Broadshore Hub

Wind Farm Development Areas

Scoping Report

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Executive Summary

Through the ScotWind and Innovation and Targeted Oil and Gas (INTOG) leasing rounds managed by Crown Estate Scotland (CES), Broadshore Offshore Wind Farm Limited, Sinclair Offshore Wind Farm Limited and Scaraben Offshore Wind Farm Limited (the Applicants) were successfully awarded exclusivity of the areas of seabed shown in **Figure 1.1** in **Appendix 1** to develop the 900 MW[1] Broadshore Offshore Wind Farm Project (the **Broadshore Project**), the 99.5 MW Sinclair Offshore Wind Farm Project (the **Sinclair Project**) and the 99.5 MW Scaraben Offshore Wind Farm Project (the **Scaraben Project**).

For consenting purposes, each of the above projects will comprise a Wind Farm Development Area (WFDA), an Offshore Transmission Development Area (OfTDA) and an Onshore Transmission Development Area (OnTDA). Separate consents will be sought for each Development Area.

Whilst the Broadshore Project, the Sinclair Project and the Scaraben Project are separate and distinct projects in their own right, given their geographic proximity and parallel consenting programme, they are collectively referred to as the **Broadshore Hub** for the purpose of this **Broadshore Hub WFDAs Scoping Report**.

The Broadshore Hub will deliver significant supply chain expenditure within Scotland, have the potential to power over one million homes[2] with renewable energy and will help achieve Scotland's net zero targets whilst improving energy security.

This Scoping Report accompanies a request for a formal Scoping Opinion submitted to the Marine Directorate - Licensing Operations Team (MD-LOT), acting on behalf of the Scottish Ministers, relating to the:

- Broadshore WFDA;
- Sinclair WFDA; and
- Scaraben WFDA.

Each WFDA will comprise the following infrastructure:

- Wind turbine generators (WTGs), with fixed bottom substructures and/or floating substructures;
- Station keeping systems (SKS) for each floating substructure, including mooring lines and anchors;
- Inter-array cables (IACs), subsea cable hub(s) and associated cable protection; and
- Scour protection for fixed bottom substructures and/or floating substructure anchoring points.

[1] Project capacities quoted throughout this Broadshore Hub WFDAs Scoping Report are approximate.
[2] https://www.broadshorewind.co.uk/

Each WFDA will comprise the following number of WTGs[3]:

- For the Broadshore WFDA, between 32 and 60 WTGs;
- For the Sinclair WFDA, between three and six WTGs; and
- For the Scaraben WFDA, between three and six WTGs.

The purpose of this Scoping Report is to provide MD-LOT and stakeholders with information on the activities and infrastructure that will be associated with the Broadshore Hub WFDAs and allow for engagement with stakeholders on the key issues to be addressed within the Broadshore Hub WFDAs EIA Report, the baseline data sources and the assessment methodologies to be used.

This Scoping Report therefore presents a broad project description, the baseline data sources and assessment methodologies to be used in the Broadshore Hub WFDAs EIA Report, and a summary of the existing environment for the following technical chapters:

- Marine Geology, Oceanography and Physical Processes;
- Benthic Ecology;
- Fish and Shellfish Ecology;
- Marine Mammals;
- Offshore Ornithology;
- Commercial Fisheries;
- Shipping and Navigation;
- Aviation and Radar;
- Marine Infrastructure and Other Users;
- Marine Archaeology and Cultural Heritage;
- Seascape, Landscape and Visual Impact;
- Socioeconomics, Tourism and Recreation;
- Climate Change;
- Offshore Air Quality; and
- Major Accidents and Disasters.

The Applicants invite Consultees to consider the information provided in this **Broadshore Hub WFDAs Scoping Report** and the supporting **Broadshore Hub WFDAs Habitats Regulations Appraisal Screening Report**, and provide comments on the proposed approach and, in particular, whether they agree with the conclusions drawn.

[3] Additional capacity may also be developed within the each WFDA for overplanting purposes.

Subsequent to obtaining a Scoping Opinion, a single Broadshore Hub WFDA EIA Report will be produced in support of applications for Section 36 (s.36) consent (under the Electricity Act 1989) and a Marine Licence (under the Marine and Coastal Access Act 2009) for the Broadshore WFDA, the Sinclair WDFA, and the Scaraben WFDA. Cumulative effects between the Broadshore Hub WFDAs, the Broadshore Hub OfTDAs and the Broadshore Hub OnTDAs will be considered within each respective EIA Report (including the Broadshore Hub WFDAs EIA Report) to ensure a full project assessment is undertaken. Cumulative effects will also be assessed for the Broadshore Hub alongside other projects and plans in the wider area.

