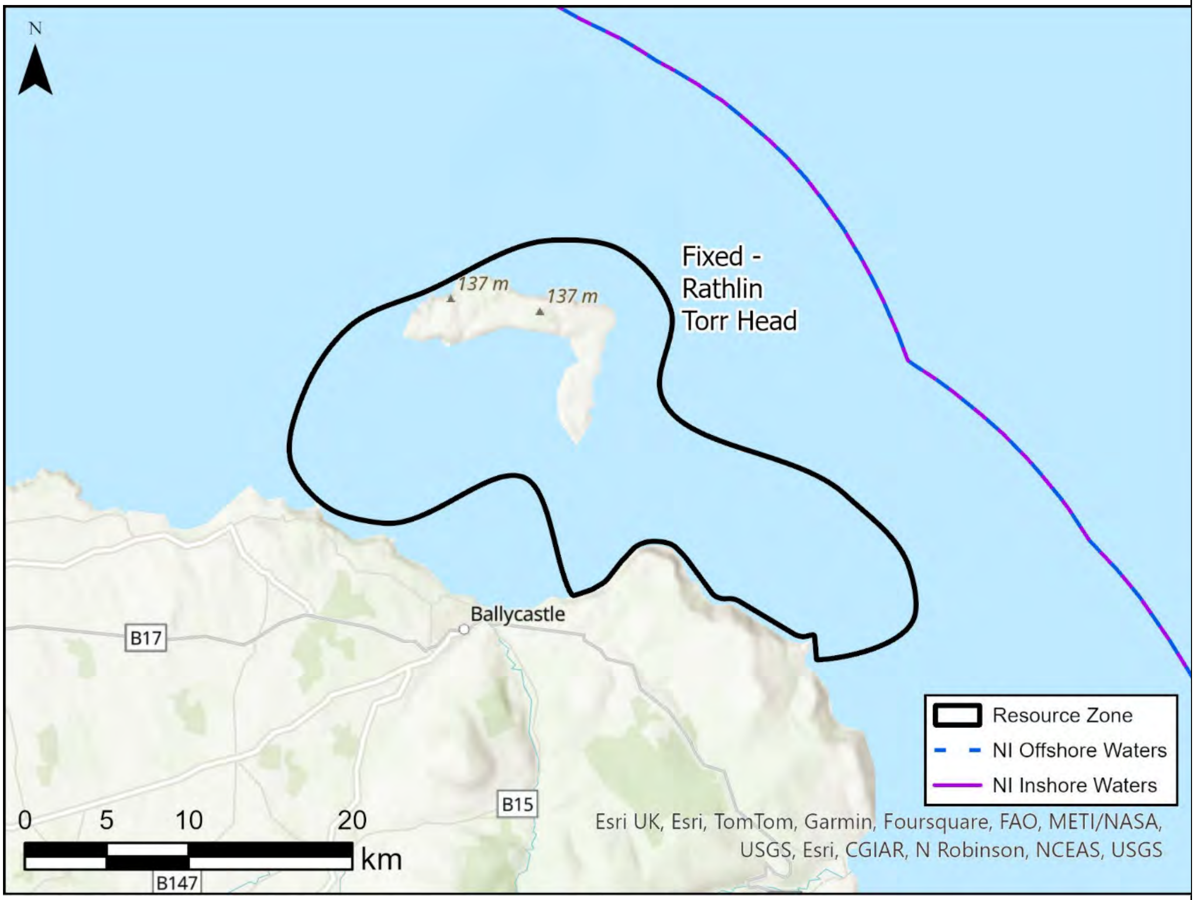
Stage 1 Fixed Wind Resource Zone – Rathlin Torr Head

The Fixed Wind Rathlin Torr Head RZ is located within Rathlin Sound off the north coast of NI. The RZ is located approximately 200m offshore of Rathlin Island and less than 100m off the coast of Fair Head, at its closest point. It encompasses an area of c.73km². The water depth of the RZ ranges from c.10m to c.80m. The average wind speeds range from c.9m/s to 9.85m/s. The predominant suitable TCE Technology Groups for the RZ include:

- Technology Group 3A (Monopile 3D Low)
- Technology Group 3B (Monopile 3D High)
- Technology Group 5B (Jacket 3D High)

The theoretical energy potential of this RZ is 0.37GW.

Fixed Wind Resource Zone – Rathlin Torr Head



Key Environmental Constraints and Sensitivities within the Resource Zone

Biodiversity, Flora and Fauna – Rathlin Island SAC, SPA and MCZ are within the RZ. There are known areas of Annex I Sandbank and Reef habitats, areas of known high density of harbour and grey seals, and areas identified by TCE as being of Moderate to Very High MPA Risk to Breeding Birds, Marine Mammals and Habitats, and High to Very High MCZ Risk to Birds within the RZ.

Population and Human Health – The RZ is in close proximity to the shoreline of the north coast (<100m).

Geology, Soils and Land Use - There are areas of offshore rock and steep sloping seabed within the RZ. There are also dumping grounds within the RZ.

Water – There are no key sensitivities within the RZ.

Air – There are no key sensitivities within the RZ.

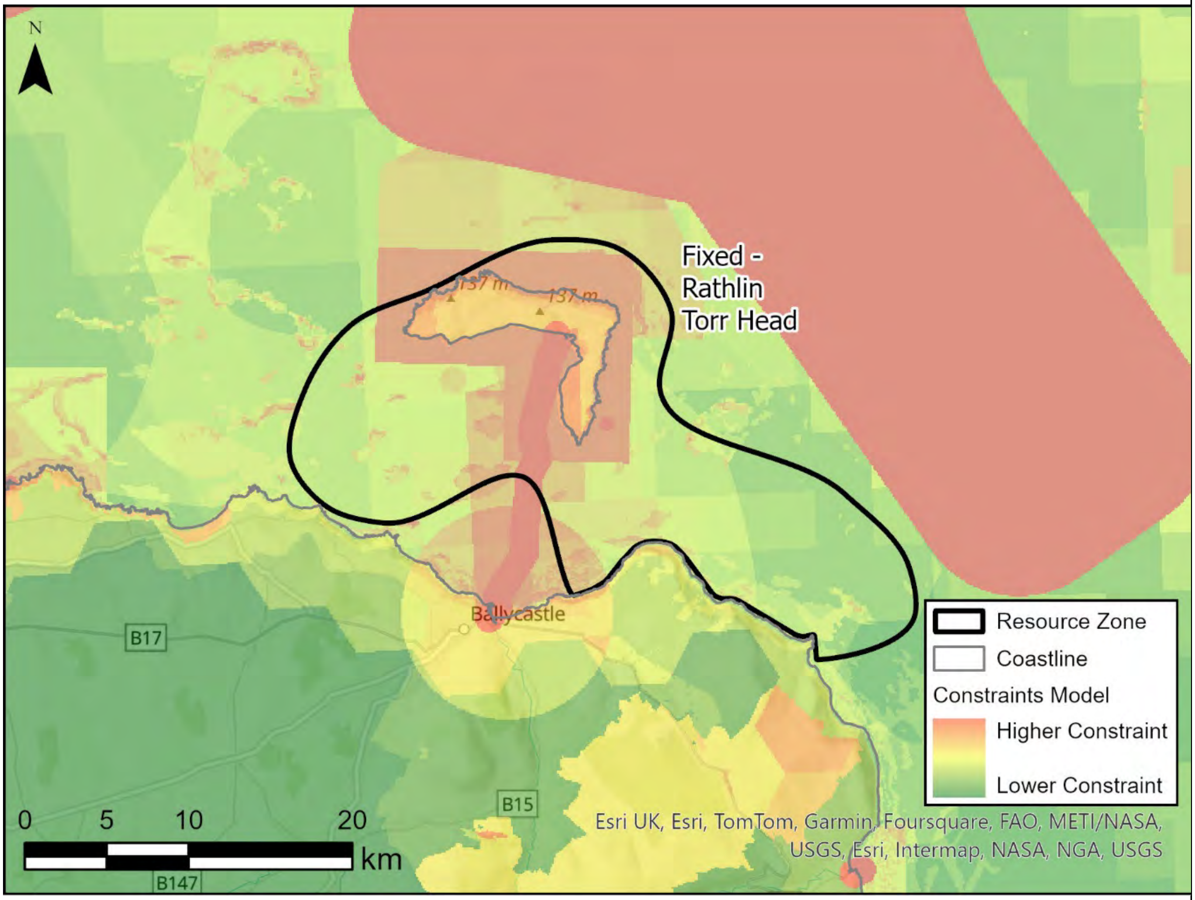
Climatic Factors - There are no key sensitivities within the RZ.

Material Assets – There are areas of high shipping density (>90th percentile) within the RZ. There are also dumping grounds and a power cable (Rathlin Interconnector) within the RZ.

Cultural, Architectural and Archaeological Heritage – There are protected wrecks within the RZ.

Landscape, Seascape and Visual Amenity - The RZ is in close proximity to the shoreline of the north coast, and is offshore of the Antrim Coast and Glens AONB, Causeway Coast AONB, and the Giants Causeway WHS, which are sensitive visual receptors.

Fixed Wind Resource Zone – Rathlin Torr Head and Combined Constraints Model



Resource Zone Refinement

Refinement of the RZ was not undertaken as the area is considered significantly constrained for fixed wind development. Areas of lower constraint within the RZ are unlikely to be sufficient for commercial development.

9.2.3 Fixed Wind Resource Zone: Ards Peninsula

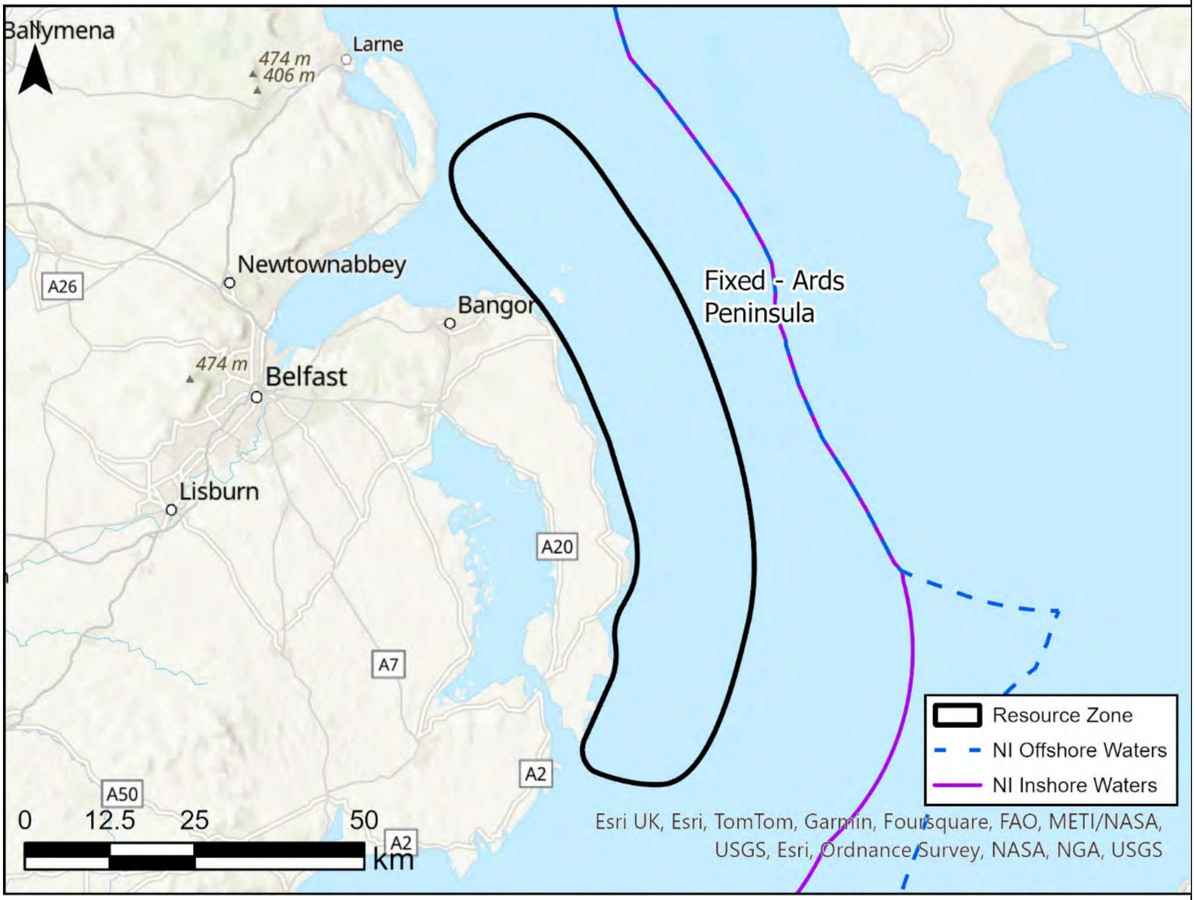
Stage 1 Fixed Wind Resource Zone – Ards Peninsula

The Fixed Wind Ards Peninsula RZ is located in the North Channel off the east coast of NI, approximately 215m offshore of the Ards Peninsula. It encompasses an area of c.367km². The water depth of the RZ ranges from c.10m to c.80m. The average wind speeds range from c.9m/s to 10.05m/s. The predominant suitable TCE Technology Groups for the RZ include:

- Technology Group 3B (Monopile 3D High)
- Technology Group 5B (Jacket 3D High)
- Technology Group 7B (Jacket Socket High)

The theoretical energy potential of this RZ is 1.84GW.

Fixed Wind Resource Zone – Ards Peninsula



Key Environmental Constraints and Sensitivities within the Resource Zone

Biodiversity, Flora and Fauna – The North Channel SAC, East Coast Marine pSPA, Outer Belfast Lough MCZ, and Strangford Lough MCZ are within the RZ. There are known areas of Annex I Sandbank and Reef habitats, known areas of high density for harbour seals and grey seals, and areas identified by TCE as being of High to Very High MPA Risk to Breeding Birds, Non-Breeding birds, Marine Mammals, and Habitats, and MCZ Risk for Sessile Species and Habitats. The Ballyquintin and Drumfad Bay Scallop Enhancement Areas are also within the RZ.

Population and Human Health – The RZ is in close proximity to the shoreline of the Ards Peninsula (approximately 1km). The Ballywalter, Groomsport and Millisle Bathing Water Sites, and Donaghadee Candidate Bathing Water Site, are within the RZ. There are areas of RYA high leisure density within the RZ.

Geology, Soils and Land Use - There are areas of offshore rock within the RZ.

Water - The Ballywalter, Groomsport, Donaghadee, Cloughey, Kilclief, and Millisle Bathing Water Sites, and Donaghadee Candidate Bathing Water Site, are within the RZ. There are also dumping grounds within the RZ.

Air – There are no key sensitivities within the RZ.

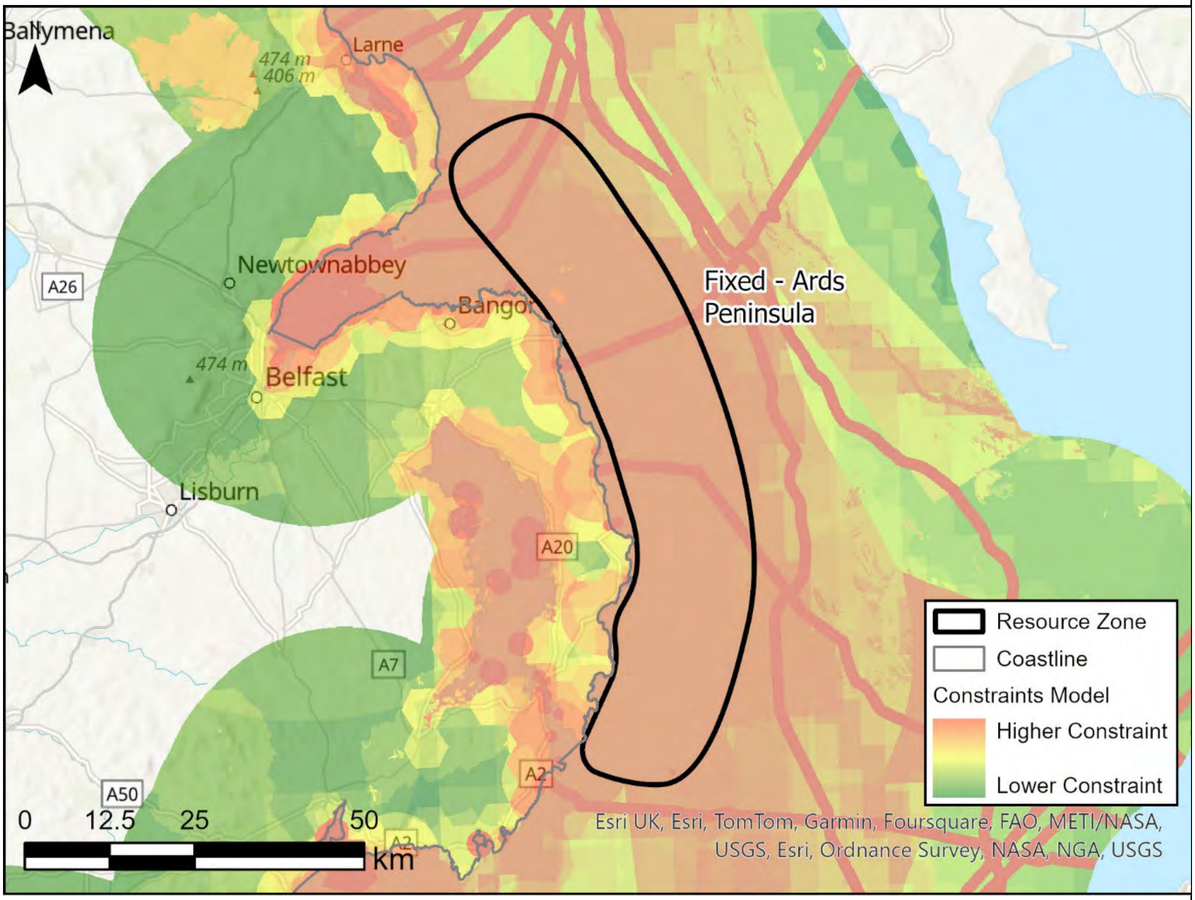
Climatic Factors – There are no key sensitivities within the RZ.

Material Assets – There are five telecommunication cables within the RZ (Lanis 2, Lanis 3, Sirius North, Scotland-NI 1 and Scotland-NI 2). Donaghadee Harbour and a Pilot Boarding Station are also within the RZ, as well as an area of high shipping density (>90th percentile).

Cultural, Architectural and Archaeological Heritage – There is a protected wreck, and there are unprotected wrecks, within the RZ.

Landscape, Seascape and Visual Amenity - The RZ is in close proximity to the shoreline of the Ards Peninsula (approximately 1km). It is offshore of the Strangford and Lecale AONB, which is a sensitive visual receptor.

Fixed Wind Resource Zone – Ards Peninsula and Combined Constraints Model



Resource Zone Refinement

Refinement of the RZ was not undertaken as the area is considered significantly constrained for fixed wind development.

9.2.4 Fixed Wind Resource Zone: Mourne Lecale

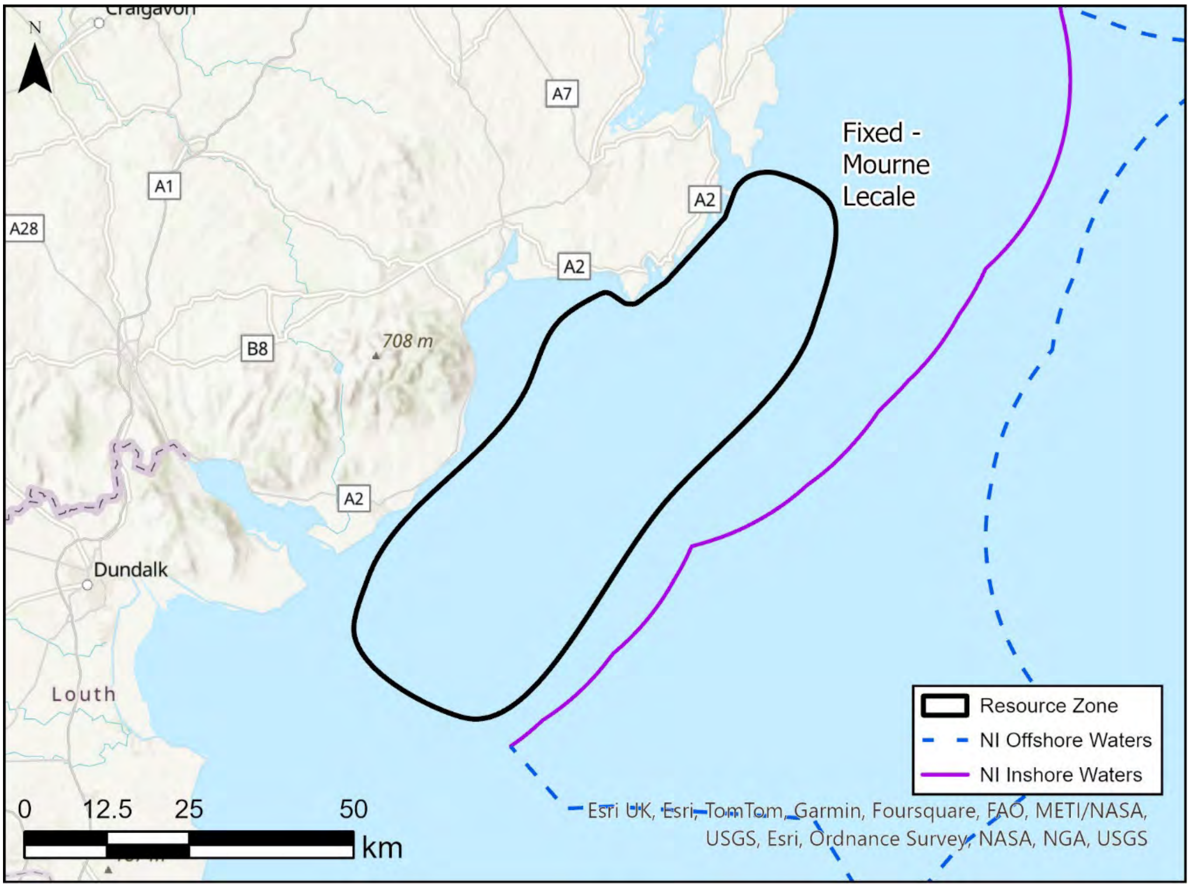
Stage 1 Fixed Wind Resource Zone – Mourne Lecale

The Fixed Wind Mourne Lecale RZ is located in the Irish Sea off the south-east coast of NI, approximately 200m offshore at its closest point. It encompasses an area of c.564km², extending from the mouth of Strangford Lough to the mouth of Carlingford Lough. The water depth of the RZ ranges from c.10m to c.80m. The average wind speeds range from c.9m/s to 10.1m/s. The predominant suitable TCE Technology Groups for the RZ include:

- Technology Group 1 (Jacket Suction)
- Technology Group 3B (Monopile 3D High)

The theoretical energy potential of this RZ is 2.82GW.

Fixed Wind Resource Zone – Mourne Lecale



Key Environmental Constraints and Sensitivities within the Resource Zone

Biodiversity, Flora and Fauna – Murlough SAC, North Channel SAC, Strangford Lough SAC, Carlingford Marine pSPA, East Coast Marine pSPA, Strangford Lough SPA, Strangford Lough Ramsar Site, and Strangford Lough MCZ are within the RZ. There are known areas of Annex I Sandbank and Reef habitats, and areas identified by TCE as being of Very High MPA Risk to Non-Breeding Birds and Habitats, and of High to Very High Risk to Breeding Birds, and Marine Mammals. The RZ also includes areas of high harbour seal and grey seal density, areas of multiple fish spawning and/or nursery grounds, and the Ballyquintin Scallop Enhancement Area.

Population and Human Health – The RZ is in proximity to the shoreline of the Mournes (approximately 3.5km). The Ballyhornan Bathing Water Sites, and a RYA high density leisure area, are within the RZ.

Geology, Soils and Land Use - There are areas of offshore rock and Dumping Grounds within the RZ.

Water – Ballyhornan, and Kilclief Bathing Water Sites, and Dumping Grounds, are within the RZ.

Air – There are no key sensitivities within the RZ.

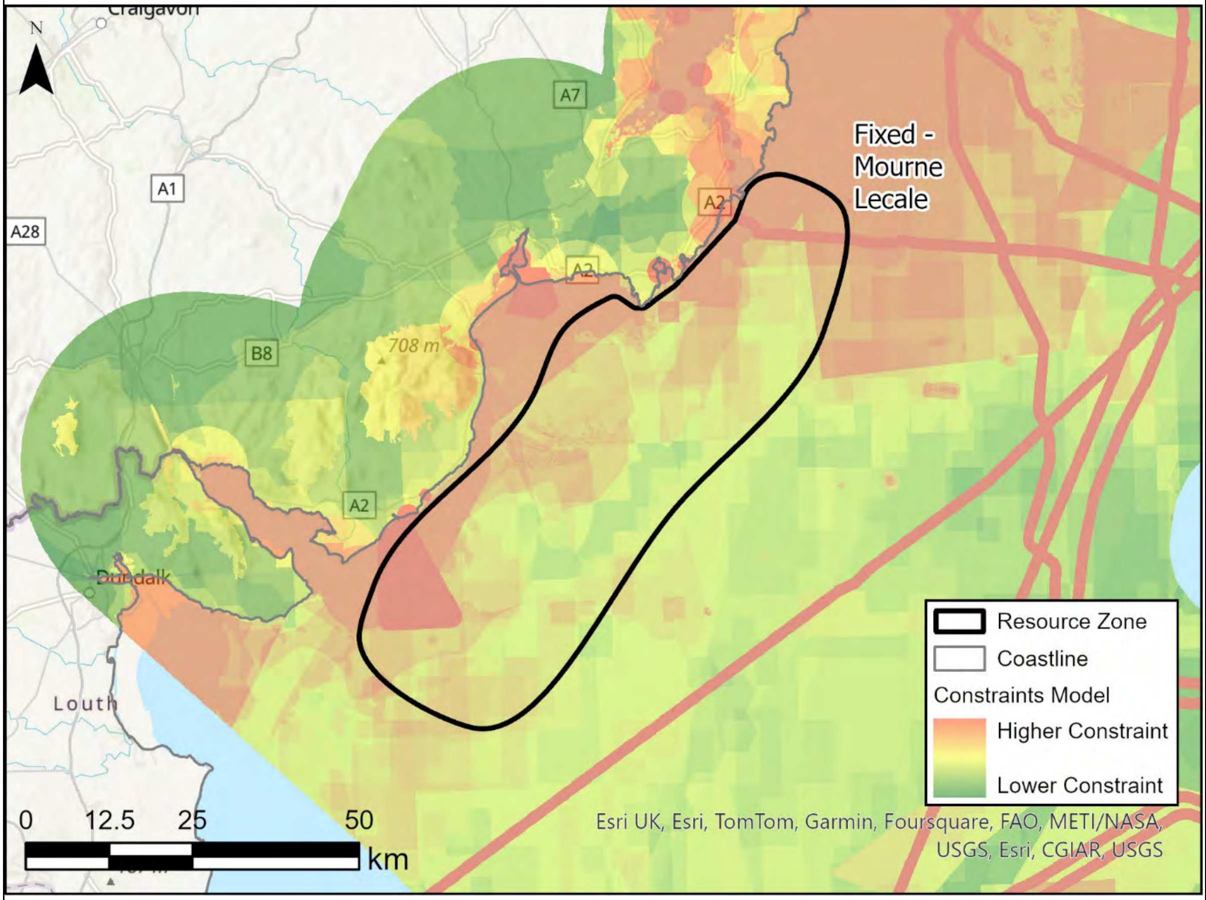
Climatic Factors - There are no key sensitivities within the RZ.

Material Assets – There is a telecommunication cable (BT-Manx NI) within the RZ. There are areas of high shipping density (>90th percentile), and a Pilot Boarding Station, within the RZ. Marine fish farms are also present within the RZ.

Cultural, Architectural and Archaeological Heritage – There are unprotected wrecks within the RZ.

Landscape, Seascape and Visual Amenity - The RZ is in proximity to the shoreline of the Mournes (approximately 3.5km). It is in proximity to the Mourne AONB, and Strangford and Lecale AONB, which are sensitive visual receptors.

Fixed Wind Resource Zone – Mourne Lecale

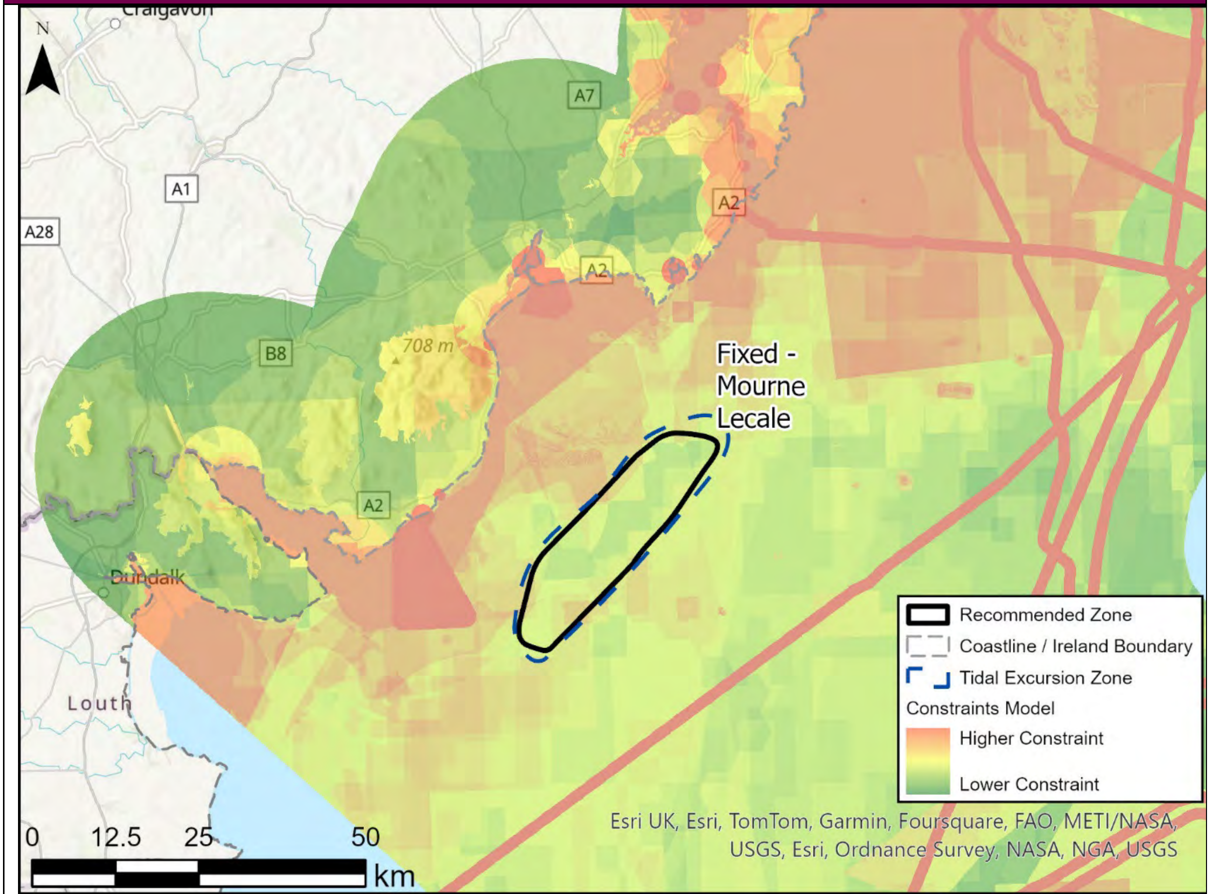


Stage 2 Recommended Fixed Wind Resource Zone – Mourne Lecale

To avoid the potential for direct impacts on identified key sensitivities, the Mourne Lecale RZ was refined through the exclusion of inshore and northern areas that were within the designated sites of North Channel SAC, Murlough SAC, East Coast Marine pSPA, Carlingford Marine pSPA, and Strangford Lough MCZ. The exclusion of further inshore, southern and northern areas avoided the Ballyhornan designated Bathing Water site, areas of high vessel density and high RYA leisure vessel density, offshore infrastructure, a marine fish farm, areas of offshore rock, a Pilot Boarding Station, several areas of Annex I habitat (Sandbanks and Reefs), several areas of overlap of fish spawning and nursery grounds, areas of high harbour and grey seal density and of Moderate to High Risk to Non-Breeding Birds, Breeding Birds, and Marnie Mammals. This also excluded the closest areas to shore to limit effects on sensitive landscapes such as the Mourne AONB and Strangford and Lecale AONB.

The theoretical energy potential of the Stage 2 recommended Mourne Lecale RZ is 0.45GW.

Recommended Fixed Wind Resource Zone – Mourne Lecale and Combined Constraints Model



Environmental Baseline and Key Issues within the Recommended Resource Zone

Environmental baseline information relevant to this recommended RZ is given below, ordered by SEA environmental topic. These sensitivities and indicators have the potential to be impacted by and impact upon the development and/or operation of offshore fixed wind.

Biodiversity, Flora and Fauna

There are no designated sites (SACs, SPAs, Ramsar sites, MCZs, ASSIs) within the recommended RZ, or within the tidal excursion zone. The closest designated sites are Carlingford Marine pSPA, c.7km inshore, Murlough SAC, c.10km inshore, and North Channel SAC, c.13km to the north-east. There are TCE Moderate MPA risk areas for Breeding Birds, Marine Mammals, and Fish within the recommended RZ. There are small known areas of the Annex I habitat ‘Sandbanks which are slightly covered by sea water all the time’ in the north and north-west of the recommended RZ, and within the tidal excursion zone to the north and north-west. The seabed habitats within the recommended RZ predominantly consist of muddy sand and sand, with sandy mud in the south.

Protected species (Wildlife Order) that have been recorded within the recommended RZ include the marine mammals: orca, minke whale, and short-beaked common dolphin. NI Priority Species that have been recorded include the starfish: sand sea star; marine mammals: orca, minke whale, and short-beaked common dolphin; hydroid: *Lytocarpia myriophyllum*; fish: whiting, cod, herring, hake, spiny dogfish, and school shark; and crustacean: circular crab. Priority Marine Features (PMFs) recorded within the recommended RZ include the molluscs: queen scallop, and great scallop; the marine mammals: orca and common dolphin; the hydroid: *Lytocarpia myriophyllum*; and the fish:

plaice, sole, spotted ray, whiting, cod, mackerel, herring, horse mackerel, small-spotted catfish, cuckoo ray, anglerfish, blue whiting, nursehound, and school shark. The fish spotted ray, spiny dogfish, and cod are also OSPAR Threatened/Declining species.

There are areas of SCANs recorded relatively high density for common dolphin, and common/striped dolphin, and areas of relatively moderate density for striped dolphin, fin whale, common dolphin, common/striped dolphin, and bottlenose dolphin. MU data also indicates that the cetaceans white-sided dolphin, white-beaked dolphin, Risso's dolphin, minke whale, harbour porpoise, common dolphin, and bottlenose dolphin may occur within the area. There are also areas of relatively moderate density for grey seal and harbour seal within the recommended RZ.

There are areas of recorded relatively moderate density for seabirds at sea within the recommended RZ. There is also a known spawning ground of low intensity for sandeel, a key food source for many species of seabird, within the recommended RZ.

There are spawning grounds for Nephrops, whiting, cod, sprat, lemon sole, plaice, horse mackerel, ling, mackerel, sandeel, and sole within the recommended RZ. Areas of AFBI surveyed relatively high egg production (spawning area) for cod and plaice are located within the recommended RZ and the tidal excursion zone. Furthermore, the entirety of the recommended RZ is located within nursery grounds for Nephrops, haddock, whiting, cod, lemon sole and herring, and AFBI surveyed juvenile density (nursery areas) for haddock and whiting are also within the recommended RZ and tidal excursion zone. There is an AFBI surveyed area for scallops (of relatively lower density) within the tidal excursion zone to the north-west. There are two areas with fishing restrictions within the recommended RZ, for scallops, under the Conservation of Scallops Regulations, and for certain fishing gear within the Irish Sea Cod Box.

There are no records of invasive species within the recommended RZ.

Population and Human Health

The recommended RZ is located offshore of the settlements of Annalong, Ballymartin, Dunnaval / Ballyardle, Glassdrumman / Mullartown, Kilkeel, Longstone and Newcastle. The inshore boundary of the recommended RZ is located approximately 19km south-east of Newcastle, and c.10–12km offshore of Annalong, Ballymartin, Dunnaval / Ballyardle, Glassdrumman / Mullartown, Kilkeel and Longstone.

The recommended RZ is located offshore of the Cranfield Bay, Murlough, Newcastle and Tyrella Bathing Water sites, and the Cranfield West, Minerstown, Murlough and Tyrella Blue Flag Beaches. However, none of these sites are located within the recommended RZ or tidal excursion zone.

There are areas of relatively high intensity RYA leisure boating activity within the northern section of the recommended RZ off the coast of Newcastle. There is relatively high leisure boating activity due to small craft travelling between Ardglass / Strangford Lough and Dublin Bay. There are also areas of relatively high intensity RYA leisure boating activity in proximity to the coastline, particularly offshore of Ardglass, and heading north towards Strangford Lough / Belfast Lough.

There are no known dive sites within the recommended RZ or tidal excursion zone.

Geology, Soils and Land Use

There are no WHSs, ASSIs, MCZs or UNESCO Geoparks designated for geology or geomorphology within the recommended RZ or the tidal excursion zone.

The main seabed geology within the recommended RZ is sand and gravel and soft mud of quaternary deposits, with areas of thickness between 5-50m, and some areas of >50m. The main seabed sediments within the recommended RZ are sand and muddy sand of either low or moderate energy, while there is also an area of sandy mud of low energy. All biozones in the recommended RZ are deep circalittoral.

TCE expected technology groups for the installation of fixed-bottom wind turbines within the recommended RZ are predominantly technology groups 1 (Jacket foundation structure, with suction installation) and 3B (Monopile foundation structure, with 3D complex piles and high ground risk), with smaller areas of technology groups 2A (Monopile foundation structure, with driven piles and low ground risk), 4A (Jacket foundation structure, with driven piles and low ground risk), 5B (Jacket foundation structure, with driven piles and high ground risk) and one area of technology group 7B (Jacket foundation structure, with socket installation and high ground risk).

There are no dumping grounds of spoil ground, explosives dumping grounds or MoD firing/danger areas within the recommended RZ.

Water

The water depths within the recommended RZ range from c.30-44m. Tidal speeds within the recommended RZ range from 0.18-0.21m/s.

There are no dumping grounds of spoil ground, explosives dumping grounds or MoD firing/danger areas within the recommended RZ.

There are no WFD Shellfish Waters, Bathing Waters or WFD coastal water bodies within the recommended RZ or tidal excursion zone.

The recommended RZ is located within the Celtic Seas sub-region for the MS (covering waters to the West of the UK and is shared with RoI and France).

Air

There are no known air quality issues within the recommended RZ, as there are no significant anthropogenic sources of air pollution in the vicinity. The recommended RZ is located offshore of the settlements of Annalong, Ballymartin, Dunnaval / Ballyardle, Glassdrumman / Mullartown, Kilkeel, Longstone and Newcastle. The inshore boundary of the recommended RZ is located approximately 19km south-east of Newcastle, and c.10–12km offshore of Annalong, Ballymartin, Dunnaval / Ballyardle, Glassdrumman / Mullartown, Kilkeel and Longstone.

There are areas of relatively high intensity RYA leisure boating activity within the northern section of the recommended RZ off the coast of Newcastle. There is relatively higher leisure boating activity due to small craft travelling between Ardglass / Strangford Lough and Dublin Bay. There are also areas of relatively higher intensity RYA leisure boating activity in proximity to the coastline, particularly offshore of Ardglass, and heading north towards Strangford Lough / Belfast Lough. Within the recommended RZ this vessel traffic intensity may cause some minor, localised, air emissions.

Climatic Factors

There are no known blue carbon habitats (Annex I Saltmarsh, Annex I Maerl, Shellfish Waters, Subtidal and Intertidal Seagrass) within the recommended RZ. There are no areas within the recommended RZ that have been identified by Ulster Wildlife as blue carbon hotspots. There are unlikely to be any sources of GHG emissions in the area, apart from vessels.

Material Assets

There is no existing infrastructure (cables, pipelines) located within the recommended RZ.

In general, there is a relatively low shipping density (<50th percentile) within the recommended RZ, with some moderate density areas (>70th percentile) primarily concentrated in the south of the recommended RZ. There is one small area (c.0.4km^2) of relatively high shipping density (>90th percentile) located in the south-west of the recommended RZ. These areas of moderate to higher shipping density are likely associated with the Warrenpoint to Heysham freight ferry route. Fishing vessels associated with the ports of Kilkeel, Ardglass or Carlingford, as well as cargo and tanker vessels passing from ports in NI, such as Belfast Lough, to Dublin or further south, may also contribute to these higher density areas. There are no TSSs, Harbour Areas, or Ports within the recommended RZ.

The recommended RZ is used by commercial fishing vessels, with relatively low fishing activity (>50th percentile) throughout. There are some small areas of higher fishing activity (>70th percentile) located along the eastern boundary and within the south of the recommended RZ. Fleets which are known to operate in the recommended RZ include whitefish, scallop, and pot. Key fishing areas for fixed pot fisheries (crab, lobster, velvets, whelks and shrimp), and mobile herring and Nephrops fisheries are located within the recommended RZ. The Irish Sea is an important catching location for stock of commercial species such as herring, haddock, plaice, and Nephrops, and significant landings of fish (haddock, cod, monkfish/anglerfish, mackerel, plaice and hake), as well as Nephrops and other shellfish, are recorded at the ports of Kilkeel and Ardglass. There is a known area of importance for inshore pot fisheries located in the east and south-east of the recommended RZ and the tidal excursion zone. The entirety of the recommended RZ is encompassed within spawning grounds for Nephrops, whiting, cod and sprat, whilst lemon sole, plaice, horse mackerel, ling, mackerel, sandeel, and sole are located within the recommended RZ. Areas of surveyed relatively high egg production (spawning area) for cod and plaice are located within the recommended RZ and the tidal excursion zone. Furthermore, the entirety of the recommended RZ is located within nursery grounds for Nephrops, haddock, whiting, cod, lemon sole and herring, and surveyed juvenile density (nursery areas) for haddock and whiting are also within the recommended RZ and tidal excursion zone. Scallops have been recorded in the north-west of the recommended RZ and tidal excursion zone. There are two restricted fishing areas within the recommended RZ (for limits on harvesting size, catch quotas, fishing methods and timeframes during which fishing is prohibited for scallops, under the Conservation of Scallops Regulations; and for certain fishing gear within the Irish Sea Cod Box). There are no marine fish farms or aquaculture sites within the recommended RZ.

The recommended RZ is used by the MoD, with nearly the entirety of the recommended RZ (74km²) being located within the Ardglass Military Practice Area (X5402). This is utilised as a submarine exercise area and a surface fleet practice and exercise area. There are, however, no MoD danger areas within the recommended RZ.

The south-west of the recommended RZ is located within a c.0.53km² area of the Derryogue Airfield 15km OLS. The airfield is located c.14.6km to the west of the recommended RZ.

There are no spoil dumping grounds located within the recommended RZ.

The south-east coast of NI has a number of coastal attractions that are within the modelled viewshed for fixed turbines within the recommended RZ, including the Mourne Mountains. Tourist activities within the recommended RZ are likely to include water sports, sailing, and fishing within inshore areas, and there are areas of known relatively high intensity RYA leisure boating activity within the recommended RZ; these activities are unlikely to occur in offshore waters. The Mourne AONB, Strangford and Lecale AONB, Ring of Gullion AONB and 10 National Trust sites are located within the modelled viewshed for fixed wind turbines within the recommended RZ, as are significant long-distance walking routes, such as the Mourne Way within the Mourne AONB, which offer significant attraction for tourism. Further information on landscape designations that may act as tourist attractions within the modelled viewshed of the area is provided in the Landscape, Seascape, and Visual Amenity baseline.

The recommended RZ has a potential capacity of 0.45GW.

Cultural, Architectural and Archaeological Heritage

There are no protected wrecks within the recommended RZ. There are four recorded wrecks within the recommended RZ, and three additional wrecks within the tidal excursion zone. The recommended RZ is situated between c.11km and c.18.5km distance from the coastline. There are 690 Listed Buildings, 388 Defence Heritage Record sites, 568 Scheduled Monuments, 101 Scheduled Zones, and 20 Parks and Gardens (including Mourne Park, Tollymore Park, Tyrella House, and Castlewellan College) within the modelled viewshed (based on a turbine height of 165m and a viewable distance of 40km).

Landscape, Seascape and Visual Amenity

The recommended RZ is situated between c.11km and c.18.5km distance from the coastline. There are 40 settlements situated inshore of the recommended RZ, which are within the modelled viewshed (based on a turbine height of 165m and a viewable distance of 40km). These include Strangford, Kilclief, Ardglass, Downpatrick, Killough, Portavogie and Newcastle, while transboundary settlements in RoI are also within the modelled viewshed. There are no WHSs situated inshore of the recommended RZ. There are three AONBs situated inshore of the recommended RZ, and which are within the modelled viewshed: Mourne AONB, Strangford and Lecale AONB, and Ring of Gullion AONB. There are also 10 National Trust Lands within the modelled viewshed: Bryansford, Castle Ward, Clough Castle, Dundrum Coastal Path, Green and Blockhouse Islands, Kearney, Mournes Coastal Path, Murlough NNR, Slieve Donard, and Strangford Lough. The recommended RZ is primarily within the Mourne Coast RSCA, while the offshore south-east of the RZ is within the Irish Sea (South Down) RSCA.

Environmental Assessment	Short-term	Medium-term	Long-term
Biodiversity, Flora and Fauna (BFF)	-3	-3	-3
Population and Human Health (PHH)	-2	-2	-2
Geology, Soils and Land Use (GSL)	-2	-2	-2
Water (W)	-1	-1	-1
Air (A)	0	+1	+1
Climatic Factors (CF)	-1	+1	+1
Material Assets and Infrastructure (MA)	-3	-3 / +1	-3 / +1
Cultural, Architectural and Archaeological Heritage (CH)	-3	-3	-3
Landscape / Seascape and Visual Amenity (L)	-3	-3	-3

Key Conclusions:
Biodiversity, Flora and Fauna – There is potential for significant adverse effects on Biodiversity, Flora and Fauna in the short-term construction and decommissioning phases, and the medium to long-term operational phase (-3), owing to the interaction with spawning and nursery areas for several fish species. There is potential for moderate adverse effects in the short-term construction and decommissioning phases, and the medium to long-term operational phase (-2) for benthic habitats and species, fish and shellfish, marine mammals and birds, owing to interaction with Moderate MPA risk areas for Marine Mammals, Breeding Birds and Fish, areas of recorded relatively high and moderate density for marine mammals and seabirds at sea, and the recorded presence of NI Protected and Priority species. **Population and Human Health –** There is potential for moderate adverse temporary, direct and indirect, effects on leisure and recreational marine users due to an increased collision risk, access restrictions and displacement, or water quality effects, during the construction and decommissioning phases (-2). There is also potential for moderate adverse long-term (device life) effects due to an enhanced collision risk for recreational and leisure vessels with devices, and displacement of recreational and leisure craft from the array area during the operational phase (-2). This is due to known relatively high use of areas within the recommended RZ by recreational and leisure vessels. **Geology, Soils and Land Use –** There is potential for moderate adverse effects on Geology, Soils and Land use in the short-term construction and decommissioning phases, due to the potential to encounter thicker geological deposits which require more invasive installation technologies with potential for moderate adverse direct long-term effects on the seabed geology and sediments through loss of material (-2). Following the installation of fixed wind technologies there is potential for slight adverse, medium-term operational phase localised impacts on erosion and deposition patterns due to the presence of devices (-2). There is potential for influence on the MS Descriptor 6 sea floor integrity from the installation processes of fixed wind technologies in the recommended RZ, however, there is not anticipated to be potential for adverse effects on the achievement of GES. **Water –** There is potential for slight short-term effects on water quality elements that are considered by the MS (e.g., Descriptor 9 Concentrations of contaminants in fish and other seafood; Descriptor 8: Concentration of contaminants within marine environment; Descriptor 10 marine litter) during seabed preparation, construction, maintenance and decommissioning activities (-1). There is not anticipated to be potential for adverse effects on the achievement of GES with the application of standard best practice mitigation.

Air – There is potential for slight positive indirect effects on regional air quality in the medium to long-term operational phase, as the operation of renewable energy devices can support a transition away from fossil fuel use and its associated air emissions, with potential for a relatively low capacity in the recommended RZ (+1).

Climatic Factors – There is potential for slight adverse short-term effects on sediment carbon storage, due to a localised release of CO_2 from seabed disturbance during the construction and decommissioning phases (-1). There is potential for slight adverse, short-term, temporary effects on localised GHG concentrations, due to GHG emissions from vessels and machinery during the construction and decommissioning phases (-1), which should be minimised at the project level through adherence to standard best practise for the minimisation of air pollution, as set out in **Section 10.1**. There is potential for slight positive, medium to long-term effects during the operational phase, as the operation of renewable energy devices can contribute to a net reduction in GHG emissions, decarbonisation of the energy sector, diversification of electricity supply and energy security, and meeting of energy objectives and climate change emission reduction targets, with potential for a relatively low capacity in the recommended RZ (+1).

Material Assets – Overall, there is considered to be potential for significant adverse effects in the short, medium, and long-term on Material Assets (-3), following the consideration of best practice mitigation measures, which is mainly attributed to the potential for moderate adverse effects on Shipping and Navigation, and Commercial Fisheries.

Given the presence of higher density known shipping areas, largely associated with the Warrenpoint to Heysham ferry route within the recommended RZ, there is the potential for significant navigational risk and displacement in the short, medium, and long-term (-3). This is owing to the potential displacement of vessels during construction and decommissioning (short-term) and operation (medium to long-term), as well as potential for direct and indirect adverse effects on navigation and communications in all phases. Significant adverse effects could be mitigated through avoidance of the higher density Warrenpoint to Heysham shipping route.

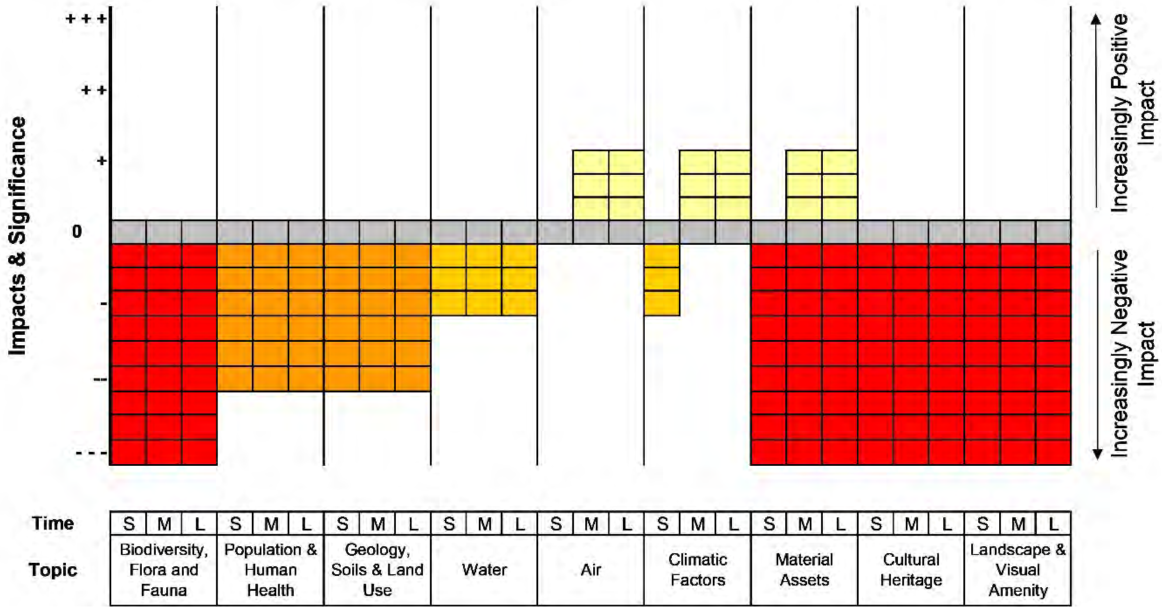
There is potential for significant indirect effects on the profitability of commercial fishing in the short, medium, and long-term (-3), such as the potential for reduced quotas, increased resource competition for fishing, and reduced landings in both tonnage and economic value. This is owing to the combination of potential significant adverse effects including: potential displacement from shipping grounds in the short, medium, and long-term (-3); potential for increased collision risk associated with the presence of construction and decommissioning vessels (short-term) (-3), and the presence of maintenance vessels and displacement from fishing grounds (medium- to long-term) (-2); as well as effects on commercial fish species and their key habitats due to direct loss of supporting habitats (-3), and indirect effects due to sediment mobilisation in the short-term (-3) and medium to long-term (-2); all of which could indirectly affect fishing activity through an alteration of commercial fish stocks.

There is potential for slight positive effects in terms of the generation of a new renewable energy supply for the NI population in the medium to long-term, as the recommended RZ has a potential capacity of 0.45GW, (+1).

Cultural, Architectural and Archaeological Heritage – There is potential for significant adverse effects on Cultural Heritage in the short-term construction and decommissioning phases, and the medium to long-term operational phase (-3) owing to the distance of the recommended RZ offshore and the high sensitivity of coastal heritage receptors whose setting may be affected.

Landscape and Visual Amenity – There is potential for significant adverse effects on Landscape, Seascape and Visual Amenity in the short-term construction and decommissioning phases, and the medium to long-term operational phase (-3) owing to the distance of the recommended RZ offshore and the very high sensitivity of the landscape areas that may be affected, including Mourne AONB, Strangford and Lecale AONB, and Ring of Gullion AONB, as well as a coastal population that may be affected by changes in visual amenity.

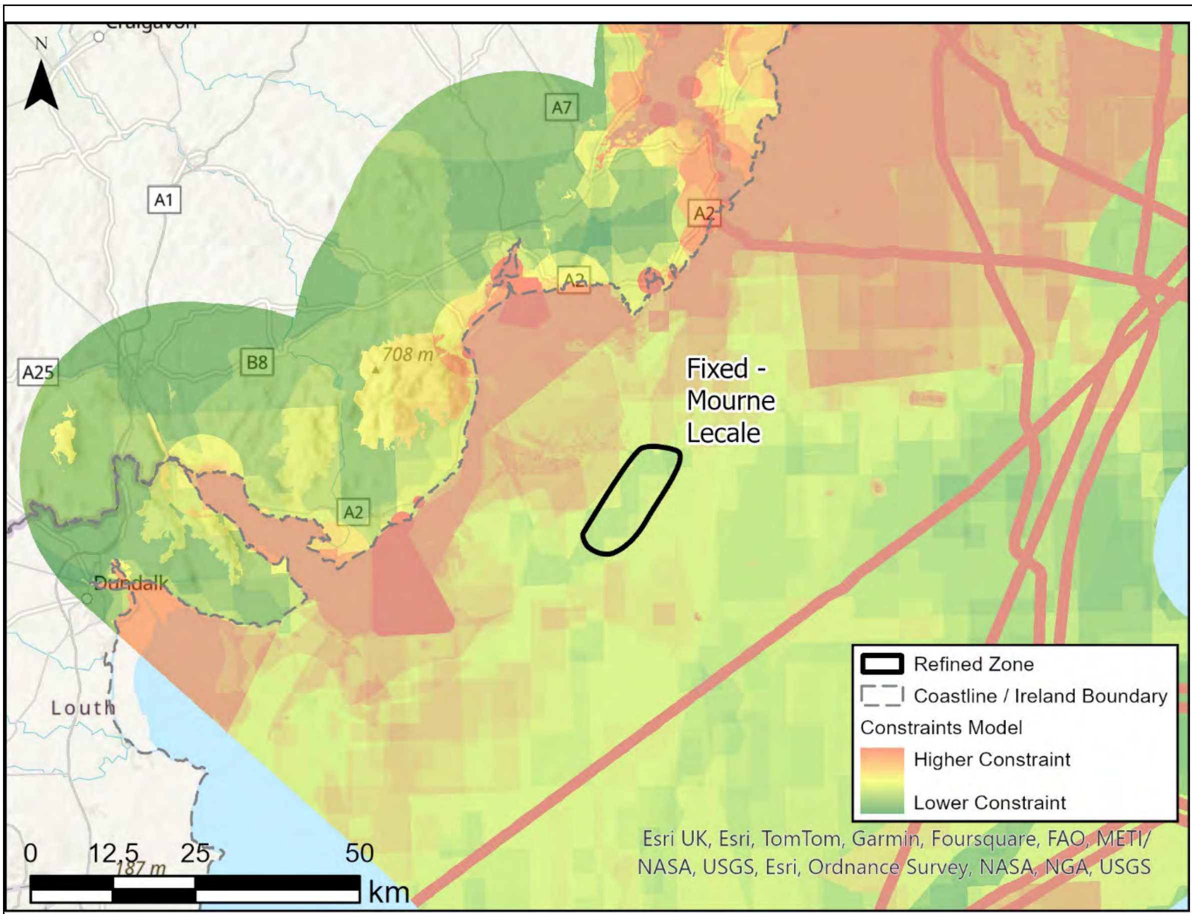
Summary Chart of Potential Effects



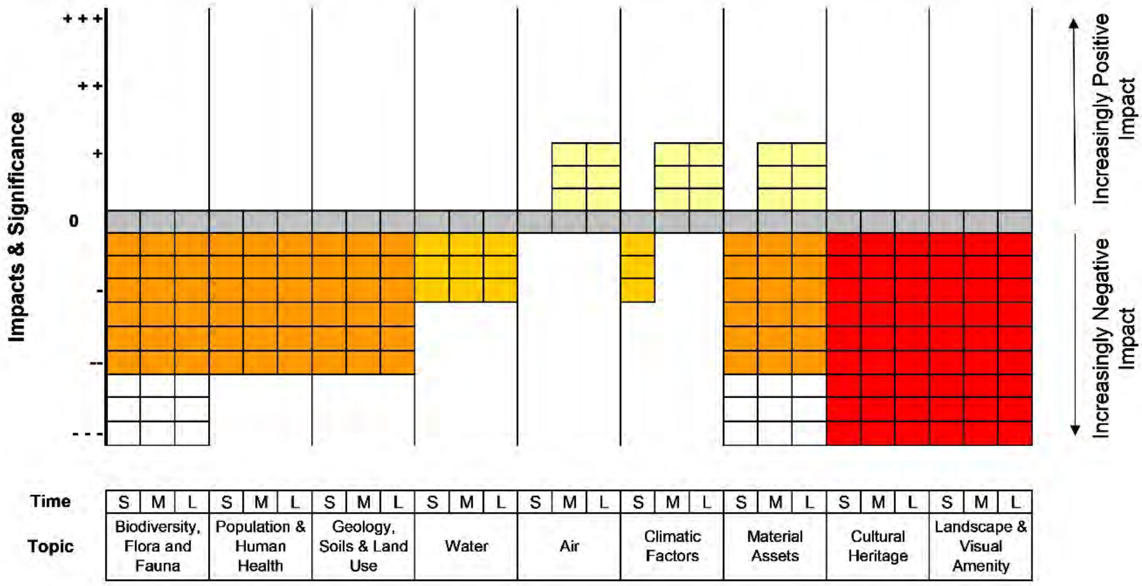
Stage 3 - Recommendations for Further Refinement

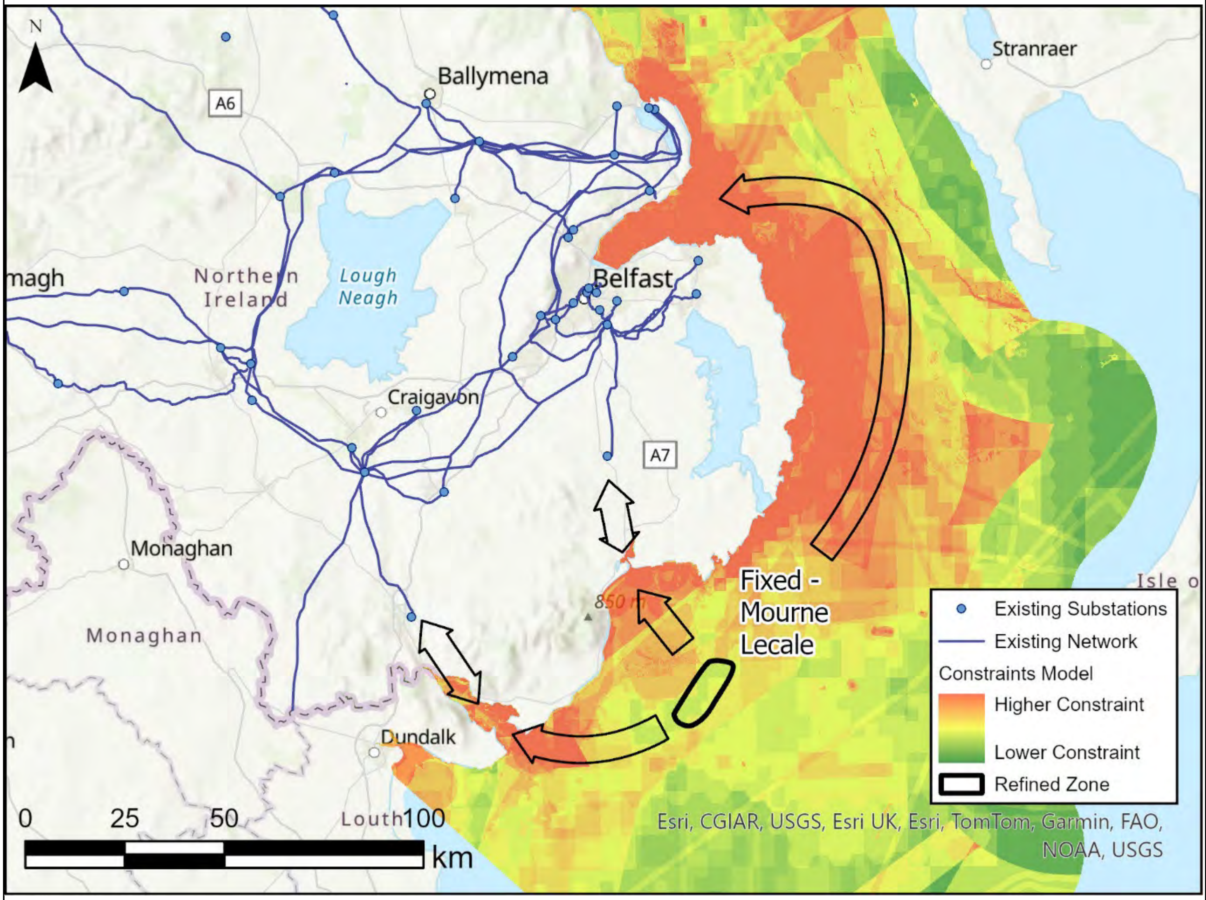
Further refinement of the Fixed Mourne Lecale RZ is recommended to exclude the south, where the greatest overlap of known fish spawning and nursery grounds occurs, which can reduce the overall score for Biodiversity, Flora, and Fauna to -2. Further refinement to avoid the areas of high to moderate shipping density, inshore pot fishing area, areas of moderate fishing activity, highest known importance for fish spawning and nursery, and Derryogue Airstrip OLS can reduce the significance of effects for Material Assets, to give an overall score of -2. It is also recommended to avoid the closest areas to shore (within 13km), reducing the potential for significant visual effects, including on landscape designations and the setting of coastal heritage receptors, however the score for Cultural Heritage and Landscape, Seascape, and Visual Amenity remains as -3 owing to the high sensitivity of the landscape and heritage receptors (AONBs) that may still be adversely affected, as the distance to shore is a maximum of c.18.5km for the RZ.

The theoretical energy potential of the refined Fixed Mourne Lecale RZ is 0.17GW.

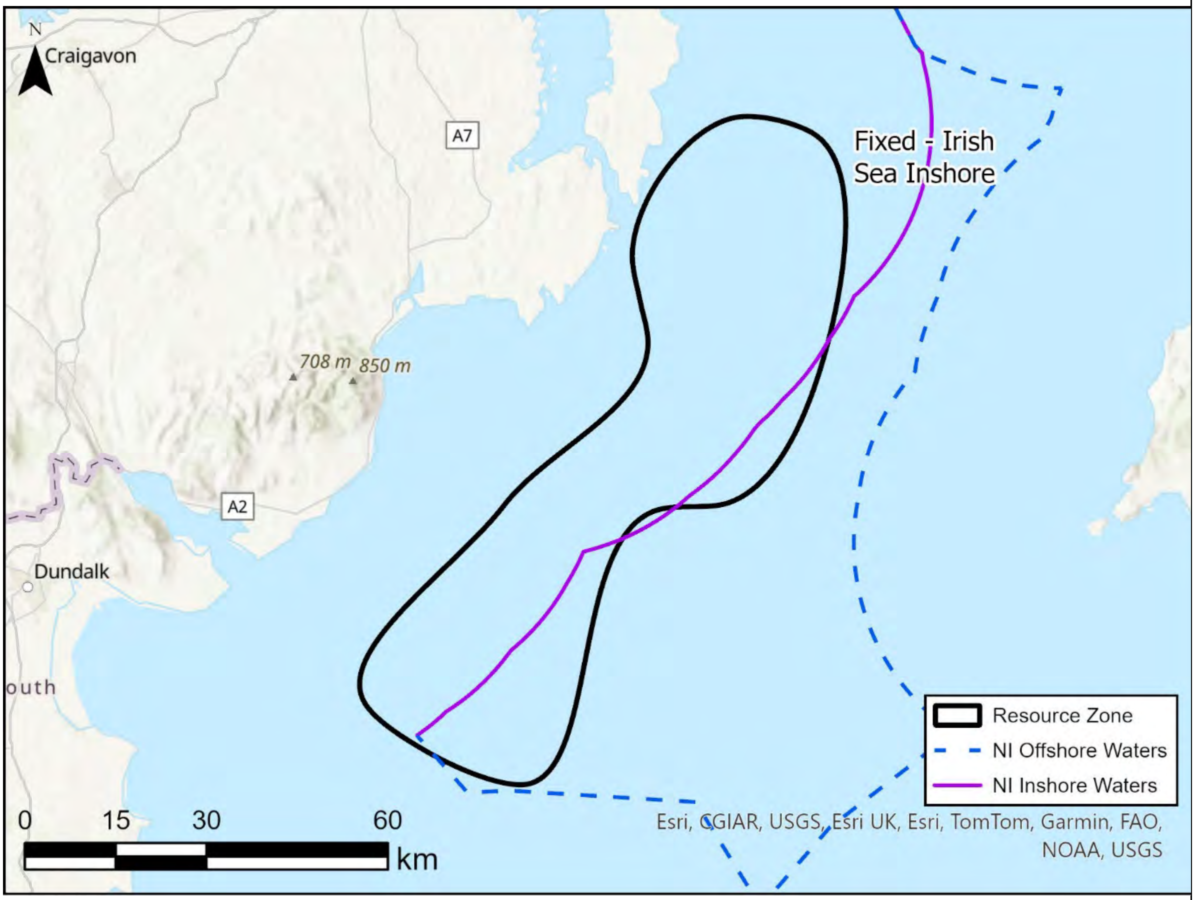


Comparative Chart



Potential Export Cable Routes

Connection into Greater Belfast area. 110kV existing network. Length approx. 95km. Significant likely constraints include North Channel SAC, East Coast Marine pSPA, Annex I Reef and telecommunication cables. Other constraints which can potentially be avoided include cliffs over 15m, Outer Belfast Lough MCZ, Scallop Enhancement Areas, Urban Areas and Ports. The Outer Ards SPA/Ramsar Site/IBA and several Bathing Water sites are unavoidable if connecting into the Bangor area.
Connection into Ballynahinch area. 110kV existing network. Length approx. 34km Significant constraints include Murlough SAC which can potentially be avoided; however, this would require a longer route. Significant likely constraints include Annex I Sandbanks, Annex I Reef, and the Mourne AONB and the Strangford and Lecale AONB. Other constraints which can potentially be avoided include marine fish farms (crustaceans/fish), Ballykinler Military Area, Urban Areas, Murlough NNR, Murlough ASSI, St. John's Point ASSI, South Down Coast IBA, Dundrum Inner Bay IBA and Murlough, Newcastle, Tyrella Bathing Water Sites.
Connection into Newry area. 110kV existing network. Length approx. 46km Significant constraints include marine fish farms (crustaceans) which can potentially be avoided; however, this would require a longer offshore route. Significant likely constraints include Carlingford Marine pSPA, Carlingford Lough ASSI, areas of high intensity fishing, Annex I Reef, Carlingford Lough IBA, a Pilot Boarding Station and the Mourne AONB. Other constraints which can potentially be avoided include Carlingford Shore SAC, Derryleckagh SAC, Carlingford Lough MCZ, Carlingford Lough Ramsar, Carlingford Lough SPA, Urban Areas onshore, Cranfield Bay and Warrenpoint Bathing Water Sites.

9.2.5 Fixed Wind Resource Zone: Irish Sea Inshore

Stage 1 Fixed Wind Resource Zone – Irish Sea Inshore
The Fixed Wind Irish Sea Inshore RZ is located in the Irish Sea off the south-east coast of NI, approximately 18km offshore of the Mourne Mountains, extending from the south extent of the Ards Peninsula to Carlingford Lough. The water depth of the RZ ranges from c.39m to c.80m. The average wind speeds range from c.9.8m/s to 10.33m/s. The predominant suitable TCE Technology Groups for the RZ include: - Technology Group 4A (Jacket Driven Low) - Technology Group 5B (Jacket 3D High) - Technology Group 7B (Jacket Socket High) The theoretical energy potential of this RZ is 3.17GW.
Fixed Wind Resource Zone – Irish Sea Inshore

Key Environmental Constraints and Sensitivities within the Resource Zone
Biodiversity, Flora and Fauna – North Channel SAC, and East Coast Marine pSPA are within the RZ. There are known areas of Annex I Reef habitat, and areas identified by TCE as being of High to Very High MPA Risk to Non-Breeding Birds, Breeding Birds, Marine Mammals, and Habitats. The RZ also includes areas of high harbour seal and grey seal density, and areas of multiple fish spawning or nursery grounds. **Population and Human Health –** There are no key sensitivities within the RZ. **Geology, Soils and Land Use -** There are areas of offshore rock within the RZ. **Water –** There are no key sensitivities within the RZ.

Air – There are no key sensitivities within the RZ.

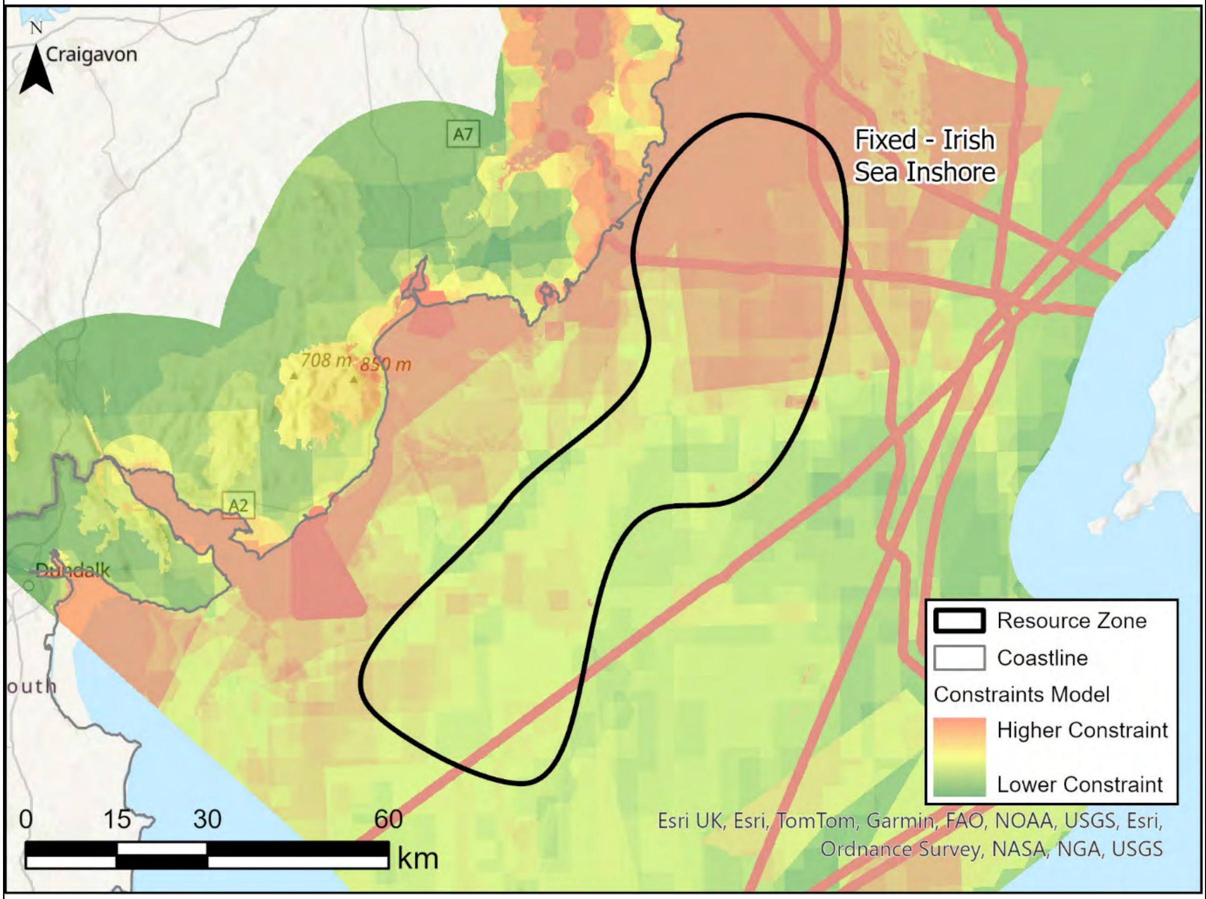
Climatic Factors - There are no key sensitivities within the RZ.

Material Assets – There is a telecommunication cable (BT-Manx NI) and a pipeline within the RZ. There are areas of high shipping density, and a Pilot Boarding Station, within the RZ. Areas of high fishing activity and areas of known pot fishing are also present within the RZ.

Cultural, Architectural and Archaeological Heritage – There is a protected wreck, and there are unprotected wrecks, within the RZ.

Landscape, Seascape and Visual Amenity – The RZ is offshore (>5km) of the Mourne AONB and Strangford and Lecale AONBs, which are sensitive visual receptors.

Fixed Wind Resource Zone – Irish Sea Inshore

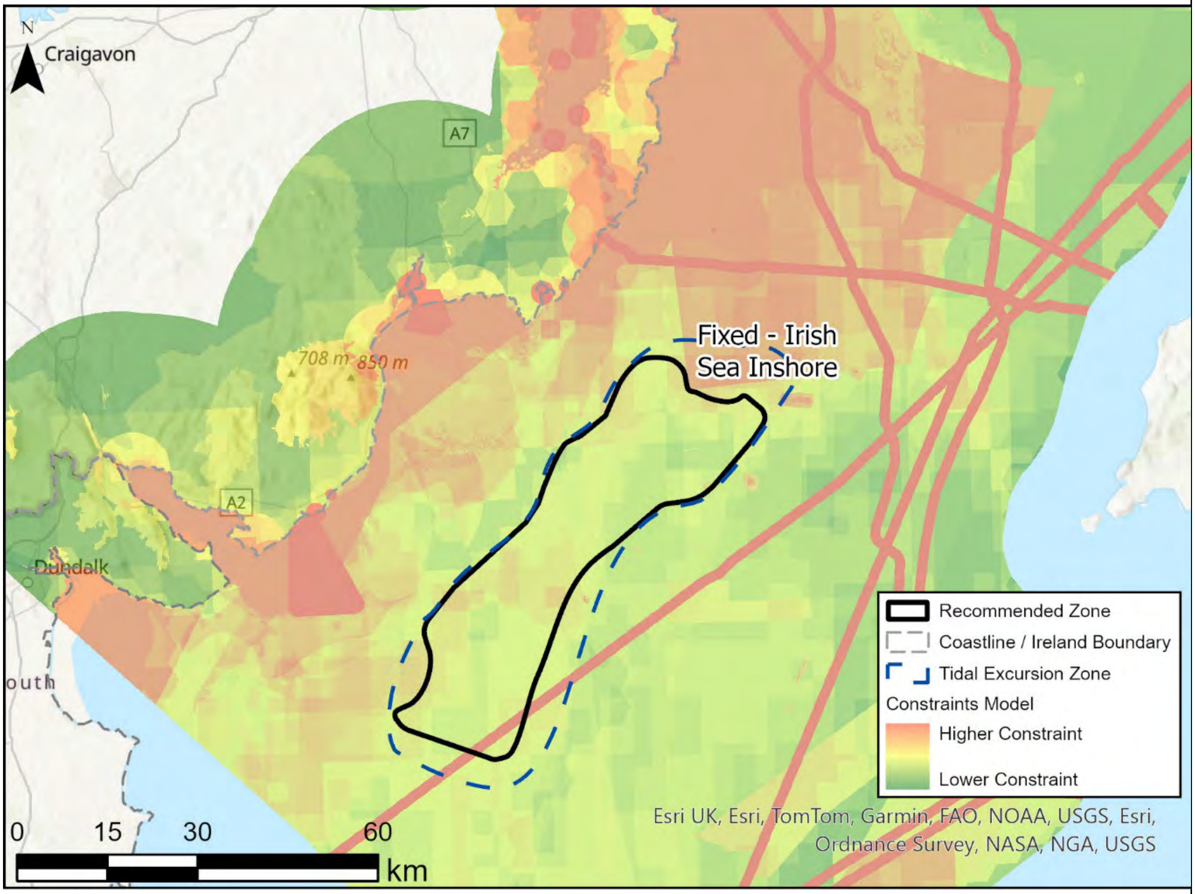


Stage 2 Recommended Fixed Wind Resource Zone – Irish Sea Inshore

To avoid the potential for direct impacts on identified key sensitivities within the Irish Sea Inshore RZ, it was refined through the exclusion of the northern and south-western areas that are within designated sites (including the North Channel SAC and East Coast Marine pSPA) and areas of high fishing activity. This also avoided areas of known pot fishing, and a protected wreck.

The theoretical energy potential of the recommended Stage 2 Irish Sea Inshore RZ is 1.76GW.

Recommended Fixed Wind Resource Zone – Irish Sea Inshore and Combined Constraints Model



Environmental Baseline and Key Issues within the Recommended Resource Zone

Environmental baseline information relevant to this recommended RZ is given below, ordered by SEA environmental topic. These sensitivities and indicators have the potential to be impacted by and impact upon the development and/or operation of offshore fixed wind.

Biodiversity, Flora and Fauna

There are no designated sites (SACs, SPAs, Ramsar sites, MCZs, ASSIs) within the recommended RZ. The North Channel SAC and Pisces Reef Complex SAC are within the tidal excursion zone to the north, and the North-West Irish Sea SPA is within the tidal excursion zone to the south. There are TCE High and Moderate MPA risk areas for Breeding Birds, and Moderate MPA risk areas for Marine Mammals within the recommended RZ. There are small known areas of Annex I Reef habitat within the tidal excursion zone in the centre of the recommended RZ and to the north-east. The seabed habitats within the recommended RZ predominantly consist of fine mud and sandy mud, with small areas of sand and mixed sediment.

Protected species (Wildlife Order) that have been recorded within the recommended RZ include the marine mammals: short-beaked common dolphin, harbour porpoise, and minke whale; and the fish: common skate. NI Priority species that have been recorded include the starfish: sand sea star; the marine mammals: short-beaked common dolphin, harbour porpoise, and minke whale; the fish: whiting, hake, herring, cod, spiny dogfish, and school shark; and the crustacean circular crab. Priority Marine Features (PMFs) recorded within the recommended RZ include the molluscs: queen scallop and great scallop; the marine mammals: short-beaked common dolphin and harbour porpoise; and the fish: whiting, hake, horse mackerel, small-spotted catfish, herring, mackerel, cod, plaice, anglerfish, sole, starry smooth-hound, cuckoo ray, thornback ray, spotted ray, blue whiting, broadnose skate, spiny dogfish, nursehound, ling, common skate, and small-eyed ray. There are also elasmobranch records of spurdog, thornback ray, spotted ray, and common skate. The harbour porpoise and fish including cod, thornback ray, spotted ray, and spiny dogfish are also OSPAR Threatened/Declining species.

There are areas of SCANs recorded relatively high density for common dolphin, and common/striped dolphin, and areas of relatively moderate density for striped dolphin, minke whale, fin whale, common dolphin, common/striped dolphin, and bottlenose dolphin within the recommended RZ. MU data also indicates that the cetaceans white-sided dolphin, white-beaked dolphin, Risso's dolphin, minke whale, harbour porpoise, common dolphin, and bottlenose dolphin may occur within the area. There are also areas of relatively moderate density for grey seal and harbour seal within the recommended RZ.

There are areas of recorded relatively high and moderate density for seabirds at sea within the recommended RZ. There is also known spawning grounds of low intensity for sandeel, a key food source for many species of seabird, within the recommended RZ.

There are spawning grounds for Nephrops, sprat, cod, whiting, lemon sole, plaice, hake, ling, mackerel, horse mackerel, sandeel, and sole within the recommended RZ and the tidal excursion zone. Areas of AFBI surveyed relatively high egg production (spawning area) for cod and moderate egg production for plaice are also located within the recommended RZ and the tidal excursion zone. Furthermore, there are nursery grounds for Nephrops, whiting, sole, hake, spurdog, plaice, anglerfish, mackerel, thornback ray, tope shark, lemon sole, haddock, herring, and cod within the recommended RZ and the tidal excursion zone, and AFBI surveyed relatively high juvenile density (nursery area) for haddock and whiting are also within the recommended RZ and tidal excursion zone. There are two areas with fishing restrictions within the recommended RZ, for scallops, under the Conservation of Scallops Regulations, and for certain fishing gear within the Irish Sea Cod Box.

There are no records of invasive species within the recommended RZ.

Population and Human Health

The recommended RZ is located offshore of the settlements of Annalong, Ardglass, Ballymartin, Dunnaval / Ballyardle, Glassdrumman / Mullartown, Coney Island, Killough, Kilkeel, Longstone and Newcastle. The inshore boundary of the recommended RZ is located approximately 22km south-east of Newcastle, and c.14–16km offshore of Annalong, Ardglass, Ballymartin, Dunnaval / Ballyardle, Glassdrumman / Mullartown, Coney Island, Killough, Kilkeel and Longstone.

The recommended RZ is located offshore of the Cranfield Bay, Murlough, Newcastle and Tyrella Bathing Water sites, and the Cranfield West, Minerstown, Murlough and Tyrella Blue Flag Beaches. However, none of these sites are located within the recommended RZ or tidal excursion zone.

There are areas of relatively high intensity RYA leisure boating activity within the northern section of the recommended RZ, off the coast of Newcastle. There is relatively high leisure boating activity due to small craft travelling between Ardglass / Strangford Lough and Dublin Bay. There are also areas of relatively high intensity RYA leisure boating activity in proximity to the coastline, particularly offshore of Ardglass, and heading north towards Strangford Lough / Belfast Lough.

There are no known dive sites within the recommended RZ or tidal excursion zone.

Geology, Soils and Land Use

There are no WHSs, ASSIs, MCZs or UNESCO Geoparks designated for geology or geomorphology within the recommended RZ or the tidal excursion zone.

The main seabed geology within the recommended RZ consists of diamict with areas of sand and gravel and soft mud of quaternary deposits, with areas of thickness predominantly between 5–50m, with some areas of >50m. The main seabed sediments within the recommended RZ are predominantly sandy mud and muddy sand, with smaller areas of sand, mixed sediment, fine mud and rock or other hard substrate of low energy. All biozones are of deep circalittoral.

TCE expected technology groups for the installation of fixed-bottom wind turbines within the recommended RZ are predominantly technology groups 5A (Jacket foundation structure, with 3D piles and low ground risk), 3B (Monopile foundation structure, with 3D complex piles and high ground risk), 4A (Jacket foundation structure, with driven piles and low ground risk) and 1 (Jacket foundation structure, with suction installation). There are some smaller areas of technology groups 5B (Jacket foundation structure, with driven piles and high ground risk), 6B (Monopile foundation structure with socket installation and high ground risk), 7B (Jacket foundation structure with socket installation and high ground risk), 2A (Monopile foundation structure, with driven piles and low ground risk) and one area of 7A (Jacket foundation structure with socket installation and low ground risk).

There are no dumping grounds of spoil ground, explosives dumping grounds or MoD firing/danger areas within the recommended RZ.

Water

Water depths within the recommended RZ range from c.47-78m. Tidal speeds within the recommended RZ range from 0.18-0.30m/s.

There are no dumping grounds of spoil ground, explosives dumping grounds or MoD firing/danger areas within the recommended RZ.

There are no WFD Shellfish Waters, Bathing Waters or WFD coastal water bodies within the recommended RZ or tidal excursion zone.

The recommended RZ is located within the Celtic Seas sub-region for the MS (covering waters to the west of the UK and shared with RoI and France).

Air

There are no known air quality issues within the recommended RZ, as there are no significant anthropogenic sources of air pollution in the vicinity. The recommended RZ is located offshore of the settlements of Annalong, Ardglass, Ballymartin, Dunnaval / Ballyardle, Glassdrumman / Mullartown, Coney Island, Killough, Kilkeel, Longstone and Newcastle. The inshore boundary of the recommended RZ is located approximately 22km south-east of Newcastle, and approximately 14–16km offshore of Annalong, Ardglass, Ballymartin, Dunnaval / Ballyardle, Glassdrumman / Mullartown, Coney Island, Killough, Kilkeel and Longstone.

There are areas of relatively high intensity RYA leisure boating activity within the northern section of the recommended RZ, off the coast of Newcastle. There is relatively high leisure boating activity due to small craft travelling between Ardglass / Strangford Lough and Dublin Bay. There are also areas of relatively high intensity RYA leisure boating activity in proximity to the coastline, particularly offshore of Ardglass, and heading north towards Strangford Lough / Belfast Lough. Within the recommended RZ, this vessel traffic intensity may cause some minor, localised, air emissions.

Climatic Factors

There are no known blue carbon habitats (Annex I Saltmarsh, Annex I Maerl, Shellfish Waters, Subtidal and Intertidal Seagrass) within the recommended RZ. There are areas in the north of the recommended RZ that have been identified by Ulster Wildlife as being of low potential for blue carbon importance.

There are unlikely to be any sources of GHG emissions in the area, apart from vessels.

Material Assets

A c.3km length of a gas transmission pipeline between Scotland and RoI is located within the recommended RZ. This pipeline extends from the south-west to the north-east of the recommended RZ.

In general, there is a relatively moderate shipping density (>70th percentile) within the recommended RZ. However, there are some lower shipping density areas (>50th percentile) in the south, north-east and north-west, and small areas of higher shipping density (>90th percentile) in the east and west, of the recommended RZ. The areas of moderate to higher shipping density are predominantly associated with the Warrenpoint to Heysham freight ferry route. Fishing vessels associated with the ports of Kilkeel, Ardglass or Carlingford, as well as cargo and tanker vessels passing from ports in NI such as Belfast Lough, to Dublin or further south, may also contribute to the higher densities within these areas. There are no TSSs within the recommended RZ.

The recommended RZ is used by commercial fisheries. Relatively moderate fishing activity (>70th percentile) is present throughout, with some small areas of relatively high fishing effort located in the north-east, south-east and south-west (>90th percentile). Fleets that are known to operate within the recommended RZ include whitefish, scallop, pot, and Nephrops (for which the area of is of high importance). Key fishing areas for mobile scallops (king and queen), white fish (cod, haddock and hake) and herring fisheries, and a significant area for Nephrops fisheries are located within the recommended RZ. The Irish Sea is an important catching location for stock of commercial species such as herring, haddock, plaice, and Nephrops, and significant landings of fish (haddock, cod, monkfish/anglerfish, mackerel, plaice and hake), as well as Nephrops and other shellfish, are recorded at the ports of Kilkeel and Ardglass. There is a known area of importance for pot fisheries located within the north-east of the recommended RZ. The entirety of the recommended RZ is encompassed within spawning grounds for Nephrops and sprat, whilst whiting, lemon sole, plaice, hake, ling, mackerel, horse mackerel, sole and cod spawning grounds are also located within the recommended RZ and the tidal excursion zone. Areas of surveyed relatively high egg production (spawning area) for cod and plaice are also located within the recommended RZ and the tidal excursion zone. Furthermore, the entirety of the recommended RZ is located within nursery grounds for Nephrops, whilst whiting, sole, hake, spurdog, plaice, anglerfish, mackerel, thornback ray, tope shark, lemon sole, haddock, herring and cod nursery grounds are located within the recommended RZ and the tidal excursion zone, and a surveyed juvenile density (nursery area) for haddock and whiting are also within the recommended RZ and tidal excursion zone. Scallops have been recorded in the north-west of the recommended RZ. There are two areas that have fishing restrictions within the recommended RZ (for limits on harvesting size, catch quotas, fishing methods and timeframes during which fishing is prohibited for scallops, under the Conservation of Scallops Regulations; and for certain fishing gear within the Irish Sea Cod Box). There are no marine fish farms or aquaculture sites within the recommended RZ.

The north of the recommended RZ is used by the MoD, with a c.205km² area of the recommended RZ being located within the Ardglass Military Practice Area (X5402). This is utilised as a submarine exercise area, and a surface fleet practice and exercise area. There are no MoD danger areas within the recommended RZ.

There are no spoil dumping grounds or safeguarding zones for aviation interference within the recommended RZ.

The south-east coast of NI has a number of coastal attractions that are within the modelled viewshed for fixed turbines within the recommended RZ, including the Mourne Mountains. Tourist activities within the recommended RZ are likely to include water sports, sailing, and fishing within inshore areas, and there are areas of known relatively high intensity RYA leisure boating activity within the recommended RZ; these activities are unlikely to occur in offshore waters. The Mourne AONB, Strangford and Lecale AONB, Ring of Gullion AONB and 11 National Trust Lands are within the modelled viewshed for fixed wind turbines within the recommended RZ, as are significant long-distance walking routes, such as the Mourne Way within the Mourne AONB, which offer significant attraction for tourism. Further information on landscape designations that may act as tourist attractions within the modelled viewshed of the area is provided in the Landscape, Seascape, and Visual Amenity baseline.

The recommended RZ has a potential capacity of 1.76GW.

Cultural, Architectural and Archaeological Heritage

There are no protected wrecks within the recommended RZ. There are 22 recorded wrecks within the recommended RZ, and four additional wrecks within the tidal excursion zone.

The recommended RZ is situated between c.15km and c.30km distance from the coastline. There are 877 Listed Buildings, 416 Defence Heritage Record sites, 593 Scheduled Monuments, 104 Scheduled Zones, and 22 Parks and Gardens (including Mourne Park, Tollymore Park, Tyrella House, Castlewellan College, and Castle Ward) within the modelled viewshed (based on a turbine height of 165m and a viewable distance of 40km).

Landscape, Seascape and Visual Amenity

The recommended RZ is situated between c.15km and c.30km distance from the coastline. There are 47 settlements situated inshore of the recommended RZ, which are within the modelled viewshed (based on a turbine height of 165m and a viewable distance of 40km). These include Kilkeel, Newcastle, Ardglass, Downpatrick, and Annalong, while transboundary settlements in RoI are also within the modelled viewshed.

There are no WHSs situated inshore of the recommended RZ. There are three AONBs situated inshore of the recommended RZ, and which are within the modelled viewshed: Mourne AONB, Strangford and Lecale AONB, and Ring of Gullion AONB. There are also 11 National Trust Lands within the modelled viewshed: Bryansford, Castle Ward, Clough Castle, Dundrum Coastal Path, Glastry, Green and Blockhouse Islands, Kearney, Mournes Coastal Path, Murlough NNR, Slieve

Donard, and Strangford Lough. The recommended RZ is within the Irish Sea (South Down) RSCA, while Mourne Coast RSCA, Lecale Coast RSCA, and Dundrum Bay RSCA are situated inshore of the recommended RZ.

Environmental Assessment	Short-term	Medium-term	Long-term
Biodiversity, Flora and Fauna (BFF)	-3	-3	-3
Population and Human Health (PHH)	-2	-2	-2
Geology, Soils and Land Use (GSL)	-2	-2	-2
Water (W)	-1	-1	-1
Air (A)	0	+3	+3
Climatic Factors (CF)	-1	+3	+3
Material Assets and Infrastructure (MA)	-3	-3 / +3	-3 / +3
Cultural, Architectural and Archaeological Heritage (CH)	-3	-3	-3
Landscape/Seascape and Visual Amenity (L)	-3	-3	-3

Key Conclusions:

Biodiversity, Flora and Fauna – There is potential for significant adverse effects on Biodiversity, Flora, and Fauna in the short-term construction and decommissioning phases (-3), owing to the location of Pisces Reef Complex SAC, designated for Annex I Reef habitat, c.1km offshore of the recommended RZ and within the tidal excursion zone, and the immediate proximity of the North-West Irish Sea SPA within the tidal excursion zone to the south, and potential for significant adverse effects on Biodiversity, Flora, and Fauna in the short-term construction and decommissioning phases (-3) and the medium to long-term operational phase (-3), owing to the interaction with spawning and nursery areas for several fish species.

There is also potential for moderate adverse effects in the short-term construction and decommissioning phases, and the medium to long-term operational phase (-2) for benthic habitats and species, owing to the occurrence of Annex I habitat and sensitive species, for marine mammals, owing to interaction with a TCE Moderate MPA risk area and the recorded occurrence of species within the recommended RZ, and birds, owing to interaction with TCE High and Moderate MPA risk areas for Breeding Birds and recorded moderate to high density of seabirds within the recommended RZ.

Population and Human Health – There is potential for moderate adverse temporary, direct and indirect, effects on leisure and recreational marine users due to an increased collision risk, access restrictions and displacement, or water quality effects, during the construction and decommissioning phases (-2). There is also potential for moderate adverse long-term (device life) effects due to an enhanced collision risk for recreational and leisure vessels with devices, and displacement of recreational and leisure craft from the array area during the operational phase (-2). This is due to known relatively high use of areas within the recommended RZ by recreational and leisure vessels.

Geology, Soils and Land Use – There is potential for moderate adverse effects on Geology, Soils and Land use in the short-term construction and decommissioning phase, due to the potential to encounter geological deposits of varying thickness, which may require more invasive installation technologies with potential for moderate adverse direct long-term effects on the seabed geology and sediments through loss of material (-2). Following the installation of fixed wind technologies there is potential for slight adverse medium to long-term operational phase localised impacts on erosion and deposition patterns due to the presence of devices (-2). There is potential for influence on the MS Descriptor 6 sea floor integrity from the installation processes of fixed wind technologies in the recommended RZ, however, there is not anticipated to be potential for adverse effects on the achievement of GES.

Water – There is potential for slight adverse short-term effects on water quality elements that are considered by the MS (e.g., Descriptor 9 Concentrations of contaminants in fish and other seafood; Descriptor 8: Concentration of contaminants within marine environment; Descriptor 10 marine litter) during seabed preparation, construction, maintenance, and decommissioning activities (-1). There is not anticipated to be potential for adverse effects on the achievement of GES with the application of standard best practice mitigation.

Air – There is potential for significant positive indirect effects on regional air quality in the medium to long-term operational phase, as the operation of renewable energy devices can support a transition away from fossil fuel use and its associated air emissions, with potential for a relatively high capacity in the recommended RZ (+3).

Climatic Factors – There is potential for slight adverse short-term effects on sediment carbon storage, due to a localised release of CO_2 from seabed disturbance during the construction and decommissioning phases (-1). There is potential for slight adverse, short-term, temporary effects on localised GHG concentrations, due to GHG emissions from vessels and machinery during the construction and decommissioning phases (-1), which should be minimised at the project level through adherence to standard best practise for the minimisation of air pollution, as set out in **Section 10.1.**

There is potential for significant positive, medium to long-term effects during the operational phase, as the operation of renewable energy devices can contribute to a net reduction in GHG emissions, decarbonisation of the energy sector, diversification of electricity supply and energy security, and meeting of energy objectives and climate change emission reduction targets, with potential for a relatively high capacity in the recommended RZ (+3).

Material Assets – Overall, there is considered to be potential for significant adverse effects in the short, medium, and long-term on Material Assets (-3), following the consideration of best practice mitigation measures, which is mainly attributed to the potential for significant adverse effects on Shipping and Navigation, and Commercial Fisheries.

Given the presence of higher density known shipping areas, largely associated with the Warrenpoint to Heysham ferry route within the recommended RZ, there is the potential for significant navigational risk and displacement in the short, medium, and long-term (-3). This is owing to the potential displacement of vessels during construction and decommissioning (short-term) and operation (medium to long-term), as well as potential for direct and indirect adverse effects on navigation and communications in all phases. Significant adverse effects could be mitigated through avoidance of the higher density Warrenpoint to Heysham shipping route.

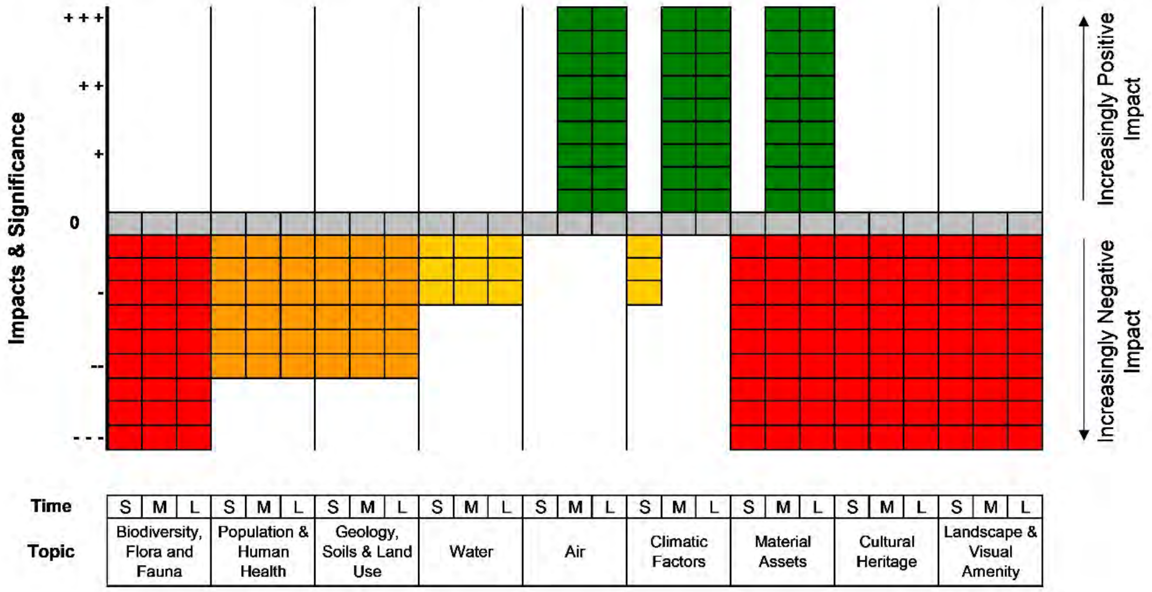
There is potential for significant indirect effects on the profitability of commercial fishing in the short, medium, and long-term (-3), such as the potential for reduced quotas, increased resource competition for fishing, and reduced landings in both tonnage and economic value. This is owing to the combination of potential significant adverse effects including: potential displacement from shipping grounds in the short, medium, and long-term (-3); potential for increased collision risk associated with the presence of construction and decommissioning vessels (short-term) (-3), and the presence of maintenance vessels and displacement from fishing grounds (medium to long-term) (-2); as well as effects on commercial fish species and their key habitats due to direct loss of supporting habitats (-3), and indirect effects due to sediment mobilisation in the short-term (-3) and medium to long-term (-2); all of which could indirectly affect fishing activity through an alteration of commercial fish stocks.

There is potential for significant positive effects in terms of the generation of a new renewable energy supply for the NI population in the medium to long-term, as the recommended RZ has a potential capacity of 1.76GW (+3).

Cultural, Architectural and Archaeological Heritage – There is potential for moderate to significant adverse effects on Cultural Heritage in the short-term construction and decommissioning phases, and the medium to long-term operational phase (-2 to -3) owing to the distance of the recommended RZ offshore and the high sensitivity of coastal heritage receptors whose setting may be affected, as well as the presence of many known (undesignated) wrecks.

Landscape, Seascape and Visual Amenity – There is potential for moderate to significant adverse effects on Landscape, Seascape and Visual Amenity in the short-term construction and decommissioning phases, and the medium to long-term operational phase (-2 to -3) owing to the distance of the recommended RZ offshore and the very high sensitivity of the landscape areas that may be affected, including Mourne AONB, Strangford and Lecale AONB, and Ring of Gullion AONB, as well as a coastal population that may be affected by changes in visual amenity.

Summary Chart of Potential Effects

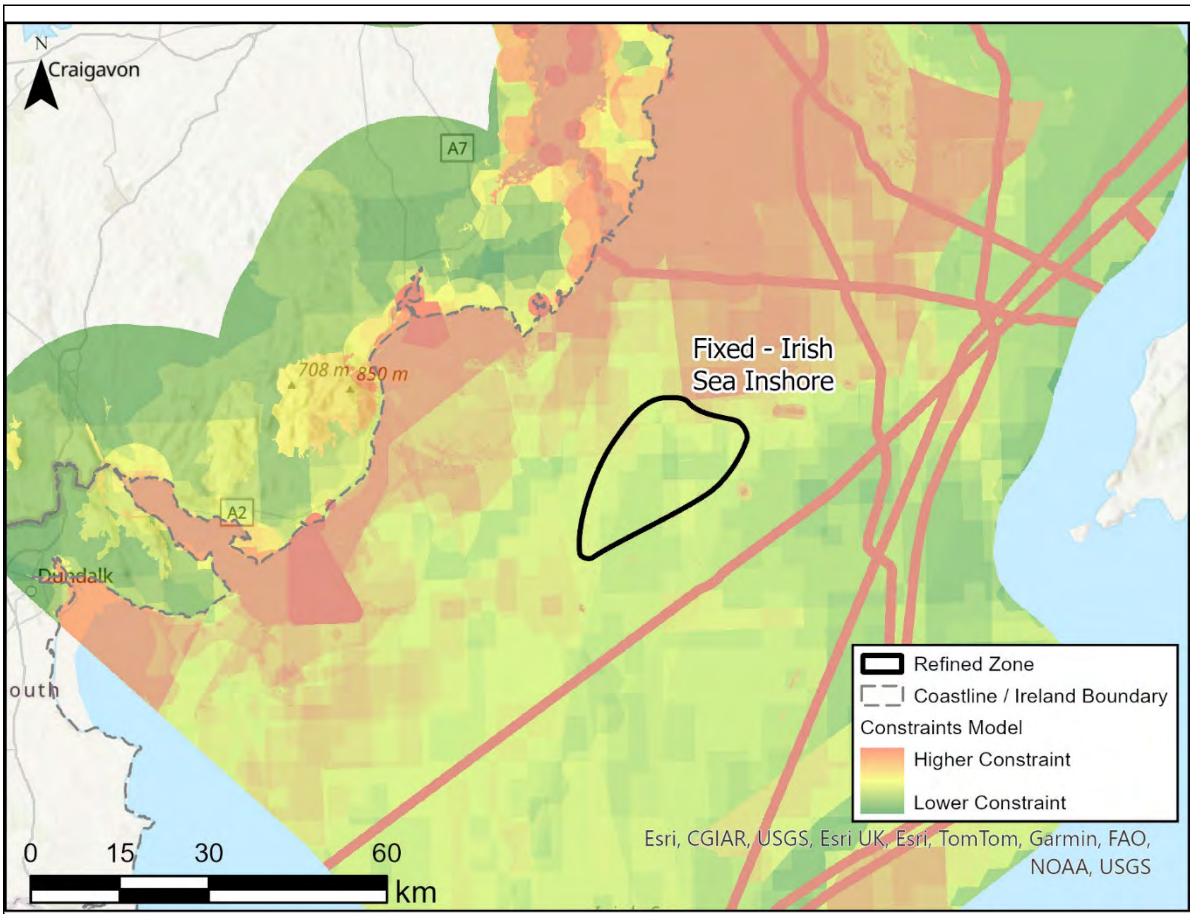


Stage 3 - Recommendations for Further Refinement

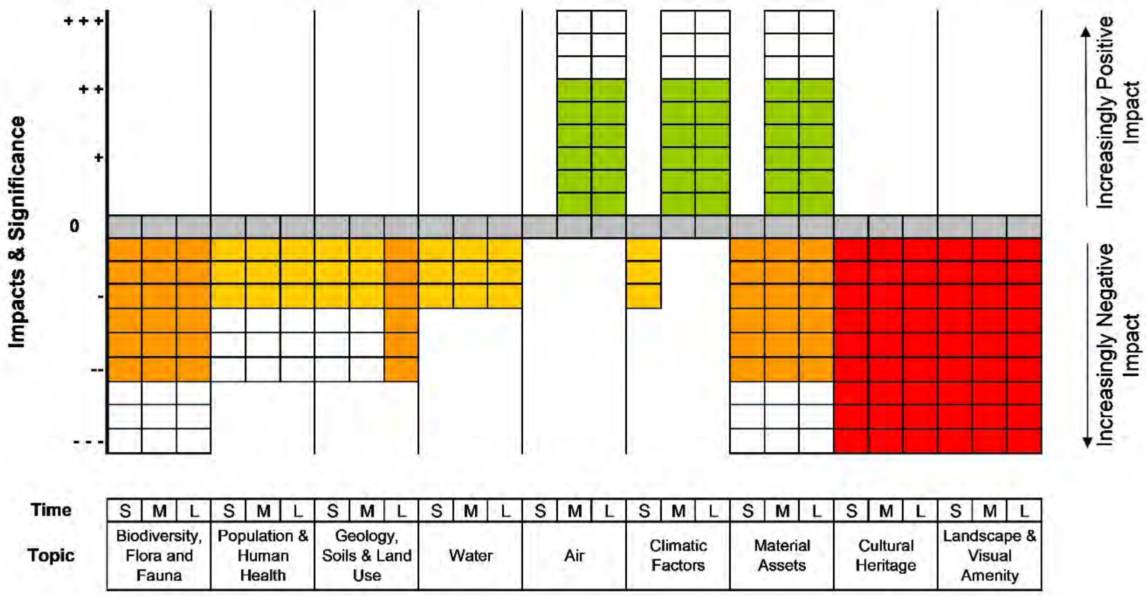
Further refinement of the Fixed Irish Sea Inshore recommended RZ is recommended to exclude the south, where the greatest overlap of known fish spawning and nursery grounds occurs, and refinement to avoid the North-West Irish Sea SPA, North Channel SAC and Pisces Reef Complex SAC being within the tidal excursion zone, which can reduce the overall score for Biodiversity, Flora, and Fauna to -2. Further refinement to avoid the areas of high and moderate shipping density, high fishing activity, and highest known importance for fish spawning and nursery can reduce the significance of effects for Material Assets, to give an overall score of -2. As the recommended RZ is >13km from shore at all points, for consistency with other RZs, no further refinement is recommended at this stage based on the potential for visual effects; the score for Cultural Heritage and Landscape, Seascape and Visual Amenity remains as -2 to -3, depending on the distance from shore within the recommended RZ (15-30km). It is also recommended to avoid the areas of known high use by leisure vessels, which can reduce the significance of effects for Population and Human Health to -1.

The theoretical energy potential of the refined Fixed Irish Sea Inshore RZ is 0.52GW.

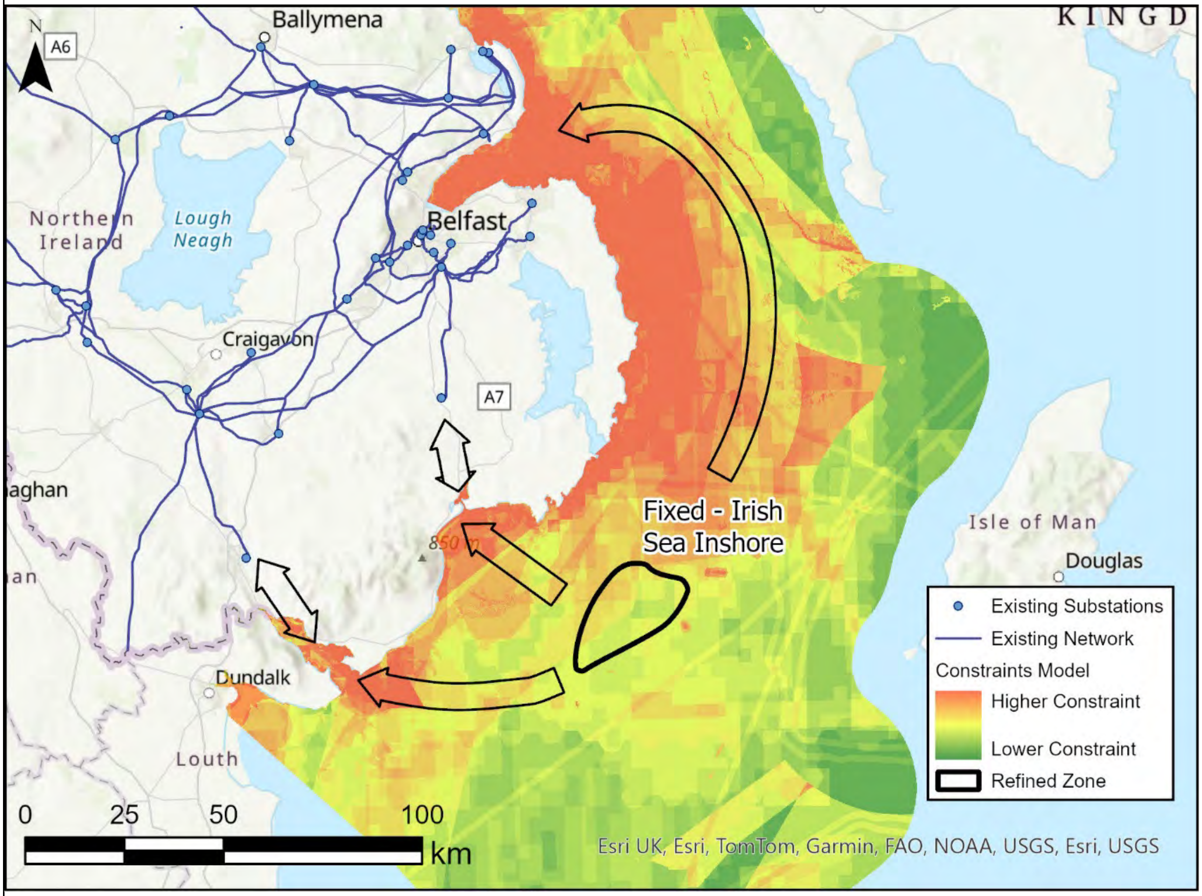
It is important to note that the south-east of the recommended RZ crosses into NI offshore waters, which may give rise to jurisdictional and consenting issues that may complicate governance and approval of the projects.



Comparative Chart



Potential Export Cable Routes



Connection into Greater Belfast area. 110kV existing network. Length approx. 86km.

Significant likely constraints include North Channel SAC, East Coast Marine pSPA, Annex I Reef and telecommunication cables. Other constraints which can potentially be avoided include cliffs over 15m, Outer Belfast Lough MCZ, Scallop Enhancement Areas, Urban Areas and Ports. The Outer Ards SPA/Ramsar Site/IBA and several Bathing Water Sites are unavoidable if connecting into the Bangor area.

Connection into Ballynahinch area. 110kV existing network. Length approx. 39km

Significant constraints include Murlough SAC which can potentially be avoided; however, this would require a longer route. Significant likely constraints include Annex I Sandbanks, Annex I Reef, and the Mourne AONB and the Strangford and Lecale AONB. Other constraints which can potentially be avoided include marine fish farms (crustaceans/fish), Ballykinler Military Areas, Urban Areas, Murlough NNR, Murlough ASSI, St. John’s Point ASSI, South Down Coast IBA, Dundrum Inner Bay IBA and Murlough, Newcastle, Tyrella Bathing Water Sites.

Connection into Newry area. 110kV existing network. Length approx. 54km

Significant constraints include marine fish farms (Crustaceans) which can potentially be avoided; however, this would require a longer offshore route. Significant likely constraints include Carlingford Marine pSPA, Carlingford Lough ASSI, areas of high intensity fishing, Annex I Reef, Carlingford Lough IBA, a Pilot Boarding Station and the Mourne AONB. Other constraints which can potentially be avoided include Carlingford Shore SAC, Derryleckagh SAC, Carlingford Lough MCZ, Carlingford Lough Ramsar, Carlingford Lough SPA, Urban Areas onshore, Cranfield Bay and Warrenpoint Bathing Water Sites

9.2.6 Fixed Wind Resource Zone: Irish Sea Offshore 1

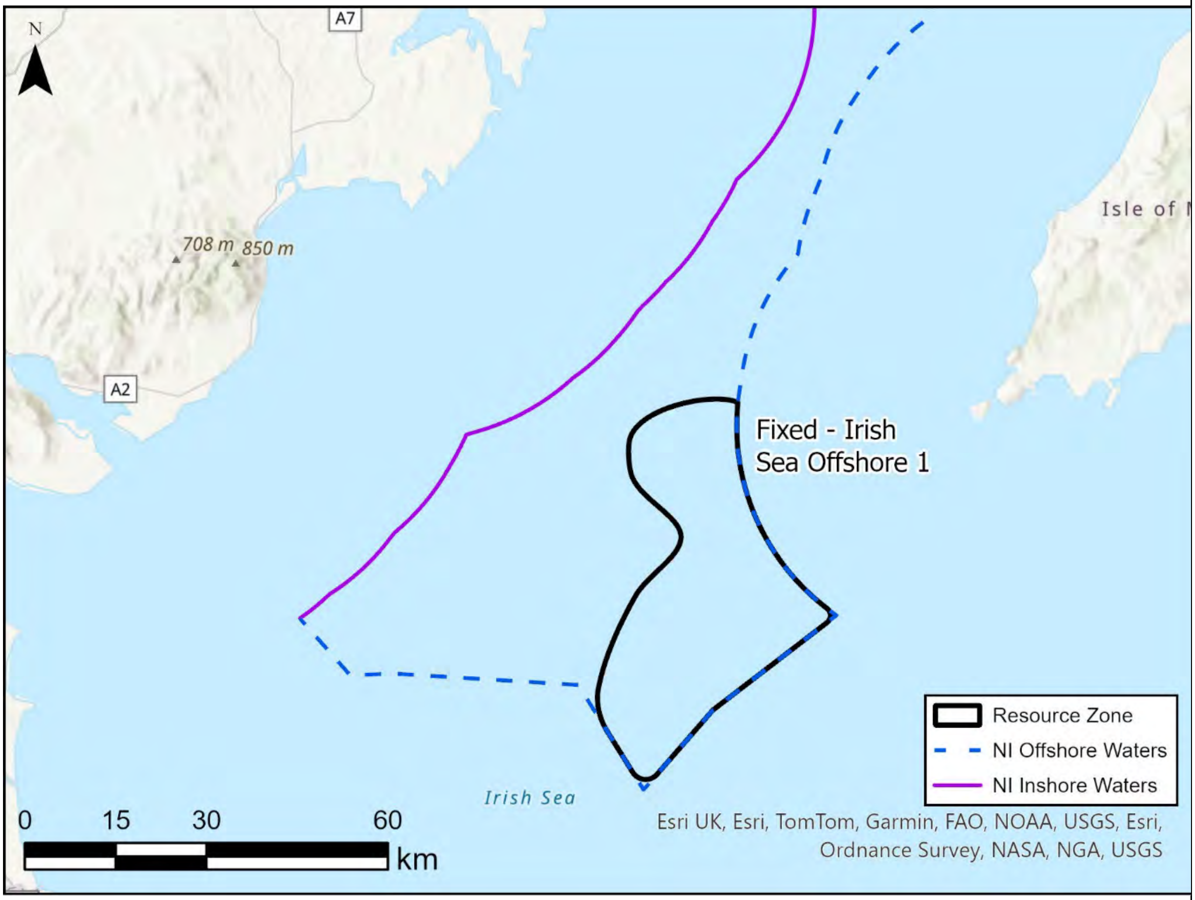
Stage 1 Fixed Wind Resource Zone – Irish Sea Offshore 1

The Fixed Wind Irish Sea Offshore 1 RZ is located in the Irish Sea off the south-east coast of NI, approximately 40km offshore of the Mourne Mountains. The water depth of the RZ ranges from c.58m to c.80m. The average wind speeds range from c.10.4m/s to 10.59m/s. The predominant suitable TCE Technology Groups for the RZ include:

- Technology Group 1 (Jacket Suction)
- Technology Group 4A (Jacket Driven Low)
- Technology Group 5B (Jacket 3D High)

The theoretical energy potential of this RZ is 1.52GW.

Fixed Wind Resource Zone – Irish Sea Offshore 1



Key Environmental Constraints and Sensitivities within the Resource Zone

Biodiversity, Flora and Fauna – Queenie Corner MCZ and North Anglesey Marine SAC are within the RZ. There are known areas of Annex I Reef habitat, and areas identified by TCE as being of High to Very High MPA Risk to Marine Mammals, and Very High MCZ Risk to Habitats.

Population and Human Health – There are no key sensitivities within the RZ.

Geology, Soils and Land Use - There are areas of offshore rock within the RZ.

Water - There are no key sensitivities within the RZ.

Air – There are no key sensitivities within the RZ.

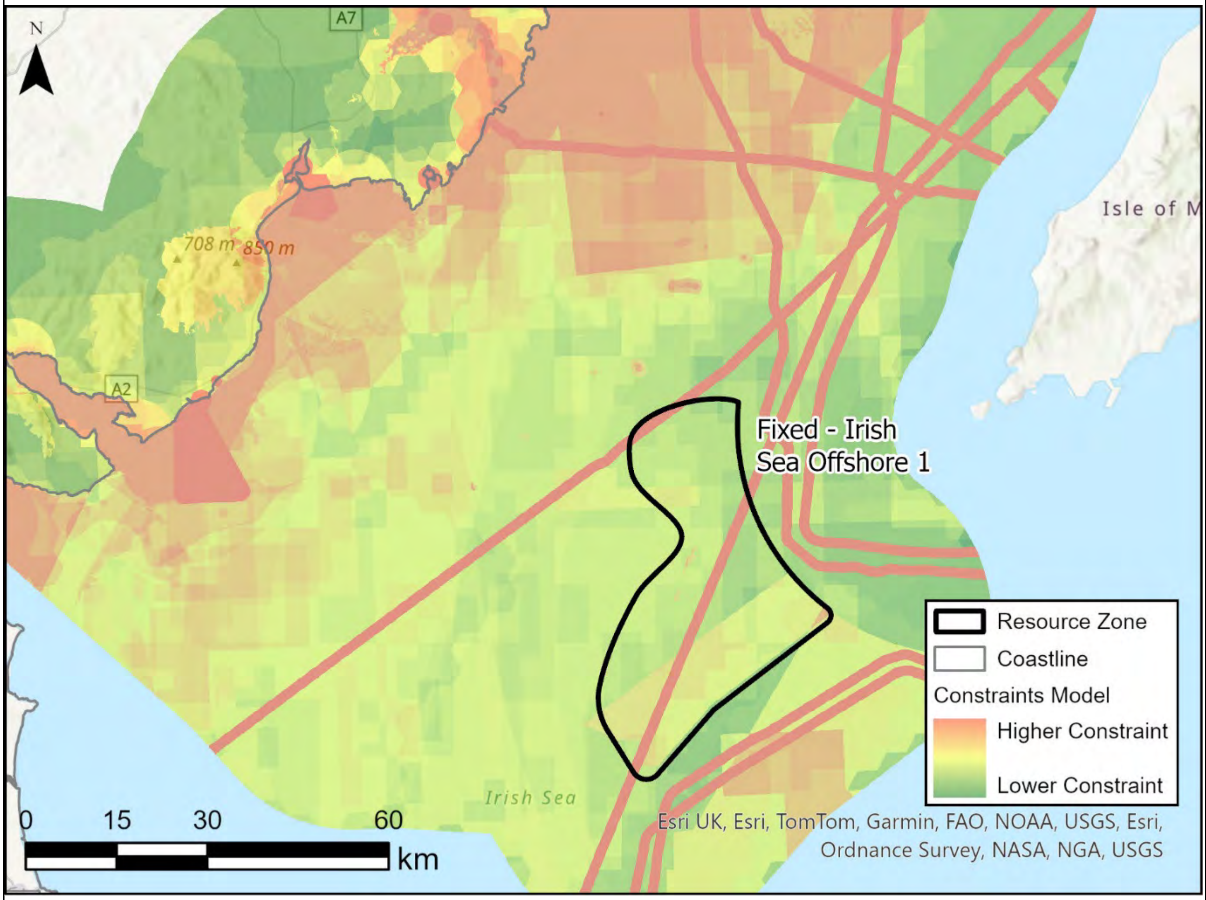
Climatic Factors - No key sensitivities are within the RZ.

Material Assets – There is a pipeline and a telecommunication cable (CeltixConnect-2 (CC-2)/Havhingsten) within the RZ. There are areas of high shipping density (>90th percentile), and areas of high fishing activity (>90th percentile) within the RZ.

Cultural, Architectural and Archaeological Heritage – There are unprotected wrecks within the RZ.

Landscape, Seascape and Visual Amenity – There are no key sensitivities identified for the RZ.

Fixed Wind Resource Zone – Irish Sea Offshore 1

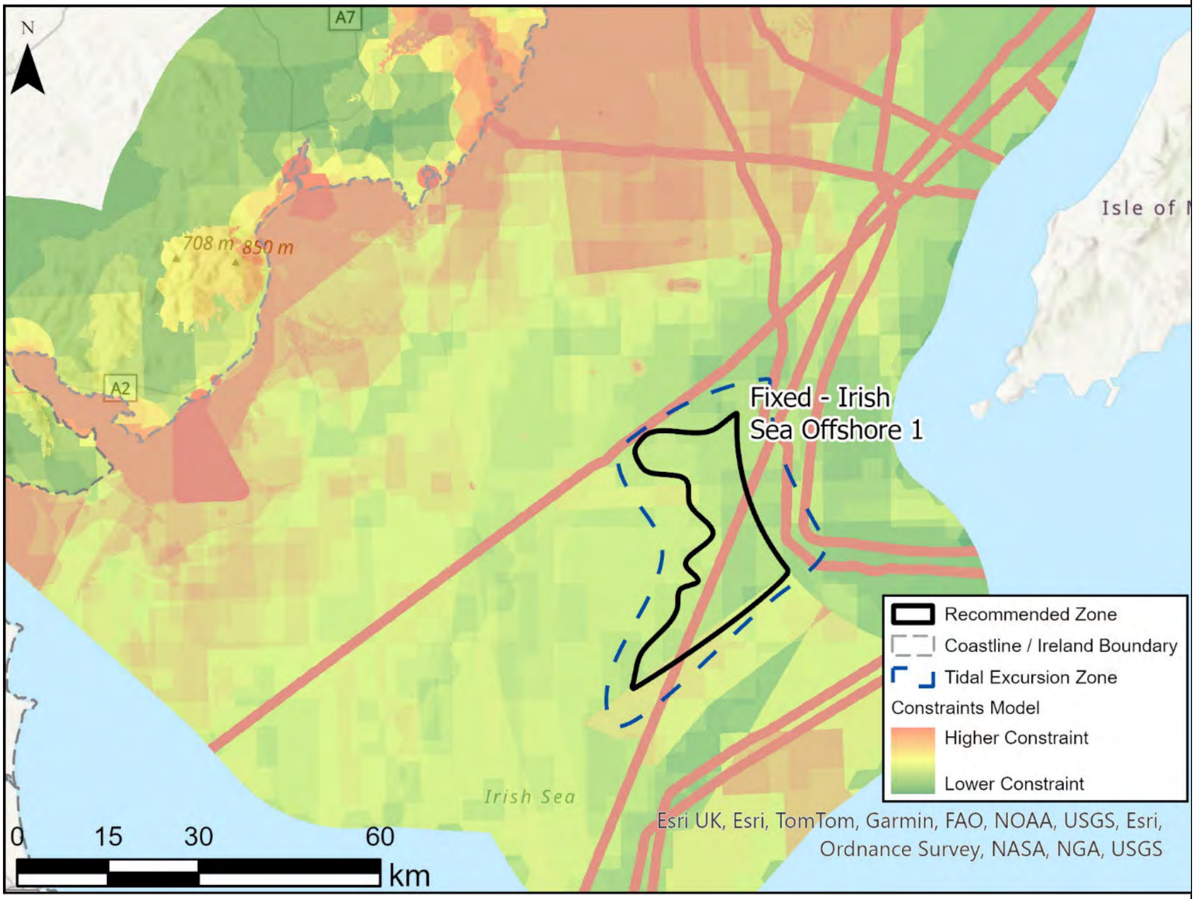


Stage 2 Recommended Fixed Wind Resource Zone – Irish Sea Offshore 1

To avoid the potential for direct adverse effects on identified key sensitivities within the Irish Sea Inshore RZ, it was refined through the exclusion of the south-east area to avoid overlap with Queenie Corner MCZ and North Anglesey Marine SAC.

The theoretical energy potential of the recommended Stage 2 Irish Sea Offshore 1 RZ is 0.79GW.

Recommended Fixed Wind Resource Zone – Irish Sea Offshore 1 and Combined Constraints Model



Environmental Baseline and Key Issues within the Recommended Resource Zone

Environmental baseline information relevant to this recommended RZ is given below, ordered by SEA environmental topic. These sensitivities and indicators have the potential to be impacted by and impact upon the development and/or operation of offshore fixed wind.

Biodiversity, Flora and Fauna

There are no designated sites (SACs, SPAs, Ramsar sites, MCZs, ASSIs) within the recommended RZ. Queenie Corner MCZ is situated immediately adjacent to the south-east boundary of the recommended RZ and is within the tidal excursion zone. There is a TCE Very High MCZ risk area for Habitats in the south-east of the recommended RZ, and Moderate MPA risk areas for Breeding Birds and Marine Mammals. There are no known areas of Annex I habitat within the recommended RZ or tidal excursion zone. The seabed habitats within the recommended RZ predominantly consist of fine mud, with sandy mud and muddy sand in the south-east, and small areas of rock/hard substrate in the west.

There are no records of Protected Species (Wildlife Order) within the recommended RZ. NI Priority Species that have been recorded include bottlenose dolphin, and fish spiny dogfish, whiting, herring, hake, and cod (these recorded fish species are also OSPAR Threatened or Declining species). Elasmobranch species with recorded presence include thornback ray, spotted ray, and school shark. There are also records of Priority Marine Features (PMFs) queen scallop and great scallop within the recommended RZ.

There are areas of SCANS recorded relatively high density for beaked whale and minke whale, and relatively moderate density for striped dolphin, fin whale, common dolphin, common/striped porpoise, and minke whale within the recommended RZ. MU data also indicates that the cetaceans white-sided dolphin, white-beaked dolphin, Risso's dolphin, minke whale, harbour porpoise, common dolphin, and bottlenose dolphin may occur within the area. There is an area of relatively moderate density for grey seal in the south-east of the recommended RZ.

There are areas of recorded relatively high and moderate density for seabirds at sea within the recommended RZ. There is also a known spawning ground of low intensity for sandeel, a key food source for many species of seabird, within the recommended RZ.

There are spawning grounds for cod, horse mackerel, ling, mackerel, sandeel, hake, plaice, sole, Nephrops, and sprat within the recommended RZ and the tidal excursion zone. Areas of AFBI surveyed relatively high egg production (spawning area) for cod and moderate egg production for plaice are also located within the recommended RZ and the tidal excursion zone. Furthermore, there are nursery grounds for Nephrops, whiting, spurdog, herring, hake, plaice, anglerfish, mackerel, and cod within the recommended RZ and the tidal excursion zone, and AFBI surveyed relatively high juvenile density (nursery area) for haddock and whiting are also within the recommended RZ and tidal excursion zone. There are two areas with fishing restrictions within the recommended RZ, for scallops, under the Fisheries Act 2012, and for certain fishing gear within the Irish Sea Cod Box.

There are no records of invasive species within the recommended RZ.

Population and Human Health

The recommended RZ is located offshore of the settlements of Annalong, Ballymartin, Dunnaval / Ballyardle, Glassdrumman / Mullartown, Kilkeel, Longstone and Newcastle. The inshore boundary of the recommended RZ is located approximately 43km south-east of Newcastle, and approximately 49–53km offshore of Annalong, Ballymartin, Dunnaval / Ballyardle, Glassdrumman / Mullartown, Kilkeel and Longstone.

The recommended RZ is located offshore of the Cranfield Bay, Murlough, Newcastle and Tyrella Bathing Water sites, and Cranfield West, Minerstown, Murlough and Tyrella Blue Flag Beaches. However, none of these sites are located within the recommended RZ or tidal excursion zone.

There are areas of relatively high intensity RYA leisure boating activity further inshore around Ardglass / Strangford Lough, heading south towards Dublin Bay, due to small craft travelling between these two areas. Within the recommended RZ, there is RYA leisure boating activity from the Isle of Man to Dublin Bay, however, this is of relatively low vessel traffic intensity comprising transient vessel traffic.

There are no known dive sites within the recommended RZ or tidal excursion zone.

Geology, Soils and Land Use

There are no WHSs, ASSIs or UNESCO Geoparks designated for geology or geomorphology within the recommended RZ or the tidal excursion zone. Queenie Corner MCZ is situated immediately adjacent to the south-east boundary of the recommended RZ and is within the tidal excursion zone. It is designated for its subtidal mud features and sea-pen and burrowing megafauna communities.

The main seabed geology within the recommended RZ is soft mud, with thickness of between 5–50m, and one area of >50m. Within the recommended RZ, the seabed substrate is predominantly sublittoral sediment, with some areas of sandy mud and rock or other hard substrate, and small areas of fine mud and muddy sand. All biozones are deep circalittoral with low energy.

TCE expected technology groups for the installation of fixed-bottom wind turbines within the recommended RZ are predominantly within technology group 5B (Jacket foundation structure, with 3D complex piles and high ground risk) with some areas of 4A (Jacket foundation structure, with driven piles and low ground risk) and small areas of 1 (Jacket foundation structure, with suction installation 5A (Jacket foundation structure, with 3D complex piles and low ground risk) and 7B (Jacket foundation structure, with socket installation and high ground risk).

There are no dumping grounds of spoil ground, explosives dumping grounds or MoD firing/danger areas within the recommended RZ.

Water

The water depths within the recommended RZ range from c.59-78m. Tidal speeds within the recommended RZ range from 0.24-0.45m/s.

There are no dumping grounds of spoil ground, explosives dumping grounds or MoD firing/danger areas within the recommended RZ.

There are no WFD Shellfish Waters, Bathing Waters or WFD coastal water bodies within the recommended RZ or tidal excursion zone.

The recommended RZ is located within the Celtic Seas sub-region for the MS (covering waters to the west of the UK and shared with RoI and France).

Air

There are no known air quality issues within the recommended RZ, as there are no significant anthropogenic sources of air pollution in the vicinity. The recommended RZ is located offshore of the settlements of Annalong, Ballymartin, Dunnaval / Ballyardle, Glassdrumman / Mullartown, Kilkeel, Longstone and Newcastle. The inshore boundary of the recommended RZ is located approximately 43km south-east of Newcastle, and approximately 49–53km offshore of Annalong, Ballymartin, Dunnaval / Ballyardle, Glassdrumman / Mullartown, Kilkeel and Longstone.

There are areas of relatively high intensity RYA leisure boating activity further inshore around Ardglass / Strangford Lough, heading south towards Dublin Bay, due to small craft travelling between these two areas. Within the recommended RZ, there is RYA leisure boating activity from the Isle of Man to Dublin Bay, however, this is of relatively low vessel traffic intensity, and is likely to cause only minor, localised, air emissions.

Climatic Factors

There are no known blue carbon habitats (Annex I Saltmarsh, Annex I Maerl, Shellfish Waters, Subtidal and Intertidal Seagrass) within the recommended RZ. There are no areas within the recommended RZ that have been identified by Ulster Wildlife as of blue carbon importance. There are unlikely to be any sources of GHG emissions in the area, apart from vessels.

Material Assets

A c.16.4km length of offshore gas transmission pipeline is located diagonally across the recommended RZ from the east to south-west. There are no offshore telecommunication cables, or offshore energy cables, within the recommended RZ.

In generally, there is a relatively low shipping density (>50th percentile) within the recommended RZ, with some moderate density areas (>70th percentile) primarily concentrated along the eastern boundary, and a small path across the north of recommended RZ. There is also a small area (c.1.67km^2) of higher shipping density (>90th percentile) located in the north-west of the recommended RZ. These areas of moderate to higher shipping density are predominantly associated with the Warrenpoint to Heysham freight ferry route. Fishing vessels associated with the ports of Kilkeel, Ardglass, and Carlingford, as well as cargo and tanker vessels passing from ports in NI, such as Belfast Lough, to Dublin or further south, may also contribute to the higher density within these areas. There are no TSSs within the recommended RZ.

The recommended RZ is heavily used by commercial fisheries. Areas of relatively high fishing activity (>90th percentile) are located in the west, while moderate fishing activity (>70th percentile) is located in the north, east and south, and the centre of the recommended RZ has lower fishing activity (>50th percentile). Fleets that are known to operate within the recommended RZ include whitefish and Nephrops (for which the area of is of high importance). Key fishing areas for mobile herring, Nephrops and whitefish (cod, haddock and hake) are located within the recommended RZ. The Irish Sea is an important location for stocks of commercial species including herring, haddock, plaice and Nephrops, and significant landings of fish (haddock, cod, monkfish/anglerfish, mackerel and hake), as well as Nephrops and other shellfish, are recorded at the port of Kilkeel. The entirety of the recommended RZ is encompassed by the West Irish Sea Nephrops Ground, known Nephrops nursery and spawning grounds as well as sprat spawning grounds and cod nursery grounds. Additionally, a cod spawning ground is located to the east of the recommended RZ within the tidal excursion zone. Furthermore, egg production areas (spawning areas) for plaice and cod, as well as juvenile (nursery areas) for haddock and whiting are located within the recommended RZ. There are no identified areas of importance for inshore fisheries within the recommended RZ. There is one area that has fishing restrictions within the recommended RZ (for certain fishing gear within the Irish Sea Cod Box). There are no marine fish farms or aquaculture sites within the recommended RZ.

The north of the recommended RZ is used by the MoD, with a c.36.8km² area being located within the Peel Military Practice Area (X540), which is used for submarine exercises. There are, however, no MoD danger areas within the recommended RZ.

There are no spoil dumping grounds or safeguarding zones for aviation interference within the recommended RZ.

The south-east coast of NI has a number of coastal attractions that are within the modelled viewshed for fixed wind turbines within the recommended RZ, including the Mourne Mountains. Tourist activities within the recommended RZ are likely to include water sports, sailing, and fishing within inshore areas, and there are areas of known relatively high intensity RYA leisure boating activity within the recommended RZ; these activities are unlikely to occur in offshore waters. The Mourne AONB, Strangford and Lecale AONB and two National Trust Lands are within the modelled viewshed for fixed wind turbines within the recommended RZ, as are significant long-distance walking routes, such as the Mourne Way within the Mourne AONB, which offer significant attraction for tourism. Further information on landscape designations that may act as tourist attractions within the modelled viewshed of the area is provided in the Landscape, Seascape, and Visual Amenity baseline.

The recommended RZ has a potential capacity of 0.79GW.

Cultural, Architectural and Archaeological Heritage

There are no protected wrecks within the recommended RZ. There are three recorded wrecks within the recommended RZ, and six additional wrecks within the tidal excursion zone. The recommended RZ is situated between c.38.5km and c.56km distance from the coastline. There are 120 Listed Buildings, 136 Defence Heritage Record sites, 83 Scheduled Monuments, 23 Scheduled Zones, and two Parks and Gardens (Tyrella House and Ballee House) within the modelled viewshed (based on a turbine height of 165m and a viewable distance of 40km).

Landscape, Seascape and Visual Amenity

The recommended RZ is situated between c.38.5km and c.56km distance from the coastline. There are seven settlements situated inshore of the recommended RZ, which are within the modelled viewshed (based on a turbine height of 165m and a viewable distance of 40km). These are Kilclief, Killough, Coney Island, Ardglass, Ballyhornan, Annalong, and Glassdrumman / Mullartown. There are no WHSs situated inshore of the recommended RZ. There are two AONBs situated inshore of the recommended RZ which are within the modelled viewshed: Mourne AONB, and Strangford and Lecale AONB. There are also two National Trust Lands (Mournes Coastal path and Strangford Lough) within the modelled viewshed. The recommended RZ is not within any Regional Seascape Character Areas (RSCA); it is situated c.10km offshore of the Irish Sea (South Down) RSCA.

Environmental Assessment	Short-term	Medium-term	Long-term
Biodiversity, Flora and Fauna (BFF)	-3	-3	-3
Population and Human Health (PHH)	-1	0	0
Geology, Soils and Land Use (GSL)	-3	-2	-2
Water (W)	-1	-1	-1
Air (A)	0	+2	+2
Climatic Factors (CF)	-1	+2	+2
Material Assets and Infrastructure (MA)	-3	-3 / +2	-3 / +2
Cultural, Architectural and Archaeological Heritage (CH)	-2	-2	-2
Landscape / Seascape and Visual Amenity (L)	-2	-2	-2

Key Conclusions:
Biodiversity, Flora and Fauna – There is potential for significant adverse effects on Biodiversity, Flora, and Fauna in the short-term construction and decommissioning phases, and the medium to long-term operational phase (-3), owing to the proximity of the recommended RZ to Queenie Corner MCZ within the tidal excursion zone, and the interaction of the south-east of the recommended RZ with a TCE High MCZ risk area for Habitats, in addition to the presence of known spawning and nursery grounds for several fish species. **Population and Human Health –** There is potential for slight adverse temporary direct and indirect effects on leisure and recreational marine users due to an increased collision risk, access restrictions and displacement, or water quality effects, during the construction and decommissioning phases (-1). The potential for adverse direct or indirect effects on these users in the medium to long-term during the operational phase is likely to be negligible, as there is relatively low recreational boating use within the recommended RZ (0). **Geology, Soils and Land Use –** There is potential for significant indirect short to long-term effects on Geology, Soils and Land use with the MCZ of Queenie Corner within the tidal excursion zone for the recommended RZ, and potential for adverse effects on designated sub-tidal mud features during seabed preparation, construction, and decommissioning (-3). There is also potential for moderate adverse direct long-term effects on the seabed geology and sediments in the use in the short-term construction and decommissioning phases; although the recommended RZ contains simple geologies which may require less complex installation technologies there is potential for moderate adverse direct long-term permanent effects on the seabed geology and sediments through loss (-2). Following the installation of fixed wind technologies, there is potential for slight adverse, medium to long-term operational phase localised impacts on erosion and deposition patterns due to the presence of devices (-2). There is potential for influence on the MS Descriptor 6 sea floor integrity from the installation processes of fixed wind technologies in the recommended RZ, however, there is not anticipated to be potential for adverse effects on the achievement of GES. Generally, there is potential for direct short-term temporary sediment loss in the vicinity of the construction works during seabed preparation activities, construction and decommissioning activities (-1), and medium to long-term loss within the footprint of foundations and scour protection during device operation (-2). **Water –** There is potential for slight adverse short-term effects on water quality elements that are considered by the MS (e.g., Descriptor 9 Concentrations of contaminants in fish and other seafood; Descriptor 8: Concentration of contaminants within marine environment; Descriptor 10 marine litter) during seabed preparation, construction, maintenance and decommissioning activities (-1). There is not anticipated to be potential for adverse effects on the achievement of GES with the application of standard best practice mitigation. **Air –** There is potential for moderate positive indirect effects on regional air quality in the medium to long-term operational phase, as the operation of renewable energy devices can support a transition away from fossil fuel use and its associated air emissions, with potential for a relatively moderate capacity in the recommended RZ (+2). **Climatic Factors –** There is potential for slight adverse short-term effects on sediment carbon storage, due to a localised release of CO_2 from seabed disturbance during the construction and decommissioning phases (-1). There is potential for slight adverse, short-term, temporary effects on localised GHG concentrations, due to GHG emissions from vessels and machinery during the construction and decommissioning phases (-1), which should be minimised at the project level through adherence to standard best practise for the minimisation of air pollution, as set out in **Section 10.1**. There is potential for moderate positive, medium to long-term effects during the operational phase, as the operation of renewable energy devices can contribute to a net reduction in GHG emissions, decarbonisation of the energy sector, diversification of electricity supply and energy security, and meeting of energy objectives and climate change emission reduction targets, with potential for a relatively moderate capacity in the recommended RZ (+2). **Material Assets –** Overall, there is considered to be potential for significant adverse effects in the short, medium, and long-term on Material Assets (-3), following the consideration of mitigation

measures, which is mainly attributed to the potential for significant adverse effects on Shipping and Navigation, and Commercial Fisheries.

Given the presence of higher density known shipping areas, largely associated with the Warrenpoint to Heysham ferry route within the recommended RZ, there is the potential for significant navigational risk and displacement in the short, medium, and long-term (-3). This is owing to the potential displacement of vessels during construction and decommissioning (short-term) and operation (medium to long-term), as well as potential for direct and indirect adverse effects on navigation and communications in all phases.

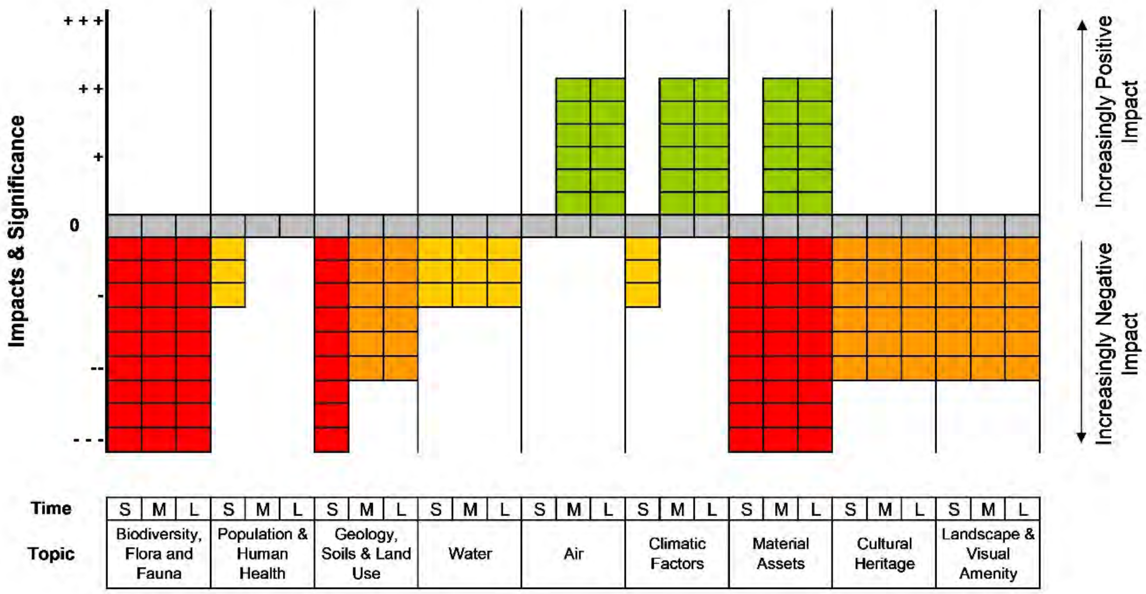
There is potential for significant indirect effects on the profitability of commercial fishing in the short, medium, and long-term (-3), such as the potential for reduced quotas, increased resource competition for fishing, and reduced landings in both tonnage and economic value. This is owing to the combination of potential significant adverse effects including: potential displacement from shipping grounds in the short, medium, and long-term (-3); potential for increased collision risk associated with the presence of construction and decommissioning vessels (short-term) (-3), and the presence of maintenance vessels and displacement from fishing grounds (medium to long-term) (-2); as well as effects on commercial fish species and their key habitats due to direct loss of supporting habitats (-3), and indirect effects due to sediment mobilisation in the short-term (-3) and medium to -long-term (-2); all of which could indirectly affect fishing activity through an alteration of commercial fish stocks.

There is potential for moderate positive effects in terms of the generation of a new renewable energy supply for the NI population in the medium to long-term, as the recommended RZ has a potential capacity of 0.79GW (+2).

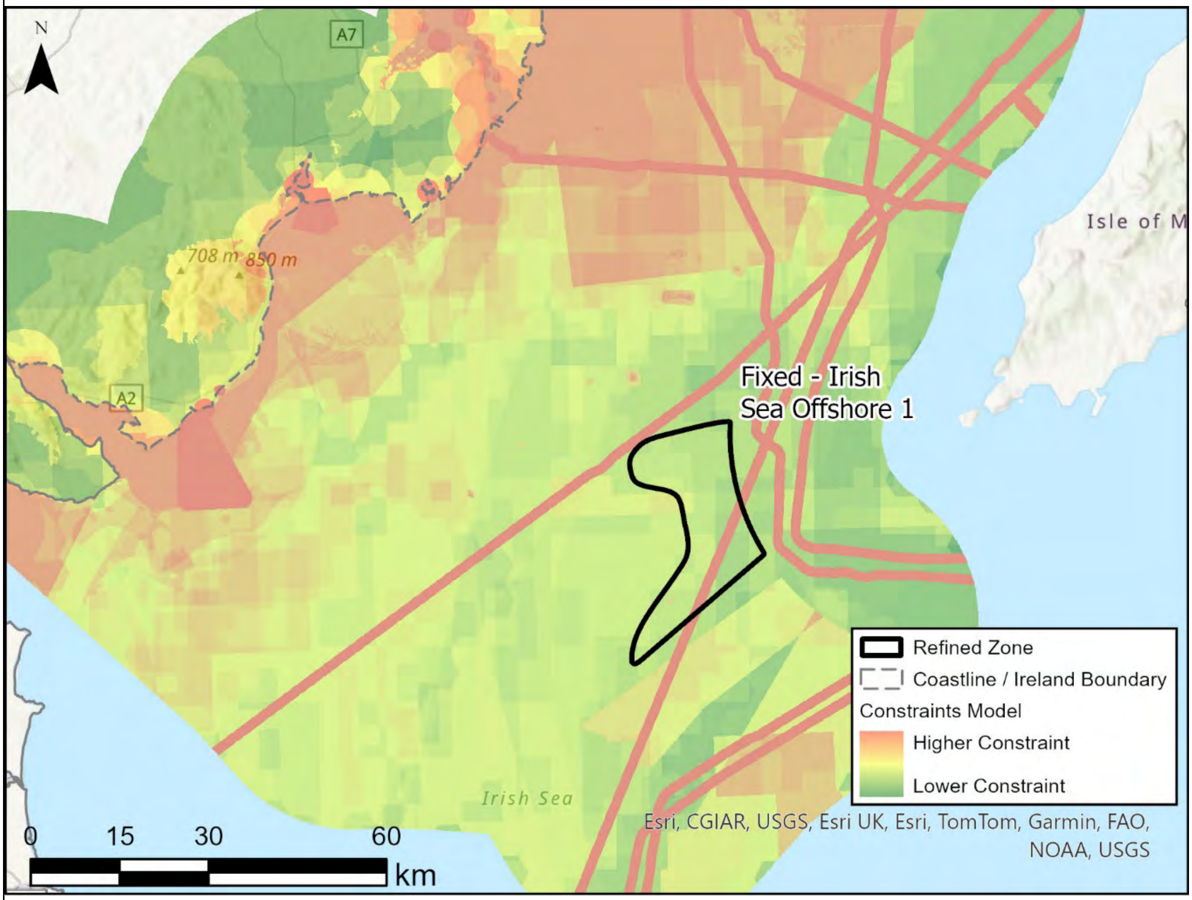
Cultural, Architectural and Archaeological Heritage – There is potential for moderate adverse effects on Cultural Heritage in the short-term construction and decommissioning phases, and the medium to long-term operational phase (-2) owing to the sensitivity of coastal heritage receptors whose setting may be affected.

Landscape and Visual Amenity – There is potential for moderate adverse effects on Landscape, Seascape, and Visual Amenity in the short-term construction and decommissioning phases, and the medium to long-term operational phase (-2) owing to the distance of the recommended RZ offshore and the high sensitivity of the landscape areas that may be affected, including Mourne AONB, and Strangford and Lecale AONB, as well as a coastal population that may be affected by changes in visual amenity.

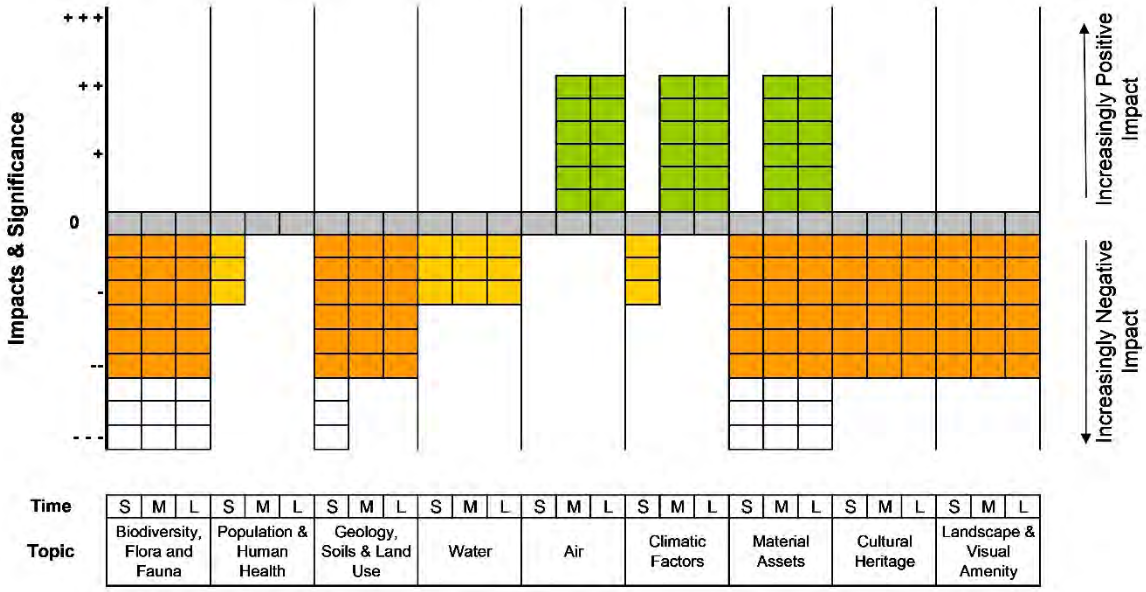
Summary Chart of Potential Effects



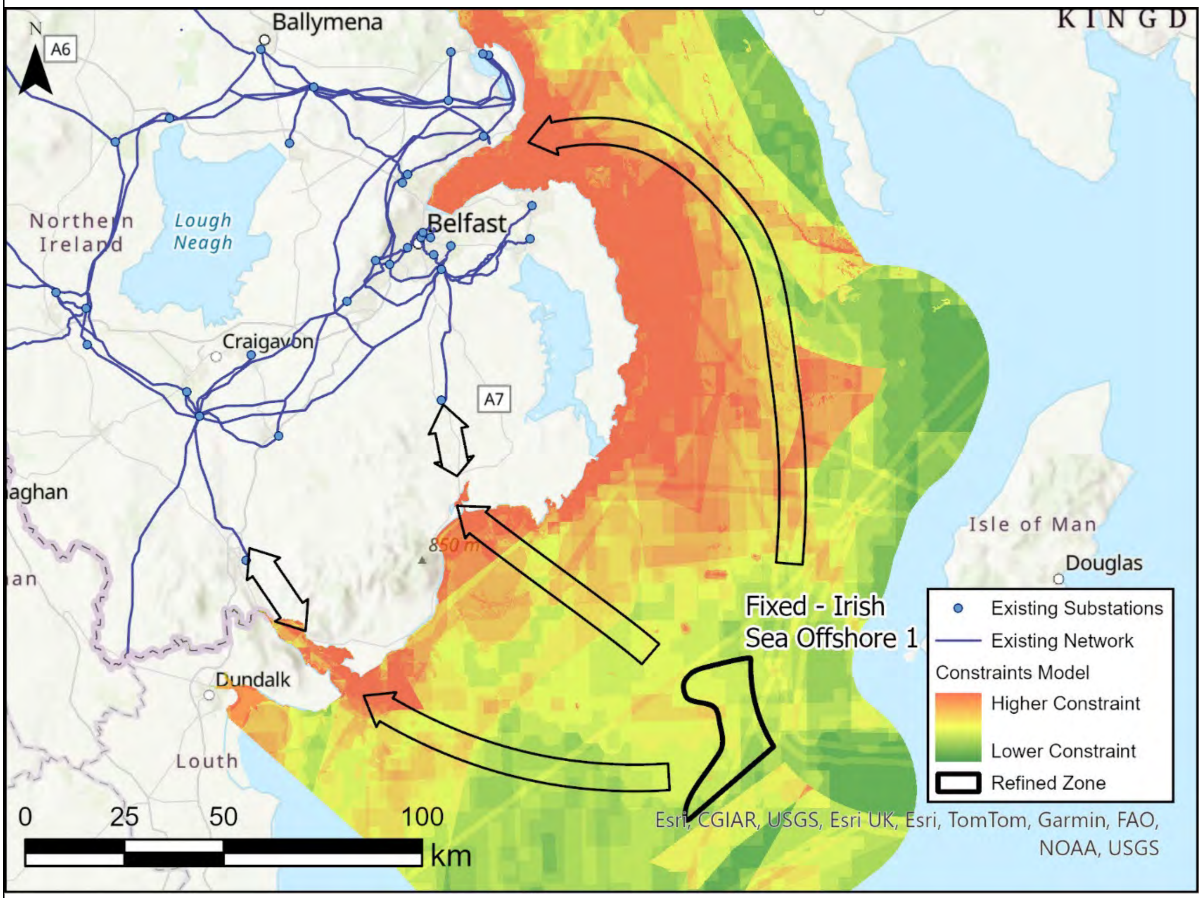
Recommendations for Further Refinement:
Further refinement of the Fixed Irish Sea Offshore 1 RZ is recommended to avoid Queenie Corner MCZ being within the tidal excursion zone and the TCE High MCZ risk area associated with this site, which can reduce the overall score for Biodiversity, Flora, and Fauna to -2, and for Geology, Soils, and Land use to -2. Further refinement to avoid the areas of high and moderate shipping density, high fishing activity, and highest known importance for fish spawning and nursery can reduce the significance of effects for Material Assets, to give an overall score of -2. No further refinements were recommended for Cultural Heritage or Landscape, Seascape, and Visual Amenity at this stage, as the recommended RZ is c.38.5km from shore, at its closest point, which is outside of the significance zone considered by the assessment for fixed wind. The theoretical energy potential of the refined Fixed Irish Sea Offshore RZ is 0.56GW. The development of wind energy sites further offshore in NI waters face increased technical challenges due to distance from ports, deeper waters and less sheltered conditions, as such construction and maintenance is more difficult and associated with higher costs requiring complex engineering solutions, specialised vessels and increased vessel trip distances. Additionally, the recommended RZ is located beyond 12nm, within NI offshore waters, which may give rise to jurisdictional and consenting issues that may complicate governance and approval of the projects.



Comparative Chart



Potential Export Cable Routes



Connection into Greater Belfast area. 110kV existing network. Length approx. 108km.

Significant likely constraints include North Channel SAC, East Coast Marine pSPA, Annex I Reef, pipelines and telecommunication/power cables. Other constraints which can potentially be avoided

include cliffs over 15m, Outer Belfast Lough MCZ, Scallop Enhancement Areas, Urban Areas and Ports. The Outer Ards SPA/Ramsar Site/IBA and several Bathing Water Sites are unavoidable if connecting into Bangor area.
Connection into Ballynahinch area. 110kV existing network. Length approx. 59km Significant constraints include Murlough SAC which can potentially be avoided; however, this would require a longer route. Significant likely constraints include a pipeline, Annex I Sandbanks, Annex I Reef, and the Mourne AONB and the Strangford and Lecale AONB. Other constraints which can potentially be avoided include marine fish farms (crustaceans/fish), Ballykinler Military Area, Urban Areas, Murlough NNR, Murlough ASSI, St. John's Point ASSI, South Down Coast IBA, Dundrum Inner Bay IBA and Murlough, Newcastle, Tyrella Bathing Water Sites.
Connection into Newry area. 110kV existing network. Length approx. 68km Significant constraints include marine fish farms (crustaceans) which can potentially be avoided; however, this would require a longer offshore route. Significant likely constraints include Carlingford Marine pSPA, Carlingford Lough ASSI, a pipeline, areas of high intensity fishing, Annex I Reef, Carlingford Lough IBA, a Pilot Boarding Station and the Mourne AONB. Other constraints which can potentially be avoided include Carlingford Shore SAC, Derryleckagh SAC, Carlingford Lough MCZ, Carlingford Lough Ramsar, Carlingford Lough SPA, Urban Areas onshore, Cranfield Bay and Warrenpoint Bathing Water Sites.

9.2.7 Fixed Wind Resource Zone: Irish Sea Offshore 2

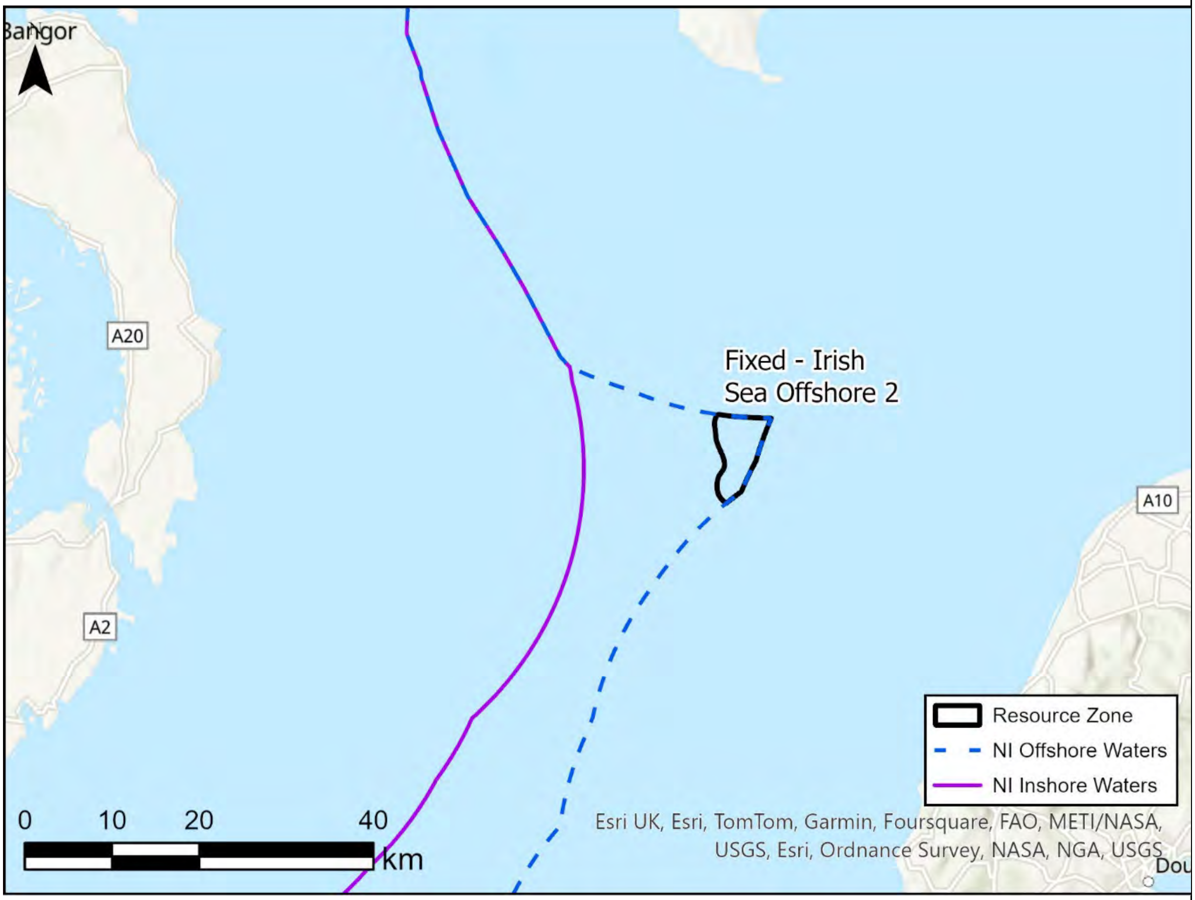
Stage 1 Fixed Wind Resource Zone – Irish Sea Offshore 2

The Fixed Wind Irish Sea Offshore 2 RZ is located in the Irish Sea between the east coast of NI and the Isle of Man, approximately 40km offshore of the Ards Peninsula, c.23km off the coast of the Isle of Man, and c.20km off the coast of the southern extent of the Rhins of Galloway (Scotland). The water depth of the RZ ranges from c.48m to c.80m. The average wind speeds range from c.10.4m/s to 10.59m/s. The predominant suitable TCE Technology Groups for the RZ include:

- Technology Group 1 (Jacket Suction)
- Technology Group 4A (Jacket Driven Low)

The theoretical energy potential of this RZ is 0.06GW.

Fixed Wind Resource Zone – Irish Sea Offshore 2



Key Environmental Constraints and Sensitivities within the Resource Zone

Biodiversity, Flora and Fauna – North Channel SAC and South Rigg MCZ are within the RZ. There are known areas of Annex I Reef habitat, and areas identified by TCE as being of High to Very High MPA Risk to Breeding Birds and Marine Mammals, and Very High MCZ Risk to Habitats.

Population and Human Health – There are no key sensitivities within the RZ.

Geology, Soils and Land Use – There are no key sensitivities within the RZ.

Water – There are no key sensitivities within the RZ.

Air – There are no key sensitivities within the RZ.

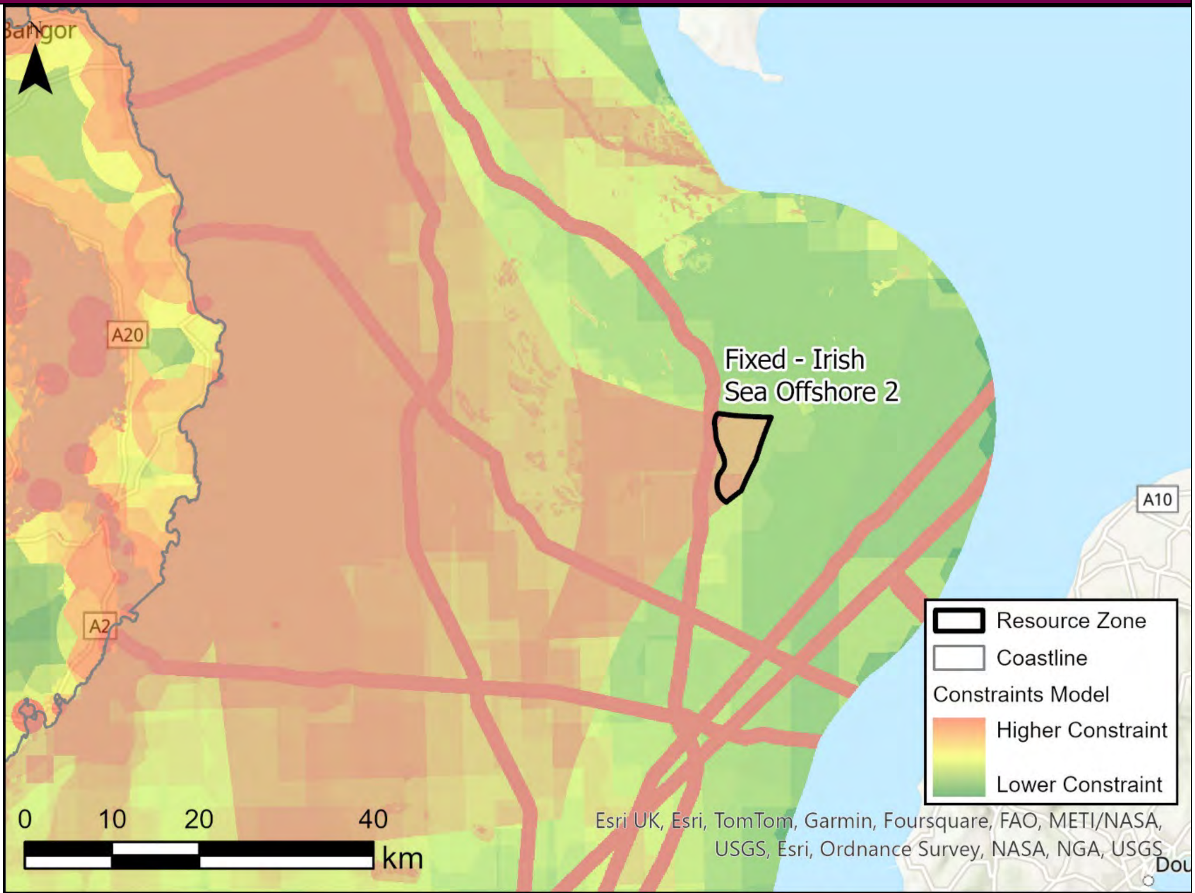
Climatic Factors – There are no key sensitivities within the RZ.

Material Assets – There is a telecommunication cable within the RZ. There are also areas of high fishing activity (>90th percentile) within the RZ.

Cultural, Architectural and Archaeological Heritage – There are no key sensitivities within the RZ.

Landscape, Seascape and Visual Amenity – There are no key sensitivities within the RZ.

Fixed Wind Resource Zone – Irish Sea Offshore 2 and Combined Constraints Model



Resource Zone Refinement for Avoidance of Direct Effects on Key Sensitivities

Refinement of the RZ was not undertaken as the area is considered significantly constrained for fixed wind development due to interaction with designated sites and areas of high shipping density.

9.2.8 Floating Wind Resource Zone: Atlantic

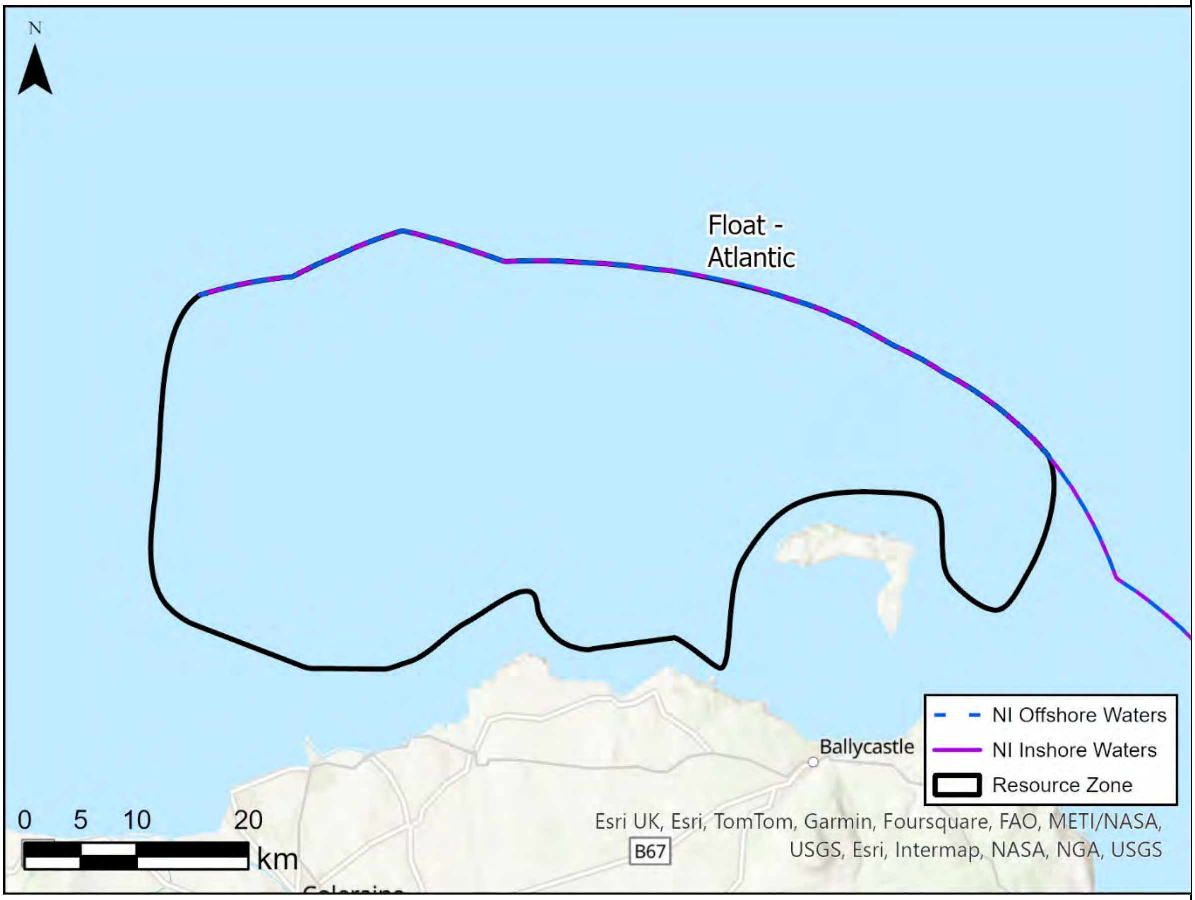
Stage 1 Floating Wind Resource Zone – Atlantic

The Floating Wind Atlantic RZ is located in the North Atlantic Ocean off the north coast of NI, approximately 1.8km offshore of the Giant's Causeway. The water depth of the RZ ranges from c.30m to c.256m. The average wind speeds range from c.9.7m/s to 10.32m/s. The predominant suitable TCE Technology Groups for the RZ include:

- Technology Group 1 (Conventional Anchoring – Moderate Sea State)
- Technology Group 3 (Complex Anchoring – Moderate Sea State)

The theoretical energy potential of this RZ is 3.34GW.

Floating Wind Resource Zone – Atlantic



Key Environmental Constraints and Sensitivities within the Resource Zone

Biodiversity, Flora and Fauna – Skerries and Causeway SAC, Rathlin Island SAC, Rathlin Island SPA, and Rathlin Island MCZ are within the RZ. There are known areas of Annex I Reef and Sandbank habitats, areas of known harbour seal density, and areas identified by TCE as being of High to Very High MPA Risk to Breeding Birds, Marine Mammals, and Habitats, and High to Very High MCZ Risk for Birds.

Population and Human Health – There are no key sensitivities within the RZ.

Geology, Soils and Land Use – There are areas of offshore rock, steep sloping seabed, and Dumping Grounds, within the RZ.

Water – There are Dumping Grounds within the RZ.

Air – There are no key sensitivities within the RZ.

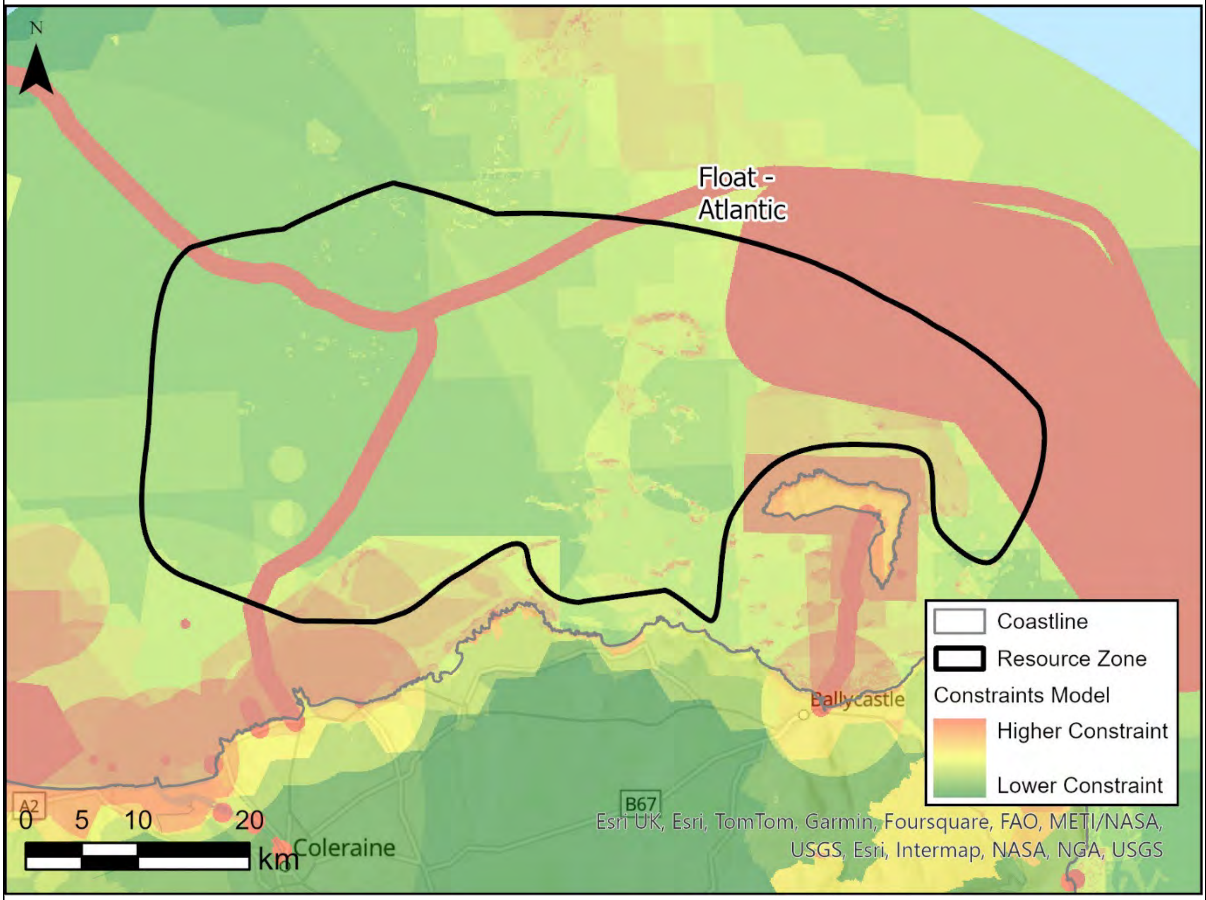
Climatic Factors – There are no key sensitivities within the RZ.

Material Assets – There is a telecommunication cable (Hibernia 'A' (including the NI Branch)) within the RZ. There are areas of high shipping density, the North Channel TSS, areas of known pot fishing and an MPA Exempted Area within the RZ.

Cultural, Architectural and Archaeological Heritage – There are unprotected wrecks within the RZ.

Landscape, Seascape and Visual Amenity – The RZ is situated offshore of the Binevenagh AONB, Causeway Coast AONB, and Giant's Causeway and Causeway Coast WHS, which are sensitive visual receptors.

Floating Wind Resource Zone – Atlantic

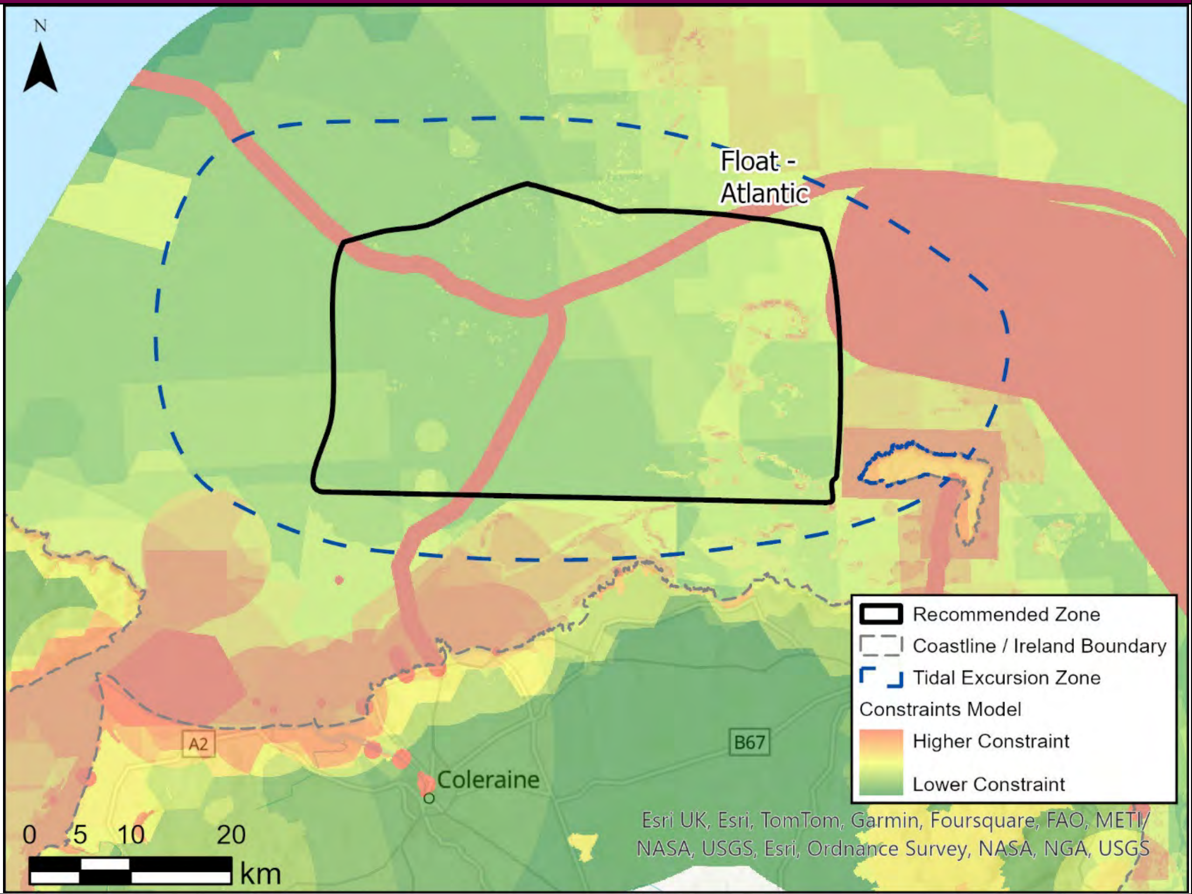


Stage 2 Recommended Floating Wind Resource Zone – Atlantic

To avoid the potential for direct adverse effects on identified key sensitivities within the Floating Atlantic RZ, it was refined through the exclusion of the eastern and inshore areas to avoid interaction with the Skerries and Causeway SAC and Rathlin Island designations, the North Channel TSS and areas of high shipping density, and to reduce the potential for landscape/seascape and visual effects in close proximity to the shoreline and the designated landscape areas.

The theoretical energy potential of the recommended Stage 2 Floating Atlantic RZ is 2.22GW.

Recommended Floating Wind Resource Zone – Atlantic and Combined Constraints Model



Environmental Baseline and Key Issues within the Recommended Resource Zone

Environmental baseline information relevant to this recommended RZ is given below, ordered by SEA environmental topic. These sensitivities and indicators have the potential to be impacted by and impact upon the development and/or operation of offshore floating wind.

Biodiversity, Flora and Fauna

There are no designated sites (SACs, SPAs, Ramsar sites, MCZs, ASSIs) within the recommended RZ. Skerries and Causeway SAC is situated immediately inshore of the recommended RZ, while Rathlin Island SAC, SPA, MCZ, and ASSI are situated c.400m to the east of the recommended RZ; these sites are all within the tidal excursion zone. There are TCE High MPA risk areas for Breeding Birds, Marine Mammals, and Habitats, and a Moderate MPA risk area for Fish within the recommended RZ, a Very High MPA risk area for Annex I habitats in the south-east owing to the proximity to Skerries and Causeway SAC, and a Very High MCZ risk area for birds in the east owing to the proximity to Rathlin Island MCZ.

There are many known areas of Annex I Reef habitat within the recommended RZ, particularly in the north-west and the south-east, and within the tidal excursion zone to the south-east. The seabed habitats within the recommended RZ predominantly consist of coarse substrate, with an area of sand through the centre and south, and smaller areas of rock or other hard substrate, and muddy sand.

Protected species (Wildlife Order) that have been recorded within the recommended RZ include the mollusc: fan mussel; marine mammals: short-beaked common dolphin, harbour porpoise, minke whale, and bottlenose dolphin; fish: basking shark, and common skate; and bird: common goldeneye. NI Priority Species that have been recorded include the starfish: goose foot starfish, sand sea star, and purple sunstar; molluscs: horse mussel, ocean quahog, variegated scallop, and fan mussel; marine mammals: harbour porpoise, minke whale, bottlenose dolphin, and short-beaked common dolphin; tunicate: sea squirt *Pyura microcosmus*; fish: porbeagle, cod, whiting, hake, spiny dogfish and basking shark; and crustaceans: circular crab and rugose squat lobster. Priority Marine Features

(PMFs) recorded within the recommended RZ include the starfish: red cushion star and purple sunstar; molluscs: great scallop, queen scallop, ocean quahog, variegated scallop, and fan mussel; sea slug *Embletonia pulchra;* marine mammals: short-beaked common dolphin, bottlenose dolphin, and harbour porpoise; fish: spotted ray, anglerfish, cuckoo ray, sole, thornback ray, small-spotted catshark, porbeagle, cod, whiting, hake, nursehound, plaice, spiny dogfish, broadnose skate, basking shark, ling, mackerel, and common skate; crustacean: rugose squat lobster; and birds: black guillemot and common eider. There are also elasmobranch records of porbeagle, basking shark, thornback ray, and spotted ray, and OSPAR records of marine mammal harbour porpoise, invertebrate ocean quahog, fish spotted ray, thornback ray, porbeagle, spiny dogfish, cod, common skate, and basking shark, and bird black-legged kittiwake.

There are areas of SCANs recorded relatively high density for white-beaked dolphin, pilot whale, fin whale, and bottlenose dolphin, and areas of relatively moderate density for fin whale, pilot whale, and bottlenose dolphin. MU data also indicates that the cetaceans white-sided dolphin, white-beaked dolphin, Risso’s dolphin, minke whale, harbour porpoise, common dolphin, and bottlenose dolphin may occur within the area. There are also areas of relatively moderate density for grey seal and harbour seal in the east of the recommended RZ.

There are areas of recorded relatively high density for seabirds at sea within the recommended RZ. The SPA of Rathlin Island, which also contains an Important Bird Area and RSPB Reserve, is in close proximity (c.400m distant) to the east of the recommended RZ.

There are spawning grounds for Nephrops, sprat, and herring within the recommended RZ and the tidal excursion zone. There are nursery grounds for Nephrops, cod, spurdog, whiting, anglerfish, blue whiting, common skate, hake, herring, and mackerel within the recommended RZ and the tidal excursion zone. There are areas of AFBI surveyed relatively high density for scallops in the west and south-east, and for queen scallops in the north-east of the recommended RZ. There is a restricted fishing area for scallops under the Conservation of Scallops Regulations, and areas in the south-east are also within a restricted area for certain fishing gear under the Union and North-East Atlantic Fisheries Commission (NEAFC) waters, and a restricted area (North Coast) for trawl or seine nets under the Inshore Fishing (Prohibition of Fishing and Fishing Methods) Regulations.

There are records of invasive species in the south-west of the recommended RZ, including the polychaete *Goniadella gracilis* and the bryozoan *Bugula stolonifera*.

Population and Human Health

The recommended RZ is located offshore of the settlements of Ballintoy, Ballycastle, Bushmills, Portballintrae, Portrush and Portstewart. The inshore boundary of the recommended RZ is located between approximately 7.3 and 11.3km north of Portrush, Portstewart, Bushmills, Portballintrae and Ballintoy, and c.17.9km north-west of Ballycastle.

The recommended RZ is located offshore of the Castlerock, Magilligan Benone, Magilligan Downhill, Portrush Curran (East Strand), Portrush Mill (West Strand), Portrush Whiterocks, Portstewart and Ballycastle Bathing Water sites, and the Ballycastle, Benone, Castlerock, Downhill, Portrush East Strand, Portrush West Strand, Portstewart Strand and Whiterocks Blue Flag Beaches. However, none of these sites are located within the recommended RZ or tidal excursion zone.

Within the wider area, there are areas of relatively high intensity RYA leisure boating activity within Lough Foyle and around Rathlin Island due to small craft travelling between these two areas. However, within the recommended RZ there is relatively low vessel traffic intensity comprising transient vessel traffic.

There are no dive sites within the recommended RZ, however, there are 20 dive sites located within the tidal excursion zone along the coast of Rathlin Island.

Geology, Soils and Land Use

There are no WHSs, ASSIs, MCZs or UNESCO Geoparks designated for geology or geomorphology within the recommended RZ. The Giant’s Causeway and Causeway Coast WHS, the Rathlin Island-Coast ASSI, and Rathlin MCZ are within the tidal excursion zone. The Giant’s Causeway and Causeway Coast WHS has been designated for its global geological significance, with exposure of columnar and massive basalt, and evidence of geological activity from the Tertiary era. The Rathlin Island-Coast ASSI has been designated for geological/geomorphological features, including isolated sea cliffs, sea stacks, wave-cut platforms and geological exposures of columnar basalt rock. Rathlin

MCZ has been designated for being the only known location of the broad scale habitat, deep-sea bed in NI waters, and for several subtidal geological/geomorphological features including a submerged coastline, underwater caves, sea arches, and lagoons which indicate global sea-level change.

The main seabed geology within the recommended RZ is soft mud, with one area of undifferentiated geology. Seabed thickness is generally <5m, with one area of thickness between 5–50m, and one area of >50m thickness. The main seabed substrate within the recommended RZ is rock or other hard substrate of either deep or shallow circalittoral biozones of predominantly moderate energy, whilst there are also several areas of coarse substrate of shallow circalittoral biozones and moderate energy. There are some smaller areas of muddy sand and sand of deep circalittoral biozones, one of which is high energy. There is one area of *Sabellaria spinulosa* reefs of deep circalittoral biozones with moderate energy. There are many known areas of Annex I Reef habitat within the recommended RZ to the north-west and the south-east, and within the tidal excursion zone to the south-east.

TCE expected technology groups for the installation of floating wind turbines within the recommended RZ are predominantly technology groups 5 (Piling with socket anchoring for a moderate sea state) and 3 (Complex anchoring for a moderate sea state), with some areas of technology group 1 (Conventional anchoring for a moderate sea state).

Two spoil dumping grounds are present within the recommended RZ towards the south-east of the area; Portstewart Bay B (silt and sand material of OSPAR code MA545), and Coleraine (material of OSPAR code MA540), both of which are not currently in use. There are no areas of explosives dumping grounds or MoD firing/danger areas within the recommended RZ.

Water

The water depths within the recommended RZ range from c.68-193m. Tidal speeds within the recommended RZ range from 0.49-1.48m/s.

Two spoil dumping grounds are present within the recommended RZ towards the south-east of the area; Coleraine (material of OSPAR code MA540), and Portstewart Bay B (silt and sand material of OSPAR code MA545), both of which are not currently in use. No areas of explosives dumping grounds are within the recommended RZ.

There are no WFD Shellfish Waters or Bathing Waters within the recommended RZ or tidal excursion zone. Two WFD coastal waterbodies of Rathlin Island and North Coast are within the tidal excursion zone; these were both at moderate status in 2021.

The recommended RZ is located within the Celtic Seas sub-region for the MS (covering waters to the west of the UK and shared with RoI and France).

Air

There are no known air quality issues within the recommended RZ, as there are no significant anthropogenic sources of air pollution in the vicinity. The recommended RZ is located offshore of the settlements of Ballintoy, Ballycastle, Bushmills, Portballintrae, Portrush and Portstewart. The inshore boundary of the recommended RZ is located approximately 7.3-11.3km north of Portrush, Portstewart, Bushmills, Portballintrae and Ballintoy, and c.17.9km north-west of Ballycastle.

Within the wider area, there are areas of relatively high intensity RYA leisure boating activity within Lough Foyle and around Rathlin Island due to small craft travelling between these two areas. Within the recommended RZ there is relatively low vessel traffic intensity, which is expected to cause only minor, localised, air emissions.

Climatic Factors

There are no known blue carbon habitats (Annex I Saltmarsh, Annex I Maerl, Shellfish Waters, Subtidal and Intertidal Seagrass) within the recommended RZ or tidal excursion zone. There are areas in the north of the recommended RZ that have been identified by Ulster Wildlife as being of low potential for blue carbon importance. There are unlikely to be any sources of GHG emissions in the area, apart from vessels.

Material Assets

A c.36.3km length of one operational telecommunication cable is within the recommended RZ; this is the Hibernia ‘A’ (including the NI Branch), a transatlantic cable connecting Europe and the USA. There are no pipelines or power cables within the recommended RZ.

In general, there is a relatively low shipping density within the recommended RZ. However, there is an area of relatively moderate shipping density (>70th percentile) in the north-east of the recommended RZ, possibly associated with vessels approaching Portrush Harbour, or cargo vessels and fishing vessels approaching Foyle Port. There are no TSSs within the recommended RZ, however, the north east of the recommended RZ is adjacent to the 2nm buffer surrounding the North Channel TSS. There are also no Harbour Areas or Ports within the recommended RZ.

The recommended RZ is used by commercial fisheries, however, there are no areas of relatively high (>90th Percentile) or moderate (>70th Percentile) fishing activity within the recommended RZ. Fishing fleets which operate in the recommended RZ include whitefish, pot, and scallop. Key fishing areas for mobile king and queen scallop fleets are located within the recommended RZ. There are small areas with relatively high whitefish fleet activity in the east and south-east of the recommended RZ. There are relatively important herring stocks in the region, as well as recorded landings of commercial species such as herring, hake and monkfish/anglerfish at Foyle Port, located to the south-west of the recommended RZ at Lough Foyle. There are no marine fish farms or aquaculture sites within the recommended RZ. The entirety of the recommended RZ is encompassed within known sprat spawning grounds, while there are Nephrops and herring spawning grounds in the east and west of the recommended RZ, respectively. The north-east of the recommended RZ and the tidal excursion zone is within known cod nursery grounds, while the east of the recommended RZ and tidal excursion zone is within Nephrops nursery grounds. Additionally, there are whiting, spurdog, anglerfish, blue whiting, common skate, hake, herring, ling (in the west), and mackerel nursery grounds within the recommended RZ and tidal excursion zone. Scallops are known to be present throughout the west and south-east of the recommended RZ, whilst queen scallops are found within the south-west, centre and north-east of the recommended RZ. There is a restricted fishing area for scallops under the Conservation of Scallops Regulations within the recommended RZ, while areas in the south-east are within a restricted area for certain fishing gear under the Union and NEAFC waters, and a restricted area (North Coast) for trawl or seine nets under the Inshore Fishing (Prohibition of Fishing and Fishing Methods) Regulations.

The recommended RZ is used by the MoD, as it is located within two Military Practice Areas - a c.137km² area in the east of the recommended RZ is within Rathlin Military Practice Area (X5536), and a c.304km² area of the west of the recommended RZ is within Skerries Military Practice Area (X5537). These areas are both utilised as submarine exercise areas and surface fleet practice and exercise areas. There are, however, no MoD danger areas within the recommended RZ.

The south-west of the recommended RZ is within an area (c.0.7km²) of an aviation safeguarding zone (15km OLS) associated with Castlerock Airstrip, which is located c.12km to the south-west of the recommended RZ.

There are two spoil dumping grounds located in the south-west of the recommended RZ, neither of which are currently in use, as discussed in the Geology, Soils and Land Use baseline.

The north coast of NI has a developed tourist infrastructure that includes a number of coastal attractions that are within the modelled viewshed for floating wind turbines within the recommended RZ, including the Dunluce Castle ruins, the Giant’s Causeway, and Carrick-a-Rede Rope Bridge. Potential tourist activities within the recommended RZ include boat tours, water sports, sailing and fishing, whilst significant long-distance walking routes such as the Causeway Coast Way within AONBs or National Parks, which offer significant attraction for tourism, are also located within the modelled viewshed for floating wind turbines within the recommended RZ. Further information on landscape designations that may act as tourist attractions within the modelled viewshed of the area is provided in the Landscape and Visual Amenity baseline.

The recommended RZ has a potential capacity of 2.22GW.

Cultural, Architectural and Archaeological Heritage

There are no protected wrecks within the recommended RZ. There are four recorded wrecks within the recommended RZ, and four additional wrecks within the tidal excursion zone. The recommended RZ is situated between c.3.5km and c.22km distance from the coastline. The Giant’s Causeway and Causeway Coast WHS is situated inshore of the recommended RZ and is within the modelled viewshed (based on a turbine height of 228m and a viewable distance of 40km). There are also 551 Listed Buildings, 405 Defence Heritage Record sites, 1370 Scheduled Monuments, 172 Scheduled Zones, and 24 Parks and Gardens (including Downhill, Cromore, Dunluce Castle, Dundarave) within the modelled viewshed.

Landscape, Seascape and Visual Amenity

The recommended RZ is situated between c.3.5km and c.22km distance from the coastline. There are 36 settlements situated inshore of the recommended RZ, which are within the modelled viewshed (based on a turbine height of 228m and a viewable distance of 40km). These include Portstewart, Portrush, Castlerock, Coleraine, Bushmills, Portballintrae, and Ballycastle.

There are three AONBs situated inshore of the recommended RZ, which are within the modelled viewshed; these are Causeway Coast AONB, Antrim Coast and Glens AONB, and Binevenagh AONB. The Giant's Causeway and Causeway Coast WHS is also situated inshore of the recommended RZ and within the modelled viewshed, as are 11 National Trust Lands (Avish, Barmouth Grangemore and Portstewart, Carrick a Rede, Cushleake Mountain, Downhill, Dunseverick, Fairhead and Murlough Bay, Giants Causeway, Hezlett House, Rathlin Island, and Whitepark Bay). Areas of the north-east County Donegal coastline in RoI and the south-west coastline of Kintyre and south coast of the Isle of Islay in Scotland are also within the modelled viewshed. There are Areas of Especially High Scenic Amenity and High Scenic Amenity in County Donegal that are within the modelled viewshed.

The recommended RZ is primarily within the Atlantic NI RSCA, with a section of the west within the RoI Seascape Character Area of North Donegal Atlantic Headlands, Loughs and Beaches. It is situated offshore of The Skerries and Dunluce Coast and Causeway Coast RSCAs.

Environmental Assessment	Short-term	Medium-term	Long-term
Biodiversity, Flora and Fauna (BFF)	-3	-3	-3
Population and Human Health (PHH)	-1	0	0
Geology, Soils and Land Use (GSL)	-2	-2	-2
Water (W)	-2	-2	-1
Air (A)	0	+3	+3
Climatic Factors (CF)	-1	+3	+3
Material Assets and Infrastructure (MA)	-2	-2 / +3	-2 / +3
Cultural, Architectural and Archaeological Heritage (CH)	-3	-3	-3
Landscape / Seascape and Visual Amenity (L)	-3	-3	-3

Key Conclusions:

Biodiversity, Flora and Fauna – There is potential for significant adverse effects on Biodiversity, Flora, and Fauna in the short-term construction and decommissioning phases, and the medium to long-term operational phase (-3), owing to the immediate proximity of Skerries and Causeway SAC, Rathlin Island SAC, SPA and MCZ, and the interaction with a TCE Very High MPA risk area for Habitat, Very High MCZ risk area for Birds, and known areas of Annex I Reef habitat. There is also potential for moderate adverse effects in the short-term construction and decommissioning phases, and the medium to long-term operational phase (-2) for benthic habitats and species, fish and shellfish, marine mammals and birds, owing to interaction with High MPA risk areas for Marine Mammals and Breeding Birds, moderate risk areas for Fish, known fish spawning and nursery grounds, areas of known high and moderate density for marine mammals and seabirds at sea, and the recorded presence of Protected and Priority species.

Population and Human Health – There is potential for slight adverse temporary, direct and indirect, effects on leisure and recreational marine users due to an increased collision risk, access restrictions and displacement, or water quality effects, during the construction and decommissioning phases (-1). The potential for adverse direct or indirect effects on these users in the medium to long-term during the operational phase is likely to be negligible, as there is relatively low recreational boating use within the recommended RZ (0).

Geology, Soils and Land Use – There are three sites designated for geological or geomorphological features within the tidal excursion zone with potential for moderate adverse indirect long-term effects on Geology, Soils and Land use (-2). There is potential for moderate direct temporary to permanent impacts on Annex 1 Reef habitats due to loss or damage during the construction/decommissioning phase (-2). Following the installation of floating wind technologies there is potential for medium to long-term operational phase localised impacts on erosion and deposition patterns due to the presence of devices (-1). There is potential for influence on the MS Descriptor 6 sea floor integrity from the installation processes of floating wind technologies in the recommended RZ, however, there is not anticipated to be potential for adverse effects on the achievement of GES. There is also potential for moderate adverse indirect short to medium-term effects in the construction and decommissioning phases due to the presence of two spoil dumping grounds within the recommended RZ, with the potential for mobilisation of contaminants to affect the seabed within the tidal excursion zone (-2).

Generally, there is potential for direct short-term, temporary sediment loss in the vicinity of the construction works during seabed preparation activities, construction and decommissioning activities (-1), and medium to long-term loss within the footprint of foundations and scour protection during device operation (-2).

Water – There is potential for slight to moderate indirect short-term effects on water quality as two WFD coastal waterbodies are within the tidal excursion zone (-1). There is potential for moderate adverse indirect effects on water quality in the short-term construction and decommissioning phases due to the presence of two spoil dumping grounds within the recommended RZ (-2). There is also potential for slight short-term effects on water quality elements that are considered by the MS (e.g., Descriptor 9 Concentrations of contaminants in fish and other seafood; Descriptor 8: Concentration of contaminants within marine environment; Descriptor 10 marine litter) during seabed preparation, construction, maintenance and decommissioning activities (-1); there is not anticipated to be potential for adverse effects on the achievement of GES with the application of standard best practice mitigation.

Air – There is potential for significant positive indirect effects on regional air quality in the medium to long-term operational phase, as the operation of renewable energy devices can support a transition away from fossil fuel use and its associated air emissions, with potential for a relatively high capacity in the recommended RZ (+3).

Climatic Factors – There is potential for slight adverse short-term effects on sediment carbon storage, due to a localised release of CO_2 from seabed disturbance during the construction and decommissioning phases (-1). There is potential for slight adverse, short-term, temporary effects on localised GHG concentrations, due to GHG emissions from vessels and machinery during the construction and decommissioning phases (-1), which should be minimised at the project level through adherence to standard best practise for the minimisation of air pollution, as set out in **Section 10.1**.

There is potential for significant positive, medium to long-term effects during the operational phase, as the operation of renewable energy devices can contribute to a net reduction in GHG emissions, decarbonisation of the energy sector, diversification of electricity supply and energy security, and meeting of energy objectives and climate change emission reduction targets, with potential for a relatively high capacity in the recommended RZ (+3).

Material Assets – Overall, there is considered to be potential for moderate adverse effects in the short, medium, and long-term on Material Assets (-2), following the consideration of mitigation measures, which is mainly attributed to the potential for slight adverse effects on Shipping and Navigation, and Commercial Fisheries.

Given the presence of the relatively higher density shipping area within the north-east of the recommended RZ, there is potential for moderate direct navigational risk and displacement effects in the short, medium, and long-term (-2). This is owing to the potential displacement of vessels during construction and decommissioning (short-term) phases and operational (medium to long term) phase, as well as potential for moderate adverse direct and indirect effects on navigation and communication in all phases.

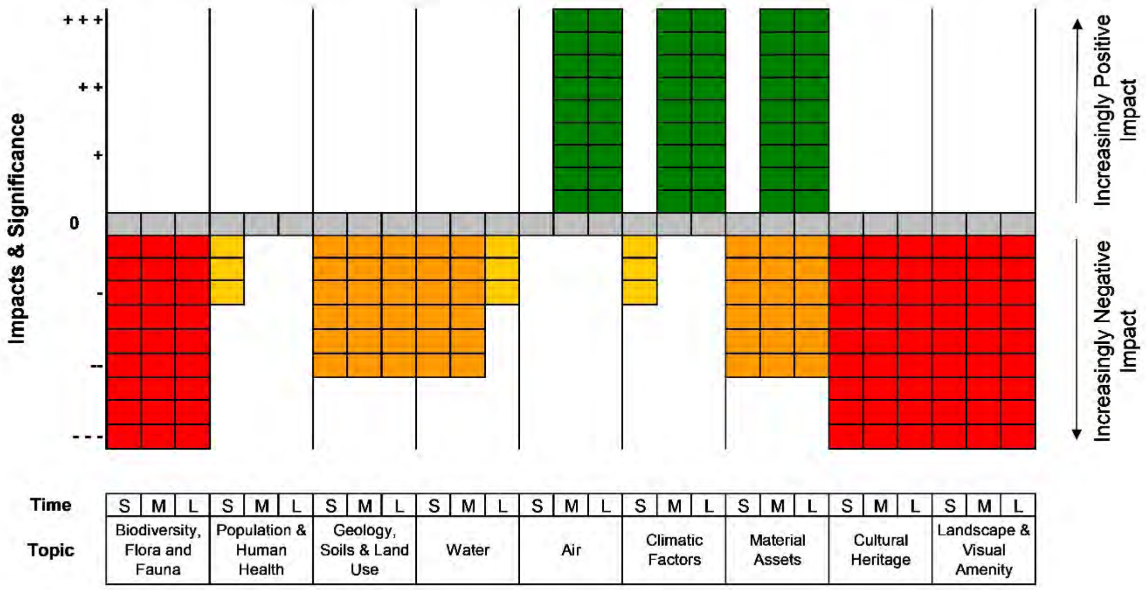
Although the recommended RZ has relatively low fishing intensity, there are also areas used by inshore fisheries; as such, there is potential for moderate indirect effects on the profitability of commercial fishing in the short, medium, and long-term (-2), such as the potential for reduced quotas, increased resource competition for fishing, and reduced landings in both tonnage and economic value. This is owing to the combination of potential moderate adverse effects including: potential displacement from shipping grounds in the short, medium, and long-term; potential for increased collision risk associated with the presence of construction/decommissioning vessels (short-term), and the presence of maintenance vessels and displacement from fishing grounds (medium to long-term); as well as effects on commercial fish species and their key habitats due to direct loss of supporting habitats, and indirect effects due to sediment mobilisation; all of which could indirectly affect fishing activity through an alteration of commercial fish stocks.

There is potential for significant positive effects in terms of the generation of a new renewable energy supply for the NI population in the medium- to long-term, as the recommended RZ has a potential capacity of 2.22GW (+3).

Cultural, Architectural and Archaeological Heritage – There is potential for significant adverse effects on Cultural Heritage in the short-term construction and decommissioning phases, and the medium to long-term operational phase (-3) owing to the very high sensitivity of coastal heritage receptors whose setting may be affected, including the Giant’s Causeway and Causeway Coast WHS.

Landscape and Visual Amenity – There is potential for significant adverse effects on Landscape, Seascape, and Visual Amenity in the short-term construction and decommissioning phases, and the medium to long-term operational phase (-3) owing to the distance of the recommended RZ offshore and the very high sensitivity of the landscape areas that may be affected, including the Giant’s Causeway and Causeway Coast WHS, Causeway Coast AONB, Antrim Coast and Glens AONB and Binevenagh AONB, as well as moderate effects on the inshore coastal population that may be affected by changes in visual amenity.

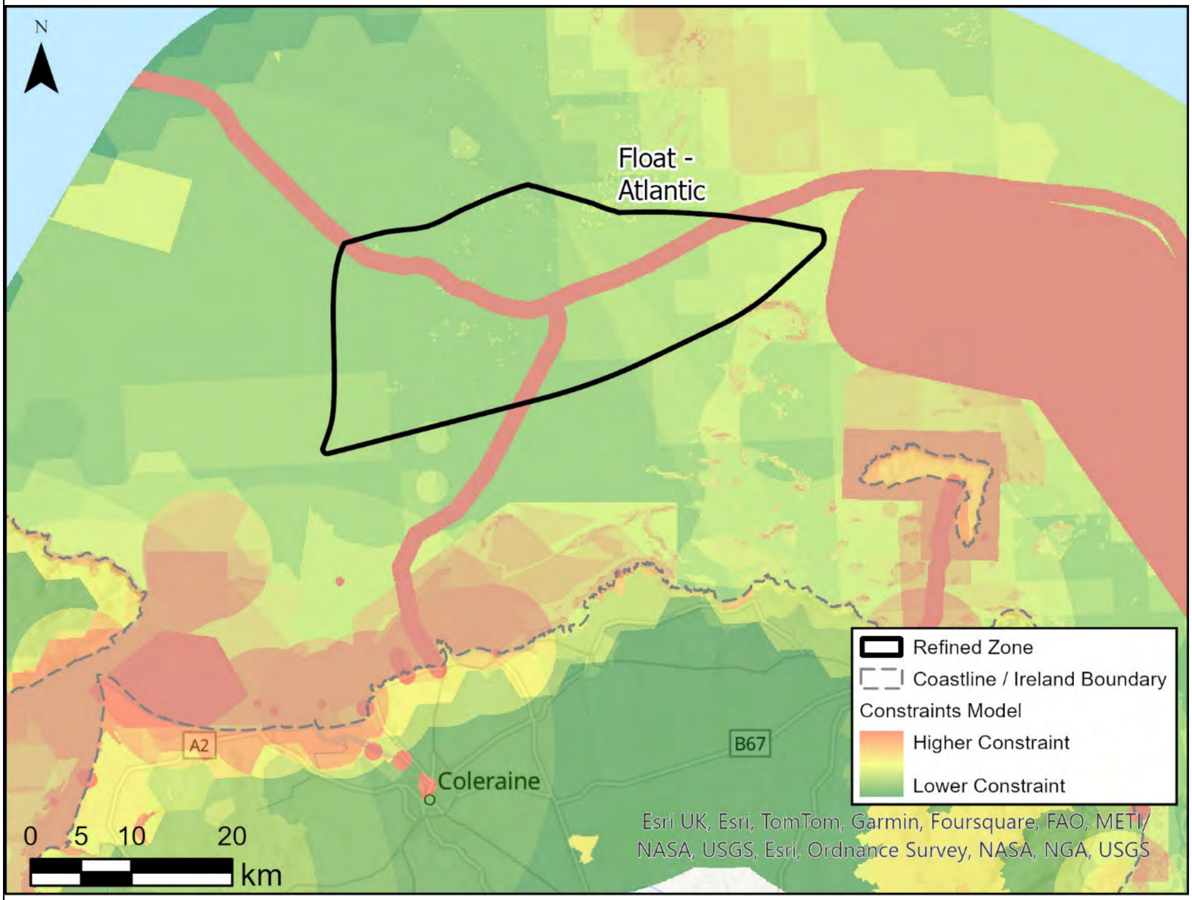
Summary Chart of Potential Effects



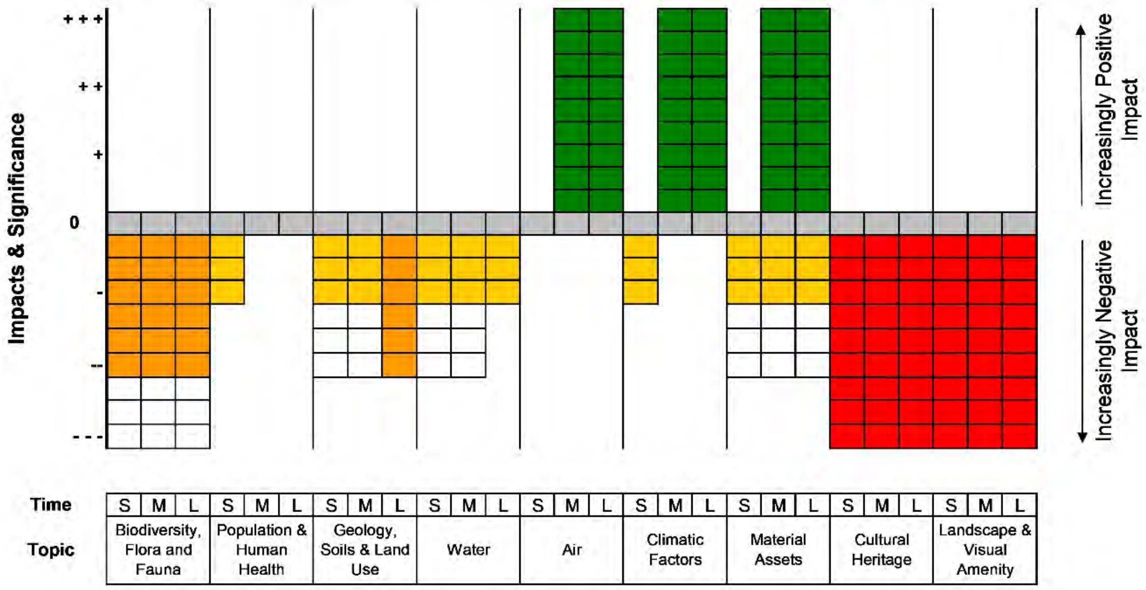
Stage 3 - Recommendations for Further Refinement:

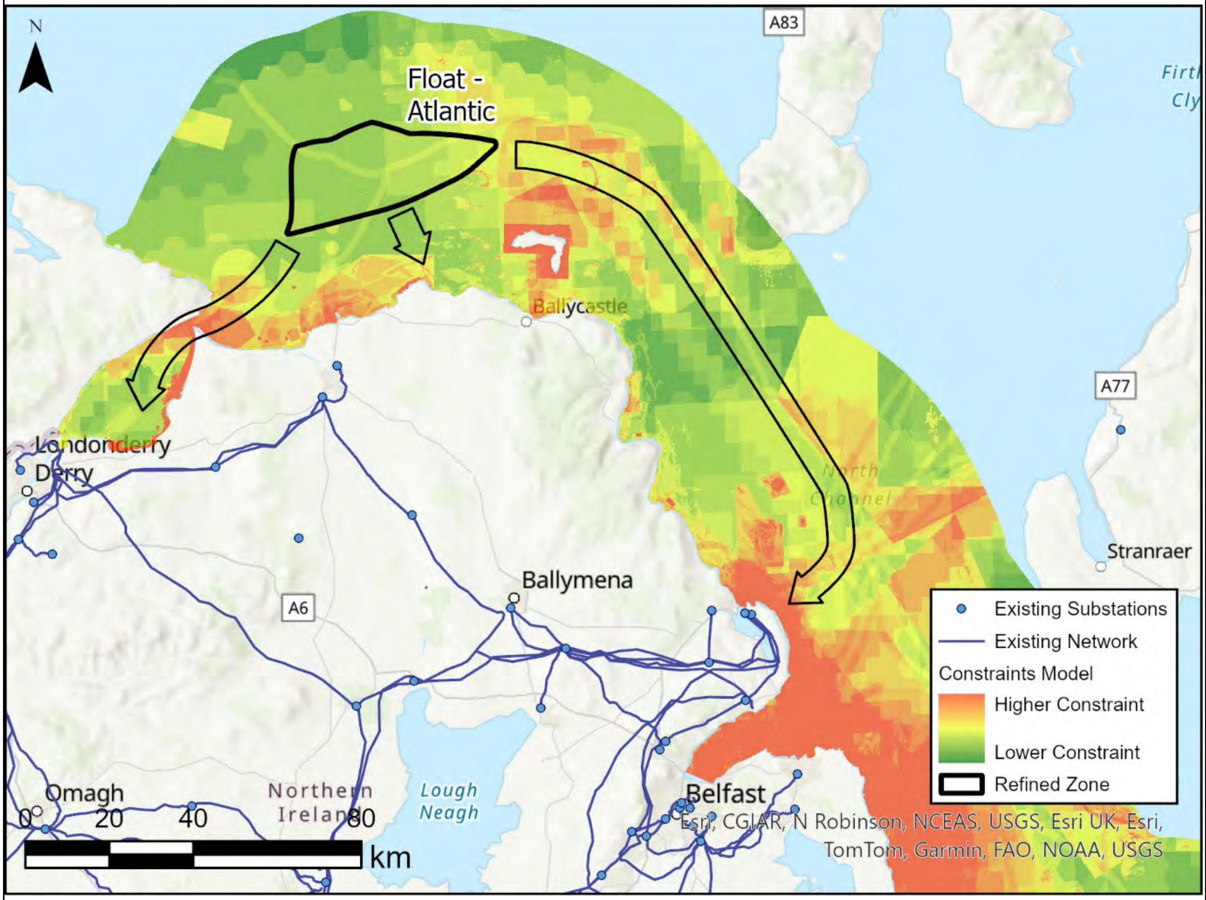
Further refinement of the Floating Atlantic RZ is recommended to exclude the inshore and south-east areas, to avoid Skerries and Causeway SAC, Rathlin Island SAC, SPA and MCZ, being within the tidal excursion zone, and to avoid the TCE Very High MPA and MCZ risk areas associated with these sites, which can reduce the overall score for Biodiversity, Flora, and Fauna to -2. This also avoids the closest areas to shore (within 13km), reducing the potential for significant visual effects, including on landscape designations and the setting of coastal heritage receptors, however the score for Cultural Heritage and Landscape, Seascape, and Visual Amenity remains as -3 owing to the very high sensitivity of the landscape and heritage receptors (WHSs, AONBs) that may still be adversely affected. Further refinement is also recommended to avoid potential for direct effects due to two dumping grounds and for indirect effects due to avoid the Giant's Causeway WHS, Rathlin Island MCZ and ASSI being within the tidal excursion zone, reducing the overall score for Geology, Soils, and Land use, and to avoid two WFD coastal waterbodies being within the tidal excursion zone, reducing the overall score for Water to -1. Further refinement to avoid areas of importance for inshore pot fisheries, areas of moderate shipping density, and the OLS associated with Castlerock Airstrip can reduce the significance of effects for Material Assets, to give an overall score of -1.

The theoretical energy potential of the refined Floating Atlantic RZ is 1.06GW.



Comparative Chart



Potential Export Cable Routes

Connection into Larne area. 275kV/110kV existing network. Length approx. 85km. Significant likely constraints include the East Coast Marine pSPA, telecommunication cables, Brown's Bay Bathing Water Site, Portmuck Bathing Water Site, Offshore Rock, Annex I Reef, North Channel TSS and Port Lands around Larne. There are several designated sites within the vicinity including the North Channel SAC, The Maidens SAC, Rathlin Island SAC/SPA/IBA, Larne Lough SPA/Ramsar/IBA, Rathlin MC and Portmuck ASSI, however these can all potentially be avoided.
Connection into Coleraine area. 110kV existing network. Length approx. 18km. Significant likely constraints include areas of Annex I Sandbanks. Other constraints which can potentially be avoided include protected wrecks, cliffs over 15m, Urban Areas and environmental designations including Bann Estuary SAC, Skerries and Causeway SAC, Bann Estuary ASSI, Portrush West Strand ASSI, Ramore Head and Skerries ASSI, Binevenagh AONB and Causeway Coast AONB.
Connection into Derry / Londonderry area. 275kV/110kV existing network Length approx. 43km. Significant likely constraints include the Lough Foyle and River Foyle IBA and Pilot Boarding Stations. Other constraints which can potentially be avoided include Magilligan SAC/ASSI, Lough Foyle SPA/Ramsar/ASSI, Binevenagh AONB, Magilligan Military Area, Urban Areas, Derry Airport / Ballarena Airfield and Lough Foyle RSPB Reserve.

9.2.9 Floating Wind Resource Zone: Rathlin Torr Head

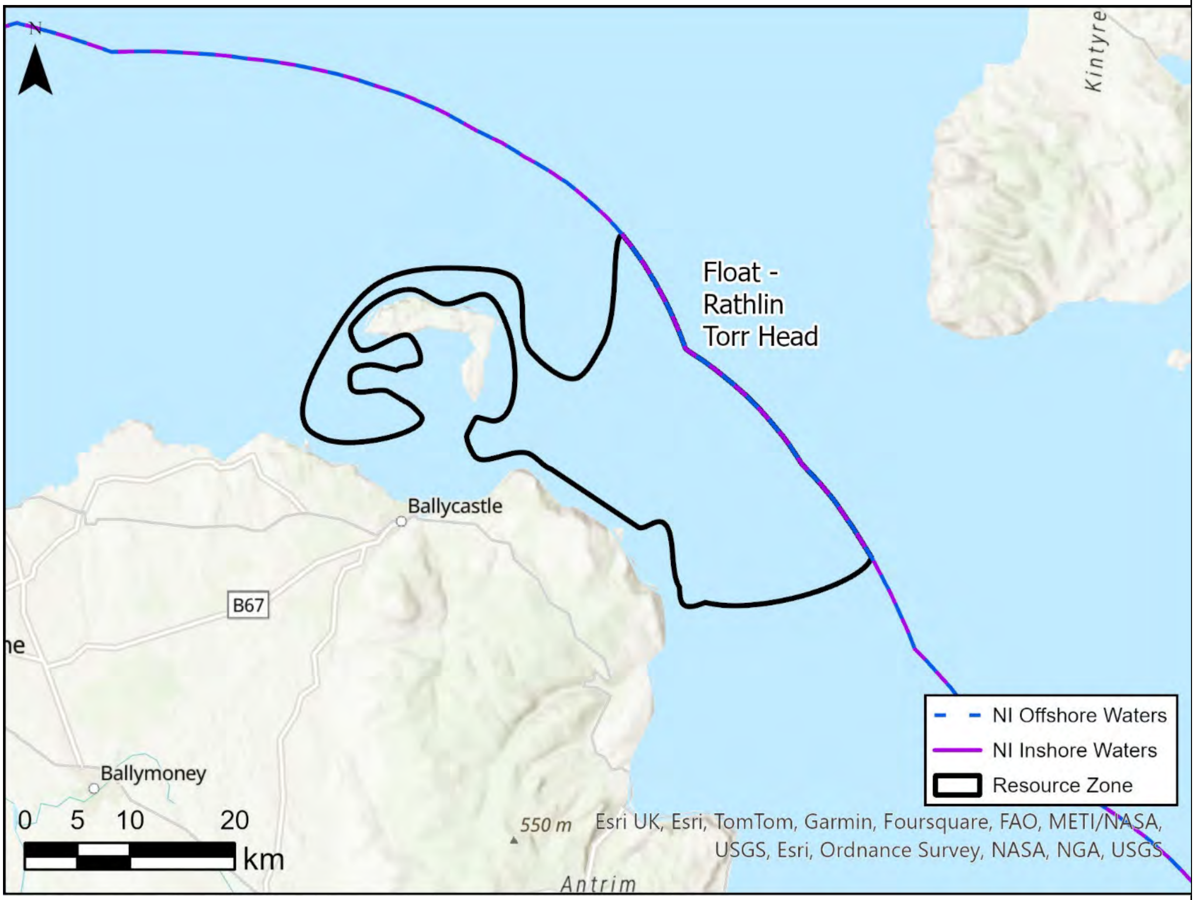
Stage 1 Floating Wind Resource Zone – Rathlin Torr Head

The Floating Wind Rathlin Torr Head RZ is located off the north-east coast of NI at Rathlin Island. The area is located approximately 200m offshore of Rathlin Island and c.800m off the coast of Torr Head. The water depth of the RZ ranges from c.18m to c.244m. The average wind speeds range from c.8.50m/s to 9.91m/s. The predominant suitable TCE Technology Groups for the RZ include:

- Technology Group 3 (Complex Anchoring - Moderate Sea State)
- Technology Group 5 (Pile/Socket Anchoring - Moderate Sea State)

The theoretical energy potential of this RZ is 1.01GW.

Floating Wind Resource Zone – Rathlin Torr Head



Key Environmental Constraints and Sensitivities within the Resource Zone

Biodiversity, Flora and Fauna – Rathlin Island SAC, Rathlin Island SPA, Rathlin Island MCZ, Rathlin Island Coast ASSI, and Rathlin Island IBA are within the RZ. There are known areas of Annex I Reef and Sandbank habitats, areas of known high harbour and grey seal density, and areas identified by TCE as being of High to Very High MPA Risk to Breeding Birds, Marine Mammals, and Habitats, and High to Very High MCZ Risk for Birds.

Population and Human Health – There are no key sensitivities within the RZ.

Geology, Soils and Land Use - There are areas of offshore rock, and a Dumping Ground, within the RZ.

Water - There are Dumping Grounds within the RZ.

Air – There are no key sensitivities within the RZ.

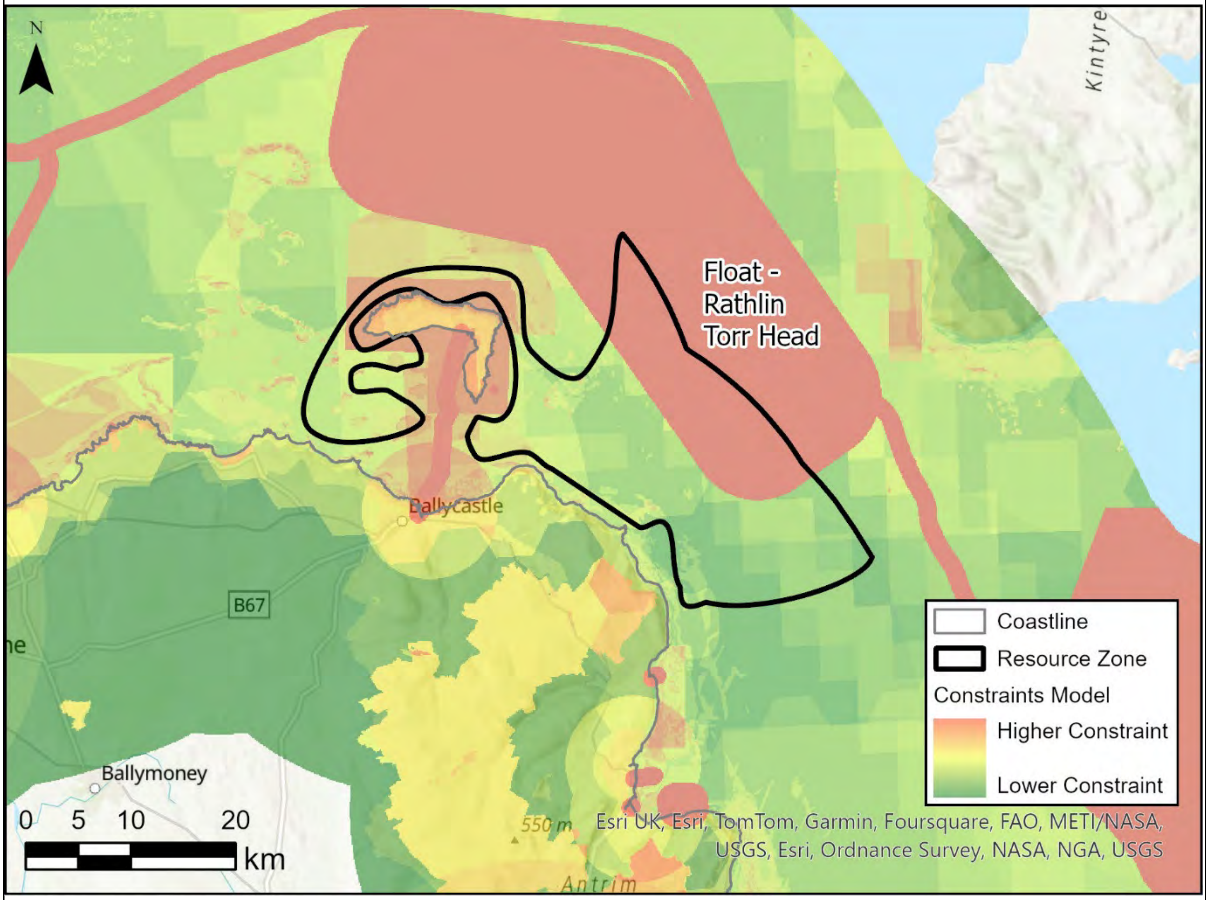
Climatic Factors - There are no key sensitivities within the RZ.

Material Assets – There are areas of high shipping density (>90th percentile) and the North Channel TSS within the RZ. There are also areas of known pot fishing and an MPA Restricted Area within the RZ.

Cultural, Architectural and Archaeological Heritage – There are unprotected wrecks within the RZ.

Landscape, Seascape and Visual Amenity – The RZ is situated in proximity to the Antrim Coast (approximately 500m) and is offshore of the Antrim Coast and Glens AONB and the Causeway Coast AONB, which are sensitive visual receptors.

Floating Wind Resource Zone – Rathlin Torr Head

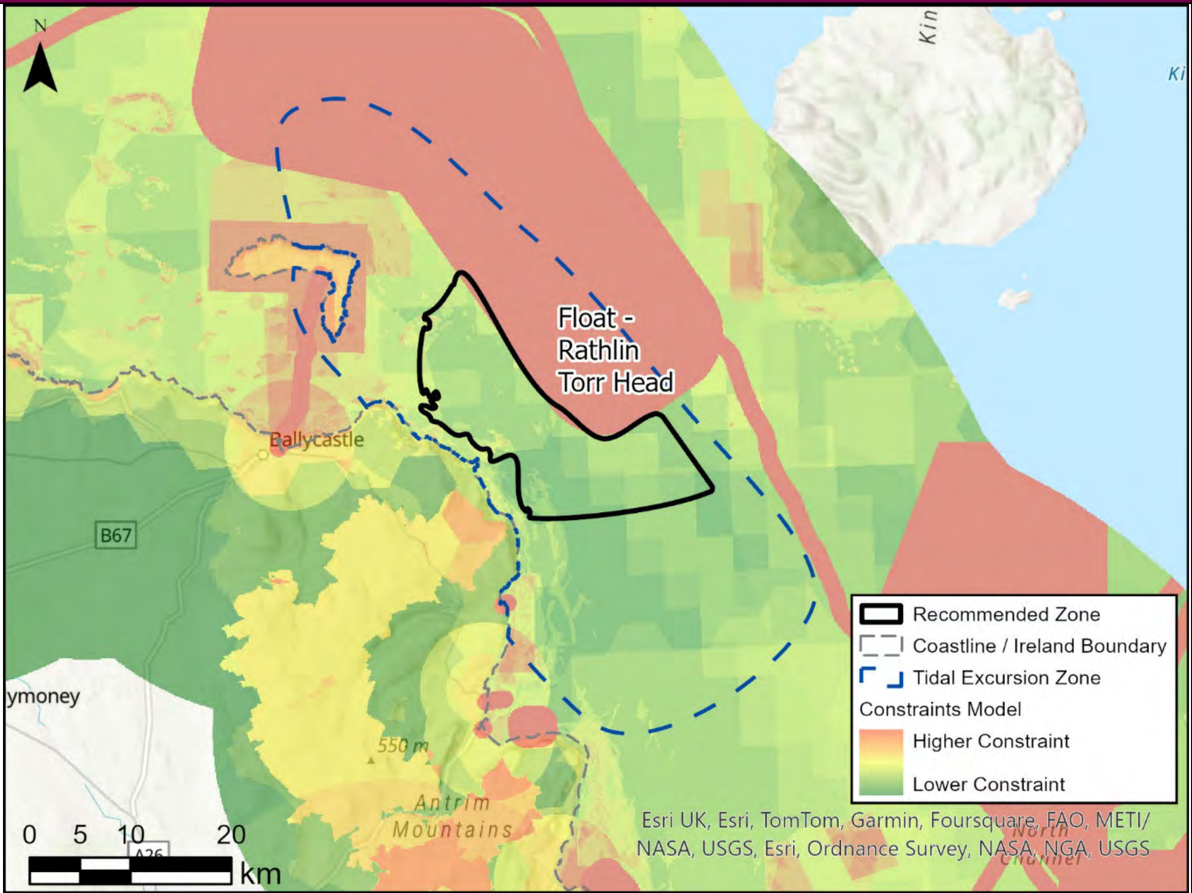


Stage 2 Recommended Floating Wind Resource Zone – Rathlin Torr Head

To avoid the potential for direct impacts on identified key sensitivities within the Floating Rathlin Torr Head RZ, it was refined through the exclusion of the north-eastern and north-western areas to avoid interaction with the Rathlin Island designations, the North Channel TSS, and areas of high shipping density. This also avoided an area of known pot fishing and dumping grounds.

The theoretical energy potential of the recommended Stage 2 Floating Rathlin Torr Head RZ is 0.43GW.

Recommended Floating Wind Resource Zone – Rathlin Torr Head and Combined Constraints Model



Environmental Baseline and Key Issues within the Recommended Resource Zone

Environmental baseline information relevant to this recommended RZ is given below, ordered by SEA environmental topic. These sensitivities and indicators have the potential to be impacted by and impact upon the development and/or operation of offshore floating wind.

Biodiversity, Flora and Fauna

There are no designated sites (SACs, SPAs, Ramsar sites, MCZs, ASSIs) within the recommended RZ. Red Bay SAC (situated c.3km south), Rathlin Island SAC and SPA (situated c.3.5km to the north-west), Rathlin Island MCZ (c.2.5km to the north-west), Rathlin Island – Coast ASSI (c.4.5km north-west), and Fair Head and Murlough Bay ASSI (c.1km west) are within the tidal excursion zone, while Antrim Hills SPA is situated inland (c.1km distance). There are TCE High MPA risk areas for Breeding Birds, and Marine Mammals, and a Moderate MPA risk area for Fish within the recommended RZ, and a Very High MCZ risk area for Birds in the north-west of the recommended RZ owing to the proximity to Rathlin Island MCZ.

There are many known areas of Annex I Reef habitat within the recommended RZ and tidal excursion zone, areas of known Annex I Sea Caves within the tidal excursion zone to the north-west (around Rathlin Island), and areas of Annex I Sandbank and Maerl habitats within the tidal excursion zone to the north-west (around Rathlin Island) and to the south-west (around Red Bay). The seabed habitats within the recommended RZ predominantly consist of coarse substrate, with scattered areas of rock or hard substrate, particularly in the north-west and inshore areas.

Protected species (Wildlife Order) that have been recorded within the recommended RZ include the marine mammals: short-beaked common dolphin, harbour porpoise, and minke whale; fish: basking shark; and bird: grey heron. NI Priority Species that have been recorded include the marine mammals: short-beaked common dolphin, harbour porpoise, and minke whale; fish: basking shark; and birds: black-legged kittiwake, Atlantic puffin, black guillemot, herring gull, oystercatcher, black-headed gull, curlew, common eider, and razorbill. Priority Marine Features (PMFs) recorded within the recommended RZ include the marine mammals: short-beaked common dolphin, and harbour porpoise; fish: basking shark; and birds: black guillemot and common eider. There are also elasmobranch records of basking shark, and OSPAR records of marine mammal harbour porpoise, fish basking shark, and bird black-legged kittiwake.

There are areas of SCANs recorded relatively high density for pilot whale, and fin whale, and areas of relatively moderate density for white-beaked dolphin, pilot whale, bottlenose dolphin, and beaked whale. MU data also indicates that the cetaceans white-sided dolphin, white-beaked dolphin, Risso's dolphin, minke whale, harbour porpoise, common dolphin, and bottlenose dolphin may occur within the area. There are also areas of relatively moderate density for grey seal (in the west), and areas of moderate to high (in the west) density for harbour seal within the recommended RZ.

There are areas of recorded relatively moderate density for seabirds at sea within the recommended RZ. There is an IBA and RSPB reserve on Rathlin Island (c.4.5km north-west) and an IBA inshore in the Antrim Hills (c.1.5km distance).

There are spawning grounds for Nephrops and sprat within the recommended RZ and the tidal excursion zone. There are nursery grounds for Nephrops, cod, anglerfish, common skate, hake, herring, and mackerel within the recommended RZ and the tidal excursion zone, and for whiting within the tidal excursion zone. There are also areas of AFBI surveyed relatively moderate density for queen scallops within the tidal excursion zone to the north-west. There is a restricted fishing area for scallops under the Conservation of Scallops Regulations within the recommended RZ.

There are no records of invasive species within the recommended RZ.

Population and Human Health

The recommended RZ is located offshore of the settlements of Ballycastle, Ballyvoy and Cushendun. The recommended RZ is located approximately 5km and 9km east of the settlements of Ballycastle and Ballyvoy, respectively, and approximately 5km north-east of Cushendun.

The recommended RZ is located offshore of the Ballycastle, Cushendall and Waterfoot Bathing Water sites, and the Ballycastle and Waterfoot Blue Flag Beaches. However, none of these sites are located within the recommended RZ or tidal excursion Zone.

There are areas of high intensity RYA leisure boating activity within the western section of the recommended RZ, off the coast of Torr Head. There is relatively higher leisure boating activity between Belfast Lough and Ballycastle, due to small craft travelling between these two areas.

There are no dive sites within the recommended RZ, however, there are 19 within the tidal excursion zone.

Geology, Soils and Land Use

There are no WHSs, ASSIs, MCZs or UNESCO Geoparks designated for geology or geomorphology within the recommended RZ. Four ASSIs; Rathlin Island-Coast, Torr Head, Fair Head and Murlough Bay and Church Bay; as well as Rathlin MCZ, are within the tidal excursion zone. Rathlin Island-Coast ASSI has been designated for geological/geomorphological features, including isolated sea cliffs, sea stacks, wave-cut platforms and geological exposures of columnar basalt rock. Torr Head ASSI is designated for metamorphosed Limestone of the Dalradian age and is of international importance for understanding other geological formations within NI and Scotland. Fair Head and Murlough Bay ASSI is designated for its tall cliffs and evidence of three rock classes present at the site. Church Bay ASSI is designated for its geological landforms of ridges composed of sand and gravel deposits, which are a unique geological feature for the island of Ireland. Rathlin MCZ has been designated for being the only known location of the broad scale habitat deep-sea bed in NI waters and for several subtidal geological/geomorphological features, including a submerged coastline, underwater caves, sea arches and lagoons, all of which indicate global sea-level change.

The seabed geology within the recommended RZ is predominantly undifferentiated quaternary deposits with diamict. Seabed thickness is predominantly <5m, with one area of thickness between 5–50m. The seabed substrate of the recommended RZ is predominantly rock or other hard substrate with some areas of coarse substrate; these are mostly moderate energy of generally deep circalittoral biozones, however shallow circalittoral biozones are also present. There are many known areas of Annex I Reef habitat within the recommended RZ and tidal excursion zone.

TCE expected technology groups for the installation of floating wind turbines within the recommended RZ are predominantly technology group 5 (Piling with socket anchoring for a moderate sea state) with one area of technology group 3 (Complex anchoring for a moderate sea state).

There are no dumping grounds of spoil ground, explosives dumping grounds or MoD firing/danger areas within the recommended RZ.

Water

The water depths within the recommended RZ range from c.56-153m. Tidal speeds within the recommended RZ range from 0.74-1.50m/s.

There are no dumping grounds of spoil ground, explosives dumping grounds or MoD firing/danger areas within the recommended RZ.

There are no WFD Shellfish Waters or Bathing Waters within the recommended RZ; one Bathing Water site, Cushendall, is within the tidal excursion zone. One WFD coastal waterbody of North Channel is within the recommended RZ; this was at moderate status in 2021. Three WFD coastal waterbodies of Rathlin Island, North Channel, and North Coast, are within the tidal excursion zone; these were all at moderate status in 2021.

The recommended RZ is located within the Celtic Seas sub-region for the MS (covering waters to the west of the UK and shared with RoI and France).

Air

There are no known air quality issues within the recommended RZ, as there are no significant anthropogenic sources of air pollution in the vicinity. The recommended RZ is located offshore of the settlements of Ballycastle, Ballyvoy and Cushendun. The recommended RZ is located approximately 5km and 9km east of the settlements of Ballycastle and Ballyvoy, respectively, and approximately 5km north-east of Cushendun.

There are areas of relatively high intensity RYA leisure boating activity within the western section of the recommended RZ, off the coast of Torr Head. There is relatively higher leisure boating activity between Belfast Lough and Ballycastle, due to small craft travelling between these two areas. Within the recommended RZ, this vessel traffic intensity may cause some minor, localised, air emissions.

Climatic Factors

There are no known blue carbon habitats (Annex I Saltmarsh, Annex I Maerl, Shellfish Waters, Subtidal and Intertidal Seagrass) within the recommended RZ. There are areas in the western and northern sections of the tidal excursion zone around Rathlin Island and Torr Head that have been identified by Ulster Wildlife as being of higher potential for blue carbon importance. There is unlikely to be any sources of GHG emissions in the area, apart from vessels.

Material Assets

There is no existing infrastructure (cables, pipelines) located within the recommended RZ.

In general, there is relatively low shipping density (<70th percentile) within the recommended RZ. However, there are areas of relatively moderate shipping density (>70th percentile) along the northern boundary, and within the east, of the recommended RZ, and an area of relatively higher shipping density (>90th percentile) in the north of the recommended RZ. These higher density shipping areas are likely associated with the Kintyre Express (Ballycastle to Campbelltown) route, or with vessels travelling between the North Channel and the Atlantic. There are no TSSs within the recommended RZ; However, TCE and MCA recommend a 2nm buffer for TSSs and the recommended RZ is within this buffer from the North Channel TSS.

The recommended RZ is used by commercial fisheries, however, there are no areas of relatively high (>90th percentile) or moderate (>70th percentile) fishing activity within the recommended RZ. Fleets which are known to operate within the recommended RZ include whitefish, scallop, pot, and Nephrops. Key fishing areas for mobile king and queen scallop fleets are located within the recommended RZ. There are no marine fish farms or aquaculture sites within the recommended RZ. There is a known area of importance for inshore pot fisheries in the north-west of the recommended RZ, and to the north-west and south of the recommended RZ, within the tidal excursion zone. Spawning and nursery grounds for Nephrops, and spawning grounds for sprat, encompass the recommended RZ. There are also nursing grounds for anglerfish, cod, common skate, hake, herring, and mackerel within the recommended RZ and tidal excursion zone. Scallops and queen scallops have been recorded within the tidal excursion zone to the north-west of the recommended RZ. There is one restricted fishing area within the recommended RZ; for scallops under the Conservation of Scallops Regulations.

The recommended RZ is used by the MoD, with the north of the recommended RZ being located within a c.14.5km² area of the Rathlin Military Practice Area (X5536), and the south located within a c.70.7km² area of the Torr Military Practice Area (X5528). Both of these areas are used as submarine exercise areas and surface fleet practice and exercise areas. There are no MoD danger areas within the recommended RZ.

There are no zones for aviation interference within the recommended RZ.

There are no spoil dumping sites located within the recommended RZ.

The north-east coast of NI has a developed tourist infrastructure that includes a number of coastal attractions that are within the modelled viewshed for floating wind turbines within the recommended RZ. The Causeway Coast AONB, Antrim Coast and Glens AONB, and Binevenagh AONB, as well as the Giant's Causeway and Causeway Coast WHS and five National Trust lands are located within the modelled viewshed. Potential tourist activities within the recommended RZ and the modelled viewshed include boat tours, water sports, sailing and fishing, and significant long-distance walking routes, such as the Causeway Coast Way, which offer significant attraction for tourism. Further information on landscape designations which may act as tourist attractions within the modelled viewshed of the area is provided in the Landscape and Visual Amenity baseline.

The recommended RZ has a potential capacity of 0.43 GW.

Cultural, Architectural and Archaeological Heritage

There are no protected wrecks within the recommended RZ. There are three recorded wrecks within the recommended RZ, and 24 additional wrecks within the tidal excursion zone. The recommended RZ is situated between c.0.5km and c.5km distance from the coastline. The Giant's Causeway and Causeway Coast WHS is situated on the coastline to the north-west of the recommended RZ and is within the modelled viewshed (based on a turbine height of 228m and a viewable distance of 40km). There are also 495 Listed Buildings, 119 Defence Heritage Record sites, 864 Scheduled Monuments, 101 Scheduled Zones, and 10 Parks and Gardens (Drumalis, Chaine Park, Carnfunnock Country Park, Glenarm Castle, Drumnasole House, Garron Tower, Cairndhu, Manor House (Rathlin), Magherintemple, and Beardiville) within the modelled viewshed.

Landscape, Seascape and Visual Amenity

The recommended RZ is situated between c.0.5km and c.5km distance from the coastline. There are 19 settlements situated inshore of the recommended RZ, which are within the modelled viewshed (based on a turbine height of 228m and a viewable distance of 40km). These include Ballycastle, Cushendall, Knocknacarry, Glenarm, Carnlough, Ballygalley, and Larne.

There are three AONBs situated inshore of the recommended RZ, and which are within the modelled viewshed; these are Causeway Coast AONB, Antrim Coast and Glens AONB, and Binevenagh AONB. The Giant's Causeway and Causeway Coast WHS is also situated on the coastline to the north-west of the recommended RZ and is within the viewshed modelling, as are 11 National Trust Lands (Carrick a Rede, Cushendun, Cushleake Mountain, Dunseverick, Fairhead and Murlough Bay, Giants Causeway, Islandmagee, Layde, Loughan Bay and Portaleen Bay, Rathlin Island, and Whitepark Bay Avish). Areas of the south coastlines of Kintyre and the Isle of Islay in Scotland are also within the modelled viewshed.

The recommended RZ is within the Torr Head Coast, and North Channel RSCAs.

Environmental Assessment	Short-term	Medium-term	Long-term
Biodiversity, Flora and Fauna (BFF)	-3	-3	-3
Population and Human Health (PHH)	-2	-2	-2
Geology, Soils and Land Use (GSL)	-3	-3	-3
Water (W)	-3	-3	-3
Air (A)	0	+1	+1
Climatic Factors (CF)	-1	+1	+1
Material Assets and Infrastructure (MA)	-3	-3 / +1	-3 / +1
Cultural, Architectural and Archaeological Heritage (CH)	-3	-3	-3
Landscape / Seascape and Visual Amenity (L)	-3	-3	-3

Key Conclusions:

Biodiversity, Flora and Fauna – There is potential for significant adverse effects on Biodiversity, Flora, and Fauna owing to the potential for adverse effects on benthic habitats in the short-term construction and decommissioning phases (-3), due to the immediate proximity of Red Bay SAC, Rathlin Island SAC, SPA and MCZ, and for both short-term construction (and decommissioning) phase, and long-term operational phase significant effects on birds, owing to the proximity to Rathlin Island MCZ and SPA and the interaction with a TCE High MCZ risk area for Birds.

There is also potential for moderate adverse effects in the short-term construction and decommissioning phases, and the medium to long-term operational phase (-2) for benthic habitats and species, fish and shellfish, marine mammals and birds, owing to interaction with High MPA risk areas for Fish, Marine Mammals and Breeding Birds, known fish spawning and nursery grounds, areas of recorded relatively high and moderate density for marine mammals and seabirds at sea, and the recorded presence of Protected and Priority species.

Population and Human Health – There is potential for moderate adverse temporary direct and indirect effects on leisure and recreational marine users due to an increased collision risk, access restrictions and displacement, or water quality effects, during the construction and decommissioning phases (-2). There is also potential for moderate adverse long-term (device life) effects due to an enhanced collision risk for recreational and leisure vessels with devices, and displacement of recreational and leisure craft from the array area (-2). This is due to known relatively high use of areas within the recommended RZ by recreational and leisure vessels.

Geology, Soils and Land Use – There are several ASSIs and MCZs designated for geological or geomorphological features within the tidal excursion zone with potential for significant adverse short to long-term operational phase effects on Geology, Soils and Land use (-3). There is potential for moderate direct temporary to permanent impacts on Annex 1 Reef habitats due to loss or damage during the construction or decommissioning phases (-2), and these areas should be avoided at the project planning phase. Following the installation of floating wind technologies there is potential for medium to long-term operational phase localised impacts on erosion and deposition patterns due to the presence of devices (-2). There is potential for influence on the MS Descriptor 6 sea floor integrity from the installation processes of floating wind technologies in the recommended RZ, however, there is not anticipated to be potential for adverse effects on the achievement of GES.

Generally, there is potential for direct short-term, temporary sediment loss in the vicinity of the construction works during seabed preparation activities, construction and decommissioning activities

(-1), and medium to long-term loss within the footprint of foundations and scour protection during device operation (-2).

Water – There is potential for adverse direct or indirect long-term effects on water quality (-3) with one coastal WFD waterbody being within the recommended RZ and three coastal WFD waterbodies being within the tidal excursion zone. There is potential for moderate direct short-term effects on one Bathing Water site of Cushendall during construction and decommissioning activities (-3).

There is also potential for slight short-term effects on water quality elements that are considered by the MS (e.g., Descriptor 9 Concentrations of contaminants in fish and other seafood; Descriptor 8: Concentration of contaminants within marine environment; Descriptor 10 marine litter) during seabed preparation, construction, maintenance and decommissioning activities (-1); there is not anticipated to be potential for adverse effects on the achievement of GES with the application of standard best practice mitigation.

Air – There is potential for slight positive indirect effects on regional air quality in the medium to long-term operational phase, as the operation of renewable energy devices can support a transition away from fossil fuel use and its associated air emissions, with potential for a relatively low capacity in the recommended RZ (+1).

Climatic Factors – There is potential for slight adverse short-term effects on sediment carbon storage, due to a localised release of CO_2 from seabed disturbance during the construction and decommissioning phases (-1). There is potential for slight adverse, short-term, temporary effects on localised GHG concentrations, due to GHG emissions from vessels and machinery during the construction and decommissioning phases (-1), which should be minimised at the project level through adherence to standard best practise for the minimisation of air pollution, as set out in **Section 10.1**.

There is potential for slight positive, medium to long-term effects during the operational phase, as the operation of renewable energy devices can contribute to a net reduction in GHG emissions, decarbonisation of the energy sector, diversification of electricity supply and energy security, and meeting of energy objectives and climate change emission reduction targets, with potential for a relatively low capacity in the recommended RZ (+1).

Material Assets – Overall, there is considered to be potential for significant adverse effects in the short, medium, and long-term on Material Assets (-3), following the consideration of best practice mitigation measures, which is mainly attributed to the potential for moderate adverse effects on Commercial Fisheries, and significant adverse effects on Shipping and Navigation.

Given the presence of the relatively higher density shipping area within the north of the recommended RZ, there is the potential for significant direct navigational risk and displacement effects in the short, medium, and long-term (-3). This is owing to the potential displacement of vessels during construction/decommissioning (short-term) phases and operational (medium to long term) phase, as well as potential for significant adverse direct and indirect effects on navigation and communications in all phases and is also due to the location of the recommended RZ within a 2nm buffer of the North Channel TSS.

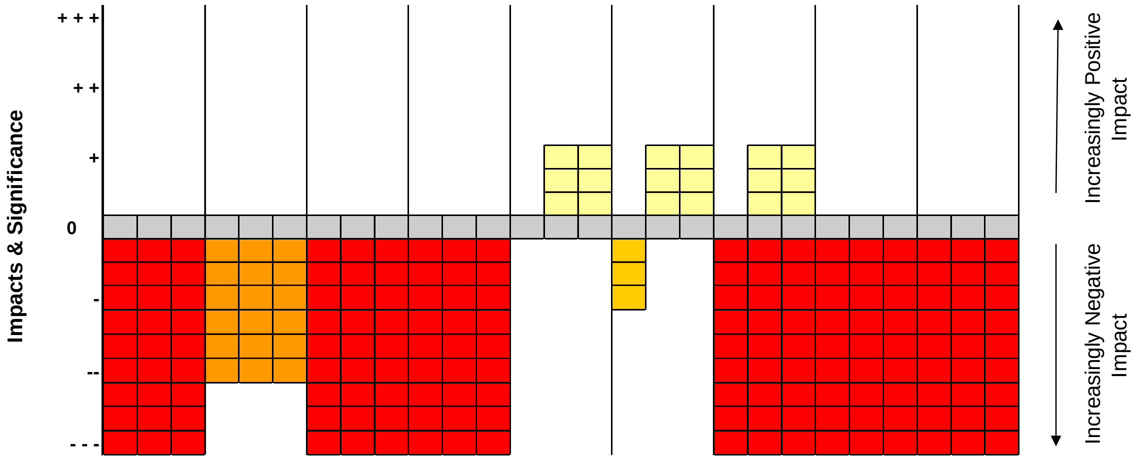
Although the recommended RZ has relatively low fishing intensity, there are areas used by inshore fisheries and as such there is potential for moderate adverse indirect effects on the profitability of commercial fishing in the short, medium, and long- term (-2), such as the potential for reduced quotas, increased resource competition for fishing, and reduced landings in both tonnage and economic value. This is owing to the combination of potential slight adverse effects including: potential displacement from shipping grounds in the short, medium, and long-term; potential for increased collision risk associated with the presence of construction/decommissioning vessels (short-term), and the presence of maintenance vessels and displacement from fishing grounds (medium to long-term); as well as effects on commercial fish species and their key habitats due to direct loss of supporting habitats, and indirect effects due to sediment mobilisation; all of which could indirectly affect fishing activity through an alteration of commercial fish stocks.

There is potential for slight positive effects in terms of the generation of a new renewable energy supply for the NI population in the medium to long-term, as the recommended RZ has a potential capacity of 0.43GW (+1).

Cultural, Architectural and Archaeological Heritage – There is potential for significant adverse effects on Cultural Heritage in the short-term construction and decommissioning phases, and the medium to long-term operational phase (-3) owing to the very high sensitivity of coastal heritage receptors whose setting may be affected, including the Giant's Causeway and Causeway Coast WHS.

Landscape, Seascape and Visual Amenity – There is potential for significant adverse effects on Landscape, Seascape and Visual Amenity in the short-term construction and decommissioning phases, and the medium to long-term operational phase (-3) owing to the distance of the recommended RZ offshore and the very high sensitivity of the landscape areas that may be affected, including the Giant's Causeway and Causeway Coast WHS, Causeway Coast AONB, Antrim Coast and Glens AONB and Binevenagh AONB, as well as moderate effects on the inshore coastal population that may be affected by changes in visual amenity.

Summary Chart of Potential Effects



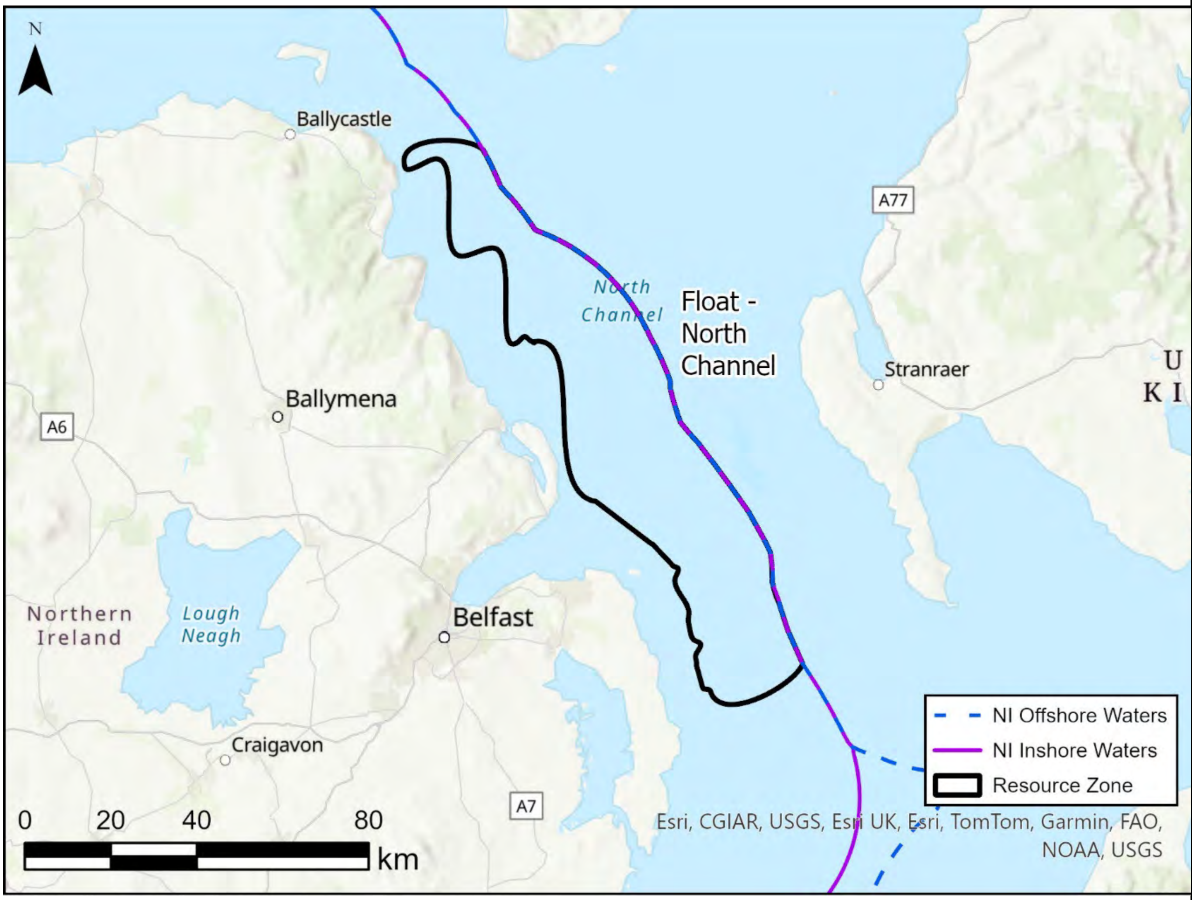
Time	S	M	L	S	M	L	S	M	L	S	M	L	S	M	L	S	M	L	S	M	L	S	M	L	S	M	L
Topic	Biodiversity, Flora and Fauna			Population & Human Health			Geology, Soils & Land Use			Water			Air			Climatic Factors			Material Assets			Cultural Heritage			Landscape & Visual Amenity		

Recommendations for Further Refinement:

No further recommendations are being made for this recommended RZ, as it is considered to be highly constrained for the development of floating wind technologies.

The theoretical energy potential of the refined Floating Rathlin Torr Head RZ remains as 0.43GW.

9.2.10 Floating Wind Resource Zone: North Channel

Stage 1 Floating Wind Resource Zone – North Channel
The Floating Wind North Channel RZ is located off the north-east coast of NI, approximately 3km offshore of Islandmagee, extending from Runabay Head to Ballywalter. The water depth of the RZ ranges from c.44m to c.263m. The average wind speeds range from c.8.25m/s to 10.2m/s. The predominant suitable TCE Technology Groups for the RZ include: - Technology Group 1 (Conventional Anchoring - Moderate Sea State) - Technology Group 3 (Complex Anchoring - Moderate Sea State) - Technology Group 5 (Pile/Socket Anchoring - Moderate Sea State) The theoretical energy potential of this RZ is 4.98GW.
Floating Wind Resource Zone – North Channel

Key Environmental Constraints and Sensitivities within the Resource Zone
Biodiversity, Flora and Fauna – North Channel SAC, The Maidens SAC, and East Coast Marine pSPA are within the RZ. There are known areas of Annex I Reef habitat, areas of known high harbour seal and grey seal density, and areas identified by TCE as being of High to Very High MPA Risk to Breeding Birds, Non-Breeding Birds, Marine Mammals, and Habitats. **Population and Human Health –** There is a RYA area of high leisure density within the RZ. **Geology, Soils and Land Use –** There are areas of offshore rock, Dumping Grounds, and dredge spoil dumping grounds, within the RZ. **Water –** There are Dumping Grounds and dredge spoil dumping grounds within the RZ.

Air – There are no key sensitivities within the RZ.

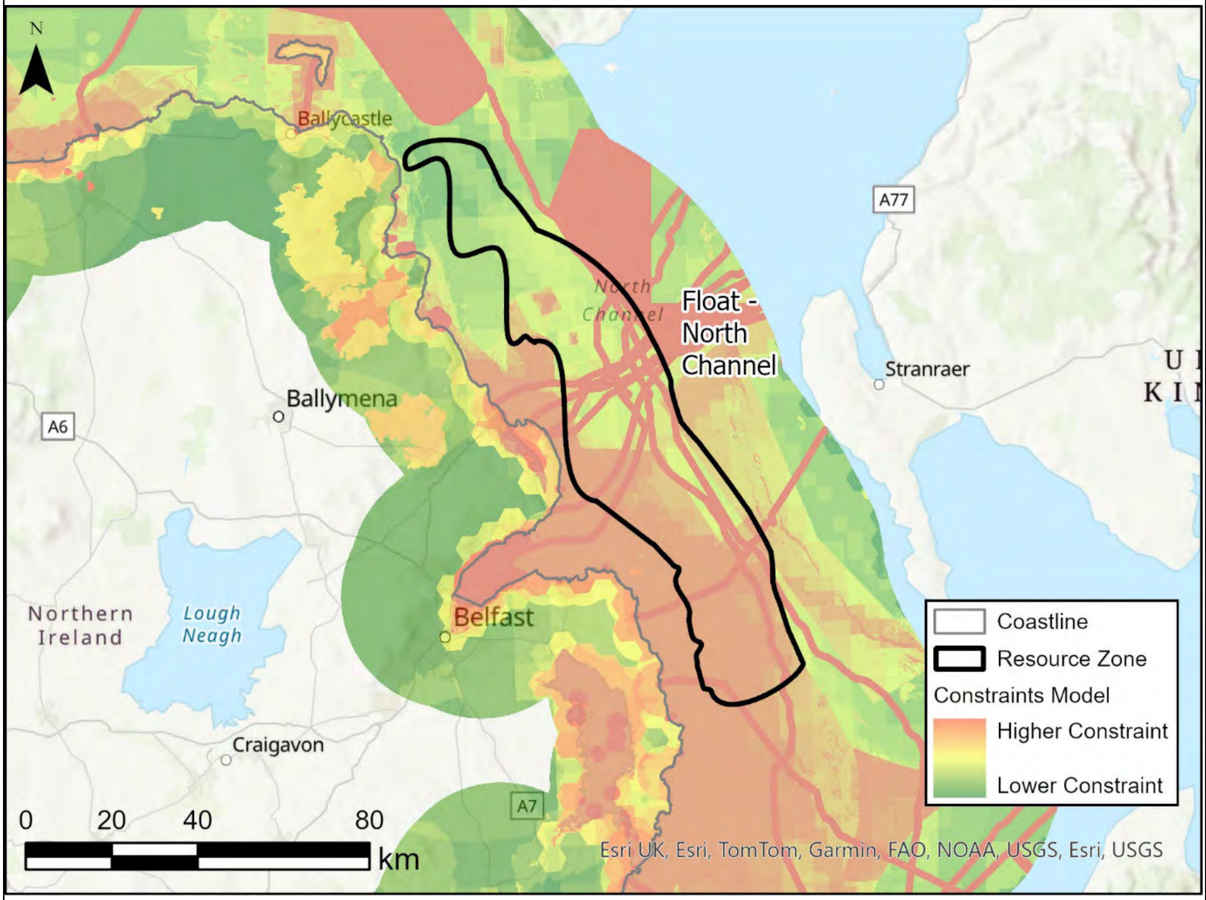
Climatic Factors – There are no key sensitivities within the RZ.

Material Assets – There is a pipeline, and there are two power cables (Moyle Interconnector and Western Link Ardneill-Wirral 1) and eight telecommunication cables (Hibernia 'A', Sirius North, Lanis 2, Lanis 3, Scotland-NI 1, Scotland-NI 2, Scotland-NI 3 and Scotland-NI 4) within the RZ. There are areas of high shipping density and a pilot boarding station within the RZ. There are areas of known pot fishing. The Campbeltown Military Area is also within the RZ.

Cultural, Architectural and Archaeological Heritage – There is a protected wreck, and there are unprotected wrecks, within the RZ.

Landscape, Seascape and Visual Amenity – The RZ is offshore of the Antrim Coast and Glens AONB and the Strangford and Lecale AONB, which are sensitive visual receptors.

Floating Wind Resource Zone – North Channel

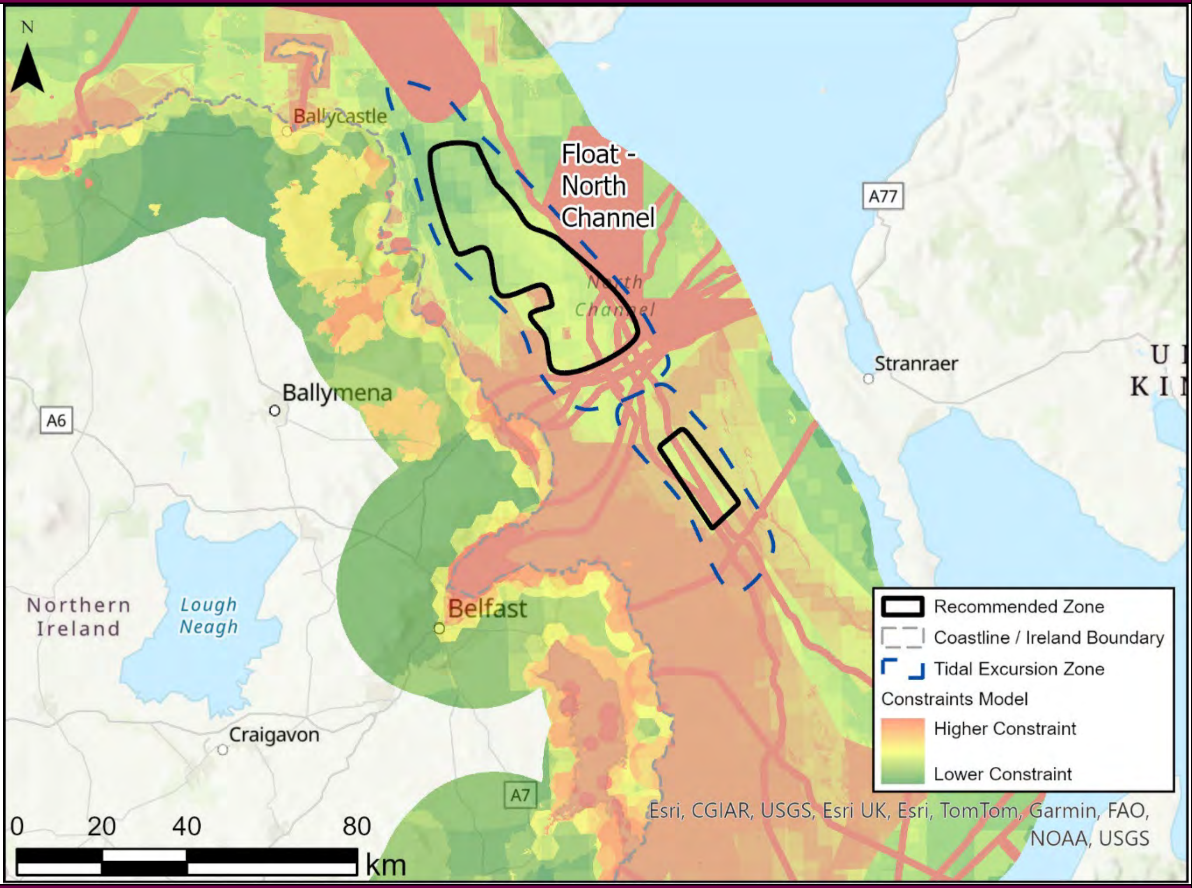


Stage 2 Recommended Floating Wind Resource Zone – North Channel

To avoid the potential for direct impacts on identified key sensitivities within the Floating North Channel RZ, it was refined through the exclusion of the central area to avoid interaction with The Maidens SAC, East Coast Marine pSPA, and North Channel SAC, cables and pipelines, high shipping density and RYA leisure density, and the Campbeltown Military Area.

The theoretical energy potential of the recommended Stage 2 North Channel RZ is 1.81GW.

Recommended Floating Wind Resource Zone – North Channel and Combined Constraints Model



Environmental Baseline and Key Issues within the Recommended Resource Zone

Environmental baseline information relevant to this recommended RZ is given below, ordered by SEA environmental topic. These sensitivities and indicators have the potential to be impacted by and impact upon the development and/or operation of offshore floating wind.

Biodiversity, Flora and Fauna

There are no designated sites (SACs, SPAs, Ramsar sites, MCZs, ASSIs) within the recommended RZ. The Maidens SAC, East Coast Marine pSPA, and North Channel SAC are adjacent to the recommended RZ and are within the tidal excursion zone. There is a TCE Very High MPA risk area for Habitat in the south of the southern section of the recommended RZ, High MPA risk areas for Breeding Birds and Marine Mammals, and a Moderate MPA risk area for Fish within the recommended RZ. There are known areas of Annex I Reef habitat within the recommended RZ, particularly in the centre of the northern section, and within the tidal excursion zone for both sections of the recommended RZ, and an area of Annex I Maerl within the tidal excursion zone inshore of the northern section of the recommended RZ. The seabed habitats within the northern section of the recommended RZ predominantly consist of coarse substrate, with sand in the south and small areas of rock or hard substrate, while the southern section is predominantly coarse substrate and mixed sediment.

Protected species (Wildlife Order) that have been recorded within the recommended RZ include the marine mammals: minke whale, harbour porpoise, bottlenose dolphin, and short-beaked common dolphin. NI Priority Species that have been recorded include the starfish: goose foot starfish; sea cucumber: *Leptosynapta bergensis*; sponge: *Clathria barleei*; molluscs: horse mussel and variegated scallop; marine mammals: orca, minke whale, harbour porpoise, and short-beaked common dolphin; fish: porbeagle; crustacean: rugose squat lobster; and bird: black-legged kittiwake. Priority Marine Features (PMFs) recorded within the recommended RZ include the starfish: red cushion star and northern starfish; sea cucumbers: *Labidoplax media* and *Leptosynapta bergensis*; molluscs: queen scallop and variegated scallop; marine mammals: orca, short-beaked common dolphin, and harbour porpoise; hydrozoan: *Tamarisca tamarisca*; bryozoan: *Pentapora foliacea*; fish: porbeagle, ling, small-spotted catfish, plaice, and spotted ray; and crustacean: rugose squat lobster. There are records of the elasmobranchs; spurdog, porbeagle, common skate, and spotted ray. The harbour porpoise, spotted ray, porbeagle, and black-legged kittiwake are also listed as OSPAR Threatened/Declining species.

There are areas of SCANs recorded relatively high density for pilot whale, fin whale, and beaked whale, and areas of relatively moderate density for white-beaked dolphin, striped dolphin, pilot whale, harbour porpoise, fin whale, bottlenose dolphin and beaked whale. MU data also indicates that the cetaceans white-sided dolphin, white-beaked dolphin, Risso's dolphin, minke whale, harbour porpoise, common dolphin, and bottlenose dolphin may occur within the area. There are also areas of relatively high and moderate density for grey seal within the recommended RZ.

There are areas of recorded relatively high and moderate density for seabirds at sea within the northern section of the recommended RZ.

There are spawning grounds for Nephrops, sprat, whiting, plaice, cod, ling, and mackerel within the recommended RZ and the tidal excursion zone. There are nursery grounds for Nephrops, whiting, cod, spurdog, anglerfish, common skate, hake, and mackerel within the recommended RZ and the tidal excursion zone, and an AFBI surveyed relatively low juvenile density (nursery area) for whiting is also within the tidal excursion zone. There are two restricted areas for fishing within the recommended RZ, for scallops, under the Conservation of Scallops Regulations, and for certain fishing gear within The Maidens SAC, under The Marine Protected Areas (Prohibited Methods of Fishing) Regulations.

There is a single record of the invasive polychaete species *Goniadella gracilis* within the recommended RZ.

Population and Human Health

The recommended RZ is located offshore of the settlements of Cushendun, Cushendall, Waterfoot, Carnlough, Larne, Whitehead, Bangor, Donaghadee and Millisle. The inshore boundary of the recommended RZ is located between approximately 7 and 19km offshore of these settlements.

The recommended RZ is located offshore of the Ballygally, Brown's Bay, Carnlough, Cushendall, Donaghadee, Drain's Bay, Groomsport, Millisle, Portmuck, and Waterfoot Bathing Water sites, and the Ballygally, Ballywalter South, Carnlough, Groomsport, Millisle and Waterfoot Blue Flag Beaches. However, none of these sites are located within the recommended RZ or tidal excursion zone.

There are areas of relatively high intensity RYA leisure boating activity within the southern section of the recommended RZ, off the coast of Bangor towards Portpatrick, due to small craft travelling between these two areas. There are also areas of relatively higher intensity RYA leisure boating activity off the coast of Larne, and in proximity to the coastline, particularly within Belfast Lough.

There are no dive sites within the recommended RZ, however there are four dive sites located within the tidal excursion zone; these are East Maiden Lighthouse, S.S Albia, S.S Housatonic and S.V. Sumatra.

Geology, Soils and Land Use

There are no WHSs, ASSIs, MCZs or UNESCO Geoparks designated for geology or geomorphology within the recommended RZ or the tidal excursion zone.

The main seabed geology within the recommended RZ is undifferentiated geology, with one area of diamict. Seabed thickness is generally <5m, with smaller areas of >50m and between 5–50m. The main seabed substrates of the recommended RZ are predominantly coarse substrate, mixed sediment, and sediment, with smaller areas of rock or other hard substrate or sand. These are all biozones of deep circalittoral with energy of either moderate or low. There are known areas of Annex I Reef habitat within the recommended RZ, particularly in the centre of the northern section, and within the tidal excursion zone for both sections of the recommended RZ.

TCE expected technology groups for the installation of floating wind turbines within the recommended RZ are predominantly technology group 3 (Complex anchoring for a moderate sea state) and 5 (Piling with socket anchoring for a moderate sea state) with one area of technology group 1 (Conventional anchoring for a moderate sea state).

There are no dumping grounds of spoil ground or MoD firing/danger areas within the recommended RZ. One area of explosive dumping grounds is within the recommended RZ of Beaufort's Dyke.

Water

The water depths within the recommended RZ range from c.113-171m. Tidal speeds within the recommended RZ range from 0.55-1.21m/s.

There are no dumping grounds of spoil ground or MoD firing/danger areas within the recommended RZ. One area of explosive dumping grounds is within the recommended RZ of Beaufort's Dyke.

There are no WFD Shellfish Waters or Bathing Waters within the recommended RZ or the tidal excursion zone. One WFD coastal waterbody of Maiden Islands is within the recommended RZ and the tidal excursion zone, which was at moderate status in 2021.

The recommended RZ is located within the Celtic Seas sub-region for the MS (covering waters to the west of the UK and shared with RoI and France).

Air

There are no air quality issues within the recommended RZ, as there are no significant anthropogenic sources of air pollution in the vicinity. The recommended RZ is located offshore of the settlements of Cushendun, Cushendall, Waterfoot, Carnlough, Larne, Whitehead, Bangor, Donaghadee and Millisle. The inshore boundary of the recommended RZ is located between approximately 7 and 19km offshore of these settlements.

There are areas of relatively high intensity RYA leisure boating activity within the southern section of the recommended RZ, off the coast of Bangor towards Portpatrick, due to small craft travelling between these two areas. There are also areas of relatively higher intensity RYA leisure boating activity off the coast of Larne, and in proximity to the coastline, particularly within Belfast Lough. Within the recommended RZ, this vessel traffic intensity may cause some minor, localised, air emissions.

Climatic Factors

There are no known blue carbon habitats (Annex I Saltmarsh, Annex I Maerl, Shellfish Waters, Subtidal and Intertidal Seagrass) within the recommended RZ or tidal excursion zone. There are no areas within the recommended RZ that have been identified by Ulster Wildlife as blue carbon hotspots.

There are unlikely to be any sources of GHG emissions in the area, apart from vessels.

Material Assets

There are three telecommunication cables and one power cable in the south-east of the recommended RZ. The telecommunication cables include a c.21.4km length of the Hibernia 'A' cable, a c.11.6km length of the Scotland-NI 4 cable, and a c.9km length of the Sirius North cable. A c.13.6km section of the Western HDVC Link (Ardneill to Wirral 1) power cable is located in the south-east of the recommended RZ. A c.0.06km² area of the recommended RZ is within 500m of the Scotland-NI 2 telecommunication cable. There are no pipelines within the recommended RZ.

In general, there is a relatively moderate shipping density (>70th percentile) within the recommended RZ. However, there are areas of relatively high shipping density (>90th percentile) along the southern boundary of the north section of the recommended RZ, and along the northern boundary of the south section. These higher density shipping areas are likely associated with the Larne to Cairnryan Ferry and the Belfast to Cairnryan Ferry routes, respectively. Fishing vessels associated with Belfast or Larne ports, as well as cargo and tanker vessels passing from the Atlantic or ports in NI, such as Belfast or Larne, to the south may also contribute to these higher densities. There are no TSSs within the recommended RZ.

The recommended RZ is used by commercial fisheries, however, there are no areas of relatively high (>90th percentile) or moderate (>70th percentile) fishing activity within the recommended RZ. Fleets which are known to operate within the recommended RZ include whitefish, scallop, pot, and Nephrops. Key fishing areas for mobile king and queen scallops, and whitefish (cod, haddock and hake) fleets are located within the recommended RZ. Relatively significant herring and mackerel landings are made into Belfast. There are no marine fish farms or aquaculture sites within the recommended RZ. There is a known area of importance for inshore pot fisheries within the west of the recommended RZ, and to the west of the recommended RZ within the tidal excursion zone. Known spawning and nursery grounds for Nephrops, and spawning grounds for sprat, encompass the recommended RZ. Spawning grounds for whiting, plaice, cod, ling, and mackerel are also located within the recommended RZ, while nursery grounds for spurdog, cod, whiting, anglerfish, common skate, hake, and mackerel are located within the recommended RZ and tidal excursion zone. Areas of surveyed high egg production (spawning area) for cod and plaice are located within the recommended RZ and the tidal excursion zone, and areas of relatively high surveyed juvenile density (nursery areas) for haddock and whiting are also within the recommended RZ and tidal excursion. There are two fishing restricted zones for scallops, under the Conservation of Scallops Regulations, and for certain fishing gear under The Marine Protected Areas (Prohibited Methods of Fishing) Regulations.

The recommended RZ is used by the MoD, with the south of the recommended RZ being located within a c.65.7km² area of the Magee Military Practice Area (X5407), the south-east within a c.1.2km² area of the Beaufort Military Practice Area (X5408), the north within a c.41.3km² area of the Torr Military Practice Area (X5528), and the southern portion of the northern section within a c.252.9km² area of the Maiden Military Practice Area (X5527). All of these Military Practice Areas are utilised as submarine exercise areas, and surface fleet practice and exercise areas. There are no MoD danger areas within the recommended RZ.

There are no zones for aviation interference within the recommended RZ.

The eastern boundary of the recommended RZ is within a 16km² area of an explosives dumping ground (Beaufort's Dyke), which is reported to no longer be in use.

The north-east coast of NI has a developed tourist infrastructure that includes a number of coastal attractions that are within the modelled viewshed for floating wind turbines within the recommended RZ. The Strangford and Lecale AONB, Antrim Coast and Glens AONB, and 18 National Trust Lands are located within the modelled viewshed. Potential tourist activities within the recommended RZ and the modelled viewshed include boat tours, water sports, sailing and fishing, and significant long-distance walking routes, such as the Ballycastle to Glenarm section of the Ulster Way, which offer significant attraction for tourism. Further information on landscape designations which may act as tourist attractions within the modelled viewshed of the area is provided in the Landscape and Visual Amenity baseline.

The recommended RZ has a potential capacity of 1.81GW.

Cultural, Architectural and Archaeological Heritage

There are no protected wrecks within the recommended RZ. There are 14 recorded wrecks within the recommended RZ, and 20 additional wrecks within the tidal excursion zone.

The recommended RZ is situated between c.4.5km and c.22km distance from the coastline. There are 1852 Listed Buildings, 440 Defence Heritage Record sites, 1572 Scheduled Monuments, 193 Scheduled Zones, and 37 Parks and Gardens (including Glenarm Castle, Drumnasole House, Garron Tower, Carnfunnock Country Park, Red Hall, Castle Dobbs, Clandeboye, and Ballywalter Park) within the modelled viewshed (based on a turbine height of 228m and a viewable distance of 40km).

Landscape, Seascape and Visual Amenity

The recommended RZ is situated between c.4.5km and c.22km distance from the coastline. There are 69 settlements situated inshore of the recommended RZ, which are within the modelled viewshed (based on a turbine height of 228m and a viewable distance of 40km). These include Belfast City, Metropolitan Newtownabbey, Carrickfergus, Bangor and Larne.

There are no WHSs situated inshore of the recommended RZ. There are two AONBs situated inshore of the recommended RZ, and which are within the modelled viewshed: Strangford and Lecale AONB, and Antrim Coast and Glens AONB. There are also 18 National Trust Lands within the modelled viewshed, including Lighthouse Island, Strangford Lough, Orlock, Islandmagee, and Ballymacormick, and three Country Parks, Scrabo, Crawfordsburn, and Redburn. The recommended RZ is within the North Channel Regional Seascape Character Area (RSCA), and is offshore of the Northern Glens Coast, Southern Glens Coast, The Gobbins, Larne Lough, and Ards Peninsula RSCAs.

Environmental Assessment	Short-term	Medium-term	Long-term
Biodiversity, Flora and Fauna (BFF)	-3	-3	-3
Population and Human Health (PHH)	-2	-2	-2
Geology, Soils and Land Use (GSL)	-1	-2	-2
Water (W)	-3	-3	-3
Air (A)	0	+3	+3
Climatic Factors (CF)	-1	+3	+3
Material Assets and Infrastructure (MA)	-2	-2 / +3	-2 / +3
Cultural, Architectural and Archaeological Heritage (CH)	-3	-3	-3
Landscape / Seascape and Visual Amenity (L)	-3	-3	-3

Key Conclusions:
Biodiversity, Flora and Fauna – There is potential for significant adverse effects on Biodiversity, Flora, and Fauna in the short-term construction and decommissioning phases (-3), owing to the immediate proximity of The Maidens SAC and East Coast Marine pSPA within the tidal excursion zone and TCE Very High MPA risk area for Habitats, and potential for indirect effects on designated benthic habitat, supporting habitat for designated birds, and disturbance and displacement of birds and marine mammals, and in the long-term operational phase due to potential significant effects on designated birds and indirect effects on designated benthic habitats in proximity to the recommended RZ boundary. There is also potential for moderate adverse effects in the short-term construction and decommissioning phases, and the medium to long-term operational phase (-2) for benthic habitats and species, fish and shellfish, marine mammals, birds, and fish, owing to interaction with Moderate to High MPA risk areas for Habitats, Fish, Marine Mammals and Breeding Birds, known fish spawning and nursery grounds, areas of recorded relatively high and moderate density for marine mammals and relatively moderate density for seabirds at sea, and the recorded presence of Protected and Priority species. **Population and Human Health –** There is the potential for moderate adverse temporary, direct and indirect, effects on leisure and recreational marine users due to an increased collision risk, access restrictions and displacement, or water quality effects, during the construction and decommissioning phases (-2). There is potential for moderate adverse long-term (device life) effects due to an enhanced collision risk for recreational and leisure vessels with devices, and displacement of recreational and leisure craft from the array area (-2). This is due to known relatively high use of areas within the recommended RZ by recreational and leisure vessels. **Geology, Soils and Land Use –** There is potential for slight adverse direct long-term effects on the seabed geology and sediments in the short-term construction and decommissioning phases through loss or damage (-1). There is potential for moderate direct temporary to permanent impacts on Annex 1 Reef habitats due to loss or damage during the construction and decommissioning phases (-2). Following the installation of floating wind technologies, there is potential for medium to long-term operational phase localised effects on erosion and deposition patterns due to the presence of devices (-2). There is potential for influence on the MS Descriptor 6 sea floor integrity from the installation processes of floating wind technologies in the recommended RZ, however, there is not anticipated

to be potential for adverse effects on the achievement of GES. There is also potential for moderate indirect medium-term effects on seabed sediments due to a release of historical contamination sources through mobilisation, as there is a former explosive dumping ground with the recommended RZ (-2). Generally, there is potential for direct, short-term temporary sediment loss in the vicinity of the construction works during seabed preparation activities, construction and decommissioning activities (-1), and medium to long-term loss within the footprint of foundations and scour protection during device operation (-2).

Water – There is potential for adverse direct long-term effects on hydromorphological status within the WFD coastal waterbody of the Maiden Islands, which is within the recommended RZ and tidal excursion zone (-3). There is also potential for moderate indirect medium-term effects on water quality due to a release of historical contamination sources through mobilisation, as there is a former explosive dumping ground within the recommended RZ (-2). There is also potential for slight short-term effects on water quality elements that are considered by the MS (e.g., Descriptor 9 Concentrations of contaminants in fish and other seafood; Descriptor 8: Concentration of contaminants within marine environment; Descriptor 10 marine litter) during seabed preparation, construction, maintenance and decommissioning activities (-1); there is not anticipated to be potential for adverse effects on the achievement of GES with the application of standard best practice mitigation.

Air – There is potential for significant positive indirect effects on regional air quality in the medium to long-term operational phase, as the operation of renewable energy devices can support a transition away from fossil fuel use and its associated air emissions, with potential for a relatively high capacity in the recommended RZ (+3).

Climatic Factors – There is potential for slight adverse short-term effects on sediment carbon storage, due to a localised release of CO_2 from seabed disturbance during the construction and decommissioning phases (-1). There is potential for slight adverse, short-term, temporary effects on localised GHG concentrations, due to GHG emissions from vessels and machinery during the construction and decommissioning phases (-1), which should be minimised at the project level through adherence to standard best practise for the minimisation of air pollution, as set out in **Section 10.1**. There is potential for significant positive, medium to long-term effects during the operational phase, as the operation of renewable energy devices can contribute to a net reduction in GHG emissions, decarbonisation of the energy sector, diversification of electricity supply and energy security, and meeting of energy objectives and climate change emission reduction targets, with potential for a relatively high capacity in the recommended RZ (+3).

Material Assets – Overall, there is considered to be potential for moderate adverse effects in the short, medium, and long-term on Material Assets (-2), following the consideration of best practice mitigation measures, which is mainly attributed to the potential for moderate adverse effects on Commercial Fisheries, and significant adverse effects on Shipping and Navigation.

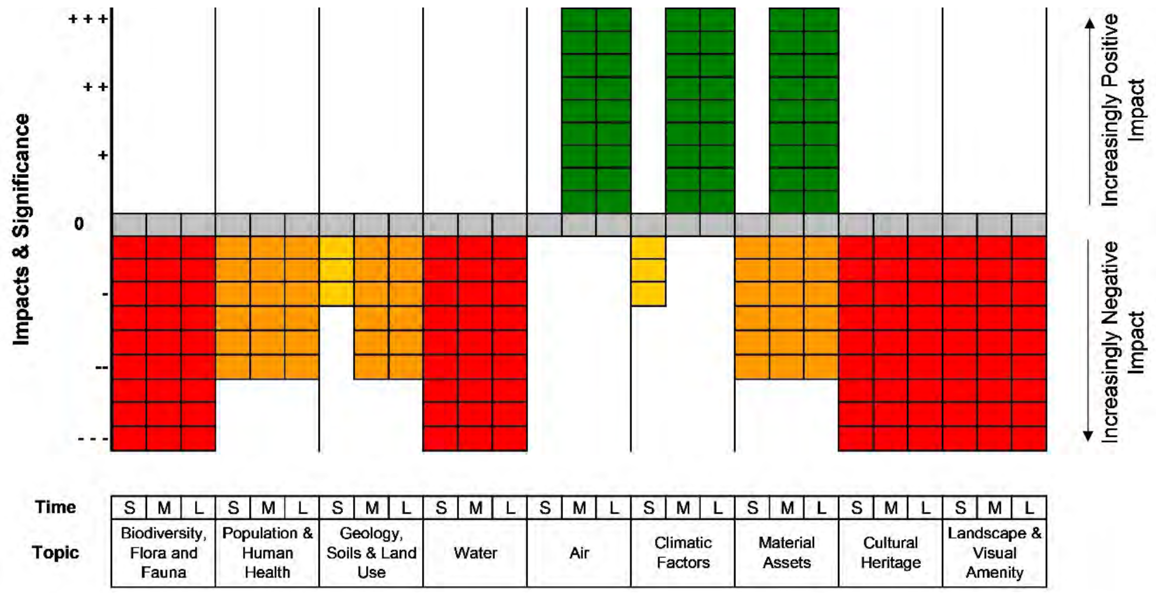
Given the presence of the relatively higher density shipping area within the recommended RZ, there is potential for significant direct navigational risk and displacement effects in the short, medium, and long-term (-3). This is owing to the potential displacement of vessels during construction and decommissioning (short-term) phases and operational (medium to long term) phase, as well as potential for moderate adverse direct and indirect effects on navigation and communications in all phases. There is potential for moderate indirect effects on the profitability of commercial fishing in the short, medium, and long-term (-2), such as the potential for reduced quotas, increased resource competition for fishing, and reduced landings in both tonnage and economic value. This is owing to the combination of potential slight adverse effects including: potential displacement from shipping grounds in the short, medium, and long-term; potential for increased collision risk associated with the presence of construction and decommissioning vessels (short-term), and the presence of maintenance vessels and displacement from fishing grounds (medium to long-term); as well as effects on commercial fish species and their key habitats due to direct loss of supporting habitats, and indirect effects due to sediment mobilisation; all of which could indirectly affect fishing activity through an alteration of commercial fish stocks.

There is potential for significant positive effects in terms of the generation of a new renewable energy supply for the NI population in the medium to long-term, as the recommended RZ has a potential capacity of 1.81GW (+3).

Cultural, Architectural and Archaeological Heritage – There is potential for significant adverse effects on Cultural Heritage in the short-term construction and decommissioning phases, and the medium to long-term operational phase (-3) owing to the distance of the recommended RZ offshore and the high sensitivity of coastal heritage receptors whose setting may be affected.

Landscape, Seascape and Visual Amenity – There is potential for significant adverse effects on Landscape, Seascape and Visual Amenity in the short-term construction and decommissioning phases, and the medium to long-term operational phase (-3) owing to the distance of the recommended RZ offshore and the very high sensitivity of the landscape areas that may be affected, including Strangford and Lecale AONB, and Antrim Coast and Glens AONB, as well as moderate effects on the inshore coastal population that may be affected by changes in visual amenity (-2).