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Glossary of Terminology

Term	Definition
Allision	Contact between a moving object and a stationary object.
Applicant(s)	Legal entity submitting consent applications for its respective project, being either: • Broadshore Offshore Wind Farm Limited; • Sinclair Offshore Wind Farm Limited; or • Scaraben Offshore Wind Farm Limited.
Automatic Identification System	A system by which vessels automatically broadcast their identity, key statistics including location, destination, length, speed, and current status, e.g., under power. Most commercial vessels and United Kingdom (UK)/European Union (EU) fishing vessels over 15 metre (m) length are required to carry AIS.
Avoided emissions	Reductions in greenhouse gas emissions that are enabled by an activity by displacing a more greenhouse gas intensive alternative.
Bathymetry	Topography of the seabed.
Bedload	Sediment particles that travel near or on the bed.
Benthic/Benthos	Refers to anything associated or occurring on the bottom of a body of water (the seabed).
Biodiversity	Refers to the variety of living species, including plants, animals, bacteria and fungi.
Biologically Defined Minimum Population Scale	The estimated population size of a species within a defined biogeographic area during a biologically relevant season, as defined by Furness (2015). For many seabird species present in UK waters there are two defined biogeographic areas; UK Western waters and UK North Sea and Channel. However, some species have different defined Biologically Defined Minimum Population Scale (BDMPS) areas, dependent on the distribution and movements of the species population through the year. Furness (2015) defines the BDMPS for non-breeding seasons; the breeding season BDMPS is defined as the breeding population within foraging range from the project, plus non-breeders and immatures.
Blue carbon	Organic and inorganic carbon that is captured and stored by the marine and coastal ecosystems.
Breeding season	Furness (2015) defines breeding season as the period from modal return to the colony through to modal departure from the colony at the end of breeding, for birds at UK colonies.
Breeding Season Apportionment	A method to determine connectivity with breeding seabird SPA's, by which it can be estimated how birds using marine renewables development sites can be 'apportioned' to multiple source colonies (NatureScot, 2018)
Broadshore Hub	The collective term for the Broadshore Offshore Wind Farm, the Sinclair Offshore Wind Farm and the Scaraben Offshore Wind Farm.
Broadshore Hub Offshore Transmission Development Areas	The collective Offshore Transmission Development Areas of the Broadshore Offshore Wind Farm, the Sinclair Offshore Wind Farm and the Scaraben Offshore Wind Farm.

Term	Definition
Broadshore Hub WFDAs Scoping Boundary	The boundary within which the Broadshore Hub Wind Farm Development Areas are located for the purpose of the Broadshore Hub WFDAs Scoping Report.
Broadshore Hub Wind Farm Development Areas	The collective Wind Farm Development Areas of the Broadshore Offshore Wind Farm, the Sinclair Offshore Wind Farm and the Scaraben Offshore Wind Farm.
Broadshore Offshore Wind Farm	An offshore wind farm capable of exporting around 900 MW of renewable energy to the National Electricity Transmission System. Additional capacity may also be developed for overplanting purposes. The Wind Farm Development Area is located 47 km north of Fraserburgh, and the working assumption is that the Broadshore Offshore Wind Farm will connect to the National Grid Electricity Transmission System in the vicinity of Peterhead. The Broadshore Offshore Wind Farm comprises of the following development areas: • Wind Farm Development Area; • Offshore Transmission Development Area; and • Onshore Transmission Development Area.
Cable protection	Protective measure to minimise the effects of scour and hazards along the inter-array cables and/or offshore export cables (e.g. cable exposure or snagging), as well as for protecting inter-array cables and/or offshore export cables at infrastructure crossing points.
Carbon budget	The cumulative amount of greenhouse gas emissions permitted over a defined period of time to achieve a certain climate target, which can be set at the national, regional, local or sectoral level.
Carbon dioxide equivalent	Carbon dioxide equivalent (CO_2e) is a term for describing different greenhouse gases in a common unit. The unit takes the different global warming potentials of greenhouses gases into account. CO_2e signifies the amount of CO_2 which would have the equivalent global warming impact.
Chronic climatic change	Long-term, gradual changes to weather patterns and the climate, also known as chronic climate hazards.
Circalittoral	A subtidal zone where light penetration is limited and therefore communities are dominated by faunal species.
Climate	The general weather conditions prevailing over a long period of time, which include seasonal averages and extremes.
Climate change impact	An impact from a climate hazard which affects the ability of the receptor to maintain its functions or purpose.
Climate change projection	A possible climate outcome defined by the modelling of various climate variables.
Climate change resilience	The ability of a project and its receptors to prepare for, respond to, recover from and adapt to changes in the climate in a manner that ensures it retains much of its original function and purpose.
Climate hazard	A weather or climate-related event or trend in climate variable, which has potential to do harm to receptors such as increased precipitation or storms

Term	Definition
Climate variable	A measurable, monitorable aspect of the weather or climate conditions such as temperature and wind speed
Collision	Contact between moving objects.
Connector	Joint between a dynamic inter-array cable and a static inter-array cable.
Controlled airspace	Defined airspace within which pilots must follow Air Traffic Control instructions implicitly. In the UK, Classes A, C, D, and E are areas of controlled airspace.
Creel	Pots and traps are generally rigid structures into which fish or shellfish are guided or enticed through funnels that make entry easy but from which escape is difficult. There are many different styles and designs, each one has been designed to suit the behaviour of its target species. Creel is typically a Scottish term for a pot or trap deployed by an inshore vessel.
Demersal	Living on or near the seabed.
Dynamic inter-array cable	The section of inter-array cable between the floating substructure and the connector to the static inter-array cable, which is designed to accommodate the dynamic movement of the floating substructure and minimise movement of the static inter-array cable.
eDNA	Environmental DNA that is collected from the environment, such as in seawater, rather than directly from an individual organism.
Embedded mitigation measure	Mitigation measures to avoid or reduce environmental effects that are directly incorporated into the design for the Broadshore Hub WFDAs.
Environmental Impact Assessment	The process of evaluating the likely significant environmental effects of a proposed development over and above the existing circumstances (or 'baseline').
Excursion limit	The maximum horizontal movement of a floating substructure from its design coordinates.
Extreme weather event	A weather event that is significantly different from the average or typical weather pattern, also known as acute or event-driven climate hazard.
Fish stock	Any natural population of fish which an isolated and self-perpetuating group of the same species.
Fishery	A group of vessel voyages which target the same species or use the same gear.
Fishing ground	An area of water or seabed targeted by fishing activity.
Fixed bottom substructure	A substructure, or foundation, that provides support for the wind turbine generator and provides a conduit for inter-array cables.
Fleet	A physical group of vessels sharing similar characteristics (e.g., nationality).
Flight Information Region	Airspace managed by a controlling authority with responsibility for ensuring air traffic services are provided to aircraft flying in it.
Floating offshore unit	The combined wind turbine generator and floating substructure.