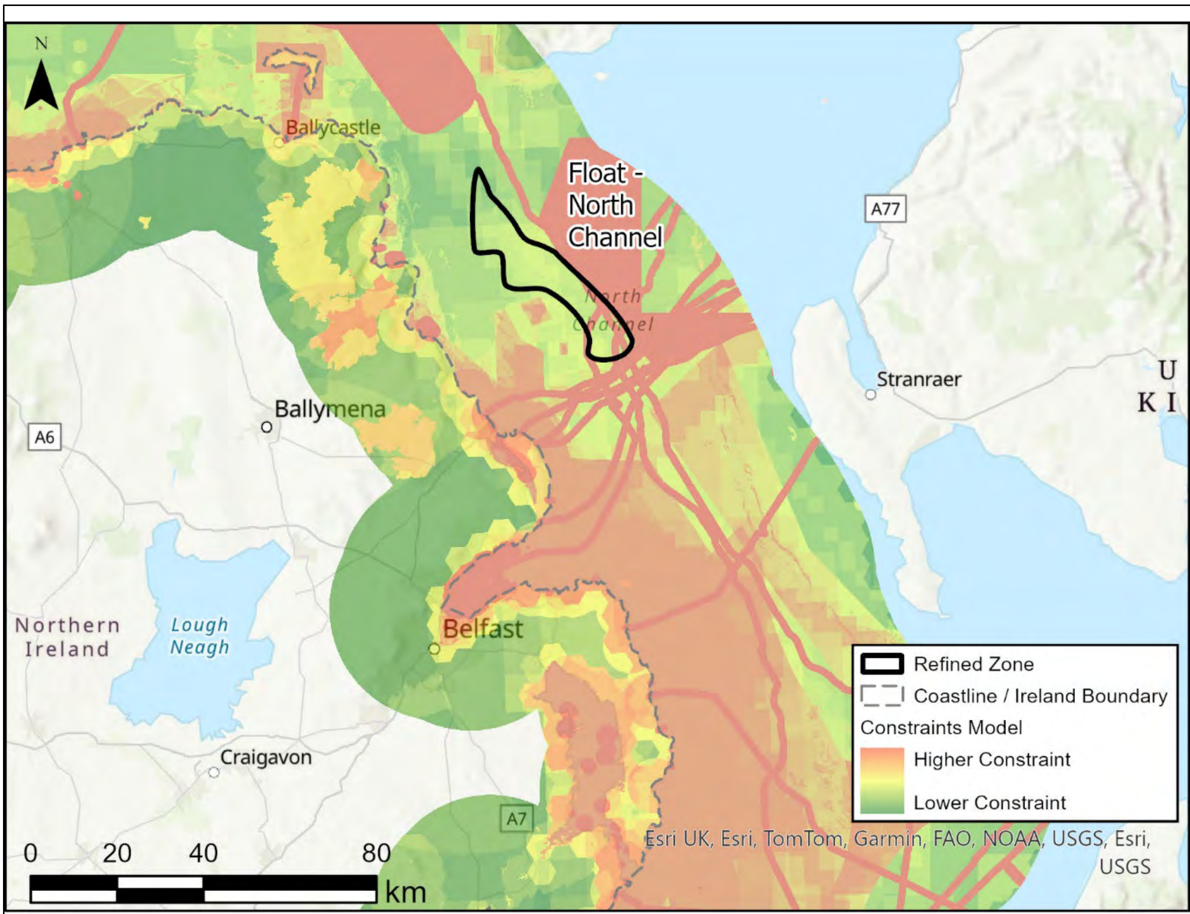
Summary Chart of Potential Effects



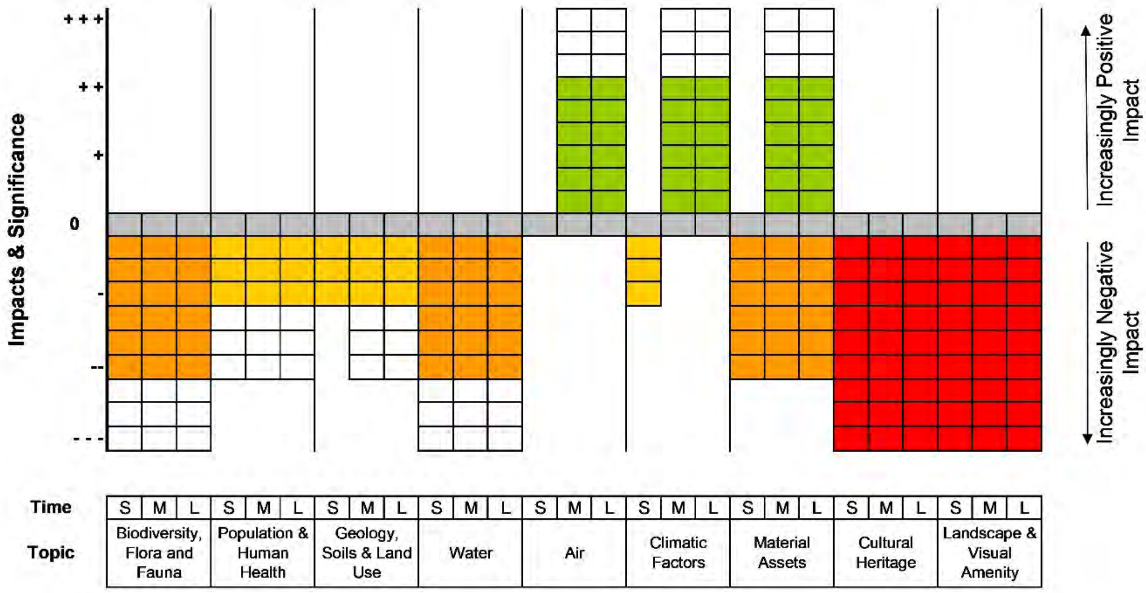
Recommendations for Further Refinement:

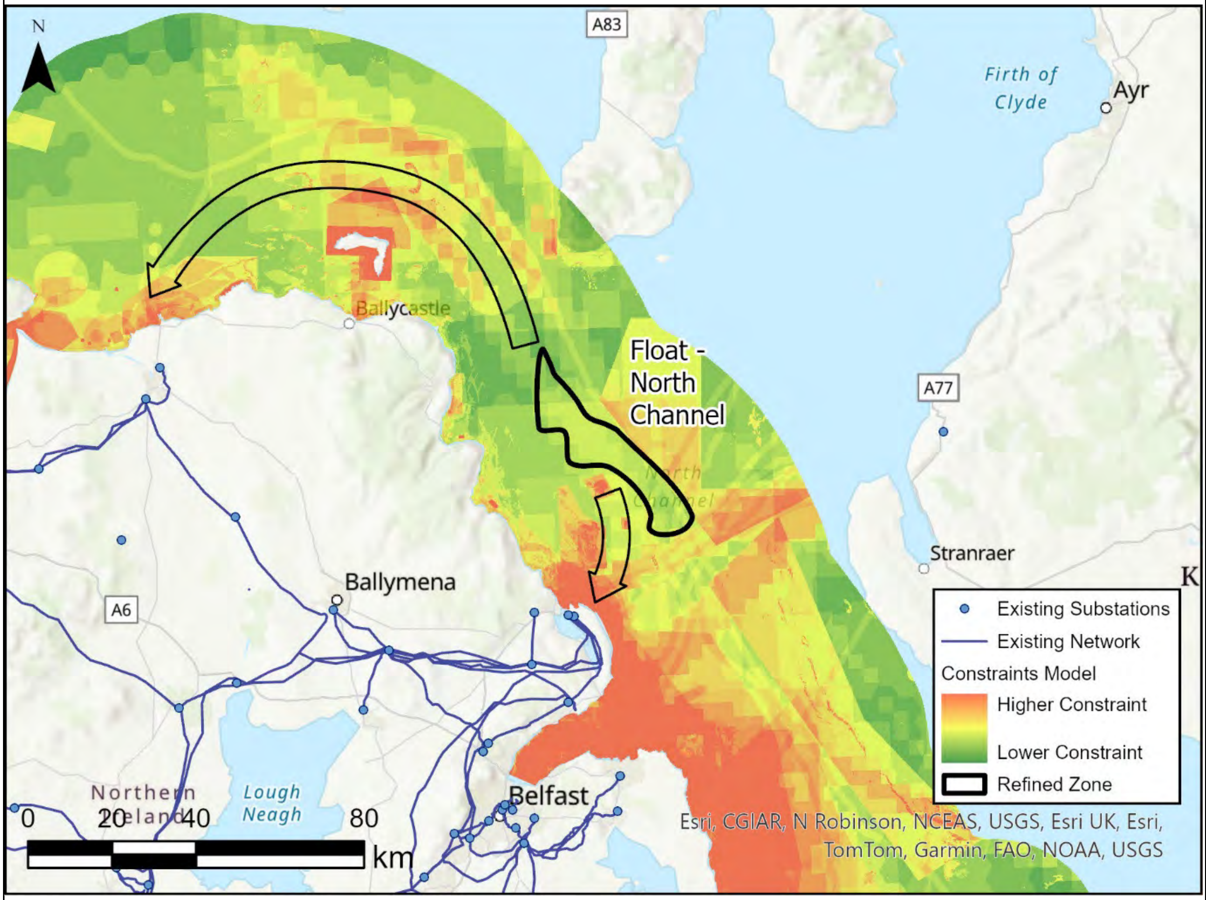
Further refinement of the Floating North Channel RZ is recommended to exclude the inshore and other sensitive areas, to avoid The Maidens SAC, East Coast Marine pSPA and North Channel SAC, within the tidal excursion zone, and to avoid the TCE Very High/High risk areas associated with these sites, which can reduce the overall score for Biodiversity, Flora, and Fauna to -2. Avoidance of the closest areas to shore (within 13km) reduces the potential for significant visual effects, including on landscape designations and the setting of coastal heritage receptors, however the score for Cultural Heritage and Landscape, Seascape, and Visual Amenity remains as -3 owing to the high sensitivity of the landscape and heritage receptors (AONBs) that may still be adversely affected, as the distance to shore is a maximum of c.22km for the RZ. Further refinement is also recommended to avoid the disposal grounds, thereby reducing the potential for adverse effects on Geology, Soils and Land use, and to avoid the Maiden Islands WFD Coastal water body, reducing the potential for adverse effects on Water. It is also recommended to avoid the areas of known high use by leisure vessels. Further refinement to avoid areas of higher density shipping, areas of importance for inshore fisheries, areas of highest known importance for fish spawning and nursery, and of areas of moderate fishing activity is recommended to reduce the potential for adverse effects on Material Assets, however the overall score would remain as -2. Refinement would also reduce the potential for renewable energy generation, thus reducing the medium to long-term positive score to +2.

The theoretical energy potential of the refined Floating North Channel RZ is 0.54GW.



Comparative Chart



Potential Export Cable Routes

Connection into Larne area. 275kV/110kV existing network. Length approx. 15km. Significant likely constraints include the East Coast Marine pSPA, telecommunication cables, Brown's Bay Bathing Water Site, Offshore Rock, Annex I Reef, Pilot Boarding Station and Port Lands around Larne. It may be difficult to avoid both The Maidens SAC and the North Channel SAC, avoiding these would require a longer offshore route. There are several designated sites within the vicinity including Larne Lough SPA/Ramsar/IBA and Portmuck ASSI, however these can all potentially be avoided.
Connection into Coleraine area. 110kV existing network. Length approx. 81km. Significant likely constraints include North Channel TSS, a telecommunication cable and areas of Annex I Sandbanks and Annex I Reefs. Other constraints which can potentially be avoided include protected wrecks, steep sloping seabed, cliffs over 15m, urban areas, Bathing Water Sites and designated sites including Bann Estuary SAC, Skerries and Causeway SAC, Rathlin MCZ, Rathlin Island SPA, Bann Estuary ASSI, Portrush West Strand ASSI, Ramore Head and Skerries ASSI, Binevenagh AONB and Causeway Coast AONB.

9.2.11 Floating Wind Resource Zone: Irish Sea Inshore

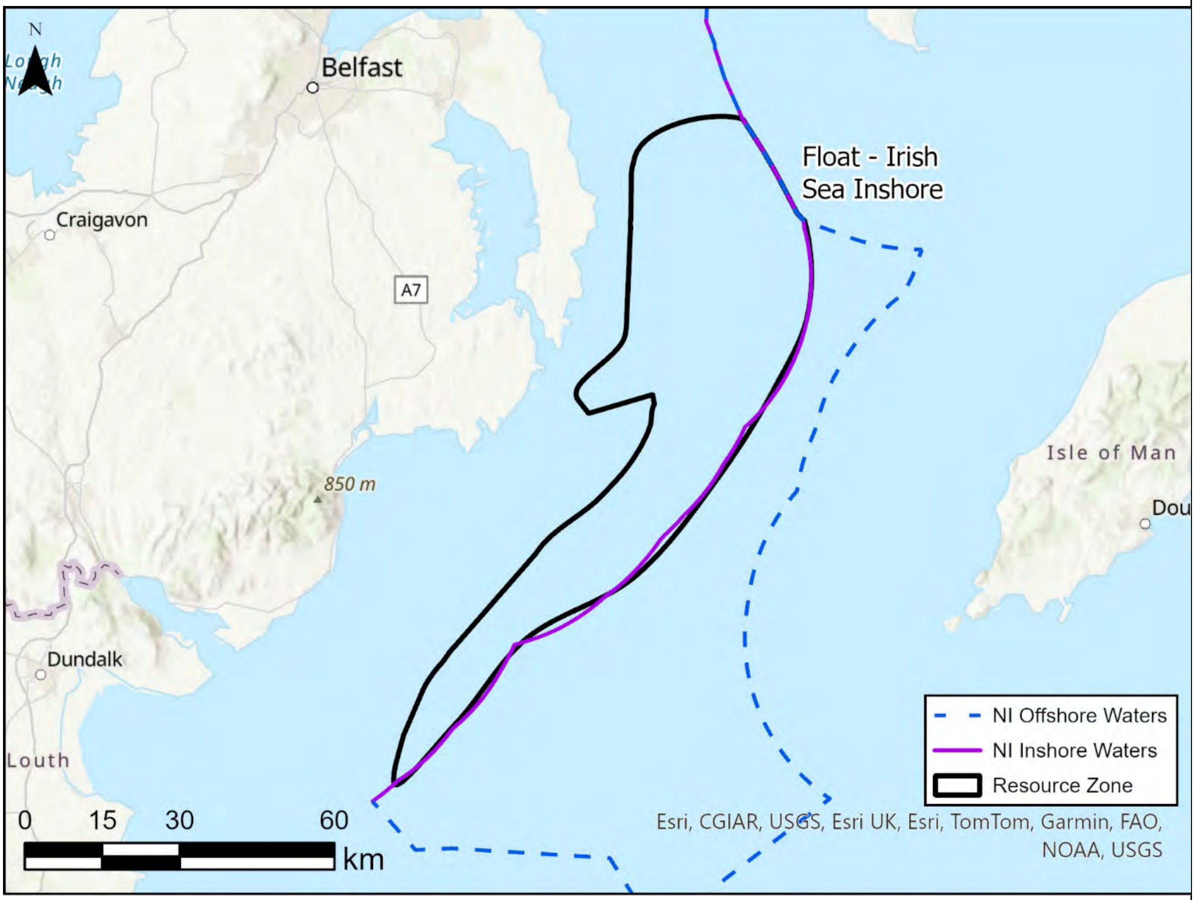
Stage 1 Floating Wind Resource Zone – Irish Sea Inshore

The Floating Wind Irish Sea Inshore RZ is located in the Irish Sea off the south-east coast of NI, approximately 4km offshore of the Ards Peninsula, extending from the southern extent of the Ards Peninsula to Carlingford Lough. The water depth of the RZ ranges from c.47m to c.160m. The average wind speeds range from c.9.62m/s to 10.39m/s. The predominant suitable TCE Technology Groups for the RZ include:

- Technology Group 1 (Conventional Anchoring - Moderate Sea State)
- Technology Group 3 (Complex Anchoring - Moderate Sea State)
- Technology Group 5 (Pile/Socket Anchoring - Moderate Sea State)

The theoretical energy potential of this RZ is 4.55GW.

Floating Wind Resource Zone – Irish Sea Inshore



Key Environmental Constraints and Sensitivities within the Resource Zone

Biodiversity, Flora and Fauna – North Channel SAC and East Coast Marine pSPA are within the RZ. There are known areas of Annex I Reef habitats, areas of known high harbour and grey seal density, areas of known spawning and nursery grounds for multiple fish species, and areas identified by TCE as being of High to Very High MPA Risk to Breeding Birds, Marine Mammals, and Habitats, and Very High MCZ Risk for Habitats.

Population and Human Health – The RZ is in close proximity to the Ards Peninsula coastline (approximately 5km). There is an area of RYA high leisure shipping density within the RZ.

Geology, Soils and Land Use - There are areas of offshore rock and sloping seabed within the RZ.

Water – There are no key sensitivities within the RZ.

Air – There are no key sensitivities within the RZ.

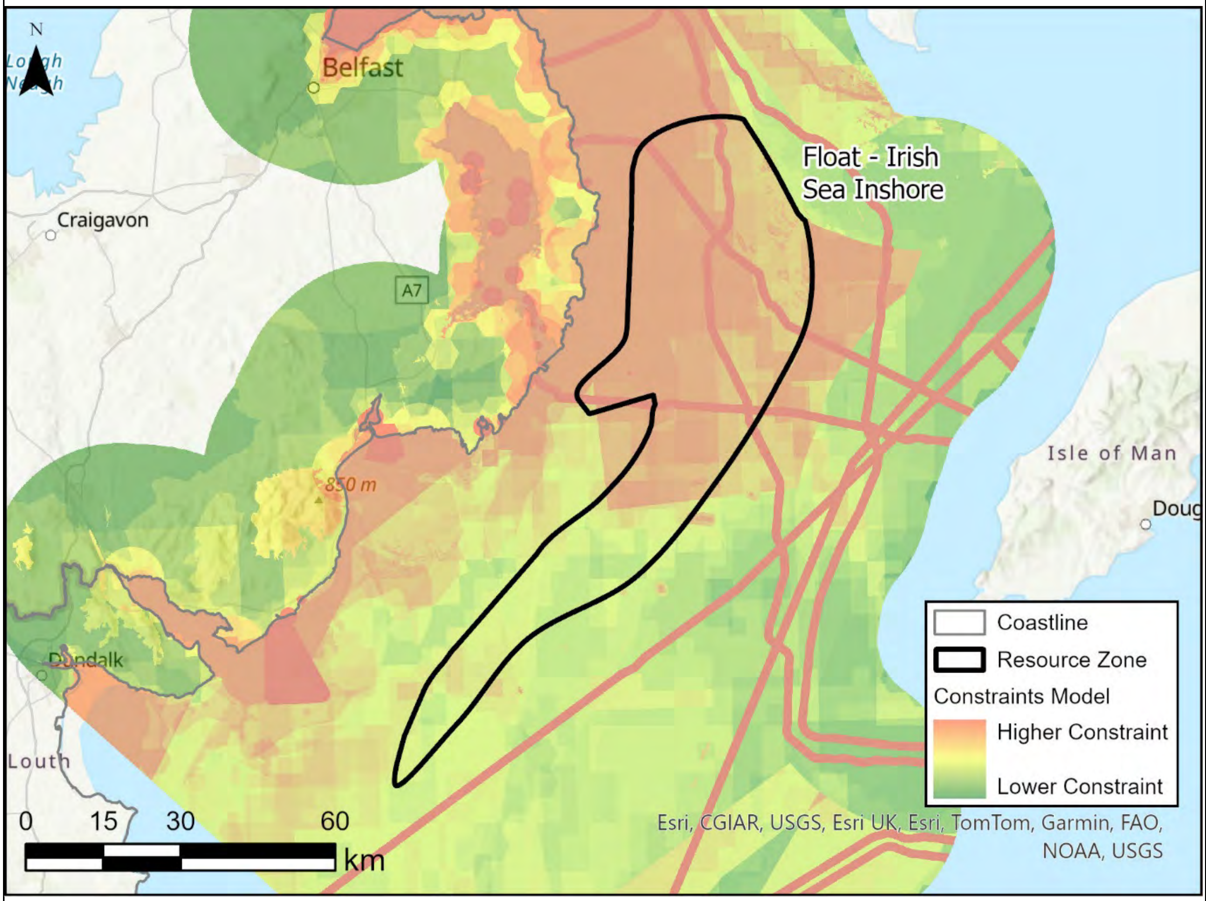
Climatic Factors - There are no key sensitivities within the RZ.

Material Assets – There is a power cable (Western Link Ardneill to Wirral 1 cable) and there are two telecommunication cables (BT-Manx NI and Lanis 2) within the RZ. There are areas of high shipping density, and areas of high fishing activity within the RZ.

Cultural, Architectural and Archaeological Heritage – There is a protected wreck, and there are unprotected wrecks, within the RZ.

Landscape, Seascape and Visual Amenity – The RZ is situated offshore of the Strangford and Lecale AONB and Mourne AONB, which are sensitive visual receptors.

Floating Wind Resource Zone – Irish Sea Inshore

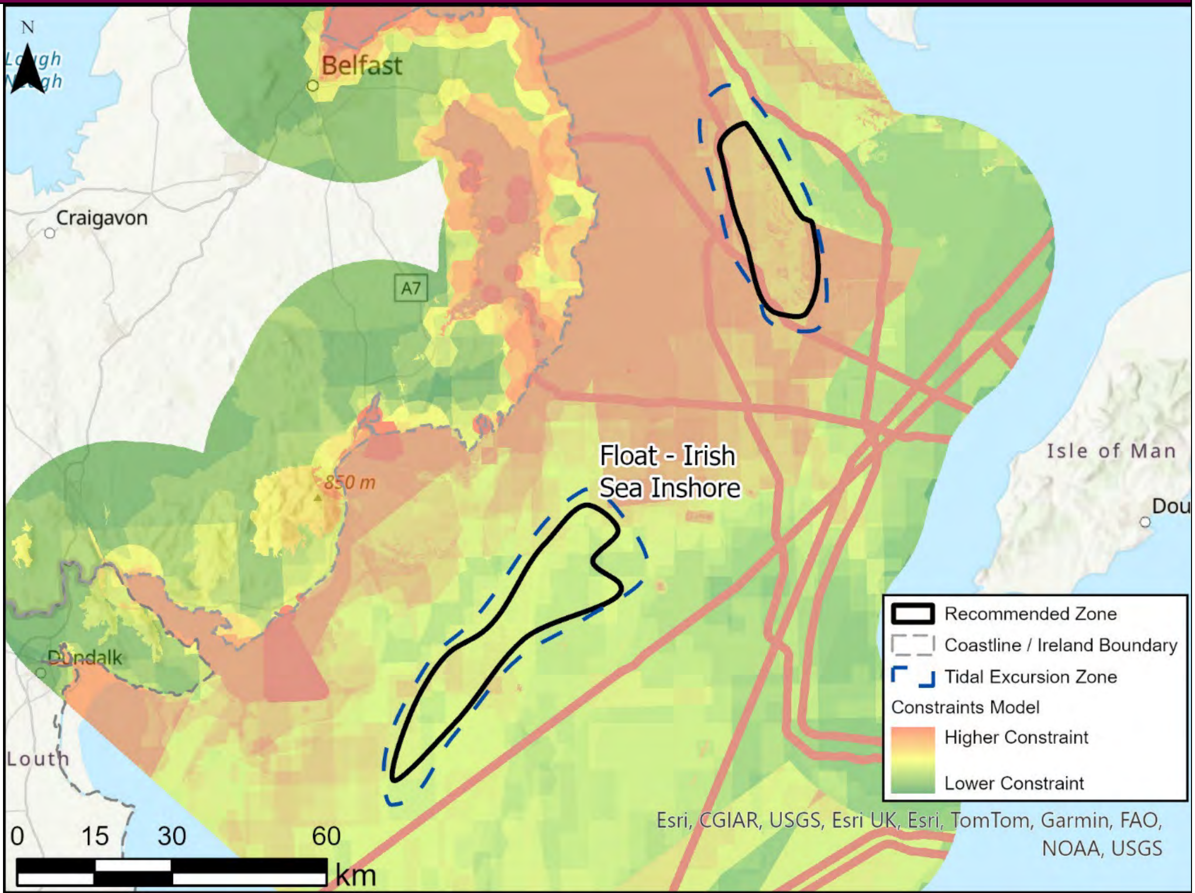


Stage 2 Recommended Floating Wind Resource Zone – Irish Sea Inshore

To avoid the potential for direct impacts on identified key sensitivities within the Floating Irish Sea Inshore RZ, it was refined through the exclusion of the north-eastern area to avoid interaction with the East Coast Marine pSPA, cables, areas of high vessel and fishing activity, and to reduce the potential for landscape/seascape and visual effects in close proximity to the shoreline and the designated landscape area.

The theoretical energy potential of the recommended Stage 2 Irish Sea Inshore RZ is 1.48GW.

Recommended Floating Wind Resource Zone – Irish Sea Inshore and Combined Constraints Model



Environmental Baseline and Key Issues within the Recommended Resource Zone

Environmental baseline information relevant to this recommended RZ is given below, ordered by SEA environmental topic. These sensitivities and indicators have the potential to be impacted by and impact upon the development and/or operation of offshore floating wind.

Biodiversity, Flora and Fauna

North Channel SAC is within the northern section of the recommended RZ and the tidal excursion zone to the north. South Rigg MCZ is situated immediately adjacent to the east of the northern section of the recommended RZ and is within the tidal excursion zone. There are no other designated sites are within the recommended RZ or tidal excursion zone; East Coast Marine pSPA is situated c.5km inshore of the northern section, and Carlingford Marine pSPA c.13km inshore of the southern section of the recommended RZ. There are TCE High and Moderate MPA risk areas for Breeding Birds and Marine Mammals within the recommended RZ, with a higher risk score for marine mammals for the northern section due to the overlap with the North Channel SAC, and a Very High MCZ risk area for Habitats in the south-east of the northern section, owing to the proximity to South Rigg MCZ.

There are many known areas of Annex I Reef habitat within the northern section of the recommended RZ and tidal excursion zone, and a small area within the southern section of the recommended RZ. In the southern section of the recommended RZ the seabed habitats predominantly consist of fine mud, with sandy mud in the inshore region, and small areas of mixed sediment and rock or other hard substrata. In the northern section there are a range of seabed habitats, including coarse substrate, mixed sediment, rock or other hard substrate, sandy mud, muddy sand, and sediment.

Protected species (Wildlife Order) that have been recorded within the recommended RZ include the marine mammal: orca; fish: common skate; and reptile: leatherback turtle. NI Priority Species that have been recorded include the starfish: sand sea star; reptile: leatherback turtle; marine mammal: orca; and fish: whiting, herring, hake, cod, spiny dogfish, and school shark. Priority Marine Features

(PMFs) recorded within the recommended RZ include the reptile: leatherback turtle; mollusc: queen scallop; marine mammal: orca; and fish: whiting, herring, hake, cod, small-spotted catshark, mackerel, horse mackerel, plaice, anglerfish, blue whiting, spiny dogfish, nursehound, sole, broadnose skate, thornback ray, spotted ray, ling, and cuckoo ray, and OSPAR records of the reptile: leatherback turtle; and fish: cod, spiny dogfish, thornback ray, and spotted ray. There are also elasmobranch records of thornback ray, spiny dogfish, spotted ray, and common skate.

There are areas of SCANs recorded relatively high density for harbour porpoise, common dolphin, and common/striped dolphin, and areas of relatively moderate density for harbour porpoise, common dolphin, fin whale, minke whale, common/striped dolphin, striped dolphin, bottlenose dolphin, and beaked whale. MU data also indicates that the cetaceans white-sided dolphin, white-beaked dolphin, Risso’s dolphin, minke whale, harbour porpoise, common dolphin, and bottlenose dolphin may occur within the area. There are also areas of relatively high and moderate density for grey seal, and relatively moderate density for harbour seal, within the recommended RZ.

There are areas of recorded relatively moderate density for seabirds at sea within the recommended RZ. There are several IBAs along the inshore coastline, including South Down Coast and Outer Ards. There is also a known spawning ground of low intensity for sandeel, a key food source for many species of seabird, within the recommended RZ.

There are spawning grounds for cod, plaice, hake, horse mackerel, ling, mackerel, whiting, sandeel, sole, lemon sole, Nephrops, and sprat within the recommended RZ and the tidal excursion zone. Areas of AFBI surveyed relatively high egg production (spawning area) for cod and moderate egg production for plaice are also located within the recommended RZ and the tidal excursion zone. Furthermore, there are nursery grounds for Nephrops, cod, herring, whiting, spurdog, anglerfish, common skate, hake, mackerel, plaice, thornback ray, tope shark, lemon sole, and haddock within the recommended RZ and the tidal excursion zone, and AFBI surveyed relatively high juvenile density (nursery area) for haddock and whiting are also within the recommended RZ and tidal excursion zone. There are restricted areas for fishing within the recommended RZ, for scallops under the Conservation of Scallops Regulations and for Cod within the Irish Sea Cod Box.

There are no records of invasive species within the recommended RZ.

Population and Human Health

The recommended RZ is located offshore of the settlements of Annalong, Ardglass, Ballymartin, Killough, Kilkeel, Newcastle, Ballyhalbert, Ballywalter, Cloughey and Portavogie. The southern inshore boundary of the recommended RZ is located between c.14-24km east of the settlements of Annalong, Ardglass, Ballymartin, Killough, Kilkeel and Newcastle. The northern inshore boundary of the recommended RZ is located between c.16-20km east of the settlements of Ballyhalbert, Ballywalter, Cloughey and Portavogie.

The recommended RZ is located offshore of the Ballywalter, Cloughey, Cranfield Bay, Murlough, Newcastle and Tyrella Bathing Water sites, and Ballywalter South, Cranfield West, Minerstown, Murlough and Tyrella Blue Flag Beaches. However, none of these sites are located within the recommended RZ or tidal excursion zone.

There are areas of relatively high intensity RYA leisure boating activity within the northern section of the recommended RZ off the coast of the Ards Peninsula, and within the southern section of the recommended RZ off the coast of Newcastle. There is relatively higher leisure boating activity between Belfast Lough and the Isle of Man, and between Ardglass / Strangford Lough and Dublin Bay, due to small craft travelling between these areas. There are also areas of relatively higher intensity RYA leisure boating activity in proximity to the coastline, particularly offshore of Strangford Lough and Belfast Lough.

There are no known dive sites within the recommended RZ or tidal excursion zone.

Geology, Soils and Land Use

There are no WHSs, ASSIs or UNESCO Geoparks designated for geology or geomorphology within the recommended RZ or the tidal excursion zone. South Rigg MCZ is immediately adjacent to the recommended RZ and is within the tidal excursion zone; this site is designated for a range of broad-scale habitats, including fine sediments and rocky habitats, that support a wide variety of species.

The seabed geology of the recommended RZ is variable, comprising of areas of diamict, sand and gravel, and soft mud with areas of undifferentiated rock. Seabed thickness is generally <5m or between 5-50m with one area of >50m. The seabed substrates are variable within the recommended RZ, comprising fine mud, sandy mud, muddy sand, sediment, mixed sediment, coarse substrate and rock or other hard substrata. There are many known areas of Annex I Reef habitat within the northern section of the recommended RZ and tidal excursion zone, and a small area within the southern section of the recommended RZ.

TCE expected technology groups for the installation of floating wind turbines within the recommended RZ are predominantly technology groups 1 (Conventional anchoring for a moderate sea state) and 5 (Piling with socket anchoring for a moderate sea state), with one area of technology group 3 (Complex anchoring for a moderate sea state).

There are no dumping grounds of spoil ground, explosives dumping grounds or MoD firing/danger areas within the recommended RZ.

Water

The water depth within the recommended RZ ranges from c.51-84m. Tidal speeds within the recommended RZ range from 0.18-0.49m/s.

There are no dumping grounds of spoil ground, explosives dumping grounds or MoD live firing /danger areas within the recommended RZ.

There are no WFD Shellfish Waters, Bathing Waters or WFD coastal waterbodies within the recommended RZ or the tidal excursion zone.

The recommended RZ is located within the Celtic Seas sub-region for the MS (covering waters to the west of the UK and shared with RoI and France).

Air

There are no known air quality issues within the recommended RZ, as there are no significant anthropogenic sources of air pollution in the vicinity. The recommended RZ is located offshore of the settlements of Annalong, Ardglass, Ballymartin, Killough, Kilkeel, Newcastle, Ballyhalbert, Ballywalter, Cloughey and Portavogie. The southern inshore boundary of the recommended RZ is located between c.14-24km east of the settlements of Annalong, Ardglass, Ballymartin, Killough, Kilkeel and Newcastle, while the northern inshore boundary is located between c.16-20km east of the settlements of Ballyhalbert, Ballywalter, Cloughey and Portavogie.

There are areas of relatively high intensity RYA leisure boating activity within the northern section of the recommended RZ off the coast of the Ards Peninsula, and within the southern section of the recommended RZ off the coast of Newcastle. There is relatively higher leisure boating activity between Belfast Lough and the Isle of Man, and between Ardglass / Strangford Lough and Dublin Bay, due to small craft travelling between these areas. There are also areas of relatively higher intensity RYA leisure boating activity in proximity to the coastline, particularly offshore of Strangford Lough and Belfast Lough. Within the recommended RZ this vessel traffic intensity may cause some minor, localised, air emissions.

Climatic Factors

There are no known blue carbon habitats (Annex I Saltmarsh, Annex I Maerl, Shellfish Waters, Subtidal and Intertidal Seagrass) within the recommended RZ or tidal excursion zone. There are no areas within the recommended RZ that have been identified by Ulster Wildlife as blue carbon hotspots. There are unlikely to be any sources of GHG emissions in the area, apart from vessels.

Material Assets

There is no existing infrastructure (cables or pipelines) within the recommended RZ.

In general, there is a relatively moderate shipping density (>70th percentile) within the recommended RZ. However, there are some lower shipping density areas (>50th percentile) in the south, north-east and north-west, and small areas of higher shipping density (>90th percentile) in the east and west, of the recommended RZ. The areas of moderate to higher shipping density are predominantly associated with the Warrenpoint to Heysham freight ferry route within the southern section of the recommended RZ, and with the Belfast to Liverpool (Birkenhead) ferry route in the northern section. Fishing vessels associated with the ports of Kilkeel, Ardglass and Carlingford, as well as cargo and tanker vessels passing from ports in NI such as Belfast Lough, to Dublin or further south, may also contribute to the higher densities within these areas. There are no TSSs within the recommended RZ.

The recommended RZ is used by commercial fishing vessels. Relatively moderate fishing activity (>70th percentile) is present throughout, with some small areas of relatively high fishing effort located in the north-east (>90th percentile). Fleets which are known to operate within the recommended RZ include whitefish, scallop, pot, and Nephrops (for which the area of is of high importance). Key areas for mobile Nephrops and herring fleets are located within the recommended RZ. The Irish Sea is an important catching location for stock of commercial species such as herring, haddock, plaice, and Nephrops, and significant landings of fish (haddock, cod, monkfish/anglerfish, mackerel, plaice and hake), as well as Nephrops and other shellfish, are recorded at the ports of Kilkeel and Ardglass. There is a known area of importance for pot fisheries located within the north-east of the tidal excursion zone, to the north-east of the southern section of the recommended RZ. The entirety of the recommended RZ is encompassed within spawning grounds for Nephrops, cod and sprat, whilst whiting, lemon sole, sole, plaice, hake, ling, mackerel, horse mackerel and sandeel spawning grounds are also located within the recommended RZ and the tidal excursion zone. Areas of surveyed relatively high egg production (spawning area) for cod and plaice are also located within the recommended RZ and the tidal excursion zone. Furthermore, the entirety of the recommended RZ is located within nursery grounds for Nephrops, whilst whiting, lemon sole, haddock, herring, spurdog, hake, plaice, anglerfish, mackerel, thornback ray and cod nursery grounds are located within the recommended RZ and the tidal excursion zone, and a surveyed juvenile density (nursery area) for haddock and whiting are also within the recommended RZ and tidal excursion zone. Scallops have been recorded in the north-west of the tidal excursion zone. There are two areas that have fishing restrictions within the recommended RZ (for limits on harvesting size, catch quotas, fishing methods and timeframes during which fishing is prohibited for scallops, under the Conservation of Scallops Regulations; and for certain fishing gear within the Irish Sea Cod Box). There are no marine fish farms or aquaculture sites within the recommended RZ.

The recommended RZ is used by the MoD, with a c.140km² area of the southern section of the recommended RZ being located within the Ardglass Military Practice Area (X5402), while c.66km² of the northern section is located within the Ardglass Military Practice Area, and c.38km² of the northern section is located within the Peel Military Practice Area (X5403). The Ardglass area is utilised as a submarine exercise area, and a surface fleet practice and exercise area, whilst the Peel area is used as a submarine exercise area. There are no MoD danger areas within the recommended RZ.

There are no spoil dumping grounds or safeguarding zones for aviation interference within the recommended RZ.

The south-east coast of NI has a number of coastal attractions that are within the modelled viewshed for floating turbines within the recommended RZ, including the Mourne Mountains. Tourist activities within the recommended RZ are likely to include water sports, sailing, and fishing within inshore areas, and there are areas of known relatively high intensity RYA leisure boating activity within the recommended RZ; these activities are unlikely to occur in offshore waters. The Mourne AONB, Strangford and Lecale AONB and 15 National Trust Lands are within the modelled viewshed for floating wind turbines within the recommended RZ, as are significant long-distance walking routes, such as the Mourne Way within the Mourne AONB, which offer significant attraction for tourism. Further information on landscape designations which may act as tourist attractions within the modelled viewshed of the area is provided in the Landscape, Seascape, and Visual Amenity baseline.

The recommended RZ has a potential capacity of 1.48GW.

Cultural, Architectural and Archaeological Heritage

There are no protected wrecks within the recommended RZ. There are 20 recorded wrecks within the recommended RZ, and a further five within the tidal excursion zone.

The recommended RZ is situated between c.14km and c.25km distance from the coastline. There are 1183 Listed Buildings, 584 Defence Heritage Record sites, 880 Scheduled Monuments, 146 Scheduled Zones, and 31 Parks and Gardens (including Mourne Park, Tollymore Park, Castlewellan Castle, Castle Ward, Portaferry House, and Ballywalter Park) situated on the coastline inshore of the recommended RZ and within the modelled viewshed (based on a turbine height of 228m and a viewable distance of 40km).

Landscape, Seascape and Visual Amenity
The recommended RZ is situated between c.14km and c.25km distance from the coastline. There are 70 settlements situated inshore of the recommended RZ, which are within the modelled viewshed (based on a turbine height of 228m and a viewable distance of 40km). These include Strangford, Newcastle, Annalong, Kilkeel, Dundrum, Ardglass, Downpatrick, Portaferry, Newtownards, Kilkeel, Millisle, Portavogie, and Donaghadee. There are two AONBs situated inshore of the recommended RZ, and which are within the modelled viewshed; these are Mourne AONB, and Strangford and Lecale AONB. There are also 15 National Trust Lands within the modelled viewshed (Bryansford, Castle Ward, Clough Castle, Dundrum Coastal Path, Glastry, Green and Blockhouse Islands, Kearney, Killynether, Lighthouse Island, Mountstewart, Mournes Coastal Path, Murlough NNR, Orlock, Slieve Donard, and Strangford Lough). An area of coastline of north County Louth in RoI is also within the modelled viewshed. The recommended RZ is within the Irish Sea (South Down) RSCA, and is offshore of the Mourne Coast, Lecale Coast, Dundrum Bay, Ards Peninsula, and Strangford Lough RSCAs.

Environmental Assessment	Short-term	Medium-term	Long-term
Biodiversity, Flora and Fauna (BFF)	-3	-3	-3
Population and Human Health (PHH)	-2	-2	-2
Geology, Soils and Land Use (GSL)	-3	-3	-3
Water (W)	-1	-1	-1
Air (A)	0	+3	+3
Climatic Factors (CF)	-1	+3	+3
Material Assets and Infrastructure (MA)	-3	-3 / +3	-3 / +3
Cultural, Architectural and Archaeological Heritage (CH)	-3	-3	-3
Landscape / Seascape and Visual Amenity (L)	-3	-3	-3

Key Conclusions:
Biodiversity, Flora and Fauna – There is potential for significant adverse effects on Biodiversity, Fauna in the short-term construction and decommissioning phases (-3), and the medium to long-term operational phase (-3), owing to the location of South Rigg MCZ immediately adjacent to the recommended RZ and within the tidal excursion zone and TCE Very High MCZ risk area and potential effects on benthic habitat; for significant adverse effects in the short-term construction and decommissioning phases (-3), owing to the location of North Channel SAC within the recommended RZ and potential effects on marine mammals, and for significant adverse effects in the short-term construction and decommissioning phases (-3) and the medium to long-term operational phase (-3), owing to the interaction with spawning and nursery grounds for many fish species. There is also potential for moderate adverse effects in the short-term construction and decommissioning phase, and the medium to long-term operational phase (-2) for benthic habitats and species, owing to the occurrence of Annex I habitat and sensitive species, for marine mammals, owing to interaction with High and Moderate MPA risk areas and the recorded occurrence of species

within the recommended RZ, and birds, owing to interaction with High and Moderate MPA risk areas for Breeding Birds and recorded relatively moderate density of seabirds within the recommended RZ.

Population and Human Health – There is potential for moderate adverse temporary, direct and indirect, effects on leisure and recreational marine users due to an increased collision risk, access restrictions and displacement, or water quality effects, during the construction and decommissioning phases (-2). There is also potential for moderate adverse long-term (device life) effects due to an enhanced collision risk for recreational and leisure vessels devices, and displacement of recreational and leisure craft from the array area during the operational phase (-2). This is due to known relatively high use of areas within the recommended RZ by recreational and leisure vessels.

Geology, Soils and Land Use – South Rigg MCZ, designated for geological/geomorphological features, is directly adjacent to the recommended RZ and is within the tidal excursion zone, with potential for moderate adverse indirect long-term effects on Geology, Soils and Land use due to the potential for indirect adverse effects on designated features (-3). There is potential for moderate direct, temporary to permanent effects on Annex 1 Reef habitats due to loss or damage during the construction and decommissioning phases (-2). Following the installation of floating wind technologies there is potential for medium to long-term operational phase localised effects on erosion and deposition patterns due to the presence of devices (-2). There is potential for influence on the MS Descriptor 6 sea floor integrity from the installation processes of floating wind technologies in the recommended RZ, however, there is not anticipated to be potential for adverse effects on the achievement of GES.

Generally, there is potential for direct short-term, temporary sediment loss in the vicinity of the construction works during seabed preparation activities, construction and decommissioning activities (-1), and medium to long-term loss within the footprint of foundations and scour protection during device operation (-2).

Water – There is potential for slight adverse short-term effects on water quality elements that are considered by the MS (e.g., Descriptor 9 Concentrations of contaminants in fish and other seafood; Descriptor 8: Concentration of contaminants within marine environment; Descriptor 10 marine litter) during seabed preparation, construction, maintenance and decommissioning activities (-1). There is not anticipated to be potential for adverse effects on the achievement of GES with the application of standard best practice mitigation.

Air – There is potential for significant positive indirect effects on regional air quality in the medium to long-term operational phase, as the operation of renewable energy devices can support a transition away from fossil fuel use and its associated air emissions, with potential for a relatively high capacity in the recommended RZ (+3).

Climatic Factors – There is potential for slight adverse short-term effects on sediment carbon storage, due to a localised release of CO_2 from seabed disturbance during the construction and decommissioning phases (-1). There is potential for slight adverse, short-term, temporary effects on localised GHG concentrations, due to GHG emissions from vessels and machinery during the construction and decommissioning phases (-1), which should be minimised at the project level through adherence to standard best practise for the minimisation of air pollution, as set out in **Section 10.1**.

There is potential for significant positive, medium to long-term effects during the operational phase, as the operation of renewable energy devices can contribute to a net reduction in GHG emissions, decarbonisation of the energy sector, diversification of electricity supply and energy security, and meeting of energy objectives and climate change emission reduction targets, with potential for a relatively high capacity in the recommended RZ (+3).

Material Assets – Overall, there is considered to be potential for significant adverse effects in the short, medium, and long-term for Material Assets (-3), following the consideration of mitigation measures, mainly attributed to identified potential for significant adverse effects on Shipping and Navigation, and Commercial Fisheries.

Given the presence of the Warrenpoint to Heysham ferry route within the recommended RZ, there is potential for significant navigational risk and displacement in the short, medium, and long-term (-3). This is owing to the potential displacement of vessels during the construction and decommissioning (short-term) phase and operational (medium to long-term) phase, as well as potential for direct and indirect adverse effects on navigation and communications in all phases. Significant adverse effects could be mitigated through avoidance of the higher density Warrenpoint to Heysham shipping route and the Belfast to Liverpool (Birkenhead) ferry route.

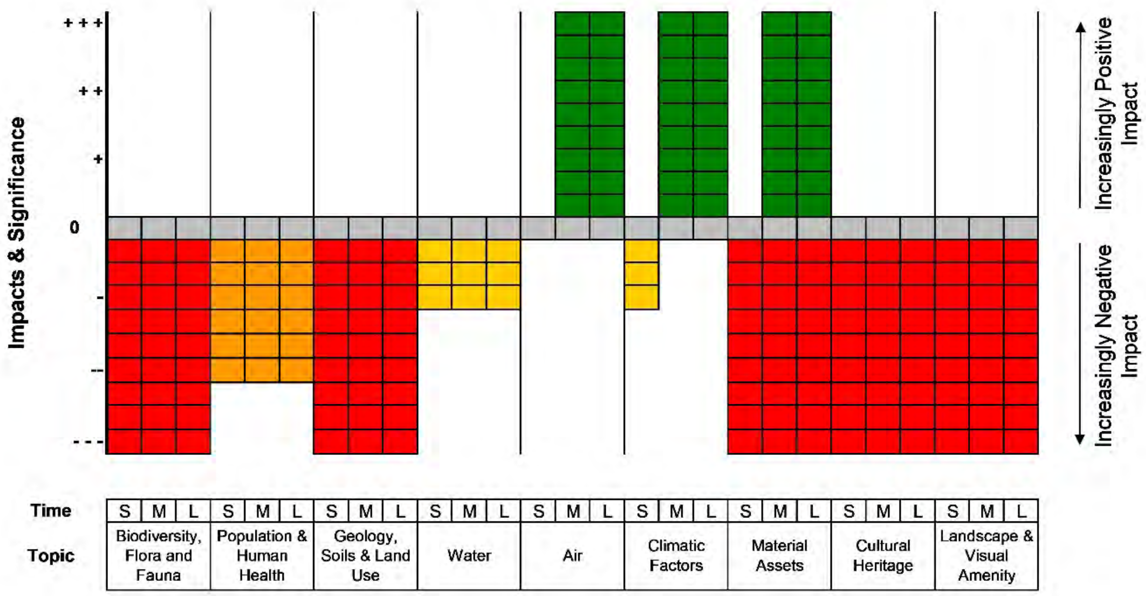
There is potential for significant indirect effects on the profitability of commercial fishing in the short, medium, and long-term (-3), such as the potential for reduced quotas, increased resource competition for fishing, and reduced landings in both tonnage and economic value. This is owing to the combination of potential significant adverse effects including: potential displacement from shipping grounds in the short, medium, and long-term (-3); potential for increased collision risk associated with the presence of construction and decommissioning vessels (short-term) (-3), and the presence of maintenance vessels and displacement from fishing grounds (medium to long-term) (-2); as well as effects on commercial fish species and their key habitats due to direct loss of supporting habitats (-3), and indirect effects due to sediment mobilisation in the short-term (-3) and medium to long-term (-2); all of which could indirectly affect fishing activity through an alteration of commercial fish stocks.

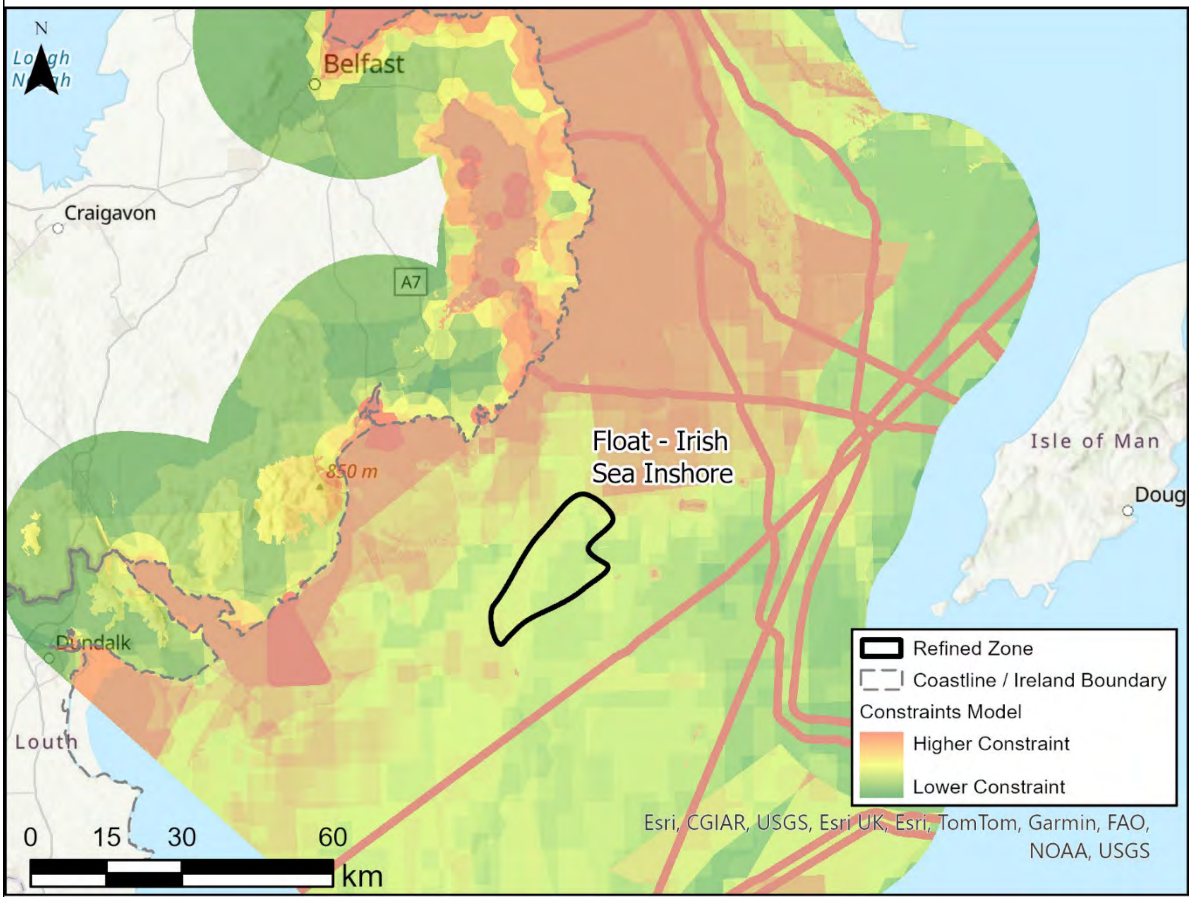
There is potential for significant positive effects in terms of the generation of a new renewable energy supply for the NI population in the medium to long-term, as the recommended RZ has a potential capacity of 1.48GW (+3).

Cultural, Architectural and Archaeological Heritage – There is potential for significant adverse effects on Cultural Heritage in the short-term construction (and decommissioning) phase, and the medium to long-term operational phase (-3) owing to the distance of the recommended RZ offshore and the high sensitivity of coastal heritage receptors whose setting may be affected, as well as the potential for moderate adverse effects in the short-term construction (and decommissioning) phase owing to the presence of many known (undesignated) wrecks.

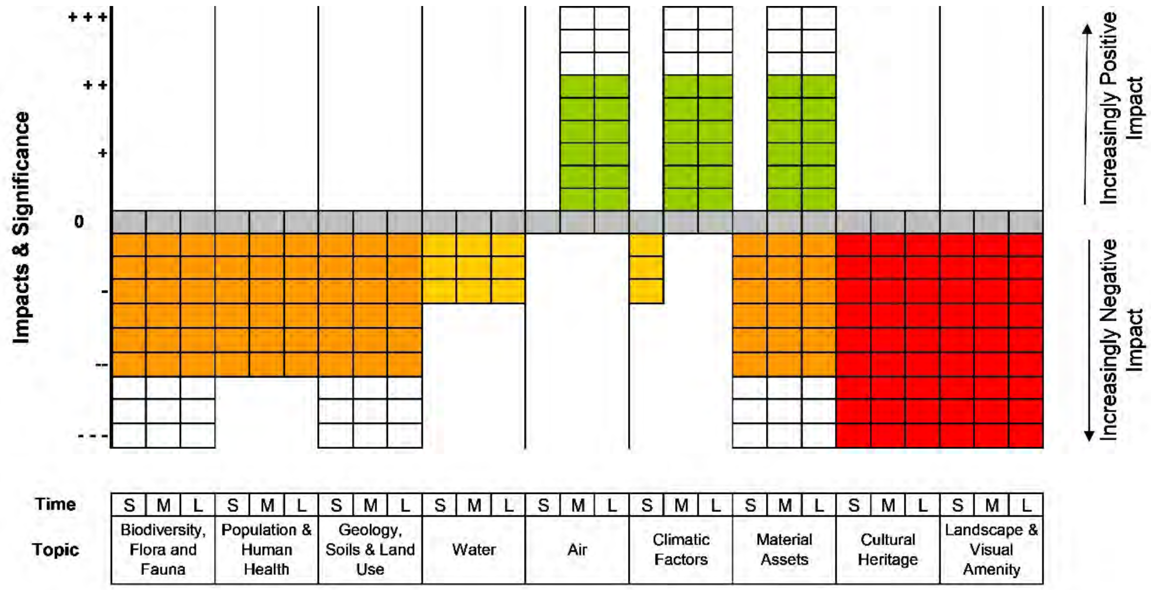
Landscape, Seascape and Visual Amenity – There is potential for significant adverse effects on Landscape, Seascape and Visual Amenity in the short-term construction and decommissioning phases, and the medium to long-term operational phase (-3) owing to the distance of the recommended RZ offshore and the high sensitivity of the landscape areas that may be affected, including Mourne AONB, and Strangford and Lecale AONB, as well as a coastal population that may be affected by changes in visual amenity.

Summary Chart of Potential Effects

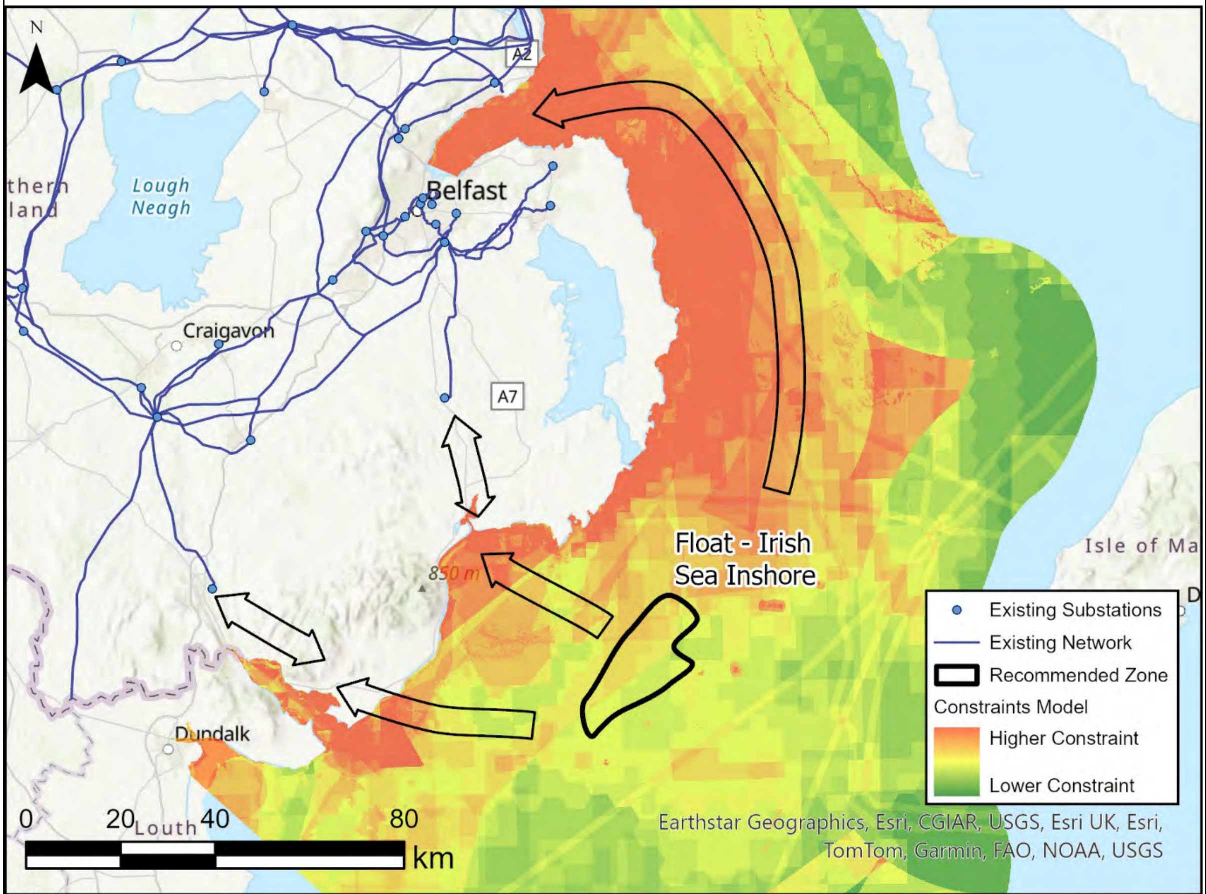


Recommendations for Further Refinement:
Further refinement of the Floating Irish Sea Inshore RZ is recommended to exclude the northern area, where North Channel SAC is within the RZ, avoid South Rigg MCZ being within the tidal excursion zone, and to avoid the south, where the greatest overlap of known fish spawning and nursery grounds occurs, which can reduce the overall score for Biodiversity, Flora, and Fauna to -2 and, in the case of South Rigg MCZ, reduce the score for Geology, Soils and Land use. Further refinement to avoid areas of higher density shipping, areas of importance for inshore fisheries, areas of highest known importance for fish spawning and nursery, and of areas of moderate fishing activity is recommended to reduce the potential for adverse effects on Material Assets and reduce the overall score to -2. Refinement would also reduce the potential for renewable energy generation, thus reducing the medium to long-term positive score to +2. No further refinement is recommended at this stage based on the potential for visual effects, as the recommended RZ is a maximum of 25km from shore at all points, which is within the significance zone considered by the assessment for floating wind.   The theoretical energy potential of the refined Floating Irish Sea Inshore RZ is 0.5GW.


Comparative Chart



Potential Export Cable Routes



Connection into Greater Belfast area. 110kV existing network. Length approx. 103km.

Significant likely constraints include North Channel SAC, East Coast Marine pSPA, Annex I Reef, pipelines, and telecommunication cables. Other constraints which can potentially be avoided include

cliffs over 15m, Outer Belfast Lough MCZ, Scallop Enhancement Areas, Urban Areas and Ports. The Outer Ards SPA/Ramsar Site/IBA and several Bathing Water Sites are unavoidable if connecting into the Bangor area.
Connection into Ballynahinch area. 110kV existing network. Length approx. 36km Significant constraints include Murlough SAC which can potentially be avoided; however, this would require a longer route. Significant likely constraints include Annex I Sandbanks, Annex I Reef, and the Mourne AONB, and the Strangford and Lecale AONB. Other constraints which can potentially be avoided include marine fish farms (crustaceans/fish), Ballykinler Military Area, Urban Areas, Murlough NNR, Murlough ASSI, St. John's Point ASSI, South Down Coast IBA, Dundrum Inner Bay IBA and Murlough, Newcastle, Tyrella Bathing Water Sites.
Connection into Newry area. 110kV existing network. Length approx. 58km Significant constraints include marine fish farms (crustaceans) which can potentially be avoided; however, this would require a longer offshore route. Significant likely constraints include Carlingford Marine pSPA, Carlingford Lough ASSI, areas of high intensity fishing, Annex I Reef, Carlingford Lough IBA, a Pilot Boarding Station and the Mourne AONB. Other constraints which can potentially be avoided include Carlingford Shore SAC, Derryleckagh SAC, Carlingford Lough MCZ, Carlingford Lough Ramsar, Carlingford Lough SPA, Urban Areas onshore, Cranfield Bay and Warrenpoint Bathing Water Sites.

9.2.12 Floating Wind Resource Zone: Irish Sea Offshore

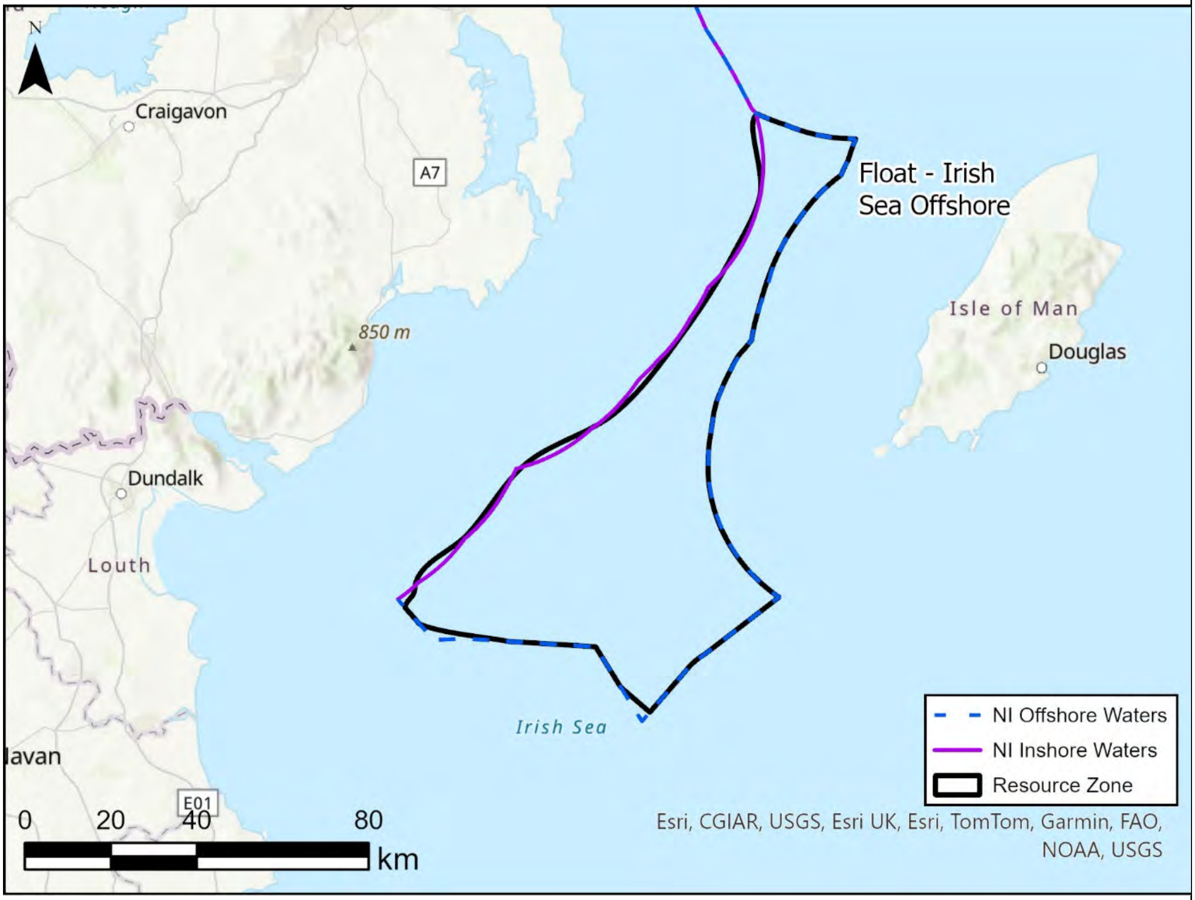
Stage 1 Floating Wind Resource Zone – Irish Sea Offshore

The Floating Wind Irish Sea Offshore RZ is located in the Irish Sea off the south-east coast of NI, approximately 25km offshore of the Mourne Mountains, extending from the southern extent of the Ards Peninsula to Carlingford Lough. The water depth of the RZ ranges from c.50m to c.154m. The average wind speeds range from c.9.9m/s to 10.59m/s. The predominant suitable TCE Technology Groups for the RZ include:

- Technology Group 1 (Conventional Anchoring - Moderate Sea State)
- Technology Group 3 (Complex Anchoring - Moderate Sea State)

The theoretical energy potential of this RZ is 7.42GW.

Floating Wind Resource Zone – Irish Sea Offshore



Key Environmental Constraints and Sensitivities within the Resource Zone

Biodiversity, Flora and Fauna – North Channel SAC, Pisces Reef Complex SAC, North Anglesey Marine SAC, Queenie Corner MCZ, and South Rigg MCZ are within the RZ. There are known areas of Annex I Reef habitat, areas of known high harbour seal density, areas of multiple spawning/nursery grounds, and areas identified by TCE as being of High to Very High MPA Risk to Breeding Birds, Marine Mammals, and Habitats, and High to Very High MCZ Risk for Habitats.

Population and Human Health – There are no key sensitivities within the RZ.

Geology, Soils and Land Use - There are areas of offshore rock and sloping seabed within the RZ.

Water - There are no key sensitivities within the RZ.

Air – There are no key sensitivities within the RZ.

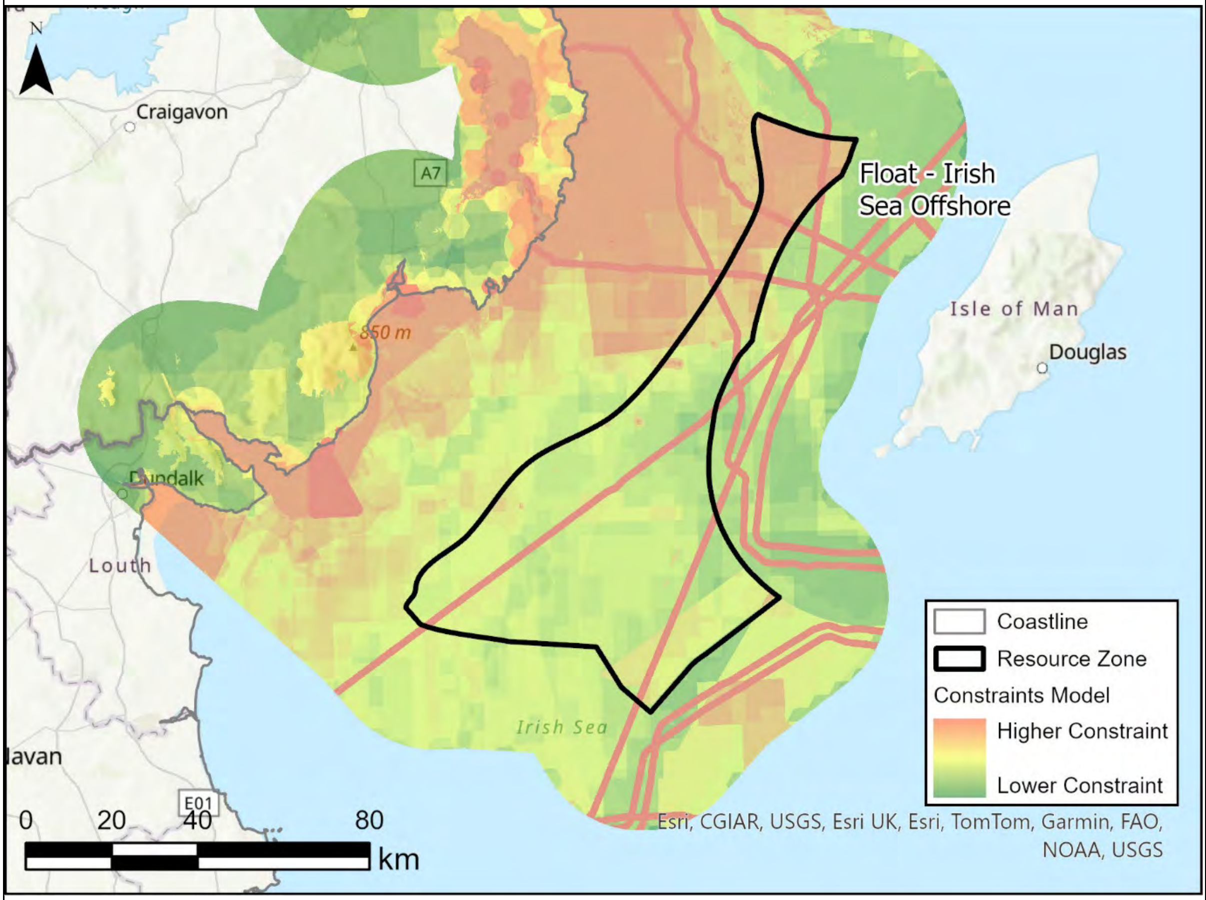
Climatic Factors - There are no key sensitivities within the RZ.

Material Assets – There are two pipelines, one power cable (Western Link Ardneil to Wirral 1) and four telecommunication cables (Lanis 2, Hibernia 'A', BT-Manx NI and CC-2) within the RZ. There are areas of high shipping density (>90th percentile) and areas of high fishing activity (>90th percentile) within the RZ.

Cultural, Architectural and Archaeological Heritage – There are unprotected wrecks within the RZ.

Landscape, Seascape and Visual Amenity – There are no key sensitivities identified for the RZ.

Floating Wind Resource Zone – Irish Sea Offshore

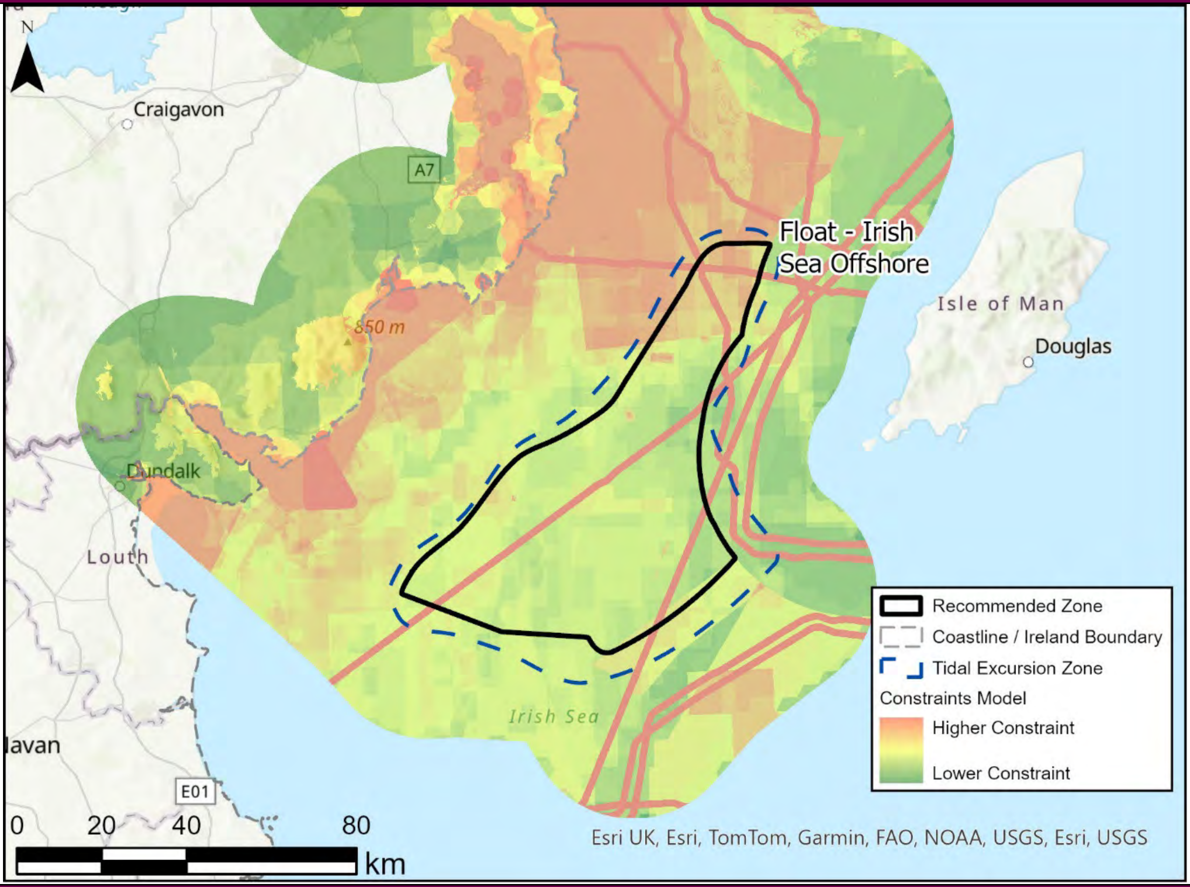


Stage 2 Recommended Floating Wind Resource Zone – Irish Sea Offshore

To avoid the potential for direct impacts on identified key sensitivities within the Floating Irish Sea Offshore RZ, it was refined through the exclusion of the western, northern and south-eastern areas to avoid overlap with designated sites (Pisces Reef Complex SAC, North Anglesey Marine SAC, Queenie Corner MCZ, and South Rigg MCZ), with the exception of North Channel SAC, as well as avoidance of a number of cables.

The theoretical energy potential of the recommended Stage 2 Floating Irish Sea Offshore RZ is 5.7GW.

Recommended Floating Wind Resource Zone – Irish Sea Offshore 1 and Combined Constraints Model



Environmental Baseline and Key Issues within the Recommended Resource Zone

Environmental baseline information relevant to this recommended RZ is given below, ordered by SEA environmental topic. These sensitivities and indicators have the potential to be impacted by and impact upon the development and/or operation of offshore floating wind.

Biodiversity, Flora and Fauna

North Channel SAC, designated for harbour porpoise, is within the north of the recommended RZ. Pisces Reef Complex SAC, designated for Annex I Reef habitat, is situated directly adjacent to the recommended RZ in the north-west, and is within the tidal excursion zone. Queenie Corner MCZ is situated immediately adjacent to the south-east boundary of the recommended RZ, and South Rigg MCZ is in close proximity to the northern boundary; these sites are both within the tidal excursion zone. North-West Irish Sea SPA, designated for 21 bird species, is situated directly adjacent to the south-west of the recommended RZ, within the tidal excursion zone. North Anglesey Marine SAC, and Irish Sea Front SPA are situated c.4.5km and c.9km, respectively, to the south-east. There is a TCE Very High MCZ risk area for Habitats in the south-east and in the north of the recommended RZ, owing to the proximity to MCZs, a High MPA risk area for Habitats (in the north-west), High and Moderate MPA risk areas for Breeding Birds (with a higher risk score in the north), and High and Moderate MPA risk areas for Marine Mammals (with a higher risk score in the north), within the recommended RZ.

There are no known areas of Annex I habitat within the recommended RZ, however there are small areas of Annex I Reef habitat situated inshore of the recommended RZ within the tidal excursion zone. The seabed habitats within the recommended RZ predominantly consist of fine mud, with sandy mud in the south-east and small areas of sandy mud, muddy sand, and rock/hard substrate.

Protected species (Wildlife Order) that have been recorded within the recommended RZ include the marine mammals: short-beaked common dolphin, minke whale, harbour porpoise, and bottlenose dolphin; and the fish: common skate and twaite shad. NI Priority species that have been recorded include the starfish: sand sea star; the mollusc: horse mussel; the marine mammals: short-beaked common dolphin, minke whale, harbour porpoise, and bottlenose dolphin; the fish: whiting, herring, spiny dogfish, cod, twaite shad, hake, school shark, common skate, and undulate ray; and the crustacean: circular crab. PMFs recorded within the recommended RZ include the molluscs: queen scallop, and great scallop; the marine mammals: harbour porpoise, bottlenose dolphin, and short-beaked common dolphin; and the fish: whiting, hake, horse mackerel, small-spotted catfish, herring, mackerel, cod, plaice, anglerfish, sole, starry smooth-hound, cuckoo ray, thornback ray, spotted ray, blue whiting, broadnose skate, spiny dogfish, nursehound, ling, common skate, and small-eyed ray. There are also elasmobranch records of spiny dogfish, thornback ray, spotted ray, undulate ray, school shark, porbeagle shark, and cuckoo ray. The harbour porpoise and fish cod, thornback ray, spotted ray, common skate, and spiny dogfish are also OSPAR Threatened/Declining species.

There are areas of SCANs recorded relatively high density for striped dolphin, minke whale, common dolphin, common/striped dolphin, and beaked whale, and areas of relatively moderate density for striped dolphin, minke whale, fin whale, common dolphin, common/striped dolphin, bottlenose dolphin, and beaked whale. MU data also indicates that the cetaceans white-sided dolphin, white-beaked dolphin, Risso’s dolphin, minke whale, harbour porpoise, common dolphin, and bottlenose dolphin may occur within the area. There are also areas of relatively moderate density for grey seal within the recommended RZ.

There are areas of recorded relatively moderate density for seabirds at sea within the recommended RZ. There is also a known spawning ground of low intensity for sandeel, a key food source for many species of seabird, within the recommended RZ.

There are spawning grounds for cod, plaice, hake, horse mackerel, ling, mackerel, whiting, sandeel, sole, lemon sole, sprat, and Nephrops within the recommended RZ and the tidal excursion zone. Areas of AFBI surveyed relatively high egg production (spawning area) for cod and moderate egg production for plaice and haddock are also located within the recommended RZ and the tidal excursion zone. Furthermore, there are nursery grounds for Nephrops, cod, herring, whiting, spurdog, anglerfish, hake, mackerel, plaice, thornback ray, tope shark, lemon sole, and haddock within the recommended RZ and the tidal excursion zone, and AFBI surveyed relatively high juvenile density (nursery areas) for haddock and whiting are also within the recommended RZ and tidal excursion zone. There are areas with fishing restrictions within the recommended RZ, for scallops, under the Conservation of Scallops Regulations and the Fisheries Act 2012, and for certain fishing gear within the Irish Sea Cod Box.

There are no records of invasive species within the recommended RZ.

Population and Human Health

The recommended RZ is located offshore of the settlements of Annalong, Ardglass, Ballyhornan, Ballymartin, Dundrum, Killough, Kilkeel, and Newcastle. The inshore boundary of the recommended RZ is located between approximately 23 and 30km offshore of these settlements.

The recommended RZ is located offshore of the Ballyhornan, Cloughey, Cranfield Bay, Kilclief, Murlough, Newcastle, and Tyrella Bathing Water sites, and the Cranfield West, Minerstown, Murlough and Tyrella Blue Flag Beaches. However, none of these sites are located within the recommended RZ or tidal excursion zone.

There are areas of relatively high intensity RYA leisure boating activity further inshore around Ardglass / Strangford Lough, heading south towards Dublin Bay, due to small craft travelling between these two areas. There are also areas of relatively high intensity RYA leisure boating activity from the Isle of Man to Dublin Bay, however this is relatively low vessel traffic intensity due to transient vessel traffic.

There are no known dive sites within the recommended RZ or tidal excursion zone.

Geology, Soils and Land Use

There are no WHSs, ASSIs or UNESCO Geoparks designated for geology or geomorphology within the recommended RZ or within the tidal excursion zone. Queenie Corner MCZ is situated immediately adjacent to the south-east boundary of the recommended RZ and is within the tidal excursion zone, and South Rigg MCZ is also within the tidal excursion zone. Queenie Corner MCZ is designated for its subtidal mud features, sea-pen and burrowing megafauna communities, while South Rigg MCZ is designated for a range of broad-scale habitats, including fine sediments and rocky habitats, supporting a wide variety of species.

The main seabed geology of the recommended RZ is undifferentiated rock, with areas of diamict, sand and gravel and soft mud. Seabed thickness is generally <5m or between 5-50m, with one area of >50m. The seabed substrates within the recommended RZ are predominantly rock or other hard substrata, sandy mud or sediment, with some smaller areas of muddy sand, fine sand and mixed sediment. The biozones of the recommended RZ are all deep circalittoral of low energy. There are small areas of Annex I Reef habitat situated inshore of the recommended RZ within the tidal excursion zone.

TCE expected technology groups for the installation of floating wind turbines within the recommended RZ are predominantly technology groups 3 (Complex anchoring for a moderate sea state) and 5 (Piling with socket anchoring for a moderate sea state), with some small areas of technology group 1 (Conventional anchoring for a moderate sea state).

There are no dumping grounds of spoil ground, explosive dumping grounds or MoD firing/danger areas within the recommended RZ.

Water

The water depths within the recommended RZ range from c.59-141m. Tidal speeds within the recommended RZ range from 0.17-0.45m/s.

There are no dumping grounds of spoil ground, explosive dumping grounds or MoD firing/danger areas are within the recommended RZ.

There are no WFD Shellfish Waters, Bathing Waters or WFD coastal waterbodies within the recommended RZ or the tidal excursion zone.

The recommended RZ is located within the Celtic Seas sub-region for the MS (covering waters to the west of the UK and shared with RoI and France).

Air

There are no known air quality issues within the recommended RZ, as there are no significant anthropogenic sources of air pollution in the vicinity. The recommended RZ is located offshore of the settlements of Annalong, Ardglass, Ballyhornan, Ballymartin, Dundrum, Killough, Kilkeel, and Newcastle. The inshore boundary of the recommended RZ is located between approximately 23 and 30km offshore of these settlements.

There are areas of relatively high intensity RYA leisure boating activity further inshore around Ardglass / Strangford Lough, heading south towards Dublin Bay, due to small craft travelling between these two areas. There are also areas of high intensity RYA leisure boating activity from the Isle of Man to Dublin Bay, however this is relatively low vessel traffic intensity which may cause some minor, localised, air emissions.

Climatic Factors

There are no known blue carbon habitats (Annex I Saltmarsh, Annex I Maerl, Shellfish Waters, Subtidal and Intertidal Seagrass) identified within the recommended RZ. There are no areas within the recommended RZ that have been identified by Ulster Wildlife as being of potential for blue carbon importance. There are unlikely to be any sources of GHG emissions in the area, apart from vessels.

Material Assets

There is existing infrastructure within the recommended RZ. There are two gas transmission pipelines that run from RoI to Scotland, which run a length of c.16km and c.50km through the recommended RZ, respectively. The recommended RZ also contains c.18.5km of the Western HDVC Link (Ardneill to Wirral 1) power cable, which runs from Scotland to England, and c.9.7km of the BT-Manx NI telecommunication cable, which runs between NI and the Isle of Man.

In general, there is a relatively low (>50th percentile) and moderate (>70th percentile) shipping density within the recommended RZ, with some higher density areas (>90th percentile) primarily concentrated along a small path across the centre, and in the north-east of the recommended RZ. The areas of moderate to higher shipping density are predominantly associated with the Warrenpoint to Heysham freight ferry route in the centre of the recommended RZ and the Belfast to Liverpool (Birkenhead) ferry route in the north-east. Fishing vessels associated with the ports of Kilkeel, Ardglass, and

Carlingford, as well as cargo and tanker vessels passing from ports in NI, such as Belfast Lough, to Dublin or further south, may also contribute to the higher density within these areas. There are no TSSs within the recommended RZ.

The recommended RZ is heavily used by commercial fisheries. Areas of relatively high fishing activity (>90th percentile) are located in the north, south, and east, while moderate fishing activity (>70th percentile) is located in the north and west. Fleets that are known to operate within the recommended RZ include whitefish and Nephrops (for which the area of is of high importance). Key fishing areas for mobile Nephrops, herring, whitefish (cod, haddock and hake), and queen and king scallops fleets are located within the recommended RZ. The Irish Sea is an important location for stocks of commercial species including herring, haddock, plaice and Nephrops, and significant landings of fish (haddock, cod, monkfish/anglerfish, mackerel and hake), as well as Nephrops and other shellfish, are recorded at the port of Kilkeel. The entirety of the recommended RZ is encompassed by the West Irish Sea Nephrops Ground, known Nephrops nursery and spawning grounds, as well as sprat spawning grounds, and cod nursery grounds. Additionally, spawning grounds for cod, plaice, hake, horse mackerel, ling, mackerel, whiting, sandeel and sole are also within the recommended RZ and tidal excursion zone. There are also nursery grounds for herring, whiting, spurdog, anglerfish, hake, plaice, thornback ray, tope shark, lemon sole and haddock within the recommended RZ and tidal excursion zone. Furthermore, high egg production areas (spawning areas) for plaice, haddock and cod, as well as high juvenile density (nursery areas) for haddock and whiting are located within the recommended RZ. There are no identified areas of importance for inshore fisheries within the recommended RZ. There are areas with fishing restrictions within the recommended RZ, for scallops, under the Conservation of Scallops Regulations and the Fisheries Act 2012, and for certain fishing gear within the Irish Sea Cod Box.

The recommended RZ is used by the MoD, with a c.122km² area of the recommended RZ in the north-west being located within the Ardglass Military Practice Area (X5402), and a c.205km² area of the Peel Military Practice Area (X5403) in the north-east. The Ardglass area is utilised as a submarine exercise area, and a surface fleet practice and exercise area, whilst the Peel area is used as a submarine exercise area.

There are no spoil dumping grounds or safeguarding zones for aviation interference within the recommended RZ.

The south-east coast of NI has a number of coastal attractions that are within the modelled viewshed for floating wind turbines within the recommended RZ, including the Mourne Mountains. Tourist activities within the recommended RZ are likely to include water sports, sailing, and fishing within inshore areas, and there are areas of known relatively high intensity RYA leisure boating activity within the recommended RZ. The Mourne AONB, Strangford and Lecale AONB, and nine National Trust Lands are within the modelled viewshed for floating wind turbines within the recommended RZ, as are significant long-distance walking routes, such as the Mourne Way within the Mourne AONB, which offer significant attraction for tourism. Further information on landscape designations which may act as tourist attractions within the modelled viewshed of the area is provided in the Landscape, Seascape, and Visual Amenity baseline.

The recommended RZ has a potential capacity of 5.7GW.

Cultural, Architectural and Archaeological Heritage

There are no protected wrecks within the recommended RZ. There are 23 recorded wrecks within the recommended RZ, and a further 28 within the tidal excursion zone.

The recommended RZ is situated between c.22km and c.56km distance from the coastline. There are 819 Listed Buildings, 396 Defence Heritage Record sites, 522 Scheduled Monuments, 91 Scheduled Zones, and 20 Parks and Gardens (including Mourne Park, Tollymore Park, Tyrella House, Ballywalter Park, Portaferry House, and Castle Ward) within the modelled viewshed (based on a turbine height of 228m and a viewable distance of 40km).

Landscape, Seascape and Visual Amenity

The recommended RZ is situated between c.22km and c.56km distance from the coastline. There are 44 settlements situated inshore of the recommended RZ, which are within the modelled viewshed (based on a turbine height of 228m and a viewable distance of 40km). These include Kilkeel, Annalong, Newcastle, Downpatrick, Ardglass, and Portaferry.

There are no WHSs situated inshore of the recommended RZ. There are two AONBs situated inshore of the recommended RZ, and which are within the modelled viewshed: Mourne AONB, and Strangford and Lecale AONB. There are also nine National Trust Lands (Mournes Coastal Path, Castle Ward, Bryansford, Clough Castle, Green and Blockhouse Islands, Kearney, Murlough NNR, Slieve Donard, and Strangford Lough) within the modelled viewshed.

The recommended RZ is within the Irish Sea (South Down) RSCA at its inshore boundary, and is offshore of Mourne Coast, Lecale Coast, Dundrum Bay, Ards Peninsula, and Strangford Lough RSCAs.

Environmental Assessment	Short-term	Medium-term	Long-term
Biodiversity, Flora and Fauna (BFF)	-3	-3	-3
Population and Human Health (PHH)	-1	0	0
Geology, Soils and Land Use (GSL)	-3	-3	-3
Water (W)	-1	-1	-1
Air (A)	0	+3	+3
Climatic Factors (CF)	-1	+3	+3
Material Assets and Infrastructure (MA)	-3	-3 / +3	-3 / +3
Cultural, Architectural and Archaeological Heritage (CH)	-3	-3	-3
Landscape / Seascape and Visual Amenity (L)	-3	-3	-3

Key Conclusions:

Biodiversity, Flora and Fauna – There is potential for significant adverse effects on Biodiversity, Flora, and Fauna in the short-term construction and decommissioning phases (-3), and the medium to long-term operational phase (-3), owing to the location of Pisces Reef Complex SAC, North-West Irish Sea SPA, Queenie Corner MCZ and South Rigg MCZ in close proximity and within the tidal excursion zone and TCE Very High MCZ risk area and potential effects on benthic habitat; for significant adverse effects in the short-term construction and decommissioning phases (-3), owing to the location of North Channel SAC within the recommended RZ and potential effects on marine mammals; and for significant adverse effects in the short-term construction and decommissioning phases (-3) and the medium to long-term operational phase (-3), owing to the interaction with spawning and nursery areas for many fish species.

There is also potential for moderate adverse effects in the short-term construction and decommissioning phases, and the medium to long-term operational phase (-2) for benthic habitats and species, owing to the occurrence of Annex I habitat (potential for indirect effects) and sensitive species, for marine mammals, and birds, owing to interaction with High and Moderate MPA risk areas and occurrence of sensitive habitats and species.

Population and Human Health – There is potential for slight adverse temporary, direct and indirect, effects on leisure and recreational marine users due to an increased collision risk, access restrictions and displacement, or water quality effects, during the construction and decommissioning phases (-1). The potential for adverse direct or indirect effects on these users in the medium to long-term during the operational phase is likely to be negligible, as there is relatively low recreational boating use within the recommended RZ (0).

Geology, Soils and Land Use – There are sites designated for geological or geomorphological features within the recommended RZ and tidal excursion zone, with potential for moderate adverse direct and indirect short to long-term effects on Geology, Soils and Land use due to the potential for adverse effects on designated features (-3). There is potential for moderate direct, temporary to permanent, effects on Annex 1 Reef habitats due to loss or damage during the construction and decommissioning phases (-2). Following the installation of floating wind technologies there is potential for medium to long-term operational phase localised impacts on erosion and deposition patterns due to the presence of devices (-2). There is potential for influence on the MS Descriptor 6 sea floor integrity from the installation processes of floating wind technologies in the recommended RZ, however, there is not anticipated to be potential for adverse effects on the achievement of GES.

Generally, there is potential for direct short-term, temporary sediment loss in the vicinity of the construction works during seabed preparation activities, construction, and decommissioning activities (-1), and medium to long-term loss within the footprint of foundations and scour protection during device operation (-2).

Water – There is potential for slight adverse short-term effects on water quality elements that are considered by the MS (e.g., Descriptor 9 Concentrations of contaminants in fish and other seafood; Descriptor 8: Concentration of contaminants within marine environment; Descriptor 10 marine litter) during seabed preparation, construction, maintenance, and decommissioning activities (-1). There is not anticipated to be potential for adverse effects on the achievement of GES with the application of standard best practice mitigation.

Air – There is potential for significant positive indirect effects on regional air quality in the medium to long-term operational phase, as the operation of renewable energy devices can support a transition away from fossil fuel use and its associated air emissions, with potential for a relatively high capacity in the recommended RZ (+3).

Climatic Factors – There is potential for slight adverse short-term effects on sediment carbon storage, due to a localised release of CO_2 from seabed disturbance during the construction and decommissioning phases (-1). There is potential for slight adverse, short-term, temporary effects on localised GHG concentrations, due to GHG emissions from vessels and machinery during the construction and decommissioning phases (-1), which should be minimised at the project level through adherence to standard best practise for the minimisation of air pollution, as set out in **Section 10.1**.

There is potential for significant positive, medium to long-term effects during the operational phase, as the operation of renewable energy devices can contribute to a net reduction in GHG emissions, decarbonisation of the energy sector, diversification of electricity supply and energy security, and meeting of energy objectives and climate change emission reduction targets, with potential for a relatively high capacity in the recommended RZ (+3).

Material Assets – Overall, there is considered to be potential for moderate adverse effects in the short, medium, and long-term on Material Assets (-2), following the consideration of mitigation measures, which is mainly attributed to the potential for moderate adverse effects on Shipping and Navigation, and Commercial Fisheries.

Given the presence of the Warrenpoint to Heysham ferry route and the Belfast – Liverpool ferry route within the recommended RZ, there is the potential for significant navigational risk and displacement in the short, medium, and long-term (-3). This is owing to the potential displacement of vessels during construction and decommissioning (short-term) phases and operational (medium to long-term) phase, as well as potential for direct and indirect adverse effects on navigation and communications in all phases. Significant adverse effects could be mitigated through avoidance of the higher density Warrenpoint to Heysham shipping route and the Belfast to Liverpool (Birkenhead) ferry route.

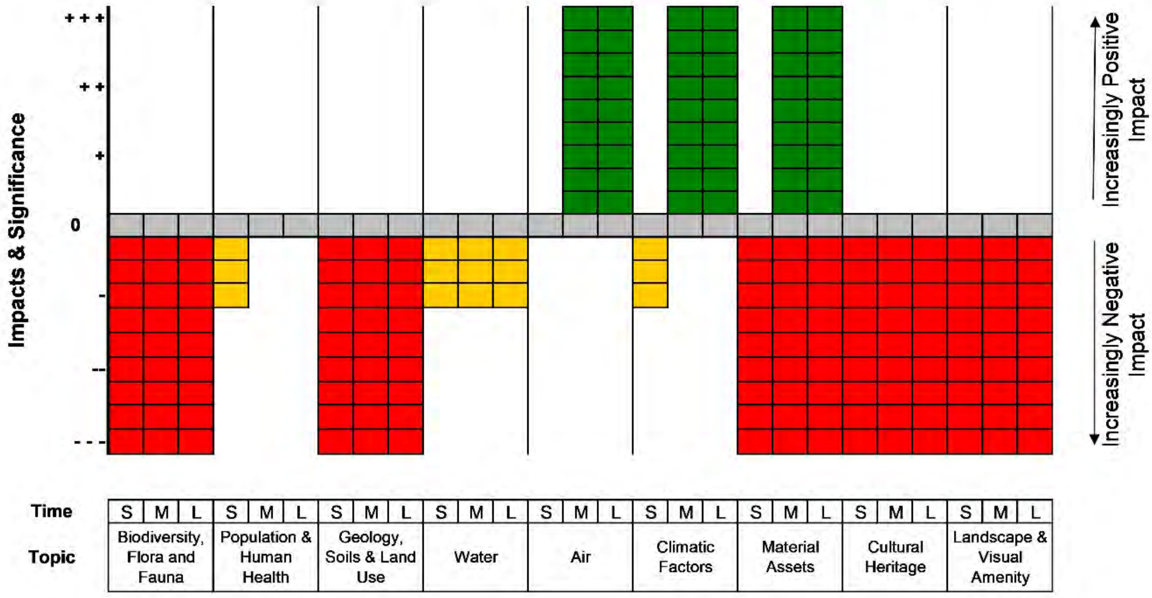
There is potential for significant indirect effects on the profitability of commercial fishing in the short, medium, and long-term (-3), such as the potential for reduced quotas, increased resource competition for fishing, and reduced landings in both tonnage and economic value. This is owing to the combination of potential significant adverse effects including: potential displacement from shipping grounds in the short, medium, and long-term (-3); potential for increased collision risk associated with the presence of construction and decommissioning vessels (short-term) (-3), and the presence of maintenance vessels and displacement from fishing grounds (medium to long-term) (-3); as well as effects on commercial fish species and their key habitats due to direct loss of supporting habitats (-3), and indirect effects due to sediment mobilisation (-3); all of which could indirectly affect fishing activity through an alteration of commercial fish stocks.

There is potential for significant positive effects in terms of the generation of a new renewable energy supply for the NI population in the medium to long-term, as the recommended RZ has a potential capacity of 5.7GW (+3).

Cultural, Architectural and Archaeological Heritage – There is potential for moderate to significant adverse effects on Cultural Heritage in the short-term construction and decommissioning phases, and the medium to long-term operational phase (-2 to -3) owing to the distance of the recommended RZ offshore and the high sensitivity of coastal heritage receptors whose setting may be affected, as well as the presence of many known (undesignated) wrecks.

Landscape, Seascape and Visual Amenity – There is potential for moderate to significant adverse effects on Landscape, Seascape, and Visual Amenity in the short-term construction and decommissioning phases, and the medium to long-term operational phase (-2 to -3) owing to the distance of the recommended RZ offshore and the high sensitivity of the landscape areas that may be affected, including Mourne AONB, and Strangford and Lecale AONB, as well as a coastal population that may be affected by changes in visual amenity.

Summary Chart of Potential Effects

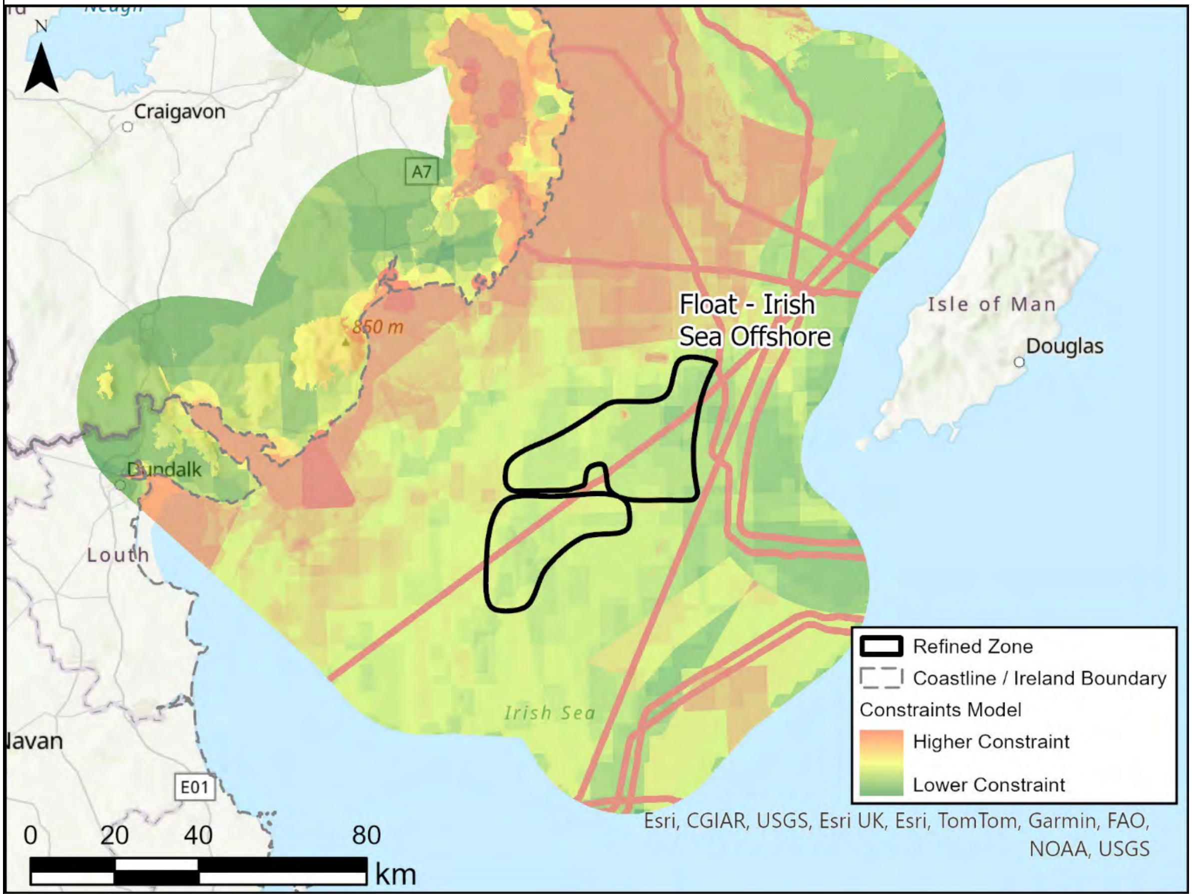


Recommendations for Further Refinement:

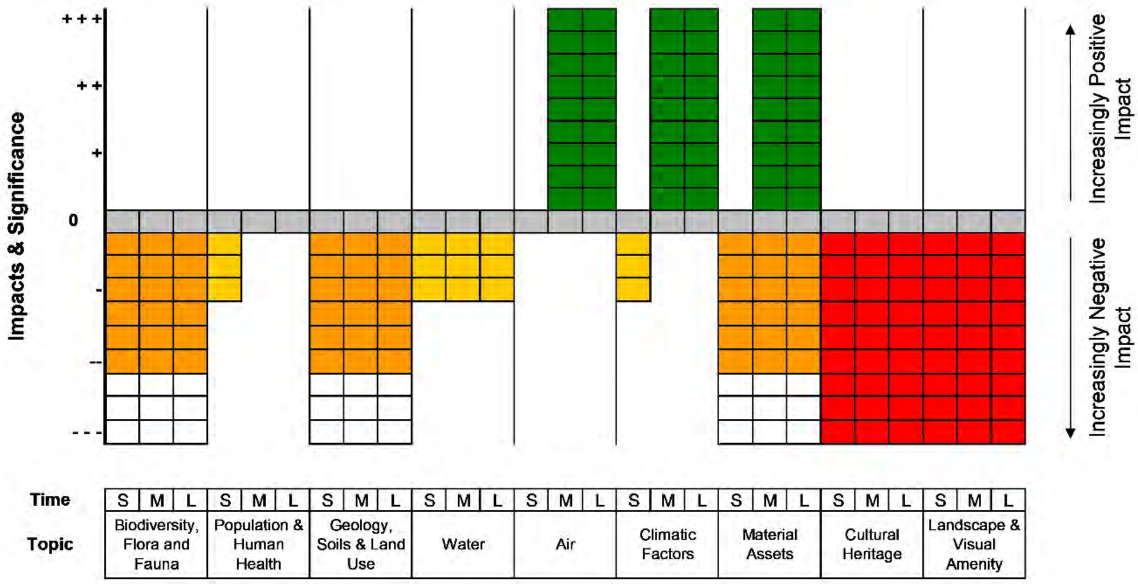
Further refinement of the Floating Irish Sea Offshore RZ is recommended to exclude North Channel SAC being within the RZ, to avoid Pisces Reef Complex SAC, North-West Irish Sea SPA, South Rigg MCZ, and Queenie Corner MCZ being within the tidal excursion zone, and to avoid areas where the greatest overlap of known fish spawning and nursery grounds occurs, which can reduce the overall score for Biodiversity, Flora, and Fauna to -2 and, in the case of South Rigg MCZ, can reduce the overall score for Geology, Soils and Land use to -1. Further refinement to avoid areas of higher density shipping, areas of high fishing activity, and areas of highest known importance for fish spawning and nursery, can reduce the potential for adverse effects on Material Assets, and reduce the overall score to -2. As the recommended RZ is >13km from shore at all points, for consistency with other RZs, no further refinement is recommended at this stage based on the potential for visual effects; the score for Cultural Heritage and Landscape, Seascape and Visual Amenity remains as -2 to -3, depending on the distance from shore within the recommended RZ (22-56km).

The theoretical energy potential of the refined Floating Irish Sea Offshore RZ is 1.72GW.

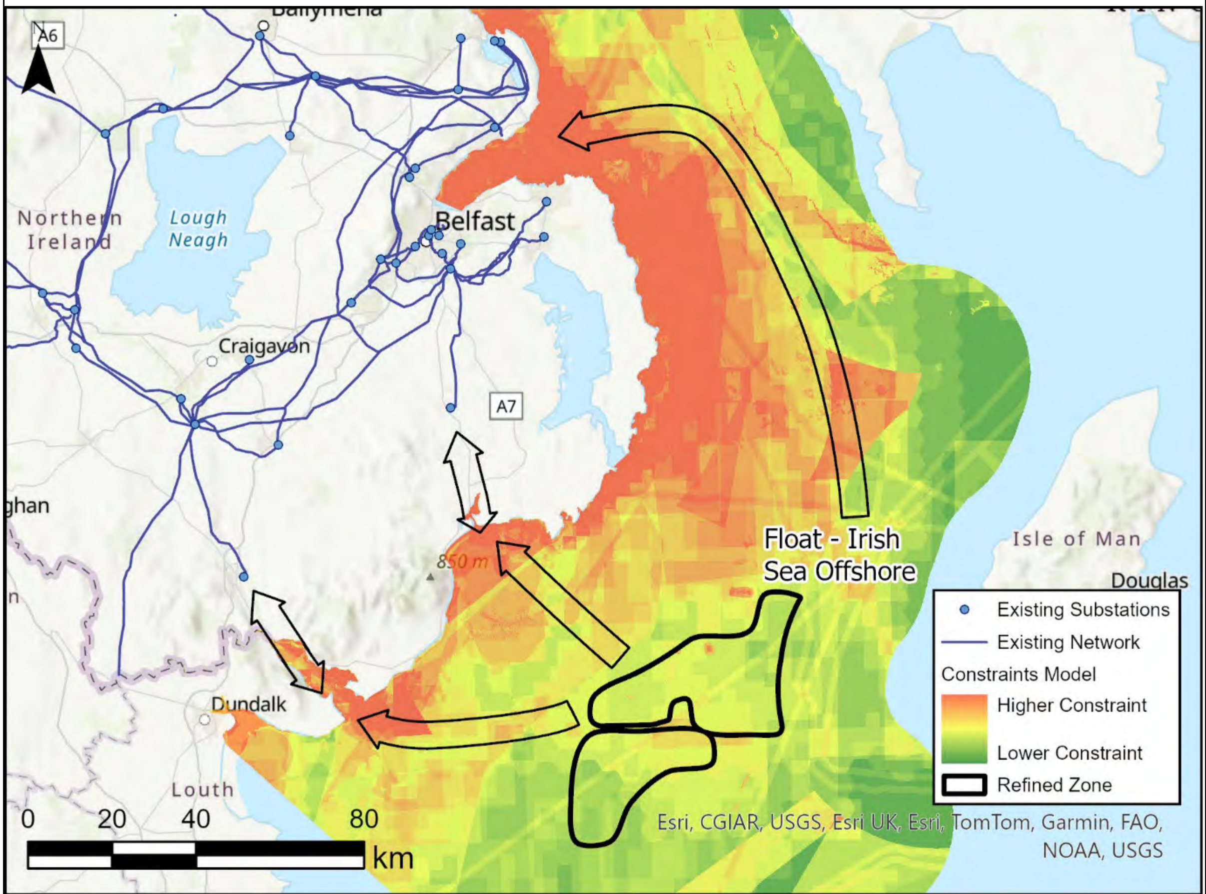
The development of wind energy sites further offshore in NI waters face increased technical challenges due to distance from ports, deeper waters and less sheltered conditions, as such construction and maintenance is more difficult and associated with higher costs requiring complex engineering solutions, specialised vessels and increased vessel trip distances. Additionally, the recommended RZ is located beyond 12nm, within NI offshore waters, which may give rise to jurisdictional and consenting issues that may complicate governance and approval of the projects.



Comparative Chart



Potential Export Cable Routes



Connection into Greater Belfast area. 110kV existing network. Length approx. 96km. Significant likely constraints include North Channel SAC, East Coast Marine pSPA, Annex I Reef, pipelines, and telecommunication cables. Other constraints which can potentially be avoided include cliffs over 15m, Outer Belfast Lough MCZ, Scallop Enhancement Areas, Urban Areas and Ports. The Outer Ards SPA/Ramsar Site/IBA and several bathing water sites are unavoidable if connecting into Bangor area.
Connection into Ballynahinch area. 110kV existing network. Length approx. 45km Significant constraints include Murlough SAC which can potentially be avoided; however, this would require a longer route. Significant likely constraints include a pipeline (unnamed), Annex I Sandbanks, Annex I Reef, and the Mourne AONB and the Strangford and Lecale AONB. Other constraints which can potentially be avoided include marine fish farms (crustaceans/fish), Ballykinler Military Area, Urban Areas, Murlough NNR, Murlough ASSI, St. John's Point ASSI, South Down Coast IBA, Dundrum Inner Bay IBA and Murlough, Newcastle, Tyrella Bathing Water Sites.
Connection into Newry area. 110kV existing network. Length approx. 58km Significant constraints include marine fish farms (crustaceans) which can potentially be avoided; however, this would require a longer offshore route. Significant likely constraints include Carlingford Marine pSPA, Carlingford Lough ASSI, a pipeline (unnamed), areas of high intensity fishing, Annex I Reef, Carlingford Lough IBA, a Pilot Boarding Station and the Mourne AONB. Other constraints which can potentially be avoided include Carlingford Shore SAC, Derryleckagh SAC, Carlingford Lough MCZ, Carlingford Lough Ramsar, Carlingford Lough SPA, Urban areas onshore, Cranfield Bay and Warrenpoint Bathing Water Sites.

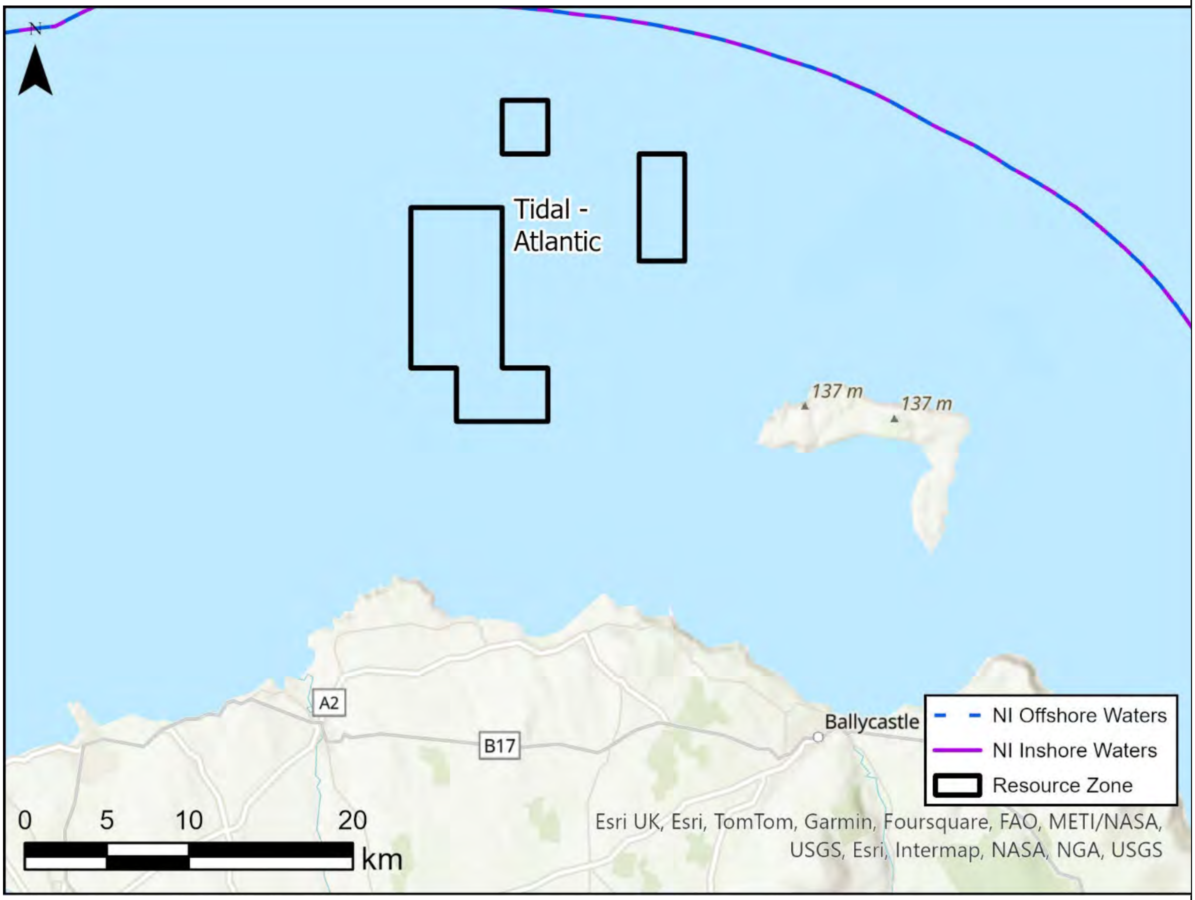
9.2.13 Tidal Resource Zone: Atlantic

Stage 1 Tidal Resource Zone – Atlantic

The Tidal Atlantic RZ is located in the North Atlantic Ocean off the north coast of NI, approximately 7km offshore of the Giant's Causeway. It encompasses an area of c.32km². The water depth of the RZ ranges from c.49m to c.154m. The average tidal speeds range from c.0.8m/s to 1.5m/s.

The theoretical energy potential of this RZ is 1.62GW[189].

Tidal Resource Zone – Atlantic



Key Environmental Constraints and Sensitivities within the Resource Zone

Biodiversity, Flora and Fauna – There are small known areas of Annex I Reef habitat, and areas of known high harbour seal density, within the RZ.

Population and Human Health – There are no key sensitivities within the RZ.

Geology, Soils and Land Use - There are areas of offshore rock, and steep sloping seabed, within the RZ.

Water - There are no key sensitivities within the RZ.

Air – There are no key sensitivities within the RZ.

Climatic Factors - There are no key sensitivities within the RZ.

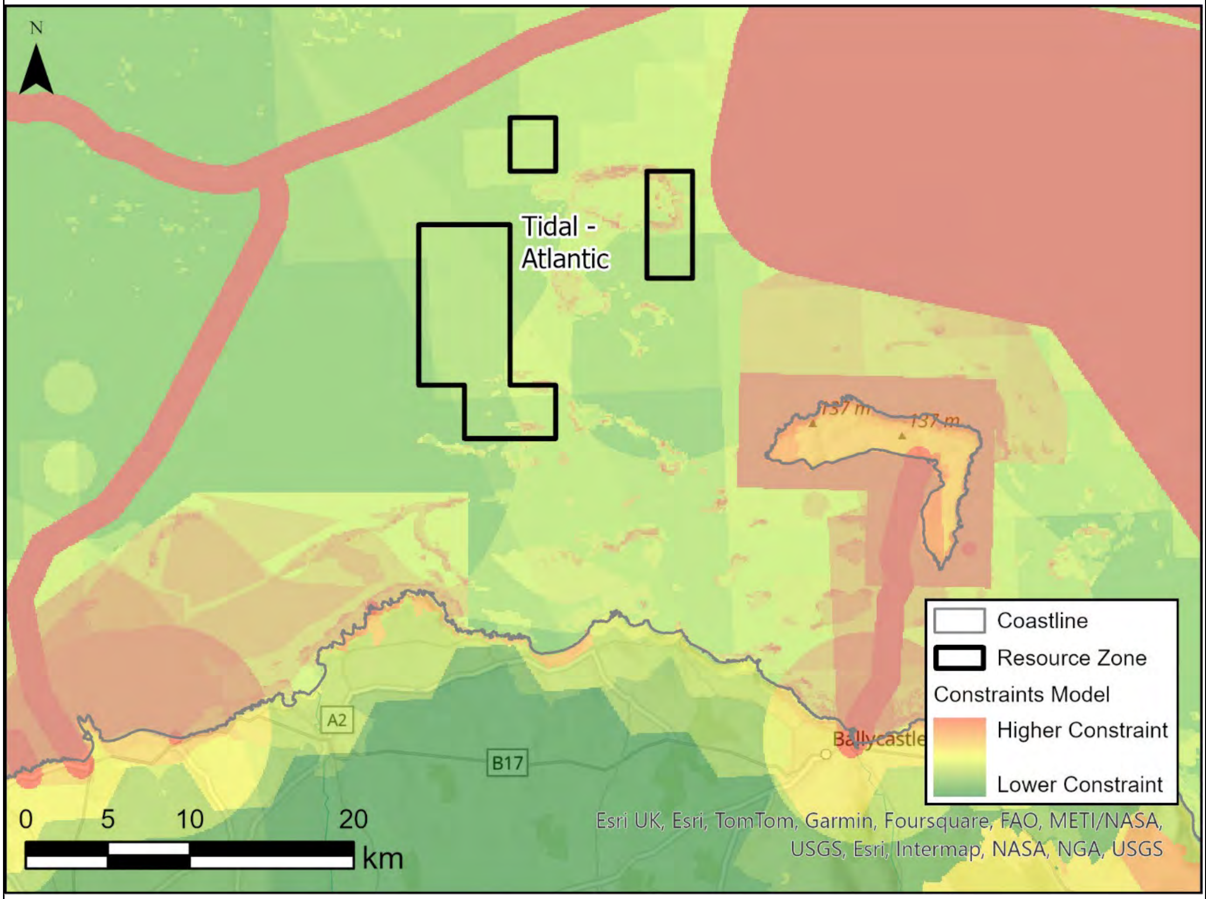
[189] Theoretical capacity, not considering physical constraints and losses from multiple devices.

Material Assets – There are areas of high shipping density (>90th percentile) within the RZ.

Cultural, Architectural and Archaeological Heritage – There are no key sensitivities within the RZ.

Landscape, Seascape and Visual Amenity – The RZ is offshore of the Causeway Coast AONB, and the Giant's Causeway and Causeway Coast WHS, which are sensitive visual receptors.

Tidal Resource Zone – Atlantic

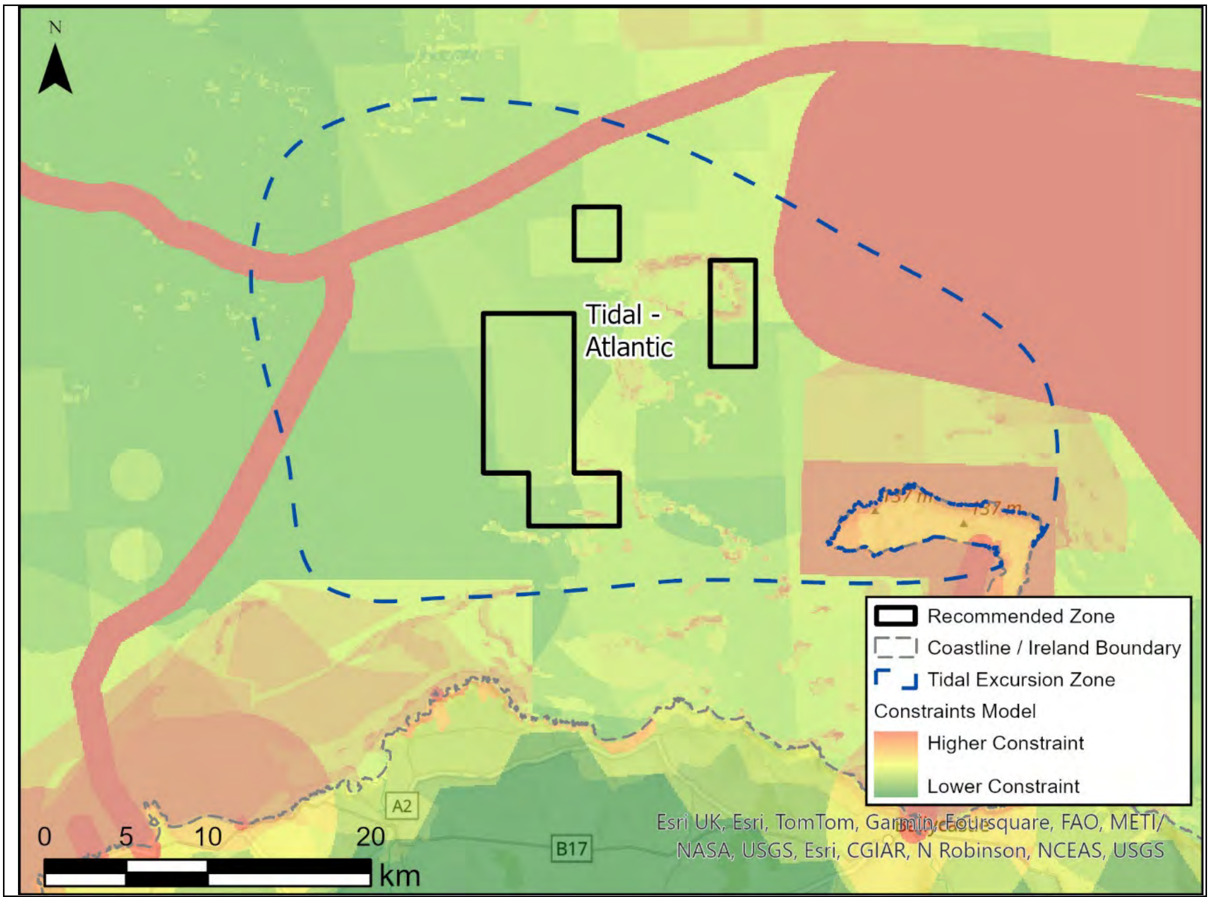


Stage 2 Recommended Tidal Resource Zone – Atlantic

Refinement of the RZ was not deemed necessary as the original areas were not significantly constrained.

The theoretical energy potential of the recommended Stage 2 Tidal Atlantic RZ remains as 1.62GW.

Recommended Tidal Resource Zone – Atlantic and Combined Constraints Model



Environmental Baseline and Key Issues within the Recommended Resource Zone

Environmental baseline information relevant to this recommended RZ is given below, ordered by SEA environmental topic. These sensitivities and indicators have the potential to be impacted by and impact upon the development and/or operation of tidal energy.

Biodiversity, Flora and Fauna

There are no designated sites (SACs, SPAs, Ramsar sites, MCZs, ASSIs) within the recommended RZ. Skerries and Causeway SAC is situated c.1.8km inshore of the recommended RZ, while Rathlin Island SAC and SPA are situated c.3.5km to the south-east, Rathlin Island MCZ c.1.7km to the south-east, and Rathlin Island ASSI c.7km to the south-east; these sites are all within the tidal excursion zone. There are TCE High MPA risk areas for Marine Mammals and Breeding Birds, and Moderate MPA risk areas for Fish, within the recommended RZ (based on the risk models for fixed wind, floating wind, and cables).

There are areas of Annex I Reef habitat within the recommended RZ in the south-east inshore area, and within the tidal excursion zone, and areas of Annex I Sandbank, Sea caves and Maerl within the tidal excursion zone to the south-east. The seabed habitats within the recommended RZ predominantly consist of coarse substrate, with areas of sand, muddy sand, and rock or other hard substrate.

There are no records of Protected species (Wildlife Order), PMF species, or OSPAR Threatened/Declining species within the recommended RZ. The NI Priority Species cod has been recorded within the recommended RZ.

There are areas of SCANs recorded relatively high density for pilot whale (in the inshore area), and fin whale, and areas of relatively moderate density for pilot whale, and bottlenose dolphin within the recommended RZ. MU data also indicates that the cetaceans white-sided dolphin, white-beaked dolphin, Risso’s dolphin, minke whale, harbour porpoise, common dolphin, and bottlenose dolphin may occur within the area. There are also areas of relatively moderate density for grey seal and harbour seal within the recommended RZ.

There are spawning grounds for sprat, herring, and Nephrops within the recommended RZ and the tidal excursion zone. There are nursery grounds for Nephrops, spurdog, anglerfish, cod, common skate, hake, herring, and mackerel within the recommended RZ and the tidal excursion zone, and for whiting, blue whiting, and ling within the tidal excursion zone. There is also an AFBI surveyed area of relatively high density for scallops within the very inshore area of the recommended RZ and within the tidal excursion zone to the south-east, and an AFBI surveyed area of relatively high density for queen scallops within the north-east of the RZ and within the tidal excursion zone to the north-east. There is a restricted area for fishing under the Conservation of Scallops Regulations.

There are areas of recorded relatively high density for seabirds at sea within the recommended RZ. Rathlin Island, c.6km distant at its closest point to the RZ, includes an SPA, IBA and RSPB Reserve.

There are no records of invasive species within the recommended RZ.

Population and Human Health

The recommended RZ is located offshore of the settlements of Ballycastle and Portballintrae. The southern inshore boundary of the recommended RZ is located approximately 10.7km north-east of Portballintrae, and 13.7km north-west of Ballycastle.

The recommended RZ is located offshore of the Ballycastle, Portrush Curran (East Strand), Portrush Mill (West Strand), and Portrush Whiterocks Bathing Water sites, and the Ballycastle and Whiterocks Blue Flag Beaches. However, none of these sites are located within the recommended RZ or tidal excursion zone.

Within the wider area there are areas of relatively high intensity RYA leisure boating activity around Rathlin Island and from small craft travelling between Rathlin Island, Coleraine, Ballycastle and Port Ellen. Within the recommended RZ there is relatively low vessel traffic intensity due to transient vessel traffic.

There are no dive sites within the recommended RZ, however, there are 25 within the tidal excursion zone.

Geology, Soils and Land Use

There are no WHSs, ASSIs, MCZs or UNESCO Geoparks designated for geology or geomorphology within the recommended RZ. Rathlin Island MCZ and two ASSIs of Rathlin Island-Coast and Church Bay are within the tidal excursion zone. Rathlin MCZ has been designated for being the only known location of the broad scale habitat, deep-sea bed in NI waters and for several subtidal geological/geomorphological features including a submerged coastline, underwater caves, sea arches and lagoons, which indicate global sea-level change. Rathlin Island-Coast ASSI has been designated for geological/geomorphological features including isolated sea cliffs, sea stacks, wave-cut platforms and geological exposures of columnar basalt rock. Church Bay ASSI is designated for its geological landforms of ridges composed of sand and gravel deposits, which are a unique geological feature for the island of Ireland.

The main seabed geology of the recommended RZ is undifferentiated rock of quaternary deposits. Seabed thickness is generally <5m, with one area of between 5–50m. The seabed substrates of the recommended RZ consist of rock or other hard substrate and coarse substrate, with two areas of muddy sand and sand. The biozones are generally evenly split between shallow and deep circalittoral of moderate energy. There are areas of Annex I Reef habitat within the recommended RZ in the south-east inshore area, and within the tidal excursion zone.

There are no dumping grounds of spoil ground, explosives dumping ground or MoD firing/danger areas within the recommended RZ.

Water

The water depths within the recommended RZ range from c.42-176m. Tidal speeds within the recommended RZ range from 0.85-1.47m/s.

There are no dumping grounds of spoil ground, explosives dumping ground or MoD firing/danger areas within the recommended RZ.

There are no WFD Shellfish Waters or Bathing Waters within the recommended RZ or tidal excursion zone. No coastal WFD waterbodies are within the recommended RZ. One coastal waterbody of Rathlin Island is within the tidal excursion zone, which was at moderate status in 2021.

The recommended RZ is located within the Celtic Seas sub-region for the MS (covering waters to the west of the UK and shared with RoI and France).

Air

There are no known air quality issues within the recommended RZ, as there are no significant anthropogenic sources of air pollution in the vicinity. The recommended RZ is located offshore of the settlements of Ballycastle and Portballintrae. The southern boundary of the recommended RZ is located approximately 10.7km north-east of Portballintrae, and 13.7km north-west of Ballycastle.

Within the wider are there are areas of relatively high intensity RYA leisure boating activity around Rathlin Island and from small craft travelling between Rathlin Island, Coleraine, Ballycastle and Port Ellen. Within the RZ there is relatively low vessel traffic intensity which may cause some minor, localised, air emissions.

Climatic Factors

There are no known blue carbon habitats (Annex I Saltmarsh, Annex I Maerl, Shellfish Waters, Subtidal and Intertidal Seagrass) within the recommended RZ. There are areas in the eastern section of the recommended RZ that have been identified by Ulster Wildlife as of low potential for blue carbon importance. There are unlikely to be any sources of GHG emissions in the area, apart from vessels.

Material Assets

There are no cables or pipelines within the recommended RZ.

In general, there is a relatively low shipping density within the RZ. However, there is an area of relatively higher shipping density (>50th and >70th percentile) within the east of the recommended RZ, possibly associated with vessels approaching Portrush Harbour, or cargo vessels and fishing vessels travelling between the North Channel and the Atlantic Ocean. There are no TSSs within the recommended RZ, with the closest being located c.4.3km to the east. There are also no Harbour Areas or Ports within the recommended RZ.

The recommended RZ is used by commercial fishing vessels. The recommended RZ is generally of low fishing activity, however, there is an area of relatively higher fishing activity (>50th percentile) within the north-west of the recommended RZ. Fishing fleets that operate in the recommended RZ include whitefish, pot, and scallop. Key fishing areas for mobile king and queen scallop are located within the recommended RZ. Small volumes of species such as herring, hake, and monkfish/anglerfish are landed at Foyle Port, whilst herring are caught from relatively important stocks located within this region. There are important areas for inshore pot fisheries located in the east and south of the recommended RZ and tidal excursion zone. No marine fish farms or aquaculture sites are within the recommended RZ. The majority of the recommended RZ, with the exception of the south-west, is within Nephrops nursery grounds, while the tidal excursion to the north-east is within a cod nursery area. Nursery grounds for spurdog, anglerfish, cod, common skate, hake, herring, and mackerel are within the recommended RZ, while nursery grounds for whiting, blue whiting and ling are within the tidal excursion zone to the west. Spawning grounds for Nephrops, sprat and herring are located within the majority of the recommended RZ (herring grounds are not present within the east of the recommended RZ, while Nephrops grounds are not within the south-west). Queen scallops are known to be present within the north-easterly part of the recommended RZ and the tidal excursion zone to the north-east, while scallops have been recorded within the very inshore area of the recommended RZ, and the inshore tidal excursion zone to the south-east. Furthermore, there is a restricted fishing area for scallops under the Conservation of Scallops Regulations within the recommended RZ.

The recommended RZ is used by the MoD, as it is located within two Military Practice Areas - a c.23.5km² area of the Rathlin Military Practice Area (X5536) in the east of the recommended RZ and a c.8.8km² area of the Skerries Military Practice Area (X5537) in the west. These are both used as submarine exercise areas, and surface fleet practice and exercise areas. There are no MoD danger areas within the recommended RZ.

There are no zones for aviation interference within the recommended RZ.

There are no spoil dumping grounds located within the recommended RZ.

The north coast of NI has a developed tourist infrastructure that includes a number of coastal attractions that are within the modelled viewshed for tidal turbines within the recommended RZ, including the Giant's Causeway. Potential tourist activities within the recommended RZ include boat tours, water sports, sailing and fishing. The Causeway Coast AONB, Antrim Coast and Glens AONB, and 11 National Trust lands, as well as significant long-distance walking routes such as the Causeway Coast Way that offer significant attraction for tourism, are also located within the modelled viewshed for tidal turbines within the recommended RZ. Further information on landscape designations that may act as tourist attractions within the modelled viewshed of the area is provided in the Landscape, Seascape and Visual Amenity baseline.

The recommended RZ has a potential capacity of 1.62GW.

Cultural, Architectural and Archaeological Heritage

There are no protected wrecks or recorded wrecks within the recommended RZ. There are 13 recorded wrecks within the tidal excursion zone.

The recommended RZ is situated between c.5.5km and c.18km distance from the coastline. The Giant's Causeway and Causeway Coast WHS is situated inshore of the recommended RZ and is within the modelled viewshed (based on a buoy height of 3m and a viewable distance of 10km). There are also 17 Listed Buildings, eight Defence Heritage Record sites, 130 Scheduled Monuments, and 14 Scheduled Zones, situated inshore of the recommended RZ or on the shoreline of the nearby Rathlin Island and within the modelled viewshed.

Landscape, Seascape and Visual Amenity

The recommended RZ is situated between c.5.5km and c.18km distance from the coastline.

The settlement of Ballintoy is situated inshore of the recommended RZ and is within the modelled viewshed (based on a buoy height of 3m and a viewable distance of 10km).

The Giant's Causeway and Causeway Coast WHS, the Causeway Coast and Antrim Coast and Glens AONBs, and 11 National Trust lands (Avish, Barmouth Grangemore and Portstewart, Carrick a Rede, Cushleake Mountain, Downhill, Dunseverick, Fairhead and Murlough Bay, Giant's Causeway, Hezlett House, Rathlin Island, and Whitepark Bay) are situated inshore of the recommended RZ and are within the modelled viewshed.

The recommended RZ is within the Atlantic RSCA and is offshore of the Causeway Coast RSCA.

Environmental Assessment	Short-term	Medium-term	Long-term
Biodiversity, Flora and Fauna (BFF)	-3	-3	-3
Population and Human Health (PHH)	-1	0	0
Geology, Soils and Land Use (GSL)	-3	-3	-3
Water (W)	-1	-1	-1
Air (A)	0	+3	+3
Climatic Factors (CF)	-1	+3	+3
Material Assets and Infrastructure (MA)	-2	-2 / +3	-2 / +3
Cultural, Architectural and Archaeological Heritage (CH)	-2	-2	-2
Landscape / Seascape and Visual Amenity (L)	-2	-2	-2

Key Conclusions:
Biodiversity, Flora and Fauna – There is potential for significant adverse effects on Biodiversity, Flora, and Fauna in the short-term construction and decommissioning phases, for benthic habitat as Skerries and Causeway SAC, Rathlin Island SAC, and Rathlin Island MCZ are within the tidal excursion zone. There is also potential for moderate adverse effects in the short-term construction and decommissioning phases, and the medium to long-term operational phase (-2) for benthic habitats and species, fish and shellfish, marine mammals and birds, owing to interaction with TCE Moderate to High MPA risk areas for Fish, Marine Mammals and Breeding Birds, known fish spawning and nursery grounds and scallop grounds, and areas of known high and moderate density for marine mammals and seabirds at sea. **Population and Human Health –** There is potential for slight adverse temporary, direct and indirect, effects on leisure and recreational marine users due to an increased collision risk, access restrictions and displacement, or water quality effects, during the construction and decommissioning phases (-1). The potential for adverse direct or indirect effects on these users in the medium to long-term during the operational phase is likely to be negligible, as there is relatively low recreational boating use within the recommended RZ (0). **Geology, Soils and Land Use –** There are three sites designated for geological or geomorphological features within the tidal excursion zone, with potential for moderate adverse indirect long-term effects on Geology, Soils and Land use due to the potential for adverse effects on designated features (-3). There is potential for moderate direct temporary to permanent impacts on Annex 1 Reef habitats due to loss or damage during the construction and decommissioning phases (-2). There is a potential for slight adverse direct long-term effects on the seabed geology and sediments in the construction and decommissioning phases through loss of material (-2). Following the installation of tidal technologies there is potential for medium to long-term operational phase localised effects on erosion and deposition patterns due to the presence of devices (-2). There is potential for influence on the MS Descriptor 6 sea floor integrity from the installation processes of tidal technologies in the recommended RZ, however, there is not anticipated to be potential for adverse effects on the achievement of GES. Generally, there is potential for direct short-term, temporary sediment loss in the vicinity of the construction works during seabed preparation activities, construction and decommissioning activities (-1), and medium to long-term loss within the footprint of foundations and scour protection during device operation (-2). **Water –** There is potential for slight to moderate, indirect, short-term effects on water quality, as one WFD coastal waterbody of Rathlin Island is within the tidal excursion zone (-1). There is potential for slight short-term effects on water quality elements that are considered by the MS (e.g., Descriptor 9 Concentrations of contaminants in fish and other seafood; Descriptor 8: Concentration of contaminants within marine environment; Descriptor 10 marine litter) during seabed preparation, construction, maintenance and decommissioning activities (-1); there is not anticipated to be potential for adverse effects on the achievement of GES with the application of standard best practice mitigation. **Air –** There is potential for significant positive indirect effects on regional air quality in the medium to long-term operational phase, as the operation of renewable energy devices can support a transition away from fossil fuel use and its associated air emissions, with potential for a relatively high capacity in the recommended RZ (+3). **Climatic Factors –** There is potential for slight adverse short-term effects on sediment carbon storage, due to a localised release of CO_2 from seabed disturbance during the construction and decommissioning phases (-1). There is potential for slight adverse, short-term, temporary effects on localised GHG concentrations, due to GHG emissions from vessels and machinery during the construction and decommissioning phases (-1), which should be minimised at the project level through adherence to standard best practise for the minimisation of air pollution, as set out in **Section 10.1**. There is potential for significant positive, medium to long-term effects during the operational phase, as the operation of renewable energy devices can contribute to a net reduction in GHG emissions, decarbonisation of the energy sector, diversification of electricity supply and energy security, and

meeting of energy objectives and climate change emission reduction targets, with potential for a relatively high capacity in the recommended RZ (+3).

Material Assets – Overall, there is considered to be potential for moderate adverse effects in the short, medium, and long-term on Material Assets (-2), following the consideration of mitigation measures, which is mainly attributed to the potential for moderate adverse effects on Shipping and Navigation, and Commercial Fisheries.

Given the presence of the relatively higher density shipping area within the east of the recommended RZ, there is the potential for moderate direct navigational risk and displacement effects in the short, medium, and long-term (-2). This is owing to the potential displacement of vessels during construction and decommissioning (short-term) and operation (medium to long-term) phases, as well as potential for moderate adverse direct and indirect effects on navigation and communications in all phases.

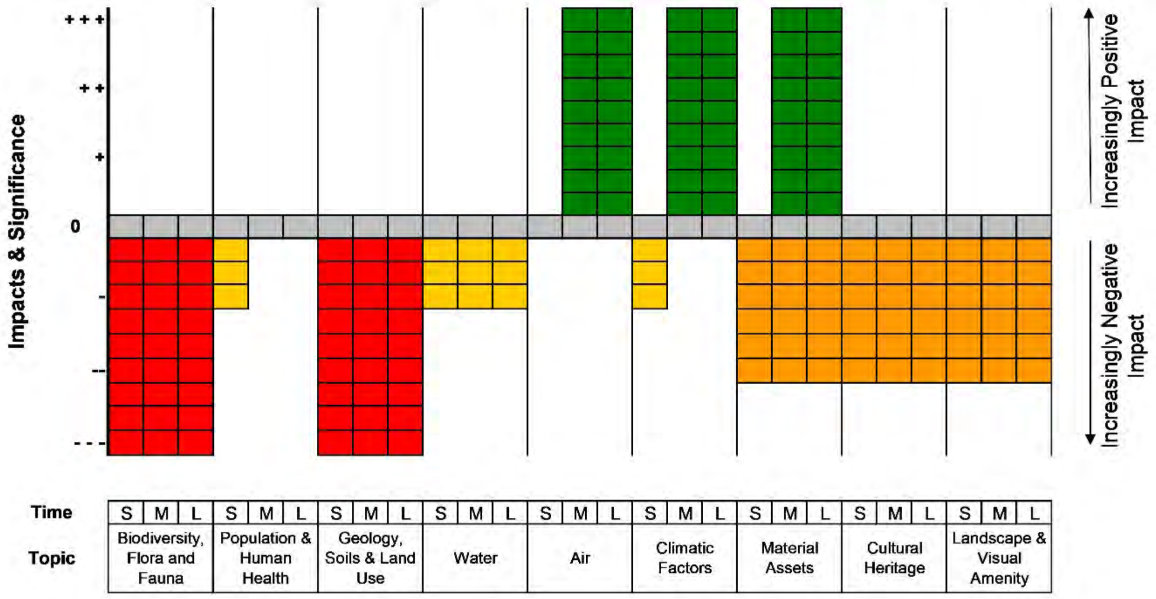
Although the recommended RZ has relatively low fishing intensity, there are also areas used by inshore fisheries as such there is potential for moderate indirect effects on the profitability of commercial fishing in the short, medium, and long-term (-2), such as the potential for reduced quotas, increased resource competition for fishing, and reduced landings in both tonnage and economic value. This is owing to the combination of potential moderate adverse effects including: potential displacement from shipping grounds in the short, medium, and long-term; potential for increased collision risk associated with the presence of construction and decommissioning vessels (short-term), and the presence of maintenance vessels and displacement from fishing grounds (medium to long-term); as well as effects on commercial fish species and their key habitats due to direct loss of supporting habitats, and indirect effects due to sediment mobilisation; all of which could indirectly affect fishing activity through an alteration of commercial fish stocks.

There is potential for significant positive effects in terms of the generation of a new renewable energy supply for the NI population in the medium to long-term, as the recommended RZ has a potential capacity of 1.62GW (+3).

Cultural, Architectural and Archaeological Heritage – There is potential for slight to moderate adverse effects on Cultural Heritage in the short-term construction and decommissioning phases, and the medium to long-term operational phase (-1 to -2) owing to the very high sensitivity of coastal heritage receptors whose setting may be affected, including the Giant's Causeway and Causeway Coast WHS. Tidal stream devices are expected to be primarily submerged, with the significance of any effects influenced by the need for markings such as buoys, or other ancillary infrastructure.

Landscape, Seascape and Visual Amenity – There is potential for moderate adverse effects on Landscape, Seascape and Visual Amenity in the short-term construction and decommissioning phases, and the medium to long-term operational phase (-2) owing to the distance of the recommended RZ offshore and the very high sensitivity of the landscape areas that may be affected, including the Giant's Causeway and Causeway Coast WHS, Causeway Coast AONB, and Antrim Coast and Glens AONB. Tidal stream devices are expected to be primarily submerged, with the significance of any effects influenced by the need for markings such as buoys, or other ancillary infrastructure. Should a tidal stream development include the need for associated infrastructure such as an above sea substation, there is greater potential for significant effects on the landscape and seascape.