Term	Definition
Floating substructure	A floating structure which provides buoyancy and, in conjunction with the station keeping system, supports a superstructure (e.g. wind turbine generator, offshore substation or similar), and maintaining verticality and movement within acceptable limits.
Formal Safety Assessment	A structured and systematic process for assessing the risks and costs (if applicable) associated with shipping activity as defined by the International Maritime Organization (IMO).
Gear type	The method/equipment used for fishing.
Glacial/Interglacial	A glacial period is a period of time within an ice age that is marked by colder temperatures and glacier advances. Interglacial correspond to periods of warmer climate between glacial periods. There are three main periods of glaciation within the last one million years, the Elsterian, the Saalian and the Weichselian which ended about 12,000 years ago. The Holocene period corresponds to the current interglacial.
Global warming potential	Global Warming Potential of a greenhouse gas is a measure of how much heat is trapped by a certain amount of gas in the atmosphere relative to carbon dioxide.
Greenhouse gas	A greenhouse gas is a gas that traps heat in the atmosphere and causes the greenhouse effect, also known by the collective shorthand "carbon".
Greenhouse gas intensity	The magnitude of greenhouse gas emissions per a unit of output or value, expressed as a ratio, also known as carbon intensity.
Gross Value Added	Measure of the value of goods and services produced in an area, industry or sector of an economy
Highly Pathogenic Avian Influenza	Highly pathogenic avian influenza viruses cause severe disease and high mortality in infected birds.
ICES statistical rectangles	International Council for the Exploration of the Seas (ICES) standardise the division of sea areas to enable statistical analysis of data. Each ICES statistical rectangle is '30 min latitude by 1 degree longitude' in size (approximately 30 x 30 nautical miles). A number of rectangles are amalgamated to create ICES statistical areas.
Infralittoral	A subtidal zone, above the circalittoral zone in which light penetration enables plant growth.
Innovation and Targeted Oil & Gas	A Crown Estate Scotland leasing round for offshore wind projects, under which the Sinclair Offshore Wind Farm and the Scaraben Offshore Wind Farm were awarded Exclusivity Agreements for their respective Wind Farm Development Areas, under which early-stage development works can progress.
Inter-array cable	Armoured cable containing electrical and fibre optic cores, which link the wind turbines to each other and to the subsea cable hub(s) and/or the offshore substation(s) and include dynamic inter-array cable and static inter-array cable sections.
Interconnector cable	Armoured cable containing electrical and fibre optic cores which link two or more offshore substations.
Landfall	The area from Mean Low Water Springs to a transition bay(s), where the offshore export cable(s) come ashore.

Term	Definition
Landings	Quantitative description of the amount of fish returned to port for sale, in terms of value or weight.
Local study area	ICES rectangle 45E8
Lowest Astronomical Tide	The lowest level that can be expected to occur under average meteorological conditions and under any combination of astronomical conditions.
Management Units	The MUs provide an indication of the spatial scales at which impacts of plans and projects alone, cumulatively and in-combination, need to be assessed for the marine mammal species in UK waters, with consistency across the UK.
Marine Guidance Note	A system of guidance notes issued by the United Kingdom (UK) Maritime and Coastguard Agency (MCA) which provide significant advice relating to the improvement of the safety of shipping at sea, and to prevent or minimise pollution from shipping.
Maritime archaeology	The remains of boats and ships and archaeological material associated with prehistoric and historic maritime activities.
Mean High Water Springs	The average over a year of the heights of two successive high waters during those periods of 24 hours (once every fortnight) when the range of the tide is greatest.
Mean Low Water Springs	The average over a year of the heights of two successive low waters during those periods of 24 hours (once every fortnight) when the range of the tide is greatest.
Mean Sea Level	The average level of the sea taking account of all tidal effects but excluding surge events.
Megafaunal species	Any species with a body mass estimate of more than 45 kg.
National Electricity Transmission System	The high-voltage electricity power transmission network serving Great Britain which receives electricity from generators (such as offshore wind farms) and transmits that electricity to anywhere on the National Electricity Transmission System to satisfy demand.
Navigational Risk Assessment	Document required by the Maritime and Coastguard Agency (MCA) under Marine Guidance Note (MGN) 654 which assesses risk associated with on Offshore Renewable Energy Installation (OREI) to shipping and navigation users.
Non-breeding season	Furness (2015) defines non-breeding season as the remaining part of the year that is not a part of breeding season.
Numerical modelling	Refers to the analysis of coastal processes using computational models.
Offshore export cable	Armoured cable containing electrical and fibre optic cores between the offshore substation(s) and the transition bay(s).
Offshore export cable corridor	The Marine Licence application boundary within which the offshore export cable route will be located.
Offshore export cable route	The area within the offshore export cable corridor where construction and commissioning of the offshore export cable(s) will be undertaken and will involve (but not limited to) seabed preparation, trenching, installation and burial of offshore export cable(s), and cable protection.

Term	Definition
Offshore substation	An offshore platform which houses electrical equipment such as transformers, switchgear, and protection and control systems, enabling the wind farm's renewable electricity to be received via inter-array cables and exported via the offshore export cable(s).
Offshore Transmission Development Area	The application boundary which extending to Mean High Water Springs and within which the following will be consented: offshore export cable(s), offshore substation(s), interconnector cables and cable protection. The Offshore Transmission Development Area refers to both the area and the infrastructure described above. Each Offshore Transmission Development Area is subject to a Section 36 consent and Marine Licence application.
Onshore export cable corridor	The planning application boundary within which the onshore export cable(s) route will be located.
Onshore export cable route	The area within the onshore export cable corridor where construction and commissioning of the onshore export cables will be undertaken, and which may include (but not limited to) the onshore export cables and trench(es); link boxes and associated fencing; temporary haul road; spoil, material and equipment laydown and/or storage; drainage infrastructure; wheel washing facilities; lighting, fencing and security; and environmental mitigation area(s).
Onshore export cables	Electrical and fibre optic cables between the transition bay(s) and the onshore substation(s) which may be laid directly within a trench or laid within cable ducts or protective covers.
Onshore substation	Onshore substation which will be fenced and house electrical equipment (such as transformers, switchgear, and protection and control systems), thereby enabling renewable electricity from the wind farm(s) to be received via the onshore export cables(s) and exported to the National Electricity Transmission System.
Onshore Transmission Development Area	The planning application boundary extending from Mean Low Water Springs and within which the following will be consented: landfall, onshore export cables, onshore substation(s), temporary construction compounds, and environmental mitigation areas. The Onshore Transmission Development Area refers to both the area and the infrastructure described above. Each Onshore Transmission Development Area is subject to a planning application through Planning Permission in Principle.
Operational life	The operational life is the expected length of time from final commissioning of the Wind Farm Development Area until the cessation of commercial operations.
OSPAR	OSPAR started in 1972 with the Oslo Convention against dumping and was broadened to cover land-based sources of marine pollution and the offshore industry by the Paris Convention of 1974. These two conventions were unified, up-dated and extended by the 1992 OSPAR Convention. OSPAR is so named because of the original Oslo and Paris Conventions ("OS" for Oslo and "PAR" for Paris).
Otter trawl	A net with large rectangular boards (otter boards) which are used to keep the mouth of the trawl net open. Otter boards are made of timber or steel and are positioned in such a way that the hydrodynamic forces, acting on them when the net is towed along the seabed, pushes them outwards and prevents the mouth of the net from closing.

Term	Definition
Overplanting	The installation of additional capacity over and above that which the wind farm can export to the National Electricity Transmission System, to allow additional renewable energy to be generated and exported during times of lower wind speed or during wind turbine generator maintenance than would otherwise have been the case.
Palaeogeographic features	Features seen within sub-bottom profiler data (buried) and multibeam bathymetry data (sea floor) interpreted as representing prehistoric physical landscape features such as former river channels (palaeochannels).
Peak pressure	The highest pressure above or below ambient that is associated with a sound wave.
Pelagic	Of or relating to the open sea.
Pelagic trawl	A net used to target fish species in the mid water column.
Permanent Threshold Shift	A permanent total or partial loss of hearing sensitivity caused by acoustic trauma. PTS results in irreversible damage to the sensory hair cells of the ear, and thus a permanent reduction of hearing acuity.
Population Viability Analysis	Within both Environmental Impact Assessments (EIA) and Habitat Regulations Appraisals (HRA) the predicted collision and/or displacement and barrier effects of offshore wind developments need to be considered against the relevant marine bird populations. The primary method used for assessing the population consequences in these assessments is a Population Viability Analysis (PVA) (NatureScot, 2023k).
Pre-construction works	Pre-construction works are activities undertaken prior to formal commencement of construction. Examples include survey works such as geotechnical and geophysical surveys and seabed preparation activities.
Primary Surveillance Radar	A radar system that measures the bearing and distance of targets using the detected reflections of radio signals.
Quaternary	The last 2 million years of earth history.
Ramp-up	Ramp-up forms the second part of the soft-start procedure and follows on from the low-energy blows. It comprises a specified minimum period of piling (e.g. 10 minutes), starting at the low-energy blow level, and gradually increasing in hammer energy. The maximum hammer energy required (operational power for that specific pile) must not be reached within this agreed ramp-up period
Regional study area	Include those ICES rectangles immediately adjacent to the commercial fisheries local study area (ICES Rectangles 46E7 to 46E9, 45E7 and 45E9, and 44E7 to 44E9).
Safety Zone	An area of water around or adjacent to a wind turbine generator and substructure which is to be constructed, extended, operated or decommissioned, from which certain or all classes of vessels are excluded and within which activities can be regulated for the purpose of securing safety of the wind turbine generator, substructure or vessels in that vicinity, and individuals on both the wind turbine generator, substructure or vessel, in line with Section 95 of the Energy Act 2004.

Term	Definition
Scaraben Offshore Wind Farm	An offshore wind farm capable of exporting around 99.5 MW of renewable energy to the National Electricity Transmission System. Additional capacity may also be developed for overplanting purposes. The Wind Farm Development Area is located 58 km north of Fraserburgh and the working assumption is that the Scaraben Project will connect to the to the National Electricity Transmission System in the vicinity of Peterhead. The Scaraben Project comprises of the following development areas: • Wind Farm Development Area; • Offshore Transmission Development Area; and • Onshore Transmission Development Area.
Scottish seine	An encircling net shot in the open sea using very long ropes to lay out the net, and ropes on the seabed prior to towing the net closed and hauling from a boat under its own power.
ScotWind	A Crown Estate Scotland leasing round for offshore wind projects in which the process enabled developers to apply for seabed rights to plan and build wind farms in Scottish waters.
Scour protection	Protective material positioned around anchors and foundations to avoid sediment being eroded as a result of the flow of water.
Seabed features	Features seen on the seafloor in the sidescan sonar or multibeam bathymetry data which are interpreted to represent heritage assets, or potential heritage assets. Also includes magnetic anomalies which may represent shallow buried ferrous material of archaeological interest.
Secondary Surveillance Radar	A radar system that transmits interrogation pulses and receives transmitted responses from suitably equipped targets.
Sinclair Offshore Wind Farm	An offshore wind farm capable of exporting around 99.5 MW of renewable energy to the National Electricity Transmission System. Additional capacity may also be developed for overplanting purposes. The Wind Farm Development Area is located 61 km north of Fraserburgh and the working assumption is that the Sinclair Project will connect to the National Electricity Transmission System in the vicinity of Peterhead. The Sinclair Project comprises of the following development areas: • Wind Farm Development Area; • Offshore Transmission Development Area; and • Onshore Transmission Development Area.
Soft-start	The procedure used to commence piling at a lower hammer energy. The soft-start procedure consists of low-energy blows for 10 minutes which are immediately followed by ramp-up for 10 minutes.
Sound exposure level	The constant sound level acting for one second, which has the same amount of acoustic energy, as indicated by the square of the sound pressure, as the original sound. It is the time-integrated, sound-pressure-squared level. SEL is typically used to compare transient sound events having different time durations, pressure levels, and temporal characteristics.
Sound pressure level	The sound pressure level or SPL is an expression of the sound pressure using the decibel (dB) scale, and the standard reference pressures of 1 μPa for water and 20 μPa for air.