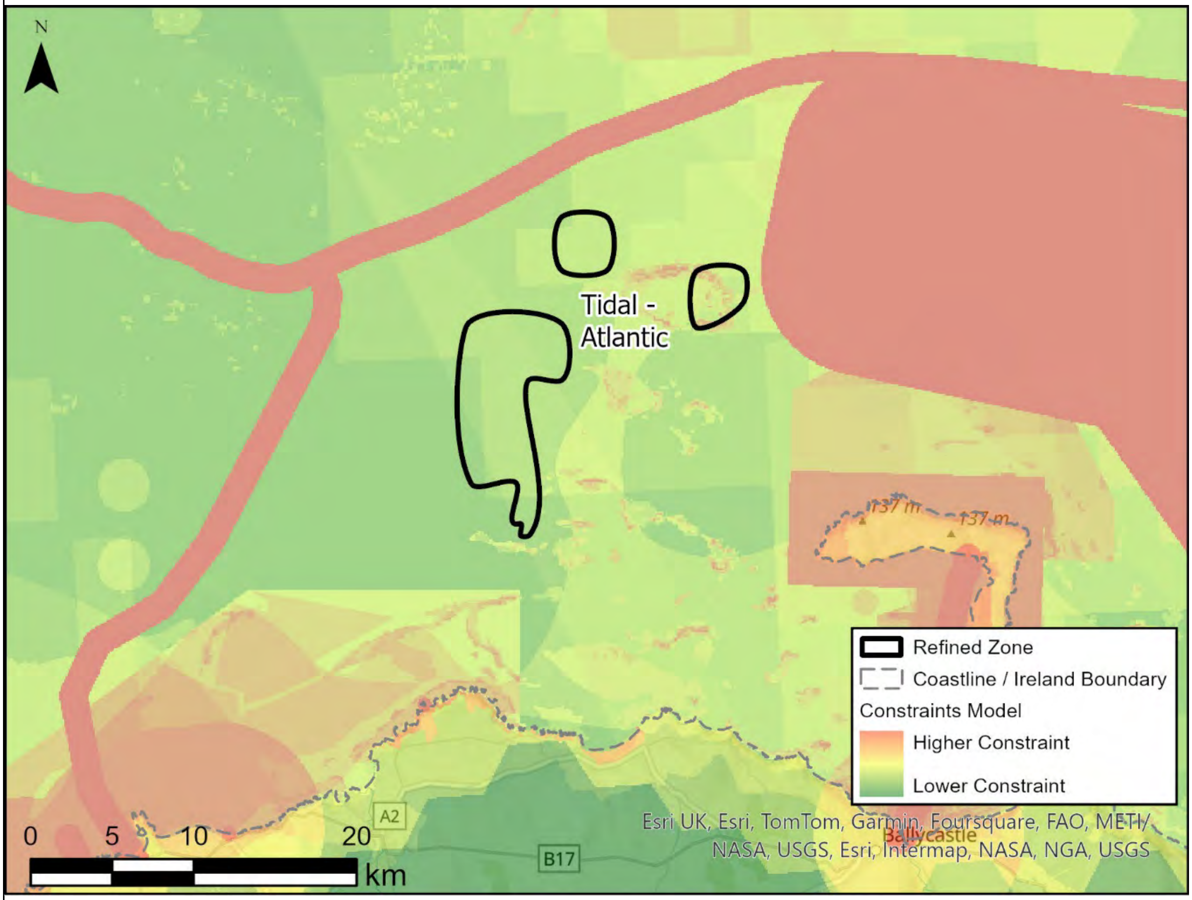
Summary Chart of Potential Effects



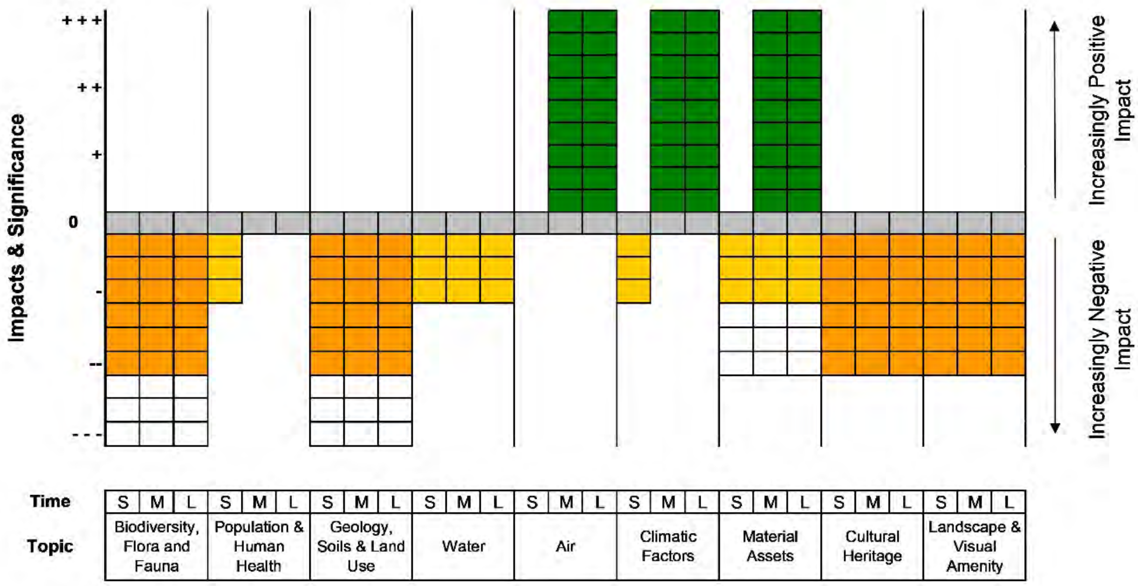
Recommendations for Refinement:

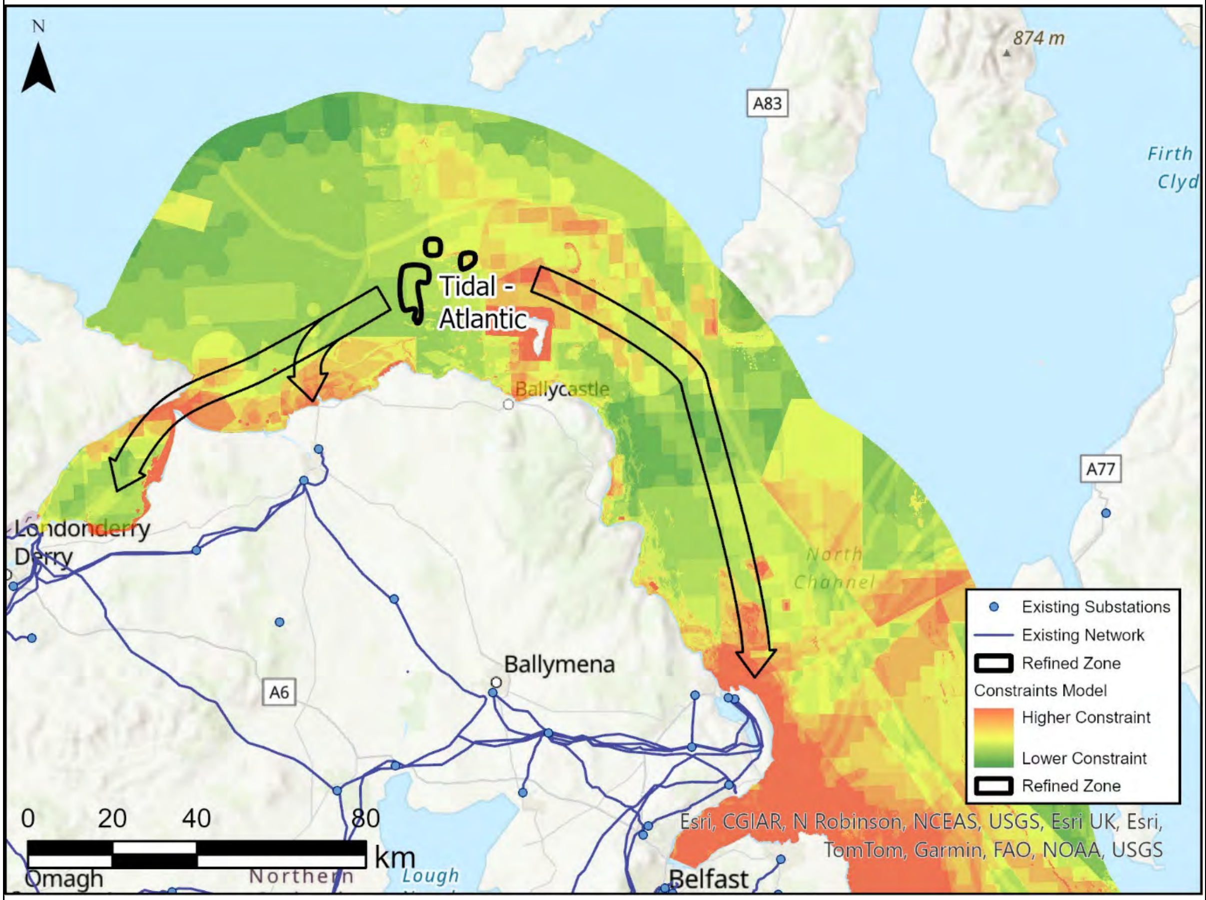
Refinement of the Tidal Atlantic recommended RZ is recommended to avoid Skerries and Causeway SAC, Rathlin Island SAC, SPA, and MCZ being within the tidal excursion zone, which can reduce the overall score for Biodiversity, Flora, and Fauna to -2. Avoidance of Rathlin Island MCZ, and Rathlin and Church Bay ASSIs, within the tidal excursion zone can also reduce the overall score for Geology, Soils and Land use to -1, while avoidance of the Rathlin WFD Coastal water body can reduce the potential for adverse effects on Water. Further refinement to avoid areas of importance for inshore fisheries, areas of highest known importance for fish spawning and nursery, and areas of moderate density shipping, can reduce the potential for adverse effects on Material Assets, and the overall score to -1. No refinement is recommended at this stage based on the potential for visual effects; the score for Cultural Heritage and Landscape, Seascape, and Visual Amenity remains as -1 to -2, depending on the distance from shore (5.5-18km) and infrastructure required, owing to the very high sensitivity of the landscape and heritage receptors (WHSs, AONBs).

The theoretical energy potential of the refined Tidal Atlantic RZ is 0.99GW.



Comparative Chart



Potential Export Cable Routes

Connection into Larne area. 275kV/110kV existing network. Length approx. 83km. Significant likely constraints include the East Coast Marine pSPA, telecommunication cables, Brown's Bay Bathing Water Site, Portmuck Bathing Water Site, Offshore Rock, Annex I Reef, North Channel TSS and Port Lands around Larne. There are several designated sites within the vicinity including the North Channel SAC, The Maidens SAC, Rathlin Island SAC/SPA/IBA, Larne Lough SPA/Ramsar/IBA, Rathlin MCZ, Portmuck ASSI; however, these can all potentially be avoided.
Connection into Coleraine area. 110kV existing network. Length approx. 33 km. Significant likely constraints include areas of Annex I Sandbanks and a telecommunication cable. Other constraints which can potentially be avoided include protected wrecks, cliffs over 15m, Urban Areas and environmental designations including Bann Estuary SAC, Skerries and Causeway SAC, Bann Estuary ASSI, Portrush West Strand ASSI, Ramore Head and Skerries ASSI, Binevenagh AONB and Causeway Coast AONB.
Connection into Derry/Londonderry area. 275kV/110kV existing network Length approx. 61km. Significant likely constraints include the Lough Foyle and River Foyle IBA, and a telecommunication cable and Pilot Boarding Stations. Other constraints which can potentially be avoided include Magilligan SAC/ASSI, Lough Foyle SPA/Ramsar/ASSI, Binevenagh AONB, Magilligan Military Area, Urban Areas, Derry Airport / Ballarena Airfield and Lough Foyle RSPB Reserve.

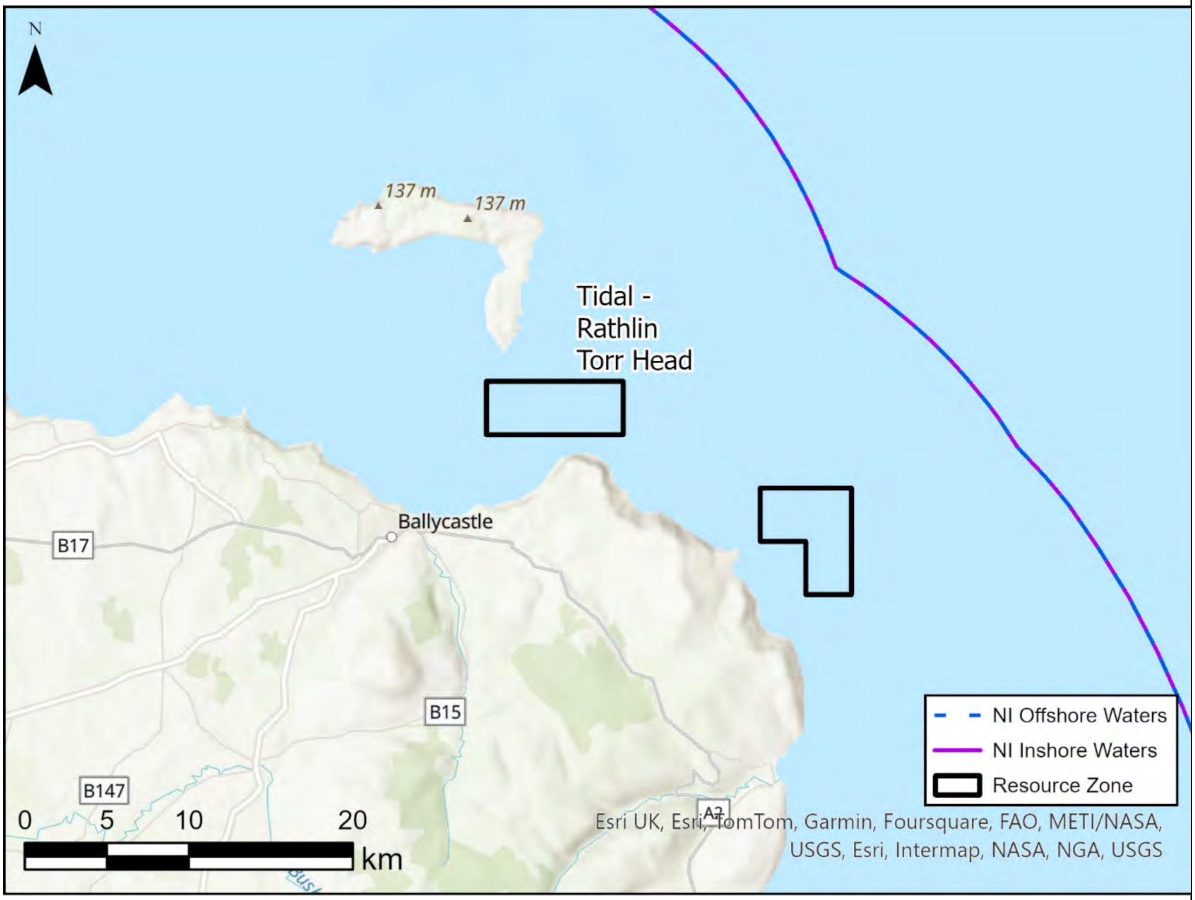
9.2.14 Tidal Resource Zone: Rathlin Torr Head

Stage 1 Tidal Resource Zone – Rathlin Torr Head

The Tidal Rathlin Torr RZ is located in the North Atlantic Ocean off the north coast of NI, approximately 1km offshore of Fair Head and Torr Head. It encompasses an area of c.17km². The water depth of the RZ ranges from c.47m to c.160m. The average tidal speeds range from c.0.5m/s to 1.5m/s.

The theoretical energy potential of this RZ is 0.89GW[190].

Tidal Resource Zone – Rathlin Torr Head



Key Environmental Constraints and Sensitivities within the Resource Zone

Biodiversity, Flora and Fauna – There are known areas of Annex I Reef habitat, and areas of known high harbour seal and grey seal density, within the RZ.

Population and Human Health – There are no key sensitivities within the RZ.

Geology, Soils and Land Use - There are areas of offshore rock within the RZ.

Water - There are no key sensitivities within the RZ.

Air – There are no key sensitivities within the RZ.

Climatic Factors - There are no key sensitivities within the RZ.

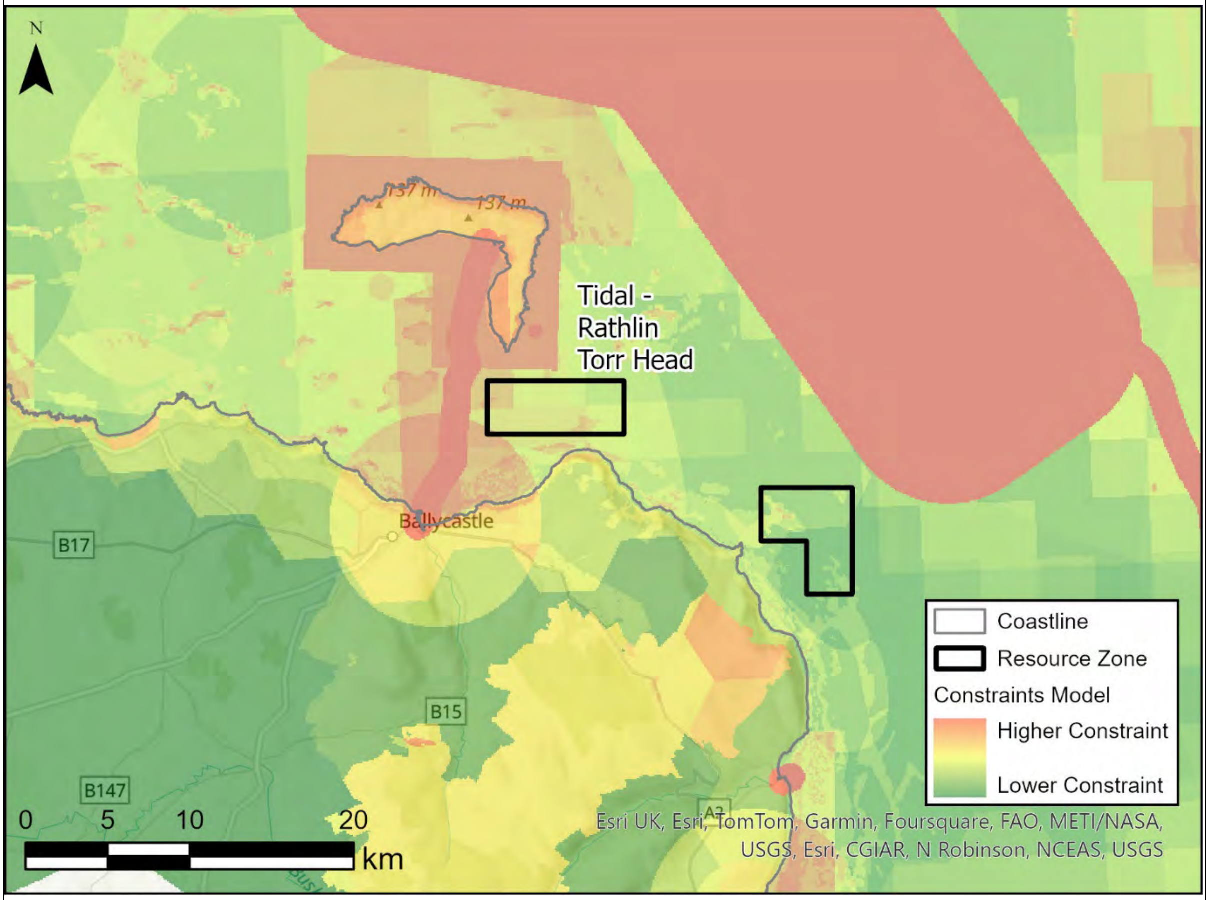
[190] Theoretical capacity, not considering physical constraints and losses from multiple devices.

Material Assets – There are areas of high shipping density (>90th percentile) within the RZ, additionally, TCE and MCA recommend a 2nm buffer of TSSs and part of the RZ is within this buffer of the North Channel TSS.

Cultural, Architectural and Archaeological Heritage – There are unprotected wrecks within the RZ.

Landscape, Seascape and Visual Amenity – The RZ is offshore of the Antrim Coast and Glens AONB, which is a sensitive visual receptor.

Tidal Resource Zone – Rathlin Torr Head

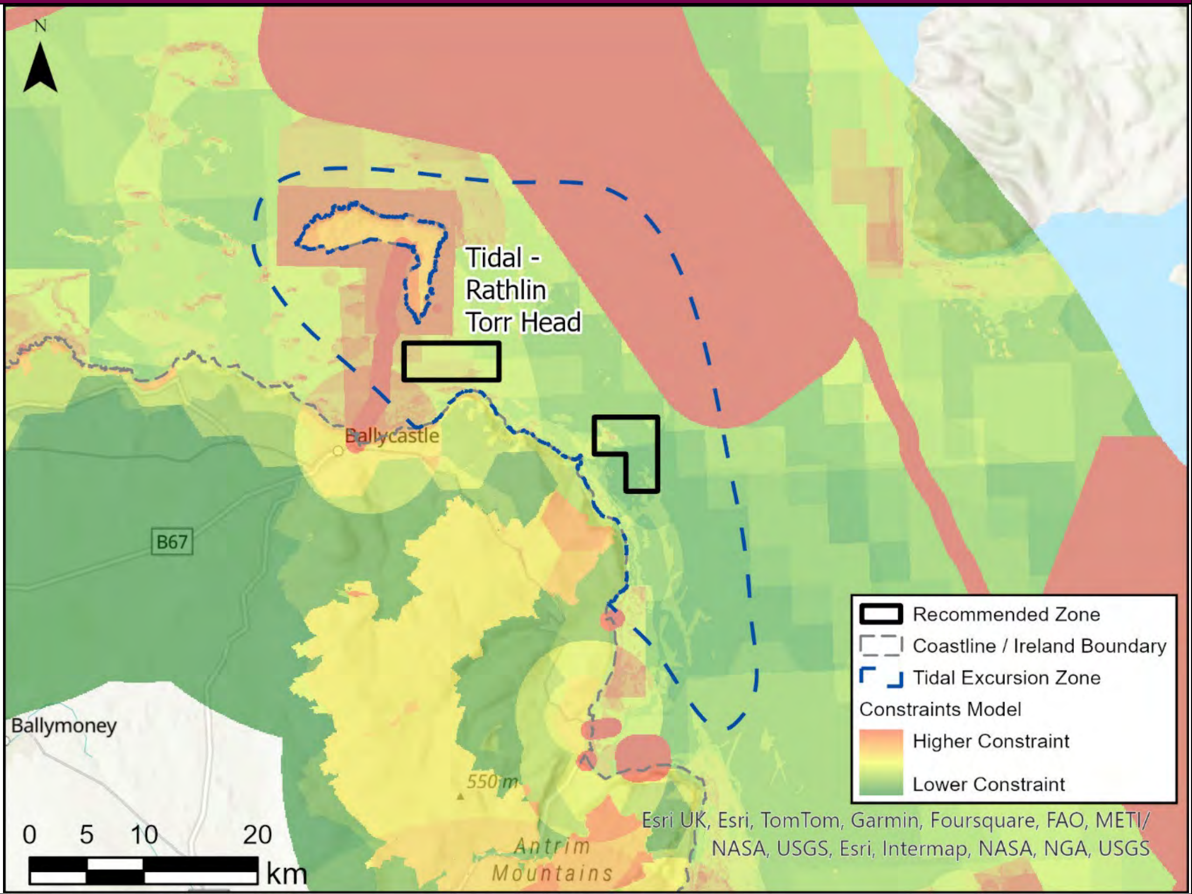


Stage 2 Recommended Tidal Resource Zone – Rathlin Torr Head

Refinement of the RZ was not deemed necessary as the original area was not significantly constrained.

The theoretical energy potential of the recommended Stage 2 Tidal Rathlin Torr Head RZ remains as 0.89GW.

Recommended Tidal Resource Zone – Rathlin Torr Head and Combined Constraints Model



Environmental Baseline and Key Issues within the Resource Zone

Environmental baseline information relevant to this recommended RZ is given below, ordered by SEA environmental topic. These sensitivities and indicators have the potential to be impacted by and impact upon the development and/or operation of tidal energy.

Biodiversity, Flora and Fauna

There are no designated sites (SACs, SPAs, Ramsar sites, MCZs, ASSIs) within the recommended RZ. Rathlin Island SAC, SPA, MCZ, and Rathlin Island Coast ASSI are situated c.400m to the north-west of the recommended RZ and are within the tidal excursion zone. Red Bay SAC (designated for Sandbanks, c.4.5km south) is also within the tidal excursion zone, while Antrim Hills SPA is c.2km inshore of the recommended RZ, and Fair Head and Murlough Bay ASSI is c.0.6km inshore. There are TCE High MPA risk areas for Marine Mammals and Breeding Birds, and Moderate MPA risk areas for Fish, within the recommended RZ (based on the risk models for fixed and floating wind, and cables).

There are areas of Annex I Reef habitat within the recommended RZ, and the tidal excursion zone, and areas of Annex I Sandbank, Sea Caves and Maerl habitats within the tidal excursion zone to the north-west and south-east of the recommended RZ. The seabed habitats within the recommended RZ predominantly consist of coarse substrate, with areas of rock or other hard substrate.

There are records of NI Protected species (Wildlife Order), including the marine mammals: harbour porpoise, minke whale, orca, and bottlenose dolphin; and birds: grey heron, black-tailed godwit, dunlin, Eurasian whimbrel, golden plover, greenshank, goldeneye, red-throated diver, whooper swan, common scoter, Arctic tern, common tern, and roseate tern within the recommended RZ. There are records of NI Priority species, including the marine mammals: harbour porpoise, minke whale, orca, and bottlenose dolphin; and birds: bar-tailed godwit, black guillemot, black-headed gull, curlew, common eider, herring gull, black-legged kittiwake, oystercatcher, razorbill, redshank, Arctic skua, black-tailed godwit, dunlin, grey plover, Atlantic puffin, whimbrel, golden plover, great skua, red knot, long-tailed duck, and roseate tern. The marine mammals: harbour porpoise, orca, bottlenose dolphin; and birds: black guillemot, common eider, red-throated diver, and common scoter are also PMF species. Harbour porpoise, black-legged kittiwake, and roseate tern are also OSPAR Threatened/Declining species.

There are areas of SCANs recorded relatively high density for pilot whale, and fin whale, and areas of relatively moderate density for white-beaked dolphin, pilot whale, bottlenose dolphin, and beaked whale within the RZ. MU data also indicates that the cetaceans white-sided dolphin, white-beaked dolphin, Risso’s dolphin, minke whale, harbour porpoise, common dolphin, and bottlenose dolphin may occur within the area. There are also areas of relatively high and moderate density for grey seal and harbour seal within the recommended RZ.

There are no areas of recorded relatively high density for seabirds at sea within the recommended RZ. Rathlin Island, c.1km distant at its closest point to the RZ, is an SPA, MCZ, IBA and RSPB Reserve, while Antrim Hills SPA and IBA are c.2km distant at the closest point.

There are spawning grounds for sprat and Nephrops within the recommended RZ and the tidal excursion zone. There are nursery grounds for Nephrops, spurdog, anglerfish, cod, common skate, hake, herring, and mackerel within the recommended RZ and the tidal excursion zone. There is also an AFBI scallop surveyed area of relatively high density within the tidal excursion zone to the west of the RZ, and an AFBI surveyed area of relatively low density for queen scallop within the tidal excursion zone to the north. There are areas of restricted fishing within the RZ, for scallops under the Conservation of Scallops Regulations, and for the use of trawl and seine nets under the Inshore Fishing (Prohibition of Fishing and Fishing Methods) Regulations.

There are no records of invasive species within the recommended RZ.

Population and Human Health

The recommended RZ is located offshore of the settlement of Ballycastle. The inshore boundary of the recommended RZ is located approximately 3.7km north-east of Ballycastle.

The recommended RZ is located offshore of the Ballycastle and Cushendall Bathing Water Sites, and Ballycastle and Waterfoot Blue Flag Beaches. However, none of these sites are located within the recommended RZ or tidal excursion zone.

There are areas of relatively high intensity RYA leisure boating activity within both the northern and southern sections of the recommended RZ, off the coast of Torr Head and Ballycastle. There is higher leisure boating activity from Rathlin Island / Ballycastle to Belfast Lough and from small craft travelling between these areas. There are areas of higher intensity RYA leisure boating activity in proximity to the coastline, particularly offshore of Ballycastle.

There are no dive sites located within the recommended RZ, however, there are 35 within the tidal excursion zone.

Geology, Soils and Land Use

There are no WHSs, ASSIs, MCZs or UNESCO Geoparks designated for geology or geomorphology within the recommended RZ. Rathlin MCZ is within the tidal excursion zone; this site has been designated for being the only known location of the broad scale habitat, deep-sea bed in NI waters and for several subtidal geological/geomorphological features, including a submerged coastline, underwater caves, sea arches and lagoons, which indicate global sea-level change. Six ASSIs are also within the tidal excursion zone; Rathlin Island-Coast, Ballycastle Coalfield, Torr Head, Carey Valley, Fair Head and Murlough Bay, and Church Bay. Rathlin Island-Coast ASSI is designated for geological/geomorphological features including isolated sea cliffs, sea stacks, wave-cut platforms and geological exposures of columnar basalt rock. Ballycastle Coalfield ASSI is designated for its exposure of a coalfield sequence from Carboniferous sedimentary rocks, contemporary lavas and younger Tertiary igneous rocks. Torr Head ASSI is designated for metamorphosed Limestone of the Dalradian age and is of international importance for understanding other geological formations within NI and Scotland. Carey Valley ASSI is designated for its geological/geomorphological evidence of recent glacial history within NI and includes features of meltwater channels, glaciofluvial terraces, a flat-topped Gilbert type delta, and exposures of the Dalradian age Runabay Head Formation of the Southern Highland Group. Fair Head and Murlough Bay ASSI is designated for its tall cliffs and evidence of three rock classes present at the site. Church Bay ASSI is designated for its geological landforms of ridges composed of sand and gravel deposits, which are a unique geological feature for the island of Ireland.

The main seabed geology in the recommended RZ is diamict and undifferentiated quaternary deposits. Seabed thickness varies from <5m to 5–50m. The main seabed substrates of the recommended RZ consist of coarse substrate or rock or other hard substrata of predominantly moderate energy with an even distribution of shallow and deep circalittoral zones. There are some small areas of high energy. There are areas of Annex I Reef habitat within the recommended RZ and the tidal excursion zone.

There are no dumping grounds of spoil ground, explosives dumping grounds or MoD firing/danger areas within the recommended RZ.

Water

The water depths in the recommended RZ range from c.35-134m. Tidal speeds within the recommended RZ range from 0.49-1.49m/s.

There are no dumping grounds of spoil ground, explosives dumping grounds or MoD firing/danger areas within the recommended RZ.

There are no WFD Shellfish Waters within the recommended RZ or the tidal excursion zone. The Ballycastle Bathing Water site is located to the south-west of the recommended RZ. There are three WFD coastal waterbodies within the recommended RZ, Rathlin Island, North Channel, and North Coast, all of which were at moderate status in 2021, the same three WFD coastal waterbodies are within the tidal excursion zone.

The recommended RZ is located within the Celtic Seas sub-region for the MS (covering waters to the west of the UK and shared with RoI and France).

Air

There are no known air quality issues within the recommended RZ, as there are no significant anthropogenic sources of air pollution in the vicinity. The recommended RZ is located offshore of the settlement of Ballycastle, with the inshore boundary of the RZ approximately 3.7km north-east of this settlement.

There are areas of relatively high intensity RYA leisure boating activity within both the northern and southern sections of the recommended RZ, off the coast of Torr Head and Ballycastle. There is higher leisure boating activity from Rathlin Island / Ballycastle to Belfast Lough and from small craft travelling between these areas. Within the RZ, this vessel traffic intensity may cause some minor, localised, air emissions.

Climatic Factors

There are no known blue carbon habitats (Annex I Saltmarsh, Annex I Maerl, Shellfish Waters, Subtidal and Intertidal Seagrass) within the recommended RZ. There are areas in the western section of the RZ that have been identified by Ulster Wildlife as being of low potential for blue carbon importance. There are unlikely to be any sources of GHG emissions in the area, apart from vessels.

Material Assets

There is no existing infrastructure (cables, pipelines) located within the recommended RZ.

The western section of the recommended RZ, off the coast of Fair Head, is generally of moderate shipping density (>70th percentile). However, there is an area of higher shipping density (>90th percentile), and an area of lower shipping density (>50th percentile) in the north-west of this section of the recommended RZ. The higher density shipping areas in this section are likely associated with the Rathlin Island Ferry route and the Kintyre Express (Ballycastle to Campbelltown) route. The eastern Torr Head section of the RZ is of relatively low shipping density (<50th percentile). There are no TSSs within the recommended RZ. However, TCE and MCA recommend a 2nm buffer for TSSs and part of the recommended RZ is within this buffer from the North Channel TSS.

The recommended RZ is used by commercial fishing vessels, however there are no areas of relatively high (>90th percentile) or moderate (>70th percentile) fishing activity within the recommended RZ. Fleets that are known to operate within the recommended RZ include scallop, pot and Nephrops. There are no marine fish farms or aquaculture sites within the recommended RZ. Key fishing areas for mobile king scallop and queen scallop fisheries are located within the recommended

RZ. There is a known area of importance for inshore pot fisheries within the western Fair Head section of the recommended RZ, and to the north-west and south of the recommended RZ, within the tidal excursion zone. Known spawning and nursery grounds for Nephrops, and spawning grounds for sprat, encompass the entire recommended RZ. There are nursing grounds for spurdog, anglerfish, cod, common skate, hake, herring, and mackerel within the recommended RZ and the tidal excursion zone. Scallops have been recorded within the tidal excursion zone to the west, and queen scallops within the tidal excursion zone to the north, of the recommended RZ. There are two restricted fishing areas: for scallops under the Conservation of Scallops Regulations, and for the use of trawl and seine nets under the Inshore Fishing (Prohibition of Fishing and Fishing Methods) Regulations.

The recommended RZ is used by the MoD, with the Fair Head section of the recommended RZ being located within a c.8.9km² area of the Rathlin Military Practice Area (X5536), and the Torr Head section being located within a c.8.9km² area of the Torr Military Practice Area (X5528). Both areas are used as submarine exercise areas and surface fleet practice and exercise areas. There are no MoD danger areas within the recommended RZ.

There are no zones for aviation interference within the recommended RZ.

There are no spoil dumping sites located within the recommended RZ.

The north-east coast of NI has a developed tourist infrastructure that includes a number of coastal attractions that are within the modelled viewshed for tidal turbines within the recommended RZ. The Causeway Coast AONB, Antrim Coast and Glens AONB and five National Trust lands are located within the modelled viewshed. Potential tourist activities within the recommended RZ and the modelled viewshed include boat tours, water sports, sailing and fishing, and significant long-distance walking routes, such as the Causeway Coast Way, which offer significant attraction for tourism. Further information on landscape designations that may act as tourist attractions within the modelled viewshed of the area is provided in the Landscape, Seascape and Visual Amenity baseline.

The recommended RZ has a potential capacity of 0.89GW.

Cultural, Architectural and Archaeological Heritage

There are no protected wrecks within the recommended RZ. There is one recorded wreck within the recommended RZ, and 23 additional wrecks within the tidal excursion zone.

The recommended RZ is situated between c.0.5km and c.5km distance from the coastline. There are 170 Listed Buildings (particularly in Ballycastle), 16 Defence Heritage Record sites, 359 Scheduled Monuments (particularly in Ballycastle), 38 Scheduled Zones, and one Registered Parks and Gardens (Manor House Rathlin) situated inshore of the recommended RZ or on the shoreline of the nearby Rathlin Island that are within the modelled viewshed (based on a buoy height of 3m and a viewable distance of 10km).

Landscape, Seascape and Visual Amenity

The recommended RZ is situated between c.0.5km and c.5km distance from the coastline. There are two settlements situated inshore of the recommended RZ that are within the modelled viewshed (based on a buoy height of 3m and a viewable distance of 10km), Church Bay and Ballycastle.

The Causeway Coast AONB, Antrim Coast and Glens AONB, and five National Trust lands (Carrick a Rede, Cushleake Mountain, Fairhead and Murlough Bay, Loughan Bay and Portaleen Bay, Rathlin Island) are situated inshore and offshore (Rathlin Island) of the recommended RZ and are within the modelled viewshed. The Fairhead and Murlough Bay, Loughan Bay and Portaleen Bay, and Cushleake Mountain National Trust Lands are also situated inshore. The recommended RZ is within the Ballycastle Coast, Rathlin, Torr Head Coast, and North Channel RSCAs.

Environmental Assessment	Short-term	Medium-term	Long-term
Biodiversity, Flora and Fauna (BFF)	-3	-3	-3
Population and Human Health (PHH)	-2	-2	-2
Geology, Soils and Land Use (GSL)	-3	-3	-3
Water (W)	-3	-3	-3
Air (A)	0	+2	+2
Climatic Factors (CF)	-1	+2	+2
Material Assets and Infrastructure (MA)	-3	-3 / +2	-3 / +2
Cultural, Architectural and Archaeological Heritage (CH)	-2	-2	-2
Landscape / Seascape and Visual Amenity (L)	-2	-2	-2

Key Conclusions:

Biodiversity, Flora and Fauna – There is potential for significant adverse effects on Biodiversity, Flora, and Fauna in the short-term construction and decommissioning phases, for benthic habitat, as Rathlin Island SAC, Rathlin Island MCZ, and Red Bay SAC, are within the tidal excursion zone. There is also potential for moderate adverse effects in the short-term construction and decommissioning phases, and the medium to long-term operational phase (-2) for benthic habitats and species, fish and shellfish, marine mammals and birds, owing to interaction with TCE Moderate to High MPA risk areas for Fish, Marine Mammals and Breeding Birds; location of Rathlin Island SPA in proximity and within the tidal excursion zone; presence of known fish spawning and nursery grounds and scallop grounds; areas of known high and moderate density for marine mammals and seabirds at sea; and records of protected and priority species within the area.

Population and Human Health – There is potential for moderate adverse temporary, direct and indirect, effects on leisure and recreational marine users due to an increased collision risk, access restrictions and displacement, or water quality effects, during the construction and decommissioning phases due to known relatively high use of the area by leisure vessels (-2). There is also potential for moderate adverse direct or indirect effects on these users in the medium to long-term during the operational phase (-2). This is due to known relatively high use of areas within the recommended RZ by recreational and leisure vessels.

Geology, Soils and Land Use – There are seven sites designated for geological or geomorphological features within the tidal excursion zone, with potential for significant adverse indirect long-term effects on Geology, Soils and Land use due to the potential for adverse indirect effects on designated features (-3). There is potential for moderate direct temporary to permanent effects on Annex 1 Reef habitats due to loss or damage during the construction and decommissioning phases (-2). Following the installation of tidal technologies there is potential for medium to long-term operational phase localised effects on erosion and deposition patterns due to the presence of devices (-2). There is potential for influence on the MS Descriptor 6 sea floor integrity from the installation processes of tidal technologies in the recommended RZ, however, there is not anticipated to be potential for adverse effects on the achievement of GES. Generally, there is potential for direct short-term, temporary sediment loss in the vicinity of the construction works during seabed preparation activities, construction and decommissioning activities (-1), and medium to long-term loss within the footprint of foundations and scour protection during device operation (-2).

Water – There is potential for significant adverse short-term construction and decommissioning phase, and long-term operational phase effects on water quality with three WFD coastal waterbodies within the recommended RZ and the tidal excursion zone (-3). There is also potential for moderate adverse direct and indirect short-term effects on one Bathing Water site located to the south-west of the recommended RZ during seabed preparation, construction and decommissioning activities (-2). There is also potential for slight short-term effects on water quality elements that are considered by the MS (e.g., Descriptor 9 Concentrations of contaminants in fish and other seafood; Descriptor 8: Concentration of contaminants within marine environment; Descriptor 10 marine litter) during seabed preparation, construction, maintenance and decommissioning activities (-1); there is not anticipated to be potential for adverse effects on the achievement of GES with the application of standard best practice mitigation.

Air – There is potential for moderate positive indirect effects on regional air quality in the medium to long-term operational phase, as the operation of renewable energy devices can support a transition away from fossil fuel use and its associated air emissions, with potential for a relatively moderate capacity in the recommended RZ (+2).

Climatic Factors – There is potential for slight adverse short-term effects on sediment carbon storage, due to a localised release of CO_2 from seabed disturbance during the construction and decommissioning phases (-1). There is potential for slight adverse, short-term, temporary effects on localised GHG concentrations, due to GHG emissions from vessels and machinery during the construction and decommissioning phases (-1). At the project level, emissions of air pollutants should be minimised through adherence to standard best practise for the minimisation of air pollution, as set out in **Section 10.1**.

There is potential for moderate positive, medium to long-term effects during the operational phase, as the operation of renewable energy devices can contribute to a net reduction in GHG emissions, decarbonisation of the energy sector, diversification of electricity supply and energy security, and meeting of energy objectives and climate change emission reduction targets, with potential for a relatively moderate capacity in the recommended RZ (+2).

Material Assets – Overall, there is considered to be potential for significant adverse effects in the short, medium, and long-term on Material Assets (-3), following the consideration of best practice mitigation measures, which is mainly attributed to the potential for significant adverse effects on Shipping and Navigation, and moderate effects on Commercial Fisheries.

Given the presence of the relatively higher density shipping area within the east of the recommended RZ, there is the potential for significant direct navigational risk and displacement effects in the short, medium, and long-term (-3). This is owing to the potential displacement of vessels during construction/decommissioning (short-term) and operation (medium to long term) phases, as well as potential for significant adverse direct and indirect effects on navigation and communications in all phases and is also due to the location of the recommended RZ within a 2nm buffer of the North Channel TSS.

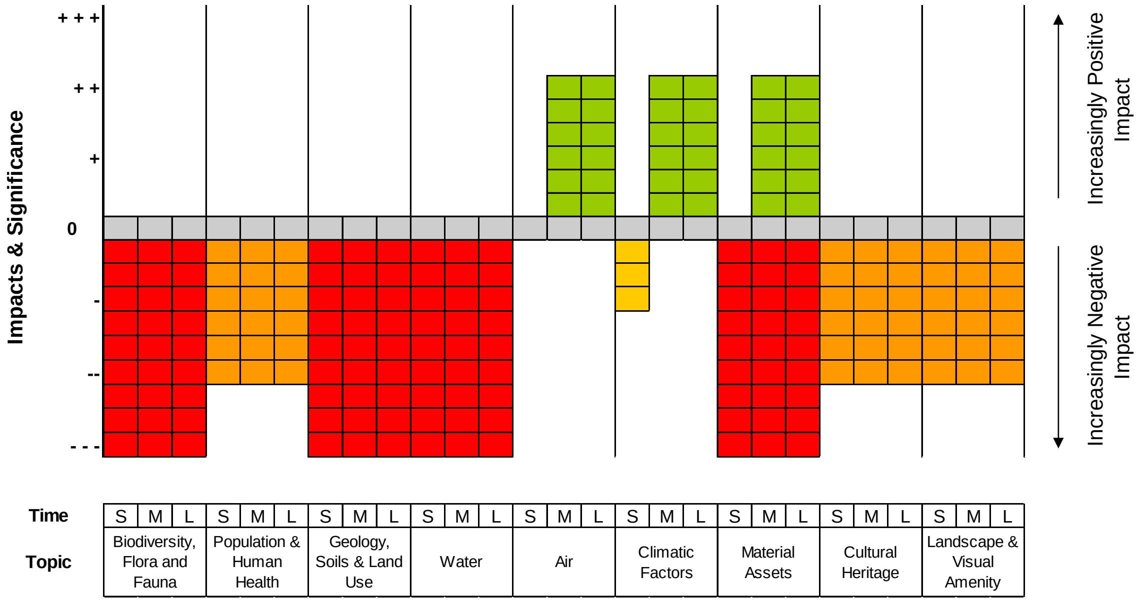
Although the recommended RZ has relatively low fishing intensity, there is potential for moderate adverse indirect effects on the profitability of commercial fishing in the short, medium, and long-term (-2), such as the potential for reduced quotas, increased resource competition for fishing, and reduced landings in both tonnage and economic value. This is owing to the combination of potential slight adverse effects including: potential displacement from shipping grounds in the short, medium, and long-term; potential for increased collision risk associated with the presence of construction and decommissioning vessels (short-term), and the presence of maintenance vessels and displacement from fishing grounds (medium to long-term); as well as effects on commercial fish species and their key habitats due to direct loss of supporting habitats, and indirect effects due to sediment mobilisation; all of which could indirectly affect fishing activity through an alteration of commercial fish stocks.

There is potential for moderate positive effects in terms of the generation to new renewable energy supply for the NI population in the medium- to long-term, as the recommended RZ has a potential capacity of 0.89 GW (+2).

Cultural, Architectural and Archaeological Heritage – There is potential for slight to moderate adverse effects on Cultural Heritage in the short-term construction and decommissioning phases, and the medium to long-term operational phase (-1 to -2) owing to the high sensitivity of coastal heritage receptors whose setting may be affected, and the close distance to shore. Tidal stream devices are expected to be primarily submerged, with the significance of any effects influenced by the need for markings such as buoys, or other ancillary infrastructure.

Landscape, Seascape and Visual Amenity – There is potential for moderate adverse effects on Landscape, Seascape and Visual Amenity in the short-term construction and decommissioning phases, and the medium to long-term operational phase (-2) owing to the close distance of the recommended RZ to shore and the high sensitivity of the landscape areas that may be affected, including Causeway Coast AONB, and Antrim Coast and Glens AONB. Tidal stream devices are expected to be primarily submerged, with the significance of any effects influenced by the need for markings such as buoys, or other ancillary infrastructure. Should a tidal stream development include the need for associated infrastructure such as an above sea substation, there is greater potential for significant effects on the landscape and seascape.

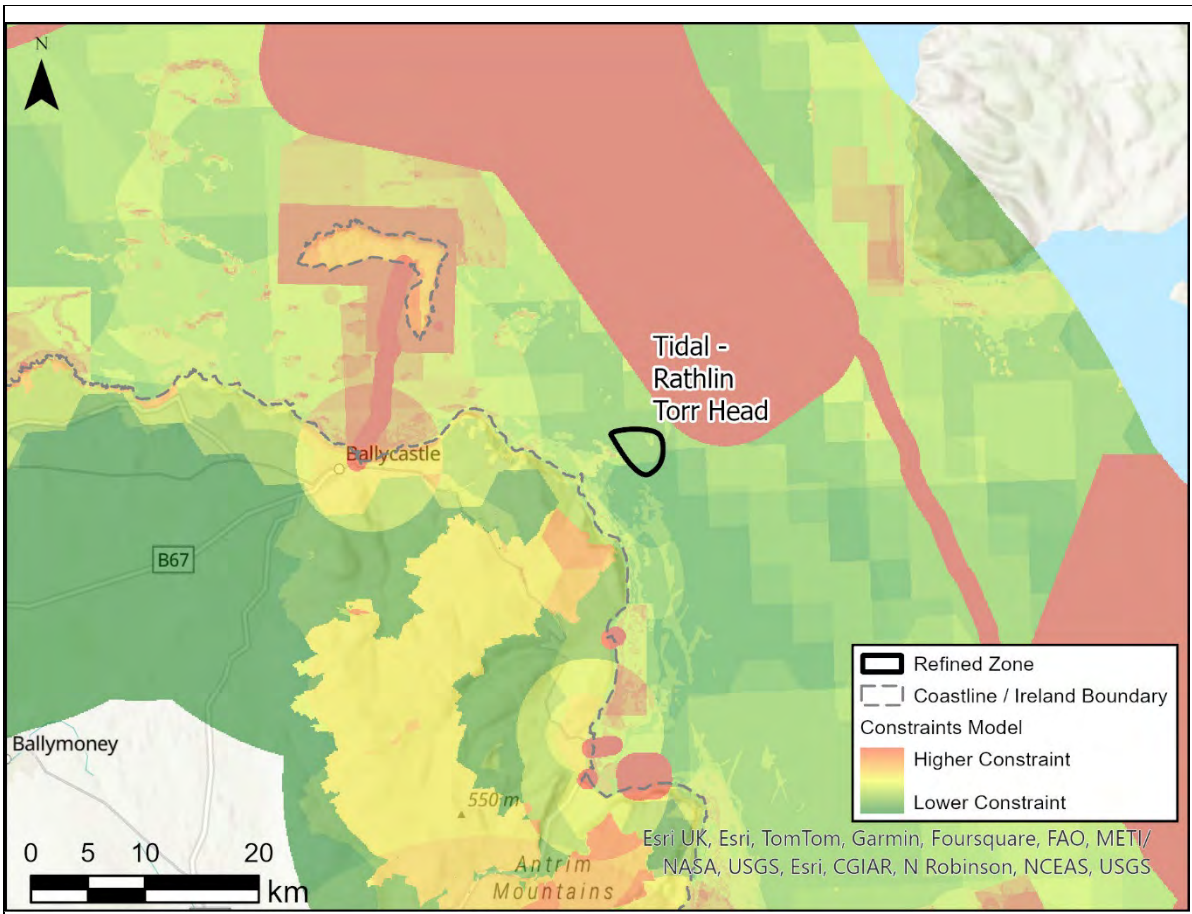
Summary Chart of Potential Effects



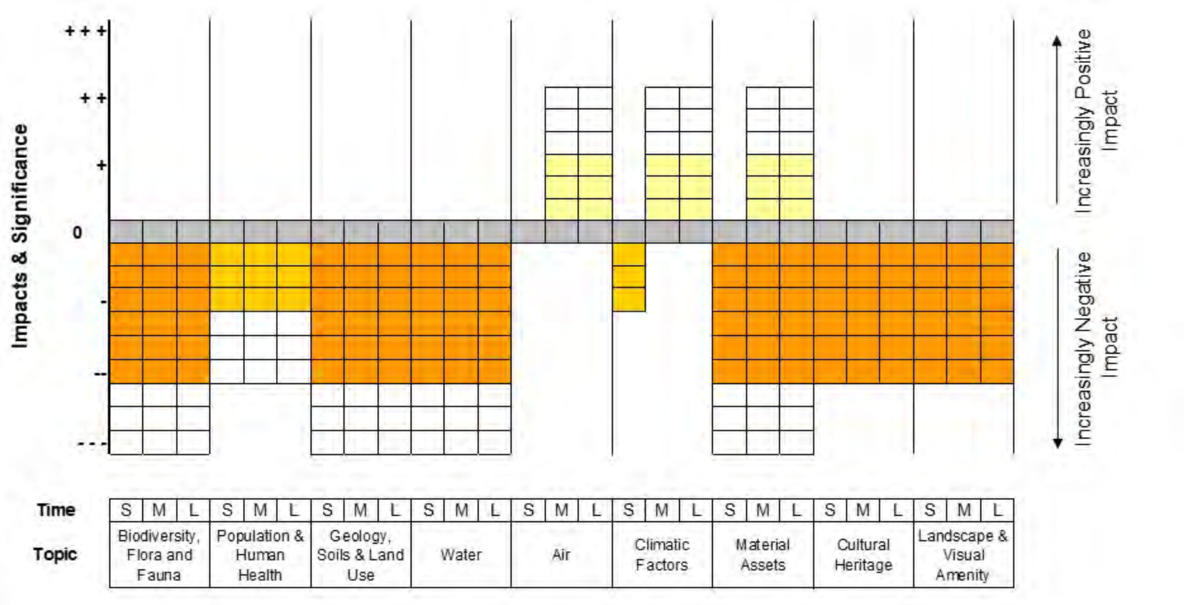
Recommendations for Refinement:

Refinement of the Tidal Rathlin Torr Head RZ is recommended to avoid Red Bay SAC, Rathlin Island SAC, SPA, and MCZ being within the tidal excursion zone, which can reduce the overall score for BFF to -2. Avoidance of designated sites within the tidal excursion zone can also reduce the overall score for Geology, Soils, and Land use to -2, while avoidance of the WFD Coastal water bodies of Rathlin Island, North Channel, and North Coast can reduce the overall score for Water to -2. Further refinement to avoid areas of higher density shipping, the 2nm buffer of the North Channel TSS and areas of importance for inshore fisheries, is recommended to reduce the potential for adverse effects on Material Assets, and the overall score to -2. Refinement would also reduce the potential for renewable energy generation, thus reducing the medium to long-term positive score to +1. It is also recommended to avoid the areas of known high use by leisure vessels, reducing the score for Population and Human Health to -1. No refinement is recommended at this stage based on the potential for visual effects; the score for Cultural Heritage remains as -1 to -2, depending on the infrastructure required, owing to the sensitivity of heritage receptors, and the score for Landscape, Seascape and Visual Amenity remains as -2 owing to the sensitivity of landscape receptors (AONBs) and proximity to shore.

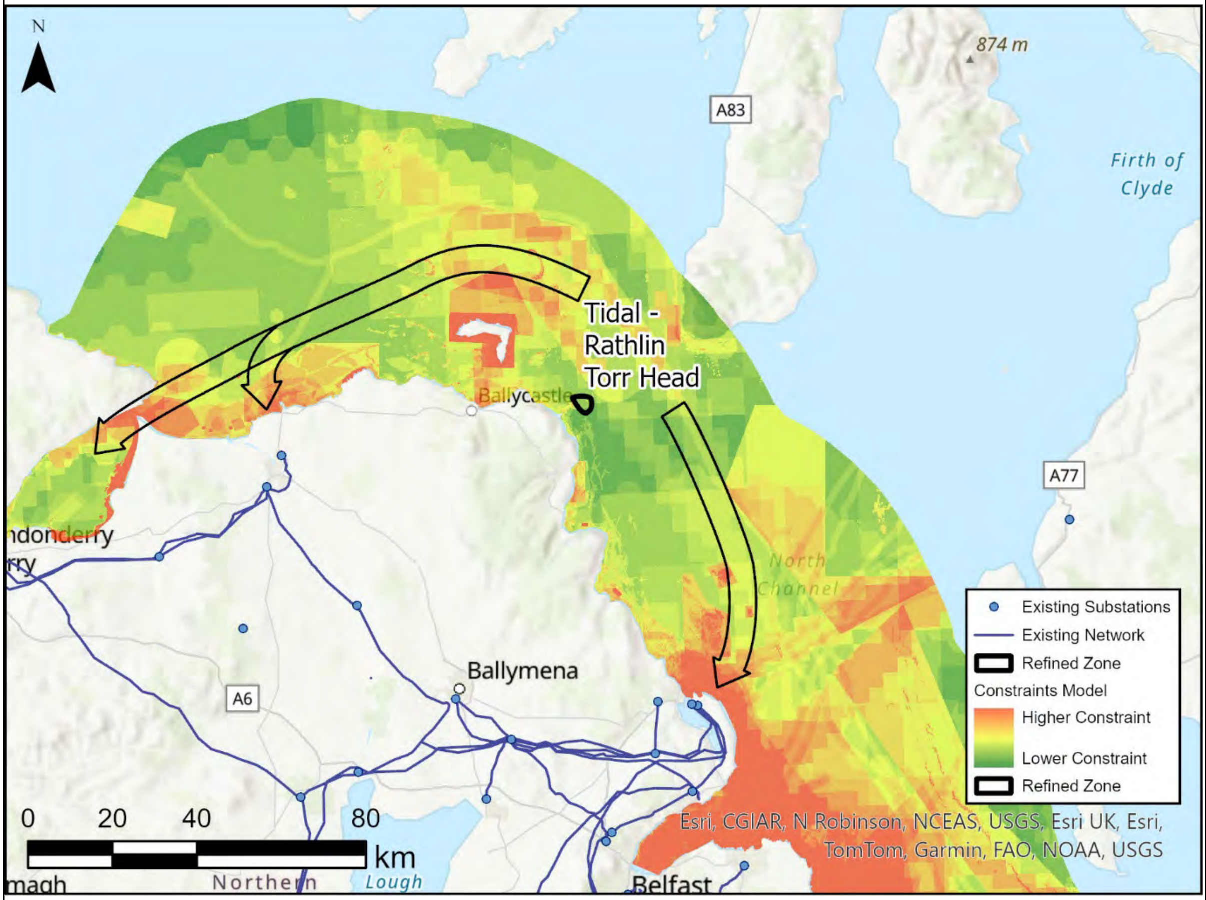
The theoretical energy potential of the refined Tidal Rathlin Torr Head RZ is 0.15GW.



Comparative Chart



Potential Export Cable Routes



Connection into Larne area. 275kV/110kV existing network. Length approx. 44km.

Significant likely constraints include the East Coast Marine pSPA, telecommunication cables, Brown's Bay Bathing Water Site, Portmuck Bathing Water Site, Offshore Rock, Annex I Reef, and Port Lands around Larne. There are several designated sites within the vicinity including the North Channel SAC, The Maidens SAC, Larne Lough SPA/Ramsar/IBA, and Portmuck ASSI; however, these can all potentially be avoided.

Connection into Coleraine area. 110kV existing network. Length approx. 66km.

Significant likely constraints include areas of Annex I Sandbanks and a telecommunication cable. Other constraints which can potentially be avoided include protected wrecks, cliffs over 15m, Urban Areas and environmental designations including Bann Estuary SAC, Skerries and Causeway SAC, Rathlin Island SAC/SPA, Rathlin MCZ, Bann Estuary ASSI, Portrush West Strand ASSI, Ramore Head and Skerries ASSI, Binevenagh AONB and Causeway Coast AONB.

Connection into Derry / Londonderry area. 275kV/110kV existing network Length approx. 100km.

Significant likely constraints include the Lough Foyle and River Foyle IBA, North Channel TSS, a telecommunication cable and Pilot Boarding Stations. Other constraints which can potentially be avoided include Magilligan SAC/ASSI, Rathlin Island SAC/SPA, Rathlin MCZ, Lough Foyle SPA/Ramsar/ASSI, Binevenagh AONB, Magilligan Military Area, Urban Areas, Derry Airport / Ballarena Airfield and Lough Foyle RSPB Reserve.

9.3 Cumulative/In-Combination Development Effects

9.3.1 Cumulative/In-Combination Effects of ORE Development

The sections below and **Figure 9-4** demonstrate the identified areas where independent projects could interact at construction stage and/or in the long-term operational stage, and where there is the greater potential for in-combination or cumulative adverse effects, which would need to be taken into consideration at the detailed project planning and design stage.

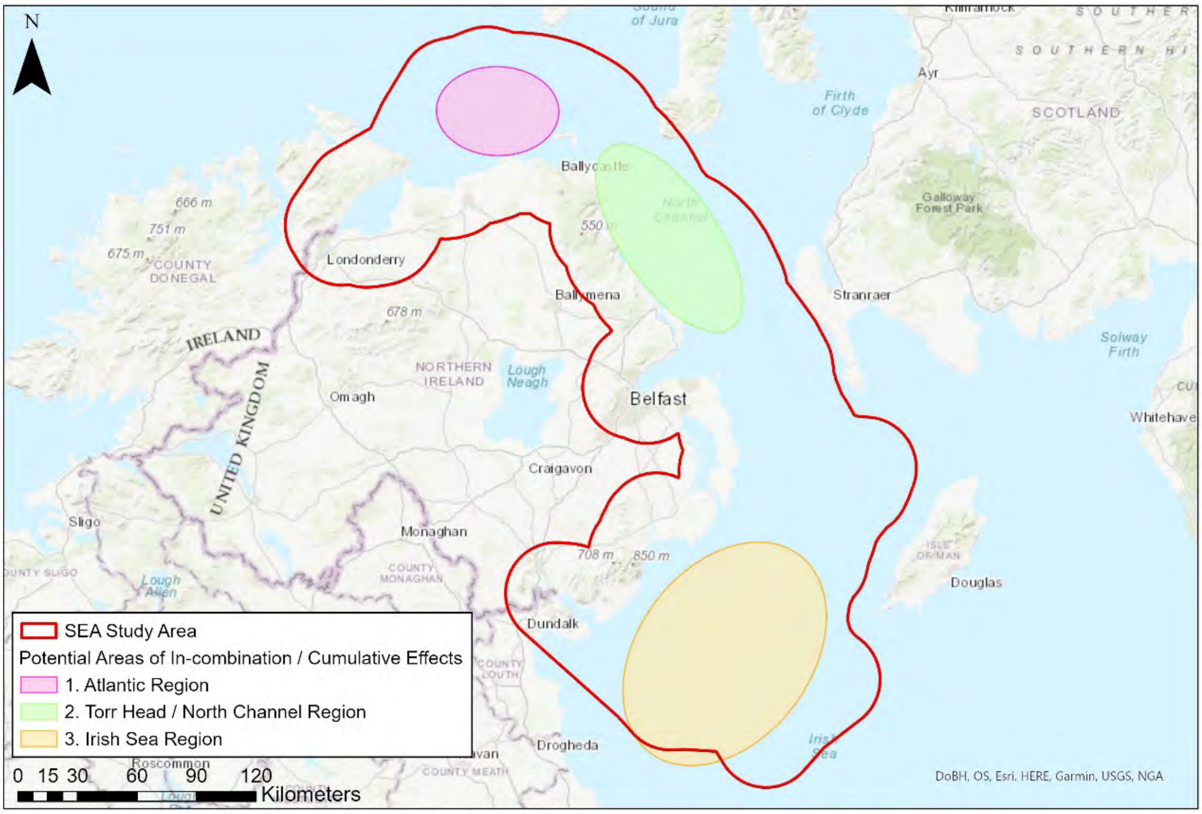


Figure 9-4 Potential Areas of In-Combination and Cumulative Impacts

9.3.2 Atlantic Area

Fixed and Floating recommended RZs in the Atlantic area would be mutually exclusive, while the development of tidal technologies within the Tidal Atlantic recommended RZ could occur alongside fixed or floating wind technologies in adjacent areas. Should leasing areas be identified and awarded by TCE within the Atlantic Fixed, Atlantic Floating, and Atlantic Tidal recommended RZs, there is potential for an increased displacement and collision/injury risk for marine mammals, seabirds and fish.

There is also potential for in-combination or cumulative effects of ORE development with renewable energy development that are in planning within adjacent territorial waters. The Malin Sea Wind project (owners ESB Wind Development Ltd., CATAGEN and Dublin Offshore) is currently at concept/early planning stage and has been granted exclusive development rights for a 100MW floating wind project in Scottish waters off the north coast of NI[191] through TCE Scotland's Innovation and Targeted Oil and Gas (INTOG) seabed leasing process. There is the potential for a range of cumulative and in-combination short, medium, and long-term effects to arise locally if leasing areas are identified and awarded by TCE within the Fixed or Floating Wind Atlantic recommended RZs. These include the potential for construction phase increased disturbance and displacement, and collision risk for marine mammals, birds, and fish (including protected and priority species). There is potential for an increased

[191] TGS. 2024. 4c Offshore Wind Map. Available at: https://map.4coffshore.com/offshorewind/

displacement of commercial fishing activities and shipping, however, the Atlantic RZs are of relatively lower density for these activities in NI waters. There is also potential for temporary increased adverse effects on sensitive landscape areas (AONBs and WHSs) and the setting of coastal heritage features should construction work occur concurrently, as well as potential for medium to long-term increased adverse effects on landscape (including sensitive landscape areas of WHSs and AONBs) and visual amenity, and the setting of coastal heritage features along the northern coastline during operation of the wind farms.

9.3.3 Torr Head/North Channel Area

There is the potential for a range of cumulative and in-combination impacts to arise locally if leasing areas are identified and awarded by TCE within the Floating Rathlin Torr Head, Tidal Rathlin Torr Head, and Floating North Channel recommended RZs. These RZs are not mutually exclusive, as floating wind could be leased within the Floating Wind RZ in adjacent areas, and further offshore from the Tidal RZ in the Rathlin Torr Head area, while North Channel Floating Wind RZ is located further to the south. There is the potential for a range of cumulative and in-combination impacts to arise locally if leasing areas are identified and awarded by TCE within these recommended RZs. These include the potential for direct and indirect adverse effects on Annex I Reef habitat and indirect effects on Rathlin Island designations within the tidal excursion zones (for Rathlin Floating Wind and Tidal RZs), an increased displacement and/or adverse effects on the supporting habitats of protected and priority fish and shellfish, increased disturbance, displacement and collision/injury risk for marine mammals, fish and seabirds, and an increased risk of invasive species introduction and/or spread. There is also an increased potential of navigational risk and displacement of commercial shipping and fishing vessels within this area, as well as recreational and leisure vessels in the inshore area, during construction and operation. There is potential for temporary increased adverse effects on sensitive landscape areas (AONBs) and the setting of coastal heritage features should construction works occur concurrently within these RZs, and potential for medium to long-term increased adverse effects on landscape (including sensitive landscape areas of AONBs) and visual amenity, and the setting of coastal heritage features along the coastline of this region, during operation of ORE projects within these RZs. There is also potential for a localised increase in air emissions (air pollutant and GHG emissions), and effects on water quality in the short-term during construction and decommissioning phases.

Regarding other known plans or projects in this general area, the LirIC Interconnector Project plans to develop a new HVDC sub-sea electricity connector between the Belfast region in NI and the Ayrshire region in Scotland. When complete, it should provide up to 700MW of further capacity between the Irish Integrated Single Energy Market (I_SEM) and the GB wholesale electricity market. There is the potential for a range of cumulative and in-combination impacts to arise locally if leasing areas are identified and awarded by TCE within the North Channel Fixed Wind recommended RZ and works occur concurrently with this project. These include the potential for construction phase increased disturbance and displacement, and collision risk for marine mammals. fish and birds (including protected and priority species), loss or damage of Annex I Reef habitat, and fish spawning and nursery habitat loss or damage, sedimentation, and smothering effects and via impacts on water quality. There is also an increased potential of navigational risk or displacement of shipping and commercial fisheries, as well as leisure vessels in the inshore area, during construction, and for temporary increased adverse effects on sensitive landscape areas (AONBs) and the setting of coastal heritage features.

9.3.4 Irish Sea Area

There is the potential for a range of cumulative and in-combination impacts to arise locally if leasing areas are identified and awarded by TCE within the Fixed Mourne Lecale, Fixed Irish Sea Inshore, Fixed Irish Sea Offshore, Floating Irish Sea Inshore, or Floating Irish Sea Offshore recommended RZs. The Fixed Irish Sea Inshore and Floating Irish Sea Inshore RZs overlap for much of their area, and the Fixed Irish Sea Offshore and Floating Irish Sea Offshore RZs for part of their area; aside from this, these RZs are not considered to be mutually exclusive. These include the potential for direct and indirect adverse effects on Annex I Reef habitat and indirect effects on the Pisces Reef Complex SAC within the tidal excursion zones (for Fixed Irish Sea Inshore and Floating Irish Sea Offshore RZs), an increased displacement and/or adverse effects on supporting habitats of protected and priority fish and shellfish and areas of importance as spawning and nursery grounds, increased disturbance, displacement and collision/injury risk for marine mammals, fish and seabirds, and an increased risk of invasive species introduction and/or spread. There is an increased potential of navigational risk and displacement of commercial fisheries from areas of significant importance in NI waters. There is also an increased potential of navigational risk and displacement of vessels from areas of relatively high density for commercial shipping in the inshore and offshore waters, and for recreational and leisure vessels in the inshore area between the Fixed Mourne Lecale and Fixed/Floating Irish Sea Inshore RZs. There is potential for temporary increased adverse effects on sensitive landscape areas (AONBs) and the setting of coastal heritage features should construction works occur concurrently within these RZs, and potential for medium to long-term increased adverse effects on landscape (including sensitive landscape areas of AONBs) and visual amenity, and the setting of coastal heritage features along the coastline of this region, during operation of ORE projects within these RZs. There is also potential for a localised increase in air emissions (air pollutant and GHG emissions), and effects on water quality in the short-term during construction and decommissioning phases.

There is also potential for in-combination or cumulative effects of ORE development with renewable energy development that are in planning within adjacent territorial waters. In the south-east, there are several offshore wind projects in the concept of early planning stages off the Louth and Dublin coasts in RoI, including Oriel, Clogherhead and North East Wind and, further south, the North Irish Sea Array (Statkraft, 500MW), which was one of four winning bids in the first RoI offshore wind auction in 2023. There is the potential for a range of cumulative and in-combination short, medium, and long-term effects to arise locally if leasing areas are identified and awarded by TCE within the Fixed Mourne Lecale, Irish Sea Inshore, or Irish Sea Offshore, or Floating Irish Sea Inshore or Irish Sea Offshore recommended RZs and works occur concurrently with these projects. These include the potential for construction phase increased disturbance and displacement, and collision risk for marine mammals, fish and birds (including protected and priority species), and an increased displacement of commercial fishing activities and shipping. There is also potential for temporary increased adverse effects on sensitive landscape areas (AONBs) and the setting of coastal heritage features should construction work occur concurrently, and potential for medium to long-term increased adverse effects on landscape (including sensitive landscape areas of WHSs and AONBs) and visual amenity, and the setting of coastal heritage features along the coastline of County Down in NI, and County Louth in RoI, during operation of the wind farms.

9.4 Assessment of OREAP Objectives and Actions

The Key Objectives and Actions of the OREAP have been considered with regard to their compatibility or potential for effects on SEA Objectives in **Table 9-1**. A positive score (+) reflects the potential for an Action to positively affect the Objective for that SEA topic, a negative score (-) reflects the potential for an Action to have a negative effect, and a neutral score (/) indicates a neutral effect or no expected potential for interaction. A neutral score does not mean that an Action and SEA Objective are in conflict, it only demonstrates where an Action and an SEA Objective are not similar, or where the Action will not have any direct effect (e.g., involves consultation or guidance).

Table 9-1 Assessment of Key Objectives and Actions of the OREAP

Key Objective	Actions	SEO								
		BFF	PHH	GSL	W	A	CF	MA	CH	L
Theme A: Sustainability and Co-existence										
Update the 2012 SEA and HRA of Offshore Renewable Energy in the NI Marine Area.	A1 Procure external consultants to conduct SEA/HRA update of offshore renewable energy in the NI marine area.	+	+	+	+	+	+	+	+	+
Align offshore renewable energy policy with marine-related environmental policy.	A2 On an ongoing basis, DfE will liaise with DAERA and TCE to ensure that offshore renewable energy policy remains aligned with marine-related environmental policy including, but not exclusively, the developing NI Marine Plan, Biodiversity Strategy and Blue Carbon Action Plan.	+	+	+	+	+	+	+	+	+
Deliver a wide stakeholder engagement forum.	A3 Establish and regularly engage with a group of wider stakeholders representing those that live close to, work in or otherwise use the marine environment.	+	+	+	+	+	+	+	+	+
Theme B: Enabling Frameworks										
Establish a decommissioning regime for NI.	B1 Consult on policy options for a decommissioning regime for offshore renewable energy installations in NI.	/	/	/	/	/	/	/	/	/
Prioritise and streamline the process for licensing and consenting.	B2 Establish a Memorandum of Understanding between DfI/DAERA/DfE to ensure that offshore renewable energy projects are prioritised and where possible, departments coordinate and communicate to progress applications expeditiously.	/	/	/	/	/	/	/	/	/

	B3 Publish guidance on consenting regimes and marine boundaries for offshore wind projects in NI.	/	/	/	/	/	/	/	/	/
Deliver an offshore wind leasing round for NI.	B4 Undertake spatial characterisation work in parallel with DfE work to update SEA/HRA.	+	+	+	+	+	+	+	+	+
	B5 Commence design of future leasing for offshore wind.	+	+	+	+	+	+	+	+	+
Theme C: Electricity Network										
Facilitate current and planned work and consider strategic network requirements to deliver the NI offshore wind ambition.	C1 Establish a working group to consider offshore transmission arrangements and related grid development, including options for offshore connections under existing processes and the options out to 2050 to inform policy direction.	/	/	/	/	/	/	/	/	/
	C2 Determine the quantity of offshore capacity that will be targeted in the short, medium, and long term.	/	/	/	/	/	/	/	/	/
Implement a cost effective and efficient offshore transmission connection and operation framework.	C3 SEA/HRA commissioning to incorporate strategic environmental considerations of offshore infrastructure.	+	+	+	+	+	+	+	+	+
Theme D: Economic Growth										
Provide a visible route to market	D1 Consult on a renewable electricity support scheme for NI.	/	/	/	/	/	/	/	/	/
	D2 Publish a Statement of Intent with TCE.	/	/	/	/	/	/	/	/	/
Support development of a skilled workforce for offshore wind and related areas.	D3 Develop policy around schemes and awareness campaigns to bring forward the skills and workforce for offshore wind.	/	/	/	/	/	/	/	/	/
	D4 Establish linkages between colleges, universities, and industry to train a	/	/	/	/	/	/	/	/	/

	workforce and address skills shortages.									
Enable NI's businesses and economy to maximise the benefits of offshore wind.	D5 Determine policy approach to maximise local content in the offshore wind supply chain.	/	/	/	/	/	/	/	/	/
	D6 Facilitate greater collaboration within the NI supply chain that benefits everyone.	/	/	/	/	/	/	/	/	/
	D7 Develop policy to bring forward public and private sector collaboration with the purpose of achieving NI and UK offshore wind targets and maximising the benefits for NI.	/	/	/	/	/	/	/	/	/
	D8 Establish a working group to identify policy necessary to maximise potential use of offshore wind energy with low carbon technologies, including green hydrogen.	/	/	/	/	/	/	/	/	/
Theme E: Legislation and Regulation										
Bring forward necessary legislative and subsequent appropriate regulatory changes to enable the sustainable deployment of offshore renewable energy projects in NI.	E1 Establish any regulatory change necessary for offshore transmission arrangements.	/	/	/	/	/	/	/	/	/
	E2 Consider any regulatory changes necessary to enable the use of offshore wind energy with low carbon technologies, including green hydrogen.	/	/	/	/	/	/	/	/	/
	E3 Regularly review the legislative and regulatory framework to establish any gaps in provision.	/	/	/	/	/	/	/	/	/

10 MITIGATION AND MONITORING

10.1 Mitigation

Mitigation measures have been recommended where potential adverse effects on environmental topic areas have been identified from implementation of the OREAP. These mitigation measures aim to prevent, reduce and, as fully as possible, offset any significant adverse effects on the environment due to implementation of the OREAP. The mitigation measures that have been put forward in the OREAP and SEA processes will be included within the OREAP and will be undertaken in the course of its adoption, pending the outcome of a 12-week public consultation period.

10.1.1 General Mitigation

The iterative development of the OREAP and SEA, involving the mapping and modelling of constraints, including environmental constraints, and review and refinement in consultation with key stakeholders, has helped to focus the plan through the identification of lower constrained areas that can avoid the areas of highest environmental risk.

The principal SEA mitigation recommendation is that the predicted negative effects on the environment, identified in this report, should be considered further during the next stage of planning, refinement, and design for ORE projects, when the specifics of the development infrastructure options can be optimised through detailed feasibility studies and design in order to limit identified impacts on sensitive receptors.

At the project planning stage, further environmental studies based on the more detailed designs and construction methodologies should be undertaken as appropriate. These studies may involve, but are not limited to, marine and terrestrial ecology surveys, marine mammal surveys, ornithological and bat surveys, fish surveys, seascape, landscape and visual impact assessments, MCZ assessments, WFD assessments, geotechnical investigations and heritage surveys. Further Appropriate Assessment, to meet the requirements of the Habitats Directive, for the detailed designs and construction methodologies will be required at the project level, where potential impacts have been identified in this SEA and accompanying RIAA for the OREAP.

Before any works are carried out, detailed method statements and management plans (construction and environmental) should be prepared, detailing timing of works, information on the specific mitigation measures to be employed for each works area, and mechanisms for ensuring compliance with environmental legislation and statutory consents.

Contractors should be required to prepare Construction Environmental Management Plans (CEMPs), which would include a requirement for related plans to be prepared, as appropriate, for project implementation, such as Erosion and Sediment Control, Invasive Species Management, Emergency Response, Traffic and Safety Management, Dust and Noise Minimisation, and Stakeholder Communication Plans.

Works should only be carried out once the method statements have been agreed with competent authorities, such as the NIEA. At the project level it will not be sufficient to defer the production of construction method statements, these should be completed during the detailed design stage and may be subject to further Appropriate Assessment where potential impacts have been identified in this SEA and accompanying RIAA for the OREAP. Where there may be unavoidable impacts on protected habitats and/or species the necessary derogation licences should be applied for prior to seeking planning permission or approval for a project.

Marine construction work has the greatest potential for negative impacts during spawning/breeding and early nursery periods for aquatic and marine protected species. No marine works should occur during restricted periods for relevant species and consultation should be undertaken with the appropriate authorities in this regard.

Monitoring of project-level mitigation measures should be undertaken during and after works, to ensure effectiveness.

All works and planning of works should be undertaken with regard to all relevant legislation, licensing and consent requirements, and recommended best practice guidelines. An ecological clerk of works should be appointed for environmental management of each development, and where specific sensitive species may be impacted, an appropriate expert should also be appointed.

Biodiversity restoration and enhancement opportunities should be factored into the implementation of development projects, wherever possible.

The timing of construction and maintenance works should be planned to avoid any potential for negative cumulative impacts or inter-relationships with other schemes, plans or projects, yet look to optimise any potential positive cumulative impacts or inter-relationships.

10.1.2 Mitigation by Environmental Effect

Table 10-1 provides environmental effect specific mitigation measures that should be adopted within the project stage development of options from the OREAP to minimise the potential for any negative effects on the wider environment. These mitigation measures should be implemented and further developed through the next stages of more detailed design/feasibility and project level study.

Table 10-1 Proposed SEA Mitigation Measures

SEA Topic	Potential Impact	Proposed Mitigation
Biodiversity, Flora, and Fauna	Impacts on designated sites	Mitigation during the project planning phase to avoid designated areas for development. Screening for Appropriate Assessment where European Sites may be affected - all potential projects must ensure compliance with the requirements of the Habitats Regulations and Offshore Habitats Regulations (further mitigation is given in **Table 10-2** for European Sites). It is recommended MCZ assessments should be undertaken at the project-level where applicable. If designated sites cannot be avoided, suitable mitigation steps and technology types of low impact should be chosen.
	Direct damage to benthic habitats and species from preparation of device installation area and cable routes. Including potential for damage to shellfish or supporting fish species habitats.	Mitigation during the project planning phase through the avoidance of areas of benthic ecological importance, particularly areas where protected habitats and species are present. Where possible, the original sediment/habitats should be reinstated to facilitate natural restoration and habitat recolonisation.
	Direct loss of benthic habitats and sedentary species in footprints of installed foundations, hard cable protection and scour protection and associated infrastructure. Including potential for long-term loss of shellfish habitats and supporting fish species habitats e.g., spawning, foraging and nursery grounds, or damage to supporting habitats for other marine species. Indirect loss of benthic habitat through scour during operation.	Project planning mitigation should aim for installation in areas where non-sensitive habitats or species are present. Project mitigation measures should consider the creation of compensatory habitats for areas that are lost e.g., within inter-tidal areas, or the use of habitat enhancement such as developing population aggregation and refuge habitat areas, within the project planning phase. Mitigation to reduce impacts within periods of vulnerable life stages such as annual migrations or known spawning periods e.g., sprat spawning (May-Aug) and herring spawning (Aug-Sept) through reducing activity or avoidance of these areas during the construction phase within these periods. Where this cannot be avoided, construction timing should be well planned and works duration and invasive workings should be kept to a minimum in these areas. During project planning, the volume of rock used for cable armouring, pipeline protection and foundation scour protection should be planned as the minimum required, to minimise habitat loss. The use of scour protection around fixed structure foundations must be considered to reduce the effects of scour on benthic habitat and non-mobile species. Alternative measures

SEA Topic	Potential Impact	Proposed Mitigation
		for protection should be considered to minimise losses - this may include the use of alternative foundations (or those with a reduced seabed footprint). All potential projects must ensure compliance with the requirements of the Habitats Regulations and Offshore Habitats Regulations, and the Marine and Coastal Access Act 2009. DAERA Marine Wildlife Team should be consulted where supporting habitats of designated species could be adversely affected (damage, destruction or obstruction to habitats required for shelter or protection of species protected by Article 10 of the Wildlife Order is an offence; where impact cannot be avoided or mitigated, a licence may be required for operations).
	Indirect loss or damage to sensitive habitats and species in the vicinity of devices and cabling routes e.g., due to release of sediments (including contaminated sediments). Including potential for short-term indirect damage or smothering of shellfish habitats or fish spawning grounds, or alteration of foraging or social behaviours due to turbidity.	As above, project planning mitigation should aim for installation in areas where non-sensitive habitats or species are present. Areas of known potential contamination should be avoided. Risks to habitats and species should be avoided or minimised through project design and adoption of appropriate mitigation measures, such as careful route selection and use of suitable installation techniques. Mitigation during the project planning phase to avoid (or implement timing restrictions for) areas that may generate increased levels of suspended sediment (or use less disruptive installation methods e.g., plough installation) that coincide with areas of fish spawning grounds or sensitive species. Mitigation during the project planning phase through suitable modelling of hydrodynamic and sediment transport processes to assess potential effects and determine suitable mitigation to minimise effects within development areas. Sediment and erosion occurrence should be minimised through the development, implementation and enforcement of an Erosion and Sedimentation Control Plan (ESCP) for construction/decommissioning works.
	Effects of infrastructure colonisation: potential for long-term community alterations. Direct loss of benthic habitats and species if colonised device structures are removed at decommissioning.	Mitigation during the project planning phase should consider how potential alterations in community structure may impact wider ecosystem functioning and communities. Ecological survey work to inform project planning, and appropriate communication with environmental consultees. Mitigation measures during the project planning phase should consider the decommissioning activities that will be used, and whether removal of colonised structures, foundations or scour protection is required or could result in a double habitat loss (that from pre-construction and decommissioning periods). This will require a consideration of the lifecycles of materials used and the overall potential for degradation/release of toxic compounds.
	Introduction of non-native/invasive species.	At the project planning phase, pre- and post-construction surveys for invasive/non-native species should be undertaken in areas of known risk and, if found to be present, an Invasive Species Management Plan should be prepared and a Code of Good Practice, which outlines controls and/or removal measures to ensure that species are not spread during the project's construction or operation. Developers should be aware

SEA Topic	Potential Impact	Proposed Mitigation
		of the potential for offences in this regard under Article 15 of the Wildlife (NI) Order 1985 (as amended). Introduction of non-native species from vessels during construction, operation, and decommissioning should be mitigated through adherence to the objectives of the IMO International Convention for the Control and Management of Ships' Ballast Water and Sediments, which requires all ships to use a Ballast Water Management Plan, have a Ballast Water Record Book, an International Ballast Water Management Certificate, and conduct a ballast water exchange at least 200nm from the coast and in a water depth of at least 200m. A Biosecurity Plan should be adopted for the construction, maintenance and decommissioning for vessels involved, with strict cleaning of equipment and machinery and strict management protocols to combat the spread of invasive species.
	Adverse effects on habitats and species from pollution due to leakage of toxic compounds from devices.	Chemicals currently used in the renewable industry are similar to those from the oil and gas industry, which are controlled via the Offshore Chemical Notification Scheme reflecting the OSPAR Harmonised Mandatory Control Scheme also implemented by the Offshore Chemicals Regulations 2002. The chemicals deemed suitable for use are based on the CEFAS pre-screen, which considers hazards and an assessed Predicted Effect Concentration: Predicted No Effect Concentration as well as a requirement on reporting the chemical use and discharge to occur. Chemicals used are typically within closed systems minimising the risk of discharges. Any spills are required to be reported irrespective of size to the Coastguard, BEIS (now Department for Energy Security and Net Zero) or other relevant authorities (Petroleum Operations Notice No.1, PON1), applicable within NI waters from the Low Water Mark to the maximum extent of the UK Continental Shelf. At the project planning phase, further mitigation includes the use of low-toxicity and biodegradable materials in minimal quantities.
	Adverse effects on species due to EMF generation e.g., on benthic species, fish, marine mammals.	Risks currently associated with EMF generation for marine life are not considered to be significant at a population level, however, research has indicated that increased data is required for understanding anthropogenic EMF environmental standards. Accepted mitigation measures at the project planning phase include burying cables to a depth of 1-3m to isolate marine organisms from the very highest electric and magnetic fields. Cable configuration and orientation can also reduce the field strength of EMF generation. The need for further mitigation should be considered during project planning such as through identifying migratory routes and avoidance of placing EMF-generating cables within these areas to avoid potential barrier effects.
	Adverse effects on habitats and species due to alteration of hydraulics, hydrodynamics or sediment dynamics during device operation.	Mitigation during the project planning phase to ensure appropriate modelling of hydraulic regimes is undertaken and anticipated effects are assessed in relation to the presence of sensitive habitats and species within development areas.

SEA Topic	Potential Impact	Proposed Mitigation
		Avoidance of impacts on hydrodynamics or coastal processes with mitigation during the project planning phase to avoid development within shallow waters of <20m depth for wave and tidal devices. Mitigations for tidal energy extraction that should be considered at the project planning phase to reduce impacts on the physical environment and associated habitats include two-way operation, regular sluicing, and fish diversion.
	Adverse effects on species due to noise impacts during pre-construction (e.g., seismic surveys), device installation and decommissioning. Including injury, behavioural, physiological, disturbance or displacement effects on marine mammals, fish, and birds.	At the project planning phase, the use of alternatives to seismic surveys and powerful sonar surveys during deep water seismic survey planning should be considered, such as optimisation of airgun design and the attenuation of unwanted high frequencies, or the use of alternative sound sources such as marine vibroseis. It is important during project planning phases to have spatial and temporal considerations of other relevant simultaneous construction activities to minimise impacts. The use of trained Marine Mammal Observers (MMOs) before commencing seismic surveys is advisable with the use of Passive Acoustic Monitoring (PAM) if surveys are due to commence during hours of darkness or low visibility[192]. If marine mammals are observed, it is recommended that surveys do not commence for 20 minutes to allow mammal dispersal from the area via the MMOs and PAM system tracking the mammals. Whenever possible, UXO should be left in-situ or rendered harmless with disposal using low-noise methods that require the use of explosive material to effect clearance but in much smaller volumes compared to the donor charges required for high order detonation. All aim to render UXOs inert without resulting in a high order detonation (only the donor charge will detonate). There must be clear justification whenever such methods are not used, and high order detonation is required. Mitigation measures such as reducing noise emissions through modifications to offshore wind installation methods and careful planning to minimise the impact of the temporal and spatial overlap between marine mammals and construction activity. Regarding foundation and attachment of devices, technologies involving piling have a greater noise and vibration effect, and projects should aim to use other lower-impact technologies wherever possible. Alternative foundation types include vibratory pile driving, foundation drilling, gravity base foundations and bucket foundations. Noise modelling should be used by developers to predict noise levels from piling and to plan the mitigation needed to reduce noise levels to an agreed standard with relevant environmental consultees. Use of soft-start mitigation measures to induce an acoustic deterrent for marine mammals in the local area.

[192] JNCC, Natural England and Countryside Council for Wales. 2010. The protection of marine European Protected Species from injury and disturbance. Guidance for the marine area in England and Wales and the UK offshore marine area. Available at:https://assets.publishing.service.gov.uk/media/5dea1d35e5274a06dee23a34/Draft_Guidance_on_the_Protection_of_Marine_European_Protected_Species_from_Injurt_and_Disturbance.pdf

SEA Topic	Potential Impact	Proposed Mitigation
		Mitigation during project planning phases for construction and decommissioning to ensure that the number of vessels and noise generation on a cumulative basis is necessary for each phase of construction. Ensure management of vessel presence considers the necessity of each specific noise/vibration generation and, where possible, use noise abatement measures to reduce the input of anthropogenic noise.
	Collision risks for marine mammals, fish and birds with vessels and machinery during pre-construction, installation, and decommissioning.	Mitigation in the project planning phase to consider key areas of use and migratory routes, including through appropriate surveys and consultation with key stakeholders and groups. Relevant seabird tracking data registered on Birdlife International Seabird Tracking Database, https://data.seabirdtracking.org should be considered. Monitoring for the presence of marine mammals should occur using MMOs before the commencement of operations, and operations should only begin if there are none present e.g., within a mitigation zone of 1km. MMOs should be present onboard construction vessels to implement shutdown of works if marine mammals are identified. If marine mammals are observed, it is recommended works do not commence for 20 minutes to allow mammal dispersal from the area via the MMOs and PAM system tracking the mammals. The duration of the pre-search and mitigation zone depends on the activity, and additional passive acoustic monitoring systems may complement marine mammal observers. Further mitigation includes the enforcement of speed limits for installation, maintenance, and decommissioning vessels in areas of high marine mammal or fish species abundance. Mitigation with the use of a sound deterrent (at a volume less acoustically damaging than actual activity) or suitable harassment device e.g., a pinger, to induce an avoidance response by marine mammals or fish species to move away from the area during construction should be considered at all stages of development for all infrastructure being planned. Mitigation with temporal activity planning to shut down operations for construction and maintenance, with night-time considerations when birds are more vulnerable to collisions.
	Collision risks for birds, marine mammals, fish, and bats with devices during operation. Potential for entrapment or entanglement within submerged devices e.g., tidal and wave devices for marine mammals, fish, and diving birds.	During project planning for wind turbines, the key areas of bird habitats and migratory routes should be identified, including through the conduction of pre-construction surveys and consultation with environmental stakeholders, and development avoided within these areas, whenever possible. Relevant seabird tracking data registered on Birdlife International Seabird Tracking Database, https://data.seabirdtracking.org should be considered. Project mitigation should consider that collision risks are elevated whenever devices are sited closer to shore or near to bird population areas on-land. Mitigation during wind turbine height selection to avoid collisions within migratory bird flight pathways identified during pre-consent surveys. Mitigation for migratory birds can include aligning turbines parallel to the main migratory bird direction. The provision of corridors for migration/flight of up to a few kilometres within wind turbine developments can help to reduce collision risks.

SEA Topic	Potential Impact	Proposed Mitigation
		On-demand turbine shutdown can also be considered if birds are detected within a certain safety perimeter. Other forms of mitigation to reduce collision risks may include increasing device visibility e.g., using bird flight deflectors or bird warning spheres, the use of protective netting or grids for submerged turbines, or using acoustic or laser-based deterrents for fixed wind turbines. The quantity of cabling/submerged attachments used should be minimised to reduce risk for diving birds and marine mammals where possible for wind, tidal and wave devices. There is likely to be lower collision risks with narrow diameter and wide spacing of wind turbines (in comparison to tidal and wave devices), the degree of impact will depend on the specific design of device arrays and should be considered during project planning. During the project planning for wind turbines, mitigation should consider key areas of bat foraging habitats and migratory routes through surveys or consultation with key stakeholders and groups involved with bat conservation. During the project planning phase for tidal stream and wave technologies, the location, and array layout, should be considered to avoid or minimise the risk of collisions for marine mammals, fish and diving birds with turbines, devices, and attachment infrastructure. The quantity of cabling/submerged attachments used should be minimised to reduce risk. Sufficient clearance should be left between the blade tip of submerged turbines and the seabed to allow demersal and benthic species to pass under the device safely, and sufficient clearance should be left between the blade tip and sea surface to allow pelagic species to pass over the device. Mitigation against mortality or injury risk can include a reduction in turbine speeds to 25-30rpm, the use of blunted blade edges to reduce the incidence of laceration injuries with rotor strikes and adding smooth edges or padding on device parts. Mitigation against entrapment and entanglement for marine species can include incorporation of escape hatches within device design for wave and tidal devices and the use of protective screens to prevent marine organisms from entering devices e.g., shrouded turbines with protective netting or grills. Avoidance of turbines can also be achieved by using strong colours, high contrast patterns on moving parts, night-time lighting and bubble curtains (or bubble trees) to mitigate collision risks. Mitigation during the project planning phase with the introduction of noise abatement measures at the source to reduce the input of anthropogenic noise into the environment. Mitigation and control measures can also include the use of active sonar deployment to trigger tidal turbine shutdown whenever marine mammals are detected within a certain distance. Similarly, active sonar triggered Acoustic Deterrent Devices (ADD) can be a deterrent used for mitigation.
	Short-term disturbance and displacement for species e.g., marine mammals, birds, due to presence of vessels and machinery, and use of artificial	At the project planning phase, construction and decommissioning phases should be avoided in periods of the year known to be important for bird breeding or specific stress-related times of year e.g., during moults. Where possible the planning of developments should

SEA Topic	Potential Impact	Proposed Mitigation
	lighting in construction and decommissioning phases.	avoid the breeding season to minimise impacts on these areas and where this cannot be avoided, construction timing should be well planned and works duration, and invasive workings should be kept to a minimum in these areas. Monitoring during the project planning phase for mitigation to understand trends in site populations and displacement effects with developments. Mitigation during the project planning phase with considerations of the location and timing of works (e.g., daily/seasonal periods which may be important for certain species such as fish species moving to the surface during daily periods or seasonal breeding periods) to reduce impacts on migration and breeding. Where this cannot be avoided, construction timing should be well planned and works duration, and invasive workings should be kept to a minimum in these areas. Avoidance of installation during turtle migration periods and avoidance of turtle migration routes can also be used to reduce the risk of displacement. Mitigation measures for reducing impacts on birds, particularly migratory birds, from lighting used on vessels may include the removal of steady state red lights for flashing lights or green down-lights to reduce upward light transmission or the use of radar-activated lighting to only switch on lighting whenever aircraft are near.
	Long-term displacement, habitat exclusion, or barrier effects for species e.g., birds, marine mammals, fish, due to device operation.	During project planning, the key areas of supporting habitats and migratory routes should be identified, including through the conduction of pre-construction surveys and consultation with environmental stakeholders, and development avoided within these areas to minimise displacement, habitat exclusion and barrier effects, whenever possible. This should include consideration of regular bird transit routes e.g., to foraging, loafing, or breeding areas, or migratory routes, important habitats for fish species such as spawning and nursery areas, and migration routes of diadromous fish. Pre-construction surveys and consultation with relevant environmental stakeholder to inform avoidance and mitigation measures. Further mitigation can be achieved during the project planning phase through array layout, such as device arrays being orientated parallel to the coastline to help minimise the barrier effect for swimming marine species. Suitable spatial planning should be used to minimise effects of arrays. As described above, sufficient clearance should be left between the blade tip of submerged tidal turbines and the seabed to allow demersal and benthic species to pass under the device safely, and sufficient clearance should be left between the blade tip and sea surface to allow pelagic species to pass over the device. Use of time-area closure mitigation methods to cease operations whenever critical aggregations of species occur for specific lifecycles/behaviours during construction and decommissioning periods. Minimising behavioural disturbances can be achieved during the project planning phase through a suitable design and placement of rotors within device arrays

SEA Topic	Potential Impact	Proposed Mitigation
		particularly for wave or tidal devices for groups such as marine mammals and fish.
	Adverse effects on marine species due to the generation of heat by installed cables.	Mitigation at the project planning phase through cable burial to a suitable depth may help to prevent localised water column temperature fluctuations.
Population and Human Health	Short-term disturbance (noise and visual) to local populations and marine leisure users during construction and decommissioning. Operational disturbance of populations from flicker and noise if device arrays located close to shore.	Mitigation during the project planning phase for device construction to ensure construction and decommissioning noise occurs during daylight hours to avoid impacts on local population health, where local populations have potential to be affected. Enhanced noise generation occurs with piling activities and piling should only be used if necessary and no alternatives are possible. Project-level mitigation planning must consider the impacts of concurrent or sequential piling activities. Regular communication with local communities is advisable to monitor complaints regarding noise and vibration emissions from construction works. Noise assessment criteria (ETSU-R-97) guide the assessment and mitigation of such effects of wind farm developments, airborne operational noise is not considered to be a major source for concern from offshore wind farms provided there is enough distance between the turbines and coastal settlements for sound attenuation between the source and receptor[193]. To minimise impacts on recreational activity, suitable planning should occur during the project planning phase to avoid areas of key importance to mitigate against deterioration in leisure activity access. Suitable management during the project planning phase on the use of lighting is required to minimise potential impacts on nearby populations. Mitigation of potential flicker effects occurs during the project planning phase to consider the size of the turbines required and the distance located offshore.
	Impacts on marine and coastal leisure and recreational users (collision risks with devices and submerged cables/devices and access restrictions to certain areas around device arrays; impacts on water quality with release of substances).	Any licensing and development of offshore device arrays should aim to ensure the minimisation of risks to other marine users and must be subjected to planning policy specific to such projects e.g., the draft Marine Plan for NI. Suitable safety information should be communicated to the public through various communicative means. Mitigation can be achieved to allow leisure and recreational activities to continue through the use of exclusion zones around developments as well the use of warning marker buoys on devices, particularly submerged features/devices or cables. The installation of devices that lie below the water surface at a suitable depth to allow sailing/cruising activities to still take place is desirable to minimise impacts on recreational activities. The Royal Yachting Association (RYA) has developed an atlas of cruising routes, general sailing and racing areas around the UK and has indicated, to mitigate against collision risks, having a minimum rotor-to-sea surface gap of 22m for submerged renewable

[193] DTI. 1996. The Assessment and Rating of Noise from Wind Farms. Available at: https://assets.publishing.service.gov.uk/media/5a798b42ed915d07d35b655a/ETSU_Full_copy__Searchable_.pdf

SEA Topic	Potential Impact	Proposed Mitigation
		development devices above mean high water springs – this should be considered for device designs during project planning.
Geology, Soils and Land Use	Damage (direct or indirect) to designated geological/geomorphological features within designated sites (WHSs, UNESCO Geoparks, MCZs, ASSIs), and other features of importance, during device or cable installation or decommissioning. Indirect effects on designated features, and other features of importance, during device operation due to impacts on coastal processes.	Mitigation during the project planning phase with the conduction of geophysical and geotechnical surveys to identify areas of key geological/geomorphological interest, with avoidance of these areas during development. Avoidance of rocky outcrops for installation is advisable for reducing potential impacts on geology and geomorphological features. Modelling of coastal processes to determine potential for impacts. Further mitigation can be achieved with a suitable design of device arrays in terms of adequate spacing between developments/arrays to reduce the potential for excessive energy extraction altering coastal processes and regimes. Consultation with DAERA where potential effects on designated features are identified during project planning.
	Loss of seabed sediments and change in morphology during installation and decommissioning. Loss of seabed sediments through scour. Alteration of sediment transport due to device or cable presence.	Modelling of hydrodynamic and sediment transport processes during the project planning phase to assess potential effects and determine any appropriate mitigation. Project phase mitigation should also assess the degree of disturbance occurring on the seabed and, if appropriate, additional contaminant and water quality monitoring should be implemented. Sediment and erosion occurrence should be minimised through the development, implementation and enforcement of an Erosion and Sedimentation Control Plan (ESCP) for construction works. Decommissioning methods should be used that aim to minimise the amount of sediment generated. Impacts of local scour may be reduced by locating arrays in areas where the amount of sediment available for mobilisation and transfer is low.
	Seabed contamination during construction.	During project planning, pre-construction surveys should be conducted to identify potential sources of seabed contamination, with avoidance of these areas for development. Materials used in construction e.g., drilling wastes generated and particulate discharges, should aim to be of low toxicity to ensure lower contamination risk. A Litter Pollution Prevention strategy should be designed for all stages of development to prevent marine pollution, in accordance with the objectives of the Marine Strategy Regulations 2010 and the draft Marine Plan for NI.
	Alteration of coastal processes through changes in hydrodynamics due to device operation (tidal and wave device arrays).	Modelling of hydrodynamic processes during the project planning phase to assess potential effects and determine any appropriate mitigation, such as array location and arrangement. Mitigations for tidal energy extraction to reduce the impacts on the physical environment and associated habitats and species include two-way operation, regular sluicing, and fish diversion.

SEA Topic	Potential Impact	Proposed Mitigation
Water	Effects on water quality due to sediment mobilisation and disturbance during installation and decommissioning.	Avoidance of areas of known potential contamination during licensing of areas and project planning. Mitigation at the project level with sediment testing and water quality monitoring through construction and decommissioning phases to manage potential effects. Consultations should take place with environmental bodies on the construction methodology and appropriate timing of works to provide the least potential for sediment mobilisation to water bodies.
	Effects on water quality due to construction discharges or accidental contaminant release from machinery or vessels during construction and maintenance.	At the project planning phase, mitigation against water quality impacts from construction-based discharges by using materials of low toxicity. Mitigation against accidental contamination from vessels as described under Material Assets - Shipping and Navigation. Preparation and adherence to a Pollution Prevention and Control Plan during construction, maintenance, and decommissioning activities. A Litter Pollution Prevention strategy should be designed for all stages of development to prevent marine pollution, in accordance with the objectives of the Marine Strategy Regulations 2010 and the draft Marine Plan for NI.
	Effects on water quality during device and cable operation due to leakage of hydraulic fluids, anti-fouling components or corrosion of sacrificial anodes.	At the project planning phase, mitigation to ensure that any hydraulic fluids, anti-fouling components and corrosion of anodes used will release non-toxic compounds (chemicals currently used in the renewable industry are similar to those from the oil and gas industry which are controlled via the Offshore Chemical Notification Scheme reflecting the OSPAR Harmonised Mandatory Control Scheme) - chemicals used are typically within closed systems, minimising the risk of discharges. Recent research has raised concerns regarding the amounts of sacrificial anodes being used and a need for further data collection by developers, regulators, or trade associations. Alternative technologies should be considered at project level e.g., impressed current cathodic protection, paint, and coatings for structural protection to mitigate against potentially unknown sacrificial anode issues.
Air Quality	Temporary increase in air emissions from vessels and machinery during device and cable installation, maintenance, and decommissioning.	At the project phase, emissions of air pollutants should be minimised through adherence with the requirements of the Merchant Shipping (Prevention of Air Pollution from Ships) Regulations 2008[194], and amendments of The Merchant Shipping (Prevention of Air Pollution from Ships and Motor Fuel (Composition and Content) (Amendment) Regulations 2014 and the Merchant Shipping (Prevention of Air Pollution from Ships) (Amendment) Regulations 2021[195].

[194] The Regulations implemented 19 regulations and a technical code on the control of emissions of Nitrogen Oxides applicable to ships over 400 gross tonnages as well as fixed and floating platforms and drilling rigs - these vessels must be fitted with an exhaust gas cleaning system and use fuel oil with a sulphur content less than 1.5% m/m.

[195] The 2021 amendment implemented several air quality measures to control sulphur and nitrogen oxide emissions.

SEA Topic	Potential Impact	Proposed Mitigation
		Further mitigation at project level should include limiting the idling of vessels or construction machinery when not required or in use to minimise emissions to air.
Climatic Factors	Temporary increase in GHG emissions from vessels and machinery during device and cable installation, maintenance, and decommissioning.	During the project planning phase, there should be lifecycle assessment to consider the overall net gain or loss in GHG emissions throughout the device array lifecycle, and consideration of the overall benefit of the project regarding carbon cost. At the project phase, GHG emissions from vessels should be minimised through adherence to Regulations from the Merchant Shipping (Prevention of Air Pollution from Ships) (Amendment) Regulations 2021.
	Seabed disturbance or loss and release of CO_2 during construction and decommissioning, particularly relating to 'blue carbon' habitats.	During the project planning phase, areas that have the potential for high carbon sequestration or as blue carbon hotspots should be considered and development within these areas should be avoided to ensure minimal disturbance e.g., through surveys and ecosystem mapping of sediment potential, and consultation with DAERA or other relevant stakeholders regarding the location of areas of known importance such as 'blue carbon' habitats.
	Climate change effects on areas of landfall for export cables or associated coastal facilities.	Considerations on projected climate change scenarios should be accounted for during project planning phases for suitable locations of landfall points of export cables and locations of coastal infrastructure/facilities associated with development arrays to avoid potential impacts on these from flooding, sea-level rise or storm damage. Associated infrastructure and landfall areas should also be chosen through modelling of potential scenarios, to ensure that they do not increase the risk of flooding or coastal damage elsewhere.
Material Assets	**Existing Infrastructure: Cables and Pipelines**	
	Damage to cables or pipelines during installation and operation, with potential to impact telecommunications or release hazardous substances. Reduced access to existing cables or pipelines during installation and operation.	At the project planning phase, the location of pre-existing cable and pipeline routes should be considered. Safety zones (e.g., 500m avoidance areas) are typically used for activities of the offshore oil and gas sector to ensure the safety of subsea structures and installations. Safety zones can be used for pre-existing cables and pipelines and should be adhered to within offshore developments to avoid development within these zones. During project planning and through the array installation process, there should be communication with the owners of existing cables and pipelines that could potentially be affected to ensure that the construction process does not impact on access requirements to this infrastructure.
	Other Users: Commercial Fisheries and Aquaculture	
	Displacement from fishing grounds during installation, operation, and decommissioning activities.	During further consideration prior to project development, there should be strategic level caution regarding the siting of ORE infrastructure to ensure that fishing activities and skills of local cultural and economic importance are not inadvertently lost through prevention or significant hindrance of fishing activity. Identification of core fishing grounds should follow the approaches proposed by the Marine Management

SEA Topic	Potential Impact	Proposed Mitigation
		Organisation Project 1074[196], and the objectives of the draft Marine Plan for NI, with a pre-emptive analysis of local fishing activity during the project planning phase. Developments should aim to avoid occupying recognised fishing grounds in coastal/offshore areas unless there is a successful agreement between the industries that co-location is achievable. ORE developments and fisheries have the potential to co-exist whenever wind farm design can account for fisheries' use of an area. This requires suitable consultation and discussion between marine users and ORE developers to ensure that activities can continue to take place by incorporating these views into the early design and planning process. Co-location of ORE and commercial fishing has been implemented at several offshore wind farms, predominantly for passive fisheries (pot and trap), through good communication between the ORE developer and fishing industries; use of safety zones around devices and associated infrastructure; the indication of defined "fishing areas" to promote co-location and reduce the risk of gear snagging, vessel safety issues and damage to wind farm infrastructure; and the provision of accurate surface and subsurface spatial location information in formats that are readily accessible to fisheries e.g., uploadable plotter data for navigation systems. Presently, trawler fishing is occurring in Walney 1 and 2 wind farms using both larger fishing vessels over 15m in length for whitefish fishing, and 10m length vessels that deploy static pot fishing gear within the area. Extensive lobster fishing takes place in the Westermost Rough Offshore Wind Farm, while the use of passive fishing gear has been deployed at the Hywind Floating Wind Farm off the coast of Scotland. With the presence of ORE developments, despite best efforts to accommodate co-existence, this may not be possible for every form of commercial fishing with potential restrictions regarding access, vessel size, fishing methods, and gear that can be used. Recent ORE developments have begun to explore the establishment of new additional industries in the form of aquaculture by incorporating these within device array designs, to provide an alternative source of income for commercial fisheries impacted by ORE development. Within the Belwind Offshore Wind Farm in Belgium, aquaculture is aiming at restoring native flat oyster reefs, culturing European flat oysters and seaweed intended for human consumption, through the installation of offshore screw anchors with the connection of aquaculture lines to these for oyster and subsequent installation of seaweed nets for seaweed growth. The AquaWind Project in Spain is based on the existing floating wind farm of W2Power located off the coast of Gran Canaria for the integration of fish farming and ORE; aquaculture cages have been developed alongside remote feeding and monitoring systems for

[196] MMO. 2014. Scoping the Opportunities and Challenges to Using a 'Core Fishing Grounds' Approach to Develop a Spatial Marine Plan Policy for Fishing. A report produced for the Marine Management Organisation, pp 85 MMO Project No: 1074. Available at: https://assets.publishing.service.gov.uk/media/5a7e1790e5274a2e87daf7ec/1074.pdf

SEA Topic	Potential Impact	Proposed Mitigation
		fish health and structural behaviour assessments have been established. At the project planning phase, direct disturbance to commercial fisheries and shellfisheries may be minimised by using device arrays that rely on less intrusive forms of attachment e.g., anchoring or clump weights. The identification of cable-free corridors within development arrays that are suitable for trawling could also be provided to indicate to local fisheries the areas that remain viable for fishing activities and device arrays to co-exist. For small fishing vessels and non-commercial vessels such as recreational vessels, fishing activities may still be able to occur within development areas, provided adherence to safety zones can be met and that physical constraints such as device array design and size can allow co-location between fishing and the ORE array.
	Increased collision risk with vessels during construction and maintenance.	As above, developments should aim to avoid occupying recognised fishing grounds in coastal/offshore areas unless there is a successful agreement between the industries that co-location is achievable. Standard mitigation methods to reduce collision risks include extensive notifications of works occurring, use of safety zones, if appropriate, and ensuring the maintenance of access to ports and harbours for fishing vessels. Provisions should be made by the offshore developers for seabed maps showing accurate and precise locations of any hazards and potential alterations on seabed depths and potential impacts on underkeel clearance for passing vessels. Construction and maintenance vessels should use suitable lighting to ensure that they are visible during night-time and in poor weather conditions to reduce the risk of collisions.
	Increased allision risks with devices, or entanglement of fishing gear with devices or attachment infrastructure.	As above, developments should aim to avoid occupying recognised fishing grounds in coastal/offshore areas unless there is a successful agreement between the industries that co-location is achievable. Markers/surface buoys and lighting should be used on device arrays to ensure that these are visible to fishing vessels in poor weather conditions and at night-time. These should also be used to ensure that submerged features, particularly subsurface wave, or tidal devices, are obvious to above surface vessels. Mitigation from the UK Hydrographic Office Mariners Handbook should be adhered to, which advises vessels not to anchor or trawl for fish within 0.25nm of a subsea cable, requires suitable and accurate updating and accurate marking of marine maps to inform the location of such features by developers. The identification of cable-free corridors within development arrays, which are suitable for trawling could also be provided.
	Impacts of spoil, construction or decommissioning debris on the seabed.	Ensure minimal construction spoil or decommissioning debris is left to prevent impacts on fishing activities, such as the use of bottom trawler-based equipment or

SEA Topic	Potential Impact	Proposed Mitigation
		through affecting underkeel clearance. All feasible removal of such material should take place and be incorporated into the construction and decommissioning programmes.
	Direct and indirect impacts on commercial fish and shellfish species.	Mitigation as set out under the Biodiversity, Flora and Fauna; Geology, Soils and Land Use; and Water topics. Mitigation during project planning should consider avoidance of disturbances during key fishing seasons, in consultation with the industry e.g., the period of mussel seed settlement (February-April; September) and the salmon migration period (May-July).
	Other Users: Shipping and Navigation	
	Collision and allision risk with vessels during installation, operation and decommissioning, with potential for spillage of oil or hazardous cargo.	The integrated OREAP and SEA development and constraints assessment has aimed to identify and avoid important navigational routes. At the next stage of consideration, prior to project development, shipping routes should be further considered to ensure an up-to-date understanding of potential strategy level effects on shipping routes and traffic. If required, important navigational routes could be treated as “clearways” for the siting and consenting of any marine developments, however, this requires agreement from all waters in the British Isles and international co-operation for transboundary routes. At the project planning stage, mitigation should include the development of a navigational risk assessment, which surveys vessels within the vicinity of the proposed development and takes into consideration Marine Guidance Note (MGN) 654[197] , MGN 372 Amendment 1[198], and the Methodology for Assessing the Marine Safety Navigational Safety and Emergency Response Risks of Offshore Renewable Energy Installations (MCA 2023)[199], to seek formal consent for marine works and address the navigational and emergency response impacts of proposed development arrays. Standard mitigation methods that should be considered during project planning include extensive notification of works occurring, and the use of safety zones around devices. A minimisation of the number of vessels present should also be employed and guard vessels should be deployed within construction areas. Safety zones are typically 500m during installation, maintenance and decommissioning under The

[197] Maritime and Coastguard Agency. 2021. MGN 654 Safety of navigation: Guidance on UK navigational practice, safety and emergency response. Available at: https://assets.publishing.service.gov.uk/media/64637cd60b72d3000c34454c/MGN_654.pdf

[198] Maritime and Coastguard Agency. 2022. MGN 372 Amendment 1 (M+F) Safety of Navigation: Guidance to Mariners Operating in the Vicinity of UK Offshore Renewable Energy Installations (OREIs). Available at: https://www.gov.uk/government/publications/mgn-372-amendment-1-mf-guidance-to-mariners-operating-in-vicinity-of-uk-oreis/mgn-372-amendment-1-mf-safety-of-navigation-guidance-to-mariners-operating-in-the-vicinity-of-uk-offshore-renewable-energy-installations-oreis.

[199] Maritime and Coastguard Agency. 2023. Methodology for Assessing Marine Navigational Safety and Emergency Response Risks of Offshore Renewable Energy Installations (OREIs). Available at: https://assets.publishing.service.gov.uk/media/656f2dc49462260721c56932/NRA_Methodology_2023_v3.1.pdf.

SEA Topic	Potential Impact	Proposed Mitigation
		Electricity (Offshore Generating Stations) (Safety Zones) (Application Procedures and Control of Access) Regulations 2007 (as amended). Mitigation measures also include the guidance on vessel visibility based on MGN 654, IALA lighting G1162[200], Trinity House guidance[201], and marking recommendations and vessel compliance with the Convention on the International Regulations for Preventing Collisions at SEA (COLREGs) to reduce collision and allision risks. The use of Shipboard Oil Pollution Emergency Planning (SOPEP) plans should be considered as mitigation within the project planning phase, as well as pollution and environmental emergency response plans.
	Potential for long-term collision risk with stationary device arrays and risk of hazardous spills. Potential effects on shipping safety with the reduction in under-keel clearance due to the presence of subsea structures.	As above, the integrated OREAP and SEA development and constraints assessment has aimed to identify and avoid important navigational routes. At the next stage of consideration, prior to project development, shipping routes should be further considered to ensure an up-to-date understanding of potential strategic level effects on shipping routes and traffic to minimise the density of traffic within the device array area. Developments should aim to avoid impingement on major commercial navigation routes, which could significantly increase collision risks. Mitigation through Marine Policy Plan, whereby public authorities must consider any potential impact from proposed developments on shipping activity and freedom of navigation. This includes information which indicates that static sea surface infrastructure should not be introduced on shipping/navigation routes that are high-density, strategically important navigation routes (e.g. typically for vessels exceeding 300 tonnes and routes which are essential for regional, national or international trade), or pose a risk to the viability of passenger services, and the developments should not proceed unless there are exceptional circumstances, and any developments must have suitable buffers applied to these areas to prevent implications on these networks[202]. During the project planning phase, impingement on major commercial navigation routes should be avoided where developments could significantly reduce under-keel clearance within water columns, and only suitable water column depths should be chosen for development. Consideration should also be made of the keel sizes of vessels regularly transiting areas to ensure that minimum depths are maintained. Other mitigation techniques include the use of additional hydrographic surveys and the use of dredging, if suitable, to ensure water column height is acceptable. As above, safety zones are typically 500m during operation under The Electricity (Offshore Generating

[200] IALA. 2021. G1162 The marking of offshore man-made structures. Available at: https://www.iala-aism.org/product/g1162/

[201] Trinity House. 2016. Guidelines on the provision and maintenance of local aids to navigation. Available at: https://www.trinityhouse.co.uk/asset/1040

[202] DAERA NI. 2018. Draft Marine Plan for Northern Ireland Publication Consultation.

SEA Topic	Potential Impact	Proposed Mitigation
		Stations) (Safety Zones) (Application Procedures and Control of Access) Regulations 2007 (as amended), suitable care for safety zones should be employed for moorings and cables to ensure adequate coverage. The above mitigation measures regarding marking, SOPEP, and pollution and environmental emergency response plans should also be applied.
	Displacement from construction areas and operational array areas due to safety exclusion zones. Restrictions on port and harbour access.	As above, the integrated OREAP and SEA development and constraints assessment has aimed to identify and avoid important navigational routes. At the next stage of consideration, prior to project development, shipping routes should be further considered to ensure an up-to-date understanding of potential strategy level effects on shipping routes and traffic. As above, mitigation through the Marine Policy Plan, whereby public authorities must consider any potential impact from proposed developments on shipping activity and freedom of navigation[11]. The level of displacement is likely to be greater for wind and wave developments as these tend to occupy larger areas than tidal developments; wind and wave devices may also occupy the entire water column, whereas tidal devices may be fully submerged and allow for the co-existence of shipping. Mitigation through the introduction of TSSs to indicate marine vessel traffic travel directions around offshore developments and reduce the likelihood of collisions. Proposed developments should mitigate against alteration of the ease and safety of navigation in port approaches that could reduce the commercial attractiveness of the ports e.g., an increase in vessel insurance premiums. Mitigation in the project planning phase should ensure that developments do not constrain entrances to harbours/ports that are typically high vessel activity areas, and that limited manoeuvrability does not become restricted further by offshore developments. There should be regular communications with port authorities and issuing of the appropriate notifications during installation, maintenance, and decommissioning periods.
	Effects on search and rescue operations within installation/decommissioning areas.	Mitigation during the project planning phase with discussion and regular communication with groups involved with search and rescue, and provision of detailed maps and information on development arrays, preliminary assessment of the potential impacts of the offshore development on search and rescue must be considered as per Marine Guidance Note 654[6] and the Methodology for Assessing the Marine Safety Navigational Safety and Emergency Response Risks of Offshore Renewable Energy Installations[203], to seek formal consent for marine works and address the navigational and emergency response impacts of proposed development arrays.

[203] Maritime and Coastguard Agency. 2023. Methodology for Assessing Marine Navigational Safety and Emergency Response Risks of Offshore Renewable Energy Installations (OREIs). Available at: https://assets.publishing.service.gov.uk/media/656f2dc49462260721c56932/NRA_Methodology_2023_v3.1.pdf.

SEA Topic	Potential Impact	Proposed Mitigation
		The construction, operation and decommissioning phases of any development require a Hub Emergency Response Co-operational Plan (ERCoP) to be in place.
	Potential for impacts on navigation by devices obstructing lights, buoys and coastlines and impacts on radar, magnetic interference with compass deviation.	Mitigation during the project planning phase to ensure that installation of device arrays does not impact navigation equipment, and consideration of sightlines when planning device arrays and layout. Mitigation measures have been successfully applied for some military radar sites through the Windfarm Mitigation for UK Air Defence programme, this can include the use of a TPS77 radar system, which provides mitigation against the effects of wind farms.
	Other Users: Military Activities	
	Risk of UXO presence in array area and cable routes during construction.	Areas of known live military firing or munitions disposal should be avoided during the next stage of consideration, prior to project development, At the project stage, mitigation should follow appropriate procedures for the management/removal of UXO e.g., Crown Estates 2006[204] (Dealing with munitions in marine aggregates).
	Temporary disruption of military exercises and activities during construction and decommissioning phases.	During the project planning phase, mitigation must aim to avoid jeopardising national security unless the impacts are appropriately mitigated or deemed acceptable in consultation with the MoD.
	Long-term disruption of military exercise and activities with the presence of device arrays and infrastructures.	Areas of known military importance should be avoided during the next stage of consideration, prior to project development. Mitigation with MoD through the identification of practice and exercise areas on charts, during dialogue from device array developers to MoD and with MoD being a statutory consultee on planning applications.
	Other Users: Disposal Areas	
	Disturbance of previously disposed materials during construction/decommissioning.	Mitigation during project planning phase to identify areas that were previously used for disposal, or sampling of sites prior to construction works in potentially hazardous areas, to establish potential risk e.g., pre-construction surveys and consultations with key stakeholders/companies to identify disposal areas. Avoidance of development within 500m of disposal areas.
	Disruption of vessel access to disposal sites during construction, operation and decommissioning activities.	Mitigation during the project planning phase to identify key transit and navigational routes for vessels accessing disposal areas with consultation undertaken to avoid disrupting routes to the usage of safety exclusion zones to allow navigation/transit to areas to occur safely. Avoidance of development of device arrays within 500m of disposal areas.
	Other Users: Aggregate Extraction	
	Loss of access to future mineral resources due to device or cable presence during the operational lifecycle.	Project planning and mitigation should aim to avoid potential disruption of future aggregate supplies. During the pre-construction and construction phase suitable technical and expert analysis should be used within NI

[204] Crown Estate (TCE). 2006. Dealing with munitions in marine aggregates. Guidance Note. Available at: https://www.safequarry.com/hotTopics/Munitions%20vrsion%202.pdf

SEA Topic	Potential Impact	Proposed Mitigation
		waters to determine if any aggregate resources are uncovered.
	Other Users: Tourism	
	Temporary impacts on coastal tourism activities with the generation of noise and visual impacts and potential release of contaminants during construction/decommissioning phases.	Mitigation during the project planning phase to avoid coinciding with the most disruptive periods of construction/decommissioning with high seasonality periods for tourism. Mitigation as set out under the Population and Human Health topic for 'Temporary disturbance (noise and visual) to local populations and marine leisure users during construction/decommissioning', and 'Impacts on marine and coastal leisure and recreational users (collision risks with devices and submerged cables/devices and access restrictions to certain areas around device arrays; impacts on water quality with release of substances)' are also of relevance.
	Temporary impacts with the loss of access to coastal areas during construction/decommissioning phases.	Mitigation during the project planning phase to avoid coinciding with the most disruptive periods of construction/decommissioning with high seasonality periods for tourism. Mitigation as set out under the Population and Human Health topic for 'Impacts on marine and coastal leisure and recreational users (access restrictions to certain areas around device arrays)' is also of relevance.
	Long-term effects on seascape and visual amenity from device arrays	Mitigation as set out under the Landscape, Seascape, and Visual Amenity topic for 'Long-term effects on seascape and visual amenity from device arrays'.
	Other Users: Aviation	
	Long-term direct effects by turbine obstruction to low-flying aircraft and potential collisions for helicopters and fixed-wing aircraft.	During the project planning phase, mitigation must aim to avoid interference with civilian aviation operations to ensure aviation safety, efficiency, and capacity. Effective communication with the CAA, NATS and airports is vital to ensure developments are located suitably. To mitigate against collisions for helicopters, there has been an indication by CAA that a 2nm obstacle-free buffer should be used for these routes. Consultation with helicopter and installation operators should occur to mitigate the potential effects of wind farm obstructions. To identify device arrays as potential obstacles for aviation activities there is a range of guidance, policy and legislation available on markings and lightings e.g., CAA CAP764[205], MGN 654[206] in relation to Search and Rescue, CAA document CAP393 and Air Navigation Order 2016[207], with the statutory requirement for the lighting of any wind turbine in territorial waters above 60m in height. The CAA CAP 764[14] recommends further mitigations with the use of additional lighting

[205] Civil Aviation Authority (CAA). 2016. CAA Policy and Guidelines on Wind Turbines - CAP 764. Available at: https://www.caa.co.uk/publication/download/14561

[206] Maritime and Coastguard Agency. 2021. MGN 654 (M+F) Safety of Navigation: Offshore Renewable Energy Installations (OREIs) - Guidance on UK Navigational Practice, Safety and Emergency Response. Available at: https://assets.publishing.service.gov.uk/media/64637cd60b72d3000c34454c/MGN_654.pdf

[207] Civil Aviation Authority (CAA). 2021. Regulations made under powers in the Civil Aviation Act 1982 and the Air Navigation Order 2016 – CAP 393. Available at: https://www.caa.co.uk/publication/download/15773

SEA Topic	Potential Impact	Proposed Mitigation
		and one medium-intensity light visible in all directions and the use of infrared lighting under MoD guidance.
	Impacts of device arrays on communications, navigation and surveillance during operation.	During the project planning phase, mitigation should aim to have developments that avoid interference with radar systems (for civil aviation, primary surveillance radar is most likely to be affected) unless anticipated impacts are temporary or reversible, or the use of radar systems such as TPS77 (creation of 3D Non-Automatic Initiation Zone to prevent false returns) are employed, which can provide mitigation from the effects of wind farms. Mitigation measures have been successfully applied for some military radar sites through the Windfarm Mitigation for UK Air Defence programme and include the use of hybrid techniques such as specialised radar signal processing and the use of materials within the design to control the radar signal from wind turbines.
Cultural Heritage	**Archaeology and Wrecks**	
	Loss of, or damage to wrecks or submerged archaeological artefacts during device and cable installation, maintenance, and decommissioning. Indirect damage or degradation of archaeological sites or features due to sedimentation impacts during construction/decommissioning.	Mitigation during the project planning phase to identify sites of interest for archaeological potential and use exclusion zones around these areas. Mitigation should include the conduction of site surveys or trial trenching before potentially damaging activities occur, with survey results informing further mitigation such as a relocation of the proposed activities to ensure sensitive seabed surface or subsurface features are avoided. Use of geotechnical surveys to identify previously unknown wreck locations within development areas and cable routes, with notification and submission of artefacts, potential archaeological and vessel remains to suitable authorities in line with the Protection of Wrecks Act (1973) and the HMAOO, within NI territorial waters within 12 miles of shore. Adherence to NIEA and Crown Estates 2007 JNAPC code of conduct and guidance note with consultation to key stakeholders e.g., Department for Communities, NIEA, Local Authorities and the Department of the Environment Heritage and Local Government of the Republic of Ireland. The main policy framework for the protection of heritage assets in the planning process in NI is set out in Planning Policy Statement 6 (PPS 6) Planning, Archaeology and the Built Heritage. Consultation with qualified archaeologists during project planning phase for the suitable design and construction of developments with the requirement for statutory consents for works. Protocols for Archaeological Discoveries (PADs) are systems of monitoring for unexpected or incidental finds relating to the historic environment, these should be used at all stages of the development process where any archaeological information may be obtained[208] (TCE, 2014). PADs include specific mitigation measures and protocols to be followed for the recovery and locating of discoveries. Within NI, archaeological objects must be reported to the

[208] The Crown Estate (TCE). 2014. Protocol for Archaeological Discoveries: Offshore Renewables Projects. Published by Wessex Archaeology, Salisbury, on behalf of The Crown Estate. Available at: https://www.wessexarch.co.uk/sites/default/files/field_file/2_Protocol%20For%20Archaeological%20Discoveries.pdf

SEA Topic	Potential Impact	Proposed Mitigation
		Department for Communities Historic Environment Division or Police within 14 days of recovery under the HMAOO. Mitigation during the project planning phase to undertake coastal process assessment to assess potential effects of construction/decommissioning on sediment dispersion and transport and modelling of these changes to determine potential effects on surrounding archaeological sites or features.
	Damage or degradation of archaeological sites or features with the potential for scouring and exposure to occur around devices and cable protection.	As above, mitigation during the project planning phase to identify sites of interest for archaeological potential and use exclusion zones around these areas. Undertaking coastal process assessment to assess potential effects from installed device arrays on sediment dispersion and transport and modelling can help to identify potential impact areas on a wider basis around device developments.
	Coastal Heritage	
	Short-term effects on the setting of designated and non-designated coastal heritage sites due to the presence of vessels and machinery during construction and decommissioning phases. Long-term effects on the setting of designated and non-designated coastal heritage sites from the presence of devices and associated infrastructure.	Areas of highest landscape and seascape sensitivity should be avoided, where possible, during the next stage of consideration, prior to project development. Mitigation during the project planning phase with consideration of the impacts of settings on historical assets within the project-level assessment, and the management of cultural heritage through the development and application of a MARP (Marine Archaeology Reporting Plan). In line with DfC (2018) Guidance[209], heritage assets that may be impacted should be identified first, the setting defined on how the surroundings contribute to the significance of the heritage asset, and an assessment made as to how any change will impact on the setting. Consultation with qualified archaeologists/architects during project planning phase for the suitable design of developments with the requirement for statutory consents for works.
	Loss of, or damage to, archaeological and architectural heritage at export cable landfall locations.	Mitigation during the project planning phase, with surveys of potential export cable routes and landfall areas to identify routes of the least environmental effect. Surveys undertaken should include habitat, ecological and cultural heritage. Consultation with qualified archaeologists or requirement for statutory consents for works, where appropriate.
Landscape, Seascape and Visual Amenity	Short-term effects on seascape and visual amenity from activity of vessels and machinery and the use of artificial lights during construction, maintenance and decommissioning phase of devices and cabling.	Mitigation during planned construction, maintenance or decommissioning activities with ensuring that visual impacts are constrained around the development area, wherever possible, and do not spread into unnecessary areas. Limited mitigation measures are available beyond ensuring that the number of vessels/machinery and planned lighting is the minimum required and is

[209] Department for Communities Historic Environment Division. 2018. Guidance on Setting and the Historic Environment. Available at: https://www.communities-ni.gov.uk/sites/default/files/publications/communities/guidance-on-setting-and-the-historic-environment.pdf

SEA Topic	Potential Impact	Proposed Mitigation
		carefully planned not to exceed requirements for activities to induce additional visual impacts.
	Potential for long-term effects on seascape and visual amenity from device arrays.	Areas of highest landscape and seascape sensitivity should be avoided, where possible, during the next stage of consideration, prior to project development. At the project planning phase, a Seascape and Visual Impact Assessment (SVIA) should be undertaken and should inform project design and appropriate mitigation. Effects of arrays on seascapes will depend on the seascape character type and sensitivity, the presence of protected landscapes, and the type and magnitude/scale of development, development within industrialised and developed seascapes should also be considered given the potential for cumulative effects. Developments occurring further offshore generally have lower visual impacts, and there are lower impacts expected for nearshore wave and tidal devices compared to wind devices given the lower profile, smaller vertical components and subsurface nature of such developments. Developments should be located in low sensitivity or high-capacity seascapes, with development siting aiming to minimise the visibility of devices e.g., located behind headlands. Mitigation during the project planning phase to ensure a coherent design and layout of device arrays to minimise visual impacts, with suitable spatial planning and turbine selection, avoidance of development of device arrays in constrained coastal areas e.g., bays, loughs, narrows or sounds where blockage or separation of views can occur. Development of device arrays, particularly offshore wind farms and wave devices, should be avoided near scattered settlement locations as these can dominate the fragmented patterns of the settlement. Construction should also be avoided where the wind farms and wave devices will conflict with the scale, and subtleties of complex, indented coastal forms. Tidal arrays should be developed in submerged locations where possible, with a maximised distance from the shoreline, avoiding where these devices would protrude above the water surface or conflict with the scale and subtleties of complex, indented coastal forms and block constrained coastal areas, and avoiding siting near scattered settlements. Further mitigation can be achieved with public consultation on the proposed design of offshore development arrays. Considerations on the chromatic contrast of structures at sea compared to the surrounding sea and sky should also be considered during project planning and device design as a potential mitigation technique. Further mitigation also includes considering all navigational standards and recommendations, the use of colour most appropriate for prevailing meteorological conditions can reduce the visibility of device structures and minimise visual impact. Considerations should also be made on the use and amount of safety lighting where appropriate.

10.1.3 RIAA Mitigation

10.1.3.1 Plan-level Mitigation

The aim of the OREAP is to set out the direction for planning, licensing, consenting and the development of ORE in NI. It is anticipated that the OREAP will be further developed following input from the SEA and RIAA and there is an opportunity at this stage to include plan-level mitigations that will ensure that any ORE development arising from the plan fully considers the impacts and effects on European sites, their Qualifying Interest Features (QIFs), and Conservation Objectives (COs) at a project-level.

The following plan-level mitigation should be included within the OREAP:

- All ORE projects arising from the plan must undertake project-level HRA to fully assess the impacts and effects on European sites, their QIFs and COs and must avoid adverse effects on European sites.
- The mitigation hierarchy must be applied to avoid impacts for all offshore renewable energy projects affecting marine ecosystems.
- The mitigation hierarchy must be applied to noise and water quality impacts for all offshore renewable energy projects.
- All offshore renewable energy projects arising from the plan must include biosecurity measures to reduce the risk of introducing or spreading INNS.

10.1.3.2 Project-level Mitigation

Further AA, to meet the requirements of the Habitats Regulations, of the detailed designs and construction methodologies of ORE projects will be required at the project-level, where potential impacts and effects have been identified in the accompanying RIAA for the OREAP.

Table 10-2 sets out the project-level mitigation measures that should be adopted to prevent, reduce, and offset Adverse Effects on Site Integrity (AEOSI) on European sites.

The mitigation measures should be considered further at the detailed planning and design stage for ORE projects, when the specifics of the development infrastructure options can be optimised through detailed feasibility studies and design in order to limit identified impacts on European sites.

Table 10-2 Proposed RIAA Mitigation Measures

Potential Impact	Proposed Mitigation
Physical Loss/Change/Disturbance to Marine Habitats/Species	• Avoid sensitive sites/species/areas/periods • Consider buffers to sites/species/areas • Micro-site around any sensitive features • Alternative infrastructure design and physical specifications • Minimise fixed structure foundation scour protection and cable length
Disturbance (Visual, Noise & Vibration) to Marine Habitats/Species	• Avoid sensitive sites/species • Time of works to avoid sensitive seasons e.g., breeding season or migration season • Modelling of noise to predict noise levels and inform mitigation • Alternative survey techniques to seismic surveys and powerful sonar surveys for deep water surveys • Alternative construction methods and barriers • Alternative foundation types include vibratory pile driving, foundation drilling, gravity base foundations and bucket foundations • Scheduling construction and turbine operational timing to avoid, reduce or phase activities at ecologically sensitive times • Use methods and/or timings to reduce noise where necessary and practical (e.g., soft start piling during construction)

Potential Impact	Proposed Mitigation
	• Minimise use of high noise emission activities such as impact piling where necessary • Noise abatement measures at the source • Use of marine mammal observers where necessary
Contamination in the Marine Environment	• Avoid areas of known contamination • Use of route selection studies • Use of suitable installation techniques • Time of works to avoid sensitive seasons e.g., spawning season • Modelling of hydrodynamic and sediment transport processes • Production of Erosion and Sedimentation Control Plans
Collision Risk/Barrier Effects to Marine Species	• Design devices for minimal impact e.g., wave and tidal devices with escape hatches, protective screens, netting or grills • Design arrays parallel to the coastline to minimise barrier effect for underwater marine species • Spatial planning of array to minimise barrier effects • Avoid siting devices in key sensitive areas e.g., foraging, loafing, and breeding areas or migratory routes • Increasing device visibility e.g., coloured blades, bird flight deflectors, bird warning spheres, protective netting or grids for submerged turbines, laser-based deterrents, bubble curtains, night-time lighting • Use of acoustic warning devices • Scheduling construction and turbine operational timing to avoid, reduce or phase activities at ecologically sensitive times • Automatic shutdown of vessel rotary mechanisms by proximity sensor/observer where necessary • Design surveys to avoid visual disturbance and/or collision risk from vessels or shoreline activity where necessary • Underwater noise during operation may alert species to the presence of the device, reducing the risk of collision • Avoid undertaking installation/decommissioning activities at night when birds may be more vulnerable to collisions • Use of marine mammal observers where necessary
Invasive Non-Native Species in the Marine Environment	• INNS Surveys • Production of Invasive Species Management Plans • Adherence to the International Maritime Organisation (IMO) International Convention for the Control and Management of Ships' Ballast Water and Sediments • Production of Biosecurity Plans
EMF in the Marine Environment	• Avoid siting EMF cables in key sensitive areas e.g., migratory routes • Design cables (e.g., burial depth of 1-3m) to minimise EMF fields where necessary • Design cable export route to minimise exposure to electro sensitive species • Design cable route configuration and orientation to reduce the field strength of EMF generation

10.2 Monitoring

The SEA Directive requires that significant environmental effects arising from implementation of a Plan or Programme are monitored in order to identify, at an early stage, any unforeseen adverse effects and in order to undertake appropriate remedial action. The proposed monitoring programme in **Table 10-3** is based on the Indicators and Targets established in the SEOs (given in **Section 6.2**). SEA monitoring should be undertaken in conjunction with proposed reviews of the OREAP, in advance of updates, to enable monitoring outcomes to influence the OREAP development. Much of the environmental monitoring proposed can be collated from ongoing environmental monitoring and reviews undertaken by bodies such as DAERA, OSPAR and NISRA. The indicators and data proposed for the monitoring of OREAP implementation are at a strategic level, to match the SEO objectives. The suggested data sources for monitoring of effects are mostly at a strategic level, are nationally consistent and are freely available.

Monitoring is also likely to be required as part of consenting conditions at the project level for ORE developments. Projects that are developed within the areas that are considered in the cumulative/in-combination appraisal in **Section 9.3**, i.e., the Atlantic, Torr Head/North Channel, and Irish Sea areas, should undertake monitoring within the wider area, to inform the baseline and potential adverse effects of subsequent developments within that area.

Project level monitoring outcomes may influence future understanding of environmental interactions that can be taken into account during subsequent OREAP updates.

Table 10-3 Proposed SEA Monitoring of the OREAP

SEO	Indicator	Target	Proposed Data Source(s)
Objective 1 – Biodiversity, Flora and Fauna Avoid damage to, and where possible enhance, biodiversity, flora and fauna. **Objective Description** Preserve, protect, maintain and, where possible, enhance biodiversity and ecosystems within the NI marine area, including internationally, nationally, and locally protected sites, habitats and species, and other known species of conservation concern.	• Conservation status of designated habitats and species within International/European and national designated sites (SACs, SPAs, Ramsar sites, MCZs, ASSIs). • Status of protected and priority habitats and species (Annex I habitats, Annex II species and Annex IV species, NI Priority Habitats and Species, OSPAR Threatened or Declining Habitats and Species). • MS Environmental status of marine area (e.g., Descriptor 1, 2, 4).	• No negative change, or a positive change, in the conservation status of designated habitats and species within International, European and National designated sites. • No negative change, or a positive change, in the status of protected or priority species and habitats outside designated sites, or to areas of known importance. • No negative change, or a positive change, in the Environmental status of MS Descriptors.	• DAERA National Site Network reporting (every 6 years) for European sites. NatureScot reporting for transboundary European sites in Scotland / NPWS Article 17 Habitats Directive reporting and Article 12 Birds Directive reporting for transboundary European sites in RoI. • DAERA MCZ reviews (every 6 years). • DAERA Condition Assessment reporting for ASSIs. • DAERA reporting of protected and priority species. • DAERA reporting of non-native and invasive species. • CEFAS or DAERA/AFBI reviews of fish spawning and nursery grounds. • OSPAR review/further mapping or threatened or declining habitats and species. • Information from TCE leasing review and project-level studies. • DfE plan-level monitoring.
Objective 2 – Population and Human Health Avoid disruption to the local population, while maximizing potential benefit to the population. **Objective Description** Minimise disruption to the local population, and displacement of recreational and leisure use of the area while providing a new secure renewable	• Population centres in proximity to RZs. • Use of the area by recreational and leisure users. • Capacity for new renewable energy supply for the NI population, with potential employment and other benefit opportunities.	• Delivery of offshore energy arrays with minimal adverse nuisance to communities. • Minimise the risk to, or displacement of, recreational and leisure users of the area. • Delivery of offshore energy arrays that maximise the potential benefits to the population.	• NISRA census data. • NISRA statistics on population health. • DAERA reporting of Bathing Water quality. • DAERA reporting of Shellfish Water quality. • RYA leisure density data (review of any changes). • Information from TCE leasing review and project-level studies.

SEO	Indicator	Target	Proposed Data Source(s)
energy supply for the NI population, with potential employment and other benefit opportunities.			• DfE plan-level monitoring, including data on capacity of new renewable energy generated.
Objective 3 – Geology, Soils and Land Use Avoid damage to the function and quality of the seabed, and effects on sediment transport, hydrodynamics or coastal processes. **Objective Description** Preserve, protect, maintain and, where possible, enhance, sites designated for geological or geomorphological features, and minimize direct and indirect damage to the function and quality of the seabed or changes to sediment transport, hydrodynamics or coastal processes.	• Site condition/status of protected geological/geomorphological features within designated sites (WHSs, MCZs, ASSIs, UNESCO Geoparks). • Potential scale of loss or alteration to seabed geology and sediments. • Potential to alter hydrodynamics, sediment dynamics, or coastal processes (tidal excursion and sediment type). • Potentially contaminated sediment mobilisation areas (see Water).	• No negative change, or a positive change, in the condition of protected geological/geomorphological features within designated sites. • Minimise potential loss or alteration to seabed geology and sediments. • Minimise the potential for alteration of hydrodynamics, sediment dynamics, or coastal processes.	• DAERA MCZ reviews (every 6 years). • DAERA Condition Assessment reporting for ASSIs. • DAERA review and reporting for the Marine Strategy (e.g., Descriptor 6: sea floor integrity). • Information from TCE leasing review and project-level studies. • DfE plan-level monitoring.
Objective 4 – Water Avoid impacts on, and where possible enhance, the status or quality of water bodies. **Objective Description** Support the objectives of the WFD and MS by avoiding damage to or deterioration of water status, quality and resource.	• Status of WFD coastal water bodies (ecological, chemical, hydromorphological). • Status of WFD Protected Areas (Bathing waters, Shellfish waters, Designated sites). • MS Environmental status of marine area (e.g., Descriptor 5, 8, 9, 10, 11). • Interaction with known areas of potential contamination (MoD live firing areas, munition disposal areas, UXO, dumping grounds).	• Potential to contribute to a change in the status of WFD coastal water bodies, and protected areas. • Potential to contribute to a change in the Environmental status of MS Descriptors. • Minimise potential interaction with areas of potentially contaminated sediments.	• WFD reporting of water body status in RBMPs by DAERA/EPA reporting of transboundary WFD water bodies in RoI. • DAERA review and reporting for the MS / by the EPA under the MSFD in RoI (e.g., Descriptor 5: human induced eutrophication, Descriptor 8: concentration of contaminants within marine environment, Descriptor 9: concentrations of contaminants in fish and other seafood, Descriptor 10: marine litter, Descriptor 11: human introduced noise). • Information from TCE leasing review and project-level studies. • DfE plan-level monitoring.

SEO	Indicator	Target	Proposed Data Source(s)
Objective 5 - Air Quality Minimise risk to local air quality and contribute to improving regional emissions. **Objective Description** Minimise risk to local air quality and contribute to improving regional emissions.	• Sensitive receptors in proximity to RZs. • Capacity for new renewable energy connection, with potential effects on pollutant reduction	• Minimise the potential for negative effects on air quality from vessel emissions. • Delivery of offshore energy arrays that maximise the potential for a reduction in air pollutant emissions.	• NISRA census data. • Local Authority, DAERA data – Annual air quality monitoring summaries and continuous air quality monitoring. • DfE plan-level monitoring, including data on capacity of new renewable energy generated.
Objective 6 - Climatic Factors Contribute to a reduction in GHG emissions. **Objective Description** Minimise loss of carbon sequestering seabed while contributing to a reduction in GHG emissions from the energy supply sector in line with national commitments.	• Capacity for new renewable energy connection, with potential effects on GHG reduction. • Interaction with areas of known or potential blue carbon habitats.	• Delivery of offshore energy arrays that maximise the potential for a reduction of GHG emissions. • Minimise the potential for loss of known blue carbon habitat (in line with objectives of the Blue Carbon Action Plan).	• DAERA reporting of Annex I habitats / areas of known or potential blue carbon habitat. • NI GHG inventory reporting. • Information from TCE leasing review and project-level studies. • DfE plan-level monitoring, including data on capacity of new renewable energy generated.
Objective 7 – Material Assets Provide new, robust offshore renewable energy infrastructure with minimal disruption to other assets and infrastructure. **Objective Description** Provide new, robust offshore renewable energy infrastructure with minimal disruption to other assets and infrastructure.	• Potential capacity of new offshore renewable energy. • Presence of marine infrastructure (cables, pipelines). • Interaction with other users of the marine area (shipping, fisheries, military, aviation, dredging sites).	• Delivery of offshore energy arrays that maximise the potential energy output. • Minimise the potential for loss or damage to other marine infrastructure. • Minimise the risk to, or displacement of, other users of the area (fisheries and aquaculture, shipping, military activities, aviation, dredging sites).	• DfE plan-level monitoring, including data on capacity of new renewable energy generated. • Information from TCE leasing review and project-level studies. • Shipping statistics and data (e.g., NISRA, ports traffic, VMS density data – review of any changes). • Fisheries statistics and data (e.g., UK Sea fisheries annual statistics reporting, DAERA fish landings reporting, and data (e.g., NISRA, ports traffic, VMS density data – review of any changes)). • Tourism statistics (NISRA).

SEO	Indicator	Target	Proposed Data Source(s)
Objective 8 - Cultural Heritage Protect, conserve, and enhance designated and non-designated heritage assets and their settings. **Objective Description** Protect, conserve, and enhance designated and non-designated heritage assets and their settings.	• Interaction with known marine heritage features. • Interaction with known designated coastal archaeological or architectural heritage features (including their setting). • Potential for discovery of previously unknown archaeological heritage features.	• Minimise the potential for effects on known heritage features. • Minimise the potential for indirect effects on the setting of heritage features.	• Information from TCE leasing review and project-level studies. • Number of new assets discovered by proposed works. • Condition of heritage assets directly impacted by proposals. • Planning decisions determined against HED advice. • DfE plan-level monitoring.
Objective 9 - Landscape and Visual Amenity Protect and where possible enhance the landscape and seascape character and visual amenity of the NI shoreline. **Objective Description** Protect and where possible enhance the landscape and seascape character and visual amenity of the NI shoreline.	• Population centres in proximity to RZs. • Landscape/seascape sensitivity to infrastructure development. • Potential for impacts on visually sensitive areas, such as AONBs and country parks.	• No negative change, or a positive change, in visual amenity or landscape/seascape character. • No long-term negative change, or a positive change, to areas designated for landscape (AONBs, WHSs).	• Information from TCE leasing review and project-level studies. • DfE plan-level monitoring. • Reviews, updates or sensitivity assessments of NI Landscape and Seascape Character Assessments. • Local Development Plans.

11 SUMMARY AND CONCLUSIONS

An SEA and an RIAA were undertaken to assist in the guiding of the draft Offshore Renewable Energy Action Plan (OREAP) for NI.

The SEA Environmental Report has identified the potential positive and adverse effects on the wider environment of undertaking each type of ORE development, and of constructing and operating potential ORE developments within the proposed RZs, along with highlighting the potential cumulative or in-combination effects of developing within these areas. This report is designed to help support the future decision making in the implementation of the OREAP, to ensure that DfE and future developers are fully aware of the environmental constraints and opportunities of potential ORE technologies and areas for development, and to support the future sustainable development of projects that come from the OREAP.

Stage 1 technically suitable areas for the operation of ORE technology types (fixed wind, floating wind, tidal stream, wave) were determined, accounting for requirements for water depths, wind speeds, wave height and energy, and current speed across the tidal cycle, and these areas were partitioned into RZs. Seven Technically Suitable RZs were identified for fixed offshore wind, five for floating offshore wind, and two for tidal stream energy. No technically suitable areas were found for wave energy development.

A Stage 1 assessment was undertaken, that considered the key environmental constraints and sensitivities within each Technically Suitable RZ across the SEA topics of Biodiversity, Flora and Fauna; Population and Human Health; Geology, Soils and Land Use; Water; Air; Climatic Factors; Material Assets; Cultural, Architectural, and Archaeological Heritage; and Landscape, Seascape, and Visual Amenity. This included the seven Fixed Wind RZs of Atlantic, Rathlin Torr Head, Ards Peninsula, Mourne Lecale, Irish Sea Inshore, Irish Sea Offshore 1, and Irish Sea Offshore 2; the five Floating Wind RZs of Atlantic, Rathlin Torr Head, North Channel, Irish Sea Inshore, and Irish Sea Offshore; and the two Tidal RZs of Atlantic and Rathlin Torr Head. Following the Stage 1 assessment it was concluded that several RZs are significantly constrained for ORE development, and these were not considered further; these are: Rathlin Torr Head Fixed Wind RZ, Ards Peninsula Fixed Wind RZ, and Irish Sea Offshore 2 Fixed Wind RZ. The remaining Fixed Wind and Floating Wind RZs were refined in area to avoid areas of key environmental constraints and sensitivities. No refinement of the Tidal RZs was deemed necessary based on the key environmental constraints and sensitivities data.

A Stage 2 assessment was undertaken, that considered a wider range of available strategic level data within each recommended RZ across the SEA topics. The assessment indicated the potential for significant adverse effects on Biodiversity, Flora and Fauna in each of the recommended RZs. This was due to the potential for direct adverse effects on designated sites (Irish Sea Inshore Floating Wind recommended RZ and Irish Sea Offshore Floating Wind recommended RZ), indirect effects on designated sites, and/or overlap with spawning and nursery grounds for many fish species. The potential for significant adverse effects was identified for Material Assets for the Mourne Lecale Fixed Wind, Irish Sea Inshore Fixed Wind, Irish Sea Offshore Fixed Wind, Rathlin Torr Head Floating Wind, Irish Sea Inshore Floating Wind, Irish Sea Offshore Floating Wind, and Rathlin Torr Head Tidal recommended RZs. This was primarily due to the potential for adverse effects on Shipping and Navigation, and Commercial Fisheries. The potential for significant adverse effects was identified for Geology, Soils, and Land Use for the Irish Sea Offshore Fixed Wind, Rathlin Torr Head Floating Wind, Irish Sea Inshore Floating Wind, Irish Sea Offshore Floating Wind, Atlantic Tidal, and Rathlin Torr Head Tidal recommended RZs, owing to the potential for indirect effects on designated sites for geology/geomorphology, while the potential for significant adverse effects on Water was identified for the North Channel Floating Wind, and Rathlin Torr Head Tidal recommended RZs, owing to overlap with WFD water bodies. The assessment also indicated the potential for significant adverse effects on Cultural, Architectural, and Archaeological Heritage, and Landscape, Seascape, and Visual Amenity for the Atlantic Fixed Wind, Mourne Lecale Fixed Wind, Irish Sea Inshore Fixed Wind, Atlantic Floating Wind, Rathlin Torr Head Floating Wind, North Channel Floating Wind, Irish Sea Inshore Floating Wind, and Irish Sea Offshore Floating Wind recommended RZs. This was due to the high sensitivity of landscape areas and coastal heritage receptors whose setting could be affected. Several slight to moderate, adverse effects were also identified from the development, operation, and decommissioning of ORE projects within the recommended RZs. Best practice mitigation was outlined in the assessments for the avoidance or minimisation of identified adverse effects.

The potential for positive effects was also identified by the Stage 2 assessment of recommended RZs. The potential for significant medium to long-term positive effects on Material Assets was identified for the Irish Sea Inshore Fixed Wind, Atlantic Floating Wind, North Channel Floating Wind, Irish Sea Inshore Floating Wind, Irish Sea Offshore Floating Wind, and Atlantic Tidal recommended RZs, owing to the relatively high potential capacity of the RZs, while significant positive indirect effects on Air and Climatic Factors were also identified, as the operation of renewable energy devices can support a transition away from fossil fuel use and its associated air emissions, and can contribute to a net reduction in GHG emissions and the meeting of climate change emission reduction targets. Slight to moderate positive effects on Material Assets, Air and Climatic Factors were also recognised for the remaining recommended RZs. The recommended RZs identified through this iterative OREAP, and environmental assessment process are shown in **Figure 11-1**. These will be taken forward for further consideration by TCE during the next stage of leasing assessment, with the acknowledgement that there are more focused, aspirational refined RZs identified through the SEA within these areas.

A Stage 3 assessment of recommended RZs was undertaken, leading to more focused, aspirational refined RZs (**Figure 11-2**), which further refined the RZs through the exclusion of areas that contributed to the potential for significant adverse effects identified in the Stage 2 assessment. Further consideration of other factors, such as economics and deliverability will need to be taken into consideration in the further assessment and refinement of the resource zones offered for lease to enable the delivery of the most sustainable ORE Resource Zones possible within NI waters.

No further recommendations were made for the Rathlin Torr Head Floating recommended RZ, as it was considered highly constrained for the development of floating wind technologies. Where the potential for significant adverse effects for Landscape, Seascape and Visual Amenity, and Cultural, Architectural, and Archaeological Heritage was identified at the Stage 2 assessment, this remained following the Stage 3 refined RZs, owing to the high sensitivity of landscape and coastal heritage receptors and the distance to shore. This should be further considered prior to project development.

Further environmental studies based on the more detailed designs and construction methodologies should be undertaken as appropriate and may include, for instance, surveys of various biotic groups, Seascape, Landscape and Visual Impact Assessments, or heritage assessments, with any recommended avoidance or mitigation measures applied to ensure that there are no significant adverse environmental effects during construction, operation, and decommissioning of the ORE developments. Further Appropriate Assessment, to meet the requirements of the Habitats Directive, of the detailed designs and construction methodologies will be required at the project level, where potential impacts have been identified in this SEA and accompanying RIAA for the OREAP. At the project implementation stage, all works and planning of works should be undertaken with regard to all relevant legislation, licensing and consent requirements, and recommended best practice guidelines. Areas that may be more sensitive to these developments have also been highlighted, to help inform DfE of the areas that should be avoided to minimise potential environmental impacts.

In the medium and long-term, the development of potential ORE projects within the identified RZs has the potential for slight to significant positive impacts, including facilitating the connection and supply of more renewable energy, and support of economic growth. These positive impacts in turn will help to ensure that electricity supply is able to meet future demand, and that there is less reliance on fossil fuels into the future, resulting in better air quality and less GHG emissions. Furthermore, the further development of ORE through the OREAP could play a key role in shaping a reliable and sustainable energy future for Northern Ireland and help achieve the 2030 renewable electricity target of the Climate Change Act.

The RIAA included a Screening Assessment and AA to consider the potential for Likely Significant Effects, and subsequently Adverse Effects on Site Integrity of identified European sites, with regard to their Qualifying Interest Features and associated Conservation Objectives. The Screening Assessment concluded that the possibility of Likely Significant Effects of developing fixed offshore wind, floating offshore wind and tidal energy within the identified recommended RZs of the NI Marine Area could not be excluded, alone and in combination with other plans and projects. The RIAA, having conducted further investigation and analysis, and having applied appropriate plan-level measures including applying the mitigation hierarchy intended to avoid or reduce harmful effects on European sites and taking into consideration the safeguarding regime of lower level HRA at a project-level, for each of the projects brought forward from the OREAP and as part of the relevant development consent procedures in the NI Marine Area; it is concluded that adoption of the OREAP will not adversely affect the integrity of any European site.

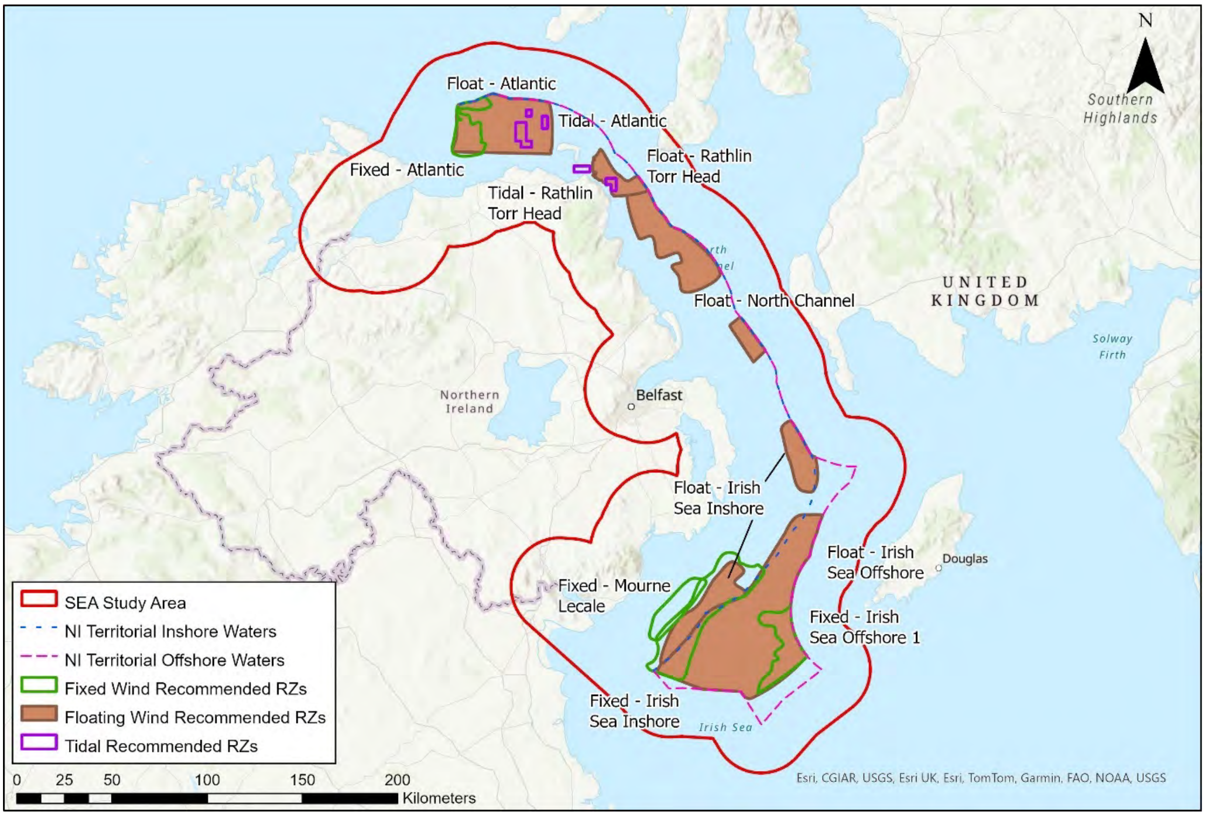


Figure 11-1 Recommended Resource Zones for Fixed Wind, Floating Wind, and Tidal ORE Technologies.

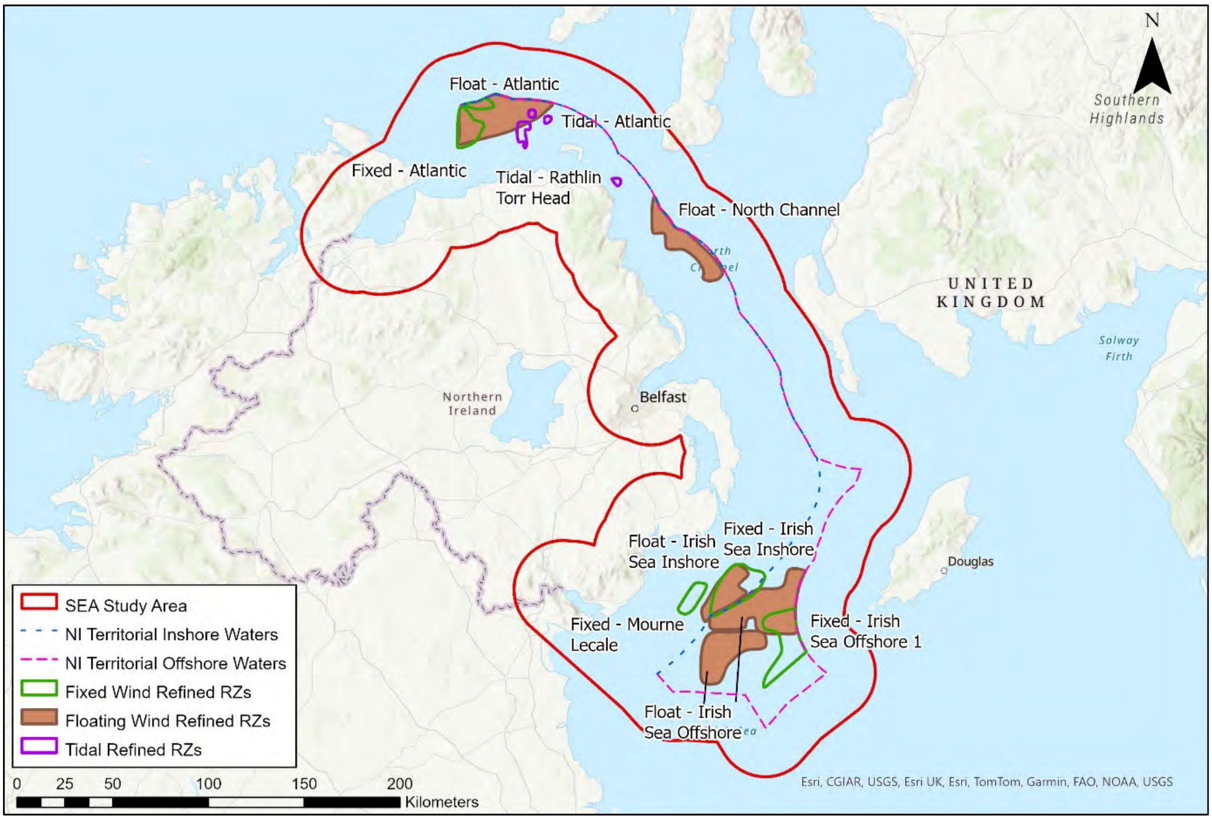


Figure 11-2 Refined Resource Zones for Fixed Wind, Floating Wind, and Tidal ORE Technologies.

12 NEXT STEPS

Consultations on the OREAP consultation document (Offshore Renewable Energy Action Plan: Consultation on the Strategic Environmental Assessment (SEA) Environmental Report and Report to Inform Appropriate Assessment (RIAA)), SEA Environmental Report and RIAA are anticipated to commence in February 2025 and run for 12 weeks. These documents will be made available for viewing digitally via the DfE website:

https://www.economy-ni.gov.uk/consultations/consultation-sea-environmental-report-and-riaa

Following completion of the consultation period, all comments will be collated and the OREAP, Environmental Report and RIAA will be reviewed and revised as necessary. Provided there are no objections or comments that will significantly alter the OREAP, the final version of the OREAP can be drafted and adopted. This is anticipated to be in July - August 2025. Following release of the adopted OREAP, an SEA Statement will be drafted to summarise the process undertaken and identify the manner by which environmental considerations and consultations were integrated into the final OREAP. **Table 12-1** demonstrates the proposed upcoming time stages for the OREAP, SEA and HRA/RIAA.

Table 12-1 Draft Anticipated Milestones

OREAP	Dates	SEA / HRA
Development of the revised OREAP	September 2023 - June 2024	Strategic Environmental Assessment and Appropriate Assessment. Writing of Environmental Report and RIAA.
Public and statutory consultation on the OREAP consultation document	February – May 2025	Statutory, Non-Statutory and Public Consultation on Environmental Report and RIAA.
Release of Final revised OREAP	July - August 2025	SEA Statement and HRA by competent authority.

Following adoption of the final OREAP the next stage of development for any of the potential options is detailed design and further detailed study, including TCE consideration, incorporating the advice and mitigation measures proposed in these environmental reports.

The contact details for any information regarding the OREAP or its environmental assessments is as follows:

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By email	oreap_ni@rps.tetratech.com

Appendix A– SEA Guidance

NI

A Practical Guide to the Strategic Environmental Assessment Directive. September 2005. Office of the Deputy Prime Minister. https://www.gov.uk/government/publications/strategic-environmental-assessment-directive-guidance

Guidance on Sustainability Appraisal and Strategic Environmental Assessment for the Historic Environment. June 2018. Department for Communities – Historic Environment Division

Strategic Environmental Assessment. Services and Standards for Responsible Authorities. Environment and Heritage Service. https://www.daera-ni.gov.uk/publications/strategic-environmental-assessment

Other

Article 8 (Decision Making) of EU Directive 2001/42/EC on Strategic Environmental Assessment (SEA) as amended. DoECLG Circular (PL 9/2013).

Developing and Assessing Alternatives in Strategic Environmental Assessment. 2015. Environmental Protection Agency. http://www.epa.ie/pubs/advice/ea/SEA-Alternatives-157-Published_web.pdf

Development of Strategic Environmental Assessment (SEA) Methodologies for Plans and Programmes in Ireland. Synthesis Report. 2001. Environmental Protection Agency. https://www.epa.ie/pubs/advice/ea/EPA_development_methodology_SEA_synthesis_report.pdf

Further Transposition of EU Directive 2001/42/EC on Strategic Environmental Assessment (SEA). DoECLG Circular (PSSP 6/2011).

GISEA Manual, Improving the Evidence Base in SEA, 2016. Environmental Protection Agency.

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Implementation of SEA Directive (2001/42/EC). Assessment of Certain Plans and Programmes on the Environment. Guidelines for Regional Planning Authorities. November 2004. Department of Environment, Heritage and Local Government. http://www.environ.ie/en/Publications/DevelopmentandHousing/Planning/FileDownLoad,1616,en.pdf

SEA Scoping Guidance Document. 2016. Environmental Protection Agency. http://www.epa.ie/pubs/advice/ea/seascopingguidance.html

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Guidance on Consideration of Air in Strategic Environmental Assessment. April 2017. Scottish Environment Protection Agency.

Guidance on Consideration of Climatic Factors within Strategic Environmental Assessment. March 2010. Scottish Environment Protection Agency.

Guidance on Consideration of Material Assets in Strategic Environmental Assessment. August 2016. Scottish Environment Protection Agency.

Guidance on Consideration of Soil in Strategic Environmental Assessment. April 2017. Scottish Environment Protection Agency.

Appendix B – Plans and Programmes

REVIEW OF PLANS AND PROGRAMMES

Plan/Programme	High Level Description	Key Objectives, Actions etc.	Relevance to the OREAP
International/European			
Biodiversity			
UN Convention on Biological Diversity (1992)	Maintenance and enhancement of Biodiversity, and strategies to ensure a fair and equitable sharing of the benefits from the use of genetic resources.	• Conservation of biological diversity (or biodiversity); • Sustainable use of its components; • Fair and equitable sharing of benefits rising from genetic resources; and • Development of national strategies for the conservation and sustainable use of biological diversity.	The OREAP should have regard for this Convention and look for opportunities to conserve, and, where possible, restore or enhance biodiversity. Environmental protection objectives of the Convention are reflected in the SEOs for Biodiversity, Flora and Fauna.
Kunming-Montreal Global Biodiversity Framework (GBF)	The GBF aims to halt and reverse nature loss.	• The framework consists of global targets to be achieved by 2030 and beyond to safeguard and sustainable use biodiversity.	The OREAP should have regard for the GBF and look for opportunities to conserve, and, where possible, restore or enhance biodiversity. Environmental protection objectives of the Framework are reflected in the SEOs for Biodiversity, Flora and Fauna.
Ramsar Convention on Wetlands of International Importance (1971 and amendments)	Protection and conservation of wetlands.	• Objectives include protection and conservation of wetlands, particularly those of importance to waterfowl as Waterfowl Habitat.	The OREAP should ensure that European Sites, including a consideration of Ramsar sites, are suitably protected from loss or damage. Appropriate Assessment is being undertaken for the OREAP, to ensure that its implementation will not adversely affect European Sites. Environmental protection objectives of the Convention are reflected in the

Plan/Programme	High Level Description	Key Objectives, Actions etc.	Relevance to the OREAP
			SEOs for Biodiversity, Flora and Fauna.
Bern Convention (Convention on European Wildlife and Natural Habitats) (1982)	The Bern Convention is a binding international legal instrument in the field of nature conservation, covering most of the natural heritage of the European continent and extending to some States of Africa.	• Objectives are to conserve wild flora and fauna and their natural habitats, as well as to promote European co-operation in this field. • The treaty also takes account of the impact that other policies may have on natural heritage.	The OREAP should have regard for this Convention and look for opportunities to conserve, and, where possible, restore or enhance biodiversity. Environmental protection objectives of the Convention are reflected in the SEOs for Biodiversity, Flora and Fauna.
The Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR) (1992)	The current instrument guiding international cooperation on the protection of the marine environment of the North-East Atlantic. Objectives include the protection of the marine environment.	• Prevention and elimination of pollution, and protection of the maritime area against the adverse effects of human activities, to safeguard human health and to conserve marine ecosystems.	The OREAP should have regard for the Convention and ensure that it does not compromise its objectives, and that it contributes to achieving its aims. Environmental protection objectives of the Convention are reflected in the SEOs for Water.
Bonn Convention on the Conservation of Migratory Species of Wild Animals [L210, 19/07/1982 (1983)]	The Bonn Convention focuses on preserving the habitats used by migratory species and aims to enhance the conservation of terrestrial, marine and avian species on a global scale throughout their range.	• Establishes a legal foundation for internationally coordinated conservation measures throughout a migratory range; • Migratory species threatened with extinction are listed on Appendix I of the Convention. Parties strive towards strictly protecting these animals, conserving, or restoring the places where they live, mitigating obstacles to migration and controlling other factors that might endanger them; and • In Europe, legislation to ensure that the provisions of the Bonn Convention are applied includes the Birds Directive and the Habitats Directive.	The OREAP should have regard for any implications on migratory species. Environmental protection objectives of the Convention are reflected in the SEOs for Biodiversity, Flora and Fauna.

Plan/Programme	High Level Description	Key Objectives, Actions etc.	Relevance to the OREAP
EU Biodiversity Strategy to 2030 [COM(2020)380]	Aims to put Europe's biodiversity on the path to recovery by 2030 for the benefit of people, climate and the planet. The Strategy aims to build societies' resilience to future threats such as: the impacts of climate change, forest fires, food insecurity and disease outbreaks.	The strategy contains specific commitments and actions to be delivered by 2030: • Establishing a larger EU-wide network of protected areas on land and at sea. Enlarging of existing Natura 2000 areas with strict protection for areas of very high biodiversity and climate value; • Launching an EU nature restoration plan. Including concrete commitments and actions (and proposed binding nature restoration targets) to restore degraded ecosystems by 2030 and manage them sustainably, addressing the key drivers of biodiversity loss; • Introducing measures to enable the necessary transformative change. Unlocking funding for biodiversity, and setting in motion a new, strengthened governance framework; and • Introducing measures to tackle the global biodiversity challenge. In particular, working towards adoption of an ambitious global biodiversity framework under the Convention on Biological Diversity.	The OREAP should have regard for this strategy and look for opportunities to conserve, and, where possible, restore or enhance biodiversity. Environmental protection objectives of the strategy are reflected in the SEOs for Biodiversity, Flora and Fauna.
EU Directive on the conservation of wild birds (Birds Directive) [2009/147/EC]	Protects all wild birds, their nests, eggs and habitats within the European Community. It gives EU member states the power and responsibility to classify Special Protection Areas (SPAs) to protect birds which are rare or vulnerable in Europe, as well as all migratory birds which are regular visitors.	• Preserve, maintain or re-establish a sufficient diversity and area of habitats for all the species of birds referred to in Annex I; • Preserve, maintain, and establish biotopes and habitats to include the creation of protected areas (Special Protection Areas); ensure the upkeep and management in accordance with the ecological needs of habitats inside and outside the protected zones, re-establish destroyed biotopes and creation of biotopes; and	Environmental protection objectives of the Directive are reflected in the SEOs for Biodiversity, Flora and Fauna. The OREAP should ensure that European Sites are suitably protected from loss or damage. Appropriate Assessment is being undertaken for the OREAP, to ensure that its implementation will not adversely affect European Sites.

Plan/Programme	High Level Description	Key Objectives, Actions etc.	Relevance to the OREAP
		• Measures for regularly occurring migratory species not listed in Annex I are required as regards their breeding, moulting, and wintering areas and staging posts along their migration routes. The protection of wetlands, and particularly wetlands of international importance.	
EU Directive on the conservation of natural habitats and of wild fauna and flora (Habitats Directive) [92/43/EEC]	Builds on the Birds Directive (see above) by protecting natural habitats and other species of wild plants and animals. Together with the Birds Directive, it underpins a European network of protected areas known as Natura 2000: Special Protection Areas (SPAs, classified under the Birds Directive) and Special Areas of Conservation (SACs, classified under the Habitats Directive).	• Propose and protect sites of importance to habitats, plant and animal species; • Establish a network of Natura 2000 sites hosting the natural habitat types listed in Annex I and habitats of the species listed in Annex II, to enable the natural habitat types and the species' habitats concerned to be maintained or, where appropriate, restored at a favourable conservation status in their natural range; • Carry out comprehensive assessment of habitat types and species present; and • Establish a system of strict protection for the animal species and plant species listed in Annex IV.	Environmental protection objectives of the Directive are reflected in the SEOs for Biodiversity, Flora and Fauna. The OREAP should ensure that European Sites are suitably protected from loss or damage. Appropriate Assessment is being undertaken for the OREAP, to ensure that its implementation will not adversely affect European Sites.
Convention for the Conservation of Salmon in the North Atlantic	This Convention recognises that Salmon originating in the rivers of different states intermingle in certain parts of the North Atlantic Ocean.	• The key objectives of the Convention are the desire to promote the acquisition, analysis and dissemination of scientific information pertaining to Salmon stocks in the North Atlantic Ocean and the desire to promote the conservation, restoration, enhancement, and rational management of salmon stocks in the North Atlantic Ocean through international cooperation.	The OREAP should contribute towards the achievement of the desires of the Convention and the Articles therein.

Plan/Programme	High Level Description	Key Objectives, Actions etc.	Relevance to the OREAP
EU Common Fisheries Policy	The CFP is a set of rules for sustainable managing EU fishing fleets and conserving fish stocks.	The CFP was established in 1983 with two broad goals: to protect and increase Europe's fish stocks at risk from overfishing, and to safeguard fishing businesses and local communities that depend on them. The reformed CFP became law on 1 January 2014. This framework features the following: • attention to the **environmental, economic and social dimensions** of fisheries; • fish stock management at **maximum sustainable yield** for all managed stocks; • gradual introduction of a **landing obligation** by 2019; • continued application of the so-called **multiannual plans** (MAPs) to manage fisheries in different sea basins; • **regionalisation** to allow EU countries with a management interest to propose detailed measures, which the Commission can then adopt as delegated or implementing act and transpose them into EU law; and • **fleet capacity ceilings** per EU country in combination with the obligation for EU countries to ensure a stable and enduring balance between fishing capacity and fishing opportunities over time. EU countries may need to develop action plans to reduce overcapacity (for which they can use scrapping money).	The OREAP should have regard for the environmental protection objectives of the CFP in planning for offshore renewable infrastructure.
Climate Change			
Paris Agreement (UNFCCC, 2016)	A legally binding international treaty on climate change, adopted by 196 parties at the UN Climate Change Conference (COP21) in December 2015.	The Paris Agreement and the outcomes of the UN climate conference (COP21) cover all the crucial areas identified as essential for a landmark conclusion:	The OREAP should aim to contribute towards climate change mitigation. The OREAP should contribute to reducing GHG emissions by

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	It aims to strengthen the global response to the threats of climate change by keeping this century's global temperature rise below 2 degrees Celsius above pre-industrial levels.	• Mitigation – reducing emissions fast enough to achieve the temperature goal; • A transparency system and global stock-take – accounting for climate action; • Adaptation – strengthening ability of countries to deal with climate impacts; • Loss and damage – strengthening ability to recover from climate impacts; and • Support – including finance, for nations to build clean, resilient futures.	connecting offshore renewable energy generators to the system. Environmental protection objectives of the Agreement are reflected in the SEOs for Climatic Factors.
UN Kyoto Protocol, the Doha Amendment, The United Nations Framework Convention on Climate Change (UNFCC, 1997)	The Framework Convention on Climate Change seeks to alleviate the impacts of climate change and reduce global emissions of GHGs. The Protocol operationalises this Convention. It was adopted in December 1997 and entered into force in February 2005.	• Commits industrialised countries and economies in transition to limit and reduce GHG emissions in accordance with agreed individual targets; • Places a heavier burden on developed countries under the principle of "common but differentiated responsibility and respective capabilities"; • Annex B sets binding emission reduction targets for 37 industrialised countries and economies in transition and the EU. Overall, the targets for the first period (2008-2012) added up to an average 5% emission reduction compared to 1990 levels; and • The Doha Amendment was adopted in December 2012 and entered into force in December 2020. This set a second period (2013-2020) with new commitments and a revised list of GHG to be reported.	The OREAP can contribute to achieving emission reduction targets through connection of offshore renewable energy generators to the system. Environmental protection objectives of the Protocol are reflected in the SEOs for Climatic Factors.
EU 20-20-20 Climate and Energy Package Agreement (2007)	Objectives seek to alleviate the impacts of climate change and reduce global emissions of GHGs.	To meet the EU's obligation under international law and in line with European ambition. Member States are required to: • 20% cut in GHG emissions collectively (from 1990 levels);	As an EU Member State when the Agreement was produced, the UK was subject to its obligations. The more recent Energy Strategy for NI sets out more stringent targets

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		• 20% of EU energy produced from renewables; and • 20% improvement in energy efficiency. The collective EU target of reducing emissions by 20% by 2020 is to be achieved by: The EU Emissions Trading System, the backbone of the EU mitigation effort, which sets a cap on emissions from the most polluting sectors, including over 11,000 factories, power plants and other installations, including airlines. By 2020, the cap should result in a 21% reduction relative to 2005 levels. The EU ETS covers about 40% of all EU emissions. The 'effort sharing decision', which operates outside the EU ETS and establishes annual binding GHG emission targets for individual Member States for the 2013-2020 period. These concern emissions from sectors such as waste, agriculture, buildings, etc. The '20-20-20' targets are supported by the long-term target of 85-90% reduction in GHG emissions against 1990 levels by 2050.	relating to GHG emissions and the energy sector. The OREAP can contribute to achieving emission reduction targets through connection of offshore renewable energy generators to the system.
The European Green Deal 2019	The European Green Deal is a plan to make the EU's economy sustainable.	The growth strategy outlines transformation of the EU to a resource-efficient and competitive economy where: • There are no net emissions of GHGs by 2050; • Economic growth is decoupled from resource use; and • No person and no place is left behind. The Deal provides an Action Plan to: • Boost the efficient use of resources by moving to a clean circular economy; and • Restore biodiversity and cut pollution.	As an EU Member State when the strategy was produced, the UK was subject to its obligations. The Climate Change Act (NI (2022) has subsequently been introduced, setting a legal framework for a net zero target of GHG emissions by 2050 from baseline levels. The OREAP can contribute to achieving emission reduction targets through connection of offshore renewable energy generators to the system.

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Renewable Energy Directive (RED) (2009/28/EC), and revision [Directive EU/2018/2001] (RED II)	This first RED establishes a common framework for the use of energy from renewable sources in order to limit greenhouse gas emissions and to promote cleaner transport. The Member States are to establish national action plans that set the share of energy from renewable sources consumed in transport, as well as in the production of electricity and heating, for 2020. The second RED II revises RED and sets an overall European renewable energy target of 32% by 2030.	The RED requires the EU to fulfil at least 20% of its total energy needs with renewable by 2020 – to be achieved through the attainment of individual national targets. All EU countries must also ensure that at least 10% of their transport fuels come from renewable sources by 2020. The RED II sets a target of 32% renewable energy for Europe by 2030 and includes measures to promote renewable energy across the EU.	The OREAP can contribute to achieving renewable energy targets through connection of offshore renewable energy generators to the system. Environmental protection objectives of the Directive are reflected in the SEOs for Climatic Factors and Material Assets.
EU Strategy on Adaptation to Climate Change	The Adaptation Strategy recognises how important impact assessment is for climate proofing, identifies the key priorities for action and how EU policies can encourage effective adaptation action.	The strategy was adopted by the EC in April 2013. It outlines the measures for taking climate change preparedness to a new level. The strategy has three main objectives: • Promote climate action in Member States through encouraging the adoption of adaptation strategies; • The promotion of informed decision-making through addressing knowledge gaps and the development of the European Climate Adaptation Platform for better knowledge dissemination; and • Promoting adaptation in key vulnerable sectors.	As an EU Member State when the strategy was produced, the UK was subject to its obligations. The NI Climate Change Adaption Programme 2019-2024 (NICCAP2) outlines the risks and opportunities relevant to NI, as identified in the UK Climate Change Risk Assessment 2017. The OREAP should aim to contribute towards climate change mitigation and infrastructure to be planned for and resilient to climatic change.
Forging a climate-resilient Europe – the new EU Strategy on Adaptation to Climate Change 2021[COM(2021)82]	The Strategy outlines a long-term vision for the EU to become a climate-resilient society, fully adapted to the unavoidable impacts of climate change by 2050 and complements the EU's goal of becoming climate neutral by this date. Deepens and expands upon adaptation actions in the 2013 EU Adaptation Strategy.	This strategy aims to reinforce the adaptive capacity of the EU and the world, and minimise vulnerability to the impacts of climate change, in line with the Paris Agreement and the proposal for European Climate Law. It seeks to step up action across the economy and society in synergy with other Green Deal policies such as biodiversity protection and sustainable agriculture.	As an EU Member State when the strategy was produced, the UK was subject to its obligations. The NICCAP2 outlines the risks and opportunities relevant to NI, as identified in the UK Climate Change Risk Assessment 2017. The OREAP should aim to contribute towards climate change mitigation

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		The Strategy has three objectives, and proposes a range of actions in order to meet them: • To make adaptation smarter - improving knowledge and availability of data, while managing the inherent uncertainty brought upon us by climate change; securing more and better data on climate-related risk and losses; and making Climate-ADAPT the authoritative European platform for adaptation knowledge; • To make adaptation more systemic - supporting policy development at all levels of governance, society, and the economy and in all sectors by improving adaptation strategies and plans; integrating climate resilience in macro-fiscal policy, and promoting nature-based solutions for adaptation; and • To speed up adaptation across the board – by accelerating development and rollout of adaptation solutions; reducing climate-related risk; closing the climate protection gap; and ensuring the availability and sustainability of fresh water.	and infrastructure to be planned for and resilient to climatic change.
Second European Climate Change Programme (ECCP II) 2005.	Objectives seek to develop the necessary elements of a strategy to implement the Kyoto protocol.	Develop a framework for a low carbon economy which will be achieved through a National Mitigation Plan (to lower GHG emissions) and a National Adaptation Framework (to provide for responses to changes caused by climate change). This includes: • Reform of the EU Emissions Trading System (EU ETS) to include a cap on emission allowances in addition to existing system of national caps;	The OREAP will need to have regard for this programme in the planning of offshore renewable infrastructure. The OREAP can contribute towards climate change mitigation though connection of offshore renewable energy generators to the system.

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		• Agreement of national targets for non-EU ETS emissions from countries outside the EU; • Commitment to meet the national renewable energy targets of 16% for Ireland by 2020; and • Preparation of a legal framework for technologies in carbon capture and storage.	
EU Green Infrastructure Strategy (COM(2013) 249 final).	Aims to develop preserve and enhance healthy green infrastructure to help stop the loss of biodiversity and enable ecosystems to deliver their many services to people and nature. The greater the scale, coherence and connectivity of the green infrastructure network, the greater its benefits. The EU Strategy on green infrastructure aims to outline how to deploy such a network and encourages action at all levels.	The Green Infrastructure strategy is a key step towards the success of the EU Biodiversity Strategy. It is made up of four main elements: • Promoting Green Infrastructure in the main EU policy areas; • Supporting EU-level GI projects; • Improving access to finance for GI projects; and • Improving information and promoting innovation.	The OREAP will need to have regard for this strategy in regard to the development of green infrastructure as part of offshore renewable infrastructure developments.
Air Quality			
Stockholm Convention (2004)	The Stockholm Convention is an international treaty with the aim of eliminating or restricting the production and use of persistent organic pollutants (POPs).	The main objective of the treaty is in seeking to protect human health and the environment from POPs.	The OREAP will need to have regard for this Convention with regard to the potential for cumulative emission effects.
WHO Air Quality Guidelines – global update (2005).	Objectives seek the elimination or minimisation of certain airborne pollutants for the protection of human health.	• Air Quality Guidelines (AQGs) were published by the WHO in 1987 and revised in 1997 and most recently in 2005; • These offer guidance on threshold limits for key air pollutants that pose health risks and provide a reference for setting air pollution	The OREAP should have regard for the environmental protection objectives of these guidelines, in terms of cumulative emissions affecting air quality from the energy supply sector and other sources. The OREAP may be able to contribute to

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		targets at regional and national levels to improve air quality; and • The 2005 guidelines offer recommended exposure levels for particulate matter (PM10 and PM2.5), ozone, nitrogen dioxide and sulphur dioxide, as well as a set of interim targets to encourage a progressive improvement in air quality.	reducing air emissions by connecting offshore renewable energy generators to the system.
The Gothenburg Protocol (1999), as amended in 2012.	The 1999 Gothenburg Protocol to Abate Acidification, Eutrophication and Ground-level Ozone (Gothenburg Protocol) is a multi-pollutant protocol designed to reduce acidification, eutrophication, and ground-level ozone by setting emissions ceilings for sulphur dioxide, nitrogen oxides, volatile organic compounds and ammonia to be met by 2010. The protocol was updated and amended in 2012.	• The 1999 Protocol set national emission ceilings for 2010 for four pollutants: sulphur dioxide (SO_2), nitrogen oxides (NO_x), volatile organic compounds (VOCs) and ammonia (NH_3); • As amended in 2012, the Protocol includes national emission reduction commitments to be achieved by 2020 and beyond; and • Parties must report on their emissions annually and are required to provide projections of their future emissions.	The OREAP should have regard for the environmental protection objectives of the Protocol, relating to the control of emissions from construction. The OREAP may be able to contribute to reducing air emissions by connecting offshore renewable energy generators to the system.
Ambient Air Quality and Cleaner Air for Europe (CAFE) Directive [2008/50/EC] & 4th Daughter Directive of the Air Quality Framework Directive [2004/107/EC]	Set air quality standards for protection of human health and the environment. Addresses air pollution at the level of zones, while the complementary NEC Directive addresses total emissions.	• The Ambient Air Quality and Cleaner Air for Europe (CAFE) Directive (2008/50/EC) was published in May 2008. It replaced the Framework Directive and the first, second and third Daughter Directives; • Sets limit and target values for certain pollutants. Covers in particular nitrogen dioxide (NO_2) and particulate matter or fine dust (PM10), which is emitted by traffic and combustion engines; • Lays down limit values to be respected by Member States in their zones; and	The OREAP should have regard for the environmental protection objectives of these Directives, relating to the control of emissions from construction. The OREAP will be obliged to comply with air quality standards set out in these Directives and has potential to contribute to reducing air emissions by connecting renewable offshore renewable energy generators to the system.

Plan/Programme	High Level Description	Key Objectives, Actions etc.	Relevance to the OREAP
		• The 4th Daughter Directive relates to arsenic cadmium, mercury, nickel and polycyclic aromatic hydrocarbons.	
Industrial Emissions Directive [2010/75/EU]	• Aims to achieve a high level of protection of human health and the environment taken as a whole by reducing harmful industrial emissions across the EU, in particular through better application of Best Available Techniques (BAT); and • Around 50,000 installations undertaking the industrial activities listed in Annex I of the Industrial Emissions Directive (IED) are required to operate in accordance with a permit (granted by the authorities in Member States).	The IED is based on several pillars, in particular (1) an integrated approach, (2) use of best available techniques, (3) flexibility, (4) inspections and (5) public participation: • The integrated approach means that the permits must take into account the whole environmental performance of the plant; • The permit conditions including emission limit values must be based on the Best Available Techniques (BAT); • The IED allows competent authorities some flexibility to set less strict emission limit values; • The IED contains mandatory requirements on environmental inspections. Member States shall set up a system of environmental inspection and draw up inspection plans accordingly; and • The IED ensures that the public has a right to participate in the decision-making process, and be informed of its consequences, by having access to permit applications, permits and the results of the monitoring releases.	The OREAP should have regard for the environmental protection objectives of the Directive, which includes protection from emissions from certain power plants, in terms of cumulative emissions affecting air quality.
National Emissions reduction Commitments (NEC) Directive [2016/2284/EU]	This Directive seeks to limit the national emissions of certain airborne pollutants for the protection of human health and the environment. Implements at the EU level obligations under the Geneva Convention and Gothenburg Protocol. It replaced the earlier National Emission Ceilings for Certain Atmospheric Pollutants Directive (2001/81/EC).	It sets the limits on total national emissions from four pollutants - sulphur dioxide, nitrogen oxides, volatile organic compounds and ammonia. These can cause acidification (e.g., the chemical composition of the sea acidifies), water and soil pollution (eutrophication) and ground-level ozone (ozone resulting from the	The OREAP should have regard for the environmental protection objectives of the Directive, relating to the control of emissions from construction. The OREAP should, where possible, contribute to the protection of air quality. Connection of offshore renewable energy

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		reaction of the four pollutants with heat and sunlight).	infrastructure could contribute to reducing national emissions.
Geneva Convention (1979) on Long-range Transboundary Air Pollution (LRTAP)	International agreement with the aim of limiting problems of air pollution on a broad regional basis.	• First international legally binding instrument dealing with problems of air pollution on a broad regional basis. It was signed in 1979 and entered into force in 1983. It has since been extended by eight specific protocols. • Under the Convention, the parties commit to working together to limit, to gradually prevent, and to reduce their discharges of air pollutants in order to combat the resulting transboundary pollution. • The Convention has substantially contributed to the development of international environmental law and has created the essential framework for controlling and reducing the damage to human health and the environment caused by transboundary air pollution.	The OREAP should have regard for the environmental protection objectives of the Directive, relating to the control of emissions from construction.
Sustainable Development			
Eighth Environmental Action Programme (EAP) (2021-2030) of the European Community	The Programme provides a framework for the EU's overall environmental policy development and guides the policy-making by identifying priorities and setting out a long-term vision and goals.	• Replaces the 7th programme; • The new 10-year programme keeps the 2050 vision and enforces it by aiming to accelerate the EU transition to a climate-neutral, resource efficient clean circular economy in a just and inclusive way, fully endorsing the environmental and climate objectives of the European Green Deal. The 8th EAP should also provide a basis for the achievement of the environmental objectives of the UN Agenda 2030 and its 17 SDGs; and	The OREAP should have regard for the environmental protection objectives of the Programme.

Plan/Programme	High Level Description	Key Objectives, Actions etc.	Relevance to the OREAP
		• The 8th EAP has 6 thematic priority objectives in areas of: – Climate neutrality; – Adaptation and resilience to climate change and other environmental risks; – Circular economy and regenerative growth decoupling economy from resource use and environmental degradation; – Zero pollution ambition for a toxic-free environment; – Protecting and restoring biodiversity, and enhancing natural capital; and – Environmental sustainability and reduction of the environmental pressures from production and consumption.	
EUROPE 2020 A strategy for smart, sustainable and inclusive growth (COM/2010/2020)	Europe 2020 is a 10-year growth strategy proposed by the European Commission in 2010 for advancement of the EU economy. It aims at "smart, sustainable, inclusive growth", with greater coordination of national and European policy. It follows the Lisbon Strategy for the period 2000–2010.	The Strategy set five overarching objectives to be reached by 2020: • Employment: 75% of population aged 20-64 should be employed; • Innovation: 3% EU's GDP should be invested in R&D; • Climate Change: 20/20/20 climate/energy targets should be met (including an increase to 30% of emissions reduction if conditions are right); • Education: Share of early school leavers should be under 10% and at least over 40% of the younger generation should have a tertiary degree; and • Poverty: At least 20m fewer people in at-risk-of-poverty and social exclusion.	Environmental protection objectives of the Strategy, with regard to climate change objectives, are reflected in the SEO for Climatic Factors.
Roadmap to a Resource Efficient Europe (COM(2011) 571)	Outlines how to transform the EU economy to a sustainable one by 2050. It proposes ways to increase resource productivity and decouple	• Areas where policy action can make a real difference are a particular focus, and specific bottlenecks like inconsistencies in policy and	The OREAP should have regard for the environmental protection objectives of this roadmap in planning

Plan/Programme	High Level Description	Key Objectives, Actions etc.	Relevance to the OREAP
	economic growth from resource use and its environmental impact. It sets out a vision for the structural and technological change needed up to 2050, with milestones to be reached by 2020. These milestones illustrate what will be needed to put Europe on a path to resource efficient and sustainable growth.	market failures are tackled to ensure that policies are all going in the same direction; • Cross-cutting themes such as addressing prices that do not reflect the real costs of resource use and the need for more long-term innovative thinking are also in the spotlight; and • Key resources are analysed from a life-cycle and value-chain perspective. Nutrition, housing and mobility are the sectors responsible for most environmental impacts; actions in these areas are being proposed to complement existing measures.	for offshore renewable infrastructure and should contribute to achieving renewable energy targets.
SEA Directive [2001/42/EC]	To provide for a high level of protection of the environment and to contribute to the integration of environmental considerations into the preparation and adoption of plans and programmes with a view to promoting sustainable development.	• Requires that Plans & Programmes take into account protection of the environment and integration of the Plan into the sustainable planning of the country as a whole; and • Eleven sectors are specified in the Directive and Competent Authorities (Plan/Programme makers) must subject specific Plans and Programmes for these sectors to an environmental assessment where they are likely to have significant effects on the environment.	The OREAP will be subject to the SEA process. This is being undertaken through this SEA Environmental Report.
UN Convention on Environmental Impact Assessment (ESPOO Convention) 1997 and Kyiv (SEA) Protocol 2003	The ESPOO (EIA) Convention provides for protection of the environment at an early stage of planning for certain activities. Complemented by the Protocol on Strategic Environmental Assessment (Kyiv Protocol).	• Sets out the obligations of Parties to assess the environmental impact of certain activities at an early stage of planning; • Sets out the general obligation of States to notify and consult each other on all major projects under consideration that are likely to have a significant adverse environmental impact across boundaries; and • The SEA Protocol augments the Convention by ensuring that individual Parties integrate environmental assessment into their plans	The OREAP will be subject to the SEA process. This is being undertaken through this SEA Environmental Report.

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		and programmes at the earliest stages and provides for extensive public participation in the decision-making process.	
EIA Directive [85/337/EEC] [2014/52/EU]	The objective of this Directive is to require Environmental Impact Assessment of the environmental effects of those public and private projects, which are likely to have significant effects on the environment. Aims to assess and implement avoidance or mitigation measures to eliminate environmental effects, before consent is given of projects likely to have significant effects on the environment by virtue, inter alia, of their nature, size or location. Projects of this type are subject to a requirement for development consent and an assessment with regard to their effects.	• All projects listed in Annex I are considered as having significant effects on the environment and compulsorily require an EIA; • For projects listed in Annex II, a "screening procedure" is required to determine the effects of projects on the basis of thresholds/criteria or a case-by-case examination. The competent authority may give a decision on whether a project requires EIA; • Requirement for identification, description and assessment in an appropriate manner, in the light of each individual case, on the direct and indirect effects of a project on the following factors: human beings, fauna and flora, soil, water, air, climate and the landscape, material assets, cultural heritage, and the interactions between these factors; • Requirement for consultation with relevant authorities, stakeholders and the public, allowing sufficient time for these to make a submission before a decision is made; • Establishment of a recognised structure and content for the Environmental Impact Statement, which is the document submitted as a written account of the EIA; and • Inclusion of proposed flood risk management schemes in EIA screening process.	The OREAP will have regard to the EIA Directive in the development of any offshore renewable infrastructure. Development and operation of offshore renewable development projects may be subject to EIA.
Energy Efficiency Directive [2012/27/EU]	European Union directive which mandates energy efficiency improvements within the European Union.	The aim of the EU Energy Efficiency Directive was to save energy and to reach the EU's energy savings targets:	The OREAP will be obliged to comply with the requirements of this Directive. Development and operation

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		• By 2020, a 20% cut in energy consumption, or in absolute terms -calculated in million tons of oil equivalent (Mtoe) - 1483 Mtoe in 2020 compared to projected consumption in that year of 1842 Mtoe for the EU as a whole; and • The Directive included a legal obligation to establish energy saving schemes in all Member States: energy distributors or retail energy sales companies were obliged to save 1.5 % of their energy sales annually, by volume, through the implementation of energy efficiency measures such as improving the efficiency of heating systems, installing double glazed windows or insulating roofs, among final energy customers.	of new electricity offshore renewable infrastructure should contribute to improved energy efficiency.
UN 2030 Agenda for Sustainable Development	The UN 2030 Agenda envisages "a world of universal respect for human rights and human dignity, the rule of law, justice, equality and non-discrimination". It is grounded in the Universal Declaration on Human Rights and international human rights treaties and emphasises the responsibilities of all states to respect, protect and promote human rights.	The Agenda's 17 Sustainable Development Goals (SDG), and their 169 targets, aim to: Eradicate poverty in all forms and "seek to realize the human rights of all and achieve gender equality".	The OREAP should have regard for the environmental protection objectives of the Agenda in the planning of offshore renewable infrastructure. It should promote sustainable planning and management in the development and operation of offshore renewable infrastructure.
	Water		
International Convention for the Prevention of Pollution from Ships (The MARPOL Convention)	The main international convention covering prevention of marine environment pollution by ships from operational or accidental causes.	The Convention includes regulations aimed at preventing and minimizing pollution from ships - both accidental pollution and that from routine operations. Six Annexes are currently included that cover:	The OREAP should have regard for the pollution prevention objectives of the Convention. Any vessels used for installation and transport of equipment or personnel may have the potential to pollute the marine environment. The draft plan

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		• ***Annex I Regulations for the Prevention of Pollution by Oil -*** Prevention of pollution by oil; • ***Annex II Regulations for the Control of Pollution by Noxious Liquid Substances in Bulk -*** The discharge criteria and measures for the control of pollution by 250-listed noxious liquid substances carried in bulk; • **Annex III Prevention of Pollution by Harmful Substances Carried by Sea in Packaged Form -** General requirements for the issuing of detailed standards on packing, marking, labelling, documentation, stowage, quantity limitations, exceptions and notifications of “harmful substances”; • ***Annex IV Prevention of Pollution by Sewage from Ships -*** Requirements to control pollution of the sea by sewage; • ***Annex V Prevention of Pollution by Garbage from Ships -*** Different types of garbage and specifies the distances from land and the manner in which they may be disposed of; and • ***Annex VI Prevention of Air Pollution from Ships -*** Limits on sulphur oxide and nitrogen oxide emissions from ship exhausts and prohibits deliberate emissions of ozone depleting substances.	should have regard for the pollution prevention aims of the regulations included in the Convention during the planning of infrastructure construction and installation.
UNCLOS (United Nations Convention on the Law of the Sea) 1982	UNCLOS is a comprehensive regime of law and order in the oceans and seas. It sets out the legal framework within which all ocean and sea activities must be carried out. The Convention contains 320 articles and nine annexes which govern all aspects of ocean space such as environmental control, delimitation, marine scientific research, transfer of technology.	The objectives of UNCLOS are to: • Promote peaceful use of oceans and seas; • Facilitate International Communications; • Enable equitable and efficient ocean resource utilisation; and • Promote maritime safety.	The OREAP should have regard for the ocean space governance objectives and laws of the Convention.

Plan/Programme	High Level Description	Key Objectives, Actions etc.	Relevance to the OREAP
	commercial and economic activities, and settlement of disputes relating to ocean matters.		
European Integrated Maritime Policy 2007	The Integrated Maritime Policy (IMP) of the European Union (EU) is a holistic approach to all sea-related EU policies. It is a crucial policy framework aiming to foster the sustainable development of all sea-based activities and coastal regions by improving the coordination of policies affecting the oceans, seas, islands, coastal and outermost regions and maritime sectors, and by developing cross-cutting tools.	The main objectives and corresponding fields of action of the IMP are: • Maximising the sustainable use of the oceans and seas in order to enable the growth of maritime regions and coastal regions as regards shipping, seaports, shipbuilding, maritime jobs, the environment and fisheries management; • Building a knowledge and innovation base for maritime policy through a comprehensive European Strategy for Marine and Maritime Research (e.g. the Maritime Strategy Framework Directive (2008/56/EC) and the Horizon 2020 programme (2.4.5); • Improving the quality of life in coastal regions by encouraging coastal and maritime tourism, creating a Community Disaster Prevention Strategy and developing the maritime potential of the EU's outermost regions and islands; • Promoting EU leadership in international maritime affairs through enhanced cooperation at the level of international ocean governance and, on a European scale, through the European Neighbourhood Policy (ENP) (5.5.5) and the Northern Dimension (5.5.3); and • Raising the visibility of maritime Europe through the 'European Atlas of the Seas' internet application, as a means of highlighting the common European	The OREAP should have regard for the main objectives and actions of the IMP.

Plan/Programme	High Level Description	Key Objectives, Actions etc.	Relevance to the OREAP
		maritime heritage, and by celebrating an annual European Maritime Day on 20 May.	
Water Framework Directive (2000/60/EC), (as amended by Decision 2455/2001/EC and Directives 2008/32/EC, 2008/105/EC and 2009/31/EC.	• Aims to improve water quality and quantity within rivers, estuaries, coasts and aquifers; • Aims to prevent the deterioration of aquatic ecosystems and associated wetlands by setting out a timetable until 2027 to achieve good ecological status or potential; • Member States are required to manage the effects on the ecological quality of water which result from changes to the physical characteristics of water bodies; • Action is required in those cases where these “hydro-morphological” pressures are having an ecological impact which will interfere with the ability to achieve WFD objectives; and • The following Directives have been subsumed into the Water Framework Directive: - The Drinking Water Abstraction Directive; - Sampling Drinking Water Directive; - Exchange of Information on Quality of Surface Freshwater Directive; - Shellfish Directive; - Freshwater Fish Directive; - Groundwater (Dangerous Substances) Directive; and - Dangerous substances Directive.	• Identification and establishment of individual river basin districts; • Preparation of individual river basin management plans for each of the catchments. These contain the main issues for the water environment and the actions needed to deal with them; • Establishment of a programme of monitoring water quality in each RBD; • Establishment of a Register of Protected Areas (includes areas previously designated under the Freshwater Fish and Shellfish Directives which have become sites designated for the protection of economically significant aquatic species under WFD and placed on the Protected Areas register); and • Promotion of sustainable management of the water environment by carefully considering current land use and future climate scenarios, minimising the effects of flooding and drought events and facilitating long term improvements in water quality, including the protection of groundwater near landfill sites, as well as minimising agricultural runoff.	The OREAP should have regard for the environmental protection objectives of the WFD in the planning of offshore renewable infrastructure. It will need to consider the requirements of the WFD and ensure that it does not compromise its objectives, and that it contributes to achieving its aims.
Marine Strategy Framework Directive (2008/56/EC) (MSFD)	• Establishes a framework whereby the necessary measures are undertaken to achieve or maintain GES in the marine environment by the year 2020;	• Preparation of an assessment of the current environmental status of the waters concerned and the environmental impact of human activities;	The OREAP should have regard for the environmental protection objectives of the MSFD in the

Plan/Programme	High Level Description	Key Objectives, Actions etc.	Relevance to the OREAP
	• Requires the development and implementation of marine strategies in order to protect and preserve the marine environment, prevent its deterioration or, where practicable, restore marine ecosystems in areas where they have been adversely affected; and • It aims to prevent and reduce inputs in the marine environment, with a view to phasing out pollution as defined in Article 3(8), so as to ensure that there are no significant impacts on or risks to marine biodiversity, marine ecosystems, human health or legitimate uses of the sea.	• Establishment of a series of environmental targets and associated indicators; • Development of a programme of measures designed to achieve or maintain GES, by 2020; • Establishment of a monitoring programme for ongoing assessment and regular updating of targets; and • Cooperation with transboundary Member States to implement these measures.	planning of offshore renewable infrastructure. The OREAP could have implications on the environmental status of marine waters. Development and operation of offshore renewable infrastructure should aim to avoid impacts on the marine environment. Environmental protection objectives of the Directive are reflected in the SEOs for Water.
Floods Directive (2007/60/EC)	This Directive provides a framework for the assessment and management of flood risks, aiming to reduce the adverse consequences associated with flooding for human health, the environment, cultural heritage and economic activity.	Member States must: • Assess the risk of flooding of all water courses and coast lines; • Map the flood extent and assets and humans at risk in these areas at River Basin level and in areas covered by Article 5(1) and 13(1); and • Implement flood risk management plans and take adequate and coordinated measures to reduce this flood risk. Member States are required to first carry out a preliminary assessment by 2011 to identify the river basins and associated coastal areas at risk of flooding. For such zones they would then need to draw up flood risk maps by 2013 and establish flood risk management plans focused on prevention, protection and preparedness by the end of 2015. The public must be informed and allowed to participate in the planning process.	The OREAP should have regard for the environmental protection objectives of the Floods Directive in the planning of onshore cabling requirements of offshore renewable infrastructure.

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Bathing Water Directive (2006/7/EC)	The overall objective of the revised Bathing Water Directive remains the protection of public health whilst bathing. It: • Imposes stricter standards for water quality and the implementation of new method of assessment; • Establishes a more pro-active approach to the assessment of possible pollution risks, and to the management of bathing waters; and • Places considerable emphasis on promoting increased public involvement, and for improved dissemination of information on bathing water quality to the general public.	• Updates the way in which water quality is measured, focusing on fewer microbiological indicators, and setting different standards for inland and coastal bathing sites; • Reduces the health risks linked to bathing by setting scientifically based minimum water quality standards; • Makes changes to monitoring and sampling frequency; • Allows a limited number of water samples to be disregarded during short term pollution incidents, if the event is predicted and the public is warned beforehand; • Provides better information to the public, allowing more informed choices to be made about the risk of bathing; • Improves the overall management of bathing water quality by requiring an assessment of potential sources of pollution; and • Is compatible with other EU water related legislation, in particular the Water Framework Directive.	The OREAP should have regard for the environmental protection objectives of this Directive in the planning of offshore renewable infrastructure, relating to the potential for cumulative effects on waters used for recreation. Development and operation of offshore renewable transmission infrastructure should not negatively impact on designated bathing waters.
Environmental Quality Standards Directive (Directive 2008/105/EC) (also known as the Priority Substances Directive), as amended by Directive 2013/39/EU.	Establishes environmental quality standards (EQS) for priority substances and certain other pollutants as provided for in Article 16 of the Water Framework Directive and aims to achieve good surface water chemical status in accordance with the provisions and objectives of Article 4 of the Water Framework Directive.	• Apply the EQS laid down in Part A of Annex I to this Directive for bodies of surface water; • Determine the frequency of monitoring in biota and/or sediment of substances; • Monitoring shall take place at least once every year, unless technical knowledge and expert judgment justify another interval; • Notify the European Commission if the substances for which EQS have been established if a deviation of the monitoring is planned along with the rationale and approach; and	Impacts on water quality are of relevance to the OREAP, as offshore renewable development options have potential to be associated with water pollution. Development and operation of offshore renewable transmission infrastructure should aim to not negatively impact on any environmental quality standards.

Plan/Programme	High Level Description	Key Objectives, Actions etc.	Relevance to the OREAP
		• Establish an inventory, including maps, if available, of emissions, discharges and losses of all priority substances and pollutants listed in Part A of Annex I to this Directive for each river basin district.	
Environmental Liability Directive [2004/35/EC]	• Establishes a framework for environmental liability based on the 'polluter-pays' principle, to prevent and remedy environmental damage; and • Relates to environmental damage caused by occupational activities (listed in Annex III), and to any imminent threat of such damage occurring by reason of any of those activities; damage to protected species and natural habitats caused by any occupational activities other than those listed in Annex III, and to any imminent threat of such damage occurring by reason of any of those activities, whenever the operator has been at fault or negligent.	• Describes procedures for circumstances where environmental damage has occurred. Requires the polluter to take all practicable steps to immediately control, contain, remove or otherwise manage the relevant contaminants and/or any other damage factors in order to limit or to prevent further environmental damage and adverse effects on human health or further impairment of services and the necessary remedial measures; • Establishes measures for cases where environmental damage has not yet occurred, but there is an imminent threat of such damage occurring; and • The regulations make the polluter financially liable and allow the competent authority to initiate cost recovery proceedings where appropriate.	The OREAP will be obliged to comply with the requirements of the Directive and to prevent environmental damage. Development and operation of offshore renewable infrastructure should aim to cause no damage to the wider environment.
		Waste	
Waste Electrical and Electronic Equipment Directive [2002/96/EC], as recast by [201219/EU]	EU rules on waste electrical and electronic equipment (widely known as WEEE or e-waste) aim to contribute to sustainable production and consumption. They address environmental and other issues caused by the growing number of discarded electronics in the EU.	The WEEE Directive aims to contribute to sustainable production and consumption by: • preventing the creation of WEEE as a first priority; • contributing to the efficient use of resources and the retrieval of secondary raw materials through re-use, recycling and other forms of recovery; and	The OREAP should consider the implications of this Directive for developmental infrastructure options within the Plan that are likely to result in waste electrical equipment being generated.

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		• improving the environmental performance of everyone involved in the life cycle of WEEE In order to achieve these objectives, the Directive: • requires the separate collection and proper treatment of WEEE and sets targets for their collection as well as for their recovery and recycling; • helps European countries fight illegal waste exports more effectively by making it harder for exporters to disguise illegal shipments of WEEE; and • reduces the administrative burden by calling for the harmonisation of national WEEE registers and of the reporting format.	
Waste Framework Directive [2008/98/EC], as amended in 2018 [2018/51/EU]	• Sets the basic concepts and definitions related to waste management, such as definitions of waste, recycling, recovery; and • Explains when waste ceases to be waste and becomes a secondary raw material (so called end-of-waste criteria), and how to distinguish between waste and by-products.	The Directive requires that: • Waste is managed without endangering human health; • Waste is managed without harming the environment; • Waste is managed without harming water, air, soil, plants or animals; and • Waste does not cause a nuisance through noise or odours, or to countryside or places of special interest.	The OREAP will be obliged to comply with the requirements of the Directive in the management of waste arising from offshore renewable developments.
Cultural Heritage			
Valletta Convention (1992)	Convention for the Protection of the Archaeological Heritage of Europe (revised) (Valletta, 1992). The Valletta Treaty aims to protect the European archaeological heritage "as a source of European collective memory and as an instrument for historical and scientific study".	Sets guidelines for the funding of excavation and research work and publication of research findings. Deals with public access, in particular to archaeological sites, and educational actions to be undertaken to develop public awareness of the value of the archaeological heritage. The Convention constitutes an institutional	The OREAP should consider sites of archaeological heritage and ensure that they are protected from loss or damage resulting from the development of infrastructure.

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		framework for pan-European co-operation on the archaeological heritage, entailing a systematic exchange of experience and experts among the various States. The Committee responsible for monitoring the application of the Convention assumes the role of strengthening and co-ordinating archaeological heritage policies in Europe.	Environmental protection objectives of the Treaty are reflected in the SEO for Cultural Heritage.
Granada Treaty (1985)	Convention for the Protection of the Architectural Heritage of Europe (Granada, 1985). The main purpose of the Convention is to reinforce and promote policies for the conservation and enhancement of Europe's heritage. It also affirms the need for European solidarity with regard to heritage conservation and is designed to foster practical co-operation among the Parties.	• Conservation of European architectural heritage.	The OREAP should consider sites of architectural heritage and ensure that they are protected from loss or damage resulting from the development of infrastructure. Environmental protection objectives of the Treaty are reflected in the SEO for Cultural Heritage.
World Heritage Convention [WHC-2005/WS/02]	Objectives seek to ensure the identification, protection, conservation, presentation and transmission to future generations of cultural and natural heritage and ensure that effective and active measures are taken for these. The Convention recognises the way in which people interact with nature and encourages signatories to integrate the protection of cultural and natural heritage into regional planning programmes, set up staff and services at their sites, undertake scientific and technical conservation research and adopt measures which give this heritage a function in the day-to-day life of the community.	• Establishment of measures for the protection of monuments of national importance by virtue of the historical, architectural, traditional, artistic or archaeological interest attaching to them. Includes the site of the monument, the means of access to it and any land required to preserve the monument from injury or to preserve its amenities; and • WHSs in Ireland are specific locations that have been included in the UNESCO World Heritage Programme list of sites of outstanding cultural or natural importance to the common heritage of humankind. Two such sites in Ireland have been designated.	The OREAP should consider sites of archaeological, architectural, cultural and natural heritage, and ensure they are protected from loss or damage resulting from the development of infrastructure. Environmental protection objectives of the Treaty are reflected in the SEO for Cultural Heritage.
Landscape			

Plan/Programme	High Level Description	Key Objectives, Actions etc.	Relevance to the OREAP
European Landscape Convention [ETS No. 176]	• Promotion of the protection, management and planning of European landscapes and organising European co-operation on landscape issues; • Applies to the entire territory of the Parties and covers natural, rural, urban and peri-urban areas; • Inclusion of landscapes that might be considered outstanding as well as everyday or degraded landscapes; • Aimed at the protection, management and planning of all landscapes and raising awareness of the value of a living landscape; and • Complements the Council of Europe's and UNESCO's heritage conventions.	• Respond to the public's wish to enjoy high-quality landscapes and to play an active part in the development of landscapes; and • Each administrative level (national, regional and local) should draw up specific and/or sectoral landscape strategies within the limits of its competencies. These are based on the resources and institutions which, when co-ordinated in terms of space and time, allow policy implementation to be programmed. The various strategies should be linked by landscape quality objectives.	The OREAP could potentially have implications on landscapes, seascapes and visual amenity. Infrastructure should be planned to avoid sensitive landscapes. Environmental protection objectives of the Treaty are reflected in the SEO for Landscape and Visual Amenity.

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National			
Biodiversity			
Biodiversity Strategy for NI to 2020	A strategy for NI to meet its international obligations and local targets to protect biodiversity.	The strategy sets out the proposals for action to help halt the loss of biodiversity and the degradation of ecosystems up to 2020. 1. Address the underlying causes of biodiversity loss by mainstreaming biodiversity across government and society; 2. Reduce the direct pressures on biodiversity and promote sustainable development; 3. To improve the status of biodiversity by safeguarding ecosystems, species and genetic diversity; 4. Enhance the benefits to all from biodiversity and ecosystem services; and 5. Enhance implementation through participatory planning, knowledge management and capacity building.	The OREAP should look for opportunities to conserve, and where possible, restore biodiversity.
UK Post-2020 Biodiversity Framework	Succeeds the UK Biodiversity Action Plan and 'Conserving Biodiversity – the UK Approach'. Sets out the UK's response to the CBD's 'Strategic Plan for Biodiversity 2011-2020' and its 20 'Aichi Targets' (2010), and the EU Biodiversity Strategy (2011).	The Framework demonstrates how the work of the four countries and the UK contributes to achieving the Aichi Targets, and identifies the activities required to complement the country's biodiversity strategies in achieving the Targets. The following are the Strategic Goals of the Framework: • Address the underlying causes of biodiversity loss by mainstreaming biodiversity across government and society; • Reduce the direct pressures on biodiversity and promote sustainable use; • To improve the status of biodiversity by safeguarding ecosystems, species and genetic diversity;	The OREAP should look for opportunities to conserve, and where possible, restore biodiversity.

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		• Enhance the benefits to all from biodiversity and ecosystems; and • Enhance implementation through participatory planning, knowledge management and capacity building	
Conservation (Natural Habitats, etc.) Regulations (NI) 1995, and amendment Regulations	These Regulations give effect to Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (Habitats Directive) and the Minister to designate special areas of conservation (endangered species and habitats of endangered species). These sites, together with SPAs designated under the EU Directive on the Conservation of Wild Birds (EC/79/409), formed part of the Natura 2000 network of protected sites. Following the UK's exit from the EU, there is now a UK National Site Network of European sites, comprising existing designated sites and any further sites designated under the Habitats Regulations.	Protects certain birds, plants, animals, marine life and their habitats, including Natura 2000 sites, through creating criminal offences and changing planning requirements.	The OREAP should ensure that European Sites are suitably protected from loss or damage. Appropriate Assessment is being undertaken for the OREAP, to ensure that its implementation will not adversely affect European Sites. Environmental protection objectives of the Regulations are reflected in the SEOs for Biodiversity, Flora and Fauna.
The Wildlife (NI) Order 1985, as amended	Prohibits the intentional killing, taking or injuring of certain wild birds and wild animals or the intentional destruction, uprooting or picking of certain wild plants.	• If a development site is known or is likely to support a protected plant and animal species, the developer is obliged under legislation not to harm those species; • Lays down provisions regarding the protection of wild birds, their nests and eggs the prohibition of certain methods of killing or taking wild birds and the sale of live or dead wild birds or eggs, and the protection of captive birds; • Prohibits certain methods of killing or taking wild animals, use of spring traps and sale of live or dead wild animals, as well as providing protection for wild plants and	The OREAP should have regard for the environmental protection objectives of the Order in the planning of offshore renewable infrastructure.

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		prohibiting the sale of invasive, non-native species; and • Also covers the protection of deer (game), sales and purchases of venison and prevention of poaching, possession of pesticides harmful to wildlife, wildlife refuges, and the possession of articles for the purposes of committing certain offences.	
Wildlife and Natural Environment Act (NI) 2011	Introduced a statutory duty on all public bodies to further the conservation of biodiversity, makes provision for the conservation of wild flora and fauna and amends other legislation.	• Requires every public body to promote the conservation of biodiversity and defines functions of public bodies in NI with respect to the conservation of biodiversity. • Requires the designation of a strategy/strategies for the conservation of biodiversity, and the publishing of lists of species of flora and fauna, and habitats of principal importance for conserving biodiversity; and • Amended the Wildlife (NI) Order 1985 and the Environment (NI) Order 2002. Gives protection to a wider range of plants, animals and birds, and providing additional enforcement powers and increased penalties for wildlife related offences.	The OREAP should have regard for the environmental protection objectives of the Act in the planning of offshore renewable infrastructure. The OREAP will have a 'Duty of Care' to conserve biodiversity.
The Environment (NI) Order 2002	Covers several environmental issues, including pollution prevention control, assessment and management of air quality, and designation of areas of special scientific interest (ASSIs).	This order regulates activities which are capable of causing environmental pollution; otherwise preventing or controlling emissions which are capable of causing any such pollution through the transposition of the EC Directives 96/61 on Integrated Pollution Prevention and Control and 96/62 on Ambient Air Quality Assessment and Management with permitting required for installations which have potential for pollution e.g., intensive livestock agricultural holdings, landfill sites,	The OREAP should have regard for the environmental protection objectives of this legislation in the planning of offshore renewable infrastructure. The OREAP should look for opportunities to conserve, and where possible, restore biodiversity, should aim to not cause any negative impacts on air quality, and may be able to contribute to reducing air emissions by

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		slaughterhouse and processing plants for raw animal and vegetable materials. Introduce measures for the better protection and management of ASSIs, including conservation statements to owners and occupiers of ASSIs, powers to amend ASSI boundaries, and powers for officials to enter land for survey, monitoring and enforcement, powers to enforce fines and refuse consent for activities which may damage the ASSI. Implementation for Council Directive 96/62 EC on Ambient Air Quality Assessment and Management and requirement for NI to undertake an Air Quality Strategy.	connecting offshore renewable energy generators to the system.
DAERA Conservation Management Plans for SACs (in prep.)	Series of Management Plans for SACs in NI, determining the pressures and threats to habitats and species at the sites, and identifying the management actions required to address these pressures.	In line with obligations under The Conservation (Natural Habitats, etc.) Regulations (NI) 1995 (as amended), measures must be put in place to maintain and, where needed, improve the ecological health of NI SACs (58 no.) In 2017, NIEA began a 4-year work programme to develop a series of Management Plans.	The OREAP should ensure that European Sites are suitably protected from loss or damage, with regard to the information provided in these Conservation Management Plans.
UK National Ecosystem Assessment (2011)	Provides a comprehensive overview of the state of the natural environment in the UK and a new way of estimating our national wealth. NI is covered in Chapter 18. The four key components are: 1. environmental spaces; 2. cultural practices; 3. cultural values; and 4. benefits need to be considered if cultural ecosystem services are to be fully addressed in the ecosystem service framework	Undertaking the comprehensive overview aimed to provide a coherent evidence body on the UK environment and provide new tools for the valuation of the environment in both an economic and non-economic way. It aims to provide information on the best way to use the services provided for national wealth and wellbeing in both the present and in future planning.	The OREAP should ensure that the natural environment is suitably protected from loss or damage in its implementation.

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NI Species and Habitat Action Plans	NI Species and Habitat Action Plans are published to assist delivery of the NI Biodiversity Strategy, for the protection and enhancement of NI Priority Species populations and areas of Priority Habitats which in turn supports Nature Recovery Networks and Green Growth Strategies.	A wide range of actions for these habitats and species continues to be undertaken, e.g., through the management of designated sites, planning regulation, agri-environment schemes and grant-aided projects, but have not been specifically designed to fully implement these action plans or any overarching Habitat and Species Action Plan.	The OREAP should look for opportunities to conserve, and where possible, restore biodiversity. Environmental protection objectives to protect European designated sites and species are reflected in the SEOs for Biodiversity, Flora and Fauna.
Marine Protected Areas (Prohibited Methods of Fishing) Regulations (NI) 2022	Aims to protect sensitive habitats from destructive fishing methods.	Specifies fishing method restrictions (demersal mobile gear or static gear) within nine MPAs: • Carlingford Lough MCZ; • Murlough SAC; • Outer Belfast Lough MCZ; • Rathlin Island SAC and MCZ; • Red Bay SAC; • Skerries and Causeway SAC; • Strangford Lough MCZ; • The Maidens SAC; and • Waterfoot MCZ.	The OREAP should look for opportunities to conserve, and where possible, restore biodiversity. Environmental protection objectives to protect designated sites and sensitive species are reflected in the SEOs for Biodiversity, Flora and Fauna.
The Scallop Enhancement Sites (Prohibited Methods of Fishing) Regulations (NI) 2022	Aims to further the Conservation Objectives of MPAs and support fishing at sustainable levels.	Prohibits fishing for sea-fish using demersal mobile gear and diving for scallops within the following sites: • Ballyquintin scallop enhancement site; • Drumfad Bay scallop enhancement site; • Roaring Rock scallop enhancement site; and • Whitehead scallop enhancement site.	The OREAP should look for opportunities to conserve, and where possible, restore biodiversity. Environmental protection objectives to protect designated sites and sensitive species are reflected in the SEOs for Biodiversity, Flora and Fauna.
UK Fisheries Act 2020	The Fisheries Act lays down the discipline regarding fisheries, fishing, aquaculture and marine conservation in the UK.	• The Act is divided in 55 Articles and entails 11 Schedules; • The Act includes provisions on fisheries objectives, fisheries statement, and fisheries management plans;	The OREAP should have regard for the objectives of the Act in the planning of offshore renewable infrastructure.

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		• Part (a)ii of the sustainability objective may be compromised or more difficult to achieve as a result of the OREAP, “managed so as to achieve economic, social and employment benefits and contribute to the availability of food supplies”; and • Part (a) of the bycatch objective may be more difficult to achieve if fishing activity is condensed into a small area/less options for moving away from high bycatch occurrences due to displacement, “the catching of fish that are below minimum conservation reference size, and other bycatch, is avoided or reduced”.	
NI Blue Carbon Action Plan (draft for consultation April 2024)	This draft plan sets out how blue carbon habitats are managed and protected in NI in the future. The vision for the plan is ‘By 2050, NI has protected, well-managed and enhanced blue carbon habitats, providing us with increased carbon storage alongside wider ecosystem service benefits, which help address the challenges presented by climate change and biodiversity loss’.	The draft plan has three proposed aims: 1. Establish and maintain a framework that monitors and protects NI’s existing blue carbon habitats, supporting their active management, creation and restoration; 2. Promote blue carbon habitats as a nature-based solution for addressing the challenges presented by climate change and biodiversity loss, while highlighting wider societal benefits; and 3. Align the Blue Carbon Action Plan with cross-cutting policies relating to climate change, biodiversity, and other environmental obligations, recognising the linkages between marine and terrestrial ecosystems. The draft plan has seven key objectives falling within six themes: Theme 1: Evidence 1. Continue to collate evidence and by 2025 publish a baseline for NI’s blue carbon habitats in terms of location, extent and	The OREAP may interact with the Action Plan as ORE developments that require fixed structures that are placed onto the seabed have the potential to cause loss or damage to blue carbon habitat. The OREAP should have regard to the objectives of the Action Plan, when published, in the planning of offshore renewable infrastructure.

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		condition, against which the monitoring and assessment can be carried out. 2. From 2024 undertake research projects in partnership with stakeholders to contribute to the evidence base for total blue carbon stocks and flows in NI's marine environment, advancing the inclusion of NI's blue carbon contribution to the UK GHG Emissions Inventory and the UK CCRAs. This will also consider the impacts of human activities and climate change on these stocks. <u>Theme 2: Prioritisation</u> 3. By 2025 identify and agree a mechanism of prioritisation of NI's blue carbon habitats for management, restoration and creation. <u>Theme 3: Restoration and Creation</u> 4. From 2024 continue to promote blue carbon pilot projects, leading to the initiation of demonstration and larger scale prioritised restoration and creation projects, delivered with stakeholders. <u>Theme 4: Funding</u> 5. From 2024 develop funding to support delivery of the Plan, to include exploring opportunities for green finance and other revenue streams. <u>Theme 5: Governance</u> 6. Establish an inclusive governance structure within the first three months of the Plan being published and implement to deliver for climate action and biodiversity benefits. <u>Theme 6: Communication</u> 7. From 2024 promote blue carbon as a nature-based solution for climate action	

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		and wider biodiversity, societal and environmental benefits in support of the draft Green Growth Strategy, accompanied with an effective engagement, outreach and communications strategy.	
Review of the MPA Strategy for the NI Inshore Area 2024-2030 (draft for consultation April 2024)	Updates the MPA strategy 2014. The draft Strategy Review sets out how MPAs that fall under the jurisdiction of NI will be managed in the future. The vision of the draft Strategy is 'NI's marine area is effectively conserved, managed, restores and valued through a network of ecologically representative, resilient and equitably governed protected areas'.	The three aims of the draft 2024-2030 Strategy are: • Further develop and manage the MPA network to ensure it achieves its conservation objectives while being ecologically coherent, representative and climate resilient; • Use a co-management approach to develop and implement effective management measures for network features; and • Assess the effectiveness of management measures through appropriate monitoring and an adaptive management approach. The draft Strategy sets out nine objectives to deliver the vision and aims to 2030: 1. From 2024, evaluate and take actions to improve the ecological coherence of the existing MPA network. 2. By 2030, comply with and enhance, where relevant, the MPA OSPAR network design principles, taking account of the importance of adaptability and flexibility as evidence changes, and in response to climate and other anthropogenic pressures. 3. By 2030, have a well-managed MPA network which enables the achievement of favourable condition and/or GES, through regular monitoring of species and habitats in collaboration with stakeholders.	The OREAP may interact with the Strategy Review as the environmental effects resulting from the construction and operation of ORE have to potential to interact, directly or indirectly, with priority marine features associated with designated sites. The OREAP should have regard to the objectives of the Strategy Review, when published, in the planning of offshore renewable infrastructure.

Plan/Programme	High Level Description	Key Objectives, Actions etc.	Relevance to the OREAP
		4. By 2025, we will explore the benefits of implementing management approaches from strict non extractive Highly Protected Marine Areas to sustainable use management measures for MPAs. 5. By 2030, explore how Other Effective Area-Based Conservation Measures (OECMs) will complement the existing MPA network, and where relevant apply OECMs, in consultation with stakeholders. 6. By 2025, develop and commence implementation of an engagement, outreach and communications strategy, building on co-design principles employed in the development of this strategy. 7. By 2025 DAERA will invest in restoration projects that work towards achieving GBF Target 2 in partnership with stakeholders. 8. By 2025, establish an inclusive governance structure and develop, publish and deliver a new MPA Monitoring and Reporting Framework outlining statutory requirements and policy drivers. 9. From 2024, develop approaches to scope, develop and measure the cobenefits (costs and benefits) of the MPA network, in partnership with stakeholders.	
Draft MPA Management Plans	MarPAMM is an environment project to develop tools for monitoring and managing a number of protected coastal marine environments in Ireland, NI and Western Scotland. The MPA management plans work package aims to increase capacity and collaborations for MPA management planning between the RoI, NI and Scotland. The main outputs will be six management plans.	Four regional MPA plans will be produced to achieve a managed network of MPAs: • Argyll region, Scotland. • Co. Down – Co. Louth region, NI/RoI cross-border. • North Coast – North Channel region, NI/RoI cross-border. • Outer Hebrides region, Scotland. Two site-based MPA management plans will also be produced covering:	The OREAP may interact with the MPA management plans associated with NI waters as the environmental effects resulting from the construction and operation of ORE have to potential to interact, directly or indirectly, with features associated with designated sites. The OREAP should have regard to the objectives of the relevant MPA management plans, when published, in

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		• Murlough SAC, NI. • Carlingford Lough SPA, NI/RoI cross-border. The draft North Coast – North Channel MPAs Management Plan (2023) covers the north of the Island of Ireland and encompasses all the transboundary inshore marine areas from Mullaghmore, County Sligo, to Belfast Lough, County Antrim. It seeks to protect all inshore marine areas and designated features to aid sustainability. This includes strategic guidance for renewable energy, setting out the policy setting, existing areas of interest and potential ORE projects within the region. It establishes that: 'The installation and supporting infrastructure of offshore renewable energy sources should follow government guidelines, marine licencing, and marine spatial planning (including EU Directive, National Marine Planning Framework, draft Marine Plan for NI, and UK Marine Policy Statement) and use biodiversity friendly strategies to enhance and support ecologically valuable features. These strategies should include precautionary measures to protect and enhance the integrity of the key features and/or key habitats that are based on the ecosystems approach.'	the planning of offshore renewable infrastructure.
NI Seabird Conservation Strategy (in prep.)	The Strategy will review and report on the status of seabird populations and identify and assess their sensitivity to threats and pressures, informing management recommendations to maintain and improve conservation status.	The NI Seabird Conservation Strategy's objectives include the following; • Review current data and distribution of NI seabirds in marine areas and at breeding locations. • Undertake vulnerability assessments of the pressures and threats on seabirds to inform future management.	The OREAP may interact with the Strategy Review as the environmental effects resulting from the construction and operation of offshore renewable energy have to potential to interact, directly or indirectly, with seabirds. The OREAP should have regard to the objectives of the Strategy, when published, in the

Plan/Programme	High Level Description	Key Objectives, Actions etc.	Relevance to the OREAP
		• Collate existing evidence from all seabird monitoring efforts and identify knowledge gaps for future research and monitoring. • Ensure the development of effective protection and management of the marine ecosystem around NI to benefit seabirds with targeted research and monitoring.	planning of offshore renewable infrastructure.
NI Elasmobranch Strategy (in prep.)	The Strategy will review and report on the status of elasmobranch populations and inform management recommendations to maintain and improve conservation status.		The OREAP may interact with the Strategy Review as the environmental effects resulting from the construction and operation of offshore renewable energy have to potential to interact, directly or indirectly, with elasmobranch species. The OREAP should have regard to the objectives of the Strategy, when published, in the planning of offshore renewable infrastructure.
(RoI) National Biodiversity Action Plan 2017-2022 and Ireland's 4th National Biodiversity Action Plan (draft, 2022)	RoI National strategy for the maintenance and enhancement of biological diversity, which should be integrated across other policy sectors. The draft 4th National Biodiversity Action Plan (NBAP) will set the national biodiversity agenda for the period 2023-2027 and aims to deliver the transformative changes required to the ways in which we value and protect nature.	The key targets include: • Mainstream biodiversity in the decision-making process across all sectors; • Substantially strengthen the knowledge base for conservation management and sustainable use of biodiversity; • Increase awareness and appreciation of biodiversity and ecosystems services; • Conserve and restore biodiversity and ecosystem services in the wider countryside; • Conserve and restore biodiversity and ecosystem services in the marine environment; • Expand and improve on the management of protected areas and legally protected species; and	The OREAP should have regard for the current and draft action plans and look for opportunities to conserve, and, where possible, restore or enhance biodiversity, from potential transboundary impacts.

Plan/Programme	High Level Description	Key Objectives, Actions etc.	Relevance to the OREAP
		• Strengthen international governance for biodiversity and ecosystem services. The draft 4th NBAP has the following six Objectives: • Adopt a whole of Government, whole of society approach to biodiversity; • Meet urgent conservation and restoration needs; • Secure nature's contribution to people; • Embed biodiversity at the heart of climate action; • Enhance the evidence base for action on biodiversity; and • Strengthen Ireland's contribution to international biodiversity initiatives.	
Climate Change/Air Quality			
NI's second Climate Change Adaptation Programme (NICCAP2) 2019 – 2024	The NICCAP2 contains the NICS Department's response to the risks and opportunities relevant to NI, as identified in the UK Climate Change Risk Assessment 2017 (CCRA 2017). It sets out preparation for climate change impacts that are already happening and puts in place plans for future impacts.	• NICCAP2 focuses on priority areas identified in the NI Evidence Report as requiring urgent adaptation action over the next 5 years; and • Sets the strategies, policies and actions by which government departments will deliver on the agreed outcome objectives.	The OREAP should aim to contribute towards climate change adaptation and infrastructure to be planned for and resilient to climatic change.
UK Climate Change Act 2008	The Climate Change Act, the first of its kind in any country, set out a framework for moving the UK to a low-carbon economy.	The key component of the legislation requires a mandatory 60% cut in the UK's carbon emissions by 2050. Two key aims underpinning the Act: 1. Improve carbon management and help the transition towards a low carbon economy in the UK; and 2. Demonstrate strong UK leadership internationally, signalling that we are committed to taking our share of	The OREAP should aim to contribute towards climate change mitigation. The Plan can contribute towards achieving renewable energy targets through connection of offshore renewable generators to the electricity system.

Plan/Programme	High Level Description	Key Objectives, Actions etc.	Relevance to the OREAP
		responsibility for reducing global emissions in the context of developing negotiations on a post-2012 global agreement at Copenhagen in 2009.	
The Climate Change Act 2008 (2050 Target Amendment) Order 2019	Sets a legal requirement to reduce the UK's emissions of GHGs by 100% relative to 1990 levels by 2050.	Legislative basis for achieving the 'net zero' target by 2050, increasing the previous target committed to within UK legislation.	The OREAP should aim to contribute towards climate change mitigation. The Plan can contribute towards achieving renewable energy targets through connection of offshore renewable generators to the electricity system.
Climate Change (NI) Act 2022	Sets a legal requirement to reduce NI's emissions of GHGs by 100% relative to 1990 levels by 2050.	• Target of an at least 100% reduction in net zero greenhouse gas (GHG) emissions by 2050 (i.e., net zero emissions by 2050) for NI compared to baseline; • Target of at least 48% reduction in net emissions by 2030; and • Raised the commitment for renewable electricity consumption from 70% as established in the NI Energy Strategy to 80% by 2030.	The OREAP should aim to contribute towards climate change mitigation. The Plan can contribute towards achieving renewable energy targets through connection of offshore renewable generators to the electricity system. Environmental Protection Objectives of the Act are reflected in the SEO for Climatic Factors.
UK Climate Change Risk Assessment (CCRA) Programme 2022	The UK Government is required, under the Climate Change Act, to publish a CCRA every 5 years, setting out the risks and opportunities facing the UK from climate change.	The first CCRA was published by the Department for Environment, Food and Rural Affairs (Defra) in 2012, second in 2017 and third in 2022. These assessments identify the risks and opportunities posed by climate change over the next 5 years. Evidence Reports feed into the UK National Adaptation Programme, and national adaptation programmes of devolved administrations (i.e., the NICCAP2).	The OREAP should aim to contribute towards climate change mitigation. The Plan can contribute towards achieving renewable energy targets through connection of offshore renewable generators to the electricity system.
(RoI) National Adaptation Framework 2018	The National Adaption Framework (NAF) was developed under the Climate Action and Low Carbon Development Act 2015 and sets out the	Key actions under the NAF include: • Putting in place revised governance and reporting arrangements;	The draft OREAP should aim to contribute towards climate change adaptation and

Plan/Programme	High Level Description	Key Objectives, Actions etc.	Relevance to the OREAP
	national strategy to reduce the vulnerability of the Republic of Ireland to the negative effects of climate change and to avail of any positive impacts.	• Formalising the status of existing guidelines; • Formalising long term operational support for key sectors; • Facilitating the establishment of regional local authority climate action offices; • Increasing awareness around climate adaption and resilience; and • Integrating climate adaption into key national plans and policies.	infrastructure to be planned for and resilient to climatic change.
(RoI) Climate Action Plan 2023 (CAP23)	CAP23 is the second annual update to Ireland's Climate Action Plan 2019. It implements the carbon budgets and sectoral emissions ceilings introduced in 2022 and sets the roadmap for taking action to halve emissions by 2030 and reach net zero emissions no later than 2050.	• Identifies the nature and scale of the challenge, outlining the current situation across key sectors such as Electricity, Transport, Built Environment, Industry and Agriculture; and • The supplementary Annex of Actions provides the specific actions required to implement the targets set out in the Plan.	The OREAP should aim to contribute towards climate change mitigation. The Plan can contribute towards achieving renewable energy targets through connection of offshore renewable generators to the electricity system.
The National Emissions Ceiling Regulations 2018	Implement in the UK Directive 2016/2284/EU relating to national emission ceilings for certain atmospheric pollutants.	The Regulations require: • Preparation of an annual inventory of emissions of certain pollutants occurring in the UK, and projections of such emission; • Ensure from 2010-2019 that anthropogenic emissions of sulphur dioxide, nitrogen oxides, VOCs and ammonia occurring within the UK do not exceed specified amounts; • Ensure from 2020-2029 that anthropogenic emissions of sulphur dioxide, nitrogen oxides, VOCs, ammonia and fine particulate matter occurring within the UK do not exceed specified amounts, and from 2030 that they do not exceed additional specified amounts;	The OREAP should have regard for the environmental protection objectives of the Regulations. The plan should aim to not cause any negative impacts on air quality that could breach standards and objectives and may be able to contribute to reducing air emissions by connecting offshore renewable energy generators to the system.

Plan/Programme	High Level Description	Key Objectives, Actions etc.	Relevance to the OREAP
		• Ensure emissions in 2025 are following a linear reduction trajectory between 2020 and 2030 targets; • Preparation of a national air pollution control programme, to which public authorities must have regard; and • Locate sites representative of specified ecosystems and habitats in order to monitor the negative impacts of air pollution.	
UK National Air Pollution Control Programme (NAPCP) 2023	Programme required under The National Emission Ceilings Regulations 2018. The NAPCP sets out how the UK can meet the legally binding 2020 and 2030 emission reduction commitments.	• Emission reduction commitments apply for 5 pollutants: nitrogen oxides, ammonia, non-methane VOCs, particulate matter and sulphur dioxide.	The OREAP should have regard for the environmental protection objectives of the Programme. The plan should aim to not cause any negative impacts on air quality and may be able to contribute to reducing air emissions by connecting offshore renewable energy generators to the system.
The Environment Act 2021 and The Environment (2021 Act) (Commencement and Saving Provision) Order (NI) 2022	This legislation acts as the UK's new framework of environmental protection. It provides the Government with powers to set new binding targets, including for air quality, water, biodiversity, and waste reduction.	• Establishes the Office for Environmental Protection as a new environmental watchdog; • Sets the priority areas as air quality, water, biodiversity, and resource efficiency and waste reduction; and • Established a legally binding duty on Government to bring forward at least two new air quality targets in secondary legislation.	The OREAP should have regard for the environmental protection objectives of this legislation. The plan should aim to not cause any negative impacts on air quality, water, biodiversity and waste, and may be able to contribute to reducing air emissions by connecting offshore renewable energy generators to the system.
Air Quality Strategy for England, Scotland, Wales and NI 2007	The Air Quality Strategy (AQS) sets out air quality objectives and policy options to improve air quality in the UK from current to long term. As well as direct benefits to human health, these options are intended to provide important benefits to quality of life and to help protect the environment.	• The Strategy sets out the UK Government and devolved administrations' air quality objective and the measures selected to achieve desired improvements in air quality; • The overall aim is a steady decrease in ambient levels of pollutants towards the	The OREAP should have regard for the environmental protection objectives of the Strategy. The plan should aim to not cause any negative impacts on air quality and may be able to contribute to reducing air emissions by connecting offshore

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	The AQS was due for review in 2023, and has resulted in the following changes: • For NI, this is under review, with a Clean Air Strategy for NI – Public Discussion Document published in November 2020; • For England, Defra reviewed the AQS in April 2023 and published the 'Air quality strategy: framework for local authority delivery', to supersede the AQS: Volume 1 in England; • For Wales, the Welsh Government reviewed the AQS in 2023, and modified the 2007 National Air Quality Strategy (NAQS) for Wales by replacing this with the 'Clean Air Plan' published in 2020, while retaining air quality objectives in Table 2 of the NAQS; and • For Scotland, the national AQS was reviewed in 2021 and the 'Cleaner Air for Scotland 2 – Towards a Better Place for Everyone' was published.	objectives over the period of implementation; • These objectives are a statement of policy intentions or targets and are not legally binding in themselves; and • The main sources, hazards and strategy's objectives are provided for the following pollutants: particulate matter, oxides of nitrogen, ozone, sulphur dioxide, polycyclic aromatic hydrocarbons, benzene, 1,3-butadiene, carbon monoxide, lead and ammonia.	renewable energy generators to the system.
Air Quality Standards Regulations (NI) 2010, and amendments (2017)	Transpose the EU Air Quality Directives and place a duty on the NI government departments to monitor levels of air pollutants specified in the Air Quality Directives and ensure compliance with limit values for these pollutants.	Designate zones in which ambient air will be protected by limiting the concentration of pollutants within them.	The OREAP should have regard for the environmental protection objectives of the Strategy. The plan should aim to not cause any negative impacts on air quality and may be able to contribute to reducing air emissions by connecting offshore renewable energy generators to the system.
Clean Air Strategy for NI – A Public Discussion Document, 2020	Discussion document in advance of developing the first Clean Air Strategy for NI.	Presents evidence and research on a range of ambient air pollutants and outline policy and legislation currently in place to control air pollution.	The OREAP should have regard for Environmental Protection Objectives of this Strategy. The plan should aim to not cause any negative impacts on air quality and may be able to contribute to reducing air emissions by connecting offshore renewable energy generators to the system.

Plan/Programme	High Level Description	Key Objectives, Actions etc.	Relevance to the OREAP
Sustainable Development			
NI Energy Strategy – the Path to Net Zero (2021)	Energy accounts for almost 60% of NI's GHG emissions. The Strategy sets out a pathway for energy to 2030 that aims to mobilise the skills, technologies and behaviours needed to take NI towards the vision of net zero carbon and affordable energy by 2050.	The Strategy set the following targets to drive the desired changes: • Energy Efficiency – Deliver energy savings of 25% from buildings and industry by 2030; • Renewables – Meet at least 70% of electricity consumption from a diverse mix of renewable sources by 2030; and • Green Economy – Double the size of our low carbon and renewable energy economy to a turnover of more than £2 billion by 2030.	The OREAP has a key role to play in furthering the ambitions set out in the Energy Strategy.
Energy Strategy for NI – the Path to Net Zero Energy. Action Plan (2022)	The Action Plan sets out the actions that are considered necessary to achieve the targets of the Energy Strategy.	Action plan was developed following the publication of The Path to Net Zero Energy and has a series of objectives aimed to deliver 2050 net zero carbon through a £10 million green innovation fund, a hydrogen centre of excellence and an energy advice board to enable people to make informed and supported decisions on the transition to decarbonised energy sources. The key objectives include the following; 1. Households and businesses have access to affordable energy with the ability to transition to decarbonised energy sources. 2. Deliver energy savings of 25% from buildings and industry by 2025. 3. Ensure all new buildings are net zero by 2027. 4. Reduction in distance travelled by private vehicle users. 5. Support transition to low and zero carbon fuel sources for vehicles.	The OREAP has a key role to play in furthering the ambitions set out in the Energy Strategy.

Plan/Programme	High Level Description	Key Objectives, Actions etc.	Relevance to the OREAP
		6. Meet at least 80% of electricity consumption from mixture of renewable sources.	
Energy Strategy Action Plan 2023	Follows on from the Energy Strategy Action Plan 2022. Outlines the priority areas of action and the associated tasks for delivery in 2023, which is year 2 of the delivery of the Energy Strategy programme.	Aims for a net 48% emission reduction by 2030 and requires all NI Departments to contribute to five-year carbon budget periods from 2027. The key objectives include the following; 1. Households and businesses have access to affordable energy with the ability to transition to decarbonised energy sources. 2. Deliver energy savings of 25% from buildings and industry by 2025. 3. Ensure all new buildings are net zero by 2027. 4. Reduction in distance travelled by private vehicle users. 5. Support transition to low and zero carbon fuel sources for vehicles. 6. Meet at least 80% of electricity consumption from mixture of renewable sources.	The OREAP has a key role to play in furthering the ambitions set out in the Energy Strategy.
Electricity (NI) Order 1992 (Article 39)	This legislation establishes a legal structure for the generation, supply, transmission and distribution of electricity in NI. Article 39 requires a consent from the Department of the Economy (DfE) for the construction, extension or operation of a generating station if the capacity of the station exceeds certain limits.	The construction, extension or operation of an electricity generation station must apply for an Article 39 Consent from DfE, if the capacity of the station exceeds: • 10MW for onshore • 1MW for offshore	The OREAP should have regard for the consent requirements of the Order, during the planning and development of offshore renewable infrastructure.
Food and Environment Protection Act 1985 (FEPA)	This Act is UK legislation which was enacted to protect public health from the consumption of unsuitable food, the environment from pollution and waste disposal, and to regulate pesticide use. The Act allows for the authorisation of otherwise prohibited activities.	The objective of the seeking authorisation of otherwise prohibited activities is to: • Protect against the human consumption of food rendered unsuitable due to pollution; • Provide fresh provision of the deposit of substances or articles in the sea or under	The OREAP should comply with the objectives of the Act, in the planning and development of offshore renewable infrastructure.

Plan/Programme	High Level Description	Key Objectives, Actions etc.	Relevance to the OREAP
		the seabed, replacing the Dumping at Sea Act 1974; • Regulate pesticides and substances, preparations and organisms prepared or used for pest control; and • for connected purposes. A FEPA license is required for or the deposit of any substances or articles in the sea or under the seabed in UK waters, UK controlled waters, or from British vessels.	
(RoI) Offshore Renewable Energy Development Plan (OREDP) 2014, and draft OREDP II	The OREDP is a plan that identifies the opportunity for the sustainable development of Ireland's abundant offshore renewable energy resources for increasing indigenous production of renewable electricity, thereby contributing to reductions in greenhouse gas emissions. The draft OREDP II provides an updated assessment of this resource.	The OREDP was based on the following: • Ireland is obliged to reach a target of 16% of all energy consumed in the State coming from renewable sources by 2020; and • This obligation is to be met by 10% in transport, 12% from heat and 40% from electricity. The OREDP II considers advances in technology to assess the offshore renewable energy potential in Irish waters and seek to map areas most suitable for offshore renewable energy, and assist in delivering the PfG commitment to develop a long-term plan to take advantage of a potential of at least 30GW of floating wind off the Atlantic coast.	The OREAP should have consideration for this plan, as it identifies the opportunity for offshore renewable energy which may have transboundary impacts on DfE strategic planning.
Environmental Assessment of Plans and Programmes Regulations (NI) 2004	Implements the SEA Directive (2001/42/EC) in NI. To provide for a high level of protection of the environment and to contribute to the integration of environmental considerations into the preparation and adoption of plans and programmes with a view to promoting sustainable development.	See SEA Directive.	The OREAP will be subject to the SEA process. This is being undertaken through this Environmental Report.

Plan/Programme	High Level Description	Key Objectives, Actions etc.	Relevance to the OREAP
(RoI) European Communities (Environmental Assessment of Certain Plans and Programmes) Regulations 2004, as amended	Implements the SEA Directive (2001/42/EC) in the Republic of Ireland. Description as for NI above.	See SEA Directive.	The OREAP will be subject to the SEA process. This is being undertaken through this Environmental Report.
(Scotland) Environmental Assessment (Scotland) Act 2005	Implements the SEA Directive (2001/42/EC) in Scotland. Description as for NI above.	See SEA Directive.	The OREAP will be subject to the SEA process. This is being undertaken through this Environmental Report.
(England) The Environmental Assessment of Plans and Programmes Regulations 2004	Implements the SEA Directive (2001/42/EC) in England. Description as for NI above.	See SEA Directive.	The OREAP will be subject to the SEA process. This is being undertaken through this Environmental Report.
(Wales) Environmental Assessment of Plans and Programmes (Wales) Regulations 2004	Implements the SEA Directive (2001/42/EC) in Wales. Description as for NI above.	See SEA Directive.	The OREAP will be subject to the SEA process. This is being undertaken through this Environmental Report.
UK Offshore Energy Plan and SEA 3 (OESEA3). Department of Energy & Climate Change 2016	A Strategic Environmental Assessment (SEA) of a draft plan/programme to enable future renewable leasing for offshore wind, wave and tidal devices and licensing/leasing for seaward oil and gas rounds, hydrocarbon and carbon dioxide gas storage. The renewable energy elements of the draft plan/programme cover parts of the UK Exclusive Economic Zone and the territorial waters of England and Wales.	The OESEA 3 was conducted to: • Consider the environmental implications of DECC’s draft plan/programme to enable further licensing/leasing for offshore energy (oil and gas, hydrocarbon gas storage, carbon dioxide storage and marine renewables including wind, wave, tidal stream and tidal range). This includes consideration of the implications of alternatives to the plan/programme and consideration of potential interactions with other users of the sea;	The OREAP should have consideration for this plan, as it provides information on renewable leasing and licensing of offshore renewable energy projects in the future.

Plan/Programme	High Level Description	Key Objectives, Actions etc.	Relevance to the OREAP
		• Inform the UK Government's decisions on the draft plan/programme; and • Provide routes for public and stakeholder participation in the process.	
Offshore Wind Leasing Round 4 (Regions Refinement Report). The Crown Estate 2019	A report which undertakes significant spatial analysis and engagement on offshore wind resource and constraints at a strategic level across NI, English and Welsh waters, to support the Offshore Wind Leasing Round 4 Process. The aim is to identify and characterise the most favourable areas of seabed for offshore wind development with relatively lower levels of constraint.	The regions refinement process has identified: • Ten regions that will not be taken forward in Round 4; • Four regions of seabed that remain unchanged since November 2018 and will be used to form relevant bidding areas in Round 4; and • Four regions of seabed that have been modified since November 2018 based on specific constraints and stakeholder feedback, with the modified boundaries used to form relevant Bidding Areas in Round 4 in refined form.	The OREAP should have consideration for this report, as it provides information on UK regions that have been identified as favourable for offshore wind development with lower constraint levels.
Broad Horizons: Key Resource areas for offshore wind. Everoze Report, commissioned by The Crown Estate 2020	A study which maps the 'key resource areas' for offshore wind enabling early conversations over future development potentials in English, Welsh and NI waters. The evolving technology landscape was surveyed to assess how practical limits to installation of offshore wind will change until 2040. .	The report identifies the future technology profiles for nineteen different resource areas Key findings include: • Advances in engineering will expand the technical reach of offshore wind; • Floating wind and fixed foundation are complimentary technologies; and • There is no one-size-fits-all technology solution.	The OREAP should have consideration for this report, as it provides information on key resource areas and which technology is best suited to different regions.
Draft Marine Plan for NI 2018	The Marine Plan for NI will inform and guide the regulation, management, use and protection of our marine area. It is a single document made up of two plans, one for the inshore region and one	The Marine Plan will be used by Public Authorities in taking decisions which affect or might affect the marine area, including: • Authorisation or enforcement decisions; and	As described for the Marine Act (NI) 2013. The OREAP will have to consider the policies of the Marine Plan in the strategic planning for offshore renewable

Plan/Programme	High Level Description	Key Objectives, Actions etc.	Relevance to the OREAP
	for the offshore region. All public authorities are responsible for implementing the Plan through existing regulatory and decision-making processes. As well as public authorities, all applicants, third parties and advisors should also consider the Plan.	• Decisions that relate to the exercise of any function capable of affecting the marine area.	infrastructure. Proposals should conform with all relevant policies, taking account of economic, environmental and social considerations.
Marine Act (NI) 2013	The Marine Act sets out a new framework for NI's seas based on: a system of marine planning that will balance conservation, energy and resource needs; improved management for marine nature conservation and the streamlining of marine licensing for some electricity projects.	The Marine Act enables DAERA to prepare a marine plan for the inshore region and to designate areas as MCZs.	The OREAP will operate within a new marine planning system for NI, underpinned by the draft Marine Plan for NI 2018, the NI Marine Act 2013 and the UK Marine Policy Statement 2011, and Marine and Coastal Access Act (MCAA) 2009. The draft Marine Plan will inform and guide the regulation, management, use, and protection of the NI marine area, and the MCCA and Marine Act require that public authorities, in taking authorisation or enforcement decisions that might affect the marine area, must do so in accordance with the draft Marine Plan. The OREAP will have regard to the requirements of the Act and the draft Marine Plan.
Marine and Coastal Access Act 2009	New Marine Licensing legislation came into operation in NI on the 6th April 2011. It replaced licensing under the Food and Environment Protection Act 1985 (FEPA). The purpose of this licensing system is to aid industry and encourage investment by enabling more strategic decisions to be made about what activities are permissible in the marine environment. The overall objective of marine licensing is to regulate sustainable development in a cohesive and fair manner.	The key features of the new system include • The definition of marine licensable activities; • exempt activities; • fees and charges; • implementation of measures for sanctioning and enforcement; and • making appeals against licensing decisions, statutory notices and monetary penalties.	The OREAP should consider licencing requirements for offshore renewable energy infrastructure under this Act.

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UK Marine Policy Statement 2011	The Marine Policy Statement (MPS) is the framework for preparing Marine Plans and taking decisions affecting the marine environment.	• Achieve integration between different objectives; • Recognise that the demand for use of our seas and the resulting pressures on them will continue to increase; • Manage competing demands on the marine area, taking an ecosystem-based approach; • Enable the co-existence of compatible activities wherever possible; and • Integrate with terrestrial planning.	The OREAP will have to consider the policies of the MPS in the strategic planning for offshore renewable infrastructure options that may impact on marine areas. The MPS includes a number of high-level principles for decision making that should be taken into account, particularly in relation to those impacts associated with Section 2.6.7 Climate change adaptation and mitigation and Section 2.6.8 Coastal change and flooding.
Integrated Coastal Zone Management Strategy for NI 2006-2026	The Integrated Coastal Zone Management Strategy for NI 2006-2026 is based around 4 broad themes, consistent with the principles of sustainable development.	The Integrated Coastal Zone Management Strategy for NI 2006-2026 is intended to set out long-term objectives for achieving sustainable coastal management, through improvements to existing management systems, the development of new management systems and identifying and dealing with potential areas of conflict.	The OREAP will have to consider this strategy in the strategic planning for offshore renewable infrastructure options within the plan that may impact on coastal areas, with particular relevance to priority 2: safeguarding and improving the environment within the coastal zone and priority 4: integration of planning effort.
(Scotland) National Marine Plan 2015	The Marine Plan aims to provide a strategic framework for managing all developments, activities and interests in or affecting Scotland's marine area (territorial and offshore waters). This is in order to protect Scotland's seas and balancing economic growth with environmental sustainability. Adopted in March 2015, the NMP sets out high-level objectives, general policies and sectoral policies. This plan serves as a long-term strategic document, guiding decision making and informing sectoral plans and projects.	The Marine Act requires that economic, social and marine ecosystem objectives, and objectives relating to the mitigation of and adaption to climate change are set by marine plans. Plans must also state policies for, and in connection with, the sustainable development of the area to which this Plan applies. The main objectives of the plan include: • Promoting sustainable economic development while minimising conflicts between different sectors and considering the marine environment's carrying capacity. • Protecting and enhancing the marine environment, safeguarding the diversity,	The OREAP should have regard for the objectives of this plan in the planning and development of offshore renewable infrastructure.

Plan/Programme	High Level Description	Key Objectives, Actions etc.	Relevance to the OREAP
		health and productivity of marine ecosystems and habitats in Scotland. • Coordinating and integrating decision-making processes to facilitate a holistic approach to marine management and planning. • Encouraging engagement and collaboration involving a wide-range of stakeholders such as industry, environmental organisations and local communities to promote effective marine management. • Considering the impacts of climate change on the marine environment and incorporating mitigation measures in the planning process.	
(Scotland) Marine (Scotland) Act 2010	The Marine (Scotland) Act provides a framework which will help balance competing demands on Scotland's seas. It introduces a duty to protect and enhance the marine environment and includes measures to help boost economic investment and growth in areas such as marine renewables.	• Marine planning: a new statutory marine planning system to sustainably manage the increasing, and often conflicting, demands on our seas • Marine licensing: a simpler licensing system, minimising the number of licences required for development in the marine environment to cut bureaucracy and encourage economic investment • Marine conservation: improved marine nature and historic conservation with new powers to protect and manage areas of importance for marine wildlife, habitats and historic monuments • Seal conservation: much improved protection for seals and a new comprehensive licence system to ensure appropriate management when necessary • Enforcement: a range of enhanced powers of marine conservation and licensing	The OREAP will have to consider the policies of the Marine (Scotland) Act in the strategic planning for offshore renewable infrastructure.

Plan/Programme	High Level Description	Key Objectives, Actions etc.	Relevance to the OREAP
(Scotland) ScotWind Offshore Wind Leasing Round (The Crown Estate)	ScotWind Leasing – the process of making seabed available for commercial-scale offshore wind projects – will benefit Scottish businesses and communities for decades to come as well as providing a major boost to UK clean energy production.	Key points of the leasing round: • There are 20 ScotWind projects with seabed option agreements. The first 17 successful projects were announced in April 2022. These were joined in October 2022 by three further projects, granted agreements through the Clearing process. • These agreements are for up to ten years. Crown Estate Scotland will offer a full seabed lease (enabling projects to be built and operated) once developers have secured the necessary consents, licences, and finance. • ScotWind is 'plan-led'. This means that all sites are within the areas of seabed identified in the Scottish Government's Sectoral Marine Plan for Offshore Wind. • Supply chain commitments were required from the outset. This approach – the first of its kind – will ensure a focus from the earliest stage on supply chain capacity to develop and deliver the projects. • Latest figures, taking into account all 20 projects, now show initial total Scottish commitments total £28.8bn, indicating an average of £1.4bn investment in Scotland per project built, and £1bn investment in Scotland per gigawatt of capacity built. • Offshore wind projects typically take several years to plan, develop, and build. ScotWind projects are expected to be built from the late 2020s onwards. • 14 of the 20 projects are for floating rather than fixed turbines. Scotland is already a world leader in floating wind test and demonstration. Commercial-scale projects will place Scotland at the forefront of this global technology.	The OREAP should have consideration for leasing outcomes, as they provide information on planned developments in transboundary Scottish waters.

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(Scotland) Sectoral Marine Plan for Offshore Wind for Innovation and Targeted Oil and Gas Decarbonisation (INTOG): Initial Plan Framework.	The Initial Plan Framework outlines the process for development of the Sectoral Marine Plan for Innovation and Targeted Oil and Gas Decarbonisation. It also sets out the areas that will be used for future seabed leasing.	This plan looks at encompasses spatial opportunities and the strategic development of offshore wind developments. It sets out the spatial planning framework and describes the stages involved in the planning process which relate to the Scottish Government responsibilities. It involves assessment with an opportunity and constraints analysis to identify areas where future developments may be challenging or negative effects for other sea users or environmental receptors with Areas of Search (potential locations for development) and Areas of Exclusions (where development under the planning process would not be considered).	The OREAP should have consideration for this current and ongoing work in respect of sectoral marine plans for offshore wind in Scottish waters, as it provides information on potential areas for offshore wind development in transboundary Scottish waters.
(Scotland) Innovation and Targeted Oil and Gas (INTOG) leasing round	INTOG is a leasing round for offshore wind projects that will directly reduce emissions from oil and gas production and boost further innovation. Designed in response to demand from government and industry, to help achieve the targets of the North Sea Transition Sector Deal.	Developers can apply for seabed rights to build two types of offshore wind project: • IN – Small scale, innovative projects, of less than 100MW. • TOG – Projects connected directly to oil and gas infrastructure, to provide electricity and reduce the carbon emissions associated with production. On 24th March 2023 it was announced that 13 projects had been offered exclusivity agreements.	The OREAP should have consideration for leasing outcomes, as they provide information on planned developments in transboundary Scottish waters.
(RoI) National Marine Planning Framework	The NMPF contains a vision, objectives and planning policies for all marine-based human activities. It outlines how those activities will interact with each other in an increasingly pressured ocean space. It is the key decision-making tool for Government departments, State agencies, regulatory authorities and policymakers for decisions on marine activities up to 2040. Decisions will include planning	The NMPF details how these marine activities will interact with each other in an ocean space that is under increasing spatial pressure, ensuring the sustainable use of our marine resources to 2040. This approach will enable the Government to: • set a clear direction for managing our seas	The OREAP will have regard to these objectives and policies in the development of any offshore renewable infrastructure.

Plan/Programme	High Level Description	Key Objectives, Actions etc.	Relevance to the OREAP
	applications as well as policies, projects and strategies. The Framework is a parallel document to the National Planning Framework, which guides terrestrial planning and development. This is Ireland's first national framework for managing marine activities.	• clarify objectives and priorities • direct decision makers, users and stakeholders towards strategic, plan-led, and efficient use of our marine resources	
(RoI) The Maritime Area Planning Act 2021 (all-encompassing Act that covers both on-shore and off-shore planning)	The Act provides a new legislative framework and streamlined development consent process for activities in the maritime area. A new regulatory body, the Maritime Area Regulatory Authority (MARA) is established under the Act. Although the Act is not solely applicable to offshore renewable energy projects, it will contribute to enabling Ireland to achieve its goal of generating 5GW of offshore wind energy by 2030.	The Act will play an integral role in Ireland reaching the renewable electricity target of having renewable energy account for 80% of energy within the State by the year 2030. The Act provides for two separate consent requirements for an offshore renewable energy project: • Apply to MARA for a Maritime Area Consent (MAC) which allows the right to occupy a particular maritime area. • Development permission must be sought under the Planning and Development Act 2000. A MAC is a prerequisite for development permission.	The OREAP will have regard to these regulations and consent requirements in the development of any offshore renewable infrastructure.
The Planning (Environmental Impact Assessment) Regulations (NI) 2017	Implement the EIA Directive in NI in respect of the planning system.	• Contains procedures to facilitate the preparation of environmental statements and the provision of information relevant to their preparation and sets out the minimum content and requirements when preparing an environmental statement. • Ensure that environmental impact assessment (EIA) development cannot be permitted without the consideration of environmental information, describe the EIA	The OREAP will have regard to these EIA Regulations in the development of offshore renewable infrastructure. Development and operation of certain offshore renewable development projects included in the OREAP may be subject to EIA.

Plan/Programme	High Level Description	Key Objectives, Actions etc.	Relevance to the OREAP
		process and set out the matters that confirm that development is EIA development.	
Draft Transmission Development Plan for NI 2023-2032	The draft Transmission Development Plan NI (TDPNI) 2023-2032 is the blueprint for the development of the transmission network and interconnection over the next ten years. This ten-year plan presents projects that are expected to meet the operational needs of the transmission network and also outlines future needs that may drive future potential projects.	A wide range of environmental policies and objectives are compiled in the Plan to ensure SONI has regard for existing environmental protection legislation and best practices. These environmental objectives fall under topics such as: • Biodiversity • Climate Change • Noise • Landscape • Cultural Heritage • Water • Air Quality • Tourism There are also planning, social and technical policies and objectives.	The OREAP should have regard for the environmental policies and objectives outlined in the draft TDPNI. Future planning and development of onshore infrastructure will support the outcomes of the OREAP implementation in connecting renewable energy generated.
Air defence and offshore wind – working together towards Net Zero 2021	The Air Defence and Offshore Wind (AD&OW) Strategy & Implementation Plan (S&IP) sets the direction for collaboration between Government Departments and the Wind Industry in pursuit of identifying, assessing and deploying solutions that will enable the co-existence of AD&OW operations such that neither is unduly or excessively compromised. Through identification of such solutions, and processes through which they will be deployed, the S&IP will support the achievement of its objective to enable the co-existence of AD&OW. Mitigation of the adverse impacts of wind farms on current AD systems will be a stepping stone towards a longer term solution that will enable co-existence.	In order to achieve the Strategy's aims, it will be necessary to: • Draw on timely evidence which enables a high degree of confidence that mitigation concepts and solutions can be resourced and deployed to meet 2030 targets and Net Zero timelines. • Implement processes that allow the MoD to make irrevocable decisions on the release of wind farm development planning consent conditions. • Confirm that such concepts and solutions are realistic in terms of: - performance: laws of Physics as well as against the MoD requirements - time: balancing the time available against the time necessary for deployment.	The OREAP should have regard for the objectives and actions of the AD&OW S&IP, in the planning and operation of offshore renewable infrastructure.

Plan/Programme	High Level Description	Key Objectives, Actions etc.	Relevance to the OREAP
	This plan contributes to the Government's ambition for the rapid increase of offshore wind developments out to 2030 and beyond.	- cost: available funding and procurement processes - policy: laws, safety standards, security regulations, etc. • Outline how different concepts could be deployed in either a national, regional, clustered and/or project level such that solutions can be implemented according to short, medium and longer-term timelines	
NI Executive Programme for Government 2016-2021	The Programme for Government identifies the actions the Executive stated purpose – Improve wellbeing for all – by tackling disadvantage and driving economic growth.	List of Programme for Government Outcomes • We prosper through a strong, competitive, regionally balanced economy. • We live and work sustainably – protecting the environment. • We have a more equal society. • We enjoy long, healthy, active lives. • We are an innovative, creative society where people can fulfil their potential. • We have more people working in better jobs. • We have a safe community where we respect the law and each other. • We care for others and we help those in need. • We are a shared, welcoming and confident society that respects diversity. • We have created a place where people want to live and work, to visit and invest. • We connect people and opportunities through our infrastructure. • We give our children and young people the best start in life.	The OREAP will have regard to this programme and will (in combination with other users and bodies) aim to cumulatively contribute towards the achievement of the objectives of this programme.

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Programme for Government Draft Outcomes Framework 2021	The NI Executive is currently developing a new strategic, outcomes-based Programme for Government. Two of the key outcomes in the draft PfG that are most relevant to the OREAP are: 'an economy that is globally competitive, regionally balanced and carbon neutral'; and 'that we live and work sustainably – protecting the environment'.	Draft PfG sets out nine key strategic outcomes to provide a vision for NI citizens, these will be delivered through a series of actions focusing on key priority areas relating to each outcome and the Departments responsible for each and relevant strategies relating to each. 1. Our children and young people have the best start in life. 2. We live and work sustainably – protecting the environment. 3. We have an equal and inclusive society where everyone is valued and treated with respect. 4. We all enjoy long, healthy, active lives. 5. Everyone can reach their potential. 6. Our economy is globally competitive, regionally balanced and carbon-neutral. 7. Everyone feels safe – we all respect the law and each other. 8. We have a caring society that supports people throughout their lives. 9. People want to live, work and visit here.	The OREAP will have regard to this programme and will (in combination with other users and bodies) aim to cumulatively contribute towards the achievement of the objectives of this programme.
Strategic Planning Policy Statement for NI 2015	This planning policy sets out the Department's regional planning policies for securing the orderly and consistent development of land in NI under the reformed two-tier planning system. The provisions of the SPPS must be taken into account in the preparation of Local Development Plans and are also material to all decisions on individual planning applications and appeals.	There are two new Core Planning Principles included in the SPPS: • Supporting Sustainable Economic Growth; and • Preserving and Improving the Built and Natural Environment	The OREAP will have consideration for these planning policies in the development and operation of offshore renewable infrastructure.
Planning Policy Statements 1 – 23	Policies on land-use and other planning matters that apply to the whole of NI. Planning Policy Statements will be superseded by Local Development Plans when they are adopted.	PPS1: General Principles- Sets out the general principles that the DoENI observes in carrying out its planning functions. PPS2: Natural Heritage- Sets out the Department's planning policies for the	The OREAP should have consideration for these planning policies and LDPs, when adopted, in strategic and detailed planning for offshore renewable infrastructure.

Plan/Programme	High Level Description	Key Objectives, Actions etc.	Relevance to the OREAP
		conservation, protection and enhancement of our natural heritage. PPS4: Planning and Economic Development- Sets out the Department's revised planning policies for economic development uses and indicates how growth associated with such uses can be accommodated and promoted in development plans. PPS6: Planning, Archaeology and the Built Heritage- Provides the main criteria in assessing proposals which affect the archaeological or built heritage. PPS15: Planning and Flood Risk- The main objectives are to: Adopt a precautionary approach to decision-making taking account of climate change so that risk is avoided where possible. PPS18: Renewable Energy- Sets out the planning policy for development that generates energy from renewable resources. PPS21: Sustainable Development in the Countryside- sets out planning policies for development in the countryside.	
The Regional Development Strategy 2035 – Shaping Our Future Updates the Regional Development Strategy for NI 2025	The strategy aims to take account of the economic ambitions and needs of the Region, and put in place spatial planning, transport and housing priorities that will support and enable the aspirations of the Region to be met.	The over-arching vision of the Regional Development Strategy is: "An outward-looking, dynamic and liveable Region with a strong sense of its place in the wider world; a Region of opportunity where people enjoy living and working in a healthy environment which embraces the quality of their lives and where diversity is a source of strength rather than division. " The aims of the RDS 2025 remain valid: • Support strong, sustainable growth for the benefit of all parts of NI;	The OREAP should have consideration for this planning strategy in strategic and detailed planning for offshore renewable infrastructure.

Plan/Programme	High Level Description	Key Objectives, Actions etc.	Relevance to the OREAP
		• Strengthen Belfast as the regional economic driver and Londonderry as the principal city of the North West; • Support our towns, villages and rural communities to maximise their potential; • Promote development which improves the health and well-being of communities; • Improve connectivity to enhance the movement of people, goods, energy and information between places; • Protect and enhance the environment; • Take actions to reduce our carbon footprint and facilitate adaptation to climate change; and • Strengthen links between north and south, east and west, with Europe and the rest of the world.	
(RoI) National Planning Framework (Project Ireland 2040)	A national document that will guide, at a high-level, strategic planning and development for Ireland over the next 20+ years, so that as the population grows, that growth is sustainable.	The ultimate objectives of the National Planning Framework (NPF) are to: • Guide the future development of Ireland, taking into account a projected 1 million increase in population, the need to create 660,000 additional jobs to achieve full employment and a need for 550,000 more homes by 2040; • Of the 1 million extra people: - 25% is planned for Dublin, recognised as a key international and global city of scale and principal economic driver, - 25% across the other four cities combined (Cork, Limerick, Galway and Waterford), enabling all four to grow their population and jobs by 50-60% and become cities of greater scale, i.e., growing by twice as much	The OREAP should have regard for this Framework by considering the potential transboundary impacts from the development of offshore renewable infrastructure and promoting sustainable development.

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		as they did over the previous 25 years to 2016, and - With the remaining 50% of growth to occur in key regional centres, towns, villages and rural areas, to be determined in the forthcoming regional plans. • Enable people to live closer to where they work, moving away from the current unsustainable trends of increased commuting; • Regenerate rural Ireland by promoting environmentally sustainable growth patterns; • Plan for and implement a better distribution of regional growth, in terms of jobs and prosperity; • Transform settlements of all sizes, through imaginative urban regeneration and bring life/jobs back into cities, towns and villages; and • Co-ordinate delivery of infrastructure and services in tandem with growth, through joined up NPF/National Investment Plan and consistent sectoral plans, which will help to manage this growth and tackle congestion and quality of life issues in Dublin and elsewhere.	
UK Sustainable Development Strategy, Agenda 21	The strategy aims to take account of the economic ambitions and needs of the Region, and put in place spatial planning, transport and housing priorities that will support and enable the aspirations of the Region to be met.	The over-arching vision of the Regional Development Strategy (RDS) is: “An outward-looking, dynamic and liveable Region with a strong sense of its place in the wider world; a Region of opportunity where people enjoy living and working in a healthy environment which embraces the quality of their lives and where diversity is a source of strength rather than division. “	The OREAP should have regard for the environmental protection objectives of the Strategy in the development and operation of offshore renewable infrastructure.

Plan/Programme	High Level Description	Key Objectives, Actions etc.	Relevance to the OREAP
		The aims of the RDS 2025 remain valid: • Support strong, sustainable growth for the benefit of all parts of NI; • Strengthen Belfast as the regional economic driver and Londonderry as the principal city of the North West; • Support our towns, villages and rural communities to maximise their potential; • Promote development which improves the health and well-being of communities; • Improve connectivity to enhance the movement of people, goods, energy and information between places; • Protect and enhance the environment; • Take actions to reduce our carbon footprint and facilitate adaptation to climate change; and • Strengthen links between north and south, east and west, with Europe and the rest of the world.	
10X Economy – An Economic Vision	In May 2021, the Department for the Economy launched its economic vision for the next 10 years, called 10X Economy – an economic vision for a decade of innovation.	The concept embraces innovation to deliver a ten times (10X) better economy with benefits for all the people of NI. Ten guiding principles have been identified to underpin this vision and a number of these are relevant to the energy sector, such as delivering positive economic, environmental and societal outcomes; supporting a greener, sustainable economy; position NI amongst the most competitive small, advanced economies in the world; and focussing on increasing innovation in high value-added areas and priority clusters.	The OREAP should have regard for the environmental protection objectives of the vision in the development and operation of offshore renewable infrastructure. The Plan has potential to support the aims of the Vision by contributing to the growth of the low carbon and renewable energy economy.

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Draft Environment Strategy for NI 2019	A NI Environment Strategy is required to form the basis for a coherent and effective set of interventions that can deliver real improvements in the quality of the environment.	Sets out six Strategic Environmental Outcomes for the strategy, that include a description of the Current Position, Actions, Targets, and Visions/Outcomes. These are: • Excellent air, water, land and neighbourhood quality; • Healthy and accessible environment and landscapes everyone can connect with and enjoy; • Thriving, resilient and connected nature and wildlife; • Sustainable production and consumption on land and at sea; • Zero waste and highly developed circular economy; and • Fair contribution to UK net zero greenhouse gas emissions and improved climate resilience and adaptability.	The OREAP should aim to contribute towards the aims of the draft Environment Strategy.
Draft Green Growth Strategy for NI– Balancing our Climate, Environment and Economy 2021	Green Growth is an over-arching multi-decade Strategy, led by DAERA, which sets out the long-term vision and a solid framework for tackling the climate crisis by balancing climate action with the need for a clean, resilient environment and economy. It has been developed by all Ministers and Government departments working together, in collaboration with external stakeholders from local government, the private sector, voluntary and community sectors and others.	The cross-cutting strategy will be delivered through a series of Climate Action Plans, which will set out the actions to meet sector-specific greenhouse gas emission targets to deliver a cleaner environment rich in biodiversity; delivering a more efficient use of resources within a circular economy; and green jobs.	The OREAP should aim to contribute towards climate change mitigation. The Plan can contribute towards achieving GHG emission reduction targets through connection of offshore renewable generators to the electricity system.
Water			
The Marine Strategy Regulations 2010	The Regulations are a set of regulations implemented to support the European Union's Marine Strategy Framework Directive (MSFD) implementation in the UK.	The Regulations aim to achieve and maintain GES in UK marine waters by implementing the objectives of the European Union's Marine Strategy Framework Directive (MSFD).	The OREAP should have regard for the key provisions of the Regulations in the planning and operation of offshore renewable infrastructure. It will need to consider the requirements of the MS and

Plan/Programme	High Level Description	Key Objectives, Actions etc.	Relevance to the OREAP
	The main aim of the regulations is to establish a framework for the development and implementation of marine strategies, aiming to achieve and maintain GES in UK marine waters. It helps to deliver key international obligations and commitments to protect and preserve the marine environment including those under the UN Convention on the Law of the Sea (UNCLOS), the UN Sustainable Development Goal 14 (to conserve and sustainably use the ocean, seas and marine resources for sustainable development), the OSPAR North-East Atlantic Environment Strategy and the Convention on Biological Diversity.	The Regulations require the production of a "Marine Strategy" for all UK waters that integrate economic, social and environmental considerations for the protection and sustainable use of marine resources, and that the approach is coordinated across all four UK Administrations. It also requires cooperation with other countries sharing our seas. Key provisions of the Regulations include: • Marine Strategy Unit (MSU) establishment within each country to develop and coordinate marine strategy implementation; • Marine Region identification; • Environmental target setting within each region to achieve or maintain GES; • Monitoring and assessment to gather data on the environmental status of marine waters and the impact of anthropogenic activities on those waters; • The development and implementation of programmes of measures to achieve GES, considering the monitoring and assessment results; and • Strategy and progress reporting, and regular reviews of strategy and measure effectiveness.	ensure that it does not compromise its objectives, and that it contributes to achieving its aims
Water Environment (Floods Directive) Regulations (NI) 2009, and amendment Regulations 2018	Implement EU Floods Directive 2007/60/EC on the risk and management of flood risk in NI.	Main purpose is to establish a framework for the assessment of adverse consequences of flooding on human health, the environment, cultural heritage and economic activity.	The OREAP should have regard for the environmental protection objectives of the Floods Regulations in planning onshore cabling requirements of offshore renewable infrastructure.
The Water Environment (Water Framework	Transpose the Water Framework Directive (2000/60/EC) into NI legislation.	• Place a responsibility on NI to try to ensure that all inland and coastal waters reach at least "good status" (or good ecological	The OREAP should have regard for the environmental protection objectives of the WFD in the planning and operation of offshore renewable infrastructure. It will

Plan/Programme	High Level Description	Key Objectives, Actions etc.	Relevance to the OREAP
Directive) Regulations (NI) 2017		potential for artificial or heavily modified water bodies); and • Implementation of management planning at river basin level, to achieve this target, linking with other key policy areas such as agriculture, land use, biodiversity, tourism and flood protection through a river basin management plan (RBMP). This sets out a programme of measures to be implemented over 6-year cycles aimed at improving water body status.	need to consider the requirements of the WFD and ensure that it does not compromise its objectives, and that it contributes to achieving its aims. Environmental protection objectives of the Directive are reflected in the SEOs for Water.
Water Framework Directive (Classification, Priority Substances and Shellfish Waters) Regulations (NI) 2015	Transpose Directive 2013/39/EU which revised environmental standards for some priority substances and added a further twelve additional substances to the list of priority substances introduced by the original Priority Substances Directive (2008/105/EC). Consolidate all the current legislation which set out the Water Framework Classification Schemes.	• Consolidate all the current legislation which set out the Water Framework Classification Schemes; • Sets environmental quality standards for priority substances; and • Outlines standards required for Shellfish waters.	The OREAP should have regard for the environmental protection objectives of the WFD in the planning and operation of offshore renewable infrastructure. It will need to consider the requirements of the WFD and ensure that it does not compromise its objectives, and that it contributes to achieving its aims.
The Quality of Bathing Water Regulations (NI) 2008	These Regulations set quality standards for bathing water.	• Require regular testing of bathing waters, to ensure that they are of high enough quality for the general public to bathe in; • Require a Profile to be prepared for each designated bathing water site, giving detailed information on the physical characteristics, and assessing the pollution risk to each site; and • Set quality standards for a number of issues, the most important of which relate to coliform and streptococcal groups of bacteria, which can indicate the mount of sewage or other faecal contaminants present.	The OREAP should have regard for the environmental protection objectives of these Regulations in the planning and operation of offshore renewable infrastructure and ensure that these do not negatively impact on designated bathing waters.

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Environmental Liability (Prevention and Remediation) Regulations 2009 and amendment	Implement the Environmental Liability Directive (2004/35/EC) in NI.	• Brings into force rules to force polluters to prevent and repair damage to water systems, land quality, species and their habitats and protected sites; and • The polluter does not have to be prosecuted first, so remedying the damage should be faster.	The OREAP will be obliged to comply with the requirements of the Regulations and to prevent environmental damage. Development and operation of offshore renewable infrastructure should aim to cause no damage to the wider environment.
Pollution Control and Local Government (NI) Order 1978	Primary legislation for waste treatment and management through measures on the processing and handling of waste and introduce measures on the identification of contaminated sites and enforcement requirements for pollution.	Regulates waste on land, abandoned vehicles, noise nuisance, noise abatement zones, sulphur content of oil fuel used in furnaces and engines, cable burning, and pollution of the atmosphere and water. Other aspects have been revoked.	The OREAP should have regard for the environmental protection objectives of this Order. Development and operation of offshore renewable infrastructure should aim to cause no damage to the wider environment.
NI Flood Risk Management Plan, 2021-2027	The NI Flood Risk Management Plan (FRMP) is a key requirement of the Floods Directive (Directive 2007/60/EC on the assessment and management of flood risks) and is aimed at reducing the potential adverse consequences of significant floods on human health, economic activity, cultural heritage, and the environment.	The objectives set, in relation to each area of impact are: Economic Activity • To reduce the cost of potential future flood damages to properties and infrastructure; • To reduce the economic costs caused by disruption to essential infrastructure and services; and • To optimise the economic return on flood risk management investment. Human Health and Social • To reduce the risk to life, health and wellbeing; • To increase awareness and understanding of flooding and its adverse consequences and improve community resilience; • To reduce the impact on people caused by the disruption to essential infrastructure and services; and • To improve recreation and public amenities.	The OREAP should have regard for the environmental protection objectives of the FRMP in planning onshore cabling requirements of offshore renewable infrastructure.

Plan/Programme	High Level Description	Key Objectives, Actions etc.	Relevance to the OREAP
		Environmental • To consider the impact of Climate Change across all areas of impact; • To support the objectives of the Water Framework Directive and contribute to the achievement of good ecological potential/status for water bodies; and • To protect and enhance the natural environment.	
Draft 3rd cycle River Basin Management Plan (RBMP) for NI 2021-2027	Describes existing condition of waters in the River Basin Districts, the objectives for improving their condition and the measures to be used to deliver these improvements. • Establish a framework for the protection of water bodies at River Basin District (RBD) level; • Preserve, prevent the deterioration of water status and where necessary improve and maintain "good status" of water bodies in that RBD; and • Promote sustainable water usage.	• Aims to improve water quality and quantity within inland surface waters (rivers and lakes), transitional waters, coastal waters and groundwater and meet the environmental objectives outlined in Article 4 of the Water Framework Directive; • Identifies and manages water bodies in the RBD; • Establishes a programme of measures for monitoring and improving water quality in the RBD; • Involves the public through consultations; and • RBMPs are prepared and reviewed every six years. The most recent is the draft 3rd cycle RBMP, which runs from 2021-2027.	The OREAP should have regard for the environmental protection objectives of the RBMP in the planning of offshore renewable infrastructure. It will need to consider the requirements of the WFD and ensure that it does not compromise its objectives, and that it contributes to achieving its aims.
(RoI) Draft River Basin Management Plan for Ireland 2022 - 2027	The overall aim of the plan is to ensure that natural waters in Ireland are sustainably managed and that freshwater resources are protected so as to maintain and improve Ireland's water environment.	• Sets out the measures that are necessary to protect and restore water quality in Ireland.	The OREAP should have regard for the environmental protection objectives of the draft RBMP in the planning of offshore renewable infrastructure, where there is potential for transboundary impacts to the aquatic environment.

Plan/Programme	High Level Description	Key Objectives, Actions etc.	Relevance to the OREAP
Waste			
NI Waste Management Strategy, 2012 (new Strategy under development 2023)	The Waste Management Strategy sets out in detail those proposed policies, including specific actions to be taken. Strategy development is a continuous process, and the Waste Management Strategy for NI is considered as a living document, requiring regular review and revision to ensure that it remains relevant and the policies and actions therein remain appropriate.	The proposals of this Strategy are as follows: • The development of a Waste Prevention Programme; • A new 60% recycling target for local authority collected municipal waste (LACMW); • The introduction of a statutory requirement on waste operators to provide specified data on commercial and industrial waste; • New and more challenging collection and recycling targets for packaging and WEEE; • The introduction of a landfill restriction on food waste; • The potential for the devolution of landfill tax; • The implementation of legislation on carrier bags; and • The development of detailed proposals for an Environmental Better Regulation Bill.	The OREAP should consider the implications of this Management Strategy with developmental infrastructure options within the Plan which are likely to result in waste being generated.
Draft Waste Management Plan for NI 2019	The draft Waste Management Plan (WMP) for NI 2019 outlines how it will efficiently manage waste for the Councils it represents with the overall goal of creating a system that 'meets the region's needs and contributes towards economic and sustainable development'. Subject to review every five years the Plan details how NI will fulfil its statutory obligations under the EU Waste Framework Directive and The Waste and Contaminated Land (NI) Order 1997.	• Updates the previous WMP (2013-2020); and • Provides an overview of waste management in NI and fulfils the requirements of Article 2 (mandatory requirements) of the Waste Framework Directive and other required content as set out in Schedule 3 to the Waste and Contaminated Land (NI) Order 1997.	The OREAP should consider the implications of this plan with developmental infrastructure options within the Plan which are likely to result in waste being generated.
Cultural Heritage			

Plan/Programme	High Level Description	Key Objectives, Actions etc.	Relevance to the OREAP
Archaeology 2030 – A Strategic Approach for NI	A review of the current position of archaeology in NI, to develop a sector-wide, strategic approach, with recommendations for the future.	The overall vision of this strategy is: • By 2030, we want archaeology to be accessed and valued by as many people as possible, led by a sector which is healthy, resilient and connected. It sets the following priorities, with associated recommendations for their successful delivery: • Aim 1 – Archaeology on the ground; • Aim 2 – Understanding the past; • Aim 3 – Sustaining the historic environment; • Aim 4 – Engaging and enriching people's lives; and • Aim 5 – Innovation, understanding and skills.	The OREAP should have regard for the environmental protection objectives of this Strategy, in the planning and operation of offshore renewable infrastructure. Environmental Protection Objectives of the Strategy are reflected in the SEO for Cultural Heritage.
Historic Monuments and Archaeological Objects (NI) Order 1995	The Order allows for Monuments to be protected by taking them into State Care, or by Scheduling, and also places restrictions on searching for archaeological material.	The purpose of designation is to ensure that policies are created and action taken to: • Conserve or enhance the natural beauty or amenities of that area; • Conserve wildlife, historic objects or natural phenomena within it; • Promote its enjoyment by the public; and • Provide or maintain public access to it.	The OREAP should have regard for the environmental protection objectives of this Order, in the planning and operation of offshore renewable infrastructure.
Planning Act (NI) 2011	The principal piece of planning legislation in NI. Underpinned the reform of the planning system, the key aims of which were to deliver NI Executive decisions to transfer the majority of planning functions to the newly formed councils thus creating a two-tier planning system; and to bring forward short, medium and long term process improvements to modernise the system.	The main objectives of the Planning Act were: • The continued formulation and co-ordination of planning policy by the Department for Infrastructure; • Councils preparing Local Development Plans; • Councils determining the majority of planning applications for development and additional planning related consents; and • Councils taking appropriate enforcement action where a breach of planning control may have taken place.	The OREAP should have regard for the requirements of this Act, in the planning of onshore infrastructure associated with offshore renewable developments.

Plan/Programme	High Level Description	Key Objectives, Actions etc.	Relevance to the OREAP
		The Act transferred the majority of departmental planning functions of the former Department of the Environment to the Department for Infrastructure. A number of historical built environment functions of the 2011 Act were transferred to the Department for Communities. These included the: • Power to list buildings under sections 80 to 84; • Power to designate conservation areas under section 104; and • Listed building enforcement powers under sections 158 to 161.	
The Regional Development Strategy 2035 – RG11	A description of the RDS is provided above.	RG11 of the RDS is to "Conserve, protect and where possible enhance, our built heritage and our natural environment".	The OREAP will need to consider strategic policies of the RDS in the development and operation of offshore renewable infrastructure.
The Protection of Wrecks Act 1973	An Act to protect the historic wrecks located in UK territorial waters from unauthorised interference by designation. On account of the historical, artistic or archaeological importance of the vessel, a restricted area around the vessel on or in the seabed is designated.	The Key Objectives of the Act are: • The protection and preservation of wrecks of historic and archaeological significance, ensuring their survival; • Designation of wrecks as 'protected' through official designation orders by the Secretary of State, legally protecting wreck sites and associated artefacts from unauthorised interference; • A legal framework is established that prohibits activities such as diving, excavation, salvage and removal without an appropriate license or consent; • Licensing and regulation for activities can be granted for specific purposes including conservation, archaeological research and controlled excavation; and	The OREAP should have regard for the protection objectives of this Act, in the planning, installation and operation of offshore renewable infrastructure. Environmental Protection Objectives of the Order are reflected in the SEO for Cultural Heritage.

Plan/Programme	High Level Description	Key Objectives, Actions etc.	Relevance to the OREAP
		• Responsible research and exploration of the wrecks are allowed by licenced individuals or organisations if the regulations and guidelines are followed.	
The Protection of Military Remains Act 1986	An Act to secure the protection from unauthorised interference of the remains of military aircraft and vessels that have crashed, sunk or been stranded and of associated human remains; and for connected purposes.	All military aircraft are automatically protected under this Act. It is an offence to interact with any of these vessels in absence of a licence from the MoD.	The OREAP should have regard for the protection objectives of this Act, in the planning, installation and operation of offshore renewable infrastructure.
(RoI) National Monuments (Amendment) Act 1987	Provides further provision for the protection and preservation of national monuments and archaeological objects including provision for the regulation of the use and possession of detection devices, to make provision for the protection and preservation of historic wrecks. This act amends and extends the National Monuments Acts, 1930 and 1954, and provides for connected matters.	The main objectives of the Act include: • The protection and preservation of national monuments. It establishes legal frameworks and mechanisms to safeguard these monuments from damage, destruction or unauthorised alteration; • The facilitation of effective management of national monuments by providing guidelines and regulations for their proper maintenance and access; • Governance of the excavation and research activities related to national monuments. It establishes a licensing system that regulates archaeological surveys and excavations, ensuring they comply with ethical and scientific standards; and • The clarification of the ownership of national monuments (mostly to the State)) and recognises the responsibility of the state.	The OREAP should have regard for the protection objectives of this Act, in the planning, installation and operation of offshore renewable infrastructure.
Landscape			

Plan/Programme	High Level Description	Key Objectives, Actions etc.	Relevance to the OREAP
Nature conservation and Amenity Lands Order (NI 1985	Provides for designation of the finest landscape areas as either Areas of Outstanding Natural Beauty (AONB) or National Parks land and takes steps to manage them for both conservation and recreation.	Aims to establish, manage and maintain nature reserves in NI with requirements for the provision of publicity, mapping and information services relating to the countryside and to places of beauty/interest and to ensure that measures to prevent damage to sites and encouraging proper standards of behaviour is undertaken. It also requires actions to be taken for the restoration of derelict sites.	The OREAP should have regard for the environmental protection objectives of this Order, in the planning and operation of offshore renewable infrastructure.
(ROI) National Landscape Strategy for Ireland 2015-2025	Strategy for the provision of a framework for the protection of the many cultural, social, economic and environmental values embedded in the landscape.	• To be implemented by the State, working in co - operation with public authorities, stakeholders, communities and individuals; • Objectives include to establish and to implement, through a series of actions, policies aimed at understanding, managing, protecting and planning the landscape; and • Sets out specific measures to integrate and embed landscape considerations in all sectors which influence the landscape and improve and enhance the quality of decision-making by those who have an impact on it.	The OREAP should consider the potential transboundary impacts on landscape and visual amenity within Ireland, particularly in sensitive areas, from the development of offshore renewable infrastructure.
Regional			
Local Biodiversity Action Plans (LBAPs)	Local Biodiversity Action Plans are a way of encouraging people to work together and deliver a programme of continuing action for biodiversity at a local level. They set out practical steps that aim to help protect biodiversity, enhance and improve biodiversity where possible, and promote biodiversity at a local level.	Aim to guide conservation and enhancement of biodiversity within local areas. LBAPs will develop actions in line with the United Kingdom Biodiversity Strategy 1995 and the Northern Ireland Biodiversity Strategy 2002. These plans must link with other plans with an area and aim for the following; • Conserve and enhance biodiversity for the present and the future.	The OREAP should have regard for these plans and look for opportunities to conserve, and, where possible, restore or enhance biodiversity.