Term	Definition
Static inter-array cable	The section of inter-array cable between the connector from the dynamic inter-array cable to the subsea cable hub(s) and/or the offshore substation(s).
Station keeping system	The system (including mooring lines and anchors) used to hold a floating substructure within its excursion limit and maintain the intended orientation of the floating substructure.
Stochastic Collision Risk Modelling (sCRM)	A programme used to assess the collision risk (estimated mortality) of seabirds to operational turbines of offshore windfarms. A sCRM is used to account for uncertainty around input variables.
Subsea cable hub	A subsea device which allows the connection of multiple inter-array cables.
Substrate	An underlying substance or layer, such as the surface or material on or from which an organism lives, grows, or obtains its nourishment.
Substrate type	An underlying substance or layer, such as the surface or material on or from which an organism lives, grows, or obtains its nourishment.
Swept Area Ratio	Swept Area Ratio (derived from Vessel Monitoring System data) indicates the number of times in an annual period that a fishing gear makes contact with (or sweeps) the seabed surface. Surface Swept Area Ratio provides a proxy for fishing intensity.
Temporary construction compound	Area within the Onshore Transmission Development Area used temporarily to support the construction and commissioning, which may include (but not limited to) office, welfare and workshop facilities; vehicle parking; spoil, material and equipment laydown and/or storage; drainage infrastructure; wheel washing facilities; and lighting, fencing and security.
Transition bay	An underground structure at the landfall accessed by manhole or other means which accommodates the jointing of the offshore export cable(s) and the onshore export cables. A fence may be installed around the access manhole for protection.
Uncontrolled airspace	Defined airspace in which Air Traffic Control does not exercise exclusive authority but may provide basic information services to aircraft in radio contact. In the UK, class G is uncontrolled airspace.
Unweighted sound level	Sound levels which are ‘raw’ or have not been adjusted in any way, for example to account for the hearing ability of a species.
Vessel Monitoring System	A system used in commercial fishing to allow environmental and fisheries regulatory organizations to monitor, minimally, the position, time at a position, and course and speed of fishing vessels.
Weather	Atmospheric conditions prevailing at specific moments in time or over short time periods, defined by climate variables such as temperature and precipitation.
Weighted sound level	A sound level which has been adjusted with respect to a ‘weighting envelope’ in the frequency domain, typically to make an unweighted level relevant to a particular species. Examples of this are the filters used by Southall et al. (2019) for marine mammals.
Wet storage	The temporary storage for floating substructures and/or floating offshore units prior to their transportation to the relevant Wind Farm Development Area.

Term	Definition
Wind Farm Development Area	The application boundary within which the following will be consented: wind turbine generators, floating and/or fixed bottom substructures and station keeping systems; inter-array cables; subsea cable hubs and associated cable protection; and scour protection. The Wind Farm Development Area refers to both the area and the infrastructure described above. Each Wind Farm Development Area is subject to a separate Section 36 consent and Marine Licence application.
Wind turbine generator	A wind turbine generator which converts wind energy into electrical energy. Each wind turbine generator is a complex system composed of a high number of components. Generally, the main components include the rotor assembly (composed of three blades and a hub); the nacelle (containing a generator, shaft and gearbox, power electronic converter and transformer); and the tower (containing lifting equipment and the switchgear).

Glossary of Abbreviations

Term	Definition
AARA	Air to Air Refuelling Area
AD	Air Defence
AD and OW	Air Defence and Offshore Wind
ADBA	Archaeological Desk-Based Assessment
AEoI	Adverse Effect on Integrity
AEZ	Archaeological Exclusion Zone
AHTS	Anchor Handling Tug Supply
AHVs	Anchor handling vessels
AIP	Aeronautical Information Publication
AIS	Automatic Identification System
ALARP	As Low As Reasonably Practicable
AMSL	Above Mean Sea Level
ANO	Air Navigation Order
ANSP	Air Navigation Service Provider
ATC	Air Traffic Control
ATS	Air Traffic Service
AWR	Air Weapons Range
BDMPS	Biologically Defined Minimum Population Scale

Term	Definition
BEIS	Department for Business, Energy and Industrial Strategy
BERR	Department for Business, Enterprise and Regulatory Reform
BGS	British Geological Survey
BTO	British Trust for Ornithology
CAA	Civil Aviation Authority
CaP	Cable Plan
CAP	Civil Aviation Publication
CBRA	Cable burial risk assessment
CCC	Climate Change Committee
CCR	Climate Change Resilience
CCRA	Climate Change Risk Assessment
CCS	Carbon Capture Storage
CEA	Cumulative Effects Assessment
CEF	Cumulative Effects Framework
Cefas	Centre for Environment, Fisheries and Aquaculture Science
CES	Crown Estate Scotland
CfD	Contracts for Difference
CGNS	Celtic and Greater North Seas
CIEEM	Chartered Institute for Ecology and Environmental Management
CO_2	Carbon Dioxide
COMAH	Control of Major Accident Hazards
COP	Conference of Parties
COWRIE	Collaborative Offshore Wind Research into The Environment
CPA	Coast Protection Act
CPGR	Counterfactual Ratio of Population Growth Rate
CPOD	Cetacean-Porpoise Detectors
CPR	Continuous Plankton Recorder
CPS	Counterfactual Ratio of Final Population Size