Plan/Programme	High Level Description	Key Objectives, Actions etc.	Relevance to the OREAP
		• Educate and raise awareness on the importance of biodiversity. • Encourage local ownership of biodiversity.	
Local Development Plans/Draft Plan Strategies	Development Plans set out how an area should look in the future by deciding the type and scale of development and where building should be allowed. Each Council must prepare a development plan for their area in consultation with the local community.	When preparing a development plan the council should consider; • The council's Community Plan, a long-term vision for the social, environmental and economic well-being of the area and its citizens; • The council's Statement of Community Involvement (SCI) which sets out who, how, where and when consultation and policy making is to take place; • The RDS 2035, as the spatial strategy for NI; • Planning Policy and guidance; and • A sustainability appraisal prepared by the council so that economic and social factors are considered alongside environmental factors when developing the plan.	The OREAP should have regard to these plans/strategies in order to take into consideration the local community in development and operation of offshore renewable infrastructure.

Appendix C – Constraints Data

Subject	Theme	Data Displaying	Fixed Wind	Floating Wind	Wave	Tidal	Cabling	Buffer (m)
Environmental	SACs	Onshore and offshore NI SACs - those identified for habitats	R	R	R	R	R	0
		Onshore and offshore NI SACs - those identified for mobile species	R	R	R	R	A	0
Environmental	SPAs (including pSPAs)	Onshore and offshore NI SPAs	R	R	A	A	A	0
Environmental	MCZs	NI MCZs	R	R	R	R	R	0
Environmental	MPAs	MPAs - Restricted Areas	A	A	A	A	A	0
Environmental	MPAs	MPAs - Exempted Areas	A	A	A	A	A	0
Environmental	Scallop Enhancement Areas	Scallop Enhancement Areas	R	R	R	R	R	0
Environmental	Seagrass Beds	Subtidal and Intertidal Seagrass Beds	A	A	A	A	A	0
Environmental	Ramsar	NI Ramsar Sites - those identified for habitats	R	R	R	R	R	0
Environmental	ASSIs	NI ASSIs	A	A	A	A	A	0
Environmental	NNRs	NI NNRs	A	A	A	A	A	0

Subject	Theme	Data Displaying	Fixed Wind	Floating Wind	Wave	Tidal	Cabling	Buffer (m)
Environmental	Annex 1 Reefs outside designated sites	NI Annex 1 Reefs	A	A	A	A	A	0
Environmental	Annex 1 Sandbanks outside designated sites	NI Annex 1 Sandbanks	A	A	A	A	A	0
Environmental	Annex 1 Saltmarsh outside designated sites	NI Annex 1 Saltmarsh	A	A	A	A	A	0
Environmental	Fish Spawning Grounds overlapping Fish Nursery Grounds	Areas where UK Fish Spawning Grounds / UK Fish Nursery Grounds overlap	R	R	R	R	R	0
Environmental	Important Bird Areas	UK Important Bird Areas	R	R	A	A	A	0
Environmental	RSPB Reserves	UK RSPB Reserves	N/A	N/A	A	A	A	0
Environmental	UK Grey Seals	UK Grey Seal - High Density	A	A	A	A	G	0
Environmental	UK Harbour Seals	UK Harbour Seal - High Density	A	A	A	A	G	0
Environmental	TCE Designated Feature Risk Layers	TCE Designated Feature Risk Layers	R	R	R	R	R	0

Subject	Theme	Data Displaying	Fixed Wind	Floating Wind	Wave	Tidal	Cabling	Buffer (m)
Community	Fishing Activity	UK Fishing Activity - Areas of high intensity fishing effort	A	A	A	A	G	0
Community	Marine Fish Farms	UK Marine Finfish	B	B	B	B	B	1000
Technical	Port Lands	Port Lands	N/A	N/A	N/A	N/A	A	1000
Technical	Harbour Areas	Harbour Areas	R	R	R	R	G	0
Technical	Traffic Separation Schemes	Traffic Separation Schemes	B	B	B	B	A	3704 (2nm)
Technical	Safeguarding Pilotage Areas	Safeguarding Pilotage Areas	R	R	R	R	A	3704 (2nm)
Technical	AIS Vessel Density Grid	High density shipping areas	R	R	R	R	G	1852 (1nm)
Technical	Designated anchorage areas	Designated anchorage areas	R	R	R	R	R	0
Technical	RYA marinas	RYA marinas	B	B	B	B	R	200
Community	RYA leisure density data	RYA leisure density data	R	R	R	R	G	0
Community	National Trust Land	National Trust Land	N/A	N/A	N/A	N/A	A	0

Subject	Theme	Data Displaying	Fixed Wind	Floating Wind	Wave	Tidal	Cabling	Buffer (m)
Technical	Military Areas	Military Areas - Onshore and Offshore danger areas	B	B	B	B	R	0
Technical	Military Areas	Military Areas - Onshore and Offshore practice areas	A	A	A	A	A	0
Technical	Dredge and Spoil Dumping Sites	UK Dredge Spoil Dumping Sites	A	A	A	A	A	0
Community	Major settlements/Urban Areas	UK Major Urban Settlements	N/A	N/A	N/A	N/A	R	0
Technical	Passenger Airports Lands	Airports	N/A	N/A	N/A	N/A	A	0
Technical	OLS	Obstacle Limitation Surfaces	G	G	N/A	N/A	N/A	15000/30000
Technical	Offshore Rock	Offshore Rock	A	A	A	A	A	0
Technical	Water- lakes	Lakes and large water bodies for NI	N/A	N/A	N/A	N/A	G	0
Technical	Water- rivers	Rivers for NI	N/A	N/A	N/A	N/A	G	0
Technical	National Flood Zones	NI Flood Zones	N/A	N/A	N/A	N/A	G	0
Community	Bathing waters	Bathing waters	R	R	R	R	A	1852 (1nm)
Environmental	Shellfish waters	Shellfish waters	G	G	G	G	G	0

Subject	Theme	Data Displaying	Fixed Wind	Floating Wind	Wave	Tidal	Cabling	Buffer (m)
Technical	Offshore Infrastructure	Offshore Telecommunication Cables - in service	B	B	B	B	A	500
		Offshore Energy Cables - in service	B	B	B	B	A	500
		Offshore Pipelines - in service	B	B	B	B	A	500
Technical	Offshore Infrastructure	Offshore Telecommunication Cables - out of service	R	R	R	R	A	500
		Offshore Power Cables - out of service	R	R	R	R	A	500
		Offshore Pipelines - out of service	R	R	R	R	A	500
Technical	Major Onshore Infrastructure	NI Power Stations / Other Major Infrastructure	N/A	N/A	N/A	N/A	R	0
Community	World Heritage Sites (WHS)	NI World Heritage Sites	N/A	N/A	N/A	N/A	B	0
Community	Scheduled Monuments	NI Scheduled Monuments	N/A	N/A	N/A	N/A	R	20
Community	Listed Buildings	NI listed buildings (Grade I, II* and II listed buildings)	N/A	N/A	N/A	N/A	R	20

Subject	Theme	Data Displaying	Fixed Wind	Floating Wind	Wave	Tidal	Cabling	Buffer (m)
Community	Registered Parks, Gardens and Demesnes	NI Registered Historic Parks, Gardens and Demesnes	N/A	N/A	N/A	N/A	A	0
Community	Wreck locations	UK wreck locations	A	A	A	A	G	25
Community	Protected wrecks	NI Protected Wrecks	B	B	B	B	B	250
Community	Country Parks	NI Country Parks	N/A	N/A	N/A	N/A	A	0
Community	Areas of Outstanding Natural Beauty	NI AONBs	A	A	G	G	A	0
Technical	Water Depth	Water Depth m to chart datum approximately equivalent to Lowest Astronomical Tide	<10m - >80m	<50m - >250 m	<10m >200m	<5m - >130m	N/A	0
Technical	Theoretical Wind Resource	Annual Mean Wind Speed at 110m height a MSL (m/s)	<9.0 m/s	<9.0 m/s	N/A	N/A	N/A	0
Technical	Theoretical Wave Resource	Average Wave Height (m)	N/A	N/A	<1.2m	N/A	N/A	0
Technical	Theoretical Wave Resource	Average Wave Energy (kW/m)	N/A	N/A	<20 kW/m wave crest	N/A	N/A	0
Technical	Theoretical Tidal Resource	Average current speed across the tidal cycle (m/s)	N/A	N/A	N/A	<1.5 m/s	N/A	0
Technical	Bathymetry	Slope 10-15%	A	A	A	A	G	0

Subject	Theme	Data Displaying	Fixed Wind	Floating Wind	Wave	Tidal	Cabling	Buffer (m)
Technical	Bathymetry	Slope >15%	R	R	R	R	R	0
Technical	Cliff Shoreline	>15m	N/A	N/A	N/A	N/A	R	0
Technical	Topography - Slope	Slope >57% (30 degrees)	N/A	N/A	N/A	N/A	R	0

Constraints BRAG Ranking Definitions

Rating	Environment/Community	Technical	Constraint Score**
Black	Significantly sensitive features/receptors to proposed infrastructure development and/or operation. Pose such a significant degree of risk to a design that they should be avoided completely.	Significantly constraining features to proposed infrastructure development and/or operation. Pose such a significant degree of risk to a design that they should be avoided completely.	9999
Red	Highly sensitive features/receptors to proposed infrastructure development and/or operation. Pose such a high degree of risk to the design that they should be avoided*.	Highly constraining features to proposed infrastructure development and/or operation. Pose such a high degree of risk to the design that they should be avoided unless potential solutions to the issues are identified.	10
Amber	Moderately sensitive features/receptors to proposed infrastructure development and/or operation. Includes most protected features, sensitive receptors and/or areas that are likely to require detailed assessment and potentially mitigation and should be avoided* if possible.	Moderately constraining features to proposed infrastructure development and/or operation. Technical constraints that may cause cost increases and/or schedule delays; not ideal but likely to be achievable and/or capable of resolution.	5
Green	Features and receptors of low sensitivity to proposed infrastructure development and/or operation. Receptors or designations to be considered in constraint assessment/study but which are likely to be capable of resolution. Note, are still a constraint.	Informative of approach but medium to low likely technical constraint causing cost increase and/or schedule delays. Note, are still a constraint.	3
*To be avoided except for linear constraints, which may need to be crossed.			
** For constraints modelling.			

Appendix D – SEA Assessment Data

SEA Topic	Description
Biodiversity, Flora and Fauna	
SACs (including offshore and transboundary)	Sites of international importance designated under the Habitats Directive, forming part of the National Site Network of protected areas. Legislative protections apply.
SPAs (including transboundary)	Sites of international importance designated under the Birds Directive, forming part of the National Site Network of protected areas. Legislative protections apply. Data includes pSPAs.
Ramsar sites (including transboundary RoI)	Sites of international importance designated under the Ramsar Convention, forming part of the National Site Network of protected areas. Legislative protections apply.
Marine Conservation Zones (including transboundary)	Sites designated under the Marine Act NI for protection of marine species and habitats of national importance. Legislative protections apply.
Nature Conservation Marine Protected Areas (transboundary in Scotland)	Sites designated under the Marine Act Scotland for protection of marine species and habitats of national importance - equivalent to MCZs). Legislative protections apply.
ASSIs	Sites of national importance in NI designated under the Environmental (NI) Order. Legislative protections apply.
SSSIs (Sites of Special Scientific Interest – transboundary in Scotland)	Sites of national importance in Scotland designated under the Nature Conservation Scotland Act. Legislative protections apply.
NHAs (Natural Heritage Areas – transboundary in RoI)	Sites of national importance in RoI designated under the Wildlife Amendment Act. Legislative protections apply. Data includes pNHAs.
MPA Restricted Areas	The Marine Protected Areas (Prohibited Methods of Fishing) Regulations (NI) 2022. Came into operation Jan 1st 2023. Fishing is prohibited in the sites for sea-fishing using demersal/static gear. Except for those with a licence.
MPA Exempted Areas	The Marine Protected Areas (Prohibited Methods of Fishing) Regulations (NI) 2022. Came into operation Jan 1st 2023. Fishing is prohibited in the sites for sea-fishing using demersal/static gear. Except for those with a licence.
SLNCI	Sites of local importance in NI. These are designated for their habitats, species, earth science and/or landscape value.
TCE MPA risk areas for breeding seabirds	Dataset considers the risk to breeding seabirds within and outside of National Site Network Sites, based on foraging distance, density, and site condition to assess risk. Distribution matrix is based on foraging range and density. Foraging range is based on Woodward *et al* (2020), Density based on Waggitt *et al.* (2020) and Kober *et al.* (2010). Sensitivity scores to pressures relating to the ORE technology were considered from scientific literature e.g., Wade *et al* 2016 and Webb *et al* 2016. Feature vulnerability based on distribution and sensitivity. Site vulnerability (current

SEA Topic	Description
	condition and existing pressures), and mitigation difficulty are also taken into account in overall scores.
TCE MPA risk areas for non-breeding coastal birds	Dataset considers the risk to non-breeding coastal birds within and outside of National Site Network Sites, based on foraging distance, density, and site condition to assess risk. Distribution matrix is based on foraging range and density. Foraging range in bands with High for the site itself, Medium for a buffer of 2-10km depending on species, and Low a 15km buffer. Density based on the proximity buffers as above. Sensitivity scores to pressures relating to the ORE technology were considered from scientific literature e.g., Cutts *et al* 2014. Feature vulnerability based on distribution and sensitivity. Site vulnerability (current condition and existing pressures), and mitigation difficulty are also taken into account in overall scores.
TCE MPA risk areas for marine mammals	Dataset considers the risk to marine mammals within and outside of National Site Network Sites, based on foraging range, density, and site condition to assess risk. Distribution matrix is based on foraging range and density. Foraging range is taken as max 100km for bottlenose dolphin, harbour porpoise and grey seal, 50km for common seal and 10km for otter, with impact range as 26km for all except otter. Density is based on Waggitt *et al*. (2020) for harbour porpoise and bottlenose dolphin, Carter *et al*. (2020) for grey and common seal. Sensitivity scores to pressures relating to the ORE technology were considered from scientific literature e.g., JNCC Guidance). Feature vulnerability based on distribution and sensitivity. Site vulnerability (current condition and existing pressures), and mitigation difficulty are also taken into account in overall scores.
TCE MPA risk areas for fish	Dataset considers the risk to fish within and outside of National Site Network Sites, based on foraging range, and range extent to assess risk.
TCE MPA risk areas for habitats	Dataset considers the risk to Habitats within and outside of National Site Network Sites, based on percentage cover within designated sites to assess risk. Low, Medium or High Scores relate percentage cover.
TCE MCZ risk areas	Dataset considers the risk to MCZ features/sites. Habitat features considers percentage cover. Sessile and geological features within the site and within a maximum screening distance. For mobile features scores were determined based on foraging range/range extent.
Nature Reserves	Protected areas of importance for flora, fauna, funga, or features of geological or other special interest which are reserved for conservation.
RSPB Sites	Nature reserves managed and protected by RSPB.
Ulster Wildlife Sites	Nature reserves managed and protected by Ulster Wildlife.
Scallop Enhancement Areas	These are sites identified for reseeding of scallops. Fishing for sea-fish using demersal mobile gear is prohibited in these sites without a permit.
Seagrass beds – Subtidal and Intertidal Seagrass	Subtidal and Intertidal Seagrass Beds

SEA Topic	Description
Seabed Habitat Description (EMODnet) – Seabed Habitats	Seabed Habitat Map
Important Bird Areas	An Important Bird and Biodiversity Area (IBA) is an area identified using an internationally agreed set of criteria as being globally important for the conservation of bird populations
Seabirds at Sea density	Dataset showing predicted at-sea density.
UK Grey seal density	Dataset showing predicted at-sea density.
UK Harbour seal density	Dataset showing predicted at-sea density.
Seal haul out sites	Designated haul-out sites: locations on land where seals come ashore to rest, moult or breed.
SCANS III marine mammals	Distribution and abundance of cetaceans in European Atlantic waters. SCANS III Point data was created into a density grid. SCANS III polygon only gives species density. Species include common dolphin, beaked whale, bottlenose dolphin, common or striped dolphin, fin whale, harbour porpoise, minke whale, pilot whale, white beaked dolphin.
Marine Mammal Units data	Geographical area in which the animals of a particular species are found to which management of human activities is applied. Marine Mammal Units Dataset is large polygons which cover the entire study area. Attributes do not give occurrence of density estimates for species. Data includes bottlenose dolphin, common dolphin, harbour porpoise, minke whale, Risso's dolphin, whitebeaked dolphin, whitesided dolphin.
Fish Spawning grounds	CEFAS 2012 Spawning Grounds. Species include cod, hake, horse mackerel, ling, mackerel, plaice, sandeel, sole and whiting. Layer contains intensity data.
	CEFAS 1998 Spawning Grounds layers used. Species include cod spawning, herring spawning, lemon sole spawning, plaice spawning, sole spawning, sprat spawning, whiting spawning.
	AFBI Surveyed areas of egg production. The indices are based on the abundance of individuals (eggs/juvenile fish). Species include cod, haddock, whiting and plaice.
Fish Nursery grounds	CEFAS 2012 Nursery Grounds. Species include anglerfish, blue whiting, cod, common skate, hake, herring, ling, mackerel, plaice, sandeel, sole, spotted ray, spurdog, thornback ray, tope shark, undulate ray and whiting. Layer contains intensity data.
	CEFAS 1998 Nursery Grounds layers used. Species include cod, haddock, herring, lemon sole, mackerel, plaice, saithe and whiting.
	AFBI Surveyed areas for juvenile density. Juvenile nursery areas based on pelagic stages of gadoids caught during early summer (May/June) NIMIK survey. The indices are based on the abundance of individuals (eggs/juvenile fish). Species include cod, haddock, whiting and plaice.
Nephrops grounds	CEFAS Nephrops habitats or grounds in waters around Ireland.

SEA Topic	Description
Fishery restriction	Fishing restrictions within UK Waters. Provides Site Name and Summary of Site.
Elasmobranch data	Point shapefile showing public records of elasmobranchs in NI
Annex I habitats outside designated sites	Annex I habitats as identified under the Habitats Directive. Habitats include Coastal Lagoons, Estuaries, Large Shallow Inlets and Bays, Maerl, Mudflats and Sandflats, Reef, Saltmarsh, Sandbanks, Sea Caves.
Priority Species (Wildlife Order)	Point shapefile showing locations. Data includes birds, crabs and lobsters, fish, mammals (Common harbour seal), mammals (grey seal), mammals (Land Boat Surveys), molluscs and shellfish, and reptiles.
NI Priority Species	Point shapefile showing locations. Data includes birds, crab and lobster, fish, jellyfish and coral, mammals, molluscs and shellfish, reptiles, sponges, starfish, and worms.
Priority Marine Features	Point shapefile showing locations. Birds, crabs and lobsters, fish, jellyfish and coral, mammals, molluscs and shellfish, reptiles, seaweeds, sponges, starfish, and worms.
OSPAR Threatened and/or Declining Species	Point shapefile showing locations. Data includes birds, fish, invertebrates, mammals and reptiles.
Non-native/invasive Species	Data split into Marine Invasive Species, Marine Invasive Species High Risk, Marine Invasive Species Moderate Risk, Marine Invasive Species Unknown Risk.
Tidal Excursion data - Zone of Influence	Data modelled by RPS. Zone of influence created around each RZ.
Queen Scallop Survey Data	AFBI surveyed areas for queen scallops, showing density in area.
Scallops Data	AFBI surveyed areas for scallops, indicates the catches of scallops over the AFBI surveys, from low to high.
Population and Human Health	
Population settlements	2015 Urban areas/Settlement boundaries
Bathing Water sites	Bathing water sites are sites which are designated under the Bathing Water Regulations 2013. Data digitised to include Candidate Bathing Waters.
Shellfish Water sites	Shellfish water protected areas are areas designated for the protection of shellfish growth and production.
Blue Flag Beaches and/or award beaches	The Blue Flag is a certification by the Foundation for Environmental Education (FEE) that a beach, marina, or sustainable boating tourism operator meets its standards.
RYA marinas	Point locations of Royal Yachting Association Marinas
RYA leisure density	Royal Yachting Association Leisure Data for Recreational Boats.

SEA Topic	Description
Dive sites	Point location of Recreational Dive Sites
Geology, Soils and Land use	
WHS	UNESCO World Heritage Sites.
MCZ	Marine Conservation Zones (MCZs) are a type of marine protected area that can be designated in English, Welsh and Northern Irish territorial and offshore waters.
ASSI (geological/geomorphological)	Area of special scientific interest, any area of land which is considered to be of special interest by virtue of its fauna, flora, geological or physiographical/geomorphological features.
UNESCO Geoparks (Mourne, Gullion, and Strangford became a Geopark in 2023)	UNESCO Global Geoparks (UGGp) are single, unified geographical areas where sites and landscapes of international geological significance are managed with a holistic concept of protection, education and sustainable development
Seabed geology	Seabed Geology
Seabed sediments	Seabed sediments
TCE Technology Group (simple/complex geology and less/more invasive techniques)	Key Resource Areas from The Crown Estate for Fixed Wind and Floating Wind. Split into different technology groups
Potential contamination: MoD Live firing areas / danger areas	Military Areas - firing area/danger areas extracted
Potential contamination: Munition disposal areas	Dumping Ground - Explosives dumping ground (data also covers Potential contamination: UXO)
Potential contamination: Dumping Grounds	Dumping Ground - Spoil Ground
Tidal Excursion data - Zone of Influence	Data modelled by RPS. Zone of influence created around each RZ.
Water	
WFD water bodies (and current status)	Coastal waterbodies polygon dataset
Potential contamination: MoD Live firing areas	Military Areas - firing area/danger areas extracted
Potential contamination: Munition disposal areas	Dumping Ground - Explosives dumping ground (data also covers Potential contamination: UXO)
Potential contamination: Dumping Grounds	Dumping Ground - Spoil Ground
Tidal speeds (to be used in baseline for the RZs)	Average current speed across the tidal cycle (m/s)
Water depths (to be used in baseline for the RZs)	Water depths extracted from the bathymetry from EMODnet. Water Depth along with theoretical resources was used to initially determine feasible areas.
Tidal Excursion data from ABPMar -Zone of Influence	Data modelled by RPS. Zone of influence created around each RZ.

SEA Topic	Description
Air	
Population settlements (receptors)	2015 Urban areas/settlement boundaries
RYA high density areas (receptors)	Royal Yachting Association Leisure Data for Recreational Boats.
Climatic Factors	
Blue carbon habitats	Blue Carbon Restoration in NI – Feasibility Study. Data digitised to show Potential Blue Carbon Hotspots.
	Habitats include - Annex I Saltmarsh, Annex I Maerl, Shellfish Waters, Subtidal and Intertidal Seagrass
Material Assets	
Offshore Telecommunication cables	Offshore Telecommunication Cables. Combined into one layer for Telecommunication Cables/Energy Cables/Pipelines.
Offshore energy cables – in service	Offshore Power Cables. Combined into one layer for Telecommunication Cables/Energy Cables/Pipelines.
Offshore pipelines – in service	Offshore Pipelines. Combined into one layer for Telecommunication Cables/Energy Cables/Pipelines.
Fishing activity – areas of fishing effort	Data was downloaded from ICES (2021) as recommended by AFBI. AFBI recommended using the layer called; ‘Total’ which includes all fishing types, and the attribute representing the hours spent fishing called ‘Hour_low’ or ‘Hour_upp’. An average of the two was taken and the layer was banded accordingly.
Fish Spawning grounds	CEFAS 2012 spawning grounds. Species include cod, hake, horse mackerel, ling, mackerel, plaice, sandeel, sole and whiting. Layer contains intensity data.
	CEFAS 1998 spawning grounds layers used. Species include cod spawning, herring spawning, lemon sole spawning, plaice spawning, sole spawning, sprat spawning and whiting spawning. A combined layer was produced to show where the highest number of these spawning/nursery areas overlapped.
	Surveyed areas of egg production. The indices are based on the abundance of individuals (eggs/juvenile fish). Species include cod, haddock, whiting and plaice.
Fish Nursery grounds	CEFAS 2012 nursery grounds. Species include anglerfish, blue whiting, cod, common skate, hake, herring, ling, mackerel, plaice, sandeel, sole, spotted ray, spurdog, thornback ray, tope shark, undulate ray and whiting. Layer contains intensity data.

SEA Topic	Description
	CEFAS 1998 nursery grounds layers used. Species include cod nursery, haddock nursery, herring nursery, lemon sole nursery, mackerel nursery, plaice nursery, saithe nursery and whiting nursery. A combined layer was produced to show where the highest number of these spawning/nursery areas overlapped.
	Surveyed areas for juvenile density. The indices are based on the abundance of individuals (eggs/juvenile fish). Species include cod, haddock, whiting and plaice.
Nephrops grounds	CEFAS Nephrops habitats or grounds in waters around Ireland.
Marine fish farms	Locations of marine finfish farms in the EU
Aquaculture sites	Marine aquaculture sites licensed by The Department of Agriculture and Rural Development under the Fisheries Act (NI) 1966 and or authorised under The Aquatic Animal Health Regulations (NI) 2009 enacting COUNCIL DIRECTIVE 2006/88/EC on animal health requirements for aquaculture animals and products thereof, and on the prevention and control of certain diseases in aquatic animals.
Inshore fisheries data	Pot Fishing, Scallops, Queen scallop data. AFBI surveyed areas for Queen scallops, showing density in area. AFBI surveyed areas for Scallops, indicates the catches of scallops over the AFBI surveys, from low to high. Locations which AFBI have had observers out on pot boats.
AIS vessel density	Density grid (1x1km cells) for vessels over 15m.
Traffic separation scheme	Maritime traffic-management route-system ruled by the International Maritime Organization or IMO. Polygons of Traffic Separation extracted from EMAP administrative data.
Port lands	Port lands point dataset.
Harbour areas	Polygons of harbour areas extracted from EMAP administrative data.
Pilot boarding stations	Point location of Pilot boarding stations extracted from EMAP administrative data.
Designated anchorage areas	Polygons of anchorage areas extracted from EMAP administrative data.
Military danger areas – live firing areas	Military Areas - firing area/danger areas extracted.
Military practice areas	Military practice areas - polygons cover the entire Study Area.
Airports	Airport Lands digitised including City of Derry Airport, Belfast International Airport, Belfast City Airport.
Obstacle limitation surfaces and radar interference	Data digitised and buffered to give OLS areas. City of Derry Airport, Belfast International Airport, Belfast City Airport - buffered by 30km. Other airfields buffered by 15km.
Cultural Heritage	

SEA Topic	Description
Protected wrecks	Protected wrecks - restricted area around a wreck to prevent uncontrolled interference.
Unprotected wreck and ship hulk	Wreck locations - includes unprotected wrecks and ship hulk.
WHS	UNESCO World Heritage Sites.
Scheduled Monuments	Scheduled Monuments - The sites and monuments record is a list of known important archaeological sites.
Listed buildings	Listed Buildings are those designated through listing as being of 'special architectural or historic interest' under Section 80 of the Planning Act (NI) 2011.
Registered Parks, gardens and demesnes	A Register of Parks, Gardens and Demesnes of Special Historic Interest was established in the late 1990s to identify those sites that can be considered of exceptional importance within NI.
DHR	Defence heritage sites are sites designated for defence heritage features that have been recorded as part of the Defence Heritage Project (1997).
Scheduled Zones	Scheduled Zones are areas scheduled for protection under Article 3 of the Historic Monuments and Archaeological Objects (NI) Order 1995.
Viewshed for ORE Technologies	Viewshed modelling undertaken for each RZ - enabled an approximation of the landscape and cultural heritage receptors from which ORE developments would likely be visible. Parameters fixed wind height of 165m, 40km radius. Floating wind 228m, 40km radius. Tidal 3m, 10km radius.
Landscape, seascape and visual amenity	
AONBs	Area of Outstanding Natural Beauty - designated for conservation due to its significant landscape value.
WHS	UNESCO World Heritage Sites.
AoHSV	Areas of High Scenic Value - a local designation recognising areas of local landscape quality. Map of AoHSV taken from Donegal County development plan.
Country Parks	Country Parks in NI
National Trust Land	National Trust land in NI
Seascape Character Areas	Twenty-four different regional seascape character areas have been identified round the coast of NI
Population settlements	Settlement boundaries
Viewshed for ORE Technologies	Viewshed modelling undertaken for each RZ - enabled an approximation of the landscape and cultural heritage receptors from which ORE developments would likely be visible. Parameters fixed wind height of 165m, 40km radius. Floating wind 228m, 40km radius. Tidal 3m, 10km radius.

Appendix E – High-level Effects of ORE Technologies

E.1.1 Biodiversity, Flora, and Fauna

Benthic Habitats and Species

Preparation of the seabed within the device installation area and within the route to shore for export cables has the potential to result in habitat loss or damage to benthic communities. For the device installation area, the seabed preparation required will vary depending on the renewable energy type and foundation or attachment type to be used: monopile and jacket structures typically require localised seabed clearance; seabed preparation for floating wind turbines and other moored renewable devices will depend on the attachment method and seabed conditions but is usually minimal; while seabed levelling (by dredging and removal of boulders and other obstructions) may be required for gravity bases and suction caisson designs. Prior to cable laying, pre-clearance activities such as sandwave and boulder clearance may be required, and may be within larger corridors (e.g., between 20m and 30m wide) than the cable installation corridor (typically 10-15m wide). Sandbank habitats are particularly sensitive to sandwave clearance, as well as to any subsequent use of hard substrates for cable protection.

There is potential for benthic communities to be directly lost or damaged during installation and decommissioning of devices and to be disturbed from maintenance during operation. Effects on designated and/or sensitive benthic habitat such as Annex 1 *Sabellaria* Reef from direct physical damage, including foundations, could be particularly detrimental, and take time to recover. Benthic habitat will be lost from the placement of devices, foundations, scour protection, support structures or moorings, and damaged or disturbed within the working area during installation. It is likely that physical habitat recovery and benthic recolonisation of the working area around foundations will occur following installation, with the timescale related to the sedimentary regime, dispersal of individuals and seabed preparation methods. There is potential for removal of these structures at decommissioning to result in a double habitat loss, whereby benthic habitats that have colonised these artificial hard surfaces are also removed. Gravity-based foundations could potentially result in the greatest direct loss of seabed, while for floating technologies the physical footprint of anchors on the seabed and therefore direct disturbance is likely to be smaller, depending on the methodology (e.g., embedment anchors, piles or suction caissons), but spread out over a larger area; the anchorage type used can affect the area of seabed and benthic habitat disturbed or damaged e.g., drag anchors may affect a relatively large area when embedding. Cables are buried by processes including ploughing, jetting, trenching or, in some circumstances, may be laid directly onto the seabed and covered with protective material. These processes can directly remove benthic habitat. The placement of anchors and cables has potential to negatively affect sensitive subtidal and intertidal habitats such as native oyster reefs, seagrass beds, kelp forests, saltmarsh, and coastal sand and mud. The use of equipment such as jack-up barges can make depressions on the seabed, with potential for damage to benthic habitats and species, which is likely to be temporary. Recovery of benthic habitats from physical abrasion depends on the remobilisation of sediments and a combination of migration, redistribution and larval settlement; mud habitats (which may support benthic communities of burrowing crustaceans and sea-pens) are typically more sensitive to physical disturbance than coarser sand and gravel habitats that are likely to recover more rapidly.

Indirect adverse effects on benthic habitats and species may also occur during installation of devices and cables. These activities can result in increased suspended sediment and turbidity, with potential for indirect temporary localised smothering and sediment changes (granulometry and chemistry) associated with drilling, cuttings, and piles, or mortality and reduction in overall species density or displacement of benthic fauna (typically within 50m of the construction site). There is potential for recovery of benthic faunal populations through recruitment from adjacent unaffected areas. Impacts are expected to be lower where structures do not require seabed piling. Increases in suspended sediment and its localised deposition during construction and decommissioning has potential to damage sensitive habitat and species such as shellfish and spawning grounds of fish e.g., herring; impacts can occur from the clogging of gills and feeding mechanisms or affecting oxygenation of spawning grounds where suitable open substrate with good oxygenation in the sediment interstices is required.

During operation, there is potential for seabed sediments and associated benthic habitats and sedentary species to be disturbed through scour (localised erosion and lowering of the seabed around a fixed structure such as wind turbine and other renewable devices or moorings/foundations), dependent on substrate type and hydrodynamics of the area. Chains associated with floating technologies may present a continual disturbance during operation. There is also potential for scour effects to occur around cable protection.

The operation of tidal stream and wave devices has potential to affect benthic communities through changes to tidal and wave energy and to suspended sediment levels and turbidity. A decrease in water flow from the operation of tidal devices has the potential to affect habitat and species that may be sensitive to these changes e.g., maerl beds, modiolus beds, and some deep mud habitats. Regarding wave devices, maerl beds and modiolus beds are highly sensitive to decreases in wave energy, while wave exposed habitats, and those consisting of mobile sediments, are likely to be more resilient to the removal of wave energy. Extraction of tide and wave energy may result in increases or decreases of both sediment suspension and deposition, with maerl beds particularly sensitive to these effects.

During seabed preparation, installation, operation and maintenance, and decommissioning, there is potential for the introduction of non-native species to the area, primarily from vessels and machinery. Depending on the community composition and the species introduced, this could have the potential for long-term indirect negative effects on native species and community structure within the area.

Foundations and devices within the water column or at the seabed, and hard cable protection materials, have the potential to act as artificial habitats through epifaunal colonisation; this may lead to an increase in biodiversity, however the community on these hard structures can be different from that which was present prior to installation and in adjacent areas, and could influence a change in the distribution of prey and subsequently predator species. Where the presence of structures within offshore energy arrays prevents the use of bottom towed fishing gear, this has the potential to aid the recovery of degraded seabed habitats[210].

Fish and Shellfish

Pre-construction seismic and other geophysical surveys introduce noise and vibration, while preparation of the device installation area and route to shore for export cables may require the clearance of UXOs. During installation of devices, the key sources of noise include shipping machinery, dredging and pile driving while, during decommissioning, the removal of piled devices will generate noise from the cutting or excavation of foundations or use of explosives. Marine fish can produce and hear marine noise which, whilst not fully understood, is thought to be associated with alarm calls and social behaviour. There is a wide diversity in hearing structures among fishes, resulting in different auditory capabilities across species. Herring and cod have been identified as being highly sensitive to marine noise. There is potential for physical effects including external or internal injury, deafness or mortality for species within a limited range of these seismic or pile-driving operations, while behavioural effects such as startle and alarm reaction and temporary avoidance to longer term displacement from the area may also occur. The cumulative disturbance due to multiple sources of noise and vessel activity during pre-construction, construction and decommissioning may also result in longer-term avoidance and displacement from the area. Sensitivity of species to sound can be related to their physiology (e.g., the presence or absence of a swim bladder and whether it is involved in hearing). Benthic invertebrates are generally considered less susceptible to acute trauma and behavioural disturbance due to noise and vibration, however data is relatively limited and there may also be potential for effects on these species. The Fisheries Resource Access Mapping Project (FishRAMP), assessing the importance to the NI fishing industry of the Wind RZ off the County Down coast, carried out a literature review that included impact on fisheries sources via noise and vibration, EMF and sediment, seabed morphology and scour[211]. This review found that the recorded negative impacts of underwater sound on fish and shellfish species ranged from physical injury/mortality to behavioural effects. Biological damage from sound was generally related to a large pressure change (barotrauma) or to the total quantity of sound energy

[210] ICES. 2021. Working Group on Marine Benthal and Renewable Energy Developments (WGMBRED). ICES Scientific Reports. Report. Available at: https://ices-library.figshare.com/articles/report/Working_Group_on_Marine_Benthal_and_Renewable_Energy_Developments_WGMBRED_/18621809

[211] Poseidon. 2015. Fish Resource Access Mapping Project (Fish Ramp) Economic Analysis and Literature Review. Available at: https://www.seafish.org/document?id=4268d1ff-c514-4cc0-a9e8-d41ed0ef4566

received by a receptor (fish/shellfish). The most significant noise relating to wind farms related to the installation of turbines via piling. Demersal fish and shellfish species were generally considered to have a low vulnerability and high recovery to localised noise and vibration impacts, with long-term significant effects not expected.

There is potential for shellfish and supporting habitats for fish to be directly lost or damaged during installation and decommissioning of devices and cables, from the placement of devices, foundations, scour protection, support structures or moorings, and within the working area during installation. Small fish or nests have the potential to be damaged or crushed during the construction process. As described for benthic habitats, biogenic reefs are susceptible to damage from direct impacts. Construction and decommissioning have the potential to release sediments (which could include contaminated sediments) into the water. Settling of the coarser fraction has the potential to smother sensitive habitats in the immediate vicinity (c.50m) of the works; these include shellfish such as Nephrops, king and queen scallop, cockles and periwinkles, as well as the spawning areas of finfish species such as herring and sandeels. Increased suspended sediments and turbidity in the wider area has potential to adversely affect filter feeders (e.g., scallops, cockles and mussels) or to affect foraging, social or predator/prey interactions; this is likely to be temporary with rapid dispersion of suspended sediments, particularly for tidal and wave devices that will generally be installed in high-energy environments. During operation, supporting habitat may be lost due to scour around foundations, or from the movement of mooring lines, or be adversely affected by contaminants from devices.

The physical presence of infrastructure in the water column has the potential to pose a collision risk for fish. The potential for collision with wind turbines is expected to be low owing to the relatively narrow diameter (<5m) and wide spacing of turbines. Wave and tidal devices are expected to pose a greater collision risk as they may have extensive submerged components or rotating submerged turbines or other moving infrastructure, with tidal energy devices most likely to cause significant effects through collision or barrier effects, particularly to migratory, diadromous species; specific species at risk will depend on the type and size of device and its physical and mechanical features, location and depth of operation, and fish behaviours. There is also potential for an increased collision risk due to reduced visibility resulting from increased turbidity during operation. There are limited observations, to date, of interactions of fish in close proximity to turbines, which have not recorded obvious harm, suggesting that collisions with devices may be rare[212]. The likelihood of collision is influenced by factors such as the characteristics of the device, animal behaviour, and number of animals that are in the vicinity of moving parts of the device, while overall risks from device arrays will likely be influenced by array location and configuration.

Submerged infrastructure in the water column is also associated with floating wind turbines and floating tidal or wave devices (e.g., anchors, mooring lines, and foundations), which may pose a risk of collision or entanglement. The presence of devices (and associated infrastructure), vessel traffic for maintenance during operation, and associated noise has the potential for habitat loss, exclusion, disturbance or displacement of fish species from suitable habitat, including foraging habitat, by providing a physical or perceptual barrier. The presence of device arrays has the potential to form a barrier to transit or migration of fish due to collision risk or behavioural reaction to operational noise, and the presence of devices and infrastructure, particularly in constrained areas such as the mouths of loughs. The colonisation of devices, moorings and cable protection may provide habitat for shellfish and foraging opportunities by acting as an artificial reef with potential fish aggregation. If fishing is excluded from the array area, there may be potential for positive effects on fish species and supporting habitats such as spawning and nursery grounds within the device lifetime. Information regarding operational noise from devices may also affect the behaviour of fish in proximity; underwater noise associated with wave and tidal energy devices is relatively limited, owing to the wide variety of designs and relatively early stage of development, with generation dependent on the design and operating conditions, and the sound arising from the device itself (e.g., rotating machinery) as well as its interaction with the water (e.g., turbulence); lower noise levels are expected for wave devices than for tidal devices.

During operation of tidal stream devices, the extraction of tidal energy and decrease in water flow has the potential to affect species sensitive to change in tidal flow and wave exposure (e.g., shellfish or

[212] Copping, A.E. and Hemery, L.G., editors. 2020. OES-Environmental 2020 State of the Science Report: Environmental Effects of Marine Renewable Energy Development Around the World. Report for Ocean Energy Systems (OES). Available at: https://www.osti.gov/servlets/purl/1632878

spawning areas such as for herring), with the extent of effects likely to vary depending on the number of devices and geographical location, with more noticeable influences expected in estuarine and narrow channel conditions than open waters. Extraction of wave energy may affect wave exposed habitats, shellfish such as cockles and nearshore juvenile fish such as plaice, cod, and saithe, with the extent of effects likely to be influenced by device and wave type, array spacing and shape and distance from the shore. Extraction of tidal and wave energy may also lead to changes in suspended sediment and turbidity, which could affect sensitive shellfish and fish species.

Studies have found that general noise such as that generated by shipping activity can cause an avoidance or an attraction reaction in fish[213]. Operational noise from wind farms, wave and tidal energy projects therefore has the potential to affect fish in the immediate vicinity of operations. The COWRIE (Collaborative Offshore Wind Research Into the Environment) project reported on the effects of offshore wind farm noise on marine mammals and fish. During the operation of offshore wind turbines, the main source of underwater noise is transmitted into the water from the tower as structural noise. This study indicated that species such as dab and salmon might detect the operational noise of a wind turbine at relatively short distances of no more than 1km. The zone of audibility for cod and herring will be larger, perhaps up to 4-5km from the source. The level of behavioural response within this detection zone is not well understood, however, it is likely to occur only at very close ranges.

EMF generation from devices and subsea power cables is expected to be small and within the variation range of the naturally occurring field within the environment but can be detectable to electro/magneto-sensitive species. EMF have the potential to affect migration and prey detection in certain electro-sensitive fish species such as elasmobranchs (sharks and rays). A number of research reports have been undertaken by COWRIE into the likely field strengths and potential effects on marine species; a study in 2009 aimed to determine whether electrosensitive fish respond to the EMF emitted by sub-sea cables of the type and intensity associated with offshore wind farm cables[214] based on EMF mesocosm studies and wind farm surveys. This indicated that the benthic, elasmobranch species investigated (spurdog, thornback ray and dogfish) can respond to the presence of EMF of the type and intensity associated with sub-sea cables, but that this response appears to be species-specific and not predictable. Field measurement of EMF at operational offshore wind farms indicated both magnetic and electric field emissions associated with export cables to be comparable to the EMF produced in the laboratory study, with the zone of EMF potentially within the range of elasmobranch species detection spanning several hundred metres. Some crustaceans (such as lobster and crab) have shown a response to magnetic fields however, with the exception of elasmobranchs, experiments to date do not indicate significant concerns for fish and shellfish species from EMF[14]. There is therefore evidence that, at an individual level, EMFs from subsea power cables may interact negatively with sensitive marine species such as benthic and demersal organisms e.g., through effects on predator/prey interactions, avoidance/attraction and other behavioural effects, effects on species navigation/orientation capabilities and physiological and developmental effects (e.g., some crustacean (crabs and lobster) species are known to demonstrate a response to magnetic fields, with behavioural changes due to EMF emissions from cables during device operation); however, there is uncertainty as to whether adverse effects at a population level will occur.

Marine Mammals and Reptiles

The presence of vessels and machinery involved in seabed preparation, installation and decommissioning of devices, associated infrastructure and cables has the potential to pose a collision risk for cetaceans, seals and turtles during these stages.

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[213] Tomsen, F., Lüdemann, K., Kafemann, R. and Piper, W. 2006. Effects of Offshore Wind Farm Noise on Marine Mammals and Fish. Report by Collaborative Offshore Wind Research into the Environment (COWRIE). Available at: https://tethys.pnnl.gov/publications/effects-offshore-wind-farm-noise-marine-mammals-fish

[214] Gill, A.B., Huang, Y., Gloyne-Philips, I., Metcalfe, J., Quayle, V., Spencer, J. and Wearmouth, V. 2009. COWRIE 2.0 Electromagnetic Fields (EMF) Phase 2: EMF-sensitive fish response to EM emissions from sub-sea electricity cables of the type used by the offshore renewable energy industry. Available at: https://tethys.pnnl.gov/sites/default/files/publications/Sensitive_Fish_Response_to_EM_Emissions_from_Offshore_Renewable.pdf

As described for fish and shellfish, there is potential for noise and vibration to be introduced into the marine environment in the device installation area and along cable routes, from seismic surveys, the clearance of UXOs and vessel activity prior to construction. During installation of devices, sources of noise include shipping machinery, dredging and pile driving while, during decommissioning, the removal of piled devices will generate noise from the cutting or excavation of foundations or use of explosives. Underwater noise has the potential to adversely affect sensitive marine mammals, including cetaceans, turtles, and seals (as well as otters should works be in proximity to the coast). Sound sources that are most likely to be considered significant are the effects of pulse sources, associated with activities such as seismic surveys, impact pile-driving, and UXO clearance using detonation. Marine mammals, and in particular harbour porpoise, seem to be particularly sensitive to sound (hearing and behaviour). Generated noise may interfere with seal and cetacean-produced noises, however sensitivity to noise will depend on typical background noise levels. Effects range from the masking of communication, small behavioural reactions to chronic disturbance or displacement, injury or mortality. Direct injury may occur within a limited range from the sound source (tens to hundreds of metres). There is potential for disturbance and behavioural effects, including avoidance of the area, from a combination of factors including the physical presence of vessels and machinery, noise from multiple sources, vibration, visual and light intensity changes, habitat disturbance and water quality changes that may lead to increased turbidity and reduced visibility, which can affect foraging, social and predator/prey interactions. Otters and hauled-out seals on land will be sensitive to disturbance, particularly during the breeding season, as will moulting seals. There is also potential for supporting foraging habitat (e.g., fish spawning and nursery habitat) to be directly lost or damaged during installation and decommissioning of devices and cables, from the placement of devices, foundations, scour protection, support structures or moorings, and within the working area during installation.

As for fish, the physical presence of infrastructure in the water column has the potential to pose a collision and/or entanglement risk for marine mammals and turtles. There is potential for injury due to collisions with submerged structures or associated cables, as well as vessels involved in maintenance. Operation of wave and tidal devices is expected to carry a collision risk for marine mammals, due to submerged internal chambers and moving parts such as rotating turbines, with tidal energy devices most likely to cause significant effects through collision or barrier effects. The risk of collision is influenced by the type and size of device, its physical and mechanical features (including rotating speed), the depth at which it is operating, and behaviour of the animal, e.g., avoidance or fine-scale evasive responses. Should submerged turbines cause increased turbidity and reduced visibility this could increase the injury risk. If horizontal surfaces are present near the water level, these may be used as haul-out sites for seals; while providing potential habitat, this could increase the risk of injury. An evidence review of collision risk indicated that there were no observations of a marine mammal colliding with a turbine, suggesting that collision events may be rare[172]. As for fish, the likelihood of collision is influenced by factors such as the characteristics of the device, animal behaviour, and number of animals that are in the vicinity of moving parts of the device, while overall risks from device arrays will likely be influenced by array location and configuration.

Operational noise of devices is expected to be considerably lower in magnitude than construction noise. The underwater noise produced during operation of wave and wind devices is expected to be less than for tidal devices. Operational noise has the potential for ‘masking effects’, which disrupt the location of prey, navigation, and social interactions. The presence of wind, wave or tidal arrays has the potential to cause a loss of habitat during operation. Devices may exclude marine mammals from suitable habitat, including foraging habitat, by providing a physical or perceptual barrier or producing noise that results in avoidance behaviour. They may also cause the exclusion of cetaceans from areas used as nursery or breeding areas, transit or migration routes, and socialising areas. There is potential for induced EMF associated with cabling to affect the behaviour of migratory patterns of cetaceans.

During operation of tidal stream devices, the extraction of tidal energy and changes in tidal flows has the potential to affect species sensitive to these changes such as seals. Extraction of wave and tidal energy may lead to changes in suspended sediment and turbidity, which has potential to affect seals and cetaceans through visibility changes.

The presence of devices may act as artificial reefs or lead to fish aggregation, which may affect foraging opportunities of marine mammals at the local scale (the wider ecological significance is not clear), but also an associated increased collision risk.

Birds and Bats

There is potential for marine noise within the array area and along cable routes during pre-construction, installation and decommissioning, with sources including shipping machinery, dredging, pile driving (and removal during decommissioning) and the detonation of UXOs. This results in potential for hearing damage for marine birds whilst underwater from activities that result in very high sound pressure levels such as UXO detonation and pile driving, or behavioural effects such as disorientation and foraging success. There is potential for disturbance in the vicinity of pre-construction, installation and decommissioning works from noise as well as the physical and visual presence of vessels and machinery. The use of artificial lighting during these activities may affect behavioural patterns or disrupt flight patterns, increasing the risk of collisions, particularly at night, and may pose a particular risk to species that are disorientated by lights[215]. Disturbance may lead to increased stress, disrupt breeding, and lead to site avoidance and displacement from the area, with potential effects on foraging, breeding and energy expenditure.

There is a short-term slight potential collision risk for birds with vessels and machinery during pre-construction, installation and decommissioning including collision with birds in flight or with birds rafting on the sea surface.

Seabed preparation, device, infrastructure and cable installation and decommissioning has the potential to damage the benthic environment directly and indirectly, which may affect invertebrates and fish, and reduce prey availability and foraging opportunities for birds. Installation and decommissioning also has the potential to temporarily increase turbidity, with implications for visibility and foraging and predator/prey interactions, as well as to disturb contaminated sediments, which may affect sensitive species.

During operation, offshore wind turbines can pose a collision risk to birds; the degree of sensitivity to collision risk is influenced by a range of factors including sensitivity of the species, time of year (i.e., across breeding seasons and migration), weather conditions and visibility, the nature of turbines including the use of lighting, location of bird populations relative to the device array, flight behaviour including manoeuvrability and avoidance, migration routes and routes to foraging grounds. Close to shore, collision risk may be higher due to the movement of many species between feeding areas, between feeding areas and roosts, and between feeding areas and breeding areas. Topography may influence risk, as avoidance behaviours could be restricted. The proportion of birds flying at collision risk height is an important factor, with species that typically fly at low altitudes (above the sea surface and below turbine height) considered to be at lower risk, and other species (e.g., large gulls and gannets) that typically fly at higher altitudes and have longer travel distances between wintering grounds likely to have a higher collision risk. Species and populations that are ranked as highest risk are herring gull, great black-backed gull and lesser black-backed gull, while other birds considered as high risk include other gull species, gannet, kittiwake, skuas, Manx shearwater, and sandwich tern. The use of lighting for wind turbines to comply with aviation safety guidelines can have an attraction or disorienting effect on seabirds and affect collision risk and displacement[209]. There is also a potential collision and/or entanglement risk for diving birds with devices, including submerged tidal and wave devices, mooring cables and anchors for floating technologies. The creation of new resting and breeding habitats on surface structure devices, may increase collision risk of diving birds with submerged infrastructure. The potential collision risk with devices such as sub-surface turbines, may be affected by water depth and water quality e.g., increased suspended sediment and turbidity (with possible contaminated substances or device leakages) may increase collision risk, particularly for diving species and night-time foraging. There is potential for devices to increase collision risk should they alter flow characteristics and cause high flow zones i.e., high flow can provide good foraging and could encourage new foraging locations, however these areas could lead to increased collision risk. An evidence review of collision risk indicated that there were no observations of a diving seabird colliding with a submerged turbine, suggesting that collision events may be rare[172]. As for fish and marine mammals, the likelihood of collision is influenced by factors such as the characteristics of the device, animal behaviour, and number of animals that are in the vicinity of moving parts of the device, while overall risks from device arrays will likely be influenced by array location and configuration.

[215] Scottish Government. 2022. Offshore wind developments - collision and displacement in petrels and shearwaters: literature review. Risks from collision, displacement and lighting attraction. Available at: https://www.gov.scot/publications/review-inform-assessment-risk-collision-displacement-petrels-shearwaters-offshore-wind-developments-scotland/pages/5/

In addition to birds, there may be a potential long-term collision risk for bats with offshore wind turbines. Bats may use wind farms as resting areas when completing longer migrations and may be attracted to static and moving blades. Bat fatality is associated with barotrauma, which is caused by rapid air pressure reductions near moving turbines causing internal damage. There is potential for an increased risk of collisions between devices and bats whenever artificial lighting is used on devices, with an enhanced risk at night-time.

As for installation and decommissioning, operation of offshore renewable devices can result in habitat loss for birds, loss of prey species, and exclusion or displacement from foraging areas. Devices may exclude birds from a suitable foraging habitat by providing a physical or perceptual barrier, or producing noise that results in avoidance behaviour, and lead to a net loss of foraging area, with potential for reduced foraging success, increased distance to foraging areas, and increased pressure on alternative foraging grounds. Construction of offshore renewable arrays within, or in close proximity to, key bird foraging areas could increase direct impacts through collision risk as a significant number of birds could be attracted to the site, in addition to an indirect reduction in food availability, which could adversely affect bird populations. Proximity to breeding colonies and foraging grounds are significant factors in the level of risk associated with inshore arrays. The UK OESEA 4 considered offshore wind farms to have potential for displacement of birds, leading to effective habitat loss, associated with exclusion from ecologically important areas (e.g., feeding, breeding), barrier effects and disturbance of regular movements (e.g., foraging, migration), potentially increasing flight energy demands and collision risk. It considered that diving birds, particularly red-throated diver, are highly sensitive to displacement by offshore activities and installation presence, and that those species considered to be particularly vulnerable through sensitivity to collision or displacement were red-throated diver, common scoter, Manx shearwater, gannet, lesser black-backed gull, Sandwich tern in Regional Sea 6 (Irish Sea), and kittiwake, Manx shearwater in Regional Sea 7 (Minches and Western Scotland). During operation there is also potential for positive effects for birds due to the creation of new resting and breeding habitats on surface structures, and for increased foraging opportunities as devices may act as artificial reefs and lead to fish aggregation within array areas.

The development of ORE has the potential to contribute towards combatting adverse effects of climate change on the marine environment, such as ocean temperature change and acidification[172], and therefore has the potential for indirect positive effects on marine fauna and habitats in the long-term.

E.1.2 Population and Human Health

Population Disturbance

There is potential for short-term, temporary, noise and visual disturbance effects on the local residential population, and leisure and recreational activities due to the generation of noise and visual impacts during pre-construction, installation, and decommissioning. The main sources of noise include the presence of vessels, detonation of UXOs, piling, movement and installation of machinery/device components, cable trenching, excavation and cutting noise or use of explosives to remove piled foundations, and installation of the onshore grid connection. Direct population disturbance during installation and decommissioning is related to general disturbance in coastal locations from the presence of vessels and associated machinery, while installation and decommissioning activities that result in increased underwater noise may have indirect effects on the population e.g., through effects on wildlife watching due to displacement. There is also potential for adverse disturbance effects such as increased light pollution and potential for increased traffic congestion impacting access to road networks and/or services such as ferry ports.

During operation of fixed wind devices, there may be potential for adverse disturbance effects on the local population from the generation of noise, vibration and light by operational devices and during maintenance particularly if devices are located near shore, and for increased traffic congestion impacting access to road networks and/or services such as ferry ports during device maintenance periods. Wind turbines can cast long shadows due to their height. Shadow flicker is a term used to describe when turbine blades cast a shadow over a nearby property window and the blade rotation causes this to flick on and off. Generally, it is considered that the occurrence of shadow flicker is very low at distances greater than ten rotor diameters from a turbine or at a distance of greater than 1km. Regarding operation noise effects on population, a simplified noise condition for wind farms with very large separation distances between the turbines and the nearest properties is provided by the current UK guidance as a limit of 35dB LA90, 10min at wind speeds up to 10m/s (at 10m height)[216].

Marine and coastal leisure and recreation

There is potential for a short-term increase in collision risk with vessels and machinery for leisure and recreational users of the area such as recreational sailing and sea angling during pre-construction, installation and decommissioning of devices and cables. There is potential for access restrictions and short-term displacement of leisure and recreational marine users (e.g., recreational sailing, fishing, water sports and beach/coastal use) during pre-construction, installation and decommissioning. There could also be secondary adverse effects on these activities due to a potential release of contaminants (e.g., contaminants from historic disposal areas) and associated effects on water quality during pre-construction, installation and decommissioning. As described under Biodiversity, Flora and Fauna, pre-construction, installation and decommissioning noise and visual effects have potential for temporary adverse effects on marine wildlife such as seabirds and marine mammals that may lead to disturbance or displacement, with potential for indirect adverse secondary effects on recreational wildlife watching and associated tourism.

During operation, there is potential for a long-term (device life) enhanced collision risk for recreational and leisure vessels such as sailing vessels with turbine blades (the likelihood of collision with vessel masts depends on the vessel clearance and the wind turbine's blade tip height), and submerged, partially submerged and sub-aerial devices and cable protection materials. There is also potential for long-term physical exclusion and displacement of recreational and leisure users from array areas; displacement could increase collision risk should vessels be displaced into commercial navigational routes. There is potential for secondary adverse effects on recreational and leisure activities should leakage of toxic chemicals from devices or accidental chemical release occur, with potential implications for human health through contamination of fish or other seafood intended for human consumption at levels exceeding legislation or other relevant standards. As described under Biodiversity, Flora and Fauna, operational noise has potential for adverse effects on marine wildlife such as seabirds and marine mammals that may lead to habitat loss or displacement, with potential for indirect adverse secondary effects on recreational wildlife watching and associated tourism.

Energy Supply

Development and operation of offshore renewable energy has potential for long-term positive effects for the NI population through the development of a new, secure and renewable energy supply. There is potential for positive secondary effects on population employment in relation to construction and operation of devices and associated onshore infrastructure and port development.

There is potential for employment opportunities associated with the construction and maintenance of devices, as well as potential for other benefits such as boosts to local businesses, investment in ports and harbours and educational opportunities.

E.1.3 Geology, Soils, and Land Use

There is potential for short-term direct or indirect effects on geological or geomorphological features within marine and coastal designated sites during the installation and decommissioning of devices and cables, including the landfall of export cables. The presence and operation of wave and tidal devices has potential for long-term indirect effects on these features arising from changes in coastal processes.

There is potential for contamination of sediments within the device installation area from drilling wastes during the installation processes if not removed during piling operations, from sediment modification

[216] DTI. 1996. The Assessment and Rating of Noise from Wind Farms. Available at: https://assets.publishing.service.gov.uk/media/5a798b42ed915d07d35b655a/ETSU_Full_copy__Searchable_.pdf

with the introduction of particulate discharges and from reinjection of produced water and/or cuttings and carbon dioxide.

There is potential for direct adverse effects on seabed sediments and morphology through changes due to the preparation of seabed areas, excavation or disturbance of sediment or bedrock, and for permanent changes in the physical seabed through the placement of structures (devices, foundations and scour protection, anchors and mooring) directly on the seabed and from indentations left from using jack up vessels during the construction phase. There is potential for adverse effects on geology and seabed morphology post-decommissioning should cables, piles or foundations remain in-situ.

There is potential for a short-term increase in suspended sediments during device installation and during the trenching process for cable routes, and during removal on decommissioning, as well as potential for a release of additional sediment loads during drilling and grouting of foundations. It is likely that the coarser fraction of disturbed sediment will be deposited on the seabed close to the works but remain mobile. In high energy areas (such as are likely to suitable for wave and tidal devices), any fine material that is released is expected to disperse widely and deposit over a large area. For low energy areas, large quantities of fine sediments could be released. Disturbance of sediments during installation and decommissioning has the potential to release sequestered carbon, impacting the overall offset of CO_2.

During operation of devices there is potential for a modification of sediment transport pathways resulting from the physical presence of devices on the seabed acting as a barrier or diversion to sediment transport (for wind, wave and tidal devices) or through localised hydrodynamic changes associated with wave or tidal energy removal by the operating device (for wave and tidal devices). A loss of sediments may occur during operation of devices through scouring at the base of piled structures such as monopiles and, on a smaller scale, certain tidal or wave devices, as well as for other attachment methods such as anchoring, gravity bases and clump weights associated with floating wind, wave and tidal devices. There is potential for secondary effects on sediments as scour "wakes" may occur around devices in the direction of the dominant flood tide and can extend for several hundreds of metres. During operation, devices have the potential for long-term effects on sediment transport; the presence of devices may directly alter sediment transport pathways and contribute to sediment deposition or erosion on a long-term basis. There is potential for long-term effects on the occurrence of longshore drift altering sediment transfer where cables (and cable protection) sit on the seabed surface. The presence of devices throughout the water column has the potential to alter hydrodynamic regimes, with potential for impacts on biogeochemical cycles, thermal stratification, current strength, or wave climate. The operation of arrays of wave and tidal devices may have potential to alter coastal processes, tidal currents and wave regimes. Tidal stream devices, in addition to effects on water flow and resulting scour around foundations or anchors due to the physical presence in the water column, can have effects through energy removal from the water column during operation, which may reduce current velocity, alter bed shear stress and sediment transport. For single devices, such effects generally appear to be localised but are influenced by the location and site conditions of the device, while modelled effects of arrays are highly variable and influenced by the geographic area and site conditions (e.g., channels or more enclosed sites are generally more likely to have greater effects than open water sites) as well as the array size.

E.1.4 Water

Water Quality

There is potential for adverse effects on water quality during device installation and operation. During pre-construction seabed preparation activities, and installation of devices, foundations and structures (including piling works, placement of support structures or anchors) there is potential for the mobilisation of sediments resulting in increased turbidity, potential for release of substrate that may be contaminated, and contamination from installation and decommissioning equipment or vessels. There is potential for short-term release of sediment across the seabed to adversely affect nearby designated shellfish and bathing waters, and for increased weathering of newly exposed sediment during device installation/decommissioning. Installation could represent potential for adverse effects on water quality due to discharges of drainage water from marine plant involved in the installation process, and through loss of grouting/concreting materials into the water during construction (principally drilling muds and cements/grouts where drilling is required, e.g., where piles cannot be driven due to the presence of shallow or out cropping hard geology). Construction discharges could have the potential for effects on seawater or estuarine salinity, turbidity, and temperature. Subsea cabling also has the potential for re-suspension of contaminated sediments due to excavation and potential for accidental discharges from construction.

Various chemicals are used during operation and maintenance of offshore renewable devices and there is potential for accidental release during operation with adverse effects on water quality. It is difficult to predict the likelihood of occurrence or duration. There is a requirement for controls on the use and discharge of such chemicals. There is also potential for adverse effects on water quality from leakage of device hydraulic fluids and anti-fouling compounds, and potential for corrosion of sacrificial anodes (currently no noted adverse effects); however, zinc and aluminium (commonly used anode materials) are potentially toxic to marine organisms. There is also potential for accidental spillage from maintenance vessels and machinery.

E.1.5 Air

Air Quality

There is potential for a short-term, temporary, increase in air emissions from vessels and machinery and adverse effects on local air quality, during pre-construction, installation, and decommissioning. Air pollutants have potential to contribute to increased regional acid loading, low-level ozone and smog formation during routine installation processes, as well as fugitive emissions of dust/particulates and volatile organic compounds from cement tanks, diesel storage, and cooling/refrigeration systems. Potential for dust, particulate, and NOx emissions from the construction process to have adverse secondary impacts on ecosystems e.g., soiling of surfaces, impacts on soils or watercourses through deposition occurring in the localised construction area.

Potential for a smaller scale of emissions generated from vessels or machinery during operation and maintenance of devices. In the long-term, operation of renewable energy devices has the potential to contribute to positive effects on air quality by supporting a transition away from the use of fossil fuels.

E.1.6 Climatic Factors

GHG Emissions and Carbon Storage

There is potential for short-term generation of CO_2 during device manufacture and transport, and the use of vessels and machinery during pre-construction, installation and decommissioning of offshore renewable energy devices and cables. There is also potential for short-term release of CO_2 due to seabed disturbance during these phases. This may include potential for adverse effects on habitats that are valuable carbon sinks (blue carbon habitats, such as sea grass meadows, saltmarsh and maerl beds), with degradation or damage having potential to release CO_2.

Potential for a smaller scale of emissions generated from vessels or machinery during operation and maintenance of devices. In the long-term operation of renewable energy devices has the potential to contribute to long-term positive effects through a net reduction in GHG emissions, decarbonisation of the energy sector, diversification of electricity supply and energy security, and meeting of energy objectives and climate change emission reduction targets. The extent of benefits would be influenced by the scale and duration of developments.

Climate Change Effects

The long-term operation of renewable energy devices has the potential to be affected by climate change. There is potential for climate change to have direct effects on devices, which could include a change in output (e.g., wave devices could be affected by changes in mean wave height) and durability (e.g., with increased storm frequency). Climate change also has the potential to indirectly alter the environmental effects of devices (e.g., changing sea temperatures could alter the ecology of an area, and the ecological interactions of new ecology with the devices). The landfall of export cables has potential to be affected by coastal change including increased storminess and sea-level rise.

E.1.7 Material Assets

Interference with existing infrastructure

There is potential for damage to existing infrastructure such as cables and pipelines during seabed preparation, during the installation of offshore renewable devices (e.g., by device foundations, anchors, or other support structures) and installation of inter-array and export cables. Damage has the potential to disrupt telecommunications or release hazardous substances. There is also the potential for damage to cables and pipelines during device maintenance, with the same potential consequences.

There is potential for temporary reduced access to these existing cables and pipelines for maintenance during the installation and decommissioning of offshore renewable developments, and potential for reduced access in the long-term during operation of offshore renewable devices.

Disruption of other users of the marine area

Commercial fishing and aquaculture

Commercial fisheries have the potential to be affected through effects of ORE developments on fisheries ecology, i.e., damage or disturbance to target resources, and through effects on fishing activity.

There is potential for short-term direct and indirect ecological effects on fish and shellfish during pre-construction seabed preparation, construction, operation and decommissioning, as outlined under Biodiversity, Flora and Fauna. During seabed preparation, installation and decommissioning there is potential for short-term disturbance to fishing grounds affecting sedimentation rates and possibly smothering spawning areas, and potential for a release of contaminated sediments that could cause detrimental ecosystem impacts. During operation, there is potential for effects on fishing grounds from the physical presence of devices or noise generated by the operation of devices. There is potential for alterations to seabed sediments due to scour wakes around devices to have secondary impacts on species such as burrowing Nephrops, which may alter Nephrops numbers and could lead to economic impacts for commercial fisheries in terms of stock. Changes in sediment particle size, affecting burrow density, and changes to hydrology, affecting larval recruitment are factors that may impact on Nephrops. There is potential for adverse effects on fish and shellfish stocks and alterations in the availability of fishing species' targets through population changes impacting on survivability and economic profitability of fishing activities, potentially lowering quotas with increased resource competition for fishing grounds.

Commercial fishing activity has the potential to be affected through displacement, and through effects on continued activity within the array and cable route areas. There is potential for commercial fisheries operations to be temporarily displaced from traditional fishing grounds during seabed preparation, installation and decommissioning in order to facilitate safety during these stages. There is typically a safety zone of 500m around construction zones, or vessels engaged in construction (including a 500m mobile zone around cable laying). There is also potential for long-term displacement from array areas during operation, through exclusion from the whole or certain areas of the development. During operation of arrays, there may be a safety zone, or a safe operating distance, of up to 50m around single installations (such as around turbine bases), and a 500m roaming safety zone during major maintenance activities. The ability of fisheries to continue using the areas will be influenced by the type and spacing of devices, and the burying of cables, within the array as well as the method of fishing used, and whether fishing will continue to be permitted or operationally possible within the array area. Fishing gear has the potential to become entangled with offshore device infrastructure, with cable protection (including along export cable routes), or with debris on the seabed, which could particularly impact on commercial fisheries using bottom-towed fishing gear and influence the forms of fishing that can be undertaken in the area. During operation, there is also a risk of collision with devices or device maintenance vessels, and potential for enhanced allision risk with floating wind structures, which may be influenced by the weather conditions. A choice may be made to not fish the area irrespective of the physical or management constraints due to the presence of devices and infrastructure and perceived risk, acting as a de facto constraint.

Displacement of fishing effort from the ORE area has the potential to lead to reduced catches, increased competition for remaining fishing grounds with potential for unsustainable fishing effort and adverse effects on fish stocks, increased gear conflict within these areas, and additional steaming times (reducing profit due to increased fuel costs). Displacement effects may be relatively localised or may impact further afield. The impacts of displacement are both to those vessels that were fishing in the ORE area, and to those vessels fishing in the areas that displaced vessels move into. Displacement and concentration of vessels into a smaller area for shipping and navigation routes could also interfere with fishing activities.

There is potential that hard subsea infrastructure such as device foundations and scour protection material could be colonised and attract fish into array areas, as there is some evidence of increased abundance and/or species richness within offshore wind farms, which could be of benefit for commercial fisheries within or in proximity to these areas. However, the introduction of hard substrates has the potential to alter the species composition of fish and shellfish within these areas, with potential implications for those that may be targeted by the fishing industry.

Shipping and navigation

There is potential for an increased collision risk for vessels. During seabed preparation activities, installation and decommissioning there is a potential risk of collision with slow-moving or stationary vessels and equipment, while during operation there is a risk of collision with maintenance vessels and equipment and allision with stationary wind, wave, and tidal devices, with a spillage risk of oil and hazardous cargo. The presence of devices with subsea structures has potential for adverse effects on safety for vessels during operation owing to a reduction in the under-keel clearance. There is potential for short-term effects on search and rescue operations that occur within the installation/decommissioning areas, as such activities must take into consideration the installation equipment.

There is potential for the temporary displacement of vessels from the construction area during seabed preparation, installation, and decommissioning of devices and cables in order to facilitate safety during these stages; this has potential to lead to increased journey distances and journey times, which may impact shipping density and could temporarily restrict port and harbour access with short-term implications for trade. There is also potential for long-term displacement from array areas during operation, with potential to lead to increased journey distances and journey times, direct displacements in shipping density trends and trade, and impacts on supplies through reduced access to ports and harbours. The level of displacement is likely to be greater for wind and wave developments as these tend to occupy larger areas than tidal developments; wind and wave devices may also occupy the entire water column, whereas tidal devices may be fully submerged and allow for co-existence of shipping. During operation, there is potential for direct adverse effects on navigation, as devices could obstruct lights, buoys or the coastline. In terms of communication and navigational equipment, AIS (Auto Identification Systems) may potentially be affected when at short ranges and blocked behind a turbine, and radar systems (including aviation NATS) may be affected, these affects are generally most pronounced at close range to the turbines.

Military areas

There is potential for UXO to be present within the array area or export cable route owing to MoD and WWI and WWII history of the area. The presence of UXO has potential to adversely affect the development of device arrays during pre-construction seabed preparation and installation. There is potential for temporary disruption of military exercises and activities during pre-construction, installation and decommissioning, and longer-term disruption during operation, as safety areas could prevent access or cause military vessels to use alternate locations or take longer journeys.

Disposal areas

Should device arrays or export cables be installed close to disposal areas there is potential for previously disposed material to be released during pre-construction seabed preparation, installation or decommissioning activities. This could have the potential for secondary adverse effects on ecosystems. There is potential for temporary disruption or displacement of vessels moving to and from disposal sites during pre-construction, installation and decommissioning activities, and long-term disruption or displacement from the array area during device operation. This could have the potential for increased journey times/distances to access disposal sites, with possible financial implications if the distance to the disposal site is increased.

Aggregate extraction

There is no potential for adverse effects on areas of aggregate extraction during pre-construction, installation or decommissioning of offshore renewable energy devices and cables, as there are currently no licensed marine aggregate extraction areas in NI waters, and no prospective licence areas have been defined. In the long-term, the presence of device arrays and export cables has the potential to make these areas unavailable for future exploitation of aggregate resources during the operational lifecycle.

Tourism

During seabed preparation, installation and decommissioning of devices and cables there is potential for noise and visual impacts and potential for a release of contaminants, which would lead to secondary adverse effects on coastal tourism locations and recreational activities. There is also potential for short-term access restrictions on marine recreational activities.

There is potential for an increased collision risk for recreational/tourism-related vessels during device operation, and potential for long-term noise effects (mainly affecting the marine environment, but shoreline devices may generate noise with the potential to directly affect land-based receptors) that may have secondary adverse effects on tourism e.g., through displacement effects on wildlife. There is potential for the physical presence of devices, particularly the above-sea footprint of wind turbines, to affect the seascape and visual amenity of the coastal and marine area, with potential for secondary effect on tourism. While effects on visual amenity may be negative, particularly in sensitive areas, there is also potential that the marine devices themselves could have a positive effect on recreation and tourism by becoming key tourist attractions. With increased awareness of climate change and the opportunities for gaining first-hand experience of the evolution of new technologies, the attraction of marine devices which are accessible (and visible) could be potentially high in the short-term. Interest is likely to decrease as wave, tidal and wind power become more commonplace.

Aviation

There is potential that the presence of above-sea devices could cause a physical obstruction to low-flying aircraft, and potential for collisions with helicopters and fixed-wing aircraft. The presence of devices also has the potential to effect communications, navigation, and surveillance.

Air defence radar systems and sites state that no wind turbines should be installed near the sites as these may impact the ability of surveillance systems to detect and identify aircraft. Civil radar may also be impacted by EMF signals masking objects. There is potential for effects from turbine arrays on communication systems e.g., Very High Frequency (VHF) radio systems, Television (TV) signals, Global Positioning Systems (GPS), radio communications, Automated Identification Systems (AIS), mobile telephony, and various Marine Communications systems e.g., Marine Vessel Traffic System (VTS).

E.1.8 Cultural Heritage

Submerged Archaeology and Wrecks

Preparation of the seabed within the device installation area and within the route to shore for export cables, and installation of offshore renewable devices, has the potential to directly disturb, damage, or destroy known or unknown submerged archaeological sites and artefacts, including wrecks, in particular from the installation of foundations, anchoring, and trenching of cables. There is potential for permanent damage to assets, as it may not be possible to reinstate or restore these assets or their relationship with the surrounding environment. Sites and artefacts on the surface or buried within the installation and cabling areas have potential to be destroyed. There is potential for the installation process to contribute to the compression of stratigraphic components that could contain marine archaeological components. There is potential for indirect effects from sediment mobilisation and deposition damaging or burying sites or features and preventing their discovery. Surveys pre-construction could also have the potential to discover archaeological features and contribute to the marine archaeological evidence record of the area.

During operation, there is potential for scouring, alteration of hydrodynamic and sedimentary processes, and exposure of sites, to occur around sites or features in the vicinity of devices, leading to indirect damage or degradation of archaeological features, sediment deposition and further burial of features, and potential for loss of or damage to features during maintenance activities.

Coastal Heritage

There is potential for short-term direct or indirect damage to designated and undesignated coastal archaeological and architectural heritage, including the WHS, listed buildings and scheduled monuments, where export cables make landfall. There is also potential for temporary effects on the setting of coastal heritage sites from the presence of vessels and machinery during pre-construction, installation, and decommissioning.

During operation, the physical presence of ORE devices has the potential for direct and indirect effects on the setting of coastal heritage features, with effects influenced by the device type (e.g., wind turbines would be more visible than submerged devices that may be marked by buoys or horizontal surface devices), location and distance from shore, and the type of heritage feature and its sensitivity to changes in the visual setting.

E.1.9 Landscape, Seascape, and Visual Amenity

There is potential for short-term, temporary effects on seascapes and visual amenity, including protected landscapes such as WHSs, AONBs, and AoHSVs, from vessel and machinery activity and use of artificial lighting, during pre-construction, installation, and decommissioning of devices and cables.

There is potential for long-term adverse effects on sensitive landscape and visual receptors such as designated or valued landscapes/seascapes from devices and supporting infrastructure during operation. The effects of device arrays on seascapes will depend on the seascape character type and sensitivity, the presence of protected landscapes, and the magnitude/scale of development. Seascape scale considers the sensitivity of the seascape to installed devices. This relates to scenic quality, referring to a seascape's inherent visual characteristics, which may have long-term significance e.g., for tourism or traditional landscapes. Coastal topography, form, and pattern can affect how intrusive the device array will be, while the shape of arrays relative to the coastline may also influence visual impact. Greater effects are generally expected to be more likely for devices located near shore than those located further offshore, and for larger turbines that have greater height and visibility. UK field observations of wind farms indicate that turbines may be viewable at distances of 42km during the day and 39km during the night, with distances influenced by turbine height[217]. Indicative thresholds of no significance based on distance from the shore for a range of turbine sizes for a representative 500MW wind farm based on turbine height were given in the OESEA 4, based on a study by White Consultants, with thresholds of magnitude at 13km, 18km, 24km and 35km[218]. Similarly, assessments of visual sensitivity to offshore wind farms undertaken by Natural Resources Wales concluded that 15km was the maximum distance of medium effect for the smallest offshore wind turbines likely to be

[217] Sullivan, R., Kirchler, L., Cothren, J. and Winters, S. 2013. Offshore Wind Turbine Visibility and Visual Impact Threshold Distances. Environmental Practice 15, pp. 33-49.

[218] White Consultants. 2020. Offshore Energy Strategic Environmental Assessment: Review and Update of Seascape and Visual Buffer study for Offshore Wind Farms. Available at: https://assets.publishing.service.gov.uk/media/5ef9a3abd3bf7f769a4e7742/White_Consultants_2020_Seascape_and_visual_buffer_study_for_offshore_wind_farms.pdf

constructed[219]. During operation, the lighting of wind turbines for aviation navigational safety also has potential to impact on the visual landscape.

ORE devices that are completely submerged (mainly tidal devices, but potentially also wave devices) may still require the use of navigational buoys, above sub-surface devices and at the corners of arrays, with associated lighting, for identification, with potential for adverse effects within sensitive landscapes.

[219] NRW. 2019. Seascape and visual sensitivity to offshore wind farms in Wales: Strategic assessment and guidance. Stage 1- Ready reckoner of visual effects related to turbine size. Report 315. March 2019.

Appendix F – SEA Scoring Guidelines

Topic	Objective	Score	Score Description	Example of Effects
Biodiversity, Flora and Fauna	Avoid damage to, and where possible enhance, biodiversity, flora and fauna.	+3	Significant Positive Effects	Potential for direct increased protection for, or enhancement of, designated species and habitats within international, European, or national designated sites (SACs, SPAs, Ramsar sites, MCZs, ASSIs).
		+2	Moderate Positive Effects	Potential for indirect increased protection for, or enhancement of, designated species and habitats within international, European, or national designated sites (SACs, SPAs, Ramsar sites, MCZs, ASSIs). Potential for increased protection for, or enhancement of, protected or priority species and habitats outside of designated sites (Annex I habitats, Annex II species, NI Priority Habitats and Species).
		+1	Slight Positive Effects	Potential for localised enhancement of biodiversity and ecosystems within the NI marine area. Potential for the long-term exclusion of damaging activities within the marine area, providing a safe haven for marine species including fish and marine mammals.
		0	Neutral/No Effects	No potential for effects on species or habitats within international, European, or national designated sites. No potential for effects on protected or priority species or habitats outside of designated sites or known areas of importance.
		-1	Slight Negative Effects	Potential for a localised disturbance or damage to species and habitats, not within a known sensitive area.
		-2	Moderate Negative Effects	Potential for indirect impacts on a designated site/sensitive site or area, e.g., RZ is within the tidal excursion zone of an SAC/SPA/Ramsar/MCZ or ASSI site or moderate-risk area for marine mammals, birds, fish.
		-3	Significant Negative Effects	Potential for direct or indirect impacts on a designated/sensitive site or area for benthic habitats e.g., RZ overlaps with, or is within the tidal excursion zone of an SAC/SPA/Ramsar/MCZ or ASSI site or high-risk area for benthic habitats. Potential for direct impacts on a designated/sensitive site or area for marine mammals, birds, fish e.g., RZ overlaps with an SAC/SPA/Ramsar/MCZ or ASSI site or high-risk area for these groups.
Population and Human Health	Avoid disruption to the local population, while maximizing potential benefit to the population.	+3	Significant Positive Effects	Potential to significantly contribute to development of a new renewable energy supply for the population, with potential employment and other benefit opportunities. No main settlements in proximity to RZ or known use of the area for leisure and recreation.
		+2	Moderate Positive Effects	Potential to moderately contribute to development of a new renewable energy supply for the population, with potential employment and other benefit opportunities. No main settlements in proximity to RZ or known use of the area for leisure and recreation.
		+1	Slight Positive Effects	Potential to slightly contribute to development of a new renewable energy supply for the population, with potential employment and other benefit opportunities. No main settlements in proximity to RZ or known use of the area for leisure and recreation.
		0	Neutral/No Effects	No main settlements in proximity to RZ. No interaction with areas of known use for leisure or recreation.

Topic	Objective	Score	Score Description	Example of Effects
		-1	Slight Negative Effects	Potential for localised disturbance, no main settlement areas. Potential risk or displacement in known but low-density areas for leisure and recreation.
		-2	Moderate Negative Effects	Potential for localised disturbance, including to main settlement areas. Potential long-term risk or displacement in known moderate density areas for leisure and recreation. Potential for indirect effects on designated Bathing or Shellfish waters.
		-3	Significant Negative Effects	Potential for localised disturbance, including to main settlement areas. Potential long-term risk or displacement in known high density areas for leisure and recreation. Potential for direct effects on designated Bathing or Shellfish waters.
Geology, Soils and Land Use	Avoid damage to the function and quality of the seabed, and effects on hydrodynamics, sediment transport, or coastal processes.	+3	Significant Positive Effects	Potential for increased protection for protected geological/geomorphological features within international designated sites (UNESCO Geoparks, WHSs). Potential for protection/enhancement of a significant area of sensitive seabed.
		+2	Moderate Positive Effects	Potential for increased protection for protected geological/geomorphological features within national designated sites (ASSIs, MCZs). Potential for protection/enhancement of a moderate area of sensitive seabed.
		+1	Slight Positive Effects	Potential for protection of a small area of sensitive seabed.
		0	Neutral/No Effects	No effects on protected geological or geomorphological features within international or national designated sites (UNESCO Geoparks, WHSs, ASSIs, MCZs). No loss of sensitive seabed areas, no changes in hydrodynamics or sediment transport. No interaction with known areas of potential sediment contamination.
		-1	Slight Negative Effects	Potential for localised sediment loss or disturbance. Potential for localised changes to hydrodynamics and sediment transport. No interaction with designated sites for geology or geomorphology. No interaction with areas of potential sediment contamination.
		-2	Moderate Negative Effects	Increased potential to affect seabed geology and sediments. Potential interaction with known areas of potential contamination. Not within any designated site for geology or geomorphology, but potential for indirect ex situ effects.
		-3	Significant Negative Effects	Potential for RZ to have direct impacts on a designated site for geology or geomorphology e.g., RZ overlaps with a WHS/MCZ/ASSI or UNESCO Geopark site.
Water	Avoid impacts on, and where possible enhance, the status or quality of water bodies.	+3	Significant Positive Effects	Potential to contribute to improvement of coastal/transitional water body overall WFD status. Potential to contribute to improvement in the status of sensitive water bodies. Potential to contribute to improvement in the status of MS Descriptors.
		+2	Moderate Positive Effects	Potential to contribute to regional improvement of marine, coastal, or transitional water quality. Decreased potential impediment to the achievement of waterbody objectives under the WFD or GES for MS Descriptors.
		+1	Slight Positive Effects	Potential to contribute to localised improvement of marine, coastal, or transitional water quality.

Topic	Objective	Score	Score Description	Example of Effects
		0	Neutral/No Effects	No potential to affect local water quality, or the status of marine, coastal or transitional water bodies.
		-1	Slight Negative Effects	Potential for short-term or infrequent localised effects on water quality. RZ is not within any WFD water body or WFD protected area and does not interact with any known areas of potential contamination.
		-2	Moderate Negative Effects	Potential for short-term or infrequent localised effects on water quality in a WFD water body or a WFD protected area. RZ interacts with a known area of potential contamination. Potential to affect MS Descriptors.
		-3	Significant Negative Effects	Potential to contribute to deterioration of WFD status due to significant water quality effects or effects on hydromorphology. Potential deterioration in the status of sensitive water bodies or Marine Strategy Descriptors.
Air	Minimise risk to local air quality and contribute to improving regional emissions.	+3	Significant Positive Effects	Potential for significant generation of a new renewable energy supply for the NI population, with potential for indirect long-term positive effects on air pollutant reduction.
		+2	Moderate Positive Effects	Potential for moderate generation of a new renewable energy supply for the NI population, with potential for indirect long-term positive effects on air pollutant reduction.
		+1	Slight Positive Effects	Potential for slight generation of a new renewable energy supply for the NI population, with potential for indirect long-term positive effects on air pollutant reduction.
		0	Neutral/No Effects	No potential to affect air quality. No interaction with any main settlements.
		-1	Slight Negative Effects	Potential for short-term or infrequent localised effects on air quality. RZ is not in proximity to any main settlements.
		-2	Moderate Negative Effects	Potential for short-term or infrequent localised effects on air quality. RZ is in proximity to main settlements.
		-3	Significant Negative Effects	Potential for long-term or significant effects on air quality. RZ is in proximity to many main settlements or air quality sensitive areas.
Climatic Factors	Contribute to a reduction in GHG emissions.	+3	Significant Positive Effects	Potential for significant generation of a new renewable energy supply for the NI population, with potential for indirect positive effects on GHG reduction.
		+2	Moderate Positive Effects	Potential for moderate generation of a new renewable energy supply for the NI population, with potential for indirect positive effects on GHG reduction.
		+1	Slight Positive Effects	Potential for slight generation of a new renewable energy supply for the NI population, with potential for indirect positive effects on GHG reduction.
		0	Neutral/No Effects	No potential for generation of a new renewable energy supply for the NI population. No interaction with known areas of blue carbon habitat.
		-1	Slight Negative Effects	Potential for short-term or infrequent localised GHG emissions, and localised carbon release from sediments.

Topic	Objective	Score	Score Description	Example of Effects
		-2	Moderate Negative Effects	Potential for short-term disturbance, or minor loss of, or damage to, known areas of blue carbon habitat.
		-3	Significant Negative Effects	Potential for significant loss of, or damage to, known areas of blue carbon habitat.
Material Assets and Infrastructure	Provide new, robust offshore renewable energy infrastructure with minimal disruption to other assets and infrastructure.	+3	Significant Positive Effects	Potential for significant scale offshore renewable energy development.
		+2	Moderate Positive Effects	Potential for moderate offshore renewable energy development.
		+1	Slight Positive Effects	Potential for slight offshore renewable energy development.
		0	Neutral/No Effects	No potential for offshore renewable energy development. No interaction with other users of the marine area. No interaction with other marine infrastructure.
		-1	Slight Negative Effects	Potential for slight navigational risk or long-term displacement to other users of the marine area (e.g., shipping, fisheries).
		-2	Moderate Negative Effects	Potential for RZ to interact with a small number of existing infrastructure assets. Potential for moderate navigational risk or long-term displacement to other users of the marine area (e.g., shipping, fisheries).
		-3	Significant Negative Effects	Potential for RZ to interact with a large number of existing infrastructure assets. Potential for significant navigational risk or long-term displacement to other users of the marine area (e.g., shipping, fisheries). Potential interaction with a military danger area.
Cultural, Architectural and Archaeological Heritage	Protect, conserve, and enhance designated and non-designated heritage assets and their settings.	+3	Significant Positive Effects	Potential for increased protection of many designated heritage features, or their settings.
		+2	Moderate Positive Effects	Potential for increased protection of a small number of designated heritage features, or their settings.
		+1	Slight Positive Effects	Potential for the discovery of previously unknown archaeological heritage features.
		0	Neutral/No Effects	No potential for effects on known designated or undesignated cultural heritage features.
		-1	Slight Negative Effects	Potential for RZ to interact with a small number of undesignated marine heritage features. Potential for loss of, or damage to, unknown marine heritage features. Slight effects on the setting of few designated coastal heritage features.
		-2	Moderate Negative Effects	Potential for RZ to interact with many undesignated marine heritage features, or few designated marine heritage features. Potential for moderate effects on the setting of many designated coastal heritage features.
		-3	Significant Negative Effects	Potential for RZ to interact with many designated marine heritage features. Potential for significant effects on the setting of many designated coastal heritage features.

Topic	Objective	Score	Score Description	Example of Effects
Landscape, Seascape and Visual Amenity	Protect, and where possible enhance, the landscape and seascape character and visual amenity of the NI shoreline.	+3	Significant Positive Effects	Potential for long-term enhancement of designated landscapes and views, the landscape/seascape and visual amenity of the NI coastline.
		+2	Moderate Positive Effects	Potential for localised improvement of landscape/seascape and visual amenity.
		+1	Slight Positive Effects	Potential for improvement of local views.
		0	Neutral/No Effects	No effects on landscape/seascape quality or visual amenity.
		-1	Slight Negative Effects	Potential for RZ to have slight long-term effects on designated landscape areas (AONB, WHS). Potential for slight long-term effects on visual amenity.
		-2	Moderate Negative Effects	Potential for RZ to have moderate long-term effects on designated landscape areas (AONB, WHS). Potential for moderate long-term effects on visual amenity. Potential for long-term effects on regional seascape character area where ORE identified as a sensitivity.
		-3	Significant Negative Effects	Potential for RZ to have significant long-term effects on designated landscape areas (AONB, WHS). Potential for significant long-term effects on visual amenity.

Appendix G – Assessment of Potential Resource Zones

G.1 Fixed Wind Resource Zone: Atlantic

Discussion of Potential Impacts

Biodiversity, Flora and Fauna

Benthic Habitats and species:

There are no designated sites for benthic habitats and species within the recommended RZ. Skerries and Causeway SAC, designated for reef and sandbank habitats, is situated c.1.5km inshore of the recommended RZ, and is within the tidal excursion zone. There is a TCE Very High MPA risk area for Annex I habitats in the very south-easterly extent of the recommended RZ, owing to the proximity to Skerries and Causeway SAC. There is potential for significant adverse indirect effects on these features in the short-term construction (and decommissioning) phase from sedimentation or water quality effects (-3). Further refinement of the recommended RZ away from these sites is recommended to avoid the potential for significant adverse effects during the short-term construction phase.

Areas of Annex I reef habitat are also present in the north of the recommended RZ and within the tidal excursion zone. There is potential for moderate adverse direct and indirect effects on these features both in the short-term construction and decommissioning phases and in the medium to long-term, from loss or damage, and sedimentation or water quality effects (-2). The seabed habitats within the recommended RZ predominantly consist of coarse substrate, with a small area of sand. There are recorded occurrences of benthic Priority species and PMFs of starfish, molluscs, and sea slugs. There is potential for moderate direct and indirect effects on these sensitive species, as well as on non-sensitive benthic habitats from localised benthic loss, or pollution and sedimentation effects during the short-term construction and decommissioning phases (-2), and the medium and long-term operational phase (-2). These effects may be minimised based on micro-siting at the project level; project planning mitigation should aim for avoidance of areas of benthic ecological importance, particularly areas where protected habitats and species are present, and installation in areas where non-sensitive habitats or species are present with the use of appropriate installation techniques. The volume of rock used for cable armouring, pipeline protection and foundation scour protection should be planned as the minimum required, in order to minimise habitat loss. At the project planning phase, sediment and erosion occurrence should be minimised through the development, implementation and enforcement of an Erosion and Sedimentation Control Plan (ESCP) for construction and decommissioning works, and modelling of hydrodynamic and sediment transport processes to assess potential effects and determine suitable mitigation to minimise these.

There are records of invasive species within the recommended RZ; there is potential risk of their spread and a risk of a further introduction of invasive species to the area with potential for slight adverse direct effects during the short-term construction and decommissioning phases (-1), and in the medium to long-term during operational maintenance (-1). At the project planning phase, pre- and post-construction surveys for invasive/non-native species should be undertaken in areas of known risk and, if found to be present, an Invasive Species Management Plan should be prepared and a Code of Good Practice, which outlines controls and/or removal measures to ensure that species are not spread during the project's construction or operation. Further mitigation is provided in **Section 10.1.**

Fish and Shellfish:

There are no designated sites for fish and shellfish within the recommended RZ or the tidal excursion zone. There is a TCE Moderate MPA risk area for fish in the south of the recommended RZ, owing to the potential for migratory fish species to use the area (e.g., Atlantic salmon). There is potential for moderate adverse indirect effects in the short-term construction and decommissioning phases through supporting habitat loss or damage, sedimentation, and smothering effects and via impacts on water quality (-2), and in the medium and long-term operational phase due to a loss of supporting habitat (-2).

There are recorded (Ellis *et al*. (2012) CEFAS) fish nursery grounds of high intensity for spurdog and whiting, and of low intensity for anglerfish, blue whiting, cod, common skate, hake, herring, ling, and mackerel within the recommended RZ and tidal excursion zone; these grounds all cover extensive areas. Known (Coull *et al.* (1998) CEFAS) spawning grounds for sprat and herring are within the recommended RZ, while spawning and nursery areas for Nephrops are within the tidal excursion zone to the north-east. There are also areas of relatively moderate to high surveyed density for scallops, particularly in the north-east of the recommended RZ. There is potential for moderate adverse direct and indirect effects in the short-term construction and decommissioning phases from habitat loss or damage, sedimentation, and smothering effects and via impacts on water quality (-2), and in the medium and long-term operational phase due to a loss of supporting habitat (-2).

There are records of Protected and Priority fish and shellfish species such as fan mussel, horse mussel, ocean quahog, great scallop, queen scallop, basking shark, spiny dogfish, cuckoo ray, spotted ray, sole, anglerfish, thornback ray, small-spotted catshark, and plaice. There is potential for moderate adverse direct and indirect effects on these sensitive species from disturbance, displacement, and localised loss of, or damage to supporting habitats during the short-term construction and decommissioning phases (-2), and moderate adverse direct and indirect effects in the medium to long-term operational phase due to loss of supporting habitats, habitat exclusion and displacement, barrier effects, entanglement, or EMF effects (-2).

As described for Benthic Habitats and Species, project planning mitigation should aim for avoidance of areas of benthic ecological importance, particularly areas where protected habitats and species are present. Areas should be avoided that may generate increased levels of suspended sediment that coincide with areas of fish spawning grounds or sensitive species. Where this is not possible, appropriate timing restrictions should be applied to works, and/or less disruptive installation methods used, to minimise effects on sediment mobilisation and disturbance and displacement of species from the array area.

In the medium and long-term, there is potential for slight positive indirect effects (+1) owing to device colonisation and the possibility that device arrays could cause a reef effect, however this may also lead to a slight negative indirect short-term effect (-1) should colonised structures be removed at decommissioning. Mitigation measures during the project planning phase should consider the decommissioning activities that will be used, and whether removal of colonised structures, foundations or scour protection is required, or could result in a double habitat loss (that from pre-construction and decommissioning periods). If fishing is excluded from the array area, there may be potential for positive effects on fish species and supporting habitats such as spawning and nursery grounds within the operational phase.

<u>Marine Mammals:</u>

There are no designated sites for marine mammals within the recommended RZ. Skerries and Causeway SAC, designated for harbour porpoise, is situated c.1.5km inshore of the recommended RZ and is within the tidal excursion zone, and there is also a TCE High MPA risk area for marine mammals in this area. There is potential for moderate adverse direct and indirect effects on designated marine mammals, including from transboundary sites, in the short-term pre-construction, construction and decommissioning phases due to noise impacts, disturbance and displacement, collision risk, or indirect effects on supporting habitats (-2), and in the medium and long-term operational phase due to habitat exclusion and displacement and potential collision risk (-2).

There are areas of recorded relatively high (white-beaked dolphin, pilot whale, and bottlenose dolphin) and moderate (fin whale, pilot whale, and bottlenose dolphin) density for cetacean species, as well as relatively moderate density for harbour seal, within the recommended RZ. There are also records of Protected and Priority marine mammal species, including harbour porpoise, minke whale, and short-beaked common dolphin. There is potential for moderate adverse direct and indirect short, medium, and long-term effects as described above (-2), including the potential for transboundary effects on these sensitive species, as well as other marine mammals that may be present within the area.

During project planning for wind turbines, the key areas of marine mammal habitats and migratory routes should be identified, including through the conduction of pre-construction surveys and consultation with environmental stakeholders, and development avoided within these areas, whenever possible. Pre-construction, construction, and decommissioning activities should be planned to minimise the potential for adverse effects on marine mammals, including temporal activity planning, limiting vessel activity and mitigation against potential noise effects, including through

avoidance of foundation installation methods such as piling that generates higher noise, and avoidance or use of low-noise methods to dispose of any UXO within the development area. The potential for pre-construction, construction, and decommissioning phase adverse effects can be minimised through the application of standard best practice mitigation for marine mammals, including the use of marine mammal observers. Turbines and associated infrastructure should be designed to minimise effects during operation. Birds: There are no designated sites for bird species within the recommended RZ or the tidal excursion zone. A TCE High MPA risk area for breeding birds is within the recommended RZ; Lough Foyle SPA is c.16km distant, and Rathlin Island SPA and MCZ are c.20km distant. There is potential for moderate adverse direct and indirect effects on designated bird species, including from transboundary sites within Scotland and RoI, in the short-term pre-construction, construction, and decommissioning phases due to noise impacts, disturbance and displacement, damage or loss of supporting habitat, and collision risk (-2), and in the medium and long-term operational phase due to habitat exclusion, displacement and potential collision risk (-2). There are areas of recorded relatively high and moderate density for seabirds at sea within the most northerly part of the recommended RZ, and there is potential for moderate adverse direct and indirect short, medium, and long-term effects on seabird species, as described above (-2), including the potential for transboundary effects. During project planning for wind turbines, the key areas of bird habitats and migratory routes should be identified, through the conduction of pre-construction surveys and consultation with environmental stakeholders, and development avoided within these areas, whenever possible. Pre-construction, construction, and decommissioning activities should be planned to minimise the potential for adverse effects on birds, including temporal activity planning, limiting vessel activity and mitigation against potential noise effects. Turbines and associated infrastructure should be designed to minimise effects, particularly collision risk, during operation.
Population and Human Health There is potential for slight adverse, short-term, temporary noise and visual effects on the local population due to noise generated and visual impacts during the construction and decommissioning phases, and visual flicker and noise effects during operation. However, due to the distance of the recommended RZ offshore, these effects should be limited to vessel occupants transiting through the area, and there is not expected to be any direct, short, medium, or long-term, disturbance of coastal populations due to noise or visual effects during the construction, operational, or decommissioning phases (0). The potential for indirect visual effects to coastal populations during the operational phase is considered under the Landscape, Seascape and Visual Amenity topic. There are no Bathing Water Sites, Blue Flag Beaches or dive sites within the recommended RZ, and therefore there is not considered to be potential for adverse effects on these areas during the construction, operational, or decommissioning phases (0). There is potential for slight adverse temporary, direct and indirect, effects on leisure and recreational marine users due to an increased collision risk, access restrictions and displacement, or water quality effects, during the construction and decommissioning phases (-1). The potential for adverse direct or indirect effects on these users in the medium to long-term during the operational phase is considered to be negligible, as there is relatively low recreational boating use within the recommended RZ (0). At the next stage of project planning, the potential for interaction with areas of known use by leisure users should be avoided or minimised. At the project level, further mitigation to minimise risk to leisure users could include the use of exclusion zones around developments, and timely and effective communication regarding construction works, as well as appropriate marking of devices and the array area.
Geology, Soils and Land Use There are no sites designated for geological or geomorphological features, i.e., MCZs, WHSs, ASSIs, or UNESCO Geoparks, within the recommended RZ or tidal excursion zone; there is therefore not anticipated to be any potential for direct or indirect, short, medium, or long-term effects on any

features within these sites from construction or operation of fixed wind devices within the recommended RZ (0). There are Annex I Reef habitats within the recommended RZ, and there is potential for moderate direct, temporary to permanent impacts on these features through loss or damage during the construction and decommissioning phases (-2). These features should be avoided through micro-siting at the project level.

Fixed wind technologies within this recommended RZ are likely to be predominantly in the TCE technology groups of 2A and 3B i.e., primarily requiring monopile foundations and either driven installation or more complex driven and drilling installation where thinner sediments or more complex geology is present. There are also some areas within the recommended RZ where more invasive techniques may be required for installation, e.g., rock socketing in areas of harder bedrock and more complex geology with potential for moderate adverse direct long-term permanent effects on the seabed geology and sediments through loss of material (-2). There is potential for influence on the MS Descriptor 6 sea floor integrity with the installation processes of fixed wind technologies; there is not anticipated to be potential for adverse effects on the achievement of GES of this Descriptor owing to the spatial extent of physical loss, however this should be fully considered at the project phase, and any appropriate mitigation put in place.

The seabed sediments within the recommended RZ predominantly consist of coarse sediments with relatively low potential for mobilisation. There are two spoil dumping grounds in the south-east of the recommended RZ, and, if construction (and decommissioning) takes place within these areas, there is potential for the mobilisation of contaminants that may affect the seabed within the recommended RZ and the tidal excursion zone, with potential for moderate adverse indirect short to medium-term effects on sediment quality in the short-term construction and decommissioning phases (-2). It is recommended that further refinement of the recommended RZ away from these sites occurs to avoid the potential for moderate adverse effects. Should this refinement not be possible, to mitigate against potential contamination effects from these dumping grounds due to sediment mobilisation, construction and decommissioning works should aim to avoid these areas through appropriate leasing and licensing of offshore areas, or the disposed material should be fully tested to determine its toxicity, with appropriate avoidance or mitigation, depending on the results. At the project phase, the degree of disturbance to the seabed should be assessed and, if appropriate, additional contaminant and water quality monitoring should be implemented. This mitigation may also reduce the potential for adverse indirect effects on other receptors e.g., Biodiversity, Flora, and Fauna.

There is potential for long-term (device operational life) sediment loss within the footprint of foundations and scour protection, and short-term temporary loss in the vicinity of the works during seabed preparation activities, construction, and decommissioning activities (-2). Sediment and erosion occurrence should be minimised through the development, implementation and enforcement of an Erosion and Sedimentation Control Plan (ESCP) for construction works. Decommissioning methods should be used that aim to minimise the amount of suspended sediment generated. Following the installation of fixed wind technologies there is potential for medium to long-term localised impacts on erosion and deposition patterns within close proximity to the devices during the operational phase (-2), given the low mobility of sediments within the recommended RZ. Further mitigation to minimise the potential for adverse effects on sediments and sediment transport is provided in **Section 10.1.**

Water

No designated WFD Shellfish Water or Bathing Water Protected Areas, or WFD coastal or transitional water bodies are within the recommended RZ or tidal excursion zone. There is therefore not expected to be any potential for adverse, direct or indirect, short, medium or long-term effects within these sites from construction or operation of fixed wind devices within the recommended RZ (0).

Two spoil dumping grounds are present in the south-east of the recommended RZ, both of which are not currently in use. There is potential for the mobilisation of contaminants if construction and decommissioning take place within these areas, with potential for moderate adverse indirect short to medium-term effects on water quality within the recommended RZ and tidal excursion zone in the short-term construction and decommissioning phases (-2). It is recommended that further refinement of the recommended RZ away from these sites occurs to avoid the potential for moderate adverse effects. Should this refinement not be possible, to mitigate against potential contamination effects from these dumping grounds, construction and decommissioning works should aim to avoid these

areas through appropriate licensing of offshore areas, or the disposed material should be fully tested to determine its toxicity, with appropriate avoidance or mitigation, depending on the results. At the project phase, the degree of disturbance to the seabed should be assessed and, if appropriate, additional contaminant and water quality monitoring should be implemented. There is potential for localised effects on water quality within the recommended RZ and tidal excursion zone during the short-term construction and decommissioning phases and during device operation (maintenance) due to sediment mobilisation and associated turbidity, construction discharges or accidental contaminant release from machinery and vessels (-1). There is potential for localised effects on water quality, as described above, within the MS Celtic Seas sub-region, however there is not expected to be potential for adverse effects on the achievement of GES for water quality Descriptors (e.g., Descriptor 9 Concentrations of contaminants in fish and other seafood; Descriptor 8: Concentration of contaminants within marine environment; Descriptor 10 marine litter) with the application of standard best practice mitigation during seabed preparation, construction, maintenance and decommissioning activities (-1). The potential for adverse effects on water quality should be minimised at the project level, including through sediment testing and water quality monitoring during the construction and decommissioning phases to identify and mitigate for potential adverse effects at the earliest possible stage. Environmental authorities should be consulted on the construction methodology, and the most appropriate timing of works to provide the least potential for sediment mobilisation to waterbodies. Further mitigation is provided in **Section 10.1.**
Air There is potential for slight adverse, direct, short-term temporary effects on local air quality due to air emissions from vessels and machinery during the construction and decommissioning phases. There is also the potential for slight adverse, short-term, temporary emissions from vessels due to maintenance activities during the operational phase. However, due to the distance of coastal populations from the recommended RZ, it is not expected that there will be any adverse direct or indirect, short, medium, or long-term effects on these receptors from air pollution during the construction, operational and decommissioning phases (0). At the project level, emissions of air pollutants should be minimised through adherence to standard best practise for the minimisation of air pollution, as set out in **Section 10.1.** There is potential for slight positive indirect effects on regional air quality in the medium to long-term operational phase, as the operation of renewable energy devices can support a transition away from fossil fuel use and its associated air emissions (+1).
Climatic Factors There are no known areas of blue carbon habitat within the recommended RZ. Ulster Wildlife have identified areas of only low potential for blue carbon importance, therefore, there is unlikely to be potential for adverse effects on blue carbon habitats within the recommended RZ during the construction, operational and decommissioning phases (0). There is potential for slight adverse short-term effects on sediment carbon storage, due to a localised release of CO_2 from seabed disturbance during the construction and decommissioning phases (-1). There is potential for slight adverse, short-term, temporary effects on localised GHG concentrations, due to GHG emissions from vessels and machinery during the construction and decommissioning phases (-1). At the project level, emissions of air pollutants should be minimised through adherence to standard best practise for the minimisation of air pollution, as set out in **Section 10.1.** There is potential for slight positive, medium to long-term effects during the operational phase, as the operation of renewable energy devices can contribute to a net reduction in GHG emissions, decarbonisation of the energy sector, diversification of electricity supply and energy security, and meeting of energy objectives and climate change emission reduction targets (+1).
Material Assets <u>Existing Infrastructure</u> There is the potential for telecommunications of high importance within the recommended RZ to be disrupted during the construction, operation, and decommissioning phases. There is potential for moderate adverse, direct short-term effects due to damage to these cables, and subsequent disruption to telecommunications, during the construction and decommissioning phases (-2), as well

as potential for slight adverse medium to long-term (device lifetime) direct effects in the operational phase during recurrent maintenance operations (-1). There is also potential for moderate adverse indirect effects to telecommunications in the short-term during the construction and decommissioning phases, as access to these existing cables for maintenance maybe reduced temporarily (-2), as well as for slight adverse effects in the medium to long-term during the operational phase due to access issues (-1). Thus, given the high importance of the existing infrastructure within the recommended RZ, there is potential for moderate adverse effects on infrastructure in the short, medium, and long-term (-2).

Industry standard mitigation measures can be implemented at the project phase to avoid the potential for direct damage to the existing cable, such as implementation of safety zones (e.g., 500m avoidance areas) around the Hibernia 'A' cable. Clear communication should be undertaken with the owners of Hibernia 'A' during all project planning and installation, to ensure that the construction process does not impact on access requirements to this infrastructure. Taking these mitigation measures into consideration, the potential for adverse effects on infrastructure could be reduced from moderate to negligible (0) in the short, medium, and long-term.

<u>Shipping and Navigation</u>

There is potential for direct adverse effects on shipping and navigation within the recommended RZ. There is potential for slight direct adverse effects in the short-term due to displacement of vessels during construction and decommissioning (-1), as well as medium to long-term displacement from the array area during the operational phase (project lifetime) due to safety exclusion zones (-1). This can result in disruption to vessel routeing and timetables.

There is potential for slight adverse effects in the short-term during the construction and decommissioning phases due to the risk of collision and allision with vessels, which may result in hazardous cargo or oil spillage (-1). There is also potential for slight adverse effects in the medium to long-term operational phase due to a risk of collision with stationary device arrays and subsequent spill risk, as well as safety concerns with under keel clearance reduction (-1). Additionally, there is potential for slight direct adverse effects on navigation in the medium to long-term operational phase, as devices could obstruct lights, buoys, or the coastline (-1); in terms of communication and navigational equipment, AIS (Auto Identification Systems) and radar systems (including aviation NATS) may be affected. Furthermore, there is potential for slight adverse effects within installation/decommissioning areas in the short-term construction and decommissioning phases, as the presence of installation vessels and equipment may adversely impact the efficiency of search and rescue operations (-1).

Given the presence of the relatively higher density shipping area in the south-west of the recommended RZ, there is potential for slight navigational risk and displacement in the short, medium, and long-term (-1). The potential adverse effects on navigational risk could be mitigated through the implementation of mitigation measures in line with standard Shipping and Navigation mitigation outlined **Section 10.1.**

<u>Commercial Fisheries</u>

There are relatively lower intensity fishing areas and inshore fishery areas within the recommended RZ. There is potential for moderate direct adverse, short-term effects on commercial fisheries operations due to temporary displacement from traditional fishing grounds during construction and decommissioning (-2), as well as potential for long-term effects due to displacement from the recommended RZ during the operational phase (-2). Displacement of fishing activity could result in increased competition for alternate fishing grounds, with potential to adversely affect fish stocks and, by extension, landings, in nearby areas. There is potential to minimise the potential for adverse effects due to the displacement of vessels through further consideration at the next stage of project planning. There should be strategic level caution regarding the siting of ORE infrastructure, with an aim to avoid developments occupying recognised fishing grounds unless there is a successful agreement between the industries that co-location is achievable. Further mitigation with regard to potential co-location is discussed in the **Section 10.1.**

There is potential for moderate adverse direct effects due to an increased collision risk of fishing vessels with vessels associated with the ORE development in the short-term during the construction and decommissioning phases (-2), and potential for slight adverse direct effects in the medium to long-term during recurrent maintenance activities in the operational phase (-1). There is also potential for moderate adverse indirect effects in the medium to long-term operational phase, as displacement of fishing vessels from the area may concentrate vessels into a smaller area for shipping and navigation routes, with an associated increased collision risk (-2). There is also potential for moderate adverse effects on fishing activities within the recommended RZ in the operational phase, as actual and/or perceived increased allision risks with devices, or entanglement of fishing gear with devices or attachment infrastructure may lead to avoidance of the area by fishing vessels (-2). In order to mitigate for navigational risk, further mitigation measures in line with standard Commercial Fisheries mitigation outlined in **Section 10.1** should be implemented. It is imperative that a successful agreement between industries that co-location is achievable is agreed. Further mitigation with regard to potential co-location is discussed in **Section 10.1**.

There is the potential for effects on commercial fish species and their key habitats within the recommended RZ and the tidal excursion zone. There is potential that hard subsea infrastructure could lead to an enhancement of fish populations at the edges of the array for trawler fishing (+1). There is potential for moderate adverse direct effects in the short-term construction, and medium to long-term operational phase due to the direct loss of supporting habitats (-2). There is also potential for moderate adverse direct and indirect effects during the short-term construction and decommissioning phases (-2), and slight adverse direct and indirect effects during the medium to long-term operational phase (-1) due to sediment mobilisation from construction, decommissioning and maintenance activities, respectively. In turn, these could have an indirect effect on fishing activity through an alteration of fishing stocks. In order to minimise the potential for indirect effects on commercial fisheries through impacts on fishing stocks, an ESCP should be developed, implemented and enforced for construction works, while decommissioning methods used should aim to minimise sediment generated. Further information on the potential ecosystem effects on fish and shellfish species and potential mitigation can be found in the Biodiversity, Flora, and Fauna assessment for the Atlantic recommended RZ.

There is potential for moderate indirect effects on the profitability of commercial fishing in the short, medium, and long-term (-2), such as the potential for reduced quotas, increased resource competition for fishing, and reduced landings in both tonnage and economic value. These effects could be mitigated by considering the mitigation measures discussed above, and in **Section 10.1**. Further refinement of the recommended RZ through avoidance of the areas important for inshore fisheries, the areas of highest known importance for fish spawning and nursery grounds, and the areas of high to moderate fishing activity is recommended, which could reduce the potential effects on commercial fisheries to slight in the short, medium, and long-term (-1).

<u>Military Areas</u>

There is potential for moderate adverse effects on military activities, including temporary (short-term) disruption of military exercises and activities within the Skerries Military Area during pre-construction, installation, and decommissioning (-2), and medium to long-term disruption during operation due to the presence of offshore infrastructure (-2). As the entire recommended RZ is within this Military Practice Area, the area available for military practice activity could be reduced during the operational phase. Consultation with the MoD during the next stage of project planning could help to inform the key areas that should be avoided within the mapped Practice Areas, which could reduce the potential for adverse effects through the displacement of military activities. The risk of collision of military vessels with devices can be minimised with further consultation with the MoD at the next stage of further planning. Measures outlined to mitigate against navigational risk in the Shipping and Navigation Section of **Section 10.1** are also of relevance.

Considering these mitigation measures the potential for adverse impacts on military activities could be reduced from moderate to slight (-1) in the short, medium, and long term.

<u>Aviation</u>

There is potential for slight direct adverse effects on aviation navigation or radar in the medium to long-term during device operation, as the presence of offshore wind devices has the potential to effect communications, navigation, and surveillance within Castlerock Airstrip OLS (-1).

These effects could be mitigated through the implementation of mitigation measures in line with standard Aviation mitigation outlined **Section 10.1.** Further refinement of the recommended RZ through the avoidance of this c.3km^2 area of the Castlerock Airstrip OLS is recommended, which could reduce the potential for adverse effects on Aviation to negligible in the short, medium and long-term (0).

<u>Spoil Dumping Grounds</u>

The two disposal areas within the recommended RZ are not currently active. There is therefore no potential for temporary disruption or displacement of vessels moving to and from disposal sites (0).

<u>Tourism</u>

The potential for effects on tourism is considered indirectly within the topics of Landscape, Seascape and Visual Amenity (visibility of construction activity and operational devices), Population and Human Health (recreational use of the RZ), and Biodiversity, Flora, and Fauna (effects on wildlife). As discussed in the Landscape, Seascape and Visual Amenity Section, there is the potential for significant adverse effects on Landscape, Seascape and Visual Amenity, which may result in secondary adverse effects on tourism, as this may act as a deterrent to tourists. Conversely, it is possible the presence of a wind farm will act as a tourist attraction. As discussed in Population and Human Health, there is a negligible potential for adverse effects on recreational access, increased noise, and contaminant release in the short-term, as such tourism in unlikely to be impacted by these potential effects. Lastly, as discussed in Biodiversity, Flora and Fauna, there is potential for noise generation to impact wildlife, which may result in a secondary impact on tourism activities such as bird, dolphin or whale watching.

There is the potential for tourism to be impacted by secondary effects. It is not clear whether an overall negative or positive impact will arise. However, it is likely any impact on tourism will be benign and of low significance.

<u>Renewable Energy Generation</u>

The potential capacity of the recommended RZ is 0.43GW. This is considered to give potential for slight positive direct effects in the medium to long-term operational phase, due to the generation of a new renewable energy supply for the NI population (+1).

<u>Overall</u>

Overall, there is the potential for moderate negative adverse effects in the short, medium and long-term on Material Assets (-2), following the consideration of best practice mitigation measures, mainly attributed to the potential for moderate adverse effects on Commercial Fisheries.

Cultural, Architectural and Archaeological Heritage

There are a small number of known undesignated wrecks within the recommended RZ, and within the tidal excursion zone. There is potential for slight adverse temporary to permanent effects on these features during the construction and decommissioning phases, which may be due to direct damage or disturbance of features within the recommended RZ, or indirect effects via sediment displacement and deposition onto features within the recommended RZ and the tidal excursion zone (-1). There is also potential for slight adverse indirect effects on features within the recommended RZ in the medium to long-term operational phase owing to the potential for scouring and exposure to occur around features in the vicinity of devices (-1). At the project planning phase, any sites of interest for archaeological potential should be identified and exclusion zones used around these, with conduction of site surveys or trial trenching before any potentially damaging activities take place, with results informing any appropriate mitigation. Modelling of hydrodynamic and sediment transport processes may be necessary to determine potential effects on surrounding archaeological features and determine any appropriate mitigation required. Management of cultural heritage at the project

level should be considered through the development and application of a MARP (Marine Archaeology Reporting Plan). The recommended RZ is situated between c.7.2km and c.22km distance from the coastline. There is potential for significant adverse indirect effects on the setting of the Giant's Causeway and Causeway Coast WHS (-3) and for moderate to significant adverse indirect effects (-2 to -3, depending on the distance offshore) on the setting of coastal heritage features, including for, 503 Listed Buildings, 336 Defence Heritage Record sites, 1053 Scheduled Monuments, 137 Scheduled Zones, and 20 Parks and Gardens that are within the modelled viewshed. There is potential for short-term adverse effects on the setting of these features during the construction and decommissioning phases, and for medium and long-term effects during device operation, owing to the potential visibility of vessels and machinery and device arrays, respectively. Cultural heritage features that are listed as cultural influences for the Skerries and Dunluce Coast RSCA include Dunluce Castle (designated an Area of Significant Archaeological Interest, Monument in State Care, and Registered Historic Park/Garden), historic harbours and settlements at Portrush and Portballintrae, and many WW2 coastal defence sites. Further refinement of the recommended RZ away from the coastline and sensitive cultural heritage designations is recommended to reduce the potential for significant adverse effects. Areas of highest landscape and seascape sensitivity should be avoided, where possible, during the project planning stage. At the project planning phase, a Seascape, Landscape and Visual Impact Assessment (SLVIA) should be undertaken and should inform project design and appropriate mitigation to minimise adverse effects, and this should include consideration of potential impacts on views from sites of historic importance.
Landscape, Seascape and Visual Amenity The recommended RZ is situated between c.7.2km and c.22km distance from the coastline. Causeway Coast AONB, Antrim Coast and Glens AONB, and Binevenagh AONB, as well as the Giant's Causeway and Causeway Coast WHS are situated inshore and are within the modelled viewshed. There is potential for significant adverse indirect effects on these sites, both in the short-term construction and decommissioning phase from the presence of vessels and machinery (-3), and during the operational phase from the presence of device arrays (-3), owing to the very high sensitivity of the landscape. There are 11 National Trust Lands, and transboundary Areas of Especially High Scenic Amenity and High Scenic Amenity in County Donegal that are also within the modelled viewshed. There is potential for moderate to significant adverse indirect effects (-2 to -3, depending on the distance offshore) on the setting of these areas, both in the short-term construction and decommissioning phases and the medium to long-term operational phase as described above, owing to the high sensitivity of the landscapes. There is also potential for transboundary effects for the south of the Isle of Islay in Scotland. The recommended RZ is within the Atlantic NI RSCA and the Republic of Ireland Seascape Character Area of North Donegal Atlantic Headlands, Loughs and Beaches, and is immediately offshore of The Skerries and Dunluce Coast RSCA. There is potential for adverse effects in the medium and long-term within these areas, as the presence of device arrays may alter aspects of the character of these RSCAs. There is potential for moderate adverse indirect visual effects in the short, medium and long-term for a moderate coastal population, including 39 settlements (including Portstewart, Portrush, Castlerock, Coleraine, Bushmills, Portballintrae, and Ballycastle) that are within the modelled viewshed (-2). There is also potential for transboundary effects on visual amenity for the population along the north-east coastline of County Donegal in the RoI, and in the south of the Isle of Islay in Scotland, as these areas are also within the viewshed modelling. There is also potential for in-combination or cumulative landscape, seascape and visual effects with the Malin Sea Wind project (owners ESB Wind Development Ltd., CATAGEN, Dublin Offshore, currently at concept/early planning stage, which is situated further offshore https://map.4coffshore.com/offshorewind/). Further refinement of the recommended RZ away from the coastline and landscape designations is recommended to reduce the potential for significant adverse effects. Areas of highest landscape and seascape sensitivity should be avoided, where possible, at the project planning stage. At the project

planning phase, a SLVIA should be undertaken and should inform project design and appropriate mitigation to minimise adverse effects.

G.2 Fixed Wind Resource Zone: Mourne Lecale

Discussion of Potential Impacts

Biodiversity, Flora and Fauna

Benthic Habitats and species:

There are no designated sites for benthic habitats and species within the recommended RZ or the tidal excursion zone, and there are no TCE areas of Very High, High or Moderate MPA or MCZ risk for Habitats.

There are small known areas of Annex I Sandbank habitat in the north and north-west of the recommended RZ and the tidal excursion zone. There is potential for moderate adverse direct or indirect effects on these features both in the short-term construction and decommissioning phases and in the medium to long-term from loss or damage, and sedimentation or water quality effects (-2). The seabed habitats within the recommended RZ predominantly consist of muddy sand and sand, with sandy mud in the south. There are recorded occurrences of benthic NI Priority species and PMFs of starfish, hydroids, and crabs. There is potential for moderate adverse direct and indirect effects on these sensitive species, as well as on non-sensitive benthic habitats and sedentary species from localised benthic loss, or pollution or sedimentation effects during the short-term construction and decommissioning phases (-2), and the medium and long-term operational phase (-2). These effects may be minimised based on micro-siting at the project level; project planning mitigation should aim for avoidance of areas of benthic ecological importance, particularly areas where protected habitats and species are present, and installation in areas where non-sensitive habitats or species are present with the use of appropriate installation techniques. The volume of rock used for cable armouring, pipeline protection and foundation scour protection should be planned as the minimum required, to minimise habitat loss. At the project planning phase, sediment and erosion occurrence should be minimised through the development, implementation, and enforcement of an ESCP for construction and decommissioning works, and modelling of hydrodynamic and sediment transport processes to assess potential effects and determine suitable mitigation to minimise these.

There are no records of invasive species within the recommended RZ; there is a potential risk of introduction of invasive species to the area with potential for slight adverse direct effects during the short-term construction and decommissioning phases (-1), and in the medium to long-term during operational maintenance (-1). Mitigation to reduce the risk of introduction of invasive species to the area is provided in **Section 10.1.**

Fish and Shellfish:

There are no designated sites for fish and shellfish within the recommended RZ or the tidal excursion zone. There is a TCE Moderate MPA risk area for Fish in the west of the recommended RZ, owing to the potential for migratory fish species from designated SACs to use the area. There is potential for moderate adverse indirect effects in the short-term construction and decommissioning phases from supporting habitat loss or damage, sedimentation, and smothering effects and via impacts on water quality (-2), and in the medium and long-term operational phase due to a loss of supporting habitat (-2).

Within the recommended RZ and tidal excursion zone there is a (Ellis *et al.* (2012) CEFAS) fish spawning ground for cod, which is of high intensity in the south, a spawning ground for plaice which is of high intensity in the south-west and low elsewhere, a low intensity spawning ground for horse mackerel in the south, and low intensity spawning grounds for ling, mackerel, sandeel, sole, and whiting throughout. There are (Ellis *et al.* (2012) CEFAS) fish nursery grounds of high intensity for cod, herring, whiting, and spurdog, and of low intensity for plaice, anglerfish, mackerel, thornback ray, and tope shark. There are known (Coull *et al*. (1998) CEFAS) fish spawning grounds for whiting, sprat, lemon sole, cod, and Nephrops, and nursery grounds for whiting, lemon sole, haddock, herring, cod, and Nephrops within the recommended RZ and tidal excursion zone, and a spawning ground for plaice within the tidal excursion zone. There are also AFBI surveyed spawning areas for cod, particularly in the south-east, and for plaice, and nursery areas for haddock (particularly in the south-east) and for whiting, within the recommended RZ and tidal excursion zone. There is a surveyed area for scallops within the tidal excursion zone to the north-west. There is potential for significant adverse direct and indirect effects in the short-term construction and decommissioning phases from habitat loss or damage, sedimentation, and smothering effects and via impacts on water quality (-3), and in the medium and long-term operational phase due to a loss of supporting habitat (-3) for these fish and shellfish species. Further refinement of the recommended RZ away from the most important areas for fish spawning and nursery grounds is recommended to avoid the potential for significant adverse effects during construction and operation.

There are records of NI Priority and/or PMF fish and shellfish species such as whiting, cod, herring, mackerel, horse mackerel, hake, spiny dogfish, school shark, plaice, sole, spotted ray, cuckoo ray, small-spotted catfish, anglerfish, blue whiting, nursehound, queen scallop, and great scallop within the recommended RZ. There is potential for moderate adverse direct and indirect effects on these sensitive species, and sensitive supporting habitats from disturbance and displacement and localised loss of, or damage to supporting habitats during the short-term construction and decommissioning phases (-2), and medium to long-term direct and indirect adverse effects due to loss of supporting habitats, habitat exclusion and displacement, barrier effects, entanglement or EMF effects during the operational phase (-2).

As described for Benthic Habitats and Species, project planning mitigation should aim for avoidance of areas of benthic ecological importance, particularly areas where protected habitats and species are present. Areas should be avoided that may generate increased levels of suspended sediment and those that coincide with areas of fish spawning grounds or sensitive species. Where this is not possible, appropriate timing restrictions should be applied to works, and/or less disruptive installation methods used, to minimise effects on sediment mobilisation, and disturbance and displacement of species from the array area.

In the medium and long-term, there is potential for slight positive indirect effects (+1) owing to device colonisation and the possibility that device arrays could cause a reef effect, however this may also lead to a slight negative indirect short-term effect (-1) should colonised structures be removed at decommissioning. Mitigation measures during the project planning phase should consider the decommissioning activities that will be used, and whether removal of colonised structures, foundations or scour protection is required, or could result in a double habitat loss (that from pre-construction and decommissioning periods). If fishing is excluded from the array area, there may be potential for positive effects on fish species and supporting habitats such as spawning and nursery grounds within the operational phase.

Marine Mammals:

There are no designated sites for marine mammals within the recommended RZ or tidal excursion zone. However, there is a TCE Moderate MPA risk area for Marine Mammals within the recommended RZ. There is potential for moderate adverse direct and indirect effects on designated marine mammals, including from transboundary sites, in the short-term pre-construction, construction and decommissioning phases due to noise impacts, disturbance and displacement, collision risk, or through loss or damage of fishing spawning or nursery grounds, which could have secondary effects on tertiary predators (-2), and in the medium and long-term operational phase due to habitat exclusion and displacement, barrier effects and potential collision risk (-2).

There are areas of recorded relatively high (common dolphin, and common/striped dolphin) and moderate (striped dolphin, fin whale, common dolphin, common/striped dolphin, and bottlenose dolphin) density for cetacean species, as well as relatively moderate density for grey seal and harbour seal, within the recommended RZ. There are also records of Protected, NI Priority or PMF marine mammal species, including orca, minke whale, short-beaked common dolphin, and common dolphin. There is potential for moderate adverse direct and indirect short, medium, and long-term effects as described above (-2), including the potential for transboundary effects on these sensitive species, as well as other marine mammals that may be present within the area.

During project planning for wind turbines, the key areas of marine mammal habitats and migratory routes should be identified, including through the conduction of pre-construction surveys and consultation with environmental stakeholders, and development avoided within these areas, whenever possible. Pre-construction, construction, and decommissioning activities should be planned to minimise the potential for adverse effects on marine mammals, including temporal activity planning, limiting vessel activity and mitigation against potential noise effects, including through avoidance of foundation installation such as piling that generates higher noise and avoidance or use of low-noise methods to dispose of any UXO within the development area. The potential for pre-construction, construction, and decommissioning phase adverse effects can be minimised through the application of standard best practice mitigation for marine mammals, including the use of marine mammal observers. Turbines and associated infrastructure should be designed to minimise effects during operation.

Birds:

There are no designated sites for bird species within the recommended RZ or the tidal excursion zone. However, there is a TCE Moderate MPA risk area for Breeding Birds within the recommended RZ. Carlingford Marine pSPA is c.7km distant, East Coast Marine pSPA c.16km distant, Carlingford Lough SPA c.17km distant, and Strangford Lough SPA c.20km distant. There is potential for moderate adverse direct and indirect effects on designated bird species, including from transboundary sites, in the short-term pre-construction, construction, and decommissioning phases due to noise impacts, disturbance and displacement, damage or loss of supporting habitat (including through loss or damage of fishing spawning or nursery areas, which could have secondary effects on predators), and collision risk (-2), and in the medium and long-term operational phase due to habitat exclusion, displacement and potential collision risk (-2).

There are areas of recorded relatively moderate density for seabirds at sea within the recommended RZ, and there is potential for slight adverse direct and indirect short, medium, and long-term effects on seabird species, as described above (-1), including the potential for transboundary effects. There is also a known spawning ground for sandeel, a key food source for many species of seabird, within the recommended RZ, and an area of predicted medium seabed suitability for sandeel inshore of the RZ. There is greater potential for adverse effects on seabirds within important foraging areas, through loss or damage to these species and their habitats during construction and decommissioning, displacement from these areas during construction and operation, and potentially, through a higher risk of collision for seabird species that prioritise the area for foraging; the degree of effect relating to these areas will differ between seabird species, depending on the importance of sandeel to their diet, and ability to access this food source at different water depths. Key foraging grounds outside of designated sites should be further investigated at the next stage of future planning and appropriate mitigation applied to avoid or reduce the potential for adverse effects.

During project planning for wind turbines, the key areas of bird habitats and migratory routes should be identified, including through the conduction of pre-construction surveys and consultation with environmental stakeholders, and development avoided within these areas, whenever possible. Pre-construction, construction, and decommissioning activities should be planned to minimise the potential for adverse effects on birds, including temporal activity planning, limiting vessel activity and mitigation against potential noise effects. Turbines and associated infrastructure should be designed to minimise effects, particularly collision risk, during operation.

Population and Human Health

There is potential for slight adverse short-term, temporary noise and visual effects on the local population due to noise generated and visual impacts during the construction and decommissioning phases, and visual flicker and noise effects during operation. However, due to the distance of the recommended RZ offshore, these effects should be limited to vessel occupants transiting through the area, and there is not expected to be potential for direct, short, medium, or long-term, disturbance of coastal populations due to noise or visual effects during the construction, operational, or decommissioning phases (0). The potential for indirect visual effects to coastal populations during the operational phase is considered under the Landscape, Seascape and Visual Amenity topic.

There are no Bathing Water sites, Blue Flag Beaches or dive sites within the recommended RZ, and therefore there is not considered to be potential for adverse effects on these areas during the construction, operational, or decommissioning phases (0).

There is potential for moderate adverse temporary direct and indirect effects on leisure and recreational marine users due to an increased collision risk, access restrictions and displacement, or water quality effects, during the construction and decommissioning phases due to known use of the area by leisure vessels (-2). There is also potential for moderate adverse long-term (device life) effects due to an enhanced collision risk for recreational and leisure vessels with wind turbine blades or submerged infrastructure (-2), and potential for moderate adverse long-term (device life) effects due to displacement of recreational and leisure craft from the array area during the operational phase (-2). At the next stage of project planning, the potential for interaction with areas of known high use by leisure users should be avoided or minimised. At the project level, further mitigation to minimise risk to leisure users could include the use of exclusion zones around developments and timely and effective communication regarding construction works, as well as appropriate marking of devices and the array area.

Geology, Soils and Land Use

There are no sites designated for geological or geomorphological features, i.e., MCZs, WHSs, ASSIs, UNESCO Geoparks, within the recommended RZ or tidal excursion zone; there is therefore not anticipated to be any potential for direct or indirect, short, medium, or long-term effects on these features from construction or operation of fixed wind devices within the recommended RZ (0).

Fixed wind technologies within this recommended RZ are likely to be predominantly in the technology groups of 1 and 3B i.e., primarily requiring monopile foundations and either driven installation or more complex driven and drilling installation where thicker sediments or more complex geology is present, with potential to require more invasive technologies for installation to be employed; there is potential for moderate adverse direct long-term effects on the seabed geology and sediments through loss of material (-2). The main seabed sediments within the recommended RZ are sand and muddy sand, with potential for mobilisation to occur. There is potential for influence on the MS Descriptor 6 sea floor integrity with the installation processes of fixed wind technologies; there is not anticipated to be potential for adverse effects on the achievement of GES for this Descriptor owing to the spatial extent of physical loss, however this should be fully considered at the project phase, and any appropriate mitigation put in place.

There are no known areas of potential contamination within the recommended RZ i.e., no dumping grounds of spoil ground or explosive grounds. There is therefore not expected to be any potential for direct or indirect short, medium, or long-term effects on sediments within the recommended RZ from interaction with potentially contaminated areas (0).

There is potential for long-term (device operational life) sediment loss within the footprint of foundations and scour protection, and short-term temporary loss in the vicinity of the works during seabed preparation activities, construction, and decommissioning activities (-2). Sediment and erosion occurrence should be minimised through the development, implementation, and enforcement of an ESCP for construction works. Decommissioning methods should be used that aim to minimise the amount of suspended sediment generated. Following the installation of fixed wind technologies there is potential for medium to long-term localised impacts on erosion and deposition patterns within close proximity to the devices during the operational phase (-2), given the moderate mobility of sediments within the recommended RZ. Further mitigation to minimise the potential for adverse effects on sediments and sediment transport is provided in **Section 10.1.**

Water

No designated WFD Shellfish Water or Bathing Water Protected Areas, or WFD coastal or transitional water bodies are within the recommended RZ or tidal excursion zone. There is therefore not expected to be any potential for adverse, direct or indirect, short, medium or long-term effects within these sites from construction or operation of fixed wind devices within the recommended RZ (0).

There are no known areas of potential contamination within the recommended RZ i.e., no dumping grounds of spoil ground or explosive dumping grounds. There is therefore not expected to be

potential for direct or indirect short, medium, or long-term effects on water quality within the recommended RZ or tidal excursion zone from interaction with potentially contaminated areas (0). There is potential for localised effects on water quality within the recommended RZ and tidal excursion zone during the short-term construction and decommissioning phases and during device operation (maintenance) due to sediment mobilisation and associated turbidity, construction discharges or accidental contaminant release from machinery and vessels (-1). There is potential for localised effects on water quality, as described above, within the MS Celtic Seas sub-region, however there is not expected to be potential for adverse effects on the achievement of GES for water quality Descriptors (e.g., Descriptor 9 Concentrations of contaminants in fish and other seafood; Descriptor 8: Concentration of contaminants within marine environment; Descriptor 10 marine litter) with the application of standard best practice mitigation during seabed preparation, construction, maintenance and decommissioning activities (-1). The potential for adverse effects on water quality should be minimised at the project level, including through sediment testing and water quality monitoring during the construction (and decommissioning) phase to identify and mitigate for potential adverse effects at the earliest possible stage. Environmental authorities should be consulted on the construction methodology, and the most appropriate timing of works to provide the least potential for sediment mobilisation to waterbodies. Further mitigation is provided in **Section 10.1.**
Air There is potential for slight adverse, direct, short-term temporary effects on local air quality due to air emissions from vessels and machinery during the construction and decommissioning phases. There is also the potential for slight adverse, short-term, temporary emissions from vessels due to maintenance activities during the operational phase. However, due to the distance of coastal populations from the recommended RZ, it is not expected that there will be potential for adverse direct or indirect, short, medium, or long-term effects on these receptors from air pollution during the construction, operational and decommissioning phases (0). At the project level, emissions of air pollutants should be minimised through adherence to standard best practise for the minimisation of air pollution, as set out in **Section 10.1**. There is potential for slight positive indirect effects on regional air quality in the medium to long-term operational phase, as the operation of renewable energy devices can support a transition away from fossil fuel use and its associated air emissions (+1).
Climatic Factors There are no identified areas of blue carbon habitat within the recommended RZ, therefore, there is unlikely to be potential for adverse effects on blue carbon habitats within the recommended RZ during the construction, operational and decommissioning phases (0). There is potential for slight adverse short-term effects on sediment carbon storage, due to a localised release of CO_2 from seabed disturbance during the construction and decommissioning phases (-1). There is potential for slight adverse, short-term, temporary effects on localised GHG concentrations, due to GHG emissions from vessels and machinery during the construction and decommissioning phases (-1). At the project level, emissions of air pollutants should be minimised through adherence to standard best practise for the minimisation of air pollution, as set out in **Section 10.1**. There is potential for slight positive, medium to long-term effects during the operational phase, as the operation of renewable energy devices can contribute to a net reduction in GHG emissions, decarbonisation of the energy sector, diversification of electricity supply and energy security, and meeting of energy objectives and climate change emission reduction targets (+1).
Material Assets Existing Infrastructure There is no existing infrastructure (cables, pipelines) located within the recommended RZ and, as such, there is no potential for effects on infrastructure in the short, medium, or long-term (0). Shipping and Navigation

Given the presence of the high-density shipping route, there is potential for significant direct adverse effects on shipping and navigation within the recommended RZ. There is the potential for significant direct short-term displacement of vessels during construction (-3), as well as medium to long-term displacement from the array area during the operational phase (project lifetime) (-3), due to safety exclusion zones. This can result in disruption to vessel routeing and timetables.

There is the potential for short-term risk of collision and allision with vessels during construction and decommissioning, which may result in hazardous cargo or oil spillage (-3). Medium to long-term risk of collision with stationary device arrays and subsequent spill risk, as well as safety concerns with under keel clearance reduction, arise during the operational phase (-3). Additionally, there is potential for direct adverse effects on navigation, as devices could obstruct lights, buoys, or the coastline (-3). In terms of communication and navigational equipment, AIS and radar systems (including aviation NATS) may be affected (-3). Furthermore, the presence of installation vessels and equipment may adversely impact the efficiency of search and rescue operations within installation and decommissioning areas (short-term) (-3).

Given the presence of the high and moderate density shipping areas within the south of the recommended RZ associated with the Warrenpoint to Heysham freight route, there is the potential for significant navigational risk and displacement in the short, medium, and long-term (-3). The potential significant adverse effects on navigational risk could be mitigated through the implementation of mitigation measures in line with standard Shipping and Navigation mitigation outlined in **Section 10.1**. Further refinement of the recommended d RZ through avoidance of this higher density Warrenpoint to Heysham route is recommended which could reduce the potential impacts to navigational risk and displacement to moderate in the short, medium, and long-term (-2).

<u>Commercial Fisheries</u>

There are relatively moderate intensity fishing areas and areas of importance to inshore pot fisheries within the recommended RZ. There is potential for significant direct adverse, short-term effects on commercial fisheries operations due to temporary displacement from traditional fishing grounds during the construction and decommissioning phases (-3), as well as potential for direct adverse long-term effects due to displacement from the recommended RZ during the operational phase (-3). Displacement of fishing activity could result in increased competition for alternate fishing grounds, with potential to adversely affect fish stocks and, by extension, landings, in nearby areas. There is potential to minimise the potential for adverse effects due to the displacement of vessels through further consideration at the next stage of project planning. There should be strategic level caution regarding the siting of ORE infrastructure, with an aim to avoid developments occupying recognised fishing grounds unless there is a successful agreement between the industries that co-location is achievable. Further mitigation with regard to potential co-location is discussed in **Section 10.1**.

There is potential for significant adverse direct effects due to an increased collision risk of fishing vessels with vessels associated with the ORE development in the short-term during the construction and decommissioning phases (-3), and moderate adverse direct effects in the medium to long-term during recurrent maintenance activities in the operational phase (-2). There is also potential for significant adverse indirect effects in the medium to long-term operational phase, as the displacement of fishing vessels from the area may concentrate vessels into a smaller area for shipping and navigation routes, with an associated increased collision risk (-3). There is also potential for significant adverse effects on fishing activities within the recommended RZ in the operational phase, as actual and/or perceived increased allision risks with devices, or entanglement of fishing gear with devices or attachment infrastructure may lead to avoidance of the area by fishing vessels (-3). To mitigate for navigational risk, further mitigation measures in line with standard commercial fisheries mitigation outlined in **Section 10.1** should be implemented. It is imperative that a successful agreement between industries that co-location is achievable is agreed. Further mitigation with regard to potential co-location is also discussed in **Section 10.1**.

There is potential for effects on commercial fish species and their key habitats within the recommended RZ and the tidal excursion zone. There is slight potential for indirect positive effects in the medium to long-term, as hard subsea infrastructure could lead to an enhancement of fish populations at the edges of the array for trawler fishing (+1). Given the high number of spawning and nursery grounds within the recommended RZ, there is potential for significant adverse direct effects in the short-term construction and decommissioning phases, and medium to long-term operational phase due to the potential for a direct loss of these supporting habitats (-3). There is also potential for significant adverse direct and indirect effects during the short-term construction and decommissioning phases, and moderate adverse effects in the medium to long-term operational phase (-2) due to sediment mobilisation from construction, decommissioning and maintenance activities, respectively, which could have an indirect effect on fishing activity through an alteration of fishing stocks (-3). To minimise the potential for indirect effects on commercial fisheries through impacts on fishing stocks, an ESCP should be developed, implemented, and enforced for construction works, while decommissioning methods used should aim to minimise sediment generated. Further information on the potential ecosystem effects on fish and shellfish species, and potential mitigation can be found in the Biodiversity, Flora, and Fauna assessment for the Mourne Lecale recommended RZ.

There is potential for significant indirect effects on the profitability of commercial fishing in the short, medium, and long-term (-3), such as the potential for reduced quotas, increased resource competition for fishing, and reduced landings in both tonnage and economic value. These effects could be mitigated through considering the mitigation measures discussed above, and in **Section 10.1**. Further refinement of the recommended RZ through avoidance of the areas important for inshore fisheries, the areas of highest known importance for fish spawning and nursery grounds and areas of moderate fishing activity is recommended, which could reduce the potential for adverse effects on commercial fisheries to moderate in the short, medium, and long-term (-2).

Military Areas

There is potential for moderate adverse effects on military activities, including temporary (short-term) disruption of military exercises and activities within the Ardglass Military Practice Area during pre-construction, installation, and decommissioning (-2), and medium to long-term disruption during operation due to the presence of offshore infrastructure (-2). As the entire recommended RZ is within this Military Practice Area, the area available for military practice activity could be reduced during the operational phase. Consultation with the MoD during the next stage of project planning could help to inform the key areas that should be avoided within the mapped Practice Areas, which could reduce the potential for adverse effects due to the displacement of military activities. The risk of collision of military vessels with devices can be minimised through further consultation with the MoD at the next stage of further planning. Measures outlined to mitigate against navigational risk in the Shipping and Navigation Section of **Section 10.1** are also of relevance.

Considering these mitigation measures, the potential for adverse effects on military activities could be reduced from moderate to slight (-1) in the short, medium, and long-term.

Aviation

There is potential for slight direct adverse effects on aviation navigation or radar in the medium to long-term during device operation, as the presence of offshore wind devices has the potential to effect communications, navigation, and surveillance within Derryogue Airfield OLS (-1).