Term	Definition
CRM	Collision Risk Modelling
CTA	Control area
CTV	Crew transfer vessel
DDC	Drop down camera
DEA	Drag embedment anchors
DESNZ	Department for Energy Security and Net Zero
DETR	Department of the Environment, Transport and the Regions
DTI	Department of Trade and Industry
EcIA	Ecological Impact Assessment
ECOMMAS	East Coast Marine Mammal Acoustic Study
eDNA	Environmental Deoxyribonucleic Acid
EDR	Effective Deterrence Radius
EEA	European Economic Area
EEZ	Exclusive Economic Zone
EIA	Environmental Impact Assessment
EMF	Electromagnetic field
EMP	Environmental Management Plan
EMSA	European Maritime Safety Agency
EPS	European Protected Species
ESc	East Scotland
ESP	Energy Skills Partnership
EU	European Union
EUMETNET	European Meteorological Network
EUNIS	European Nature Information System
FBSS	Fixed bottom substructures
FCS	Favourable Conservation Status
FeAST	Feature Activity Sensitivity Tool
FEPA	Food and Environmental Protection Act

Term	Definition
FIR	Flight Information Region
FL	Flight level
FLAGS	Far North Liquids and Associated Gas System
FLO	Fisheries Liaison Officer
FLOWW	Fisheries Liaison with Offshore Wind and Wet Renewables group
FMMS	Fisheries Management and Mitigation Strategy
FOU	Floating offshore unit
FPSO	Floating Production, Storage and Offloading
FSS	Floating Substructure
GBP	Great British Pound
GEN	General Policy
GHG	Greenhouse Gas
GLVIA3	Guidelines for Landscape and Visual Impact Assessment. Third Edition
GNS	Greater North Sea
GPS	Global Positioning System
GVA	Gross Value Added
GW	Gigawatt
GWP	Global Warming Potential
HabMoS	Habitat Map of Scotland
HCA	Helideck Certification Association
HDD	Horizontal Directional Drilling
HEPS	Historic Environment Policy for Scotland
HER	Historic Environment Record
HES	Historic Environment Scotland
HF	High-Frequency
HIAL	Highlands and Islands Airport Limited
HiDef	HiDef Aerial Surveying Limited
HLV	Heavy Lift Vessels

Term	Definition
HM	His Majesty
HMC	His Majesty's Coastguard
HMCS	Harmonised Mandatory Control System
HMPA	Historic Marine Protected Areas
HMRI	Helicopter Main Routing Indicators
HPAI	Highly Pathogenic Avian Influenza
HRA	Habitats Regulations Appraisal
HVDC	High-Voltage Direct Current
IAC	Inter-Array Cable
IAMMWG	Inter-Agency Marine Mammal Working Group
ICAO	International Civil Aviation Organisation
ICE	Inventory of Carbon and Energy
ICES	International Council for the Exploration of the Sea
ICOL	Inch Cape Offshore Limited
IEF	Important Ecological Features
IEMA	Institute of Environmental Management and Assessment
IF	Intermediate Approach Fix
IFP	Instrument Flight Procedure
IFR	Instrument Flight Rules
IMO	International Marine Organisation
IN	Innovation
INNS	Invasive Non-Native Species
INTOG	Innovation and Targeted Oil and Gas
IPCC	Intergovernmental Panel on Climate Change
iPCoD	Interim Population Consequences of Disturbance
IPF	Initial Plan Framework
IROPI	Imperative Reasons of Overriding Public Interest
ISO	International Organisation of Standardisation

Term	Definition
IUCN	International Union for Conservation of Nature
JCP	Joint Cetacean Protocol
JNAPC	Joint Nautical Archaeology Policy Committee
JNCC	Joint Nature Conservation Committee
JRC	Joint Radio Company
JUV	Jack-up Vessels
kJ	Kilojoule
km	Kilometre
LAT	Lowest Astronomical Tide
LCT	Landscape Character Types
LF	Low-Frequency
LMP	Lighting and Marking Plan
LSE	Likely Significant Effects
LUC	Land Use Consultants
m	Metres
MALSF	Marine Aggregate Levy Sustainability Fund
MarESA	Marine Evidence based Sensitivity Assessment
MarLIN	Marine Life Information Network
MARPOL	International Convention for the Prevention of Pollution from Ships
MAU	Marine Analytical Unit
MBES	Multi-Beam Echosounder
MCA	Maritime and Coastguard Agency
MCAA	Marine and Coastal Access Act
MCCIP	Marine Climate Change Impacts Partnership
MCEU	Marine Consents and Environment Unit
mCRM	Migration Collision Risk Modelling
MCZ	Marine Conservation Zones
MD-LOT	Marine Directorate – Licensing Operations Team

Term	Definition
MD-SEDD	Marine Directorate – Science, Evidence, Data and Digital
MEDIN	Marine Environmental Date and Information Network
Met	Meteorological
MF	Moray Firth
MFRAG	Moray Firth Regional Advice Group
MGN	Marine Guidance Notes
MHWS	Mean High Water Springs
MM	Mean Maximum
MMO	Marine Management Organization
MoD	Ministry of Defence
MPA	Marine Protected Area
MPCP	Marine Pollution Contingency Plan
MPS	UK Marine Policy Statement
MRE	Marine Renewable Energy
MSA	Minimum Sector Altitude
MSS	Marine Scotland Science
MU	Management Unit
MW	Megawatt
NAFC	North Atlantic Fisheries College
NAMMCO	North Atlantic Marine Mammal Commission
NAP	National Adaptation Programme
NATS	National Air Traffic Service
NBN	National Biodiversity Network
NCMPA	Nature Conservation Marine Protected Area
NCO	North Coast and Orkney
NDB	Non-Directional Beacon
NDC	Nationally Determined Contribution
NEE	North-East England