These effects could be mitigated through the implementation of mitigation measures in line with standard Aviation mitigation outlined **Section 10.1**. Further refinement of the recommended RZ through the avoidance of this c.0.53km^2 area of the Derryogue Airfield OLS is recommended, which could potentially reduce the potential for adverse effects on Aviation to negligible in the short, medium and long term (0).

Spoil Dumping Grounds

There are no spoil dumping grounds located within the recommended RZ. There is therefore no potential for temporary disruption or displacement of vessels moving to and from disposal sites (0).

Tourism

The potential for effects on tourism is considered indirectly within the topics of Landscape, Seascape and Visual Amenity (visibility of construction activity and operational devices), Population and Human

Health (recreational use of the RZ), and Biodiversity, Flora, and Fauna (effects on wildlife). As discussed in the Landscape, Seascape and Visual Amenity Section, there is the potential for significant adverse effects on Landscape, Seascape and Visual Amenity within Mourne AONB, Strangford and Lecale AONB, Ring of Gullion AONB and various National Trust sites, which may result in secondary adverse effects on tourism, as this may act as a deterrent to tourists to visit these sites. Conversely, it is possible the presence of a wind farm will act as a tourist attraction. As discussed in Population and Human Health, there is moderate potential for adverse effects on recreational access and increased noise and contaminant release in the short-term, as such tourism could be impacted by these potential effects. Lastly, as discussed in Biodiversity, Flora and Fauna, there is potential for noise generation to impact wildlife, which may result in a secondary impact on tourism activities such as bird, dolphin or whale watching.

There is the potential for tourism to be impacted by secondary effects. It is not clear whether an overall negative or positive impact will arise. However, it is likely any impact on tourism will be benign and of low significance.

<u>Renewable Energy Generation</u>

The potential capacity of the recommended RZ is 0.45GW. As such, there is potential for slight positive effects in the medium- to long-term, owing to the generation of a new renewable energy supply for the NI population (+1).

<u>Overall</u>

Overall, there is potential for significant negative adverse effects in the short, medium, and long-term for Material Assets (-3), following the consideration of best practice mitigation measures, mainly attributed to the identified potential for significant adverse effects on Shipping and Navigation, and Commercial Fisheries.

Cultural, Architectural and Archaeological Heritage

There are a small number of known undesignated wrecks within the recommended RZ and the tidal excursion zone. There is potential for slight adverse temporary to permanent effects on these features during the construction and decommissioning phases, which may be due to direct damage or disturbance of features within the recommended RZ, or indirect effects via sediment displacement and deposition onto features within the recommended RZ and the tidal excursion zone (-1). There is also potential for slight adverse indirect effects on features within the recommended RZ in the medium to long-term operational phase owing to the potential for scouring and exposure to occur around features in the vicinity of devices (-1). At the project planning phase, any sites of interest for archaeological potential should be identified and exclusion zones used around these, with conduction of site surveys or trial trenching before any potentially damaging activities take place, with results informing any appropriate mitigation. Modelling of hydrodynamic and sediment transport processes may be necessary to determine potential effects on surrounding archaeological features and determine any appropriate mitigation required. Management of cultural heritage at the project level should be considered through the development and application of a MARP.

The recommended RZ is situated between c.11km and c.18.5km distance from the coastline. There is potential for significant adverse indirect effects (-3) on the setting of coastal heritage features, including for 690 Listed Buildings, 388 Defence Heritage Record sites, 568 Scheduled Monuments, 101 Scheduled Zones, and 20 Parks and Gardens (including Mourne Park, Tollymore Park, Tyrella House, and Castlewellan College) that are within the modelled viewshed. There is potential for short-term adverse effects on the setting of these features during the construction and decommissioning phases, and for medium and long-term effects during device operation, owing to the potential visibility of vessels and machinery and device arrays, respectively. Cultural heritage features that are listed as cultural influences for the Mourne Coast RSCA include a concentration of defence heritage sites associated with Ballynahatten airfield at the southern end of the RSCA, and coastal observation post and radar site north of Kilkeel, harbours at Annalong and Kilkeel and coastguard stations along the coast, and Scheduled Areas and Monuments including Cranfield Mound and Kilkeel Medieval church site.

Further refinement of the recommended RZ away from the coastline and sensitive cultural heritage designations is recommended to reduce the potential for significant adverse effects. Areas of the highest landscape and seascape sensitivity should be avoided, where possible, during the next stage of project planning. At the project planning phase, a SLVIA should be undertaken and should inform project design and appropriate mitigation to minimise adverse effects, and this should include consideration of potential impacts on views from sites of historic importance.
Landscape, Seascape and Visual Amenity The recommended RZ is situated between c.11km and c.18.5km distance from the coastline. Mourne AONB, Strangford and Lecale AONB, and Ring of Gullion AONB are situated inshore and are within the modelled viewshed. There is potential for significant adverse indirect effects on these sites, both in the short-term construction and decommissioning phases from the presence of vessels and machinery (-3), and during the operational phase from the presence of device arrays (-3), owing to the very high sensitivity of the landscape. There are 10 National Trust Lands that are within the modelled viewshed, and there is also potential for significant adverse indirect effects (-3) on the setting of these areas, both in the short-term construction and decommissioning phase and the medium to long-term operational phase as described above, owing to the high sensitivity of the landscapes. The recommended RZ is primarily within the Mourne Coast RSCA, while the offshore south-east of the recommended RZ is within the Irish Sea (South Down) RSCA. There is potential for adverse effects in the medium and long-term within these areas, as the presence of device arrays may alter the character of these RSCAs. There is potential for moderate adverse indirect visual effects in the short, medium, and long-term for the coastal population, including within 40 settlements (including Strangford, Newcastle and Ardglass) that are within the modelled viewshed (-2). There is also potential for transboundary effects on visual amenity for the population along the RoI County Louth coastline, as these areas are also within the modelled viewshed. There is also potential for in-combination or cumulative landscape, seascape and visual effects with several offshore wind projects in RoI territorial waters off the coast of County Louth that are currently at concept/early planning stage (such as Oriel, Clogherhead and North East Wind). Further refinement of the recommended RZ away from the coastline and landscape designations is recommended to reduce the potential for significant adverse effects. Areas of the highest landscape and seascape sensitivity should be avoided, where possible, during the next stage of project planning. At the project planning phase, a SLVIA should be undertaken and should inform project design and appropriate mitigation to minimise adverse effects.

G.3 Fixed Wind Resource Zone: Irish Sea Inshore

Discussion of Potential Impacts
Biodiversity, Flora and Fauna Benthic Habitats and species: There are no designated sites for benthic habitats and species within the recommended RZ. Pisces Reef Complex SAC, designed for Annex I Reef habitat, is situated c.1km offshore of the recommended RZ and is within the tidal excursion zone. There is potential for significant adverse indirect effects on designated habitats within this area in the short-term construction (and decommissioning) phase from sedimentation or water quality effects (-3). Further refinement of the recommended RZ away from this site is recommended to avoid the potential for significant adverse effects during construction and decommissioning. There is a small known area of Annex I Reef habitat in the centre of the recommended RZ, avoided by the recommended RZ boundary but within the tidal excursion zone. The seabed habitats within the recommended RZ predominantly consist of fine mud and sandy mud, with small areas of sand

and mixed sediment. There are recorded occurrences of benthic NI Priority and PMF starfish and mollusc species within the recommended RZ. There is potential for moderate adverse direct and indirect effects on these sensitive benthic habitats and species, as well as on non-sensitive benthic habitats and sedentary species from localised benthic loss, or pollution or sedimentation effects during the short-term construction and decommissioning phases (-2), and the medium and long-term operational phase (-2). These effects may be minimised based on micro-siting at the project level; project planning mitigation should aim for avoidance of areas of benthic ecological importance, particularly areas where protected habitats and species are present, and installation in areas where non-sensitive habitats or species are present with the use of appropriate installation techniques. The volume of rock used for cable armouring, pipeline protection and foundation scour protection should be planned as the minimum required, to minimise habitat loss. At the project planning phase, sediment and erosion occurrence should be minimised through the development, implementation, and enforcement of an ESCP for construction and decommissioning works, and modelling of hydrodynamic and sediment transport processes to assess potential effects and determine suitable mitigation to minimise these.

There are no records of invasive species within the recommended RZ; there is a potential risk of introduction of invasive species to the area with potential for slight adverse direct effects during the short-term construction and decommissioning phases (-1), and in the medium to long-term during operational maintenance (-1). Mitigation to reduce the risk of introduction of invasive species to the area is provided in **Section 10.1.**

<u>Fish and Shellfish:</u>

There are no designated sites for fish and shellfish within the recommended RZ or the tidal excursion zone, and there are no TCE Moderate, High or Very High MPA risk areas for Fish within the recommended RZ.

Within the recommended RZ and tidal excursion zone there is a (Ellis *et al.* (2012) CEFAS) fish spawning ground for cod, which is of high intensity in the south-west (and low intensity elsewhere), a spawning ground for plaice, which is of high intensity in the south-west (and low intensity elsewhere), a low intensity spawning ground for hake in the north-east and horse mackerel in the south, and low intensity spawning grounds for ling, mackerel, sandeel, and sole throughout. There are (Ellis *et al.* (2012) CEFAS) fish nursery grounds of high intensity within the recommended RZ for cod (low intensity on the north-east), herring, whiting, and spurdog, and of low intensity for hake (in the north-east), plaice, anglerfish, mackerel, thornback ray (except in the north-east), and tope shark (except in the north-east). There are known (Coull *et al*. (1998) CEFAS) fish spawning grounds for whiting, sprat, lemon sole, cod, and Nephrops, and nursery grounds for whiting, lemon sole, haddock, herring, cod, and Nephrops within the recommended RZ and tidal excursion zone. There are also AFBI surveyed spawning areas for cod, particularly in the south, and for plaice, and nursery areas for haddock and whiting within the recommended RZ and tidal excursion zone. There is potential for significant adverse direct and indirect effects in the short-term construction and decommissioning phases from habitat loss or damage, sedimentation, and smothering effects, and via impacts on water quality (-3), and in the medium and long-term operational phase due to a loss of supporting habitat (-3). Further refinement of the recommended RZ away from the most important areas for fish spawning and nursery is recommended to avoid the potential for significant adverse effects during construction, operation, and decommissioning.

There are records of NI Protected, Priority and/or PMF fish and shellfish species such as common skate, whiting, hake, herring, cod, spiny dogfish, school shark, horse mackerel, small-spotted catfish, mackerel, plaice, anglerfish, sole, starry smooth-hound, cuckoo ray, thornback ray, spotted ray, blue whiting, broadnose skate, nursehound, ling, small-eyed ray, queen scallop, and great scallop, as well as elasmobranch records of spurdog, thornback ray, spotted ray, and common skate within the recommended RZ. There is potential for moderate adverse direct and indirect effects on these sensitive species, and sensitive supporting habitats from disturbance and displacement and localised loss of, or damage to supporting habitats during the short-term construction and decommissioning phases (-2), and direct and indirect adverse medium to long-term effects due to loss of supporting habitats, habitat exclusion and displacement, barrier effects, or EMF effects during the operational phase (-2).

As described for Benthic Habitats and Species, project planning mitigation should aim for avoidance of areas of benthic ecological importance, particularly areas where protected habitats and species are present. Areas should be avoided that may generate increased levels of suspended sediment and those that coincide with areas of fish spawning grounds or sensitive species. Where this is not possible, appropriate timing restrictions should be applied to works, and/or less disruptive installation methods used, to minimise effects on sediment mobilisation and disturbance and displacement of species from the array area.

In the medium and long-term, there is potential for slight positive indirect effects (+1) owing to device colonisation and the possibility that device arrays could cause a reef effect, however this may also lead to a slight negative indirect short-term effect (-1) should colonised structures be removed at decommissioning. Mitigation measures during the project planning phase should consider the decommissioning activities that will be used, and whether removal of colonised structures, foundations or scour protection is required, or could result in a double habitat loss (that from pre-construction and decommissioning periods). If fishing is excluded from the array area, there may be potential for positive effects on fish species and supporting habitats such as spawning and nursery grounds within the operational phase.

Marine Mammals:

There are no designated sites for marine mammals within the recommended RZ. North Channel SAC, designated for harbour porpoise, is situated immediately to the north of the recommended RZ (outside the boundary of the recommended RZ) and is within the tidal excursion zone, and there is a TCE Moderate MPA risk area for Marine Mammals within the recommended RZ. There is potential for moderate adverse direct and indirect effects on designated marine mammals, including from transboundary sites, in the short-term pre-construction, construction and decommissioning phases due to noise impacts, disturbance and displacement, collision risk, or indirect effects on supporting habitats (-2), and in the medium and long-term operational phase due to habitat exclusion and displacement and potential collision risk, or through loss or damage of fishing spawning or nursery areas, which could have secondary effects on tertiary predators (-2).

There are areas of recorded relatively high (common dolphin, and common/striped dolphin) and moderate (striped dolphin, minke whale, fin whale, common dolphin, common/striped dolphin, and bottlenose dolphin) density for cetacean species, as well as relatively moderate density for grey seal and harbour seal, within the recommended RZ. There are also records of NI Protected, Priority or PMF marine mammal species, including short-beaked common dolphin, harbour porpoise, and minke whale. There is potential for moderate adverse short, medium, and long-term effects as described above (-2), including the potential for transboundary effects on these sensitive species, as well as other marine mammals that may be present within the area.

During project planning for wind turbines, the key areas of marine mammal habitats and migratory routes should be identified, including through the conduction of pre-construction surveys and consultation with environmental stakeholders, and development avoided within these areas, whenever possible. Pre-construction, construction, and decommissioning activities should be planned to minimise the potential for adverse effects on marine mammals, including temporal activity planning, limiting vessel activity and mitigation against potential noise effects, including through avoidance of foundation installation such as piling that generates higher noise and avoidance or use of low-noise methods to dispose of any UXO within the development area. The potential for pre-construction, construction, and decommissioning phase adverse effects can be minimised through the application of standard best practice mitigation for marine mammals, including the use of marine mammal observers. Turbines and associated infrastructure should be designed to minimise effects during operation.

Birds:

There are no designated sites for bird species within the recommended RZ, however the North-West Irish Sea SPA in the RoI is situated directly adjacent to the southern boundary of the recommended RZ, within the tidal excursion zone. This SPA is designated for breeding or wintering populations of 21 bird species. There is also a TCE High MPA risk area for Breeding Birds within the north of the recommended RZ and a Moderate MPA risk area elsewhere; Carlingford Marine

pSPA is c.10km distant, East Coast Marine pSPA c.13km distant, Strangford Lough SPA c.17km distant, and Carlingford Lough SPA c.20km distant. There is potential for significant adverse direct and indirect effects on designated bird species, including from transboundary sites, in the short-term pre-construction, construction and decommissioning phases due to noise impacts, disturbance and displacement, damage or loss of supporting habitat (including through loss or damage of fish spawning or nursery areas, which could have secondary effects on predators), and collision risk (-3), and in the medium and long-term operational phase due to habitat exclusion, displacement and potential collision risk (-3). Further refinement of the recommended RZ away from the North-West Irish Sea SPA is recommended to avoid the potential for significant adverse effects. There are areas of recorded relatively high and moderate density for seabirds at sea within the recommended RZ, and there is potential for moderate adverse short, medium, and long-term effects on seabird species, as described above (-2), including the potential for transboundary effects. There is also a known spawning ground for sandeel, a key food source for many species of seabird, within the recommended RZ. There is greater potential for adverse effects on seabirds within important foraging areas, through loss or damage to these species and their habitats during construction, displacement from these areas during construction and operation, and potentially, through a higher risk of collision for seabird species that prioritise the area for foraging; the degree of effect relating to these areas will differ between seabird species, depending on the importance of sandeel to their diet, and ability to access this food source at different water depths. Key foraging grounds outside of designated sites should be further investigated at the next stage of future planning and appropriate mitigation applied to avoid or reduce the potential for adverse effects. During project planning for wind turbines, the key areas of bird habitats and migratory routes should be identified, including through the conduction of pre-construction surveys and consultation with environmental stakeholders, and development avoided within these areas, whenever possible. Pre-construction, construction, and decommissioning activities should be planned to minimise the potential for adverse effects on birds, including temporal activity planning, limiting vessel activity and mitigation against potential noise effects. Turbines and associated infrastructure should be designed to minimise effects, particularly collision risk, during operation.
Population and Human Health There is potential for slight adverse short-term, temporary noise and visual effects on the local population due to noise generated and visual impacts during the construction and decommissioning phases, and visual flicker and noise effects during operation. However, due to the distance of the recommended RZ offshore, these effects should be limited to vessel occupants transiting through the area, and there is not expected to be potential for direct, short, medium, or long-term, disturbance of coastal populations due to noise or visual effects during the construction, operational, or decommissioning phases (0). The potential for indirect visual effects to coastal populations during the operational phase is considered under the Landscape, Seascape and Visual Amenity topic. There are no Bathing Water Sites, Blue Flag Beaches, or dive sites within the recommended RZ, and therefore there is not considered to be potential for adverse effects on these areas during the construction, operational, or decommissioning phases (0). There is potential for moderate adverse temporary direct and indirect effects on leisure and recreational marine users due to an increased collision risk, access restrictions and displacement, or water quality effects, during the construction and decommissioning phases due to known use of the area by leisure vessels (-2). There is also potential for moderate adverse long-term (device life) effects due to an enhanced collision risk for recreational and leisure vessels with wind turbine blades or submerged infrastructure (-2), and potential for moderate adverse long-term (device life) effects due to displacement of recreational and leisure craft from the array area during the operational phase (-2). At the next stage of project planning, the potential for interaction with areas of known high use by leisure users should be avoided or minimised. At the project level, further mitigation to minimise risk to leisure users could include the use of exclusion zones around developments, and timely and effective communication regarding construction works, as well as appropriate marking of devices and the array area.
Geology, Soils and Land Use There are no sites designated for geological and geomorphological features, i.e., MCZs, WHSs, ASSIs, UNESCO Geoparks, within the recommended RZ or tidal excursion zone; there is therefore

not anticipated to be any potential for direct or indirect, short, medium, or long-term effects on these features from construction or operation of fixed wind devices within the recommended RZ (0). Fixed wind technologies within the recommended RZ are likely to be predominantly in the technology groups 5A, 3B, 4A, and 1, primarily requiring jacket installation with driven piles encountering a somewhat complex geology of areas of sand, gravel, soft mud and diamict of variable thickness with a requirement for more invasive installation technologies to be employed; there is potential for moderate adverse direct long-term effects on the seabed geology and sediments through loss of material (-2). The main seabed sediments within the recommended RZ are predominantly sandy mud and muddy sand with potential for mobilisation to occur. There is potential for influence on the MS Descriptor 6 sea floor integrity with the installation processes of fixed wind technologies; there is not anticipated to be potential for adverse effects on the achievement of GES for this Descriptor owing to the spatial extent of physical loss, however this should be fully considered at the project phase, and any appropriate mitigation put in place. There are no known areas of potential contamination within the recommended RZ i.e., no dumping grounds of spoil ground, or explosive grounds. There is therefore not expected to be potential for adverse direct or indirect short, medium, or long-term effects on sediments within the recommended RZ from interaction with potentially contaminated areas (0). There is potential for long-term (device operational life) sediment loss within the footprint of foundations and scour protection, and short-term temporary loss in the vicinity of the works during seabed preparation activities, construction, and decommissioning activities (-2). Sediment and erosion occurrence should be minimised through the development, implementation, and enforcement of an ESCP for construction works. Decommissioning methods should be used that aim to minimise the amount of suspended sediment generated. Following the installation of fixed wind technologies there is potential for medium to long-term localised impacts on erosion and deposition patterns within close proximity to the devices during the operational phase (-2), given the moderate mobility of sediments within the recommended RZ. Further mitigation to minimise the potential for adverse effects on sediments and sediment transport is provided in **Section 10.1**.
Water No designated WFD Shellfish Water or Bathing Water Protected Areas, or WFD coastal or transitional water bodies are within the recommended RZ or tidal excursion zone. There is, therefore, not expected to be any potential for adverse, direct or indirect, short, medium or long-term effects within these sites from construction or operation of fixed wind devices within the recommended RZ (0). There are no known areas of potential contamination within the recommended RZ i.e., no dumping grounds of spoil ground, or explosive dumping grounds. There is therefore not expected to be potential for adverse direct or indirect, short, medium, or long-term effects on water quality within the recommended RZ or tidal excursion zone from interaction with potentially contaminated areas (0). There is potential for localised effects on water quality within the recommended RZ and tidal excursion zone during the short-term construction and decommissioning phases and during device operation (maintenance) due to sediment mobilisation and associated turbidity, construction discharges or accidental contaminant release from machinery and vessels (-1). There is potential for localised effects on water quality, as described above, within the MS Celtic Seas sub-region, however there is not expected to be potential for adverse effects on the achievement of GES for water quality Descriptors (e.g., Descriptor 9 Concentrations of contaminants in fish and other seafood; Descriptor 8: Concentration of contaminants within marine environment; Descriptor 10 marine litter) with the application of standard best practice mitigation during seabed preparation, construction, maintenance and decommissioning activities (-1). The potential for adverse effects on water quality should be minimised at the project level, including through sediment testing and water quality monitoring during the construction and decommissioning phases to identify and mitigate for potential adverse effects at the earliest possible stage. Environmental authorities should be consulted on the construction methodology, and the most appropriate timing of works to provide the least potential for sediment mobilisation to waterbodies. Further mitigation is provided in **Section 10.1**.
Air

There is potential for slight adverse, direct, short-term temporary effects on local air quality due to air emissions from vessels and machinery during the construction and decommissioning phases. There is also the potential for slight adverse, short-term, temporary emissions from vessels due to maintenance activities during the operational phase. However, due to the distance of coastal populations from the recommended RZ, it is not expected that there will be potential for adverse direct or indirect, short, medium, or long-term effects on these receptors from air pollution during the construction, operational and decommissioning phases (0). At the project level, emissions of air pollutants should be minimised through adherence to standard best practise for the minimisation of air pollution, as set out in **Section 10.1**.

There is potential for significant positive indirect effects on regional air quality in the medium to long-term operational phase, as the operation of renewable energy devices can support a transition away from fossil fuel use and its associated air emissions, with potential for a relatively high capacity in the recommended RZ (+3).

Climatic Factors

There are no known areas of blue carbon habitat within the recommended RZ. Ulster Wildlife have identified areas of only low potential for blue carbon importance, therefore, there is unlikely to be potential for adverse effects on blue carbon habitats within the recommended RZ during the construction, operational and decommissioning phases (0). There is potential for slight adverse short-term effects on sediment carbon storage, due to a localised release of CO_2 from seabed disturbance during the construction (and decommissioning) phases (-1).

There is potential for slight adverse, short-term, temporary effects on localised GHG concentrations, due to GHG emissions from vessels and machinery during the construction (and decommissioning) phase (-1). At the project level, emissions of air pollutants should be minimised through adherence to standard best practise for the minimisation of air pollution, as set out in **Section 10.1**.

There is potential for significant positive, medium- to long-term effects during the operational phase, as the operation of renewable energy devices can contribute to a net reduction in GHG emissions, decarbonisation of the energy sector, diversification of electricity supply and energy security, and meeting of energy objectives and climate change emission reduction targets, with potential for a relatively high capacity in the recommended RZ (+3).

Material Assets

Existing Infrastructure

There is potential for slight adverse, direct short-term damage to the existing gas pipeline and subsequent disruption to energy supplies during the construction and decommissioning phases (-1), as well as slight adverse direct, medium to long-term (device lifetime), effects in the operational phase during recurrent maintenance operations (-1). There is also potential for slight adverse indirect effects to energy supplies, as access to the existing pipeline for maintenance may also be reduced temporarily during the construction and decommissioning phases (short-term) (-1), as well as during the operational phase (medium to long-term) (-1).

Industry standard mitigation measures can be implemented at the project phase to avoid the potential for direct damage to the existing pipeline, such as implementation of safety zones (e.g., 500m avoidance areas) around the pipeline. Clear communication should be undertaken with the owners of the pipeline during all project planning and installation, to ensure that the construction process does not impact on access requirements to this infrastructure. Taking these mitigation measures into consideration, the potential for adverse effects on infrastructure can be reduced from slight to negligible (0) in the short, medium, and long-term.

Shipping and Navigation

Given the presence of the high-density shipping route, there is potential for significant direct adverse effects on shipping and navigation to arise within the recommended RZ. There is potential for significant direct short-term displacement of vessels during construction and decommissioning (-3), as well as medium to long-term displacement from the array area during the project lifetime (-3), due to safety exclusion zones. This can result in disruption to vessel routeing and timetables.

There is the potential for short-term risk of collision and allision with vessels during construction and decommissioning, which may result in hazardous cargo or oil spillage (-3). Medium to long-term risk of collision with stationary device arrays and subsequent spill risk, as well as safety concerns with under keel clearance reduction, arise during the operational phase (-3). Additionally, there is potential for direct adverse effects on navigation, as devices could obstruct lights, buoys, or the coastline (-3). In terms of communication and navigational equipment, AIS and radar systems (including aviation NATS) may be affected. Furthermore, the presence of installation vessels and equipment may adversely impact the efficiency of search and rescue operations within installation and decommissioning areas (short-term) (-3).

Given the presence of the high and moderate density shipping areas within the north-west and east of the recommended RZ associated with the Warrenpoint to Heysham shipping route, there is potential for significant navigational risk and displacement in the short, medium and long-term (-3). The potential significant adverse effects on navigational risk could be mitigated through the implementation of mitigation measures in line with standard Shipping and Navigation mitigation outlined in **Section 10.1**. Further refinement of the recommended RZ through avoidance of this higher density Warrenpoint to Heysham route is recommended, which could reduce the potential impacts to navigational risk and displacement to moderate in the short, medium, and long-term (-2).

<u>Commercial Fisheries</u>

There are relatively high intensity fishing areas within the recommended RZ. There is potential for significant direct adverse, short-term effects on commercial fisheries operations due to temporary displacement from traditional fishing grounds during the construction and decommissioning phases (-3), as well as potential for direct adverse long-term effects due to displacement from the recommended RZ during the operational phase (-3). Displacement of fishing activity could result in increased competition for fishing grounds, and has potential to adversely affect fish stocks and, by extension, landings in nearby areas. There is potential to minimise adverse effects due to the displacement of vessels through further consideration at the next stage of project planning. There should be strategic level caution regarding the siting of ORE infrastructure, with an aim to avoid developments occupying recognised fishing grounds unless there is a successful agreement between the industries that co-location is achievable. Further mitigation with regard to potential co-location is discussed in **Section 10.1**.

There is potential for significant adverse direct effects due to an increased collision risk of fishing vessels with vessels associated with the ORE development in the short-term during the construction and decommissioning phases (-3), and moderate adverse effects in the medium to long-term during recurrent maintenance activities in the operational phase (-2). There is also potential for significant adverse indirect effects in the medium to long-term operational phase, as displacement of fishing vessels from the area may concentrate vessels into a smaller area for shipping and navigation routes, with an associated increased collision risk (-3). There is also potential for significant adverse effects on fishing activities within the recommended RZ in the operational phase, as actual and/or perceived increased allision risks with devices, or entanglement of fishing gear with devices or attachment infrastructure may lead to avoidance of the area by fishing vessels (-3). To mitigate for navigational risk, further mitigation measures in line with standard Commercial Fisheries mitigation outlined in **Section 10.1** should be implemented. It is imperative that a successful agreement between industries that co-location is achievable is agreed. Further mitigation with regard to potential co-location is also discussed in **Section 10.1**.

There is potential for effects on commercial fish species and their key habitats within the recommended RZ and the tidal excursion zone. There is slight potential for indirect positive effects in the medium to long-term, as hard subsea infrastructure could lead to an enhancement of fish populations at the edges of the array for trawler fishing (+1). Given the high number of spawning and nursery grounds within the recommended RZ, there is potential for significant adverse direct effects in the short-term construction, and medium to long-term operational phase, due to the potential for a direct loss of these supporting habitats (-3). There is also potential for significant adverse direct and indirect effects during the short-term construction and decommissioning phases (-3), and moderate adverse effects in the medium to long-term operational phase (-2) due to sediment mobilisation from construction, decommissioning and maintenance activities, respectively, which could have an indirect effect on fishing activity through an alteration of fishing stocks (-3). To minimise the potential for indirect effects on commercial fisheries through impacts on fishing stocks, an ESCP should be developed, implemented and enforced for construction works, while the decommissioning methods used should aim to minimise sediment generated. Further information on the potential ecosystem effects on fish and shellfish species, and potential mitigation can be found in the Biodiversity, Flora, and Fauna assessment for the Irish Inshore recommended RZ.

There is potential for significant indirect effects on the profitability of commercial fishing in the short, medium, and long- term (-3), such as the potential for reduced quotas, increased resource competition for fishing, and reduced landings in both tonnage and economic value. These effects could be mitigated through considering the mitigation measures discussed above, and in **Section 10.1**. Further refinement of the recommended RZ through avoidance of the areas of high and moderate fishing activity, and the areas of highest known importance for fish spawning and nursery, is recommended, which could reduce the potential effects on commercial fisheries to moderate in the short, medium, and long-term (-2).

Military Areas

There is potential for moderate adverse effects on military activities, including temporary (short-term) disruption of military exercises and activities within the Ardglass Military Practice Area during pre-construction, installation, and decommissioning (-2), and medium to long-term disruption during operation, due to the presence of offshore infrastructure (-2). As the entire recommended RZ is within this Military Practice Area, the area available for military practice activity could be reduced during the operational phase. Consultation with the MoD during the next stage of project planning could help to inform the key areas that should be avoided within the mapped Practice Areas, which could reduce the potential for adverse effects due to the displacement of military activities. The risk of collision of military vessels with devices can be minimised through further consultation with the MoD at the next stage of further planning. Measures outlined to mitigate against navigational risk in the Shipping and Navigation Section of **Section 10.1** are also of relevance.

Considering these mitigation measures the potential for adverse effects on military activities could be reduced from moderate to slight (-1) in the short, medium, and long-term.

Aviation

There are no safeguarding zones for aviation interference within the recommended RZ. The presence of devices has limited potential to effect communications, navigation, and surveillance, therefore, there is potential for negligible effects on aviation navigation or radar (0).

Spoil Dumping Grounds

There are no spoil dumping grounds located within the recommended RZ. There is therefore no potential for temporary disruption or displacement of vessels moving to and from disposal sites (0).

Tourism

The potential for effects on tourism is considered indirectly within the topics of Landscape, Seascape and Visual Amenity (visibility of construction activity and operational devices), Population and Human Health (recreational use of the RZ), and Biodiversity, Flora, and Fauna (effects on wildlife). As discussed in the Landscape, Seascape and Visual Amenity Section, there is potential for significant adverse effects on Landscape, Seascape and Visual Amenity within Mourne AONB, Strangford and Lecale AONB, Ring of Gullion AONB and various National Trust sites, which may result in secondary adverse effects on tourism, as this may act as a deterrent to tourists to visit these sites. Conversely, it is possible the presence of a wind farm will act as a tourist attraction. As discussed in Population and Human Health, there is potential for moderate adverse effects on recreational access, increased noise, and contaminant release in the short-term, as such tourism could be impacted by these potential effects. Lastly, as discussed in Biodiversity, Flora and Fauna, there is potential for noise generation to impact wildlife, which may result in a secondary impact on tourism activities such as bird, dolphin or whale watching.

There is the potential for tourism to be impacted by secondary effects. It is not clear whether an overall negative or positive impact will arise. However, it is likely any impact on tourism will be benign and of low significance.

Renewable Energy Generation

The potential capacity of the recommended RZ is 1.76GW. As such, there is potential for significant positive effects in the medium- to long-term, owing to the generation of a new renewable energy supply for the NI population (+3).

Overall

Overall, there is considered to be potential for significant adverse effects in the short, medium, and long-term for Material Assets (-3), following the consideration of best practice mitigation measures, mainly attributed to the identified potential for significant adverse effects on Shipping and Navigation, and Commercial Fisheries.

Cultural, Architectural and Archaeological Heritage

There are many known undesignated wrecks within the recommended RZ, and several additional wrecks within the tidal excursion zone. There is potential for moderate adverse temporary to permanent effects on these features during the construction and decommissioning phases, which may be due to direct damage or disturbance of features within the recommended RZ, or indirect effects via sediment displacement and deposition onto features within the recommended RZ and the tidal excursion zone (-2). There is also potential for slight adverse indirect effects on features within the recommended RZ in the medium to long-term operational phase owing to the potential for scouring and exposure to occur around features in the vicinity of devices (-1). At the project planning phase, any sites of interest for archaeological potential should be identified and exclusion zones used around these, with conduction of site surveys or trial trenching before any potentially damaging activities take place, with results informing any appropriate mitigation. Modelling of hydrodynamic and sediment transport processes may be necessary to determine potential effects on surrounding archaeological features and determine any appropriate mitigation required. Management of cultural heritage at the project level should be considered through the development and application of a MARP.

The recommended RZ is situated between c.15km and c.30km distance from the coastline. There is potential for moderate to significant adverse indirect effects (-2 to -3, depending on the distance offshore) on the setting of coastal heritage features, including for 877 Listed Buildings, 416 Defence Heritage Record sites, 593 Scheduled Monuments, 104 Scheduled Zones, and 22 Parks and Gardens (including Mourne Park, Tollymore Park, Tyrella House, Castlewellan College, and Castle Ward) that are within the modelled viewshed. There is potential for adverse indirect short-term effects on the setting of these features during the construction and decommissioning phase, and for medium and long-term effects during device operation, owing to the potential visibility of vessels and machinery and device arrays, respectively.

The recommended RZ is within the Irish Sea (South Down) RSCA, while Mourne Coast RSCA, Lecale Coast RSCA, and Dundrum Bay RSCA are situated inshore of the recommended RZ. Cultural heritage features that are listed as cultural influences for the Irish Sea (South Down) RSCA include a large number of shipwrecks scattered across the seabed. Cultural heritage features that are listed as cultural influences for the Mourne Coast RSCA include a concentration of defence heritage sites associated with Ballynahatten airfield at the southern end of the RSCA, and coastal observation post and radar site north of Kilkeel, harbours at Annalong and Kilkeel and coastguard stations along the coast, and Scheduled Areas and Monuments including Cranfield Mound and Kilkeel Medieval church site. Cultural heritage features that are listed as cultural influences for Dundrum Bay RSCA include Dundrum Castle (a Scheduled Monument), Medieval sites including several churches (most designated Scheduled Monuments and/or Areas), industrial sites including those reflecting coastal trade and industry, e.g., harbours (Scheduled Monument and Area), Registered Historic Parks/Gardens at Tyrella House and Mount Panther House, and defensive sites such as pillboxes, and anti-air-landing poles. Features listed for Lecale Coast RSCA include a cluster of Medieval fortified towerhouses in Ardglass (some of which are Scheduled Monuments/Areas, and some of

which are in state care), Medieval churches, including St John's Point Church and St Nicholas's Church of Droneyl (both in state care), and the harbour, pier and ropewalk at Killough (Scheduled Monuments and/or Areas). Further refinement of the recommended RZ away from the coastline and sensitive cultural heritage designations is recommended to reduce the potential for significant adverse effects. Areas of highest landscape and seascape sensitivity should be avoided, where possible, during the next stage of project planning. At the project planning phase, a SLVIA should be undertaken and should inform project design and appropriate mitigation to minimise adverse effects, and this should include consideration of potential impacts on views from sites of historic importance.
Landscape, Seascape and Visual Amenity The recommended RZ is situated between c.15km and c.30km distance from the coastline. Mourne AONB, Strangford and Lecale AONB, and Ring of Gullion AONB are situated inshore and are within the modelled viewshed. There is potential for moderate to significant adverse indirect effects on these sites, both in the short-term construction and decommissioning phases from the presence of vessels and machinery (-2 to -3, depending on the distance offshore), and during the operational phase from the presence of device arrays (-2 to -3, depending on the distance offshore), owing to the very high sensitivity of the landscape. There are 11 National Trust Lands that are within the modelled viewshed, and there is also potential for moderate to significant adverse indirect effects (-2 to -3, depending on the distance offshore) on the setting of these areas, both in the short-term construction and decommissioning phases and the medium to long-term operational phase as described above, owing to the high sensitivity of the landscapes. The recommended RZ is within the Irish Sea (South Down) RSCA, while Mourne Coast RSCA, Lecale Coast RSCA, and Dundrum Bay RSCA are situated inshore of the recommended RZ. There is potential for adverse effects in the medium and long-term within these areas, as the presence of device arrays may alter the RSCA character. There is potential for moderate adverse indirect visual effects in the short, medium and long-term for the coastal population, including within 47 settlements (Kilkeel, Newcastle, Ardglass, Downpatrick, and Annalong) that are within the modelled viewshed (-2). There is also potential for transboundary effects on visual amenity for the population along the RoI County Louth coastline and the south-west of the Isle of Man, as these areas are also within the modelled viewshed. There is also potential for in-combination or cumulative landscape/seascape and visual effects with several offshore wind projects in RoI territorial waters off the coast of County Louth that are currently at concept/early planning stage (such as Oriel, Clogherhead and North East Wind). Further refinement of the recommended RZ away from the coastline and landscape designations is recommended to avoid the potential for significant adverse effects. Areas of highest landscape and seascape sensitivity should be avoided, where possible, during the next stage of project planning. At the project planning phase, a SLVIA should be undertaken and should inform project design and appropriate mitigation to minimise adverse effects.

G.4 Fixed Wind Resource Zone: Irish Sea Offshore

Discussion of Potential Impacts
Biodiversity, Flora and Fauna <u>Benthic Habitats and species:</u> There are no designated sites for benthic habitats and species within the recommended RZ. However, Queenie Corner MCZ, designated for subtidal mud and sea-pen and burrowing megafauna communities, is situated immediately adjacent to the south-east boundary and is within the tidal excursion zone, and there is a TCE Very High MCZ risk area for Habitats in the south-east of the recommended RZ. There is potential for significant adverse indirect effects on these features in the short-term construction and decommissioning phases from sedimentation or water quality effects (-

3). Further refinement of the recommended RZ away from this site is recommended to avoid the potential for significant adverse effects during construction and decommissioning.

The seabed habitats within the recommended RZ predominantly consist of fine mud, with sandy mud and muddy sand in the south-east, and small areas of rock/hard substrate in the west, with no recorded occurrences of NI protected or priority benthic habitats or species. There is potential for slight adverse direct and indirect effects on non-sensitive benthic habitats from localised benthic loss, or pollution or sedimentation effects during the short-term construction and decommissioning phases (-1), and medium to long-term operational maintenance (-1). Project planning mitigation should aim for avoidance of areas of benthic ecological importance, particularly areas where protected habitats and species are present, with installation in areas where non-sensitive habitats or species are present with the use of appropriate installation techniques. The volume of rock used for cable armouring, pipeline protection and foundation scour protection should be planned as the minimum required, to minimise habitat loss. At the project planning phase, sediment and erosion occurrence should be minimised through the development, implementation, and enforcement of an ESCP for construction and decommissioning works, and modelling of hydrodynamic and sediment transport processes to assess potential effects and determine suitable mitigation to minimise these.

There are no records of invasive species within the recommended RZ; there is a potential risk of introduction of invasive species to the area with potential for slight adverse direct effects during the short-term construction (and decommissioning) phases (-1), and in the medium to long-term during operational maintenance (-1). Mitigation to reduce the risk of introduction of invasive species to the area is provided in **Section 10.1**.

Fish and Shellfish:

There are no designated sites for fish and shellfish within the recommended RZ or the tidal excursion zone, and there are no TCE Very High, High, or Moderate MPA risk areas for Fish within the recommended RZ.

Within the recommended RZ and tidal excursion zone there is a (Ellis *et al.* (2012) CEFAS) fish spawning ground for cod, which is of high intensity in the centre and east (and low intensity elsewhere), a low intensity spawning ground for horse mackerel (except for the north), and low intensity spawning grounds for ling, mackerel, sandeel, hake, plaice, and sole throughout. There are (Ellis *et al.* (2012) CEFAS) fish nursery grounds of high intensity within the recommended RZ for whiting, spurdog, and herring (in the north), and of low intensity for hake (in the north), plaice (in the north), anglerfish, mackerel, and cod. There are known (Coull *et al*. (1998) CEFAS) fish spawning grounds for sprat, and nursery area for cod, and both spawning and nursery grounds for Nephrops within the recommended RZ. There are also AFBI surveyed spawning areas for cod, particularly in the north, and for plaice, and nursery areas for haddock and whiting within the recommended RZ and tidal excursion zone. There is potential for moderate adverse direct and indirect effects in the short-term construction and decommissioning phases from habitat loss or damage, sedimentation, and smothering effects and via impacts on water quality (-2), and in the medium and long-term operational phase due to a loss of supporting habitat (-2).

There are recorded occurrences of PMF species queen scallop and great scallop, Priority and OSPAR Threatened/Declining fish species spiny dogfish, whiting, herring, hake, and cod, and elasmobranch species thornback ray, spotted ray, and school shark. There is potential for moderate adverse direct and indirect effects on these sensitive species from disturbance, displacement, and localised loss of, or damage to supporting habitats during the short-term construction and decommissioning phases (-2), and adverse direct and indirect medium to long-term effects due to loss of supporting habitats, habitat exclusion and displacement, barrier effects, entanglement, or EMF effects (-2).

As described for Benthic Habitats and Species, project planning mitigation should aim for avoidance of areas of benthic ecological importance, particularly areas where protected habitats and species are present. Areas should be avoided that may generate increased levels of suspended sediment and those that coincide with areas of fish spawning grounds or sensitive species. Where this is not possible, appropriate timing restrictions should be applied to works, and/or less disruptive installation methods used, to minimise effects on sediment mobilisation and disturbance and displacement of species from the construction area.

In the medium and long-term, there is potential for slight positive indirect effects (+1) owing to device colonisation and the possibility that device arrays may cause a reef effect, however this may also lead to a slight adverse indirect short-term effect (-1) should colonised structures be removed at decommissioning. Mitigation measures during the project planning phase should consider the decommissioning activities that will be used, and whether removal of colonised structures, foundations or scour protection is required, or could result in a double habitat loss (that from pre-construction and decommissioning periods). If fishing is excluded from the array area, there may be potential for positive effects on fish species and supporting habitats such as spawning and nursery grounds within the operational phase.

Marine Mammals:

There are no designated sites for marine mammals within the recommended RZ or tidal excursion zone. However, there is a TCE Moderate MPA risk area for Marine Mammals within the recommended RZ. There is potential for moderate adverse direct and indirect effects on designated marine mammals, including from transboundary sites in RoI, Scotland, England, or Wales, in the short-term pre-construction, construction and decommissioning phases due to noise impacts, disturbance and displacement, and collision risk (-2), and in the medium and long-term operational phase due to habitat exclusion and displacement, and potential collision risk (-2).

There are areas of recorded relatively high (minke whale and beaked whale) and moderate (striped dolphin, fin whale, common dolphin, common/striped porpoise, and minke whale) density for cetacean species, and an area of relatively moderate density for grey seal within the recommended RZ. There are also records of the Priority species bottlenose dolphin. There is potential for moderate adverse short, medium, and long-term effects as described above on these species as well as other marine mammals that may be present within the area (-2), including the potential for transboundary effects.

During project planning for wind turbines, the key areas of marine mammal habitats and migratory routes should be identified, including through the conduction of pre-construction surveys and consultation with environmental stakeholders, and development avoided within these areas, whenever possible. Pre-construction, construction, and decommissioning activities should be planned to minimise the potential for adverse effects on marine mammals, including temporal activity planning, limiting vessel activity and mitigation against potential noise effects, including through avoidance of foundation installation such as piling that generates higher noise and avoidance or use of low-noise methods to dispose of any UXO within the development area. The potential for pre-construction, construction, and decommissioning phase adverse effects can be minimised through the application of standard best practice mitigation for marine mammals, including the use of marine mammal observers. Turbines and associated infrastructure should be designed to minimise effects during operation.

Birds:

There are no designated sites for bird species within the recommended RZ or the tidal excursion zone, however there is a TCE Moderate MPA risk area for Breeding Birds within the recommended RZ. There is potential for moderate adverse direct and indirect effects on designated bird species, including from transboundary sites within Scotland and RoI, in the short-term pre-construction, construction, and decommissioning phases due to noise impacts, disturbance and displacement, damage or loss of supporting habitat, and collision risk (-2), and in the medium and long-term operational phase due to habitat exclusion, displacement and potential collision risk (-2).

There are areas of recorded relatively high and moderate density for seabirds at sea within the recommended RZ, and there is potential for moderate adverse short, medium, and long-term effects on seabird species, as described above (-2), including the potential for transboundary effects. There is also a known spawning ground for sandeel, a key food source for many species of seabird, within the recommended RZ. There is greater potential for adverse effects on seabirds within important foraging areas, through loss or damage to these species and their habitats during construction, displacement from these areas during construction and operation, and potentially, through a higher risk of collision for seabird species that prioritise the area for foraging; the degree of effect relating to these areas will differ between seabird species, depending on the importance of sandeel to their diet, and ability to access this food source at different water depths. Key foraging grounds outside of designated sites should be further investigated at the next stage of future planning and appropriate mitigation applied to avoid or reduce the potential for adverse effects.

During project planning for wind turbines, the key areas of bird habitats and migratory routes should be identified, including through the conduction of pre-construction surveys and consultation with environmental stakeholders, and development avoided within these areas, whenever possible. Pre-construction, construction, and decommissioning activities should be planned to minimise the potential for adverse effects on birds, including temporal activity planning, limiting vessel activity and mitigation against potential noise effects. Turbines and associated infrastructure should be designed to minimise effects, particularly collision risk, during operation.

Population and Human Health

There is potential for slight adverse short-term, temporary noise and visual effects on the local population due to noise generated and visual impacts during the construction and decommissioning phases, and visual flicker and noise effects during operation. However, due to the distance of the recommended RZ offshore, these effects should be limited to vessel occupants transiting through the area, and there is not expected to be potential for direct, short, medium, or long-term, disturbance of coastal populations due to noise or visual effects during the construction, operational, or decommissioning phases (0). The potential for indirect visual effects to coastal populations during the operational phase is considered under the Landscape, Seascape and Visual Amenity topic.

There are no Bathing Water Sites, Blue Flag Beaches, or dive sites within the recommended RZ, and therefore there is not considered to be potential for adverse effects on these areas during the construction, operational, or decommissioning phases (0).

There is potential for slight adverse temporary direct and indirect effects on leisure and recreational marine users due to an increased collision risk, access restrictions and displacement, or water quality effects, during the construction and decommissioning phases (-1). The potential for adverse direct or indirect effects on these users in the medium to long-term during the operational phase is likely to be negligible, as there is relatively low recreational boating use within the recommended RZ (0). At the next stage of project planning, the potential for interaction with areas of known use by leisure users should be avoided or minimised. At the project level, further mitigation to minimise risk to leisure users could include the use of exclusion zones around developments and timely and effective communication regarding construction works, as well as appropriate marking of devices and the array area.

Geology, Soils and Land Use

There are no sites designated for geology or geomorphology, i.e., WHSs, ASSIs or UNESCO Geoparks within the recommended RZ or tidal excursion zone. Queenie Corner MCZ, designated in part for its subtidal mud feature, is situated immediately adjacent to the south-east boundary of the recommended RZ and is within the tidal excursion zone, and there is potential for significant adverse indirect short to long-term effects on designated features during seabed preparation, construction, or decommissioning from sedimentation or water quality effects (-3). It is recommended that further refinement of the recommended RZ occurs to avoid interaction with, and possible impacts on, Queenie Corner MCZ. However, should this refinement not be possible, at the project planning phase, mitigation should incorporate the conduction of geophysical and geotechnical surveys to identify areas of key geological or geomorphological interest, with avoidance of these areas during development. At the project planning phase, coastal process modelling should be undertaken to determine the potential for adverse effects on designated sites, with further appropriate mitigation proposed to avoid or minimise adverse effects e.g., through a suitable design of device arrays (adequate spacing between developments/arrays) to reduce the potential for excessive energy extraction altering coastal processes and regimes.

Fixed wind technologies within this recommended RZ are likely to be predominantly in the TCE technology groups 5B and 4A i.e., primarily requiring jacket foundations with piling encountering simple geology of varying thickness, which may require less invasive technologies for installation to be employed; there is potential for moderate adverse direct long-term effects on the seabed geology and sediments through loss of material (-2). The seabed sediments primarily consist of rock or other hard substrate with low potential for mobilisation, while there are small areas of mud, which have slightly greater but still relatively low potential for mobilisation. There is potential for influence on the

MS Descriptor 6 sea floor integrity with the installation processes of fixed wind technologies; there is not anticipated to be potential for adverse effects on the achievement of GES of this Descriptor owing to the spatial extent of physical loss, however this should be fully considered at the project phase, and any appropriate mitigation put in place. There are no known areas of potential contamination within the recommended RZ i.e., no dumping grounds of spoil ground or explosive grounds. There is therefore not expected to be potential for adverse direct or indirect, short, medium, or long-term effects on sediments within the recommended RZ from interaction with potentially contaminated areas (0). There is potential for long-term (device operational life) sediment loss within the footprint of foundations and scour protection, and short-term temporary loss in the vicinity of the works during seabed preparation activities, construction, and decommissioning activities (-2). Sediment and erosion occurrence should be minimised through the development, implementation, and enforcement of an ESCP for construction works. Decommissioning methods should be used that aim to minimise the amount of suspended sediment generated. Following the installation of fixed wind technologies, there is potential for medium to long-term localised impacts on erosion and deposition patterns within close proximity to the devices during the operational phase (-2), given the low mobility of sediments within the recommended RZ. Further mitigation to minimise the potential for adverse effects on sediments and sediment transport is provided in **Section 10.1**.
Water No designated WFD Shellfish Water or Bathing Water Protected Areas, or WFD coastal or transitional water bodies are within the recommended RZ or tidal excursion zone. There is therefore not expected to be any potential for adverse, direct or indirect, short, medium, or long-term effects within these sites from construction or operation of fixed wind devices within the recommended RZ (0). There are no known areas of potential contamination within the recommended RZ i.e., no dumping grounds of spoil ground or explosive dumping grounds. There is therefore not expected to be potential for adverse direct or indirect, short, medium, or long-term effects on water quality within the recommended RZ or tidal excursion zone from interaction with potentially contaminated areas (0). There is potential for localised effects on water quality within the recommended RZ and tidal excursion zone during the short-term construction and decommissioning phases and during device operation (maintenance) due to sediment mobilisation and associated turbidity, construction discharges or accidental contaminant release from machinery and vessels (-1). There is potential for localised effects on water quality, as described above, within the MS Celtic Seas sub-region, however there is not expected to be potential for adverse effects on the achievement of GES for water quality Descriptors (e.g., Descriptor 9 Concentrations of contaminants in fish and other seafood; Descriptor 8: Concentration of contaminants within marine environment; Descriptor 10 marine litter) with the application of standard best practice mitigation during seabed preparation, construction, maintenance and decommissioning activities (-1). The potential for adverse effects on water quality should be minimised at the project level, including through sediment testing and water quality monitoring during the construction and decommissioning phases to identify and mitigate for potential adverse effects at the earliest possible stage. Environmental authorities should be consulted on the construction methodology, and the most appropriate timing of works to provide the least potential for sediment mobilisation to waterbodies. Further mitigation is provided in **Section 10.1**.
Air There is potential for slight adverse, direct, short-term temporary effects on local air quality due to air emissions from vessels and machinery during the construction and decommissioning phases. There is also the potential for slight adverse, short-term, temporary emissions from vessels due to maintenance activities during the operational phase. However, due to the distance of coastal populations from the recommended RZ, it is not expected that there will be potential for adverse direct or indirect, short, medium, or long-term effects on these receptors from air pollution during the construction, operational and decommissioning phases (0). At the project level, emissions of air pollutants should be minimised through adherence to standard best practise for the minimisation of air pollution, as set out in **Section 10.1**.

There is potential for moderate positive indirect effects on regional air quality in the medium to long-term operational phase, as the operation of renewable energy devices can support a transition away from fossil fuel use and its associated air emissions (+2).

Climatic Factors

There are no identified areas of blue carbon habitat within the recommended RZ, therefore, there is unlikely to be potential for adverse effects on blue carbon habitats within the recommended RZ during the construction, operational and decommissioning phases (0). There is potential for slight adverse short-term effects on sediment carbon storage, due to a localised release of CO_2 from seabed disturbance during the construction (and decommissioning) phases (-1).

There is potential for slight adverse, short-term, temporary effects on localised GHG concentrations, due to GHG emissions from vessels and machinery during the construction and decommissioning phases (-1). At the project level, emissions of air pollutants should be minimised through adherence to standard best practise for the minimisation of air pollution, as set out in **Section 10.1**.

There is potential for moderate positive, medium to long-term effects during the operational phase, as the operation of renewable energy devices can contribute to a net reduction in GHG emissions, decarbonisation of the energy sector, diversification of electricity supply and energy security, and meeting of energy objectives and climate change emission reduction targets (+2).

Material Assets

Existing Infrastructure

There is potential for moderate adverse, direct short-term damage to the existing gas pipeline and subsequent disruption to energy supplies during the construction and decommissioning phases (short-term) (-2), as well as slight adverse direct, medium to long-term (device lifetime) effects in the operational phase during recurrent maintenance operations (-1). There is also potential for moderate adverse indirect effects to energy supplies, as access to the existing pipeline for maintenance may also be reduced temporarily during the construction and decommissioning phases (short-term) (-2), as well as during the operational phase (long-term) (-1).

Industry standard mitigation measures can be implemented at the project phase to avoid the potential for direct damage to the existing pipeline, such as implementation of safety zones (e.g., 500m avoidance areas) around the pipeline. Clear communication should be undertaken with the owners of the pipeline during all project planning and installation, to ensure that the construction process does not impact on access requirements to this infrastructure. Taking these mitigation measures into consideration, the potential for adverse effects on infrastructure can be reduced from moderate to negligible (0) in the short, medium, and long-term.

Shipping and Navigation

Given the presence of the high-density shipping route, there is potential for significant direct adverse effects on shipping and navigation to arise within the recommended RZ. There is the potential for significant direct short-term displacement of vessels during construction (-3), as well as medium to long-term displacement from the array area during the project lifetime (-3), due to safety exclusion zones. This can result in disruption to vessel routeing and timetables.

There is the potential for short-term risk of collision and allision with vessels during construction and decommissioning, which may result in hazardous cargo or oil spillage (-3). Medium to long-term risk of collision with stationary device arrays and subsequent spill risk, as well as safety concerns with under keel clearance reduction, arise during the operational phase (-3). Additionally, there is potential for direct adverse effects on navigation, as devices could obstruct lights, buoys, or the coastline (-3). In terms of communication and navigational equipment, AIS and radar systems (including aviation NATS) may be affected. Furthermore, the presence of installation vessels and equipment may adversely impact the efficiency of search and rescue operations within installation and decommissioning areas (short-term) (-3).

Given the presence of the high and moderate density shipping areas within the northwest, north and east of the recommended RZ associated with the Warrenpoint to Heysham shipping route, there is the potential for significant navigational risk and displacement in the short, medium, and long-term (-3).

The potential significant adverse effects on navigational risk could be mitigated through the implementation of mitigation measures in line with standard Shipping and Navigation mitigation outlined in **Section 10.1**. Further refinement of the recommended RZ through avoidance of this higher density Warrenpoint to Heysham route is recommended which could reduce the potential impacts to navigational risk and displacement to moderate in the short, medium, and long-term (-2).

Commercial Fisheries

There are relatively high intensity fishing areas within the recommended RZ. There is potential for significant direct adverse, short-term effects on commercial fisheries operations due to temporary displacement from traditional fishing grounds during the construction and decommissioning phases (-3), as well as potential for direct adverse long-term effects due to displacement from the recommended RZ during the operational phase (-3). Displacement of fishing activity could result in increased competition for fishing grounds and has potential to adversely affect fish stocks and, by extension, landings in nearby areas. There is potential to minimise the potential for adverse effects due to the displacement of vessels through further consideration at the next stage of project planning. There should be strategic level caution regarding the siting of ORE infrastructure, with an aim to avoid developments occupying recognised fishing grounds unless there is a successful agreement between the industries that co-location is achievable. Further mitigation with regard to potential co-location is discussed in **Section 10.1**.

There is potential for significant adverse direct effects due to an increased collision risk of fishing vessels with vessels associated with the ORE development in the short-term during the construction and decommissioning phases (-3), and moderate adverse effects in the medium to long-term during recurrent maintenance activities in the operational phase (-2). There is also potential for significant adverse indirect effects in the medium to long-term operational phase, as the displacement of fishing vessels from the area may concentrate vessels into a smaller area for shipping and navigation routes, with an associated increased collision risk (-3). There is also potential for moderate adverse effects on fishing activities within the recommended RZ in the operational phase, as actual and/or perceived increased allision risks with devices, or entanglement of fishing gear with devices or attachment infrastructure may lead to avoidance of the area by fishing vessels (-3). To mitigate for navigational risk, further mitigation measures in line with standard commercial fisheries mitigation outlined in **Section 10.1** should be implemented. It is imperative that a successful agreement between industries that co-location is achievable is agreed. Further mitigation with regard to potential co-location is also discussed in **Section 10.1.**

There is potential for effects on commercial fish species and their key habitats within the recommended RZ and the tidal excursion zone. There is slight potential for indirect positive effects in the medium to long-term, as hard subsea infrastructure could lead to an enhancement of fish populations at the edges of the array for trawler fishing (+1). Given the high number of spawning and nursery grounds within the recommended RZ, there is potential for significant adverse direct effects in the short-term construction phase, and medium-to long-term operational phase due to the potential for a direct loss of these supporting habitats (-3). There is also potential for significant adverse direct and indirect effects during the short-term construction and decommissioning phases (-3), and moderate effects in the medium to long-term operational phase (-2) due to sediment mobilisation from construction, decommissioning and maintenance activities, respectively, which could have an indirect effect on fishing activity through an alteration of fishing stocks (-3). To minimise the potential for indirect effects on commercial fisheries through impacts on fishing stocks, an ESCP should be developed, implemented, and enforced for construction works, while decommissioning methods used should aim to minimise sediment generated. Further information on the potential ecosystem effects on fish and shellfish species, and potential mitigation can be found in the Biodiversity, Flora, and Fauna assessment for the Irish Sea Offshore recommended RZ.

There is potential for significant indirect effects on the profitability of commercial fishing in the short, medium, and long-term (-3), such as the potential for reduced quotas, increased resource competition for fishing, and reduced landings in both tonnage and economic value. These effects could be mitigated by considering the mitigation measures discussed above, and in **Section 10.1**. Further refinement of the recommended RZ through avoidance of the areas of high fishing activity and the areas of highest known importance for fish spawning and nursery is recommended, which could reduce the potential effects on commercial fisheries to moderate in the short, medium and long-term (-2).

Military Areas

There is potential for slight adverse effects on military activities, including temporary (short-term) disruption of military exercises and activities within the Peel Military Practice Area during pre-construction, installation, and decommissioning (-1), and medium to long-term disruption during the operational phase due to the presence of offshore infrastructure (-1). The area available for military practice activity could be reduced during the operational phase. Consultation with the MoD during the next stage of project planning could help to inform the key areas that should be avoided within the mapped Practice Areas, which could reduce the potential for adverse effects due to the displacement of military activities. The risk of collision of military vessels with devices can be minimised through further consultation with the MoD at the next stage of further planning. Measures outlined to mitigate against navigational risk in the Shipping and Navigation Section of **Section 10.1** are also of relevance. Further refinement of the recommended RZ through the avoidance of the c.36.8km^2 area of the Peel Military Practice Area is recommended; this could reduce the potential for adverse effects on military activities to negligible in the short, medium, and long-term (0).

Aviation

There are no safeguarding zones for aviation interference within the recommended RZ. The presence of devices has limited potential to effect communications, navigation, and surveillance, therefore, there is potential for negligible effects on aviation navigation or radar (0).

Spoil Dumping Grounds

There are no spoil dumping grounds located within the recommended RZ. There is therefore no potential for temporary disruption or displacement of vessels moving to and from disposal sites (0).

Tourism

The potential for effects on tourism is considered indirectly within the topics of Landscape, Seascape and Visual Amenity (visibility of construction activity and operational devices), Population and Human Health (recreational use of the RZ), and Biodiversity, Flora, and Fauna (effects on wildlife). As discussed in the Landscape, Seascape and Visual Amenity Section, there is potential for significant adverse effects on Landscape, Seascape and Visual Amenity within Mourne AONB, Strangford and Lecale AONB, and two National Trust sites, which may result in secondary adverse effects on tourism, as this may act as a deterrent to tourists to visit these sites. Conversely, it is possible the presence of a wind farm will act as a tourist attraction. As discussed in Population and Human Health, there is potential for adverse effects on recreational access, increased noise, and contaminant release in the short-term, as such tourism could be impacted by these potential effects. Lastly, as discussed in Biodiversity, Flora and Fauna, there is potential for noise generation to impact wildlife which may result in a secondary impact on tourist activities such as bird, dolphin or whale watching.

There is the potential for tourism to be impacted by secondary effects. It is not clear whether an overall negative or positive impact will arise. However, it is likely any impact on tourism will be benign and of low significance.

Renewable Energy Generation

The potential capacity of the recommended RZ is 0.79GW. As such, there is potential for moderate positive effects in the medium to long-term, owing to the generation of a new renewable energy supply for the NI population (+2).

Overall Overall, there is considered to be potential for significant adverse effects in the short, medium, and long-term for Material Assets (-3), following the consideration of best practice mitigation measures, mainly attributed to identified potential for significant adverse effects on Shipping and Navigation, and Commercial Fisheries.
Cultural, Architectural and Archaeological Heritage There are a small number of known undesignated wrecks within the recommended RZ, and several additional wrecks within the tidal excursion zone. There is potential for slight adverse temporary to permanent effects on these features during the construction and decommissioning phases, which may be due to direct damage or disturbance of features within the recommended RZ, or indirect effects via sediment displacement and deposition onto features within the recommended RZ and the tidal excursion zone (-1). There is also potential for slight adverse indirect effects on features within the recommended RZ in the medium to long-term operational phase owing to the potential for scouring and exposure to occur around features in the vicinity of devices (-1). At the project planning phase, any sites of interest for archaeological potential should be identified and exclusion zones used around these, with conduction of site surveys or trial trenching before any potentially damaging activities take place, with results informing any appropriate mitigation. Modelling of hydrodynamic and sediment transport processes may be necessary to determine potential effects on surrounding archaeological features and determine any appropriate mitigation required. Management of cultural heritage at the project level should be considered through the development and application of a MARP. The recommended RZ is situated between c.38.5km and c.56km distance from the coastline. There is potential for moderate adverse indirect effects on the setting of coastal heritage features, including for 120 Listed Buildings, 136 Defence Heritage Record sites, 83 Scheduled Monuments, 23 Scheduled Zones, and two Parks and Gardens (Tyrella House and Ballee House) that are within the modelled viewshed. There is potential for short-term moderate adverse effects on the setting of these features during the construction and decommissioning phases (-2), and for medium and long-term moderate effects during device operation (-2), owing to the potential visibility of vessels and machinery and device arrays, respectively. The recommended RZ is situated offshore of the Irish Sea (South Down) RSCA, Mourne Coast RSCA, and Dundrum Bay RSCA. Cultural heritage features that are listed as cultural influences for the Irish Sea (South Down) RSCA include a large number of shipwrecks scattered across the seabed. Cultural heritage features that are listed as cultural influences for the Mourne Coast RSCA include a concentration of defence heritage sites associated with Ballynahatten airfield at the southern end of the RSCA, and coastal observation post and radar site north of Kilkeel, harbours at Annalong and Kilkeel and coastguard stations along the coast, and Scheduled Areas and Monuments including Cranfield Mound and Kilkeel Medieval church site. Cultural heritage features that are listed as cultural influences for Dundrum Bay RSCA include Dundrum Castle (a Scheduled Monument), Medieval sites including several churches (most designated Scheduled Monuments and/or Areas), industrial sites including those reflecting coastal trade and industry, e.g., harbours (Scheduled Monument and Area), Registered Historic Parks/Gardens at Tyrella House and Mount Panther House, and defensive sites such as pillboxes, and anti-air-landing poles. Areas of the highest landscape and seascape sensitivity should be avoided, where possible, during the next stage of project planning. At the project planning phase, a SLVIA should be undertaken and should inform project design and appropriate mitigation to minimise adverse effects, and this should include consideration of potential impacts on views from sites of historic importance.
Landscape, Seascape and Visual Amenity The recommended RZ is situated between c.38.5km and c.56km distance from the coastline. Mourne AONB, and Strangford and Lecale AONB are situated inshore, and are within the modelled viewshed. There are also two National Trust Lands (Mournes Coastal Path and Strangford Lough) within the modelled viewshed. There is potential for moderate adverse indirect effects on these sites, both in the short-term construction and decommissioning phases from the presence of vessels and machinery (-2), and during the operational phase from the presence of device arrays (-2), owing to

the high sensitivity of the landscape. There is also potential for transboundary effects within the Isle of Man.

There is no potential for effects within a RSCA, as the recommended RZ is situated further offshore than the delimitation of these areas. RSCAs inshore of the recommended RZs are the Irish Sea (South Down) RSCA, Mourne Coast RSCA, and Dundrum Bay RSCA. There is potential for adverse effects in the medium and long-term within these areas, as the presence of device arrays may alter the RSCA character.

There is potential for slight adverse indirect visual effects in the short, medium and long-term for the inshore coastal population, including within the settlements of Kilclief, Killough, Coney Island, Ardglass, Ballyhornan, Annalong, and Glassdrumman / Mullartown, which are within the modelled viewshed (-1).

There is also potential for in-combination or cumulative landscape/seascape and visual effects with several offshore wind projects in RoI territorial waters off the coast of County Louth that are currently at concept/early planning stage (such as Oriel, Clogherhead and North East Wind).

Areas of the highest landscape and seascape sensitivity should be avoided, where possible, during the next stage of project planning. At the project planning phase, a SLVIA should be undertaken and should inform project design and appropriate mitigation to minimise adverse effects.

G.5 Floating Wind Resource Zone: Atlantic

Discussion of Potential Impacts

Biodiversity, Flora and Fauna

Benthic Habitats and species:

There are no designated sites for benthic habitats and species within the recommended RZ. Skerries and Causeway SAC, designated for reef and sandbank habitats, is situated immediately adjacent to the south of the recommended RZ, and Rathlin Island SAC, designated for sea caves, reefs, sandbanks, drift line vegetation and sea cliffs, is situated c.400m to the east of the recommended RZ; both sites are within the tidal excursion zone. There is a TCE Very High MPA risk area for Annex I Habitat in the south of the recommended RZ, owing to the proximity to Skerries and Causeway SAC, and a High MPA risk area for Habitat in the east, owing to the proximity of Rathlin Island SAC. There is potential for significant adverse indirect effects on these features in the short-term construction and decommissioning phases from sedimentation or water quality effects (-3). Further refinement of the recommended RZ away from these sites is recommended to avoid the potential for significant adverse effects during construction.

Areas of Annex I Reef habitat are also present within the recommended RZ. There is potential for significant adverse direct and indirect effects on these features both in the short-term construction and decommissioning phases, and in the medium to long-term from indirect loss or damage, and sedimentation or water quality effects (-2). The seabed habitats within the recommended RZ predominantly consist of coarse substrate, with an area of sand through the centre to the south, and smaller areas of rock or other hard substrate, and muddy sand. There are recorded occurrences of benthic NI Protected, Priority species and PMFs of starfish, molluscs, crustaceans, sea squirts, and sea slugs. There is potential for moderate adverse direct and indirect effects on these sensitive species, as well as on non-sensitive benthic habitats from localised benthic loss, or pollution/sedimentation effects during the short-term construction and decommissioning phases (-2), and the medium and long-term operational phase (-2). These effects may be minimised based on micro-siting at the project level; project planning mitigation should aim for avoidance of areas of benthic ecological importance, particularly areas where protected habitats and species are present, and installation in areas where non-sensitive habitats or species are present with the use of appropriate installation techniques. The volume of rock used for cable armouring, pipeline protection and foundation scour protection should be planned as the minimum required, to minimise habitat loss. At the project planning phase, sediment and erosion occurrence should be minimised through the development, implementation, and enforcement of an ESCP for construction and decommissioning works, and modelling of hydrodynamic and sediment transport processes to assess potential effects and determine suitable mitigation to minimise these.

There are records of invasive species within the recommended RZ; there is a potential risk of their spread, and a risk of further introduction of invasive species to the area with potential for slight adverse direct effects during the short-term construction and decommissioning phases (-1), and in the medium to long-term during operational maintenance (-1). At the project planning phase, pre- and post-construction surveys for invasive/non-native species should be undertaken in areas of known risk and, if found to be present, an Invasive Species Management Plan should be prepared and a Code of Good Practice, which outlines controls and/or removal measures to ensure that species are not spread during the project's construction or operation. Further mitigation is provided in **Section 10.1**.

Fish and Shellfish:

There are no designated sites for fish and shellfish within the recommended RZ or the tidal excursion zone. There is a TCE Moderate MPA risk area for fish in the south and east of the recommended RZ owing to the potential for migratory fish species to use the area (e.g., Atlantic salmon). There is potential for moderate adverse direct and indirect effects in the short-term construction and decommissioning phases from supporting habitat loss or damage, sedimentation, and smothering effects and via impacts on water quality (-2), and in the medium and long-term operational phase due to a loss of supporting habitat (-2).

There are (Ellis *et al*. (2012) CEFAS) fish nursery grounds of high intensity for spurdog and whiting (in the west, low intensity in the east), and of low intensity for anglerfish, blue whiting (in the west), cod, common skate, hake, herring, ling (in the west), and mackerel within the recommended RZ and tidal excursion zone; these grounds all cover extensive areas. Known (Coull et al. (1998) CEFAS) fish spawning grounds for sprat, herring, and Nephrops, and a known nursery ground for Nephrops are within the recommended RZ. There are also areas of AFBI surveyed relatively high density for scallops in the west and south-east, and for queen scallops in the north-east of the recommended RZ. There is potential for moderate adverse direct and indirect effects in the short-term construction and decommissioning phases from habitat loss or damage, sedimentation, and smothering effects and via impacts on water quality (-2), and in the medium and long-term operational phase due to a loss of supporting habitat (-2).

There are records of NI Protected, Priority, PMF, and OSPAR Threatened/Declining fish and shellfish species such as fan mussel, horse mussel, ocean quahog, great scallop, variegated scallop, queen scallop, basking shark, common skate, porbeagle, cod, whiting, hake, spiny dogfish, cuckoo ray, spotted ray, sole, anglerfish, thornback ray, small-spotted catshark, nursehound, broadnose skate, ling, mackerel, and plaice. There is potential for moderate adverse direct and indirect effects on these sensitive species from disturbance and displacement and localised loss of, or damage to supporting habitats during the short-term construction and decommissioning phases (-2), and moderate adverse direct and indirect effects in the medium to long-term due to loss of supporting habitats, habitat exclusion and displacement, barrier effects, entanglement, or EMF effects (-2).

As described for Benthic Habitats and Species, project planning mitigation should aim for avoidance of areas of benthic ecological importance, particularly areas where protected habitats and species are present. Areas should be avoided that may generate increased levels of suspended sediment and those that coincide with areas of fish spawning grounds or sensitive species. Where this is not possible, appropriate timing restrictions should be applied to works, and/or less disruptive installation methods used, to minimise effects on sediment mobilisation and disturbance and displacement of species from the construction area.

In the medium and long-term, there is potential for slight positive indirect effects (+1) owing to device colonisation and the possibility that device arrays may cause a reef effect, however this may also lead to a slight adverse indirect short-term effect (-1) should colonised structures be removed at decommissioning. Mitigation measures during the project planning phase should consider the decommissioning activities that will be used, and whether removal of colonised structures, foundations or scour protection is required, or could result in a double habitat loss (that from pre-construction and decommissioning periods). If fishing is excluded from the array area, there may be potential for positive effects on fish species and supporting habitats such as spawning and nursery grounds within the operational phase.

Marine Mammals:

There are no designated sites for marine mammals within the recommended RZ. However, Skerries and Causeway SAC, designated for harbour porpoise, is situated immediately adjacent to the inshore region of the recommended RZ, and is within the tidal excursion zone, and there is a TCE High MPA risk area for Marine Mammals within this area. There is potential for moderate adverse direct and indirect effects on designated marine mammals, in the short-term pre-construction, construction, and decommissioning phases due to noise impacts, disturbance and displacement, and collision risk (-2), and in the medium and long-term operational phase due to habitat exclusion and displacement and potential entanglement risk (-2).

There are areas of recorded relatively high (white-beaked dolphin, pilot whale, fin whale, and bottlenose dolphin) and moderate (fin whale, pilot whale, and bottlenose dolphin) density for cetacean species, as well as relatively moderate density for grey seal and harbour seal, within the recommended RZ. There are also records of NI Protected and Priority marine mammal species, including harbour porpoise, minke whale, bottlenose dolphin, and short-beaked common dolphin. There is potential for moderate adverse direct and indirect short, medium, and long-term effects as described above (-2), including the potential for transboundary effects on these sensitive species, as well as other marine mammals that may be present within the area.

During project planning for wind turbines, the key areas of marine mammal habitats and migratory routes should be identified, including through the conduction of pre-construction surveys and consultation with environmental stakeholders, and development avoided within these areas, whenever possible. Pre-construction, construction, and decommissioning activities should be planned to minimise the potential for adverse effects on marine mammals, including temporal activity planning, limiting vessel activity and mitigation against potential noise effects, including through avoidance of foundation installation such as piling that generates higher noise and avoidance or use of low-noise methods to dispose of any UXO within the development area. The potential for pre-construction, construction, and decommissioning phase adverse effects can be minimised through the application of standard best practice mitigation for marine mammals, including the use of marine mammal observers. Turbines and associated infrastructure should be designed to minimise effects during operation, such as to minimise the potential collision risk for marine mammals with turbines and attachment infrastructure.

Birds:

There are no designated sites for bird species within the recommended RZ. However, Rathlin Island SPA and MCZ are situated c.400m to the east and are within the tidal excursion zone. The SPA is designated for breeding populations of razorbill, black-legged kittiwake, and common guillemot, and its seabird assemblage, while the MCZ has been designated for its importance in supporting a large population of breeding black guillemot. There is also a TCE High MPA risk area for Breeding Birds within the recommended RZ, and a Very High MCZ risk area for birds in the east owing to the proximity to Rathlin Island MCZ. There is potential for significant adverse direct and indirect effects on designated bird species, in the short-term pre-construction, construction and decommissioning phases due to noise impacts, disturbance and displacement, damage or loss of supporting habitat, and collision risk (-3), and in the medium and long-term operational phase due to habitat exclusion and displacement and potential collision risk (-3). Further refinement of the recommended RZ away from these sites is recommended to avoid the potential for significant adverse effects.

There are areas of recorded relatively high and moderate density for seabirds at sea within the recommended RZ, and there are records of PMF and OSPAR Threatened/Declining features black guillemot, common eider, and black-legged kittiwake, and there is potential for moderate adverse direct and indirect short, medium, and long-term effects on seabird species, as described above (-2), including the potential for transboundary effects. There is also an area of predicted medium to high seabed suitability for sandeel within and inshore of the recommended RZ. There is greater potential for adverse effects on seabirds within important foraging areas, through loss or damage to these species and their habitats during construction, displacement from these areas during

construction and operation, and potentially, through a higher risk of collision for seabird species that prioritise the area for foraging; the degree of effect relating to these areas will differ between seabird species, depending on the importance of sandeel to their diet, and ability to access this food source at different water depths. Key foraging grounds outside of designated sites should be further investigated at the next stage of future planning and appropriate mitigation applied to avoid or reduce the potential for adverse effects. During project planning for wind turbines, the key areas of bird habitats and migratory routes should be identified, including through the conduction of pre-construction surveys and consultation with environmental stakeholders, and development avoided within these areas, whenever possible. Pre-construction, construction, and decommissioning activities should be planned to minimise the potential for adverse effects on birds, including temporal activity planning, limiting vessel activity and mitigation against potential noise effects. Turbines and associated infrastructure should be designed to minimise effects, particularly collision risk, during operation.
Population and Human Health There is potential for slight adverse short-term, temporary noise and visual effects on the local population due to noise generated and visual impacts during the construction and decommissioning phases, and visual flicker and noise effects during operation. However, due to the distance of the recommended RZ offshore, these effects should be limited to vessel occupants transiting through the area, and there is not expected to be potential for direct, short, medium, or long-term, disturbance of coastal populations due to noise or visual effects during the construction, operational, or decommissioning phases (0). The potential for indirect visual effects to coastal populations during the operational phase is considered under the Landscape, Seascape and Visual Amenity topic. There are no Bathing Water Sites, Blue Flag Beaches, or dive sites within the recommended RZ, and therefore there is not considered to be potential for adverse effects on these areas within the construction, operational, or decommissioning phases (0). There is potential for slight adverse temporary direct and indirect effects on leisure and recreational marine users due to an increased collision risk, access restrictions and displacement, or water quality effects, during the construction and decommissioning phases (-1). The potential for adverse direct or indirect effects on these users in the medium to long-term during the operational phase is likely to be negligible, as there is relatively low recreational boating use within the recommended RZ (0). At the next stage of project planning, the potential for interaction with areas of known high use by leisure users should be avoided or minimised. At the project level, further mitigation to minimised risk to leisure users could include the use of exclusion zones around developments timely and effective communication regarding construction works, as well as appropriate marking of devices and array area.
Geology, Soils and Land Use There are no sites designated for geological or geomorphological features, i.e., MCZs, WHSs, ASSIs, or UNESCO Geoparks, within the recommended RZ. However, Giant's Causeway and Causeway Coast WHS, Rathlin Island-Coast ASSI, and Rathlin MCZ are all within the tidal excursion zone and are designated for geological/geomorphological features; there is potential for moderate adverse indirect medium to long-term effects on designated features of these sites during the operational phase e.g., through changes in hydrodynamics and sediment dynamics (-2). At the project planning phase, mitigation should incorporate the conduction of geophysical and geotechnical surveys to identify areas of key geological/geomorphological interest, with avoidance of these areas during development, and coastal process modelling should be undertaken to determine the potential for adverse effects on designated sites, with further appropriate mitigation proposed to avoid or minimise adverse effects e.g., through a suitable design of device arrays (adequate spacing between developments/arrays) to reduce the potential for excessive energy extraction altering coastal processes and regimes. There are Annex 1 Reef habitats within the recommended RZ, and there is potential for moderate direct, temporary to permanent impacts on these features through loss or damage during the construction and decommissioning phases (-2). These features should be avoided through micro-siting at the project level. Floating wind technologies within this recommended RZ are likely to be predominantly in the TCE technology groups 5 (Piling with socket anchoring for a moderate sea state) and 3 (Complex Anchoring for a moderate sea state), with simple seabed geology of soft mud of varying thickness,

which may require less invasive installation technologies to be employed, there is potential for slight adverse direct long-term effects on the seabed geology and sediments through loss of material (-2). There is potential for influence on the MS Descriptor 6 sea floor integrity with the installation processes of floating wind technologies; there is not anticipated to be potential for adverse effects on the achievement of GES of this Descriptor owing to the spatial extent of physical loss, however this should be fully considered at the project phase, and any appropriate mitigation put in place. There are two spoil dumping grounds in the south-east of the recommended RZ, and, if construction (and decommissioning) takes place within these areas, there is potential for the mobilisation of contaminants that may affect the seabed within the recommended RZ and the tidal excursion zone, with potential for moderate adverse indirect short to medium-term effects on sediment quality in the construction and decommissioning phases (-2). It is recommended that further refinement of the recommended RZ away from these sites occurs to avoid the potential for moderate adverse effects during the short-term construction phase. Should this refinement not be possible, to mitigate against potential contamination effects from these dumping grounds due to sediment mobilisation, construction/decommissioning works should aim to avoid these areas through appropriate leasing and licensing of offshore areas, or the disposed material should be fully tested to determine its toxicity, with appropriate avoidance or mitigation, depending on the results. At the project phase, the degree of disturbance to the seabed should be assessed and, if appropriate, additional contaminant and water quality monitoring should be implemented. This mitigation may also reduce the potential for adverse indirect effects on other receptors e.g., Biodiversity, Flora and Fauna. The seabed sediments of the recommended RZ are predominantly rock or other hard substrate with some areas of coarse substrate, reducing the potential for sediment mobilisation. There is potential for long-term (device operational life) sediment loss within the footprint of foundations and scour protection, and short-term temporary loss in the vicinity of the works during seabed preparation activities, construction, and decommissioning activities (-2). Sediment and erosion occurrence should be minimised through the development, implementation, and enforcement of an ESCP for construction works. Decommissioning methods should be used that aim to minimise the amount of suspended sediment generated. Following the installation of floating wind technologies there is potential for medium to long-term localised impacts on erosion and deposition patterns within close proximity to the devices during the operational phase (-2), given the low mobility of sediments within the recommended RZ. Further mitigation to minimise the potential for adverse effects on sediments and sediment transport is provided in **Section 10.1**.
Water No designated WFD Shellfish Waters or Bathing Waters are within the recommended RZ or tidal excursion zone. Two WFD coastal waterbodies are within the tidal excursion zone, Rathlin Island and North Coast, and there is potential for slight to moderate direct short-term effects on water quality within these areas during the construction and decommissioning phases (-1). It is recommended that further refinement of the recommended RZ zone occurs to minimise potential effects within the tidal excursion zone. Should this refinement not be possible, at the project level, best practice mitigation should be put in place to minimise the potential for adverse effects. This may include sediment testing and water quality monitoring during the construction and decommissioning phases, and a requirement that any hydraulic fluids, anti-fouling components, corrosion of anodes or construction-based discharges used could only release non-toxic/low toxicity compounds (-1). Consultations should take place with environmental bodies regarding the construction methodology and appropriate timing of works to provide the least potential for sediment mobilisation to water bodies. Two spoil dumping grounds are present in the south-east of the recommended RZ, both of which are not currently in use. There is potential for the mobilisation of contaminants if construction (and decommissioning) takes place within these areas, with potential for moderate adverse indirect short- to medium-term effects on water quality within the recommended RZ and tidal excursion zone in the construction and decommissioning phases (-2). It is recommended that further refinement of the recommended RZ away from these sites occurs to avoid the potential for moderate adverse effects during the short-term construction phase. Should this refinement not be possible, to mitigate against potential contamination effects from these dumping grounds, construction/decommissioning works should aim to avoid these areas through appropriate licensing of offshore areas, or the disposed material should be fully tested to determine its toxicity, with appropriate avoidance or mitigation, depending on the results. At the project phase, the degree of disturbance to the seabed should be

assessed and, if appropriate, additional contaminant and water quality monitoring should be implemented. There is potential for localised effects on water quality within the recommended RZ and tidal excursion zone during the short-term construction and decommissioning phases and during device operation (maintenance) due to sediment mobilisation and associated turbidity, construction discharges or accidental contaminant release from machinery and vessels (-1). There is potential for localised effects on water quality, as described above, within the MS Celtic Seas sub-region, however there is not expected to be potential for adverse effects on the achievement of GES for water quality Descriptors (e.g., Descriptor 9 Concentrations of contaminants in fish and other seafood; Descriptor 8: Concentration of contaminants within marine environment; Descriptor 10 marine litter) with the application of standard best practice mitigation during seabed preparation, construction, maintenance and decommissioning activities (-1). The potential for adverse effects on water quality should be minimised at the project level, including through sediment testing and water quality monitoring during the construction and decommissioning phases to identify and mitigate for potential adverse effects at the earliest possible stage. Environmental authorities should be consulted on the construction methodology, and the most appropriate timing of works to provide the least potential for sediment mobilisation to waterbodies. Further mitigation is provided in **Section 10.1**.
Air There is potential for slight adverse, direct, short-term temporary effects on local air quality due to air emissions from vessels and machinery during the construction and decommissioning phases. There is also the potential for slight adverse, short-term, temporary emissions from vessels due to maintenance activities during the operational phase. However, due to the distance of coastal populations from the recommended RZ, it is not expected that there will be potential for adverse direct or indirect, short, medium, or long-term effects on these receptors from air pollution during the construction, operational and decommissioning phases (0). At the project level, emissions of air pollutants should be minimised through adherence to standard best practise for the minimisation of air pollution, as set out in **Section 10.1**. There is potential for significant positive indirect effects on regional air quality in the medium to long-term operational phase, as the operation of renewable energy devices can support a transition away from fossil fuel use and its associated air emissions (+3).
Climatic Factors There are no known areas of blue carbon habitat within the recommended RZ. Ulster Wildlife have identified areas of only low potential for blue carbon importance, therefore, there is unlikely to be potential for adverse effects on blue carbon habitats within the recommended RZ during the construction, operational and decommissioning phases (0). There is potential for slight adverse short-term effects on sediment carbon storage, due to a localised release of CO_2 from seabed disturbance during the construction and decommissioning phases (-1). There is potential for slight adverse, short-term, temporary effects on localised GHG concentrations, due to GHG emissions from vessels and machinery during the construction and decommissioning phases (-1). At the project level, emissions of air pollutants should be minimised through adherence to standard best practise for the minimisation of air pollution, as set out in **Section 10.1**. There is potential for significant positive, medium to long-term effects during the operational phase, as the operation of renewable energy devices can contribute to a net reduction in GHG emissions, decarbonisation of the energy sector, diversification of electricity supply and energy security, and meeting of energy objectives and climate change emission reduction targets (+3).
Material Assets <u>Existing Infrastructure</u> There is the potential for telecommunications of high importance within the recommended RZ to be disrupted during the construction, operation, and decommissioning phases. There is potential for moderate adverse, direct short-term effects due to damage to this cable, and subsequent disruption to telecommunications, during the construction and decommissioning phases (-2), as well as potential for slight adverse medium to long-term (device lifetime) direct effects in the operational phase during recurrent maintenance operations (-1). There is also potential for moderate adverse

indirect effects to telecommunications in the short-term during the construction and decommissioning phases, as access to these existing cables for maintenance maybe reduced temporarily (-2), as well as potential for slight adverse effects in the medium to long-term during the operational phase due to access issues (-1). Thus, given the high importance of the existing infrastructure within the recommended RZ, there is potential for moderate adverse effects on infrastructure in the short, medium, and long-term (-2).

Industry standard mitigation measures can be implemented at the project phase to avoid the potential for direct damage to the existing cable, such as implementation of safety zones (e.g., 500m avoidance areas) around the Hibernia 'A' cable. Clear communication should be undertaken with the owners of Hibernia 'A' during all project planning and installation, to ensure that the construction process does not impact on access requirements to this infrastructure. Taking these mitigation measures into consideration, the potential for adverse effects on infrastructure can be reduced from moderate to negligible (0) in the short, medium, and long-term.

Shipping and Navigation

Given the presence of areas with moderate shipping density, there is potential for direct adverse effects on shipping and navigation within the recommended RZ. There is potential for moderate direct adverse effects in the short-term due to displacement of vessels during construction and decommissioning (-2), as well as medium to long-term displacement from the array area during the operational phase (project lifetime) due to safety exclusion zones (-2). This can result in disruption to vessel routeing and timetables.

There is potential for moderate adverse effects in the short-term during the construction and decommissioning phases due to the risk of collision and allision with vessels associated with ORE development, which may result in hazardous cargo or oil spillage (-2). There is also potential for moderate adverse effects in the medium to long-term operational phase due to a risk of collision with stationary device arrays and subsequent spill risk, as well as safety concerns with under keel clearance reduction (-2). Additionally, there is potential for moderate direct adverse effects on navigation in the medium to long-term operational phase, as devices could obstruct lights, buoys or the coastline (-2); in terms of communication and navigational equipment, AIS and radar systems (including aviation NATS) may be affected. Furthermore, there is potential for moderate adverse effects within installation/decommissioning areas in the short-term construction and decommissioning phases, as the presence of installation vessels and equipment may adversely impact the efficiency of search and rescue operations (-2).

Given the presence of the relatively moderate density shipping area in the north-east of the recommended RZ, there is potential for moderate navigational risk and displacement in the short, medium, and long-term (-2). The potential adverse effects on navigational risk could be mitigated through the implementation of mitigation measures in line with standard Shipping and Navigation mitigation outlined **Section 10.1**. Further refinement of the recommended RZ to avoid the area of moderate density shipping in the north-east is recommended, which could reduce the potential for adverse effects on Navigation and Shipping to slight in the short, medium, and long-term.

Commercial Fisheries

There are relatively lower intensity fishing areas and areas used by inshore pot fisheries within the recommended RZ. There is potential for moderate direct adverse, short-term effects on commercial fisheries operations due to temporary displacement from traditional fishing grounds during construction and decommissioning (-2), as well as potential for long-term effects due to displacement from the recommended RZ during the operational phase (-2). Displacement of fishing activity could result in increased competition for alternate fishing grounds, with potential to adversely affect fish stocks and, by extension, landings, in nearby areas. The potential for adverse effects due to the displacement of vessels could be minimised through further consideration at the next stage of project planning. There should be strategic level caution regarding the siting of ORE infrastructure, with an aim to avoid developments occupying recognised fishing grounds unless there is a successful agreement between the industries that co-location is achievable. Further mitigation with regard to potential co-location is discussed in **Section 10.1.**

There is potential for moderate adverse direct effects due to an increased collision risk of fishing vessels with vessels associated with ORE development in the short-term during the construction and decommissioning phases (-2), and slight effects in the medium to long-term during recurrent maintenance activities in the operational phase (-1). There is also potential for moderate adverse indirect effects in the medium to long-term operational phase, as displacement of fishing vessels from the area may concentrate vessels into a smaller area for shipping and navigation routes, with an associated increased collision risk (-2). There is also potential for moderate adverse effects on fishing activities within the recommended RZ in the operational phase, as actual and/or perceived increased allision risks with devices, or entanglement of fishing gear with devices or attachment infrastructure may lead to avoidance of the area by fishing vessels (-2). To mitigate for navigational risk, further mitigation measures in line with standard Commercial Fisheries mitigation outlined in **Section 10.1** should be implemented. It is imperative that a successful agreement between industries that co-location is achievable is agreed. Further mitigation with regard to potential co-location is also discussed in **Section 10.1.**

There is potential for effects on commercial fish species and their key habitats within the recommended RZ and the tidal excursion zone. There is slight potential for indirect positive effects in the medium to long-term, as hard subsea infrastructure could lead to an enhancement of fish populations at the edges of the array for trawler fishing (+1). There is potential for moderate adverse direct effects in the short-term construction phase, and medium-to long-term operational phase due to the potential for a direct loss of supporting habitats, such as spawning and nursery grounds (-2). There is also potential for moderate adverse direct and indirect effects during the short-term construction and decommissioning phases (-2), and slight effects in the medium to long-term operational phase (-1) due to sediment mobilisation from construction, decommissioning and maintenance activities, respectively, which could have an indirect effect on fishing activity through an alteration of fishing stocks (-2). To minimise the potential for indirect effects on commercial fisheries through impacts on fishing stocks, an ESCP should be developed, implemented, and enforced for construction works, while decommissioning methods used should aim to minimise sediment generated. Further information on the potential ecosystem effects on fish and shellfish species and potential mitigation can be found in the Biodiversity, Flora, and Fauna assessment for the Atlantic Floating recommended RZ.

There is potential for moderate indirect effects on the profitability of commercial fishing in the short, medium, and long-term (-2), such as the potential for reduced quotas, increased resource competition for fishing, and reduced landings in both tonnage and economic value. These could be mitigated by considering the mitigation measures discussed above, and in **Section 10.1**. Further refinement of the recommended RZ to avoid areas used by inshore fisheries and areas with moderate shipping activity is recommended, which could reduce the potential for adverse effects on Commercial Fisheries to slight in the short, medium, and long-term.

<u>Military Areas</u>

There is potential for moderate adverse effects on military activities, including temporary (short-term) disruption of military exercises and activities within the Rathlin Military Practice area and the Skerries Military Practice Area during pre-construction, installation, and decommissioning (-2) phases, and medium to long-term disruption during operation due to the presence of offshore infrastructure (-2). As the entire recommended RZ is within these Military Practice Areas, the area available for military practice activity could be reduced during the operational phase. Consultation with the MoD during the next stage of project planning could help to inform the key areas that should be avoided within the mapped Practice Areas, which could reduce the potential for adverse effects through the displacement of military activities. The risk of collision of military vessels with devices can be minimised through further consultation with the MoD at the next stage of further planning. Measures outlined to mitigate against navigational risk in the Shipping and Navigation Section of **Section 10.1** are also of relevance.

Considering these mitigation measures the potential for adverse effects on military activities could be reduced from moderate to slight (-1) in the short, medium, and long-term.

<u>Aviation</u>

There is potential for slight direct adverse effects on aviation navigation or radar in the medium to long-term during device operation, as the presence of offshore wind devices has the potential to effect communications, navigation, and surveillance within Castlerock Airstrip OLS (-1).

These effects could be mitigated through the implementation of mitigation measures in line with standard Aviation mitigation outlined **Section 10.1.** Further refinement of the recommended RZ through the avoidance of this c.0.7km^2 area of the Castlerock Airstrip OLS is recommended, which could potentially reduce the potential for adverse effects on Aviation to negligible in the short, medium, and long-term (0).

Spoil Dumping Grounds

The two disposal areas within the recommended RZ are not currently active. There is therefore no potential for temporary disruption or displacement of vessels moving to and from disposal sites (0).

Tourism

The potential for effects on tourism is considered indirectly within the topics of Landscape, Seascape and Visual Amenity (visibility of construction activity and operational devices), Population and Human Health (recreational use of the RZ), and Biodiversity, Flora, and Fauna (effects on wildlife). As discussed in the Landscape, Seascape and Visual Amenity Section, there is the potential for significant adverse effects on Landscape, Seascape and Visual Amenity which may result in secondary adverse effects on tourism, as this may act as a deterrent to tourists. Conversely, it is possible the presence of a wind farm will act as a tourist attraction. As discussed in Population and Human Health, there is a negligible potential for adverse effects on the population due to increased noise release in the short-term, as such tourism in unlikely to be impacted by these potential effects. However, there is potential for slight adverse temporary direct and indirect effects on leisure and recreational marine users due to an increased collision risk, access restrictions and displacement, or water quality effects, during the construction and decommissioning phases, which may indirectly adversely affect tourism temporarily. Lastly, as discussed in Biodiversity, Flora and Fauna, there is potential for noise generation to adversely affect wildlife, which may result in a secondary impact on tourism activities such as bird, dolphin or whale watching.

There is the potential for tourism to be impacted by secondary effects. It is not clear whether an overall negative or positive impact will arise. However, it is likely any impact on tourism will be benign and of low significance.

Renewable Energy Generation

The potential capacity of the recommended RZ is 2.22GW. As such, there is potential for significant positive effects in the medium to long-term, owing to the generation of a new renewable energy supply for the NI population (+3).

Overall

Overall, there is considered to be potential for slight adverse effects in the short, medium, and long-term on Material Assets (-2), following the consideration of best practice mitigation measures, which is mainly attributed to the potential for slight adverse effects on Shipping and Navigation, and Commercial Fisheries.

Cultural, Architectural and Archaeological Heritage

There are a small number of known undesignated wrecks within the recommended RZ, and within the tidal excursion zone. There is potential for slight adverse temporary to permanent effects on these features during the short-term construction and decommissioning phases, which may be due to direct damage or disturbance of features within the recommended RZ, or indirect effects via sediment displacement and deposition onto features within the recommended RZ and the tidal excursion zone (-1). There is also potential for slight adverse indirect effects on features within the recommended RZ in the medium to long-term operational phase owing to the potential for scouring

and exposure to occur around features in the vicinity of devices (-1). At the project planning phase, any sites of interest for archaeological potential should be identified and exclusion zones used around these, with conduction of site surveys or trial trenching before any potentially damaging activities take place, with results informing any appropriate mitigation. Modelling of hydrodynamic and sediment transport processes may be necessary to determine potential effects on surrounding archaeological features and determine any appropriate mitigation required. Management of cultural heritage at the project level should be considered through the development and application of a MARP. The recommended RZ is situated between c.3.5km and c.22km distance from the coastline. There is potential for significant adverse indirect effects on the setting of the Giant's Causeway and Causeway Coast WHS (-3), and for significant adverse indirect effects on the setting of coastal heritage features (-3), including for, 551 Listed Buildings, 405 Defence Heritage Record sites, 1370 Scheduled Monuments, 172 Scheduled Zones, and 24 Parks and Gardens (including Downhill, Cromore, Dunluce Castle, Dundarave) that are within the modelled viewshed. There is potential for short-term adverse effects on the setting of these features during the construction and decommissioning phases, and for medium and long-term effects during device operation, owing to the potential visibility of vessels and machinery and device arrays, respectively. Skerries and Dunluce Coast and Causeway Coast RSCAs are situated inshore. Cultural heritage features that are listed as cultural influences for the Skerries and Dunluce Coast RSCA include Dunluce Castle (designated an Area of Significant Archaeological Interest, Monument in State Care, and Registered Historic Park/Garden), historic harbours and settlements at Portrush and Portballintrae, and many WW2 coastal defence sites. Those listed as cultural influences for Causeway Coast RSCA include the Giant's Causeway and Causeway Coast WHS, Dunseverick Castle and earthworks (Scheduled Area), Ecclesiastical sites, and sites that evidence early occupation and ritual use of the area (e.g., standing stones, Neolithic and Iron Age occupation sites). Further refinement of the recommended RZ away from the coastline and sensitive cultural heritage designations is recommended to reduce the potential for significant adverse effects. Areas of the highest landscape and seascape sensitivity should be avoided, where possible, during the next stage of project planning. At the project planning phase, a SLVIA should be undertaken and should inform project design and appropriate mitigation to minimise adverse effects, and this should include consideration of potential impacts on views from sites of historic importance.
Landscape, Seascape and Visual Amenity The recommended RZ is situated between c.3.5km and c.22km distance from the coastline. Causeway Coast AONB, Antrim Coast and Glens AONB and Binevenagh AONB, as well as the Giant's Causeway and Causeway Coast WHS are situated inshore and are within the modelled viewshed. There is potential for significant adverse indirect effects on these sites, both in the short-term construction and decommissioning phases from the presence of vessels and machinery (-3), and during the operational phase from the presence of device arrays (-3), owing to the very high sensitivity of the landscape. There are 11 National Trust Lands (Avish, Barmouth Grangemore and Portstewart, Carrick a Rede, Cushleake Mountain, Downhill, Dunseverick, Fairhead and Murlough Bay, Giants Causeway, Hezlett House, Rathlin Island, and Whitepark Bay), and transboundary Areas of Especially High Scenic Amenity and High Scenic Amenity in County Donegal that are also within the modelled viewshed. There is also potential for significant adverse indirect effects on the setting of these areas, both in the short-term construction and decommissioning phases and the medium to long-term operational phase as described above (-3), owing to the high sensitivity of the landscapes. There is also potential for transboundary effects for the south of the Isle of Islay and south-west of Kintyre in Scotland. The recommended RZ is within the Atlantic NI RSCA and is offshore of The Skerries and Dunluce Coast and Causeway Coast RSCAs. There is potential for adverse effects in the medium and long-term within these areas, as the presence of device arrays may alter the character of these RSCAs. There is potential for moderate adverse indirect visual effects in the short, medium, and long-term for the inshore coastal population, including within 36 settlements (including Portstewart, Portrush, Castlerock, Coleraine, Bushmills, Portballintrae, and Ballycastle) that are within the modelled viewshed (-2). There is also potential for transboundary effects on visual amenity for the population along the north-east coastline of County Donegal in RoI, and in the south of the Isle of Islay and south-west of Kintyre in Scotland, as these areas are also within the modelled viewshed.

There is also potential for in-combination or cumulative landscape/seascape and visual effects with the Malin Sea Wind project (owners ESB Wind Development Ltd., CATAGEN, Dublin Offshore, which is currently at concept / early planning stage, and situated further offshore.

Further refinement of the recommended RZ away from the coastline and landscape designations is recommended to reduce the potential for significant adverse effects. Areas of the highest landscape and seascape sensitivity should be avoided, where possible, during the next stage of project planning. At the project planning phase, a SLVIA should be undertaken and should inform project design and appropriate mitigation to minimise adverse effects.

G.6 Floating Wind Resource Zone: Rathlin Torr Head

Discussion of Potential Impacts
Biodiversity, Flora and Fauna <u>Benthic Habitats and species:</u> There are no designated sites for benthic habitats and species within the recommended RZ. Red Bay SAC, designated for sandbank habitats, is situated c.3km to the south of the recommended RZ, Rathlin Island SAC, designated for Sea Caves, Reefs, Sandbanks, Drift line vegetation and Sea Cliffs, is situated c.3.5km, and Rathlin Island MCZ, designated for Deep-sea Bed, is situated c.2.5km to the north-west; these sites are within the tidal excursion zone. There is potential for significant adverse indirect effects on designated habitat features of these sites in the short-term construction and decommissioning phases from sedimentation or water quality effects (-3). Further refinement of the recommended RZ away from these sites is recommended to avoid the potential for significant adverse effects during construction. Areas of Annex I Reef habitat are also present within the recommended RZ and tidal excursion zone. There is potential for moderate adverse direct or indirect effects on these features both in the short-term construction and decommissioning phases and in the medium to long-term from indirect loss or damage, and sedimentation or water quality effects (-2). There are areas of known Annex I Sea Caves within the tidal excursion zone to the north-west (around Rathlin Island), and areas of Annex I Sandbank and Maerl habitats within the tidal excursion zone to the north-west (around Rathlin Island) and to the south-west (around Red Bay). There is potential for moderate adverse indirect effects on these features in the short-term construction and decommissioning phases from sedimentation or water quality effects (-2). The seabed habitats within the recommended RZ predominantly consist of coarse substrate, with scattered areas of rock or hard substrate, particularly in the north-west and inshore areas. There are no recorded occurrences of benthic NI Protected, Priority species or PMFs within the recommended RZ. There is potential for slight adverse direct and indirect effects on non-sensitive benthic habitats and species from localised benthic loss, or pollution or sedimentation effects during the short-term construction and decommissioning phases (-1), and the medium and long-term operational phase (-1). These effects may be minimised based on micro-siting at the project level; project planning mitigation should aim for avoidance of areas of benthic ecological importance, particularly areas where protected habitats and species are present, and installation in areas where non-sensitive habitats or species are present with the use of appropriate installation techniques. The volume of rock used for cable armouring, pipeline protection and foundation scour protection should be planned as the minimum required, to minimise habitat loss. At the project planning phase, sediment and erosion occurrence should be minimised through the development, implementation, and enforcement of an ESCP for construction and decommissioning works, and modelling of hydrodynamic and sediment transport processes to assess potential effects and determine suitable mitigation to minimise these. There are no records of invasive species within the recommended RZ; there is a potential risk of introduction of invasive species to the area with potential for slight adverse direct effects during the short-term construction and decommissioning phases (-1), and in the medium to long-term during operational maintenance (-1). Mitigation to reduce the risk of introduction of invasive species to the area is provided in **Section 10.1.**

Fish and Shellfish:

There are no designated sites for fish and shellfish within the recommended RZ or the tidal excursion zone. There is a TCE Moderate MPA risk area for Fish within the recommended RZ owing to the potential for migratory fish species such as Atlantic salmon to use the area. There is potential for moderate adverse indirect effects in the short-term construction and decommissioning phases from supporting habitat loss or damage, sedimentation, and smothering effects and via impacts on water quality (-2), and in the medium and long-term operational phase due to a loss of supporting habitat (-2).

There are (Ellis *et al*. (2012) CEFAS) fish nursery grounds of low intensity for anglerfish, cod, common skate, hake, herring (in the west), and mackerel within the recommended RZ and tidal excursion zone; these low intensity grounds all cover large areas. There are known (Coull *et al*. (1998) CEFAS) spawning grounds for sprat and Nephrops within the recommended RZ and tidal excursion zone, a nursery ground for cod in the north-east of the recommended RZ and tidal excursion zone, a nursery ground for Nephrops across the entire recommended RZ and tidal excursion zone, and a nursery ground for whiting within the tidal excursion zone to the south-east. There are also areas of AFBI surveyed relatively moderate density for queen scallops within the tidal excursion zone to the north-west. There is potential for moderate adverse direct and indirect effects in the short-term construction and decommissioning phases from habitat loss or damage, sedimentation, and smothering effects and via impacts on water quality (-2), and in the medium and long-term operational phase due to a loss of supporting habitat (-2).

There are records of NI Protected, Priority, PMF, and OSPAR Threatened/Declining species basking shark. There is potential for moderate adverse direct and indirect effects on this sensitive species, and other species that may be within the area, from disturbance, displacement and localised loss of, or damage to supporting habitats during the short-term construction and decommissioning phases (-2), and moderate adverse direct and indirect medium to long-term effects due to loss of supporting habitats, habitat exclusion and displacement, barrier effects, entanglement or EMF effects (-2).

As described for Benthic Habitats and Species, project planning mitigation should aim for avoidance of areas of benthic ecological importance, particularly areas where protected habitats and species are present. Areas should be avoided that may generate increased levels of suspended sediment that coincide with areas of fish spawning grounds or sensitive species. Where this is not possible, appropriate timing restrictions should be applied to works, and/or less disruptive installation methods used, to minimise effects on sediment mobilisation, disturbance, and displacement of species from the construction area.

In the medium and long-term, there is potential for slight positive indirect effects (+1) owing to device colonisation and the possibility that device arrays may cause a reef effect, however this may also lead to a slight adverse indirect short-term effect (-1) should colonised structures be removed at decommissioning. Mitigation measures during the project planning phase should consider the decommissioning activities that will be used, and whether removal of colonised structures, foundations or scour protection is required, or could result in a double habitat loss (that from pre-construction and decommissioning periods). If fishing is excluded from the array area, there may be potential for positive effects on fish species and supporting habitats such as spawning and nursery grounds within the operational phase.

Marine Mammals:

There are no designated sites for marine mammals within the recommended RZ or tidal excursion zone. There is a TCE High MPA risk area for Marine Mammals in the north-west of the recommended RZ. There is potential for moderate adverse direct and indirect effects on designated marine mammals, in the short-term pre-construction, construction, and decommissioning phases due to noise impacts, disturbance and displacement, and collision risk (-2), and in the medium and long-term operational phase due to habitat exclusion, displacement and potential entanglement risk (-2).

There are areas of recorded relatively high (pilot whale, fin whale) and moderate (white-beaked dolphin, pilot whale, bottlenose dolphin, and beaked whale) density for cetacean species, as well as areas of relatively high and moderate density for harbour seal and relatively moderate density for grey seal, within the recommended RZ. There are also records of NI Protected, Priority, or PMF marine mammal species, including harbour porpoise, minke whale, and short-beaked common dolphin. There is potential for moderate adverse direct and indirect short, medium, and long-term effects as described above (-2), including the potential for transboundary effects on these sensitive species, as well as other marine mammals that may be present within the area.

During project planning for wind turbines, the key areas of marine mammal habitats and migratory routes should be identified, including through the conduction of pre-construction surveys and consultation with environmental stakeholders, and development avoided within these areas, whenever possible. Pre-construction, construction, and decommissioning activities should be planned to minimise the potential for adverse effects on marine mammals, including temporal activity planning, limiting vessel activity and mitigation against potential noise effects, including through avoidance of foundation installation such as piling that generates higher noise and avoidance or use of low-noise methods to dispose of any UXO within the development area. The potential for pre-construction, construction, and decommissioning phase adverse effects can be minimised through the application of standard best practice mitigation for marine mammals, including the use of marine mammal observers. Turbines and associated infrastructure should be designed to minimise effects during operation, such as to minimise the potential collision risk for marine mammals with turbines and attachment infrastructure.

Birds:

There are no designated sites for bird species within the recommended RZ. However, Rathlin Island SPA and MCZ are situated c.3.5km and 2.5km to the north-west, respectively, and are within the tidal excursion zone. The SPA is designated for breeding populations of razorbill, black-legged kittiwake, and common guillemot, and its seabird assemblage, while the MCZ has been designated for its importance in supporting a large population of breeding black guillemot. There is also a TCE High MPA risk area for Breeding Birds within the recommended RZ, and a Very High MCZ risk area for Birds in the north-west owing to the proximity to Rathlin Island MCZ. There is potential for significant adverse direct and indirect effects on designated bird species, in the short-term pre-construction, construction, and decommissioning phases due to noise impacts, disturbance and displacement, damage or loss of supporting habitat, and collision risk (-3), and in the medium and long-term operational phase due to habitat exclusion and displacement and potential collision risk (-3). Further refinement of the recommended RZ away from these sites is recommended to avoid the potential for significant adverse effects.

There are areas of recorded relatively moderate density for seabirds at sea within the recommended RZ, and there are records of NI Protected, Priority, PMF or OSPAR Threatened/Declining bird species grey heron, black-legged kittiwake, Atlantic puffin, black guillemot, herring gull, oystercatcher, black-headed gull, curlew, common eider, and razorbill. There is potential for moderate adverse direct and indirect short, medium, and long-term effects on seabird species, as described above (-2), including the potential for transboundary effects. There is also an area of predicted medium seabed suitability for sandeel within the recommended RZ. There is greater potential for adverse effects on seabirds within important foraging areas, through loss or damage to these species and their habitats during construction, displacement from these areas during construction and operation, and potentially, through a higher risk of collision for seabird species that prioritise the area for foraging; the degree of effect relating to these areas will differ between seabird species, depending on the importance of sandeel to their diet, and ability to access this food source at different water depths. Key foraging grounds outside of designated sites should be further investigated at the next stage of future planning and appropriate mitigation applied to avoid or reduce the potential for adverse effects.

During project planning for wind turbines, the key areas of bird habitats and migratory routes should be identified, including through the conduction of pre-construction surveys and consultation with environmental stakeholders, and development avoided within these areas, whenever possible. Pre-construction, construction, and decommissioning activities should be planned to minimise the potential for adverse effects on birds, including temporal activity planning, limiting vessel activity and mitigation against potential noise effects. Turbines and associated infrastructure should be designed to minimise effects, particularly collision risk, during operation.

Population and Human Health

There is potential for slight adverse short-term, temporary noise and visual effects on the local population due to noise generated and visual impacts during the construction and decommissioning phases, and visual flicker and noise effects during operation. However, due to the distance of the recommended RZ offshore, these effects should be limited to vessel occupants transiting through the area, and there is not expected to be potential for direct, short, medium, or long-term, disturbance of coastal populations due to noise or visual effects during the construction, operational, or decommissioning phases (0). The potential for indirect visual effects to coastal populations during the operational phase is considered under the Landscape, Seascape and Visual Amenity topic.

There are no Bathing Water sites, Blue Flag Beaches or dive sites within the recommended RZ, and therefore there is not considered to be potential for adverse effects on these areas within the construction, operational, or decommissioning phases (0).

There is potential for moderate adverse temporary direct and indirect effects on leisure and recreational marine users due to an increased collision risk, access restrictions and displacement, or water quality effects, during the construction and decommissioning phases due to known use of the area by leisure vessels (-2). There is also potential for moderate adverse long-term (device life) effects due to an enhanced collision risk for recreational and leisure vessels with wind turbine blades and submerged infrastructure (-2), and potential for moderate adverse long-term (device life) effects due to displacement of recreational and leisure craft from the array area during the operational phase (-2). At the next stage of project planning, the potential for interaction with areas of known high use by leisure users should be avoided or minimised. At the project level, further mitigation to minimised risk to leisure users could include the use of exclusion zones around developments and timely and effective communication regarding construction works, as well as appropriate marking of devices and the array area.

Geology, Soils and Land Use

There are no sites designated for geological or geomorphological features, i.e., MCZs, WHSs, ASSIs, or UNESCO Geoparks, within the recommended RZ. However, four ASSIs and one MCZ are within the tidal excursion zone and are designated for geological/geomorphological features; there is potential for significant adverse indirect short to long-term effects on designated features within these sites e.g., through changes in hydrodynamics, and sediment dynamics during the construction, decommissioning and/or operational phases (-3). At the project planning phase, coastal process modelling should be undertaken to determine the potential for adverse effects on designated sites, with further appropriate mitigation proposed to avoid or minimise adverse effects e.g., through a suitable design of device arrays (adequate spacing between developments/arrays) to reduce the potential for excessive energy extraction altering coastal processes and regimes. There are Annex 1 Reef habitats within the recommended RZ, and there is potential for moderate direct, temporary to permanent effects on these features through loss or damage during the construction and decommissioning phases (-2). These features should be avoided through micro-siting at the project level.

Floating wind technologies within this recommended RZ are likely to be predominantly in the TCE technology group of 5 (Piling with socket anchoring for a moderate sea state) with an area of technology group 3 (Complex anchoring for a moderate sea state), encountering undifferentiated quaternary deposits of diamict of generally thinner sediments of <5m thickness. This is likely to require relatively less invasive installation technologies to be employed, with potential for slight adverse direct long-term effects on the seabed geology and sediments through loss of material (-1). There is potential for influence on the MS Descriptor 6 sea floor integrity with the installation processes of floating wind technologies; there is not anticipated to be potential for effects on the achievement of GES Status of this Descriptor owing to the spatial extent of physical loss, however this should be fully considered at the project phase, and any appropriate mitigation put in place.

There are no known areas of potential contamination within the recommended RZ i.e., no dumping grounds of spoil ground, or explosive grounds. There is therefore not expected to be potential for adverse direct or indirect short, medium, or long-term effects on sediments within the recommended d RZ from interaction with potentially contaminated areas (0).

The seabed sediments of the recommended RZ are predominantly rock or other hard substrate with some areas of coarse substrate, reducing the potential for sediment mobilisation. There is potential

for long-term (device operational life) sediment loss within the footprint of foundations and scour protection, and short-term temporary loss in the vicinity of the works during seabed preparation activities, construction, and decommissioning activities (-2). Sediment and erosion occurrence should be minimised through the development, implementation, and enforcement of an ESCP for construction works. Decommissioning methods should be used that aim to minimise the amount of suspended sediment generated. Following the installation of floating wind technologies there is potential for medium to long-term localised impacts on erosion and deposition patterns within close proximity to the devices during the operational phase (-2), given the low mobility of sediments within the recommended RZ. Further mitigation to minimise the potential for adverse effects on sediments and sediment transport is provided in **Section 10.1**.
Water One WFD coastal waterbody of North Channel is within the recommended RZ and three WFD coastal waterbodies are within the tidal excursion zone; there is potential for adverse direct and indirect short- to long-term effects on hydromorphological status of these waterbodies during the operational phase (-3). No WFD Shellfish Waters or Bathing Waters are within the recommended RZ. Cushendall WFD Bathing Waters is within the tidal excursion zone, and there is potential for moderate direct short-term effects on water quality within this site during seabed preparation, construction, and decommissioning activities (-3). At the project level, best practice mitigation should be put in place to minimise the potential for adverse effects. This may include sediment testing and water quality monitoring during the construction and decommissioning phases, and a requirement that any hydraulic fluids, anti-fouling components, corrosion of anodes or construction-based discharges used could only release non-toxic/low toxicity compounds (-1). Consultations should take place with environmental bodies regarding the construction methodology and appropriate timing of works to provide the least potential for sediment mobilisation to water bodies. There are no known areas of potential contamination within the recommended RZ i.e., no dumping grounds of spoil ground, or explosive dumping grounds. There is therefore not expected to be potential for adverse direct or indirect, short, medium, or long-term effects on water quality within the recommended RZ or tidal excursion zone from interaction with potentially contaminated areas (0). There is potential for localised effects on water quality within the recommended RZ and tidal excursion zone during the short-term construction and decommissioning phases and during device operation (maintenance) due to sediment mobilisation and associated turbidity, construction discharges or accidental contaminant release from machinery and vessels (-1). There is potential for localised effects on water quality, as described above, within the MS Celtic Seas sub-region, however there is not expected to be potential for adverse effects on the achievement of GES for water quality Descriptors (e.g., Descriptor 9 Concentrations of contaminants in fish and other seafood; Descriptor 8: Concentration of contaminants within marine environment; Descriptor 10 marine litter) with the application of standard best practice mitigation during seabed preparation, construction, maintenance and decommissioning activities (-1). The potential for adverse effects on water quality should be minimised at the project level, including through sediment testing and water quality monitoring during the construction and decommissioning phases to identify and mitigate for potential adverse effects at the earliest possible stage. Environmental authorities should be consulted on the construction methodology, and the most appropriate timing of works to provide the least potential for sediment mobilisation to waterbodies. Further mitigation is provided in **Section 10.1**.
Air There is potential for slight adverse, direct, short-term temporary, effects on local air quality due to air emissions from vessels and machinery during the construction and decommissioning phases. There is also the potential for slight adverse, short-term, temporary emissions from vessels due to maintenance activities during the operational phase. However, due to the distance of coastal populations from the recommended RZ, it is not expected that there will be potential for adverse direct or indirect, short, medium, or long-term effects on these receptors from air pollution during the construction, operational and decommissioning phases (0). At the project level, emissions of air pollutants should be minimised through adherence to standard best practise for the minimisation of air pollution, as set out in **Section 10.1**.

There is potential for slight positive indirect effects on regional air quality in the medium to long-term operational phase, as the operation of renewable energy devices can support a transition away from fossil fuel use and its associated air emissions (+1).

Climatic Factors

There are no identified areas of blue carbon habitat within the recommended RZ, therefore, there is unlikely to be potential for adverse effects on blue carbon habitats within the recommended RZ during the construction, operational and decommissioning phases (0). There is potential for slight adverse short-term effects on sediment carbon storage, due to a localised release of CO_2 from seabed disturbance during the construction and decommissioning phases (-1).

There is potential for slight adverse, short-term, temporary effects on localised GHG concentrations, due to GHG emissions from vessels and machinery during the construction and decommissioning phases (-1). At the project level, emissions of air pollutants should be minimised through adherence to standard best practise for the minimisation of air pollution, as set out in **Section 10.1**.

There is potential for slight positive, medium to long-term effects during the operational phase, as the operation of renewable energy devices can contribute to a net reduction in GHG emissions, decarbonisation of the energy sector, diversification of electricity supply and energy security, and meeting of energy objectives and climate change emission reduction targets (+1).

Material Assets

Existing Infrastructure

There is no existing infrastructure (cables, pipelines) within the recommended RZ and, as such, there is no potential for effects on infrastructure in the short, medium, and long-term (0).

Shipping and Navigation

Given the presence of the high-density shipping route, there is potential for significant direct adverse effects on shipping and navigation in the short-term due to displacement of vessels during the construction and decommissioning phases (-3), as well as medium to long-term displacement from the array area during the operational phase (project lifetime) due to safety exclusion zones (-3). This can result in disruption to vessel routeing and timetables. In addition, the recommended RZ is within a 2nm buffer of the North Channel TSS.

There is potential for significant direct adverse effects in the short-term during the construction and decommissioning phases due to the risk of collision and allision with vessels associated with ORE development, which may result in hazardous cargo or oil spillage (-3). There is also potential for significant adverse effects in the medium to long-term operational phase due to a risk of collision with stationary device arrays and subsequent spill risk, as well as safety concerns with under keel clearance reduction (-3). Additionally, there is potential for significant direct adverse effects on navigation in the medium to long-term operational phase, as devices could obstruct lights, buoys or the coastline (-3); in terms of communication and navigational equipment, AIS and radar systems (including aviation NATS) may be affected. Furthermore, there is potential for significant adverse effects within installation/decommissioning areas in the short-term construction and decommissioning phases, as the presence of installation vessels and equipment may adversely impact the efficiency of search and rescue operations (-3).

Given the presence of the relatively higher density shipping areas in the north and east of the recommended RZ and the location of the recommended RZ within a 2nm buffer of the North Channel TSS, there is potential for significant navigational risk and displacement in the short, medium, and long-term (-3). The potential significant adverse effects on navigational risk could be mitigated through the implementation of mitigation measures in line with standard Shipping and Navigation mitigation outlined in **Section 10.1**. Further refinement of the recommended RZ through avoidance of this higher density Kintyre Express route is recommended which could reduce the potential impacts to navigational risk and displacement to moderate in the short, medium, and long-term (-2).

Commercial Fisheries

There are relatively lower intensity fishing areas and areas used by inshore fisheries within the recommended RZ. There is potential for moderate direct adverse, short-term effects on commercial fisheries operations due to temporary displacement from traditional fishing grounds during construction and decommissioning (-2), as well as potential for long-term effects due to displacement from the recommended RZ during the operational phase (-2). Displacement of fishing activity could result in increased competition for alternate fishing grounds, with potential to adversely affect fish stocks and, by extension, landings, in nearby areas. The potential for adverse effects due to the displacement of vessels can be minimised through further consideration at the next stage of project planning. There should be strategic level caution regarding the siting of ORE infrastructure, with an aim to avoid developments occupying recognised fishing grounds unless there is a successful agreement between the industries that co-location is achievable. Further mitigation with regard to potential co-location is discussed in **Section 10.1**.

There is potential for moderate adverse direct effects due to an increased collision risk of fishing vessels with vessels associated with the ORE development in the short-term during the construction and decommissioning phases (-2), and slight effects in the medium to long-term during recurrent maintenance activities in the operational phase (-1). There is also potential for moderate adverse indirect effects in the medium to long-term operational phase, as displacement of fishing vessels from the area may concentrate vessels into a smaller area for shipping and navigation routes, with an associated increased collision risk (-2). There is also potential for moderate adverse effects on fishing activities within the recommended RZ in the operational phase, as actual and/or perceived increased allision risks with devices, or entanglement of fishing gear with devices or attachment infrastructure may lead to avoidance of the area by fishing vessels (-2). To mitigate for navigational risk, further mitigation measures in line with standard Commercial Fisheries mitigation outlined in **Section 10.1** should be implemented. It is imperative that a successful agreement between industries that co-location is achievable is agreed. Further mitigation with regard to potential co-location is also discussed in **Section 10.1**.

There is potential for effects on commercial fish species and their key habitats within the recommended RZ and the tidal excursion zone. There is slight potential for indirect positive effects in the medium to long-term, as hard subsea infrastructure could lead to an enhancement of fish populations at the edges of the array for trawler fishing (+1). There is potential for moderate adverse direct effects in the short-term construction, and medium to long-term operational phase due to the potential for a direct loss of supporting habitats, such as spawning and nursery grounds (-2). There is also potential for moderate adverse direct and indirect effects during the short-term construction and decommissioning phases (-2), and slight effects the medium to long-term operational phase (-1) due to sediment mobilisation from construction, decommissioning and maintenance activities, respectively, which could have an indirect effect on fishing activity through an alteration of fishing stocks (-2). To minimise the potential for indirect effects on commercial fisheries through impacts on fishing stocks, an ESCP should be developed, implemented, and enforced for construction works, while decommissioning methods used should aim to minimise sediment generated. Further information on the potential ecosystem effects on fish and shellfish species and potential mitigation can be found in the Biodiversity, Flora, and Fauna assessment for the Rathlin Torr Head Floating recommended RZ.

There is potential for moderate indirect effects on the profitability of commercial fishing in the short, medium, and long-term (-2), such as the potential for reduced quotas, increased resource competition for fishing, and reduced landings in both tonnage and economic value. These effects could be mitigated through considering the mitigation measures discussed above, and in **Section 10.1**. Further refinement of the recommended RZ through avoidance of the areas important for inshore fisheries, the areas of highest known importance for fish spawning and nursery grounds and of areas of moderate fishing activity is recommended, which could reduce the potential effects on commercial fisheries to moderate in the short, medium, and long-term (-2).

<u>Military Areas</u>

There is potential for moderate adverse effects on military activities, including temporary (short-term) disruption of military exercises and activities within the Rathlin Military Practice Area and the Torr Head Military Practice Area during pre-construction, installation, and decommissioning (-2) phases, and medium to long-term disruption during the operational phase due to the presence of offshore infrastructure (-2). As the entire recommended RZ is within these Military Practice Areas, the area available for military practice activity could be reduced during the operational phase. Consultation with the MoD during the next stage of project planning could help to inform the key areas that should be avoided within the mapped Practice Areas, which could reduce the potential for adverse effects due to the displacement of military activities. The risk of collision of military vessels with devices can be minimised through further consultation with the MoD at the next stage of further planning. Measures outlined to mitigate against navigational risk in the Shipping and Navigation Section of **Section 10.1** are also of relevance.

Considering these mitigation measures the potential for adverse effects on military activities could be reduced from moderate to slight (-1) in the short, medium, and long-term.

<u>Aviation</u>

There are no safeguarding zones for aviation interference within the recommended RZ. The presence of devices has limited potential to effect communications, navigation, and surveillance and, therefore, there is potential for negligible effects on aviation navigation or radar (0).

<u>Spoil Dumping Grounds</u>

There are no spoil dumping grounds located within the recommended RZ. There is, therefore, no potential for temporary disruption or displacement of vessels moving to and from disposal sites (0).

<u>Tourism</u>

The potential for effects on tourism is considered indirectly within the topics of Landscape, Seascape and Visual Amenity (visibility of construction activity and operational devices), Population and Human Health (recreational use of the RZ), and Biodiversity, Flora, and Fauna (effects on wildlife). As discussed in the Landscape, Seascape and Visual Amenity Section, there is potential for significant adverse effects on Landscape, Seascape and Visual Amenity which may result in secondary adverse effects on tourism, as this may act as a deterrent to tourists. Conversely, it is possible the presence of a wind farm will act as a tourist attraction. As discussed in Population and Human Health, there is slight potential for adverse effects on increased noise release in the short-term, as such tourism in could be impacted by these potential effects. However, there is potential for significant adverse temporary direct and indirect effects on leisure and recreational marine users due to an increased collision risk, access restrictions and displacement, or water quality effects, during the construction (and decommissioning) phase, which may indirectly adversely affect tourism temporarily. Lastly, as discussed in Biodiversity, Flora and Fauna, there is potential for noise generation to adversely affect wildlife, which may result in a secondary impact on tourism activities such as bird, dolphin or whale watching.

<u>Renewable Energy Generation</u>

The potential capacity of the recommended RZ is 0.43GW. As such, there is potential for slight positive effects in the medium- to long-term, owing to the generation of a new renewable energy supply for the NI population (+1).

<u>Overall</u>

Overall, there is considered to be potential for significant adverse effects in the short, medium, and long-term on Material Assets (-3), following the consideration of best practice mitigation measures, which is mainly attributed to the potential for moderate adverse effects on Commercial Fisheries, and significant adverse effects on Shipping and Navigation.

Cultural, Architectural and Archaeological Heritage

There are a small number of known undesignated wrecks within the recommended RZ, and within the tidal excursion zone. There is potential for slight adverse temporary to permanent effects on these features during the construction and decommissioning phases, which may be due to direct damage or disturbance of features within the recommended RZ, or indirect effects via sediment displacement and deposition onto features within the recommended RZ and the tidal excursion zone (-1). There is also potential for slight adverse indirect effects on features within the recommended RZ in the medium to long-term operational phase owing to the potential for scouring and exposure to occur around features in the vicinity of devices (-1). At the project planning phase, any sites of interest for archaeological potential should be identified and exclusion zones used around these, with conduction of site surveys or trial trenching before any potentially damaging activities take place, with results informing any appropriate mitigation. Modelling of hydrodynamic and sediment transport processes may be necessary to determine potential effects on surrounding archaeological features and determine any appropriate mitigation required. Management of cultural heritage at the project level should be considered through the development and application of a MARP.

The recommended RZ is situated between c.0.5km and c.5km distance from the coastline. There is potential for significant adverse indirect effects on the setting of the Giant's Causeway and Causeway Coast WHS (-3), and for significant adverse indirect effects on the setting of coastal heritage features (-3), including for, 495 Listed Buildings, 119 Defence Heritage Record sites, 864 Scheduled Monuments, 101 Scheduled Zones, and 10 Parks and Gardens (Drumalis, Chaine Park, Carnfunnock Country Park, Glenarm Castle, Drumnasole House, Garron Tower, Cairndhu, Manor House (Rathlin), Magherintemple, and Beardiville) that are within the modelled viewshed. There is potential for short-term adverse effects on the setting of these features during the construction and decommissioning phase, and for medium and long-term effects during device operation, owing to the potential visibility of vessels and machinery and device arrays, respectively.

The recommended RZ is within the Torr Head Coast, and North Channel RSCAs. Cultural heritage features that are listed as cultural influences for Torr Head Coast RSCA include a concentration of sites on and close to Torr Head, including a cashel, megalithic tomb, souterrains, enclosures, standing stones and graveyard, maritime sites such as a harbour at Portaleen and coastguard stations at Torr Head and Runabay Head, and prehistoric sites, including on high land overlooking the sea. Those listed as cultural influences for North Channel RSCA include a large number of shipwrecks scattered across the seabed.

Screening out, or further refinement of the recommended RZ away from the coastline and sensitive cultural heritage designations is recommended to avoid or reduce the potential for significant adverse effects. Areas of the highest landscape and seascape sensitivity should be avoided, where possible, during the next stage of project planning. At the project planning phase, a SLVIA should be undertaken and should inform project design and appropriate mitigation to minimise adverse effects, and this should include consideration of potential impacts on views from sites of historic importance.

Landscape, Seascape and Visual Amenity

The recommended RZ is situated between c.0.5km and c.5km distance from the coastline. Causeway Coast AONB, Antrim Coast and Glens AONB and Binevenagh AONB, as well as the Giant's Causeway and Causeway Coast WHS are situated inshore and are within the modelled viewshed. There is potential for significant adverse indirect effects on these sites, both in the short-term construction and decommissioning phases from the presence of vessels and machinery (-3), and during the operational phase from the presence of device arrays (-3), owing to the very high sensitivity of the landscape. There are 11 National Trust Lands (Carrick a Rede, Cushendun, Cushleake Mountain, Dunseverick, Fairhead and Murlough Bay, Giants Causeway, Islandmagee, Layde, Loughan Bay and Portaleen Bay, Rathlin Island, and Whitepark Bay Avish) that are also within the modelled viewshed. There is also potential for significant adverse indirect effects on the setting of these areas, both in the short-term construction and decommissioning phases and the medium to long-term operational phase as described above (-3), owing to the high sensitivity of the landscapes. There is also potential for transboundary effects for the south coastlines of Kintyre and the Isle of Islay in Scotland.

The recommended RZ is within the Torr Head Coast, and North Channel RSCAs. There is potential for adverse effects in the medium and long-term within these areas, as the presence of device arrays may alter the character of these RSCAs.

There is potential for moderate adverse visual effects in the short, medium, and long-term for the inshore coastal population, including within 19 settlements (Mullaghboy, Dunaghy, Church Bay, Glenarm, Ballygalley, Ballycastle, Coleraine, Glenariff Bay, Knocknacarry, Portrush, Carnlough, Waterfoot, Ballymoney, Carncastle, Ballintoy, Cushendall, Ballybogy, Cushendun, and Larne) that are within the modelled viewshed (-2). There is also potential for transboundary effects on visual amenity for the population along the south coastlines of Kintyre and the Isle of Islay in Scotland, as these areas are also within the modelled viewshed.

Screening out, or further refinement of the recommended RZ away from the coastline and landscape designations is recommended to avoid or reduce the potential for significant adverse effects. Areas of the highest landscape and seascape sensitivity should be avoided, where possible, during the next stage of project planning. At the project planning phase, a SLVIA should be undertaken and should inform project design and appropriate mitigation to minimise adverse effects.

G.7 Floating Wind Resource Zone: North Channel

Discussion of Potential Impacts

Biodiversity, Flora and Fauna

Benthic Habitats and species:

There are no designated sites for benthic habitats and species within the recommended RZ. The Maidens SAC, designated for Reef and Sandbank habitats, is within the tidal excursion zone of the northern section of the recommended RZ, and there is also a TCE Very High MPA risk area for Habitat in this area. There is potential for significant adverse indirect effects on designated features both in the short-term construction and decommissioning phases (-3) and in the medium to long-term from loss or damage, and sedimentation or water quality effects (-3). Further refinement of the recommended RZ away from this site is recommended to avoid the potential for significant adverse effects during construction.

There are known areas of Annex I Reef habitat within the recommended RZ, particularly in the centre of the northern section, and within the tidal excursion zone. There is potential for moderate adverse direct or indirect effects on these features both in the short-term construction and decommissioning phases (-2) and in the medium to long-term from indirect loss or damage, and sedimentation or water quality effects (-2). There are recorded occurrences of benthic NI Priority species and PMFs of starfish, sea cucumbers, sponges, molluscs, hydrozoans, and bryozoans within the recommended RZ. There is potential for moderate direct and indirect adverse effects on these sensitive habitats and species, as well as on non-sensitive benthic habitats and sedentary species from localised benthic loss, or pollution and sedimentation effects during the short-term construction and decommissioning phases (-2), and the medium and long-term operational phase (-2). These effects may be minimised based on micro-siting at the project level; project planning mitigation should aim for avoidance of areas of benthic ecological importance, particularly areas where protected habitats and species are present, and installation in areas where non-sensitive habitats or species are present with the use of appropriate installation techniques. The volume of rock used for cable armouring, pipeline protection and foundation scour protection should be planned as the minimum required, to minimise habitat loss. At the project planning phase, sediment and erosion occurrence should be minimised through the development, implementation, and enforcement of an ESCP for construction and decommissioning works, and modelling of hydrodynamic and sediment transport processes to assess potential effects and determine suitable mitigation to minimise these.

There is a record of the invasive polychaete species *Goniadella gracilis* within the recommended RZ. There is potential risk of the spread and/or introduction of further invasive species to the area with potential for slight adverse direct effects during the short-term construction and decommissioning phases (-1), and in the medium to long-term during operational maintenance, or through introduced infrastructure providing a stepping stone (-1). At the project planning phase, pre- and post-construction surveys for invasive/non-native species should be undertaken in areas of known risk and, if found to be present, an Invasive Species Management Plan should be prepared and a Code of Good Practice, which outlines controls and/or removal measures to ensure that species are not spread during the project's construction or operation. Further mitigation is provided in **Section 10.1.**

Fish and Shellfish:

There are no designated sites for fish and shellfish within the recommended RZ or the tidal excursion zone.

There is a TCE Moderate MPA risk area for Fish in the west of the recommended RZ, owing to the potential for migratory fish species from designated SACs to use the area. There is potential for moderate adverse indirect effects in the short-term construction and decommissioning phases from supporting habitat loss or damage, sedimentation, and smothering effects and via impacts on water quality (-2), and in the medium and long-term operational phase due to a loss of supporting habitat (-2).

There are (Ellis *et al*. (2012) CEFAS) fish spawning grounds of low intensity for cod, ling, mackerel, and whiting, and nursery grounds of high intensity for spurdog, cod and whiting, and of low intensity for anglerfish, common skate, hake, and mackerel within the recommended RZ and tidal excursion zone; these low intensity grounds all cover extensive areas. There are known (Coull *et al*. (1998) CEFAS) fish spawning grounds for whiting, sprat, plaice, and Nephrops, and nursery grounds for whiting and Nephrops within the recommended RZ and tidal excursion zone. A nursery ground for cod is also within the tidal excursion zone to the north of the northern section, as is an AFBI surveyed area of relatively low juvenile density (nursery ground) for whiting. There is potential for moderate adverse direct and indirect effects in the short-term construction and decommissioning phases from habitat loss or damage, sedimentation, and smothering effects and via impacts on water quality (-2), and in the medium and long-term operational phase due to a loss of supporting habitat (-2).

There are records of NI Priority and/or PMF fish and shellfish species such as porbeagle, ling, small-spotted catfish, plaice, spotted ray, queen scallop and variegated scallop, as well as elasmobranchs spurdog, common skate, and spotted ray. There is potential for moderate adverse direct and indirect effects on these sensitive species, and sensitive supporting habitats, and other species that may be within the area, from disturbance and displacement and localised loss of, or damage to supporting habitats during the short-term construction and decommissioning phases (-2), and medium to long-term adverse direct and indirect effects due to loss of supporting habitats, habitat exclusion, displacement, barrier effects, entanglement or EMF effects (-2).

As described for Benthic Habitats and Species, project planning mitigation should aim for avoidance of areas of benthic ecological importance, particularly areas where protected habitats and species are present. Areas should be avoided that may generate increased levels of suspended sediment and those that coincide with areas of fish spawning grounds or sensitive species. Where this is not possible, appropriate timing restrictions should be applied to works, and/or less disruptive installation methods used, to minimise effects on sediment mobilisation and disturbance and displacement of species from the construction area.

In the medium and long-term, there is potential for slight positive indirect effects (+1) owing to device colonisation and the possibility that device arrays may cause a reef effect, however this may also lead to a slight adverse indirect short-term (-1) effect should colonised structures be removed at decommissioning. Mitigation measures during the project planning phase should consider the decommissioning activities that will be used, and whether removal of colonised structures, foundations or scour protection is required, or could result in a double habitat loss (that from pre-construction and decommissioning periods). If fishing is excluded from the array area, there may be potential for positive effects on fish species and supporting habitats such as spawning and nursery grounds within the operational phase.

Marine Mammals:

There are no designated sites for marine mammals within the recommended RZ. However, The Maidens SAC, designated for grey seal, and North Channel SAC, designated for harbour porpoise, are situated immediately adjacent to the recommended RZ, and are within the tidal excursion zone. There is also a TCE High MPA risk area for Marine Mammals within the very south of the recommended RZ, and a Moderate MPA risk area throughout with the exception of the northern area. There is potential for moderate adverse direct effects on designated marine mammals, including from transboundary sites, in the short-term pre-construction, construction, and decommissioning phases due to noise impacts, disturbance and displacement, and collision risk (-

2), and potential for moderate direct and indirect effects in the medium and long-term operational phase due to habitat exclusion and displacement or barrier effects and potential entanglement risk (-2). There are areas of recorded relatively high (pilot whale, fin whale, and beaked whale) and relatively moderate (white-beaked dolphin, striped dolphin, pilot whale, harbour porpoise, fin whale, bottlenose dolphin and beaked whale) density for cetacean species, as well as relatively high and moderate density for grey seal within the recommended RZ. There are also records of Protected, NI Priority or PMF marine mammal species, including minke whale, harbour porpoise, bottlenose dolphin, short-beaked common dolphin, and orca. There is potential for moderate adverse direct and indirect short, medium, and long-term effects as described above (-2), including the potential for transboundary effects on these sensitive species, as well as other marine mammals that may be present within the area. During project planning for wind turbines, the key areas of marine mammal habitats and migratory routes should be identified, including through the conduction of pre-construction surveys and consultation with environmental stakeholders, and development avoided within these areas, whenever possible. Pre-construction, construction, and decommissioning activities should be planned to minimise the potential for adverse effects on marine mammals, including temporal activity planning, limiting vessel activity and mitigation against potential noise effects, including through avoidance of foundation installation such as piling that generates higher noise and avoidance or use of low-noise methods to dispose of any UXO within the development area. The potential for pre-construction, construction, and decommissioning phase adverse effects can be minimised through the application of standard best practice mitigation for marine mammals, including the use of marine mammal observers. Turbines and associated infrastructure should be designed to minimise effects during operation, such as to minimise the potential collision risk for marine mammals with turbines and attachment infrastructure. <u>Birds:</u> There are no designated sites for bird species within the recommended RZ. However, the East Coast Marine pSPA is immediately adjacent to the recommended RZ and is within the tidal excursion zone. This site is designated for its breeding (sandwich, common and Arctic tern; Manx shearwater) and non-breeding (great crested grebe, red-throated diver, and eider duck) seabirds. There is also a TCE High MPA risk area for Breeding Birds within the recommended RZ. There is potential for significant adverse direct and indirect effects on designated bird species, in the short-term pre-construction, construction, and decommissioning phases due to noise impacts, disturbance and displacement, damage or loss of supporting habitat, and collision risk (-3), and in the medium and long-term operational phase due to habitat exclusion and displacement and potential collision risk (-3). Further refinement of the recommended RZ away from this site is recommended to avoid the potential for significant adverse effects. There are areas of recorded relatively moderate density for seabirds at sea within the recommended RZ, and there is potential for moderate adverse, direct and indirect, short, medium, and long-term effects on seabird species, as described above (-2), including the potential for transboundary effects. There is also an area of predicted medium seabed suitability for sandeel within and inshore of the recommended RZ. There is greater potential for adverse effects on seabirds within important foraging areas, through loss or damage to these species and their habitats during construction, displacement from these areas during construction and operation, and potentially, through a higher risk of collision for seabird species that prioritise the area for foraging; the degree of effect relating to these areas will differ between seabird species, depending on the importance of sandeel to their diet, and ability to access this food source at different water depths. Key foraging grounds outside of designated sites should be further investigated at the next stage of future planning and appropriate mitigation applied to avoid or reduce the potential for adverse effects. During project planning for wind turbines, the key areas of bird habitats and migratory routes should be identified, including through the conduction of pre-construction surveys and consultation with environmental stakeholders, and development avoided within these areas, whenever possible. Pre-construction, construction, and decommissioning activities should be planned to minimise the potential for adverse effects on birds, including temporal activity planning, limiting vessel activity and

mitigation against potential noise effects. Turbines and associated infrastructure should be designed to minimise effects, particularly collision risk, during operation.

Population and Human Health

There is potential for slight adverse short-term, temporary noise and visual effects on the local population due to noise generated and visual impacts during the construction and decommissioning phases, and visual flicker and noise effects during operation. However, due to the distance of the recommended RZ offshore, these effects should be limited to vessel occupants transiting through the area, and there is not expected to be potential for direct, short, medium, or long-term, disturbance of coastal populations due to noise or visual effects during the construction, operational, or decommissioning phases (0). The potential for indirect visual effects to coastal populations during the operational phase is considered under the Landscape, Seascape and Visual Amenity topic.

There are no Bathing Water Sites, Blue Flag Beaches, or dive sites within the recommended RZ, and therefore there is not considered to be potential for adverse effects on these areas within the construction, operational, or decommissioning phases (0).

There is potential for moderate adverse temporary, direct and indirect, effects on leisure and recreational marine users due to an increased collision risk, access restrictions and displacement, or water quality effects, during the construction and decommissioning phases due to known use of the area by leisure vessels (-2). There is also potential for moderate adverse long-term (device life) effects due to an enhanced collision risk for recreational and leisure vessels with wind turbine blades and submerged infrastructure, and potential for moderate adverse long-term (device life) effects due to displacement of recreational and leisure craft from the array area during the operational phase (-2). At the next stage of project planning, the potential for interaction with areas of known high use by leisure users should be avoided or minimised. At the project level, further mitigation to minimise risk to leisure users could include the use of exclusion zones around developments and timely and effective communication regarding construction works, as well as appropriate marking of devices and the array area.

Geology, Soils and Land Use

There are no sites designated for geological or geomorphological features, i.e., MCZs, WHSs, ASSIs, or UNESCO Geoparks within the recommended RZ or tidal excursion zone; there is therefore not anticipated to be potential for direct or indirect short, medium, or long-term effects on these features from construction or operation of floating wind devices within the recommended RZ (0). There are Annex 1 Reef habitats within the recommended RZ, and there is potential for moderate direct, temporary to permanent effects on these features through loss or damage during the construction and decommissioning phases (-2). These features should be avoided through micro-siting at the project level.