Term	Definition
NEOG	North East Ornithology Group
NERL	NATS en-route plc
NLB	Northern Lighthouse Board
nm	Nautical Mile
NMFS	National Marine Fisheries Service
NMP	National Marine Plan
NMPI	National Marine Plan Interactive
NOAA	National Oceanic and Atmospheric Administration
NPF	National Performance Framework
NPF4	National Planning Framework 4
NPS	National Policy Statement
NRW	Natural Resource Wales
NSIP	Nationally Significant Infrastructure Project
NSP	Navigational Safety Plan
NSTA	North Sea Transitional Authority
O & M	Operation and Maintenance
OFEC	Offshore Export Cable
OFSSs	Offshore Substations
OfTDA	Offshore Transmission Development Area
OMAR	Offshore Major Accident Regulator
ONS	Office for National Statistics
OnTDA	Onshore Transmission Development Area
OPERA	Operational Programme for the Exchange of Weather Radar Information
OPRED	Offshore Petroleum Regulator for Environment and Decommissioning
OREI	Offshore Renewable Energy Installations
OSPAR	Convention for the Protection of the Marine Environment of the North-East Atlantic (Oslo/Paris Convention)
OWF	Offshore Wind Farm

Term	Definition
OWFL	Ossian Offshore Wind Farm Limited
OWIC	Offshore Wind Industry Council
PAC	Pre-application Consultation
PAD	Protocol of Archaeological Discoveries
PAH	Polyaromatic hydrocarbons
PAN	Planning Advice Note
PCB	Polychlorinated Biphenyls
PCR	Polymerase Chain Reaction
PCW	Phocid Carnivores in Water
PEXA	Practice Exercise Area
PMF	Priority Marine Feature
POSEIDON	Planning Offshore Wind Strategic Environmental Impact Decisions
PSA	Particle Size Analysis
pSPA	Proposed Special Protection Area
PSR	Primary Surveillance Radar
PTS	Permanent Threshold Shift
PVA	Population Variability Analysis
QSR	Quality Status Report
RAF	Royal Air Force
RCP	Representative Concentration Pathways
REZ	Renewable Energy Zone
RIAA	Report to Inform Appropriate Assessment
RIFG	Regional Inshore Fisheries Group
RLoS	Radar Line of Sight
RMNC	Review of Marine Nature Conservation
RMP	Regional Marine Plan
RoI	Republic of Ireland
ROV	Remotely Operated Vehicle

Term	Definition
RSPB	Royal Society for the Protection of Birds
s.36	Section 36
SAC	Special Area of Conservation
SAMS	Scottish Association for Marine Science
SAR	Search and Rescue
SBL	Scottish Biodiversity List
SCANS	Small Cetaceans in European Atlantic Waters and the North Sea
ScARF	Scottish Archaeological Research Framework
SCCAP	Scottish Climate Change Adaptation Programme
SCDS	Supply Chain Development Statement
SCOS	Special Committee on Seals
ScotMER	Scottish Marine Energy Research group
SD	Standard Deviation
SEA	Strategic Environmental Assessment
SEA4	Strategic Environment Assessment 4
SEGAL	Shell Esso Gas and Associated Liquids
SEIA	Socioeconomic Impact Assessment
SEL	Sound Exposure Level
SEL_{cum}	Cumulative weighted Sound Exposure Level
SEL_{ss}	Sound Exposure Level for single strike
SEPLA	Suction Embedded Plate Anchors
SFF	Scottish Fishermen’s Federation
SHEFA	The Shefa fibre optic submarine cable
SKS	Station Keeping System
SLA	Special Landscape Areas
SLVIA	Seascape, Landscape and Visual Impact Assessment
SMP	Sectoral Marine Plan
SMR	Scottish Marine Regions

Term	Definition
SMRU	Sea Mammal Research Unit
SNCB	Statutory Nature Conservation Bodies
SNH	Scottish National Heritage
SNMP	Scottish National Marine Plan
SOV	Service Operation Vessels
SPA	Special Protected Area
SPL	Sound Pressure Level
SPL_{peak}	Peak Sound Pressure Level
S-P-R	Source-Pathway-Receptor conceptual model
SSC	Suspended Sediment Concentration
SSEN	Scottish and Southern Electricity System
SSR	Secondary Surveillance Radar
SSS	Side-Scan Sonar
SSSI	Sites of Special Scientific Interest
STECF	Scientific, Technical and Economic Committee for Fisheries
STEM	Science, Technology, Engineering and Mathematics
SWFPA	Scottish White Fish Producers Association
T&I	Transport and installation
TAA	Terminal Arrival Altitude
TCE	The Crown Estate
TLP	Tension Leg Platform
TMZ	Transponder Mandatory Zone
TOG	Targeted Oil and Gas
TRA	Temporary Reserved Area
TRL	Technology readiness level
UCG	Underground Coal Gasification
UK	United Kingdom

Term	Definition
UKCF	United Kingdom Continental Shelf
UKCP	UK Climate Projection
UKHO	United Kingdom Hydrographic Office
UNFCCC	United Nations Framework Convention on Climate Change
UXO	Unexploded Ordnance
VFR	Visual Flight Rules
VHF	Very High-Frequency
VLAs	Vertical Load Anchors
VMS	Vessel Monitoring System
WFD	Water Framework Directive
WFDA	Wind Farm Development Area
WSI	Written Scheme of Investigation
WTG	Wind Turbine Generator
WWT	Wildfowl and Wetlands Trust
ZoI	Zone of Influence
ZTV	Zone of Theoretical Visibility
μPa	Micropascal

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1 Introduction

1.1 Project Overview

1. In January 2022, as part of the ScotWind leasing round managed by Crown Estate Scotland (CES), Broadshore Offshore Wind Farm Limited was successfully awarded exclusivity of the area of seabed shown in **Figure 1.1 in Appendix 1** to develop the 900 MW[4] Broadshore Offshore Wind Farm Project (the Broadshore Project).