Floating wind technologies within this recommended RZ are likely to be in the TCE technology groups 3 (Complex Anchoring for a moderate sea state) and 5 (Piling with socket anchoring for a moderate sea state) encountering generally thinner sediments of undifferentiated geology and bedrock. These are likely to require relatively less invasive installation technologies to be employed, with potential for slight adverse direct long-term effects on the seabed geology and sediments through loss of material (-1). There is potential for influence on the MS Descriptor 6 sea floor integrity with the installation processes of floating wind technologies; there is not anticipated to be potential for adverse effects on the achievement of GES of this Descriptor owing to the spatial extent of physical loss, however this should be fully considered at the project phase, and any appropriate mitigation put in place.

One area of explosive dumping grounds is within the recommended RZ, which is not currently in use, however, there is potential for release of historical contamination sources with potential for moderate medium-term effects due to mobilisation during the construction and decommissioning phases (-2). It is recommended that further refinement of the recommended RZ away from this site occurs to avoid the potential for moderate adverse effects during the short-term construction phase. Should this refinement not be possible, to mitigate against potential contamination effects from this explosive dumping ground due to sediment mobilisation, construction and decommissioning works should aim to avoid these areas through appropriate licensing of offshore areas, with appropriate avoidance or mitigation, depending on the results. At the project phase, the degree of disturbance to the seabed should be assessed and, if appropriate, additional contaminant and water quality monitoring should

be implemented. This mitigation may also reduce the potential for adverse indirect effects on other receptors e.g., Biodiversity, Flora and Fauna. The seabed sediments of the recommended RZ are predominantly coarse substrate, mixed sediment, and sediment with smaller areas of rock or other hard substrate or sand, with relatively low potential for short-term mobilisation. There is potential for long-term (device operational life) sediment loss within the footprint of foundations and scour protection, and short-term temporary loss in the vicinity of the works during seabed preparation activities, construction, and decommissioning activities (-2). Sediment and erosion occurrence should be minimised through the development, implementation, and enforcement of an ESCP for construction works. Decommissioning methods should be used that aim to minimise the amount of suspended sediment generated. Following the installation of floating wind technologies there is potential for medium to long-term localised impacts on erosion and deposition patterns within close proximity to the devices during the operational phase (-2), given the low mobility of sediments within the recommended RZ. Further mitigation to minimise the potential for adverse effects on sediments and sediment transport is provided in **Section 10.1**.
Water No designated Shellfish Waters or Bathing Waters are within the recommended RZ or tidal excursion zone. One WFD coastal waterbody of Maiden Islands is within the recommended RZ and the tidal excursion zone, with potential for adverse direct and indirect short to long-term effects on hydromorphological status (-3). It is recommended that further refinement of the recommended RZ zone occurs to minimise potential effects within the tidal excursion zone. Should this refinement not be possible, at the project level, best practice mitigation should be put in place to minimise the potential for adverse effects. This may include sediment testing and water quality monitoring during the construction and decommissioning phases, and a requirement that any hydraulic fluids, anti-fouling components, corrosion of anodes or construction-based discharges used could only release non-toxic/low toxicity compounds (-1). Consultations should take place with environmental bodies regarding the construction methodology and appropriate timing of works to provide the least potential for sediment mobilisation to water bodies. One area of explosive dumping grounds is within the recommended RZ, which is not currently in use, however, there is potential for release of historical contamination sources with potential for moderate indirect medium-term effects due to mobilisation during the construction and decommissioning phases (-2). It is recommended that further refinement of the recommended RZ away from this site occurs to avoid the potential for moderate adverse effects during the short-term construction phase. Should this refinement not be possible, to mitigate against potential contamination effects from this explosive dumping ground, construction and decommissioning works should aim to avoid this area or undergo appropriate licensing of offshore areas, or the disposed material should be fully tested to determine its toxicity, with appropriate avoidance or mitigation, depending on the results. At the project phase, the degree of disturbance to the seabed should be assessed and, if appropriate, additional contaminant and water quality monitoring should be implemented. There is potential for localised effects on water quality within the recommended RZ and tidal excursion zone during the short-term construction and decommissioning phases and during device operation (maintenance) due to sediment mobilisation and associated turbidity, construction discharges or accidental contaminant release from machinery and vessels (-1). There is potential for localised effects on water quality, as described above, within the MS Celtic Seas sub-region, however there is not expected to be potential for adverse effects on the achievement of GES for water quality Descriptors (e.g., Descriptor 9 Concentrations of contaminants in fish and other seafood; Descriptor 8: Concentration of contaminants within marine environment; Descriptor 10 marine litter) with the application of standard best practice mitigation during seabed preparation, construction, maintenance and decommissioning activities (-1). The potential for adverse effects on water quality should be minimised at the project level, including through sediment testing and water quality monitoring during the construction and decommissioning phases to identify and mitigate for potential adverse effects at the earliest possible stage. Environmental authorities should be consulted on the construction methodology, and the most appropriate timing of works to provide the least potential for sediment mobilisation to waterbodies. Further mitigation is provided in **Section 10.1**.
Air

There is potential for slight adverse, direct, short-term temporary, effects on local air quality due to air emissions from vessels and machinery during the construction and decommissioning phases. There is also the potential for slight adverse, short-term, temporary emissions from vessels due to maintenance activities during the operational phase. However, due to the distance of coastal populations from the recommended d RZ, it is not expected that there will be potential for adverse direct or indirect, short, medium, or long-term effects on these receptors from air pollution during the construction, operational and decommissioning phases (0). At the project level, emissions of air pollutants should be minimised through adherence to standard best practise for the minimisation of air pollution, as set out in **Section 10.1**.

There is potential for significant positive indirect effects on regional air quality in the medium to long-term operational phase, as the operation of renewable energy devices can support a transition away from fossil fuel use and its associated air emissions (+3).

Climatic Factors

There are no known areas of blue carbon habitat within the recommended RZ. Ulster Wildlife have identified areas of only low potential for blue carbon importance, therefore, there is unlikely to be potential for adverse effects on blue carbon habitats within the recommended RZ during the construction, operational and decommissioning phases (0). There is potential for slight adverse short-term effects on sediment carbon storage, due to a localised release of CO_2 from seabed disturbance during the construction and decommissioning phases (-1).

There is potential for slight adverse, short-term, temporary effects on localised GHG concentrations, due to GHG emissions from vessels and machinery during the construction and decommissioning phases (-1). At the project level, emissions of air pollutants should be minimised through adherence to standard best practise for the minimisation of air pollution, as set out in **Section 10.1**.

There is potential for significant positive, medium to long-term effects during the operational phase, as the operation of renewable energy devices can contribute to a net reduction in GHG emissions, decarbonisation of the energy sector, diversification of electricity supply and energy security, and meeting of energy objectives and climate change emission reduction targets (+3).

Material Assets

Existing Infrastructure

There is the potential for telecommunications of high importance within the recommended RZ to be disrupted during the construction, operation, and decommissioning phases. There is potential for significant adverse, direct short-term effects due to damage to these cables, and subsequent disruption to telecommunications, during the construction and decommissioning phases (-3), as well as potential for significant adverse medium to long-term (device lifetime) direct effects in the operational phase during recurrent maintenance operations (-3). There is also potential for significant adverse indirect effects to telecommunications in the short-term during the construction and decommissioning phases, as access to these existing cables for maintenance may be reduced temporarily (-3), as well as for moderate adverse effects in the medium to long-term during the operational phase due to access issues (-2). Thus, given the high importance of the existing infrastructure within the recommended RZ, there is potential for significant adverse effects on infrastructure in the short, medium, and long-term (-3).

Industry standard mitigation measures can be implemented at the project phase to avoid the potential for direct damage to the existing cable, such as implementation of safety zones (e.g., 500m avoidance areas) around the cables. Clear communication should be undertaken with the owners of the cables through all project planning and installation, to ensure that the construction process does not impact on access requirements to this infrastructure. Taking these mitigation measures into consideration, the potential for adverse effects on infrastructure can be reduced from moderate to negligible (0) in the short, medium, and long-term.

Shipping and Navigation

There is potential for significant direct adverse effects on shipping and navigation within the recommended RZ in the short-term due to displacement of vessels during the construction and decommissioning phases (-3), as well as medium to long-term displacement from the array area during the operational phase (project lifetime) due to safety exclusion zones (-3). This can result in disruption to vessel routeing and timetables.

There is potential for significant adverse effects in the short-term during the construction and decommissioning phases due to the risk of collision and allision with vessels associated with ORE development, which may result in hazardous cargo or oil spillage (-3). There is also potential for significant adverse effects in the medium to long-term operational phase due to a risk of collision with stationary device arrays and subsequent spill risk, as well as safety concerns with under keel clearance reduction (-3). Additionally, there is potential for significant direct adverse effects on navigation in the medium to long-term operational phase, as devices could obstruct lights, buoys or the coastline (-3); in terms of communication and navigational equipment, AIS and radar systems (including aviation NATS) may be affected. Furthermore, there is potential for significant adverse effects within installation and decommissioning areas in the short-term construction and decommissioning phases, as the presence of installation vessels and equipment may adversely impact the efficiency of search and rescue operations (-3).

Given the presence of the relatively higher density shipping areas in the recommended RZ, there is potential for significant navigational risk and displacement in the short, medium, and long-term (-3). The potential significant adverse effects on navigational risk could be mitigated through the implementation of mitigation measures in line with standard Shipping and Navigation mitigation outlined in **Section 10.1**. Further refinement of the recommended RZ through avoidance of this higher density Larne to Cairnryan Ferry and the Belfast to Cairnryan Ferry routes is recommended which could reduce the potential impacts to navigational risk and displacement to moderate in the short, medium, and long-term (-2).

<u>Commercial Fisheries</u>

There are relatively lower intensity fishing areas and areas used for inshore fishing within the recommended RZ. There is potential for moderate direct adverse, short-term effects on commercial fisheries operations due to temporary displacement from traditional fishing grounds during the construction and decommissioning phases (-2), as well as potential for long-term effects due to displacement from the recommended RZ during the operational phase (-2). Displacement of fishing activity could result in increased competition for alternate fishing grounds, with potential to adversely affect fish stocks and, by extension, landings, in nearby areas. The potential for adverse effects due to the displacement of vessels can be minimised through further consideration during project planning. There should be strategic level caution regarding the siting of ORE infrastructure, with an aim to avoid developments occupying recognised fishing grounds unless there is a successful agreement between the industries that co-location is achievable. Further mitigation with regard to potential co-location is discussed in **Section 10.1**.

There is potential for moderate adverse direct effects due to an increased collision risk of fishing vessels with vessels associated with ORE development in the short-term during the construction and decommissioning phases (-2), and slight in the medium to long-term during recurrent maintenance activities in the operational phase (-1). There is also potential for moderate adverse indirect effects in the medium to long-term operational phase, as displacement of fishing vessels from the area may concentrate vessels into a smaller area for shipping and navigation routes, with an associated increased collision risk (-2). There is also potential for moderate adverse effects on fishing activities within the recommended RZ in the operational phase, as actual and/or perceived increased allision risks with devices, or entanglement of fishing gear with devices or attachment infrastructure may lead to avoidance of the area by fishing vessels (-2). To mitigate for navigational risk, further mitigation measures in line with standard Commercial Fisheries mitigation outlined in **Section 10.1** should be implemented. It is imperative that a successful agreement between industries that co-location is achievable is agreed. Further mitigation with regard to potential co-location is also discussed in **Section 10.1**.

There is potential for effects on commercial fish species and their key habitats within the recommended RZ and the tidal excursion zone. There is moderate potential for indirect positive effects in the medium- to long-term, as hard subsea infrastructure could lead to an enhancement of fish populations at the edges of the array for trawler fishing (+1). There is potential for moderate adverse direct effects in the short-term construction, and medium-to long-term operational phase due to the potential for a direct loss of supporting habitats, such as spawning and nursery grounds

(-2). There is also potential for slight adverse direct and indirect effects during the short-term construction and decommissioning phases (-2), and slight in the medium to long-term operational phase (-1) due to sediment mobilisation from construction, decommissioning and maintenance activities, respectively, which could have an indirect effect on fishing activity through an alteration of fishing stocks (-2). To minimise the potential for indirect effects on commercial fisheries through impacts on fishing stocks, an ESCP should be developed, implemented, and enforced for construction works, while the decommissioning methods used should aim to minimise sediment generated. Further information on the potential ecosystem effects on fish and shellfish species and potential mitigation can be found in the Biodiversity, Flora, and Fauna assessment for the North Channel recommended RZ.

There is potential for moderate indirect effects on the profitability of commercial fishing in the short, medium, and long-term (-2), such as the potential for reduced quotas, increased resource competition for fishing, and reduced landings in both tonnage and economic value.

These effects could be mitigated through considering the mitigation measures discussed above, and in the **Section 10.1**. Further refinement of the recommended RZ through avoidance of the areas important for inshore fisheries, the areas of highest known importance for fish spawning and nursery grounds and of areas of moderate fishing activity is recommended, which could reduce the potential effects on commercial fisheries to slight in the short, medium, and long-term.

Military Areas

There is potential for significant adverse effects on military activities, including temporary (short-term) disruption of military exercises and activities within the Magee, the Beaufort, the Torr and the Maiden Military Practice Areas during pre-construction, installation, and decommissioning (-3) phases, and medium to long-term disruption during operation due to the presence of offshore infrastructure (-3). As the entire recommended RZ is within these Military Practice Areas, the area available for military practice activity could be reduced during the operational phase. Consultation with the MoD during the next stage of project planning could help to inform the key areas that should be avoided within the mapped Practice Areas, which could reduce the potential for adverse effects due to the displacement of military activities. The risk of collision of military vessels with devices can be minimised through further consultation with the MoD at the next stage of further planning. Measures outlined to mitigate against navigational risk in the Shipping and Navigation Section of **Section 10.1** are also of relevance.

Considering these mitigation measures the potential for adverse effects on military activities could be reduced from significant to slight (-1) in the short, medium, and long-term.

Aviation

There are no zones for aviation interference within the recommended RZ, therefore there is potential for negligible effects on Aviation (0).

Disposal Areas

There is no potential for adverse effects due to temporary disruption or displacement of vessels moving to and from the inactive Beaufort's Dyke (0). Although Beaufort's Dyke is no longer be in use, there is the potential for disposed explosives to include the presence of UXO. There is the potential for moderate direct adverse, short-term effects from the development of device arrays during pre-construction seabed preparation and installation (-2). This could be mitigated through the mitigation measures outlined in **Section 10.1**. Taking these mitigation measures into consideration, the potential for this effect could be reduced from moderate to slight (-1). Further refinement of the recommended RZ through avoidance of this disposal area is recommended which could reduce the potential effects to negligible in the short, medium, and long-term (0).

Tourism

The potential for effects on tourism is considered indirectly within the topics of Landscape, Seascape and Visual Amenity (visibility of construction activity and operational devices), Population and Human Health (recreational use of the RZ), and Biodiversity, Flora, and Fauna (effects on wildlife). As discussed in the Landscape, Seascape and Visual Amenity Section, there is the potential for significant adverse effects on Landscape, Seascape and Visual Amenity which may result in secondary adverse effects on tourism, as this may act as a deterrent to tourists. Conversely, it is possible the presence of a wind farm will act as a tourist attraction. As discussed in Population and Human Health, there is a negligible potential for adverse effects on the population due to increased noise release in the short-term, as such tourism in unlikely to be impacted by these potential effects. However, there is potential for moderate adverse temporary direct and indirect effects on leisure and recreational marine users due to an increased collision risk, access restrictions and displacement, or water quality effects, during the construction (and decommissioning) phase, which may indirectly adversely affect tourism temporarily. Lastly, as discussed in Biodiversity, Flora and Fauna, there is potential for noise generation to adversely affect wildlife, which may result in a secondary impact on tourism activities such as bird, dolphin or whale watching.

There is the potential for tourism to be impacted by secondary effects. It is not clear whether an overall negative or positive impact will arise. However, it is likely any impact on tourism will be benign and of low significance.

<u>Renewable Energy Generation</u>

The potential capacity of the recommended RZ is 1.81GW. As such, there is potential for moderate positive effects in the medium to long-term, owing to the generation of a new renewable energy supply for the NI population (+3).

<u>Overall</u>

Overall, there is considered to be potential for moderate adverse effects in the short, medium, and long-term on Material Assets (-2), following the consideration of best practice mitigation measures, which is mainly attributed to the potential for moderate adverse effects on Commercial Fisheries, and significant adverse effects on Shipping and Navigation.

Cultural, Architectural and Archaeological Heritage

There are a relatively moderate number of known undesignated wrecks within the recommended RZ and tidal excursion zone. There is potential for moderate adverse temporary to permanent effects on these features during the construction and decommissioning phases, which may be due to direct damage or disturbance of features within the recommended RZ, or indirect effects via sediment displacement and deposition onto features within the recommended RZ and the tidal excursion zone (-2). There is also potential for slight adverse indirect effects on features within the recommended RZ in the medium to long-term operational phase owing to the potential for scouring and exposure to occur around features in the vicinity of devices (-1). At the project planning phase, any sites of interest for archaeological potential should be identified and exclusion zones used around these, with conduction of site surveys or trial trenching before any potentially damaging activities take place, with results informing any appropriate mitigation. Modelling of hydrodynamic and sediment transport processes may be necessary to determine potential effects on surrounding archaeological features and determine any appropriate mitigation required. Management of cultural heritage at the project level should be considered through the development and application of a MARP.

The recommended RZ is situated between c.4.5km and c.22km distance from the coastline. There is potential for significant adverse indirect effects (-3) on the setting of coastal heritage features, including for, 1852 Listed Buildings, 440 Defence Heritage Record sites, 1572 Scheduled Monuments, 193 Scheduled Zones, and 37 Parks and Gardens (including Glenarm Castle, Drumnasole House, Garron Tower, Carnfunnock Country Park, Red Hall, Castle Dobbs, Clandeboye, and Ballywalter Park) that are within the modelled viewshed. There is potential for adverse short-term effects on the setting of these features during the construction and decommissioning phases, and for medium and long-term effects during device operation, owing to the potential visibility of vessels and machinery and device arrays, respectively. Cultural heritage features that are listed as cultural influences for the RSCAs inshore of the recommended RZ include cultural sites around the settlements of Cushendun and Cushendall, Medieval coastal churches and graveyards, designated Scheduled Monuments and/or Areas, the Medieval castle at Red Bay, and coastguard stations within the Northern Glens Coast RSCA; East and West Rock lighthouses, prehistoric tombs, 20th Century defensive sites, and Historic Parks and Gardens of Carnfunnock Country Park, Cairndhu, Garron Tower, Glenarm Castle and Drumnasole within the Southern Glens Coast RSCA; Defensive sites including the 17th Century Castle Chichester and 16th Century Portmuck Castle (both Scheduled Monuments and/or Areas) within The Gobbins RSCA; Defensive sites including Curran Castle, industrial sites such as harbours and beacons, Prehistoric sites including a Portal Tomb (Scheduled Monument) and ring barrow overlooking the Lough, numerous Medieval sites and Registered Historic Parks and Gardens at Drumalis and Chaine Park within Larne Lough RSCA; and coastal windmill sites, coastguard stations, WW2 coastal defences, Registered Historic Park/Gardens at Portavo House, evidence of prehistoric occupation within Ards Peninsula RSCA.

There is also potential for transboundary effects on the setting of heritage features along the south Kintyre, Dumfries and Galloway, and south Ayrshire coastlines, as these areas are also within the modelled viewshed.

Further refinement of the recommended RZ away from the coastline and sensitive cultural heritage designations is recommended to avoid or reduce the potential for significant adverse effects. Areas of the highest landscape and seascape sensitivity should be avoided, where possible, at the project planning stage. At the project planning phase, a SLVIA should be undertaken and should inform project design and appropriate mitigation to minimise adverse effects, and this should include consideration of potential impacts on views from sites of historic importance.

Landscape, Seascape and Visual Amenity

The recommended RZ is situated between c.4.5km and c.22km distance from the coastline. Strangford and Lecale AONB, and Antrim Coast and Glens AONB are situated inshore and are within the modelled viewshed. There is potential for significant adverse indirect effects on these sites, both in the short-term construction and decommissioning phase from the presence of vessels and machinery (-3), and during the operational phase from the presence of device arrays (-3), owing to the very high sensitivity of the landscape. There are 18 National Trust Lands (including Lighthouse Island, Strangford Lough, Orlock, Islandmagee, and Ballymacormick) and three Country Parks (Scrabo, Crawfordsburn, and Redburn) that are within the modelled viewshed, and there is also potential for significant adverse indirect effects (-3) on the setting of these areas, both in the short-term construction and decommissioning phases and the medium to long-term operational phase as described above, owing to the high sensitivity of the landscapes.

The recommended RZ is within the North Channel Regional Seascape Character Area (RSCA), and is offshore of the Northern Glens Coast, Southern Glens Coast, The Gobbins, Larne Lough, and Ards Peninsula RSCAs. There is potential for adverse effects in the medium and long-term within these areas, as the presence of device arrays may alter the character of these RSCAs.

There is potential for moderate adverse indirect visual effects in the short, medium, and long-term for the inshore coastal population, including within 69 settlements (including Belfast City, Metropolitan Newtownabbey, Carrickfergus, Bangor, and Larne) that are within the modelled viewshed (-2). There is also potential for transboundary effects on visual amenity for the population along the south Kintyre, Dumfries and Galloway, and south Ayrshire coastlines, as these areas are also within the modelled viewshed.

Further refinement of the recommended RZ away from the coastline and landscape designations is recommended to avoid or reduce the potential for significant adverse effects. Areas of the highest landscape and seascape sensitivity should be avoided, where possible, during the next stage of project planning. At the project planning phase, a SLVIA should be undertaken and should inform project design and appropriate mitigation to minimise adverse effects.

G.8 Floating Wind Resource Zone: Irish Sea Inshore

Discussion of Potential Impacts
Biodiversity, Flora and Fauna <u>Benthic Habitats and species:</u> There are no designated sites for benthic habitats and species within the recommended RZ. South Rigg MCZ, whose protected features include moderate energy circalittoral rock, subtidal coarse sediment, subtidal sand, subtidal mud, subtidal mixed sediment, and sea-pen and burrowing megafauna communities, is situated immediately adjacent to the east of the northern section of the recommended RZ and is within the tidal excursion zone. There is a TCE Very High MCZ risk area for Habitats in the south-east of the northern section owing to the proximity to South Rigg MCZ. There is potential for significant adverse indirect effects on these features in the short-term construction and decommissioning phases from sedimentation or water quality effects (-3), and for significant adverse indirect effects during the operational phase to features in close proximity to where the site boundaries meet the recommended RZ due to hydrodynamic effects (-3). Further refinement of the recommended RZ away from this site is recommended to avoid the potential for significant adverse effects during construction and operation. There are many known areas of Annex I Reef habitat within the northern section of the recommended RZ and tidal excursion zone, and a small area within the southern section of the recommended RZ; there is potential for moderate adverse direct and indirect effects on these features both in the short-term construction and decommissioning phases and in the medium to long-term from loss or damage, and sedimentation or water quality effects (-2). In the southern section of the recommended RZ the seabed habitats predominantly consist of fine mud, with sandy mud in the inshore region, and small areas of mixed sediment and rock or other hard substrata. In the northern section there are a range of seabed habitats, including coarse substrate, mixed sediment, rock or other hard substrate, sandy mud, muddy sand, and sediment. There are recorded occurrences of benthic NI Priority species of the starfish sand sea star within the recommended RZ. There is potential for moderate adverse direct and indirect effects on this sensitive species, as well as on non-sensitive benthic habitats and species, from localised benthic loss, or pollution and sedimentation effects during the short-term construction and decommissioning phases (-2), and the medium and long-term operational phase (-2). These effects may be minimised based on micro-siting at the project level; project planning mitigation should aim for avoidance of areas of benthic ecological importance, particularly areas where protected habitats and species are present, and installation in areas where non-sensitive habitats or species are present with the use of appropriate installation techniques. The volume of rock used for cable armouring, pipeline protection and foundation scour protection should be planned as the minimum required, to minimise habitat loss. At the project planning phase, sediment and erosion occurrence should be minimised through the development, implementation, and enforcement of an ESCP for construction and decommissioning works, and modelling of hydrodynamic and sediment transport processes to assess potential effects and determine suitable mitigation to minimise these. There are no records of invasive species within the recommended RZ; there is a potential risk of introduction of invasive species to the area with potential for slight adverse direct effects during the short-term construction and decommissioning phases (-1), and in the medium to long-term during operational maintenance (-1). Mitigation to reduce the risk of introduction of invasive species to the area is provided in **Section 10.1**. <u>Fish and Shellfish:</u> There are no designated sites for fish and shellfish within the recommended RZ or the tidal excursion zone, and there are no TCE Very High, High, or Moderate MPA risk areas for Fish within the recommended RZ. There are (Ellis *et al.* (2012) CEFAS) fish spawning grounds for cod, plaice, hake, horse mackerel, ling, mackerel, whiting, sandeel, and sole, and nursery grounds for cod, herring, whiting, spurdog, anglerfish, common skate, hake, mackerel, plaice, thornback ray, and tope shark within the recommended RZ and tidal excursion zone. There are (Coull *et al*. (1998) CEFAS) fish spawning

areas for whiting, lemon sole, Nephrops, and sprat, and nursery grounds for whiting, lemon sole, cod, herring, haddock, and Nephrops within the recommended RZ and tidal excursion zone. There are also AFBI surveyed spawning areas for cod and plaice, and nursery grounds for haddock and whiting. There is potential for significant adverse direct and indirect effects in the short-term construction and decommissioning phases from habitat loss or damage, sedimentation, and smothering effects and via impacts on water quality (-3), and in the medium and long-term operational phase due to a loss of supporting habitat (-3). Further refinement of the recommended RZ away from the most important areas for fish spawning and nursery is recommended to avoid the potential for significant adverse effects during construction and operation.

There are known occurrences of NI Protected species common skate; NI Priority species whiting, herring, hake, cod, spiny dogfish, and school shark; PMF species whiting, herring, hake, cod, small-spotted catshark, mackerel, horse mackerel, plaice, anglerfish, blue whiting, spiny dogfish, nursehound, sole, broadnose skate, thornback ray, spotted ray, ling, cuckoo ray, and queen scallop; OSPAR records of cod, spiny dogfish, thornback ray, and spotted ray; and elasmobranch records of thornback ray, spiny dogfish, spotted ray, and common skate. There is potential for moderate adverse direct and indirect effects on these sensitive species from disturbance and displacement and localised loss of, or damage to supporting habitats during the short-term construction and decommissioning phases (-2), and medium to long-term direct and indirect adverse effects due to loss of supporting habitats, habitat exclusion, displacement, barrier effects, entanglement, or EMF effects (-2).

As described for Benthic Habitats and Species, project planning mitigation should aim for avoidance of areas of benthic ecological importance, particularly areas where protected habitats and species are present. Areas should be avoided that may generate increased levels of suspended sediment that coincide with areas of fish spawning grounds or sensitive species. Where this is not possible, appropriate timing restrictions should be applied to works, and/or less disruptive installation methods used, to minimise effects on sediment mobilisation and disturbance and displacement of species from the construction area.

In the medium and long-term, there is potential for slight positive indirect effects (+1) owing to device colonisation and the possibility that device arrays may cause a reef effect, however this may also lead to a slight adverse indirect short-term effect (-1) should colonised structures be removed at decommissioning. Mitigation measures during the project planning phase should consider the decommissioning activities that will be used, and whether removal of colonised structures, foundations or scour protection is required, or could result in a double habitat loss (that from pre-construction and decommissioning periods). If fishing is excluded from the array area, there may be potential for positive effects on fish species and supporting habitats such as spawning and nursery grounds within the operational phase.

Marine Mammals:

North Channel SAC, designated for harbour porpoise, is within the northern section of the recommended RZ and tidal excursion zone to the north. There is a TCE High MPA risk area for Marine Mammals within the northern section of the recommended RZ due to the overlap with the North Channel SAC, and a Moderate MPA risk area elsewhere with the exception of the very south. There is potential for significant adverse direct and indirect effects on designated marine mammals in the short-term pre-construction, construction, and decommissioning phases due to noise impacts, disturbance, displacement, and collision risk (-3). Further refinement of the recommended RZ away from this site is recommended to avoid the potential for significant adverse effects during these stages. In the medium to long-term operational phase there is potential for moderate adverse direct and indirect effects due to habitat exclusion and displacement, loss of supporting habitat or changes to prey species, and potential collision risk (-2).

There are areas of recorded relatively high (harbour porpoise, common dolphin, and common/striped dolphin) and moderate (common dolphin, fin whale, minke whale, common/striped dolphin, striped dolphin, bottlenose dolphin, beaked whale, and harbour porpoise) density for cetacean species, areas of relatively high and moderate density for grey seal and relatively moderate density for harbour seal and, and records of the NI Protected, NI Priority, and PMF species orca, and there is potential for moderate adverse, direct and indirect, short, medium and long-term effects as described above (-2), including the potential for transboundary effects.

During project planning for wind turbines, the key areas of marine mammal habitats and migratory routes should be identified, including through the conduction of pre-construction surveys and consultation with environmental stakeholders, and development avoided within these areas, whenever possible. Pre-construction, construction, and decommissioning activities should be planned to minimise the potential for adverse effects on marine mammals, including temporal activity planning, limiting vessel activity and mitigation against potential noise effects, including through avoidance of foundation installation such as piling that generates higher noise and avoidance or use of low-noise methods to dispose of any UXO within the development area. The potential for pre-construction, construction, and decommissioning phase adverse effects can be minimised through the application of standard best practice mitigation for marine mammals, including the use of marine mammal observers. Turbines and associated infrastructure should be designed to minimise effects during operation, such as to minimise the potential collision risk for marine mammals with turbines and attachment infrastructure. Birds: There are no designated sites for bird species within the recommended RZ or the tidal excursion zone. There is a TCE High MPA risk area for Breeding Birds within the north of the recommended RZ, and a Moderate MPA risk area elsewhere. There is potential for moderate adverse direct and indirect effects on designated bird species, including from transboundary sites, in the short-term pre-construction, construction, and decommissioning phases due to noise impacts, disturbance and displacement, damage or loss of supporting habitat, and collision risk (-2), and in the medium and long-term operational phase due to habitat exclusion and displacement and potential collision risk (-2). The recommended RZ is within areas of recorded relatively moderate density for seabirds at sea, and there is potential for slight adverse, direct and indirect, short, medium, and long-term effects on seabird species, as described above (-1), including the potential for transboundary effects. There is also a known spawning ground for sandeel, a key food source for many species of seabird, within the recommended RZ. There is greater potential for adverse effects on seabirds within important foraging areas, through loss or damage to these species and their habitats during construction, displacement from these areas during construction and operation, and potentially, through a higher risk of collision for seabird species that prioritise the area for foraging; the degree of effect relating to these areas will differ between seabird species, depending on the importance of sandeel to their diet, and ability to access this food source at different water depths. Key foraging grounds outside of designated sites should be further investigated at the next stage of future planning and appropriate mitigation applied to avoid or reduce the potential for adverse effects. During project planning for wind turbines, the key areas of bird habitats and migratory routes should be identified, including through the conduction of pre-construction surveys and consultation with environmental stakeholders, and development avoided within these areas, whenever possible. Pre-construction, construction, and decommissioning activities should be planned to minimise the potential for adverse effects on birds, including temporal activity planning, limiting vessel activity and mitigation against potential noise effects. Turbines and associated infrastructure should be designed to minimise effects, particularly collision risk, during operation.
Population and Human Health There is potential for slight adverse, short-term temporary, noise and visual effects on the local population due to noise generated and visual impacts during the construction and decommissioning phases, and visual flicker and noise effects during operation. However, due to the distance of the recommended RZ offshore, these effects should be limited to vessel occupants transiting through the area, and there is not expected to be potential for direct, short, medium, or long-term, disturbance of coastal populations due to noise or visual effects during the construction, operational, or decommissioning phases (0). The potential for indirect visual effects to coastal populations during the operational phase is considered under the Landscape, Seascape and Visual Amenity topic. There are no Bathing Water sites, Blue Flag Beaches, or dive sites within the recommended RZ, and therefore there is not considered to be potential for adverse effects on these areas within the construction, operational, or decommissioning phases (0).

There is potential for moderate adverse temporary, direct and indirect, effects on leisure and recreational marine users due to an increased collision risk, access restrictions and displacement, or water quality effects, during the construction and decommissioning phase due to known relatively high use of the area by leisure vessels (-2). There is also potential for moderate adverse long-term (device life) effects due to an enhanced collision risk for recreational and leisure vessels with wind turbine blades and submerged infrastructure, and potential for moderate adverse long-term (device life) effects due to displacement of recreational and leisure craft from the array area during the operational phase (-2). At the next stage of project planning, the potential for interaction with areas of known high use by leisure users should be avoided or minimised. At the project level, further mitigation to minimise risk to leisure users could include the use of exclusion zones around developments and timely and effective communication regarding construction works, as well as appropriate marking of devices and the array area.

Geology, Soils and Land Use

There are no WHSs, ASSIs, or UNESCO Geoparks designated for geological or geomorphological features within the recommended RZ or tidal excursion zone. However, the South Rigg MCZ, designated for several broad-scale seabed habitats, is directly adjacent to the recommended RZ and the tidal excursion zone, and there is potential for moderate adverse indirect short to long-term effects on designated features of this site during the construction and operational phases e.g., through changes in hydrodynamics and sediment dynamics (-3). It is recommended that further refinement of the recommended RZ occurs to avoid interaction and possible impacts on the South Rigg MCZ. However, should this refinement not be possible, at the project planning phase, mitigation should incorporate the conduction of geophysical and geotechnical surveys to identify areas of key geological/geomorphological interest, with avoidance of these areas during development. At the project planning phase, coastal process modelling should be undertaken to determine the potential for adverse effects on designated sites, with further appropriate mitigation proposed to avoid or minimise adverse effects e.g., through a suitable design of device arrays (adequate spacing between developments/arrays) to reduce the potential for excessive energy extraction altering coastal processes and regimes. There are Annex 1 Reef habitats within the recommended RZ, and there is potential for moderate direct, temporary to permanent effects on these features through loss or damage during the construction (and decommissioning) phase (-2). These features should be further considered and avoided through micro-siting at the project level.

Floating wind technologies within the recommended RZ are predominantly in the TCE technology groups 1 (Conventional anchoring for a moderate sea state) and 5 (Piling with socket anchoring for a moderate sea state), encountering variable geological composition with variable thickness. This is likely to require relatively more invasive installation technologies to be employed, with potential for moderate adverse direct long-term effects on the seabed geology and sediments through loss of material (-2). There is potential for influence on the MS Descriptor 6 sea floor integrity with the installation processes of floating wind technologies; there is not anticipated to be potential for adverse effects on the achievement of GES of this Descriptor owing to the spatial extent of physical loss, however this should be fully considered at the project phase, and any appropriate mitigation put in place.

There are no known areas of potential contamination within the recommended RZ i.e., no dumping grounds of spoil ground, or explosive grounds. There is therefore not expected to be potential for adverse direct or indirect short, medium, or long-term effects on sediments within the recommended RZ from interaction with potentially contaminated areas (0).

The main seabed sediments within the recommended RZ are predominantly sandy mud and muddy sand, with potential for mobilisation to occur. There is potential for long-term (device operational life) sediment loss within the footprint of foundations and scour protection, and short-term temporary loss in the vicinity of the works during seabed preparation activities, construction, and decommissioning activities (-2). Sediment and erosion occurrence should be minimised through the development, implementation, and enforcement of an ESCP for construction works. Decommissioning methods should be used that aim to minimise the amount of suspended sediment generated. Following the installation of floating wind technologies there is potential for medium to long-term localised impacts on erosion and deposition patterns within close proximity to the devices during the operational phase (-2), given the relatively low mobility of sediments within the recommended RZ. Further mitigation to

minimise the potential for adverse effects on sediments and sediment transport is provided in **Section 10.1**.
Water No designated WFD Shellfish Waters or Bathing Waters, or WFD coastal water bodies are within the recommended RZ or tidal excursion zone. There is therefore not expected to be potential for adverse, direct or indirect, short, medium or long-term effects within these sites from construction or operation of floating wind devices within the recommended RZ (0). There are no known areas of potential contamination within the recommended RZ i.e., no dumping grounds of spoil ground, or explosive grounds. There is therefore not expected to be potential for adverse direct or indirect, short, medium, or long-term effects on water quality within the recommended RZ from interaction with potentially contaminated areas (0). There is potential for localised effects on water quality within the recommended RZ and tidal excursion zone during the short-term construction and decommissioning phases and during device operation (maintenance) due to sediment mobilisation and associated turbidity, construction discharges or accidental contaminant release from machinery and vessels (-1). There is potential for localised effects on water quality, as described above, within the MS Celtic Seas sub-region, however there is not expected to be potential for adverse effects on the achievement of GES for water quality Descriptors (e.g., Descriptor 9 Concentrations of contaminants in fish and other seafood; Descriptor 8: Concentration of contaminants within marine environment; Descriptor 10 marine litter) with the application of standard best practice mitigation during seabed preparation, construction, maintenance and decommissioning activities (-1). The potential for adverse effects on water quality should be minimised at the project level, including through sediment testing and water quality monitoring during the construction and decommissioning phases to identify and mitigate for potential adverse effects at the earliest possible stage. Environmental authorities should be consulted on the construction methodology, and the most appropriate timing of works to provide the least potential for sediment mobilisation to waterbodies. Further mitigation is provided in **Section 10.1.**
Air There is potential for slight adverse, direct, short-term temporary, effects on local air quality due to air emissions from vessels and machinery during the construction and decommissioning phases. There is also the potential for slight adverse, short-term, temporary emissions from vessels due to maintenance activities during the operational phase. However, due to the distance of coastal populations from the recommended RZ, it is not expected that there will be potential for adverse direct or indirect, short, medium, or long-term effects on these receptors from air pollution during the construction, operational and decommissioning phases (0). At the project level, emissions of air pollutants should be minimised through adherence to standard best practise for the minimisation of air pollution, as set out in **Section 10.1**. There is potential for significant positive indirect effects on regional air quality in the medium to long-term operational phase, as the operation of renewable energy devices can support a transition away from fossil fuel use and its associated air emissions (+3).
Climatic Factors There are no identified areas of blue carbon habitat within the recommended RZ, therefore, there is unlikely to be potential for adverse effects on blue carbon habitats within the recommended RZ during the construction, operational and decommissioning phases (0). There is potential for slight adverse short-term effects on sediment carbon storage, due to a localised release of CO_2 from seabed disturbance during the construction and decommissioning phases (-1). There is potential for slight adverse, short-term, temporary effects on localised GHG concentrations, due to GHG emissions from vessels and machinery during the construction and decommissioning phases (-1). At the project level, emissions of air pollutants should be minimised through adherence to standard best practise for the minimisation of air pollution, as set out in **Section 10.1**. There is potential for significant positive, medium to long-term effects during the operational phase, as the operation of renewable energy devices can contribute to a net reduction in GHG emissions,

decarbonisation of the energy sector, diversification of electricity supply and energy security, and meeting of energy objectives and climate change emission reduction targets (+3).
Material Assets Existing Infrastructure There is no existing infrastructure located within the recommended RZ. There is, therefore, no potential for adverse effects on existing infrastructure (0). Shipping and Navigation There is potential for direct adverse effects on shipping and navigation to arise within the recommended RZ. There is the potential for significant direct short-term displacement of vessels during construction and decommissioning (-3), as well as medium to long-term displacement from the array area during the project lifetime (-3), due to safety exclusion zones. This can result in disruption to vessel routeing and timetables. There is the potential for short-term risk of collision and allision with vessels during construction and decommissioning, which may result in hazardous cargo or oil spillage (-3). There is also potential for significant adverse effects in the medium to long-term operational phase due to a risk of collision with stationary device arrays and subsequent spill risk, as well as safety concerns with under keel clearance reduction (-3). Additionally, there is potential for direct adverse effects on navigation in the medium to long-term operational phase, as devices could obstruct lights, buoys, or the coastline (-3). In terms of communication and navigational equipment, AIS (Auto Identification Systems) and radar systems (including aviation NATS) may be affected. Furthermore, there is potential for significant adverse effects within installation and decommissioning areas in the short-term construction and decommissioning phases, as the presence of installation vessels and equipment may adversely impact the efficiency of search and rescue operations (-3). Given the presence of the relatively high and moderate density shipping areas within the north-west and east of the recommended RZ associated with the Warrenpoint to Heysham shipping route, there is the potential for significant navigational risk and displacement in the short, medium, and long-term (-3). The potential significant adverse effects on navigational risk could be mitigated through the implementation of mitigation measures in line with standard Shipping and Navigation mitigation outlined in **Section 10.1**. Further refinement of the recommended RZ through avoidance of this higher density Warrenpoint to Heysham freight ferry route and the Belfast to Liverpool (Birkenhead) ferry route is recommended which could reduce the potential impacts to navigational risk and displacement to moderate in the short, medium, and long-term (-2). Commercial Fisheries There are relatively high intensity fishing areas within the recommended RZ. There is potential for significant direct adverse, short-term effects on commercial fisheries operations due to temporary displacement from traditional fishing grounds during the construction and decommissioning phases (-3), as well as potential for direct adverse long-term effects due to displacement from the recommended RZ during the operational phase (-3). Displacement of fishing activity could result in increased competition for fishing grounds and has potential to adversely affect fish stocks and, by extension, landings in nearby areas. The potential for adverse effects due to the displacement of vessels can be minimised through further consideration at the next stage of project planning. There should be strategic level caution regarding the siting of ORE infrastructure, with an aim to avoid developments occupying recognised fishing grounds unless there is a successful agreement between the industries that co-location is achievable. Further mitigation with regard to potential co-location is discussed in **Section 10.1.** There is potential for significant adverse direct effects due to an increased collision risk of fishing vessels with vessels associated with ORE development in the short-term during the construction and decommissioning phases (-3), and moderate effects in the medium to long-term during recurrent maintenance activities in the operational phase (-2). There is also potential for significant adverse indirect effects in the medium to long-term operational phase, as displacement of fishing vessels from the area may concentrate vessels into a smaller area for shipping and navigation routes, with

an associated increased collision risk (-3). There is also potential for significant adverse effects on fishing activities within the recommended RZ in the operational phase, as actual and/or perceived increased allision risks with devices, or entanglement of fishing gear with devices or attachment infrastructure may lead to avoidance of the area by fishing vessels (-3). To mitigate for navigational risk, further mitigation measures in line with standard commercial fisheries mitigation outlined in **Section 10.1** should be implemented. It is imperative that a successful agreement between industries that co-location is achievable is agreed. Further mitigation with regard to potential co-location is also discussed in **Section 10.1**.

There is potential for effects on commercial fish species and their key habitats within the recommended RZ and the tidal excursion zone. There is slight potential for indirect positive effects in the medium to long-term, as hard subsea infrastructure could lead to an enhancement of fish populations at the edges of the array for trawler fishing (+1). Given the high number of spawning and nursery grounds within the recommended RZ, there is potential for significant adverse direct effects in the short-term construction and decommissioning phases, and medium to long-term operational phase due to the potential for a direct loss of these supporting habitats (-3). There is also potential for significant adverse direct and indirect effects during the short-term construction and decommissioning phases (-3), and moderate effects the medium to long-term operational phase due to sediment mobilisation (-2) from construction, decommissioning and maintenance activities, respectively, which could have an indirect effect on fishing activity through an alteration of fishing stocks (-3). To minimise the potential for indirect effects on commercial fisheries through impacts on fishing stocks, an ESCP should be developed, implemented, and enforced for construction works, while decommissioning methods used should aim to minimise sediment generated. Further information on the potential ecosystem effects on fish and shellfish species, and potential mitigation can be found in the Biodiversity, Flora, and Fauna assessment for the Irish Sea Inshore recommended RZ.

There is potential for significant indirect effects on the profitability of commercial fishing in the short, medium, and long-term (-3), such as the potential for reduced quotas, increased resource competition for fishing, and reduced landings in both tonnage and economic value. These effects could be mitigated by considering the mitigation measures discussed above, and in **Section 10.1**. Further refinement of the recommended RZ through avoidance of the areas important for inshore fisheries, the areas of highest known importance for fish spawning and nursery and of areas of moderate fishing activity is recommended, which could reduce the potential effects on commercial fisheries to moderate in the short, medium, and long-term (-2).

Military Areas

There is potential for moderate adverse effects on military activities, including temporary (short-term) disruption of military exercises and activities within the Ardglass and Peel Military Practice Areas during pre-construction, installation, and decommissioning (-2) phases, and medium to long-term disruption during operational phases, due to the presence of offshore infrastructure (-2). As the entire recommended RZ is within these Military Practice Areas, the area available for military practice activity could be reduced during the operational phase. Consultation with the MoD during the next stage of project planning could help to inform the key areas that should be avoided within the mapped Practice Areas, which could reduce the potential for adverse effects due to the displacement of military activities. The risk of collision of military vessels with devices can be minimised through further consultation with the MoD at the next stage of further planning. Measures outlined to mitigate against navigational risk in the Shipping and Navigation Section of **Section 10.1** are also of relevance.

Considering these mitigation measures, the potential for adverse effects on military activities could be reduced from moderate to slight (-1) in the short, medium, and long-term.

Aviation

There are no safeguarding zones for aviation interference within the recommended RZ. The presence of devices has limited potential to effect communications, navigation, and surveillance, therefore, there is potential for negligible effects on aviation navigation or radar (0).

Spoil Dumping Grounds

There are no spoil dumping grounds located within the recommended RZ. There is, therefore, no potential for temporary disruption or displacement of vessels moving to and from disposal sites (0).

Tourism

The potential for effects on tourism is considered indirectly within the topics of Landscape, Seascape and Visual Amenity (visibility of construction activity and operational devices), Population and Human Health (recreational use of the RZ), and Biodiversity, Flora, and Fauna (effects on wildlife). As discussed in the Landscape, Seascape and Visual Amenity Section, there is the potential for significant adverse effects on Landscape, Seascape and Visual Amenity within Mourne AONB, Strangford and Lecale AONB and various National Trust sites, which may result in secondary adverse effects on tourism, as this may act as a deterrent to tourists to visit these sites. Conversely, it is possible the presence of a wind farm will act as a tourist attraction. As discussed in Population and Human Health, there is moderate potential for adverse effects on recreational access and increased noise and contaminant release in the short-term, as such tourism could be impacted by these potential effects. Lastly, as discussed in Biodiversity, Flora and Fauna, there is potential for noise generation to adversely affect wildlife, which may result in a secondary impact on tourism activities such as bird, dolphin or whale watching.

There is the potential for tourism to be impacted by secondary effects. It is not clear whether an overall negative or positive impact will arise. However, it is likely any impact on tourism will be benign and of low significance.

Renewable Energy Generation

The potential capacity of the recommended RZ is 1.48GW. As such, there is potential for significant positive effects in the medium- to long-term, owing to the generation of a new renewable energy supply for the NI population (+3).

Overall

Overall, there is considered to be potential for significant adverse effects in the short, medium, and long-term for Material Assets (-3), following the consideration of best practice mitigation measures, mainly attributed to identified potential for significant adverse effects on Shipping and Navigation, and Commercial Fisheries.

Cultural, Architectural and Archaeological Heritage

There are many (20) known undesignated wrecks within the recommended RZ, and a further five within the tidal excursion zone. There is potential for moderate adverse, temporary to permanent, effects on these features during the construction and decommissioning phases, which may be due to direct damage or disturbance of features within the recommended RZ, or indirect effects via sediment displacement and deposition onto features within the recommended RZ and the tidal excursion zone (-2). There is also potential for slight adverse indirect effects on features within the recommended RZ in the medium to long-term operational phase owing to the potential for scouring and exposure to occur around features in the vicinity of devices (-1). At the project planning phase, any sites of interest for archaeological potential should be identified and exclusion zones used around these, with conduction of site surveys or trial trenching before any potentially damaging activities take place, with results informing any appropriate mitigation. Modelling of hydrodynamic and sediment transport processes may be necessary to determine potential effects on surrounding archaeological features and determine any appropriate mitigation required. Management of cultural heritage at the project level should be considered through the development and application of a MARP.

The recommended RZ is situated between c.14km and c.25km distance from the coastline. There is potential for significant adverse indirect effects (-3) on the setting of coastal heritage features, including for 1183 Listed Buildings, 584 Defence Heritage Record sites, 880 Scheduled Monuments, 146 Scheduled Zones, and 31 Parks and Gardens (including Mourne Park, Tollymore Park, Castlewellan Castle, Castle Ward, Portaferry House, and Ballywalter Park) that are within the modelled viewshed. There is potential for significant adverse short-term effects on the setting of these features during the construction and decommissioning phase (-3), and for medium and long-term significant effects during device operation (-3), owing to the potential visibility of vessels and machinery and device arrays, respectively.

The recommended RZ is within the Irish Sea (South Down) RSCA, and is offshore of the Mourne Coast, Lecale Coast, Dundrum Bay, Ards Peninsula, and Strangford Lough RSCAs. Cultural heritage features that are listed as cultural influences for the Irish Sea (South Down) RSCA include a large number of shipwrecks scattered across the seabed. Cultural heritage features that are listed as cultural influences for the Mourne Coast RSCA include a concentration of defence heritage sites associated with Ballynahatten airfield at the southern end of the RSCA, and coastal observation post and radar site north of Kilkeel, harbours at Annalong and Kilkeel and coastguard stations along the coast, and Scheduled Areas and Monuments including Cranfield Mound and Kilkeel Medieval church site. Cultural heritage features that are listed as cultural influences for Dundrum Bay RSCA include Dundrum Castle (a Scheduled Monument), Medieval sites including several churches (most designated Scheduled Monuments and/or Areas), industrial sites including those reflecting coastal trade and industry, e.g., harbours (Scheduled Monument and Area), Registered Historic Parks/Gardens at Tyrella House and Mount Panther House, and defensive sites such as pillboxes, and anti-air-landing poles. Features listed for Lecale Coast RSCA include a cluster of Medieval fortified towerhouses in Ardglass (some of which are Scheduled Monuments/Areas, and some of which are in state care), Medieval churches, including St John’s Point Church and St Nicholas's Church of Droneyl (both in state care), and the harbour, pier and ropewalk at Killough (Scheduled Monuments and/or Areas). Features listed for Ards Peninsula RSCA include many shipwrecks, numerous coastal windmill sites and coastguard stations, WW2 coastal defences, and the Registered Historic Park/Gardens at Portavo House and Ballywalter Park. Features listed for Strangford Lough RSCA include a dense concentration of cultural sites including numerous Scheduled Areas/Monuments, numerous medieval ecclesiastical and defensive sites including churches, castles and manor houses, a concentration of industrial sites in Newtownards, historic piers, harbours and quays, former military sites, and numerous Registered Historic Parks and Gardens including Mount Stewart Estate and Castle Ward.

There is also potential for adverse effects on the setting of transboundary cultural heritage features on the coastline of north County Louth in RoI that are within the modelled viewshed.

Further refinement of the recommended RZ away from the coastline and sensitive cultural heritage designations is recommended to reduce the potential for significant adverse effects. Areas of the highest landscape and seascape sensitivity should be avoided, where possible, during the next stage of project planning. At the project planning phase, a SLVIA should be undertaken and should inform project design and appropriate mitigation to minimise adverse effects, and this should include consideration of potential impacts on views from sites of historic importance.

Landscape, Seascape and Visual Amenity

The recommended RZ is situated between c.14km and c.25km distance from the coastline. Mourne AONB, and Strangford and Lecale AONB are situated inshore, and are within the modelled viewshed. There are also 15 National Trust Lands (Bryansford, Castle Ward, Clough Castle, Dundrum Coastal Path, Glastry, Green and Blockhouse Islands, Kearney, Killynether, Lighthouse Island, Mountstewart, Mournes Coastal Path, Murlough NNR, Orlock, Slieve Donard, and Strangford Lough) within the modelled viewshed. There is potential for significant adverse short-term construction and decommissioning phase effects from the presence of vessels and machinery (-3), and significant adverse medium to long-term effects during the operational phase from the presence of device arrays (-3), owing to the high sensitivity of the landscape.

The recommended RZ is within the Irish Sea (South Down) RSCA, and is offshore of the Mourne Coast, Lecale Coast, Dundrum Bay, Ards Peninsula, and Strangford Lough RSCAs. There is potential for adverse effects in the medium and long-term within these areas, as the presence of device arrays may alter the RSCA character.

There is potential for moderate adverse indirect visual effects in the short, medium, and long-term for the inshore coastal population, including within the settlements of Strangford, Newcastle, Annalong, Kilkeel, Dundrum, Ardglass, Downpatrick, Portaferry, Newtownards, Kilkeel, Millisle, Portavogie, and Donaghadee, which are within the modelled viewshed (-2). There is also potential for transboundary effects for the coast of north county Louth in RoI.

There is also potential for in-combination or cumulative landscape/seascape and visual effects with several offshore wind projects in RoI territorial waters off the coast of County Louth that are currently at concept/early planning stage (such as Oriel, Clogherhead and North East Wind).

Further refinement of the recommended RZ away from the coastline and landscape designations is recommended to reduce the potential for significant adverse effects. Areas of the highest landscape and seascape sensitivity should be avoided, where possible, during the next stage of project planning. At the project planning phase, a SLVIA should be undertaken and should inform project design and appropriate mitigation to minimise adverse effects.

G.9 Floating Wind Resource Zone: Irish Sea Offshore

Discussion of Potential Impacts

Biodiversity, Flora and Fauna

Benthic Habitats and species:

There are no designated sites for benthic habitats and species within the recommended RZ. Pisces Reef Complex SAC, designated for Annex I Reef habitat, is situated directly adjacent to the recommended RZ in the north-west, and is within the tidal excursion zone. Queenie Corner MCZ, designated for subtidal mud and Sea-pen and burrowing megafauna communities, is situated immediately adjacent to the south-east boundary of the recommended RZ, and South Rigg MCZ, whose protected features include moderate energy circalittoral rock, subtidal coarse sediment, subtidal sand, subtidal mud, subtidal mixed sediment, and sea-pen and burrowing megafauna communities, is in close proximity to the northern boundary; these sites are both within the tidal excursion zone. There is a TCE Very High MCZ risk area for Habitat in the south-east and in the north, and a High MPA risk area for Habitat in the north-west of the recommended RZ. There is potential for significant adverse indirect effects on designated benthic habitat features in the short-term construction and decommissioning phases from sedimentation or water quality effects (-3), and for significant adverse indirect effects during the operational phase to features in close proximity to where the designated site boundaries meet the recommended RZ due to hydrodynamic effects (-3). Further refinement of the recommended RZ away from these sites is recommended to avoid the potential for significant adverse effects during construction and operation.

There are small areas of Annex I Reef habitat situated inshore of the recommended RZ within the tidal excursion zone; there is potential for moderate adverse indirect effects on these features in the short-term construction and decommissioning phases from sedimentation or water quality effects (-2). The seabed habitats within the recommended RZ predominantly consist of fine mud, with sandy mud in the south-east and small areas of sandy mud, muddy sand, and rock/hard substrate. There are recorded occurrences of benthic Priority species and PMFs of starfish and molluscs within the recommended RZ. There is potential for moderate adverse direct and indirect effects on these sensitive species, as well as on non-sensitive benthic habitats, from localised benthic loss, or pollution and sedimentation effects during the short-term construction and decommissioning phases (-2), and the medium and long-term operational phase (-2). These effects may be minimised based on micro-siting at the project level; project planning mitigation should aim for avoidance of areas of benthic ecological importance, particularly areas where protected habitats and species are present, and installation in areas where non-sensitive habitats or species are present with the use of appropriate installation techniques. The volume of rock used for cable armouring, pipeline protection and foundation scour protection should be planned as the minimum required, to minimise habitat loss. At the project planning phase, sediment and erosion occurrence should be minimised through the development, implementation and enforcement of an ESCP for construction and decommissioning works, and modelling of hydrodynamic and sediment transport processes to assess potential effects and determine suitable mitigation to minimise these.

There are no records of invasive species within the recommended RZ; there is a potential risk of introduction of invasive species to the area with potential for slight adverse direct effects during the short-term construction and decommissioning phases (-1), and in the medium to long-term during operational maintenance (-1). Mitigation to reduce the risk of introduction of invasive species to the area is provided in **Section 10.1**.

Fish and Shellfish:

There are no designated sites for fish and shellfish within the recommended RZ or the tidal excursion zone, and there are no TCE Very High, High, or Moderate MPA risk areas for Fish within the recommended RZ.

There are (Ellis *et al.* (2012) CEFAS) fish spawning grounds for cod, plaice, hake, horse mackerel, ling, mackerel, whiting, sandeel, and sole, and nursery grounds for cod, herring, whiting, spurdog, anglerfish, hake, mackerel, plaice, thornback ray, and tope shark within the recommended RZ and tidal excursion zone. There are known (Coull *et al*. (1998) CEFAS) fish spawning grounds for whiting, sprat, lemon sole, cod, and Nephrops, and nursery grounds for whiting, lemon sole, haddock, herring, cod, and Nephrops, within the recommended RZ and tidal excursion zone. There are also AFBI surveyed spawning areas for cod, plaice, and haddock, and nursery grounds for haddock and whiting within the recommended RZ and tidal excursion zone. There is potential for significant adverse direct and indirect effects in the short-term construction and decommissioning phases from habitat loss or damage, sedimentation, and smothering effects and via impacts on water quality (-3), and in the medium and long-term operational phase due to a loss of supporting habitat (-3). Further refinement of the recommended RZ away from the most important areas for fish spawning and nursery is recommended to avoid the potential for significant adverse effects during construction and operation.

There are known occurrences of NI Protected species common skate and twaite shad, Priority species whiting, herring, spiny dogfish, cod, twaite shad, hake, school shark, common skate, undulate ray, and horse mussel, PMF species whiting, hake, horse mackerel, small-spotted catfish, herring, mackerel, cod, plaice, anglerfish, sole, starry smooth-hound, cuckoo ray, thornback ray, spotted ray, blue whiting, broadnose skate, spiny dogfish, nursehound, ling, common skate, small-eyed ray, queen scallop and great scallop, and elasmobranch species spurdog, thornback ray, spotted ray, undulate ray, school shark, porbeagle shark, and cuckoo ray. There is potential for moderate adverse direct and indirect effects on these sensitive species from disturbance and displacement and localised loss of, or damage to supporting habitats during the short-term construction and decommissioning phases (-2), and medium to long-term adverse direct and indirect effects due to loss of supporting habitats, habitat exclusion and displacement, barrier effects, entanglement, or EMF effects (-2).

As described for Benthic Habitats and Species, project planning mitigation should aim for avoidance of areas of benthic ecological importance, particularly areas where protected habitats and species are present. Areas should be avoided that may generate increased levels of suspended sediment that coincide with areas of fish spawning grounds or sensitive species. Where this is not possible, appropriate timing restrictions should be applied to works, and/or less disruptive installation methods used, to minimise effects on sediment mobilisation and disturbance and displacement of species from the construction area.

In the medium and long-term, there is potential for slight positive indirect effects (+1) owing to device colonisation and the possibility that device arrays may cause a reef effect, however this may also lead to a slight adverse indirect short-term effect (-1) should colonised structures be removed at decommissioning. Mitigation measures during the project planning phase should consider the decommissioning activities that will be used, and whether removal of colonised structures, foundations or scour protection is required, or could result in a double habitat loss (that from pre-construction and decommissioning periods). If fishing is excluded from the array area, there may be potential for positive effects on fish species and supporting habitats such as spawning and nursery grounds within the operational phase.

Marine Mammals:

North Channel SAC, designated for harbour porpoise, is within the northern area of the recommended RZ and tidal excursion zone to the north. There is a TCE High MPA risk area for Marine Mammals within the north of the recommended RZ, due to the interaction with the North Channel SAC, and a Moderate MPA risk area elsewhere with the exception of the south-west. There is potential for significant adverse direct and indirect effects on designated marine mammals in the short-term pre-construction, construction, and decommissioning phases due to noise impacts, disturbance and displacement, and collision risk (-3). In the medium to long-term operational phase there is potential for moderate adverse direct and indirect effects due to habitat exclusion and displacement, loss of supporting habitat or changes to prey species, and potential collision risk (-2). Further refinement of the recommended RZ away from this site is recommended to avoid the potential for significant adverse effects.

There are areas of recorded relatively high (striped dolphin, minke whale, common dolphin, common/striped dolphin, and beaked whale) and relatively moderate (striped dolphin, minke whale, fin whale, common dolphin, common/striped dolphin, bottlenose dolphin, and beaked whale) density for cetacean species, and areas of relatively moderate density for grey seal. There are also records of the NI Protected and Priority species minke whale, harbour porpoise, bottlenose dolphin, and common dolphin, NI Priority species, of which harbour porpoise, bottlenose dolphin, and common dolphin are also PMF species, and there is potential for moderate adverse, direct and indirect, short, medium and long-term effects as described above (-2), including the potential for transboundary effects.

During project planning for wind turbines, the key areas of marine mammal habitats and migratory routes should be identified, including through the conduction of pre-construction surveys and consultation with environmental stakeholders, and development avoided within these areas, whenever possible. Pre-construction, construction, and decommissioning activities should be planned to minimise the potential for adverse effects on marine mammals, including temporal activity planning, limiting vessel activity and mitigation against potential noise effects, including through avoidance of foundation installation such as piling that generates higher noise and avoidance or use of low-noise methods to dispose of any UXO within the development area. The potential for pre-construction, construction, and decommissioning phase adverse effects can be minimised through the application of standard best practice mitigation for marine mammals, including the use of marine mammal observers. Turbines and associated infrastructure should be designed to minimise effects during operation, such as to minimise the potential collision risk for marine mammals with turbines and attachment infrastructure.

Birds:

There are no designated sites for bird species within the recommended RZ, however the North-West Irish Sea SPA in RoI is situated directly adjacent to the south-western boundary of the recommended RZ, within the tidal excursion zone. This SPA is designated for breeding or wintering populations of 21 bird species. There is also a TCE High MPA risk area for Breeding Birds within the north of the recommended RZ, and a Moderate MPA risk area elsewhere. There is potential for significant adverse direct and indirect effects on designated bird species, including from transboundary sites, in the short-term pre-construction, construction and decommissioning phases due to noise impacts, disturbance and displacement, damage or loss of supporting habitat (including through loss or damage of fish spawning or nursery areas, which could have secondary effects on predators), and collision risk (-3), and in the medium and long-term operational phase due to habitat exclusion, displacement and potential collision risk (-3). Further refinement of the recommended RZ away from the North-West Irish Sea SPA is recommended to avoid the potential for significant adverse effects.

The recommended RZ also includes areas of recorded relatively moderate density for seabirds at sea, and there is potential for slight adverse, direct and indirect, short, medium and long-term effects on seabird species, as described above (-1), including the potential for transboundary effects. There is also a known spawning ground for sandeel, a key food source for many species of seabird, within the recommended RZ. There is greater potential for adverse effects on seabirds within important foraging areas, through loss or damage to these species and their habitats during construction, displacement from these areas during construction and operation, and potentially, through a higher risk of collision for seabird species that prioritise the area for foraging; the degree of effect relating to these areas will differ between seabird species, depending on the importance of sandeel to their

diet, and ability to access this food source at different water depths. Key foraging grounds outside of designated sites should be further investigated at the next stage of future planning and appropriate mitigation applied to avoid or reduce the potential for adverse effects. During project planning for wind turbines, the key areas of bird habitats and migratory routes should be identified, including through the conduction of pre-construction surveys and consultation with environmental stakeholders, and development avoided within these areas, whenever possible. Pre-construction, construction, and decommissioning activities should be planned to minimise the potential for adverse effects on birds, including temporal activity planning, limiting vessel activity and mitigation against potential noise effects. Turbines and associated infrastructure should be designed to minimise effects, particularly collision risk, during operation.
Population and Human Health There is potential for slight adverse, short-term temporary, noise and visual effects on the local population due to noise generated and visual impacts during the construction and decommissioning phases, and visual flicker and noise effects during operation. However, due to the distance of the recommended RZ offshore, these effects should be limited to vessel occupants transiting through the area, and there is not expected to be potential for direct, short, medium, or long-term, disturbance of coastal populations due to noise or visual effects during the construction, operational, or decommissioning phases (0). The potential for indirect visual effects to coastal populations during the operational phase is considered under the Landscape, Seascape and Visual Amenity topic. There are no Bathing Water Sites, Blue Flag Beaches, or dive sites within the recommended RZ, and therefore there is not considered to be potential for adverse effects on these areas within the construction, operational, or decommissioning phases (0). There is potential for slight adverse temporary, direct and indirect, effects on leisure and recreational marine users due to an increased collision risk, access restrictions and displacement, or water quality effects, during the construction and decommissioning phases (-1). The potential for adverse direct or indirect effects on these users in the medium to long-term during the operational phase is likely to be negligible, as there is relatively low recreational boating use within the recommended RZ (0). At the next stage of project planning, the potential for interaction with areas of known high use by leisure users should be avoided or minimised. At the project level, further mitigation to minimise risk to leisure users could include the use of exclusion zones around developments and timely and effective communication regarding construction works, as well as appropriate marking of devices and the array area.
Geology, Soils and Land Use There are no WHSs, ASSIs or UNESCO Geoparks designated for geological or geomorphological features within the recommended RZ or tidal excursion zone. However, Queenie Corner MCZ is situated immediately adjacent to the south-east boundary of the recommended RZ, and both Queenie Corner and South Rigg MCZ are within the tidal excursion zone. and there is potential for significant adverse direct and indirect short to long-term effects on designated features from seabed preparation, construction, and decommissioning (-3). It is recommended that further refinement of the recommended RZ occurs to avoid interaction and possible impacts on the Queenie Corner and South Rigg MCZs. However, should this refinement not be possible, at the project planning phase, mitigation should incorporate the conduction of geophysical and geotechnical surveys to identify areas of key geological/geomorphological interest, with avoidance of these areas during development. At the project planning phase, coastal process modelling should be undertaken to determine the potential for adverse effects on designated sites, with further appropriate mitigation proposed to avoid or minimise adverse effects e.g., through a suitable design of device arrays (adequate spacing between developments/arrays) to reduce the potential for excessive energy extraction altering coastal processes and regimes. There are Annex 1 Reef habitats within the recommended RZ, and there is potential for moderate direct, temporary to permanent effects on these features through loss or damage during the construction and decommissioning phases (-2). These features should be further considered and avoided through micro-siting at the project level. Floating wind technologies within the recommended RZ are likely to be predominantly in the TCE technology groups 3 (Complex Anchoring for a moderate sea state) and 5 (Piling with socket

anchoring for a moderate sea state) with some small areas of technology group 1 (Conventional anchoring for a moderate sea state), encountering moderate sediments with geology of undifferentiated rock. This is likely to require relatively more invasive installation technologies to be employed, with potential for moderate adverse direct long-term effects on the seabed geology and sediments through loss of material (-2). There is potential for influence on the MS Descriptor 6 sea floor integrity with the installation processes of floating wind technologies; there is not anticipated to be potential for adverse effects on the achievement of GES of this Descriptor owing to the spatial extent of physical loss, however this should be fully considered at the project phase, and any appropriate mitigation put in place. There are no known areas of potential contamination within the recommended RZ i.e., no dumping grounds of spoil ground, or explosive grounds. There is therefore not expected to be potential for adverse direct or indirect short, medium, or long-term effects on sediments within the recommended RZ from interaction with potentially contaminated areas (0). The seabed sediments consist of predominantly rock with some small areas of mud and sediment with overall relatively low potential for mobilisation. There is potential for long-term (device operational life) sediment loss within the footprint of foundations and scour protection, and short-term temporary loss in the vicinity of the works during seabed preparation activities, construction, and decommissioning activities (-2). Sediment and erosion occurrence should be minimised through the development, implementation, and enforcement of an ESCP for construction works. Decommissioning methods should be used that aim to minimise the amount of suspended sediment generated. Following the installation of floating wind technologies there is potential for medium to long-term localised impacts on erosion and deposition patterns within close proximity to the devices during the operational phase (-2), given the relatively low mobility of sediments within the recommended RZ. Further mitigation to minimise the potential for adverse effects on sediments and sediment transport is provided in **Section 10.1**.
Water No designated WFD Shellfish Water or Bathing Waters, or WFD coastal water bodies are within the recommended RZ or tidal excursion zone. There is therefore not expected to be potential for adverse, direct or indirect, short, medium or long-term effects within these sites from construction or operation of floating wind devices within the recommended RZ (0). There are no known areas of potential contamination within the recommended RZ i.e., no dumping grounds of spoil ground, or explosive grounds. There is therefore not expected to be potential for adverse direct or indirect short, medium, or long-term effects on water quality within the recommended RZ from interaction with potentially contaminated areas (0). There is potential for localised effects on water quality within the recommended RZ and tidal excursion zone during the short-term construction and decommissioning phases and during device operation (maintenance) due to sediment mobilisation and associated turbidity, construction discharges or accidental contaminant release from machinery and vessels (-1). There is potential for localised effects on water quality, as described above, within the MS Celtic Seas sub-region, however there is not expected to be potential for adverse effects on the achievement of GES for water quality Descriptors (e.g., Descriptor 9 Concentrations of contaminants in fish and other seafood; Descriptor 8: Concentration of contaminants within marine environment; Descriptor 10 marine litter) with the application of standard best practice mitigation during seabed preparation, construction, maintenance and decommissioning activities (-1). The potential for adverse effects on water quality should be minimised at the project level, including through sediment testing and water quality monitoring during the construction and decommissioning phases to identify and mitigate for potential adverse effects at the earliest possible stage. Environmental authorities should be consulted on the construction methodology, and the most appropriate timing of works to provide the least potential for sediment mobilisation to waterbodies. Further mitigation is provided in **Section 10.1**.
Air There is potential for slight adverse, direct, short-term temporary effects on local air quality due to air emissions from vessels and machinery during the construction and decommissioning phases. There is also the potential for slight adverse, short-term, temporary emissions from vessels due to maintenance activities during the operational phase. However, due to the distance of coastal populations from the recommended RZ, it is not expected that there will be potential for adverse

direct or indirect, short, medium, or long-term effects on these receptors from air pollution during the construction, operational and decommissioning phases (0). At the project level, emissions of air pollutants should be minimised through adherence to standard best practise for the minimisation of air pollution, as set out in **Section 10.1**. There is potential for significant positive indirect effects on regional air quality in the medium to long-term operational phase, as the operation of renewable energy devices can support a transition away from fossil fuel use and its associated air emissions (+3).
Climatic Factors There are no identified areas of blue carbon habitat within the recommended RZ, therefore, there is unlikely to be potential for adverse effects on blue carbon habitats within the recommended RZ during the construction, operational and decommissioning phases (0). There is potential for slight adverse short-term effects on sediment carbon storage, due to a localised release of CO_2 from seabed disturbance during the construction (and decommissioning) phases (-1). There is potential for slight adverse, short-term, temporary effects on localised GHG concentrations, due to GHG emissions from vessels and machinery during the construction and decommissioning phases (-1). At the project level, emissions of air pollutants should be minimised through adherence to standard best practise for the minimisation of air pollution, as set out in **Section 10.1**. There is potential for significant positive, medium to long-term effects during the operational phase, as the operation of renewable energy devices can contribute to a net reduction in GHG emissions, decarbonisation of the energy sector, diversification of electricity supply and energy security, and meeting of energy objectives and climate change emission reduction targets (+3).
Material Assets <u>Existing Infrastructure</u> There is potential for significant adverse, direct short-term damage to the existing gas pipelines and cables, and subsequent disruption to energy supplies and telecommunications during the construction and decommissioning phases (short-term) (-3), as well as moderate adverse direct, medium to long-term (device lifetime) effects in the operational phase during recurrent maintenance operations (-2). There is also potential for significant adverse indirect effects to energy supplies, as access to the existing pipelines and cables for maintenance may also be reduced temporarily during the construction and decommissioning phases (short-term) (-3), as well as during the operational phase (long-term) (-3). Industry standard mitigation measures can be implemented at the project phase to avoid the potential for direct damage to the existing infrastructure, such as implementation of safety zones (e.g., 500m avoidance areas) around the pipelines and cables. Clear communication should be undertaken with the owners of the infrastructure during all project planning and installation, to ensure that the construction process does not impact on access requirements to this infrastructure. Taking these mitigation measures into consideration, the potential for adverse effects on infrastructure can be reduced from moderate to negligible (0) in the short, medium, and long-term. <u>Shipping and Navigation</u> There is potential for direct adverse effects on shipping and navigation to arise within the recommended RZ. There is the potential for significant direct short-term displacement of vessels during construction and decommissioning (-3), as well as medium to long-term displacement from the array area during the project lifetime (-3), due to safety exclusion zones. This can result in disruption to vessel routeing and timetables. There is the potential for short-term risk of collision and allision with vessels associated with ORE development during the construction and decommissioning phases, which may result in hazardous cargo or oil spillage (-3). There is also potential for significant adverse effects in the medium to long-term operational phase due to a risk of allision with stationary device arrays and subsequent spill risk, as well as safety concerns with under keel clearance reduction (-3). Additionally, there is potential for direct adverse effects on navigation in the medium to long-term operational phase, as devices could obstruct lights, buoys, or the coastline (-3). In terms of communication and navigational

equipment, AIS and radar systems (including aviation NATS) may be affected. Furthermore, there is potential for significant adverse effects within installation and decommissioning areas in the short-term construction and decommissioning phases, as the presence of installation vessels and equipment may adversely impact the efficiency of search and rescue operations (-3).

Given the presence of the relatively high and moderate density shipping areas within the recommended RZ associated with the Warrenpoint to Heysham shipping route and the Belfast to Liverpool (Birkenhead) ferry route, there is the potential for significant navigational risk and displacement in the short, medium, and long-term (-3).

The potential significant adverse effects on navigational risk could be mitigated through the implementation of mitigation measures in line with standard Shipping and Navigation mitigation outlined in **Section 10.1**. Further refinement of the recommended RZ through avoidance of this higher density Warrenpoint to Heysham freight ferry route and the Belfast to Liverpool (Birkenhead) ferry route is recommended which could reduce the potential impacts to navigational risk and displacement to moderate in the short, medium, and long-term (-2).

<u>Commercial Fisheries</u>

There are relatively high intensity fishing areas within the recommended RZ. There is potential for significant direct adverse, short-term effects on commercial fisheries operations due to temporary displacement from traditional fishing grounds during the construction and decommissioning phases (-3), as well as potential for direct adverse long-term effects due to displacement from the recommended RZ during the operational phase (-3). Displacement of fishing activity could result in increased competition for fishing grounds and has potential to adversely affect fish stocks and, by extension, landings in nearby areas. The potential for adverse effects due to the displacement of vessels can be minimised through further consideration at the next stage of project planning. There should be strategic level caution regarding the siting of ORE infrastructure, with an aim to avoid developments occupying recognised fishing grounds unless there is a successful agreement between the industries that co-location is achievable. Further mitigation with regard to potential co-location is discussed in **Section 10.1**.

There is potential for significant adverse direct effects due to an increased collision risk of fishing vessels with vessels associated with ORE development in the short-term during the construction and decommissioning phases (-3), and moderate in the medium to long-term during recurrent maintenance activities in the operational phase (-2). There is also potential for significant adverse indirect effects in the medium to long-term operational phase, as displacement of fishing vessels from the area may concentrate vessels into a smaller area for shipping and navigation routes, with an associated increased collision risk (-3). There is also potential for significant adverse effects on fishing activities within the recommended RZ in the operational phase, as actual and/or perceived increased allision risks with devices, or entanglement of fishing gear with devices or attachment infrastructure may lead to avoidance of the area by fishing vessels (-3). To mitigate for navigational risk, further mitigation measures in line with standard commercial fisheries mitigation outlined in **Section 10.1** should be implemented. It is imperative that a successful agreement between industries that co-location is achievable is agreed. Further mitigation with regard to potential co-location is also discussed in **Section 10.1**.

There is potential for effects on commercial fish species and their key habitats within the recommended RZ and the tidal excursion zone. There is slight potential for indirect positive effects in the medium to long-term, as hard subsea infrastructure could lead to an enhancement of fish populations at the edges of the array for trawler fishing (+1). Given the high number of spawning and nursery grounds within the recommended RZ, there is potential for significant adverse direct effects in the short-term construction phase, and medium to long-term operational phase due to the potential for a direct loss of these supporting habitats (-3). There is also potential for significant adverse direct and indirect effects during the short-term construction and decommissioning phases (-3), and moderate effects in the medium to long-term operational phase (-2) due to sediment mobilisation from construction, decommissioning and maintenance activities, respectively, which could have an indirect effect on fishing activity through an alteration of fishing stocks (-3). To minimise the potential for indirect effects on commercial fisheries through impacts on fishing stocks, an ESCP should be developed, implemented and enforced for construction works, while decommissioning methods used should aim to minimise sediment generated. Further information on the potential ecosystem effects on fish and shellfish species, and potential mitigation can be found in the Biodiversity, Flora, and Fauna assessment for the Irish Sea Offshore recommended RZ.

There is potential for significant indirect effects on the profitability of commercial fishing in the short, medium, and long-term (-3), such as the potential for reduced quotas, increased resource competition for fishing, and reduced landings in both tonnage and economic value. These effects could be mitigated by considering the mitigation measures discussed above, and in **Section 10.1**. Further refinement of the recommended RZ through avoidance of the areas of highest known importance for fish spawning and nursery grounds and of areas of high fishing activity is recommended, which could reduce the potential effects on commercial fisheries to moderate in the short, medium, and long-term (-2).

Military Areas

There is potential for moderate adverse effects on military activities, including temporary (short-term) disruption of military exercises and activities within the Ardglass and Peel Military Practice Areas during pre-construction, installation, and decommissioning (-2) phases, and medium to long-term disruption during the operational phase due to the presence of offshore infrastructure (-2). The area available for military practice activity could be reduced during the operational phase. Consultation with the MoD during the next stage of project planning could help to inform the key areas that should be avoided within the mapped Practice Areas, which could reduce the potential for adverse effects due to the displacement of military activities. The risk of collision of military vessels with devices can be minimised through further consultation with the MoD at the next stage of further planning. Measures outlined to mitigate against navigational risk in the Shipping and Navigation Section of **Section 10.1** are also of relevance. This could reduce the potential for adverse effects on military activities to slight in the short, medium, and long-term (-1).

Aviation

There are no safeguarding zones for aviation interference within the recommended RZ. The presence of devices has limited potential to effect communications, navigation, and surveillance, therefore, there is potential for negligible effects on aviation navigation or radar (0).

Spoil Dumping Grounds

There are no spoil dumping grounds located within the recommended RZ. There is therefore no potential for temporary disruption or displacement of vessels moving to and from disposal sites (0).

Tourism

The potential for effects on tourism is considered indirectly within the topics of Landscape, Seascape and Visual Amenity (visibility of construction activity and operational devices), Population and Human Health (recreational use of the RZ), and Biodiversity, Flora, and Fauna (effects on wildlife). As discussed in the Landscape, Seascape and Visual Amenity Section, there is the potential for moderate to significant adverse effects on Landscape, Seascape and Visual Amenity within Mourne AONB, Strangford and Lecale AONB, and various National Trust sites, which may result in secondary adverse effects on tourism, as this may act as a deterrent to tourists to visit these sites. Conversely, it is possible the presence of a wind farm will act as a tourist attraction. As discussed in Population and Human Health, there is potential for adverse effects on recreational access and increased noise and contaminant release in the short-term, as such tourism could be impacted by these potential effects. Lastly, as discussed in Biodiversity, Flora and Fauna, there is potential for noise generation to adversely affect wildlife, which may result in a secondary impact on tourism activities such as bird, dolphin or whale watching.

There is the potential for tourism to be impacted by secondary effects. It is not clear whether an overall negative or positive impact will arise. However, it is likely any impact on tourism will be benign and of low significance.

Renewable Energy Generation The potential capacity of the recommended RZ is 5.7GW. As such, there is potential for significant positive effects in the medium to long-term, owing to the generation of a new renewable energy supply for the NI population (+3). Overall Overall, there is considered to be potential for significant adverse effects in the short, medium- and long-term for Material Assets (-3), following the consideration of best practice mitigation measures, mainly attributed to identified potential for significant adverse effects on Shipping and Navigation, and Commercial Fisheries.
Cultural, Architectural and Archaeological Heritage - There are many (23) known undesignated wrecks within the recommended RZ, and a further 28 within the tidal excursion zone. There is potential for moderate adverse temporary to permanent effects on these features during the construction and decommissioning phases, which may be due to direct damage or disturbance of features within the recommended RZ, or indirect effects via sediment displacement and deposition to features within the recommended RZ and the tidal excursion zone (-2). There is also potential for slight adverse indirect effects on features within the recommended RZ in the medium to long-term operational phase owing to the potential for scouring and exposure to occur around features in the vicinity of devices (-1). At the project planning phase, any sites of interest for archaeological potential should be identified and exclusion zones used around these, with conduction of site surveys or trial trenching before any potentially damaging activities take place, with results informing any appropriate mitigation. Modelling of hydrodynamic and sediment transport processes may be necessary to determine potential effects on surrounding archaeological features and determine any appropriate mitigation required. Management of cultural heritage at the project level should be considered through the development and application of a MARP. The recommended RZ is situated between c.22km and c.56km distance from the coastline. There is potential for moderate to significant adverse indirect effects (-2 to -3, depending on the distance offshore) on the setting of coastal heritage features, including for 819 Listed Buildings, 396 Defence Heritage Record sites, 522 Scheduled Monuments, 91 Scheduled Zones, and 20 Parks and Gardens (including Mourne Park, Tollymore Park, Tyrella House, Ballywalter Park, Portaferry House, and Castle Ward) that are within the modelled viewshed. There is potential for short-term moderate to significant adverse indirect effects on the setting of these features during the construction and decommissioning phase (-2 to -3), and for medium and long-term moderate to significant adverse indirect effects during device operation (-2 to -3), owing to the potential visibility of vessels and machinery and device arrays, respectively. The recommended RZ is within the Irish Sea (South Down) RSCA at its inshore boundary, and the RSCAs of Mourne Coast, Lecale Coast, Dundrum Bay, Ards Peninsula, and Strangford Lough are situated inshore of the recommended RZ. Cultural heritage features that are listed as cultural influences for the Irish Sea (South Down) RSCA include a large number of shipwrecks scattered across the seabed. Cultural heritage features that are listed as cultural influences for the Mourne Coast RSCA include a concentration of defence heritage sites associated with Ballynahatten airfield at the southern end of the RSCA, and coastal observation post and radar site north of Kilkeel, harbours at Annalong and Kilkeel and coastguard stations along the coast, and Scheduled Areas and Monuments including Cranfield Mound and Kilkeel Medieval church site. Features listed for Lecale Coast RSCA include a cluster of Medieval fortified towerhouses in Ardglass (some of which are Scheduled Monuments/Areas, and some of which are in state care), Medieval churches, including St John's Point Church and St Nicholas's Church of Droneyl (both in state care), and the harbour, pier and ropewalk at Killough (Scheduled Monuments and/or Areas). Cultural heritage features that are listed as cultural influences for Dundrum Bay RSCA include Dundrum Castle (a Scheduled Monument), Medieval sites including several churches (most designated Scheduled Monuments and/or Areas), industrial sites including those reflecting coastal trade and industry, e.g., harbours (Scheduled Monument and Area), Registered Historic Parks/Gardens at Tyrella House and Mount Panther House, and defensive sites such as pillboxes, and anti-air-landing poles. Features listed for Ards Peninsula RSCA include many shipwrecks, numerous coastal windmill sites and

coastguard stations, WW2 coastal defences, and the Registered Historic Park/Gardens at Portavo House and Ballywalter Park. Features listed for Strangford Lough RSCA include a dense concentration of cultural sites including numerous Scheduled Areas and Monuments, numerous medieval ecclesiastical and defensive sites including churches, castles and manor houses, a concentration of industrial sites in Newtownards, historic piers, harbours and quays, former military sites, and numerous Registered Historic Parks and Gardens including Mount Stewart Estate and Castle Ward. There is also potential for adverse effects on the setting of transboundary cultural heritage features in the west of the Isle of Man and the coastline of County Louth and north County Dublin in RoI that are also within the modelled viewshed. Further refinement of the recommended RZ away from the coastline and sensitive cultural heritage designations is recommended to reduce the potential for significant adverse effects. Areas of the highest landscape and seascape sensitivity should be avoided, where possible, during the next stage of project planning. At the project planning phase, a SLVIA should be undertaken and should inform project design and appropriate mitigation to minimise adverse effects, and this should include consideration of potential impacts on views from sites of historic importance.
Landscape, Seascape and Visual Amenity - The recommended RZ is situated between c.22km and c.56km distance from the coastline. Mourne AONB, and Strangford and Lecale AONB are situated inshore, and are within the modelled viewshed. There are also nine National Trust Lands (Mournes Coastal Path, Castle Ward, Bryansford, Clough Castle, Green and Blockhouse Islands, Kearney, Murlough NNR, Slieve Donard, and Strangford Lough) within the modelled viewshed. There is potential for moderate to significant adverse indirect short-term construction and decommissioning phase effects from the presence of vessels and machinery (-2 to -3, depending on the distance offshore), and medium to long-term moderate to significant adverse indirect effects during the operational phase from the presence of device arrays (-2 to -3, depending on the distance offshore), owing to the high sensitivity of the landscape. The recommended RZ is within the Irish Sea (South Down) RSCA at its inshore boundary, and the RSCAs of Mourne Coast, Lecale Coast, Dundrum Bay, Ards Peninsula, and Strangford Lough are situated inshore of the recommended RZ. There is potential for adverse effects in the medium and long-term within these areas, as the presence of device arrays may alter the character of these RSCAs. There is potential for moderate adverse indirect visual effects in the short, medium and long-term for the inshore coastal population, including within the settlements of Kilkeel, Annalong, Newcastle, Downpatrick, Ardglass, and Portaferry, which are within the modelled viewshed (-2). There is also potential for transboundary effects for the coastal population in the west of the Isle of Man and the coastline of County Louth and north County Dublin in RoI that are also within the modelled viewshed. There is also potential for in-combination or cumulative landscape/seascape and visual effects with several offshore wind projects in RoI territorial waters off the coast of County Louth that are currently at concept/early planning stage (such as Oriel, Clogherhead and North East Wind). Further refinement of the recommended RZ away from the coastline and landscape designations is recommended to reduce the potential for significant adverse effects. Areas of the highest landscape and seascape sensitivity should be avoided, where possible, during the next stage of project planning. At the project planning phase, a SLVIA should be undertaken and should inform project design and appropriate mitigation to minimise adverse effects.

G.10 Tidal Resource Zone: Atlantic

Discussion of Potential Impacts
Biodiversity, Flora and Fauna <u>Benthic Habitats and species:</u>

There are no designated sites for benthic habitats and species within the recommended RZ. Skerries and Causeway SAC, designated for Reef and Sandbank habitats, is situated c.1.8km inshore of the recommended RZ and is within the tidal excursion zone. Rathlin Island MCZ, designated for Deep-sea bed habitat, is situated c.1.7km to the south-east, and Rathlin Island SAC, designated for Sandbanks, Sea caves, Drift line vegetation and Vegetated sea cliffs, is situated c.3.5km to the south-east; these sites are also within the tidal excursion zone. There is potential for significant adverse indirect effects on designated benthic habitat features of these sites in the short-term construction and decommissioning phases from sedimentation or water quality effects (-3). Refinement of the recommended RZ away from these sites is recommended to avoid the potential for significant adverse effects during these stages.

There are areas of Annex I Reef habitat within the recommended RZ, and the tidal excursion zone, and also areas of Annex I Sandbank, Sea caves and Maerl within the tidal excursion zone to the south-east. There is potential for moderate adverse direct or indirect effects on Annex I Reef habitat both in the short-term construction and decommissioning phases and in the medium to long-term from loss or damage, and sedimentation or water quality effects, and for moderate adverse indirect effects on Annex I Sandbank, Sea caves and Maerl habitats in the short-term construction and decommissioning phases from sedimentation or water quality effects (-2). The seabed habitats within the recommended RZ predominantly consist of coarse substrate, with areas of sand, muddy sand, and rock or hard substrate. There are no recorded occurrences of benthic Protected, NI Priority, PMF or OSPAR Threatened/Declining benthic species. There is potential for slight direct and indirect effects on non-sensitive benthic habitats and species from localised benthic loss, or pollution and sedimentation effects during the short-term construction and decommissioning phases (-1), and the medium and long-term operational phase (-1). These effects may be minimised based on micro-siting at the project level; project planning mitigation should aim for avoidance of areas of benthic ecological importance, particularly areas where protected habitats and species are present, and installation in areas where non-sensitive habitats or species are present with the use of appropriate installation techniques. The volume of rock used for cable armouring, pipeline protection and foundation scour protection should be planned as the minimum required, to minimise habitat loss. At the project planning phase, sediment and erosion occurrence should be minimised through the development, implementation, and enforcement of an ESCP for construction and decommissioning works, and modelling of hydrodynamic and sediment transport processes to assess potential effects and determine suitable mitigation to minimise these.

There are no records of invasive species within the recommended RZ; there is a potential risk of introduction of invasive species to the area with potential for slight adverse direct effects during the short-term construction and decommissioning phases (-1), and in the medium to long-term during operational maintenance (-1). Mitigation to reduce the risk of introduction of invasive species to the area is provided in **Section 10.1**.

Fish and Shellfish:

There are no designated sites for fish and shellfish within the recommended RZ or the tidal excursion zone. There is a TCE Moderate MPA risk area for Fish within the recommended RZ, owing to the potential for migratory fish species to use the area.

There are (Ellis *et al*. (2012) CEFAS) nursery grounds of high intensity for spurdog within the recommended RZ, and for whiting within the tidal excursion zone, nursery grounds of low intensity for anglerfish, cod, common skate, hake, herring, and mackerel within the RZ, and for blue whiting and ling within the tidal excursion zone. There are known (Coull *et al*. (1998) CEFAS) spawning grounds for sprat, herring and Nephrops, and a nursery ground for Nephrops, within the recommended RZ, and a nursery ground for cod within the tidal excursion zone. There is also an AFBI surveyed area of relatively high density for scallops within the very inshore area of the recommended RZ and within the tidal excursion zone, and an AFBI surveyed area of relatively high density for queen scallops within the north-east of the recommended RZ and within the tidal excursion zone. There is potential for moderate adverse direct and indirect effects in the short-term construction and decommissioning phases from habitat loss or damage, sedimentation, and smothering effects and via impacts on water quality (-2), and in the medium and long-term operational phase due to a loss of supporting habitat (-2).

The NI Priority species cod has been recorded within the recommended RZ; there are no other records of Protected, NI Priority, PMF or OSPAR Threatened/Declining fish or shellfish species. There is potential for slight adverse direct and indirect effects on fish species, including migratory species, using the area, in the short-term construction and decommissioning phases from supporting habitat loss or damage, sedimentation and smothering effects and via impacts on water quality (-1), and in the medium and long-term operational phase due to a loss of supporting habitat (-1).

As described for Benthic Habitats and Species, project planning mitigation should aim for avoidance of areas of benthic ecological importance, particularly areas where protected habitats and species are present. Areas should be avoided that may generate increased levels of suspended sediment that coincide with areas of fish spawning grounds or sensitive species. Where this is not possible, appropriate timing restrictions should be applied to works, and/or less disruptive installation methods used, to minimise effects on sediment mobilisation and disturbance and displacement of species from the construction area.

In the medium and long-term, there is potential for slight positive indirect effects (+1) owing to device colonisation and the possibility that device arrays may cause a reef effect; however, this may also lead to a slight adverse indirect short-term effect (-1) should colonised structures be removed at decommissioning. Mitigation measures during the project planning phase should consider the decommissioning activities that will be used, and whether removal of colonised structures, foundations or scour protection is required, or could result in a double habitat loss (that from pre-construction and decommissioning periods). If fishing is excluded from the array area, there may be potential for positive effects on fish species and supporting habitats such as spawning and nursery grounds within the operational phase.

<u>Marine Mammals:</u>

There are no designated sites for marine mammals within the recommended RZ. However, Skerries and Causeway SAC, designated for harbour porpoise, is situated c.1.5km inshore of the recommended RZ and is within the tidal excursion zone, and there is a TCE High MPA risk area for Marine Mammals within the RZ. There is potential for moderate adverse indirect effects on supporting habitat in the short-term construction and decommissioning phases, due to sedimentation or water quality effects (-2).

There are areas of recorded relatively high (pilot whale, and fin whale) and relatively moderate (pilot whale, and bottlenose dolphin) density for cetacean species, as well as relatively moderate density for grey seal and harbour seal, within the recommended RZ. There are no records of Protected, NI Priority, PMF and/or OSPAR Threatened/Declining marine mammal species within the recommended RZ. There is potential for moderate adverse direct and indirect effects in the short-term pre-construction, construction, and decommissioning phases due to noise impacts, disturbance and displacement, and collision risk (-2), and in the medium and long-term operational phase due to habitat exclusion, displacement, and potential collision or entanglement risk (-2), including the potential for transboundary effects on these sensitive species, as well as other marine mammals that may be present within the area.

During project planning for wind turbines, the key areas of marine mammal habitats and migratory routes should be identified, including through the conduction of pre-construction surveys and consultation with environmental stakeholders, and development avoided within these areas, whenever possible. Pre-construction, construction, and decommissioning activities should be planned to minimise the potential for adverse effects on marine mammals, including temporal activity planning, limiting vessel activity and mitigation against potential noise effects, including through avoidance of foundation installation such as piling that generates higher noise and avoidance or use of low-noise methods to dispose of any UXO within the development area. The potential for pre-construction, construction, and decommissioning phase adverse effects can be minimised through the application of standard best practice mitigation for marine mammals, including the use of marine mammal observers. Tidal stream devices and associated infrastructure should be designed to minimise effects during operation, such as to minimise the potential collision risk for marine mammals with devices and attachment infrastructure.

<u>Birds:</u>

There are no designated sites for bird species within the recommended RZ. Rathlin Island, c.1.7km distant at its closest point to the RZ, is an SPA (designated for razorbill, black-legged kittiwake, common guillemot and its seabird assemblage), MCZ (designated for black guillemot), IBA (breeding seabirds) and RSPB Reserve, and is within the tidal excursion zone, and there is a TCE High MPA risk area for Breeding Birds within the recommended RZ (based on the risk models for fixed wind, floating wind, and cables). There is potential for moderate adverse direct and indirect effects on designated bird species, including from transboundary sites, in the short-term pre-construction, construction, and decommissioning phases due to noise impacts, disturbance and displacement, damage or loss of supporting habitat (including sedimentation or water quality effects), and collision risk (-2), and in the medium and long-term operational phase due to habitat exclusion, displacement, and potential collision or entanglement risk for diving species (-2). There are no records of Protected, NI Priority, PMF and/or OSPAR Threatened/Declining bird species within the recommended RZ. There are areas of recorded relatively high density for seabirds at sea within the RZ, and there is potential for moderate adverse, direct and indirect, short, medium, and long-term effects on seabird species, as described above (-2), including the potential for transboundary effects. There is also an area of predicted medium to high seabed suitability for sandeel within and inshore of the RZ. There is greater potential for adverse effects on seabirds within important foraging areas, through loss or damage to these species and their habitats during construction, displacement from these areas during construction and operation, and potentially, through a higher risk of collision for seabird species that prioritise the area for foraging; the degree of effect relating to these areas will differ between seabird species, depending on the importance of sandeel to their diet, and ability to access this food source at different water depths. Key foraging grounds outside of designated sites should be further investigated at the next stage of future planning and appropriate mitigation applied to avoid or reduce the potential for adverse effects. During project planning for wind turbines, the key areas of bird habitats routes should be identified, including through the conduction of pre-construction surveys and consultation with environmental stakeholders, and development avoided within these areas, whenever possible. Pre-construction, construction, and decommissioning activities should be planned to minimise the potential for adverse effects on birds, including temporal activity planning, limiting vessel activity and mitigation against potential noise effects. Tidal stream devices and associated infrastructure should be designed to minimise effects during operation, such as to minimise the potential collision risk for diving birds with devices and attachment infrastructure.
Population and Human Health There is potential for slight adverse, short-term temporary, noise and visual effects on the local population due to noise generated and visual impacts during the construction and decommissioning phases. However, due to the distance of the recommended RZ offshore, these effects should be limited to vessel occupants transiting through the area, and there is not expected to be any direct, short, medium, or long-term, disturbance of coastal populations due to noise or effects during the construction, operational, or decommissioning phases (0). The potential for indirect visual effects to coastal populations during the operational phase is considered under the Landscape, Seascape and Visual Amenity topic. There are no Bathing Water Sites, Blue Flag Beaches, or dive sites within the recommended RZ, and therefore there is not considered to be potential for adverse effects on these areas during the construction, operational, or decommissioning phases (0). There is potential for slight adverse temporary, direct and indirect, effects on leisure and recreational marine users due to an increased collision risk, access restrictions and displacement, or water quality effects, during the construction and decommissioning phases (-1). The potential for adverse direct or indirect effects on these users in the medium to long-term during the operational phase is likely to be negligible, as there is relatively low recreational boating use within the recommended RZ (0). At the next stage of project planning, the potential for interaction with areas of known use by leisure users should be avoided or minimised. At the project level, further mitigation to minimise risk to leisure users could include the use of exclusion zones around developments timely and effective communication regarding construction works, as well as appropriate marking of devices and array area. Appropriate under keel clearance should also be considered for leisure craft using the area.
Geology, Soils and Land Use

There are no sites designated for geological or geomorphological features i.e., MCZs, WHSs, ASSIs or UNESCO Geoparks within the recommended RZ. However, Rathlin MCZ and two ASSIs of Rathlin Island-Coast and Church Bay are within the tidal excursion zone; there is potential for moderate adverse direct and indirect short to long-term effects on designated features of these sites during the operational phase e.g., through changes in hydrodynamics and sediment dynamics and short-term alterations to sedimentation in the construction phase (-3). It is recommended that refinement of the recommended RZ occurs to avoid interaction and possible impacts on the designated sites. However, should this refinement not be possible, at the project planning phase, mitigation should incorporate the conduction of geophysical and geotechnical surveys to identify areas of key geological/geomorphological interest, with avoidance of these areas during development. At the project planning phase, coastal process modelling should be undertaken to determine the potential for adverse effects on designated sites, with further appropriate mitigation proposed to avoid or minimise adverse effects e.g., through a suitable design of device arrays (adequate spacing between developments/arrays) to reduce the potential for excessive energy extraction altering coastal processes and regimes. There are Annex 1 Reef habitats within the recommended RZ, and there is potential for moderate direct, temporary to permanent impacts on these features through loss or damage during the construction and decommissioning phases (-2). These features should be further considered and avoided through micro-siting at the project level. There are no known areas of potential contamination within the recommended RZ i.e., no dumping grounds of spoil ground, or explosive grounds. There is therefore not expected to be potential for adverse direct or indirect short, medium, or long-term effects on sediments within the RZ from interaction with potentially contaminated areas (0). The main seabed sediments consist of rock or other hard substrate and coarse substrate with relatively low potential for mobilisation. There is potential for long-term (device operational life) sediment loss within the footprint of foundations and scour protection, and short-term temporary loss in the vicinity of the works during seabed preparation activities, construction, and decommissioning activities (-2). Sediment and erosion occurrence should be minimised through the development, implementation, and enforcement of an ESCP for construction works. Decommissioning methods should be used that aim to minimise the amount of suspended sediment generated. Following the installation of tidal technologies there is potential for medium to long-term localised impacts on erosion and deposition patterns within close proximity to the devices during the operational phase (-2), given the relatively low mobility of sediments within the RZ. Further mitigation to minimise the potential for adverse effects on sediments and sediment transport is provided in **Section 10.1**.
Water No designated WFD Shellfish Waters, Bathing Waters or WFD coastal water bodies are within the recommended RZ. One coastal WFD waterbody of Rathlin Island is within the tidal excursion zone, and there is potential for slight to moderate short-term effects on water quality within this site during the construction and decommissioning phases (-1). It is recommended that refinement of the RZ zone occurs to minimise potential effects within the tidal excursion zone. Should this refinement not be possible, at the project level, best practice mitigation should be put in place to minimise the potential for adverse effects. This may include sediment testing and water quality monitoring during the construction and decommissioning phases, and a requirement that any hydraulic fluids, anti-fouling components, corrosion of anodes or construction-based discharges used could only release non-toxic/low toxicity compounds (-1). Consultations should take place with environmental bodies regarding the construction methodology and appropriate timing of works to provide the least potential for sediment mobilisation to water bodies. There are no known areas of potential contamination within the recommended RZ i.e., no dumping grounds of spoil ground, or explosive grounds. There is therefore not expected to be potential for adverse direct or indirect short, medium, or long-term effects on water quality within the RZ from interaction with potentially contaminated areas (0). There is potential for localised effects on water quality within the RZ and tidal excursion zone during the short-term construction and decommissioning phases and during device operation (maintenance) due to sediment mobilisation and associated turbidity, construction discharges or accidental contaminant release from machinery and vessels (-1). There is potential for localised effects on water quality, as described above, within the MS Celtic Seas sub-region, however there is

not expected to be potential for effects on the achievement of GES for water quality Descriptors (e.g., Descriptor 9 Concentrations of contaminants in fish and other seafood; Descriptor 8: Concentration of contaminants within marine environment; Descriptor 10 marine litter) with the application of standard best practice mitigation during seabed preparation, construction, maintenance and decommissioning activities (-1). The potential for adverse effects on water quality should be minimised at the project level, including through sediment testing and water quality monitoring during construction and decommissioning phase to identify and mitigate for potential adverse effects at the earliest possible stage. Environmental authorities should be consulted on the construction methodology, and the most appropriate timing of works to provide the least potential for sediment mobilisation to waterbodies. Further mitigation is provided in **Section 10.1**.
Air There is potential for slight adverse, direct, short-term temporary effects on local air quality due to air emissions from vessels and machinery during the construction and decommissioning phases. There is also the potential for slight adverse, short-term, temporary emissions from vessels due to maintenance activities during the operational phase. However, due to the distance of coastal populations from the recommended RZ, it is not expected that there will be potential for adverse direct or indirect, short, medium, or long-term effects on these receptors from air pollution during the construction, operational and decommissioning phases (0). At the project level, emissions of air pollutants should be minimised through adherence to standard best practise for the minimisation of air pollution, as set out in **Section 10.1**. There is potential for significant positive indirect effects on regional air quality in the medium to long-term operational phase, as the operation of renewable energy devices can support a transition away from fossil fuel use and its associated air emissions (+3).
Climatic Factors There are no known areas of blue carbon habitat within the recommended RZ. Ulster Wildlife have identified areas of only low potential for blue carbon importance, therefore, there is unlikely to be potential for adverse effects on blue carbon habitats within the RZ during the construction, operational and decommissioning phases (0). There is potential for slight adverse short-term effects on sediment carbon storage, due to a localised release of CO_2 from seabed disturbance during the construction and decommissioning phases (-1). There is potential for slight adverse, short-term, temporary effects on localised GHG concentrations, due to GHG emissions from vessels and machinery during the construction and decommissioning phases (-1). At the project level, emissions of air pollutants should be minimised through adherence to standard best practise for the minimisation of air pollution, as set out in **Section 10.1**. There is potential for significant positive, medium to long-term effects during the operational phase, as the operation of renewable energy devices can contribute to a net reduction in GHG emissions, decarbonisation of the energy sector, diversification of electricity supply and energy security, and meeting of energy objectives and climate change emission reduction targets (+3).
Material Assets Existing Infrastructure There is no existing infrastructure (cables, pipelines) within the recommended RZ and, as such, there is no potential for effects on infrastructure in the short, medium, and long-term (0). Shipping and Navigation There is potential for moderate direct adverse effects on shipping and navigation in the short-term due to displacement of vessels during the construction and decommissioning phases (-2), as well as medium to long-term displacement from the array area during the operational phase (project lifetime) due to safety exclusion zones (-2). This can result in disruption to vessel routeing and timetables. There is potential for moderate direct adverse effects in the short-term during the construction and decommissioning phases due to the risk of collision and allision with vessels, which may result in hazardous cargo or oil spillage (-2). There is also potential for moderate adverse effects in the

medium to long-term operational phase due to a risk of collision with stationary device arrays and subsequent spill risk, as well as safety concerns with under keel clearance reduction (-2). Additionally, there is potential for moderate direct adverse effects on navigation in the medium to long-term operational phase, as devices could obstruct lights, buoys or the coastline (-2); in terms of communication and navigational equipment, AIS and radar systems (including aviation NATS) may be affected. Furthermore, there is potential for moderate adverse effects within installation and decommissioning areas in the short-term construction and decommissioning phases, as the presence of installation vessels and equipment may adversely impact the efficiency of search and rescue operations (-2).

Given the presence of the relatively higher density shipping area in the east of the recommended RZ, there is potential for moderate navigational risk and displacement in the short, medium, and long-term (-2). The potential adverse effects on navigational risk could be mitigated through the implementation of mitigation measures in line with standard Shipping and Navigation mitigation outlined **Section 10.1**. Refinement of the recommended RZ to avoid the area of moderate density shipping in the east is recommended, which could reduce the potential for adverse effects on Navigation and Shipping to slight in the short, medium, and long-term.

<u>Commercial Fisheries</u>

There are relatively lower intensity fishing areas and areas of known importance for inshore fisheries within the recommended RZ. There is potential for moderate direct adverse, short-term effects on commercial fisheries operations due to temporary displacement from traditional fishing grounds during construction and decommissioning (-2), as well as potential for long-term effects due to displacement from the RZ during the operational phase (-2). Displacement of fishing activity could result in increased competition for alternate fishing grounds, with potential to adversely affect fish stocks and, by extension, landings, in nearby areas. The potential for adverse effects due to the displacement of vessels can be minimised through further consideration at the next stage project planning. There should be strategic level caution regarding the siting of ORE infrastructure, with an aim to avoid developments occupying recognised fishing grounds unless there is a successful agreement between the industries that co-location is achievable. Further mitigation with regard to potential co-location is discussed in **Section 10.1**.

There is potential for moderate adverse direct effects due to an increased collision risk of fishing vessels with vessels associated with the ORE development in the short-term during the construction and decommissioning phases (-2), and slight in the medium to long-term during recurrent maintenance activities in the operational phase (-1). There is also potential for moderate adverse indirect effects in the medium to long-term operational phase, as displacement of fishing vessels from the area may concentrate vessels into a smaller area for shipping and navigation routes, with an associated increased collision risk (-2). There is also potential for moderate adverse effects on fishing activities within the RZ in the operational phase, as actual and/or perceived increased allision risks with devices, or entanglement of fishing gear with devices or attachment infrastructure may lead to avoidance of the area by fishing vessels (-2). To mitigate for navigational risk, further mitigation measures in line with standard commercial fisheries mitigation outlined in **Section 10.1** should be implemented. It is imperative that a successful agreement between industries that co-location is achievable is agreed. Further mitigation with regard to potential co-location is also discussed in **Section 10.1**.

There is potential for effects on commercial fish species and their key habitats within the RZ and the tidal excursion zone. There is slight potential for indirect positive effects in the medium to long-term, as hard subsea infrastructure could lead to an enhancement of fish populations at the edges of the array for trawler fishing (+1). There is potential for moderate adverse direct effects in the short-term construction, and medium to long-term operational phase due to the potential for a direct loss of supporting habitats, such as spawning and nursery grounds (-2). There is also potential for moderate adverse direct and indirect effects during the short-term construction and decommissioning phases (-2), and slight in the medium to long-term operational phase (-1) due to sediment mobilisation from construction, decommissioning and maintenance activities, respectively, which could have an indirect effect on fishing activity through an alteration of fishing stocks (-2). To minimise the potential for indirect effects on commercial fisheries through impacts on fishing stocks, an ESCP should be developed, implemented, and enforced for construction works, while the decommissioning methods used should aim to minimise sediment generated. Further information on the potential ecosystem effects on fish and shellfish species and potential mitigation can be found in the Biodiversity, Flora, and Fauna assessment for the Atlantic Tidal RZ.

There is potential for moderate indirect effects on the profitability of commercial fishing in the short, medium, and long-term (-2), such as the potential for reduced quotas, increased resource competition for fishing, and reduced landings in both tonnage and economic value. These could be mitigated by considering the mitigation measures discussed above, and in **Section 10.1**. Refinement of the RZ to avoid areas used by inshore fisheries could reduce the potential for adverse effects on Commercial Fisheries to slight in the short, medium, and long-term.

<u>Military Areas</u>

There is potential for moderate adverse effects on military activities, including temporary (short-term) disruption of military exercises and activities within the Rathlin Military Practice area and the Skerries Military Practice Area during pre-construction, installation, and decommissioning (-2), and medium to long-term disruption during operation due to the presence of offshore infrastructure (-2). As the entire recommended RZ is within these Military Practice Area, the areas available for military practice activity could be reduced during the operational phase. Consultation with the MoD during the next stage of project planning could help to inform the key areas that should be avoided within the mapped Practice Areas, which could reduce the potential for adverse effects due to the displacement of military activities. The risk of collision of military vessels with devices can be minimised through further consultation with the MoD at the next stage of further planning. Measures outlined to mitigate against navigational risk in the Shipping and Navigation Section of **Section 10.1** are also of relevance.

Considering these mitigation measures the potential for adverse effects on military activities could be reduced from moderate to slight (-1) in the short, medium, and long-term.

<u>Aviation</u>

There are no safeguarding zones for aviation interference within the recommended RZ. The presence of devices has limited potential to effect communications, navigation, and surveillance, and therefore, there is potential for negligible effects on aviation navigation or radar (0).

<u>Spoil Dumping Grounds</u>

There are no spoil dumping grounds located within the recommended RZ. There is, therefore, no potential for temporary disruption or displacement of vessels moving to and from disposal sites (0).

<u>Tourism</u>

The potential for effects on tourism is considered indirectly within the topics of Landscape, Seascape and Visual Amenity (visibility of construction activity and operational devices), Population and Human Health (recreational use of the RZ), and Biodiversity, Flora, and Fauna (effects on wildlife). As discussed in the Landscape, Seascape and Visual Amenity Section, there is potential for moderate adverse effects on Landscape, Seascape and Visual Amenity which may result in secondary adverse effects on tourism, as this may act as a deterrent to tourists. Conversely, it is possible the presence of a tidal stream development will act as a tourist attraction. As discussed in Population and Human Health, there is negligible potential for adverse effects on the population due to increased noise release in the short-term; as such, tourism in unlikely to be impacted by these potential effects. However, there is potential for a slight adverse temporary direct and indirect effects on leisure and recreational marine users due to an increased collision risk, access restrictions and displacement, or water quality effects, during the construction and decommissioning phases, which may indirectly adversely affect tourism temporarily. Lastly, as discussed in Biodiversity, Flora and Fauna, there is potential for noise generation to adversely affect wildlife, which may result in a secondary impact on tourism activities such as bird, dolphin or whale watching.

There is the potential for tourism to be impacted by secondary effects. It is not clear whether an overall negative or positive impact will arise. However, it is likely any impact on tourism will be benign and of low significance. <u>Renewable Energy Generation</u> The potential capacity of the recommended RZ is 1.62GW. As such, there is potential for significant positive effects in the medium to long-term, owing to the generation of a new renewable energy supply for the NI population (+3). <u>Overall</u> Overall, there is considered to be potential for moderate adverse effects in the short, medium, and long-term on Material Assets (-2), following the consideration of best practice mitigation measures, mainly attributed to the identified potential for moderate adverse effects on Shipping and Navigation, and Commercial Fisheries.
Cultural, Architectural and Archaeological Heritage There are no protected wrecks or known undesignated wrecks within the recommended RZ, and a relatively small number of recorded wrecks within the tidal excursion zone. There is potential for slight adverse, direct and indirect, temporary to permanent effects on as yet undiscovered features, during the construction and decommissioning phases, which may be due to direct damage or disturbance, or indirect effects via sediment displacement and deposition onto features (-1). There is also potential for slight adverse indirect effects on these features in the medium to long-term operational phase owing to the potential for scouring and exposure to occur around features in the vicinity of devices (-1). There is also potential for slight adverse indirect effects on known wrecks within the tidal excursion zone during the construction and decommissioning phases via sediment displacement and deposition onto features (-1). At the project planning phase, any sites of interest for archaeological potential should be identified and exclusion zones used around these, with conduction of site surveys or trial trenching before any potentially damaging activities take place, with results informing any appropriate mitigation. Modelling of hydrodynamic and sediment transport processes may be necessary to determine potential effects on surrounding archaeological features and determine any appropriate mitigation required. Management of cultural heritage at the project level should be considered through the development and application of a MARP. The recommended RZ is situated between c.5.5km and c.18km distance from the coastline. There is potential for slight to moderate effects (-1 to -2) on the setting of the Giant's Causeway and Causeway Coast WHS, and on the setting of coastal heritage features along the inshore coastline, including 191 Listed Buildings, 73 Defence Heritage Record sites, 473 Scheduled Monuments, 71 Scheduled Zones, and the four Registered Parks and Gardens of Downhill, Dunluce Castle, Magherintemple and Cromore that are within the modelled viewshed, during the short-term construction and decommissioning phases, and for medium and long-term effects during device operation. Tidal stream devices are expected to be primarily submerged, with the significance of any effects influenced by the need for markings such as buoys, or other ancillary infrastructure, as well as lighting. Areas of the highest landscape and seascape sensitivity should be avoided, where possible, during the next stage of project planning. At the project planning phase, a SLVIA should be undertaken and should inform project design and appropriate mitigation to minimise adverse effects, and this should include consideration of potential impacts on views from sites of historic importance.
Landscape, Seascape and Visual Amenity The recommended RZ is situated between c.5.5km and c.18km distance from the coastline. The Giant's Causeway and Causeway Coast WHS, and the Causeway Coast and Antrim Coast and Glens AONBs, as well as 11 National Trust lands, are situated inshore of the RZ and are within the modelled viewshed. There is potential for moderate adverse indirect effects on these sites, both in the short-term construction and decommissioning phases from the presence of vessels and machinery (-2), and during the operational phase from the presence of device arrays (-2), owing to the very high sensitivity of the landscape. The recommended RZ is within the Atlantic RSCA and is offshore of the Causeway Coast RSCA. There is potential for medium and long-term adverse effects

within these areas, as the presence and/or marking of device arrays may alter the character of these RSCAs. Tidal stream devices are expected to be primarily submerged, with the significance of any effects influenced by the need for markings such as buoys, or other ancillary infrastructure, as well as lighting. Should a tidal stream development include the need for associated infrastructure such as an above sea substation, there is greater potential for significant effects on the landscape and seascape. There is also potential for slight adverse indirect visual effects in the short, medium, and long-term for the relatively low population of the inshore coastline (-1). There is also potential for in-combination or cumulative landscape/seascape and visual effects with the Malin Sea Wind project (owners ESB Wind Development Ltd., CATAGEN, Dublin Offshore, which is currently at concept/early planning stage, and situated further offshore. Areas of the highest landscape and seascape sensitivity should be avoided, where possible, during the next stage of project planning. At the project planning phase, a SLVIA should be undertaken and should inform project design and appropriate mitigation to minimise adverse effects.

G.11 Tidal Resource Zone: Rathlin Torr Head

Discussion of Potential Impacts
Biodiversity, Flora and Fauna <u>Benthic Habitats and species:</u> There are no designated sites for benthic habitats and species within the recommended RZ. Rathlin Island SAC, designated for Sandbanks, Sea caves, Drift line vegetation and Vegetated sea cliffs, and MCZ, designated for Deep-sea bed habitat, are situated c.400m to the north-west of the RZ and are within the tidal excursion zone. Red Bay SAC, designated for Sandbank habitat, is situated c.4.5km to the south, and is also within the tidal excursion zone. There is potential for significant adverse indirect effects on designated benthic habitat features of these sites in the short-term construction and decommissioning phases from sedimentation or water quality effects (-3). Refinement of the recommended RZ away from these sites is recommended to avoid the potential for significant adverse effects during construction and decommissioning. There are areas of Annex I Reef habitat within the recommended RZ, and the tidal excursion zone. There is potential for moderate adverse direct or indirect effects on reef habitat both in the short-term construction and decommissioning phases and in the medium to long-term from loss or damage, and sedimentation or water quality effects (-2). The seabed habitats within the recommended RZ predominantly consist of coarse substrate, with areas of rock or hard substrate. There are no recorded occurrences of benthic Protected, NI Priority or PMF species. There is potential for slight adverse direct and indirect effects on non-sensitive benthic habitats and species from localised benthic loss, or pollution and sedimentation effects during the short-term construction and decommissioning phases (-1), and the medium and long-term operational phase (-1). These effects may be minimised based on micro-siting at the project level; project planning mitigation should aim for avoidance of areas of benthic ecological importance, particularly areas where protected habitats and species are present, and installation in areas where non-sensitive habitats or species are present with the use of appropriate installation techniques. The volume of rock used for cable armouring, pipeline protection and foundation scour protection should be planned as the minimum required, to minimise habitat loss. At the project planning phase, sediment and erosion occurrence should be minimised through the development, implementation, and enforcement of an ESCP for construction and decommissioning works, and modelling of hydrodynamic and sediment transport processes to assess potential effects and determine suitable mitigation to minimise these. There are no records of invasive species within the recommended RZ; there is a potential risk of introduction of invasive species to the area with potential for slight adverse direct effects during the short-term construction and decommissioning phases (-1), and in the medium to long-term during

operational maintenance (-1). Mitigation to reduce the risk of introduction of invasive species to the area is provided in **Section 10.1**.

Fish and Shellfish:

There are no designated sites for fish and shellfish within the recommended RZ or the tidal excursion zone. There is a TCE Moderate MPA risk area for Fish within the recommended RZ, owing to the potential for migratory fish species to use the area.

There are (Ellis *et al*. (2012) CEFAS) nursery grounds of high intensity for spurdog, and of low intensity for anglerfish, cod, common skate, hake, herring, and mackerel; these low intensity grounds all cover large areas. There are known (Coull *et al*. (1998) CEFAS) fish spawning grounds for sprat and Nephrops, and nursery grounds for Nephrops within the recommended RZ and tidal excursion zone, and a nursery ground for cod within the tidal excursion zone. There is also an AFBI scallop surveyed area of relatively high density within the tidal excursion zone to the west of the RZ, and an AFBI surveyed area of relatively low density for queen scallop within the tidal excursion zone to the north. There is potential for moderate adverse direct and indirect effects in the short-term construction and decommissioning phases from habitat loss or damage, sedimentation, and smothering effects and via impacts on water quality (-2), and in the medium and long-term operational phase due to a loss of supporting habitat (-2).

There are no records of Protected, NI Priority, PMF or OSPAR Threatened/Declining fish or shellfish species. There is potential for slight adverse direct and indirect effects on fish species, including migratory species, using the area, in the short-term construction and decommissioning phases from supporting habitat loss or damage, sedimentation and smothering effects and via impacts on water quality (-1), and in the medium and long-term operational phase due to a loss of supporting habitat (-1).

As described for Benthic Habitats and Species, project planning mitigation should aim for avoidance of areas of benthic ecological importance, particularly areas where protected habitats and species are present. Areas should be avoided that may generate increased levels of suspended sediment that coincide with areas of fish spawning grounds or sensitive species. Where this is not possible, appropriate timing restrictions should be applied to works, and/or less disruptive installation methods used, to minimise effects on sediment mobilisation and disturbance and displacement of species from the construction and decommissioning area.

In the medium and long-term, there is potential for slight positive indirect effects (+1) owing to device colonisation and the possibility that device arrays may cause a reef effect, however this may also lead to a slight negative indirect short-term effect (-1) should colonised structures be removed at decommissioning. Mitigation measures during the project planning phase should consider the decommissioning activities that will be used, and whether removal of colonised structures, foundations or scour protection is required, or could result in a double habitat loss (that from pre-construction and decommissioning periods). If fishing is excluded from the array area, there may be potential for positive effects on fish species and supporting habitats such as spawning and nursery grounds within the operational phase.

Marine Mammals:

There are no designated sites for marine mammals within the recommended RZ or tidal excursion zone. There is a TCE High MPA risk area for Marine Mammals within the RZ (based on the risk models for fixed and floating wind, and cables). There is potential for moderate adverse direct and indirect effects in the short-term pre-construction, construction, and decommissioning phases due to noise impacts, disturbance and displacement, and collision risk (-2), and in the medium and long-term operational phase due to habitat exclusion, displacement and potential collision or entanglement risk (-2), including the potential for transboundary effects on designated marine mammal species that may be present within the area.

There are areas of recorded relatively high (pilot whale, and fin whale) and relatively moderate (white-beaked dolphin, pilot whale, bottlenose dolphin, and beaked whale) density for cetacean species, as well as relatively moderate to high density for grey seal and harbour seal, within the recommended RZ. There are also records of Protected, NI Priority, PMF and/or OSPAR

Threatened/Declining marine mammal species, including harbour porpoise, minke whale, orca, and bottlenose dolphin. There is potential for moderate adverse direct and indirect effects in the short-term pre-construction, construction, and decommissioning phases (-2), and in the medium and long-term operational phase (-2) for these sensitive species, and other marine mammals that may be present within the area, as described above.

During project planning for wind turbines, the key areas of marine mammal habitats and migratory routes should be identified, including through the conduction of pre-construction surveys and consultation with environmental stakeholders, and development avoided within these areas, whenever possible. Pre-construction, construction, and decommissioning activities should be planned to minimise the potential for adverse effects on marine mammals, including temporal activity planning, limiting vessel activity and mitigation against potential noise effects, including through avoidance of foundation installation such as piling that generates higher noise and avoidance or use of low-noise methods to dispose of any UXO within the development area. The potential for pre-construction, construction, and decommissioning phase adverse effects can be minimised through the application of standard best practice mitigation for marine mammals, including the use of marine mammal observers. Turbines and associated infrastructure should be designed to minimise effects during operation.

Birds:

There are no designated sites for bird species within the recommended RZ. Rathlin Island, c.1km distant at its closest point to the recommended RZ, is an SPA (designated for razorbill, black-legged kittiwake, common guillemot, and its seabird assemblage), MCZ (designated for black guillemot), IBA (breeding seabirds) and RSPB Reserve, and is within the tidal excursion zone. Antrim Hills SPA (designated for hen harrier and merlin) and IBA (assemblage of upland bird species) are c.2km distant at their closest point. There are TCE High MPA risk areas for Breeding Birds within the recommended RZ (based on the risk models for fixed and floating wind, and cables). There is potential for moderate adverse direct and indirect effects on designated bird species, including from transboundary sites, in the short-term pre-construction, construction, and decommissioning phases due to noise impacts, disturbance and displacement, damage or loss of supporting habitat, and collision risk (-2).

There are records of Protected, NI Priority, PMF and/or OSPAR Threatened/Declining bird species, including grey heron, black-tailed godwit, dunlin, whimbrel, golden plover, greenshank, goldeneye, red-throated diver, whooper swan, common scoter, Arctic tern, common tern, roseate tern, bar-tailed godwit, black guillemot, black-headed gull, curlew, common eider, herring gull, black-legged kittiwake, oystercatcher, razorbill, redshank, Arctic skua, grey plover, Atlantic puffin, great skua, red knot, long-tailed duck, and roseate tern. There is potential for moderate adverse direct and indirect effects on sensitive bird species, including from transboundary areas within Scotland and RoI, in the short-term pre-construction, construction, and decommissioning phases due to noise impacts, disturbance and displacement, damage or loss of supporting habitat, and collision risk (-2), and in the medium and long-term operational phase due to habitat exclusion, displacement and potential collision or entanglement risk for diving species (-2). There are also small areas of predicted medium seabed suitability for sandeel within and offshore of the recommended RZ. There is greater potential for adverse effects on seabirds within important foraging areas, through loss or damage to these species and their habitats during construction, displacement from these areas during construction and operation, and potentially, through a higher risk of collision for seabird species that prioritise the area for foraging; the degree of effect relating to these areas will differ between seabird species, depending on the importance of sandeel to their diet, and ability to access this food source at different water depths. Key foraging grounds outside of designated sites should be further investigated at the next stage of future planning and appropriate mitigation applied to avoid or reduce the potential for adverse effects.

During project planning for wind turbines, the key areas of bird habitats and migratory routes should be identified, including through the conduction of pre-construction surveys and consultation with environmental stakeholders, and development avoided within these areas, whenever possible. Pre-construction, construction, and decommissioning activities should be planned to minimise the potential for adverse effects on birds, including temporal activity planning, limiting vessel activity and

mitigation against potential noise effects. Turbines and associated infrastructure should be designed to minimise effects, particularly collision risk, during operation.
Population and Human Health There is potential for slight adverse, short-term temporary noise and visual effects on the local population due to noise generated and visual impacts during the construction and decommissioning phases. However, due to the distance of the recommended RZ offshore, these effects should be limited to vessel occupants transiting through the area, and there is not expected to be potential for direct, short, medium, or long-term, disturbance of coastal populations due to noise effects during the construction, operational, or decommissioning phases (0). The potential for indirect visual effects to coastal populations during the operational phase is considered under the Landscape, Seascape and Visual Amenity topic. There are no Bathing Water Sites, Blue Flag Beaches, or dive sites within the recommended RZ, and therefore there is not considered to be potential for adverse effects on these areas during the construction, operational, or decommissioning phases (0). There is potential for moderate adverse temporary, direct and indirect, effects on leisure and recreational marine users due to an increased collision risk, access restrictions and displacement, or water quality effects, during the construction and decommissioning phases due to known relatively high use of the area by leisure vessels (-2). There is also potential for moderate adverse long-term (device life) effects due to an enhanced collision risk for recreational and leisure vessels with devices and infrastructure, and potential for moderate adverse long-term (device life) effects due to displacement of recreational and leisure craft from the array area during the operational phase (-2). At the next stage of project planning, the potential for interaction with areas of known high use by leisure users should be avoided or minimised. At the project level, further mitigation to minimise risk to leisure users could include the use of exclusion zones around developments and timely and effective communication regarding construction works, as well as appropriate marking of devices and the array area. Appropriate under keel clearance should also be considered for leisure craft using the area.
Geology, Soils and Land Use There are no sites designated for geological or geomorphological features, i.e., MCZs, WHSs, ASSIs, or UNESCO Geoparks, within the recommended RZ. However, Rathlin MCZ and six ASSIs are within the tidal excursion zone; there is potential for significant adverse indirect short to long-term effects on designated features during seabed preparation, construction, and decommissioning (-3). It is recommended that refinement of the recommended RZ occurs to avoid interaction and possible impacts on these sites. However, should this refinement not be possible, at the project planning phase, mitigation should incorporate the conduction of geophysical and geotechnical surveys to identify areas of key geological/geomorphological interest, with avoidance of these areas during development. At the project planning phase, coastal process modelling should be undertaken to determine the potential for adverse effects on designated sites, with further appropriate mitigation proposed to avoid or minimise adverse effects e.g., through a suitable design of device arrays (adequate spacing between developments/arrays) to reduce the potential for excessive energy extraction altering coastal processes and regimes. There are Annex 1 Reef habitats within the recommended RZ, and there is potential for moderate direct, temporary to permanent effects on these features through loss or damage during the construction and decommissioning phases (-2). These features should be further considered and avoided through micro-siting at the project level. There are no known areas of potential contamination within the recommended RZ i.e., no dumping grounds of spoil ground, or explosive grounds. There is therefore not expected to be potential for adverse direct or indirect short, medium, or long-term effects on sediments within the RZ from interaction with potentially contaminated areas (0). The seabed sediments and geology of the area are undifferentiated rock and sediments of coarse substrate or rock or other hard substrate with relatively low potential for mobilisation (e.g., fine/coarse sediments, bedrock). There is potential for long-term (device operational life) sediment loss within the footprint of foundations and scour protection, and short-term temporary loss in the vicinity of the works during seabed preparation activities, construction, and decommissioning activities (-1).

Sediment and erosion occurrence should be minimised through the development, implementation, and enforcement of an ESCP for construction works. Decommissioning methods should be used that aim to minimise the amount of suspended sediment generated. Following the installation of tidal technologies there is potential for medium to long-term localised effects on erosion and deposition patterns within close proximity to the devices during the operational phase (-2), given the relatively low mobility of sediments within the recommended RZ. Further mitigation to minimise the potential for adverse effects on sediments and sediment transport is provided in **Section 10.1**.
Water There are three WFD coastal waterbodies within the recommended RZ and the tidal excursion zone, and there is potential for significant adverse direct and indirect short to long-term effects on hydromorphological status and for short-term effects during the construction and decommissioning phases (-3). It is recommended that refinement of the recommended RZ occurs to minimise potential effects within the tidal excursion zone. Should this refinement not be possible, at the project level, best practice mitigation should be put in place to minimise the potential for adverse effects. This may include sediment testing and water quality monitoring during the construction and decommissioning phases, and a requirement that any hydraulic fluids, anti-fouling components, corrosion of anodes or construction-based discharges used could only release non-toxic/low toxicity compounds (-1). Consultations should take place with environmental bodies regarding the construction methodology and appropriate timing of works to provide the least potential for sediment mobilisation to water bodies. The Ballycastle Bathing Water site is located to the south-west of the recommended RZ, and there is potential for moderate direct short-term effects on water quality within this site during seabed preparation, construction, and decommissioning activities (-2). There are no known areas of potential contamination within the recommended RZ i.e., no dumping grounds of spoil ground, or explosive grounds. There is therefore not expected to be potential for adverse direct or indirect short, medium, or long-term effects on water quality within the RZ from interaction with potentially contaminated areas (0). There is potential for localised effects on water quality within the RZ and tidal excursion zone during the short-term construction and decommissioning phases and during device operation (maintenance) due to sediment mobilisation and associated turbidity, construction discharges or accidental contaminant release from machinery and vessels (-2). There is potential for localised effects on water quality, as described above, within the MS Celtic Seas sub-region, however there is not expected to be potential for effects on the achievement of GES for water quality Descriptors (e.g., Descriptor 9 Concentrations of contaminants in fish and other seafood; Descriptor 8: Concentration of contaminants within marine environment; Descriptor 10 marine litter) with the application of standard best practice mitigation during seabed preparation, construction, maintenance and decommissioning activities (-1). The potential for adverse effects on water quality should be minimised at the project level, including through sediment testing and water quality monitoring during construction and decommissioning phase to identify and mitigate for potential adverse effects at the earliest possible stage. Environmental authorities should be consulted on the construction methodology, and the most appropriate timing of works to provide the least potential for sediment mobilisation to waterbodies. Further mitigation is provided in **Section 10.1**.
Air There is potential for slight adverse, direct, short-term temporary, effects on local air quality due to air emissions from vessels and machinery during the construction and decommissioning phases. There is also the potential for slight adverse, short-term, temporary emissions from vessels due to maintenance activities during the operational phase. However, due to the distance of coastal populations from the recommended RZ, it is not expected that there will be potential for adverse direct or indirect, short, medium, or long-term effects on these receptors from air pollution during the construction, operational and decommissioning phases (0). At the project level, emissions of air pollutants should be minimised through adherence to standard best practise for the minimisation of air pollution, as set out in **Section 10.1**. There is potential for moderate positive indirect effects on regional air quality in the medium to long-term operational phase, as the operation of renewable energy devices can support a transition away from fossil fuel use and its associated air emissions (+2).

Climatic Factors

There are no known areas of blue carbon habitat within the recommended RZ. Ulster Wildlife have identified areas of only low potential for blue carbon importance, therefore, there is unlikely to be potential for adverse effects on blue carbon habitats within the RZ during the construction, operational and decommissioning phases (0). There is potential for slight adverse short-term effects on sediment carbon storage, due to a localised release of CO_2 from seabed disturbance during the construction and decommissioning phases (-1).

There is potential for slight adverse, short-term, temporary effects on localised GHG concentrations, due to GHG emissions from vessels and machinery during the construction and decommissioning phases (-1). At the project level, emissions of air pollutants should be minimised through adherence to standard best practise for the minimisation of air pollution, as set out in **Section 10.1**.

There is potential for moderate positive, medium to long-term effects during the operational phase, as the operation of renewable energy devices can contribute to a net reduction in GHG emissions, decarbonisation of the energy sector, diversification of electricity supply and energy security, and meeting of energy objectives and climate change emission reduction targets (+2).

Material Assets

Existing Infrastructure

There is no existing infrastructure (cables, pipelines) within the recommended RZ, as such, there is no potential for effects on infrastructure in the short, medium, and long-term (0).

Shipping and Navigation

Given the presence of the relatively higher density shipping area in the west, there is potential for significant direct adverse effects on shipping and navigation in the short-term due to displacement of vessels during the construction and decommissioning phases (-3), as well as medium to long-term displacement from the array area during the operational phase (project lifetime) due to safety exclusion zones (-3). This can result in disruption to vessel routeing and timetables. In addition, the recommended RZ is partly within a 2nm buffer of the North Channel TSS.

There is potential for significant direct adverse effects in the short-term during the construction and decommissioning phases due to the risk of collision and allision with vessels, which may result in hazardous cargo or oil spillage (-3). There is also potential for significant adverse effects in the medium to long-term operational phase due to a risk of allision with stationary device arrays and subsequent spill risk, as well as safety concerns with under keel clearance reduction (-3). Additionally, there is potential for significant direct adverse effects on navigation in the medium to long-term operational phase, as devices could obstruct lights, buoys, or the coastline (-3); in terms of communication and navigational equipment, AIS and radar systems (including aviation NATS) may be affected. Furthermore, there is potential for significant adverse effects within installation and decommissioning areas in the short-term construction and decommissioning phases, as the presence of installation vessels and equipment may adversely impact the efficiency of search and rescue operations (-3).

Given the presence of the relatively higher density shipping area in the west of the recommended RZ, and the location of part of the recommended RZ within a 2nm buffer of the North Channel TSS, there is potential for significant navigational risk and displacement in the short, medium, and long-term (-3). The potential adverse effects on navigational risk could be mitigated through the implementation of mitigation measures in line with standard Shipping and Navigation mitigation outlined in **Section 10.1**. Refinement of the RZ to avoid the area of high-density shipping in the west is recommended, which could reduce the potential for adverse effects on Navigation and Shipping to slight in the short, medium, and long-term.

Commercial Fisheries

There are relatively lower intensity fishing areas and areas of known importance for inshore fisheries within the recommended RZ. There is potential for moderate direct adverse, short-term effects on commercial fisheries operations due to temporary displacement from traditional fishing grounds during construction and decommissioning (-2), as well as potential for long-term effects due to displacement from the recommended RZ during the operational phase (-2). Displacement of fishing activity could result in increased competition for alternate fishing grounds, with potential to adversely affect fish stocks and, by extension, landings, in nearby areas. The potential for adverse effects due to the displacement of vessels can be minimised through further consideration at the next stage of project planning. There should be strategic level caution regarding the siting of ORE infrastructure, with an aim to avoid developments occupying recognised fishing grounds unless there is a successful agreement between the industries that co-location is achievable. Further mitigation with regard to potential co-location is discussed in **Section 10.1**.

There is potential for moderate adverse direct effects due to an increased collision risk of fishing vessels with vessels associated with the ORE development in the short-term during the construction and decommissioning phases (-2), and slight effects in the medium to long-term during recurrent maintenance activities in the operational phase (-1). There is also potential for moderate adverse indirect effects in the medium to long-term operational phase, as displacement of fishing vessels from the area may concentrate vessels into a smaller area for shipping and navigation routes, with an associated increased collision risk (-2). There is also potential for moderate adverse effects on fishing activities within the RZ in the operational phase, as actual and/or perceived increased allision risks with devices, or entanglement of fishing gear with devices or attachment infrastructure may lead to avoidance of the area by fishing vessels (-2). To mitigate for navigational risk, further mitigation measures in line with standard Commercial Fisheries mitigation outlined in **Section 10.1** should be implemented. It is imperative that a successful agreement between industries that co-location is achievable is agreed. Further mitigation with regard to potential co-location is also discussed in **Section 10.1**.

There is potential for effects on commercial fish species and their key habitats within the RZ and the tidal excursion zone. There is slight potential for indirect positive effects in the medium to long-term, as hard subsea infrastructure could lead to an enhancement of fish populations at the edges of the array for trawler fishing (+1). There is potential for moderate adverse direct effects in the short-term construction and decommissioning phases, and medium to long-term operational phases due to the potential for a direct loss of supporting habitats, such as spawning and nursery grounds (-2). There is also potential for moderate adverse direct and indirect effects during the short-term construction and decommissioning phases (-2), and slight effects in the medium to long-term operational phase (-1) due to sediment mobilisation from construction, decommissioning and maintenance activities, respectively, which could have an indirect effect on fishing activity through an alteration of fishing stocks (-2). To minimise the potential for indirect effects on commercial fisheries through impacts on fishing stocks, an ESCP should be developed, implemented, and enforced for construction works, while decommissioning methods used should aim to minimise sediment generated. Further information on the potential ecosystem effects on fish and shellfish species and potential mitigation can be found in the Biodiversity, Flora, and Fauna assessment for the Rathlin Torr Head recommended RZ.

There is potential for moderate indirect effects on the profitability of commercial fishing in the short, medium, and long-term (-2), such as the potential for reduced quotas, increased resource competition for fishing, and reduced landings in both tonnage and economic value. These could be mitigated by considering the mitigation measures discussed above, and in **Section 10.1**. Refinement of the recommended RZ to avoid areas used by inshore fisheries could reduce the potential for adverse effects on commercial fisheries to slight in the short, medium, and long-term.

Military Areas

There is potential for moderate adverse effects on military activities, including temporary (short-term) disruption of military exercises and activities within the Rathlin Military Practice area and the Torr Head Military Practice Area during pre-construction, installation, and decommissioning (-2), and medium to long-term disruption during operation due to the presence of offshore infrastructure (-2). As the entire recommended RZ is within these Military Practice Areas, the area available for military practice activity could be reduced during the operational phase. Consultation with the MoD during the next stage of project planning could help to inform the key areas that should be avoided within the mapped Practice Areas, which could reduce the potential for adverse effects due to the displacement of military activities. The risk of collision of military vessels with devices can be minimised through further consultation with the MoD at the next stage of further planning. Measures outlined to mitigate against navigational risk in the Shipping and Navigation Section of **Section 10.1** are also of relevance.

Considering these mitigation measures the potential for adverse effects on military activities could be reduced from moderate to slight (-1) in the short, medium, and long-term.

Aviation

There are no safeguarding zones for aviation interference within the recommended RZ. The presence of devices has limited potential to effect communications, navigation, and surveillance and, therefore, there is potential for negligible effects on aviation navigation or radar (0).

Spoil Dumping Grounds

There are no spoil dumping grounds located within the recommended RZ. There is, therefore, no potential for temporary disruption or displacement of vessels moving to and from disposal sites (0).

Tourism

The potential for effects on tourism is considered indirectly within the topics of Landscape, Seascape and Visual Amenity (visibility of construction activity and operational devices), Population and Human Health (recreational use of the RZ), and Biodiversity, Flora, and Fauna (effects on wildlife). As discussed in the Landscape, Seascape and Visual Amenity Section, there is potential for moderate adverse effects on Landscape, Seascape and Visual Amenity which may result in secondary adverse effects on tourism, as this may act as a deterrent to tourists. Conversely, it is possible the presence of a tidal stream development will act as a tourist attraction. As discussed in Population and Human Health, there is negligible potential for adverse effects on the population due to increased noise release in the short-term; as such, tourism in unlikely to be impacted by these potential effects. However, there is potential for a moderate adverse temporary direct and indirect effects on leisure and recreational marine users due to an increased collision risk, access restrictions and displacement, or water quality effects, during the construction and decommissioning phases, which may indirectly adversely affect tourism temporarily. Lastly, as discussed in Biodiversity, Flora and Fauna, there is potential for noise generation to adversely affect wildlife, which may result in a secondary impact on tourism activities such as bird, dolphin or whale watching.

Renewable Energy Generation

The potential capacity of the recommended RZ is 0.89GW. As such, there is potential for moderate positive effects in the medium to long-term, owing to the generation of a new renewable energy supply for the NI population (+2).

Overall

Overall, there is considered to be potential for significant adverse effects in the short, medium, and long-term on Material Assets (-2), following the consideration of best practice mitigation measures, mainly attributed to the identified potential for significant adverse effects on Shipping and Navigation, and moderate effects on Commercial Fisheries.

Cultural, Architectural and Archaeological Heritage

There are no protected wrecks and one known undesignated wreck within the recommended RZ, and a moderate number of known wrecks within the tidal excursion zone. There is potential for slight adverse, temporary to permanent, effects on the known wreck, or other as yet undiscovered features, within the RZ, during the construction and decommissioning phases, which may be due to direct damage or disturbance, or indirect effects via sediment displacement and deposition onto features (-1), and potential for slight adverse effects on these features in the medium to long-term operational phase owing to the potential for scouring and exposure to occur around features in the vicinity of devices (-1). There is also potential for slight adverse indirect effects on known wrecks within the

tidal excursion zone during the construction and decommissioning phases via sediment displacement and deposition onto features (-1). At the project planning phase, any sites of interest for archaeological potential should be identified and exclusion zones used around these, with conduction of site surveys or trial trenching before any potentially damaging activities take place, with results informing any appropriate mitigation. Modelling of hydrodynamic and sediment transport processes may be necessary to determine potential effects on surrounding archaeological features and determine any appropriate mitigation required. Management of cultural heritage at the project level should be considered through the development and application of a MARP. The recommended RZ is situated between c.0.5km and c.5km distance from the coastline. There is potential for slight to moderate adverse indirect effects (-1 to -2) on the setting of coastal heritage features along the inshore coastline, including 170 Listed Buildings, 16 Defence Heritage Record sites, 359 Scheduled Monuments, 38 Scheduled Zones, and Manor House Rathlin Registered Park and Garden, that are within the modelled viewshed, during the construction and decommissioning phases, and for medium and long-term effects during device operation. Tidal stream devices are expected to be primarily submerged, with the significance of any effects influenced by the need for markings such as buoys, or other ancillary infrastructure, as well as lighting. Areas of the highest landscape and seascape sensitivity should be avoided, where possible, during the next stage of project planning. At the project planning phase, a SLVIA should be undertaken and should inform project design and appropriate mitigation to minimise adverse effects, and this should include consideration of potential impacts on views from sites of historic importance.
Landscape, Seascape and Visual Amenity The recommended RZ is situated between c.0.5km and c.5km distance from the coastline. The Causeway Coast and Antrim Coast and Glens AONBs, and five National Trust lands (Carrick a Rede, Cushleake Mountain, Fairhead and Murlough Bay, Loughan Bay and Portaleen Bay, Rathlin Island), are situated inshore of the RZ, and are within the modelled viewshed. There is potential for moderate adverse indirect effects on these sites, both in the short-term construction and decommissioning phases from the presence of vessels and machinery (-2), and during the operational phase from the presence of device arrays (-2), owing to the very high sensitivity of the landscape and the nearshore location of the recommended RZ. The recommended RZ is within the Ballycastle Coast, Rathlin, Torr Head Coast, and North Channel RSCAs. There is potential for adverse effects in the medium and long-term within these areas, as the presence and/or marking of device arrays may alter the character of these RSCAs. Tidal stream devices are expected to be primarily submerged, with the significance of any effects influenced by the need for markings such as buoys, or other ancillary infrastructure, as well as lighting. Should a tidal stream development include the need for associated infrastructure such as an above sea substation, there is greater potential for significant effects on the landscape and seascape. There is potential for slight adverse visual effects in the short, medium, and long-term for the relatively low population of the inshore coastline (-1). Areas of the highest landscape and seascape sensitivity should be avoided, where possible, during the next stage of project planning. At the project planning phase, a SLVIA should be undertaken and should inform project design and appropriate mitigation to minimise adverse effects.