2. In May 2023, under the innovation arm of the Innovation and Targeted Oil and Gas (INTOG) leasing round managed by CES, Sinclair Offshore Wind Farm Limited and Scaraben Offshore Wind Farm Limited was also successfully awarded exclusivity of the area of seabed shown in **Figure 1.1 in Appendix 1** to develop the 99.5 MW Sinclair Offshore Wind Farm Project (the Sinclair Project) and the 99.5 MW Scaraben Offshore Wind Farm Project (the Scaraben Project) respectively.

3. For consenting purposes, each of the above projects comprises a Wind Farm Development Area (WFDA), an Offshore Transmission Development Area (OfTDA) and an Onshore Transmission Development Area (OnTDA). Separate consents will be sought for each Development Area.

4. Whilst the Broadshore Project, the Sinclair Project and the Scaraben Project are separate and distinct projects in their own right, given their geographic proximity and parallel consenting programme they are collectively referred to as the Broadshore Hub for the purpose of this Broadshore Hub WFDAs Scoping Report.

5. This Scoping Report accompanies a request for a formal Scoping Opinion submitted to the Marine Directorate - Licensing Operations Team (MD-LOT), acting on behalf of the Scottish Ministers, relating to the:

   - Broadshore WFDA**;**
   - Sinclair WFDA; and the
   - Scaraben WFDA.

6. The above WFDAs are located approximately 47 km, 58 km and 61 km north of Fraserburgh respectively as shown in **Figure 1.1 in Appendix 1**.

7. Consents for the Broadshore Project, the Sinclair Project and the Scaraben Project will be sought in due course by the following (collectively, the **Applicants)**:

   - Broadshore Offshore Wind Farm Limited (the **Broadshore Applicant**);
   - Sinclair Offshore Wind Farm Limited (the **Sinclair Applicant**); and
   - Scaraben Offshore Wind Farm Limited (the **Scaraben Applicant**).

[4] Project capacities quoted throughout this Broadshore Hub WFDAs Scoping Report are approximate.

8. Whilst the grid connection location(s) of the Broadshore Project, the Sinclair Project and the Scaraben Project are yet to be confirmed, the Applicants' working assumption is that all projects will connect to the National Electricity Transmission System in the vicinity of Peterhead. Confirmation of the grid connection location(s) is expected in early 2024.

9. The Broadshore Hub will deliver significant supply chain expenditure within Scotland, has the potential to power over one million homes[5] with renewable energy and will help achieve Scotland's net zero targets whilst improving energy security.

1.2 Scoping Report Overview

10. The geographic proximity and parallel consenting programme of the Broadshore Hub WFDAs allows for a combined Scoping Report (the Broadshore Hub WFDAs Scoping Report) to be prepared and a single Broadshore Hub WFDAs Scoping Opinion to be issued (as discussed with MD-LOT during the Scoping Workshop; see **Section 4.3, Chapter 4: Approach to Scoping and Environmental Impact Assessment** for further detail).

11. This approach is intended to reduce the time required by stakeholders to review three separate WFDAs Scoping Reports, whilst maintaining the integrity and validity of the scoping process. This same approach will also be applied to the Environmental Impact Assessment (EIA) stage, whereby a single Broadshore Hub WFDAs EIA Report will be produced to support separate WFDA consent applications for the Broadshore Project, the Sinclair Project and the Scaraben Project.

12. The purpose of this Broadshore Hub WFDAs Scoping Report is to provide MD-LOT and stakeholders with information on the activities and infrastructure that will be associated with the Broadshore Hub WFDAs (see **Table 1.1**) and allow for engagement with stakeholders on the key issues to be addressed within the Broadshore Hub WFDAs EIA Report, the baseline data sources and the assessment methodologies to be used.

1.3 Development Areas

13. In addition to the WFDAs as discussed in **Section 1.1** above, the Broadshore Project, Sinclair Project and Scaraben Project will also comprise the Offshore Transmission Development Area (OfTDA) and the Onshore Transmission Development Area (OnTDA) to allow for the generation of electricity from the wind turbine generators (WTGs) and its transmission to the National Electricity Transmission System. The three development areas are summarised below and are shown schematically in **Plate 1.1** and the key infrastructure associated with each Development Area is presented in **Table 1.1** below.

- **WFDA:** Individually referred to as the **Broadshore WFDA**, the **Sinclair WFDA** and the **Scaraben WFDA**, and collectively referred to as the **Broadshore Hub WFDAs**;

[5] www.broadshorewind.co.uk

- **OfTDA: I**ndividually referred to as the **Broadshore OfTDA**, the **Sinclair OfTDA** and the **Scaraben OfTDA**, and for the purpose of this Scoping Report are collectively referred to as the **Broadshore Hub OfTDAs**; and
- **OnTDA**: Individually referred to as the **Broadshore OnTDA**, the **Sinclair OnTDA** and the **Scaraben OnTDA**, and for the purpose of this Scoping Report are collectively referred to as the **Broadshore Hub OnTDAs**.

Table 1.1: Key Infrastructure within each Development Area

Development Area	Key Infrastructure
Broadshore Hub WFDAs	Area as shown in **Figure 1.1** in **Appendix 1** within which the following will be consented: WTGs and associated substructures and station keeping systems (SKS) if applicable; inter-array cables (IACs), subsea cable hub(s) and associated cable protection; and scour protection.
Broadshore Hub OfTDAs	Area extending seaward from Mean High Water Springs (MHWS) and overlapping with the WFDAs within which the following will be consented: offshore substation(s), interconnector cables, offshore export cable(s) and associated cable protection.
Broadshore Hub OnTDAs	Area extending landward from Mean Low Water Springs (MLWS) within which the following will be consented: landfall(s), onshore export cable(s), onshore substation(s), and temporary construction compounds.

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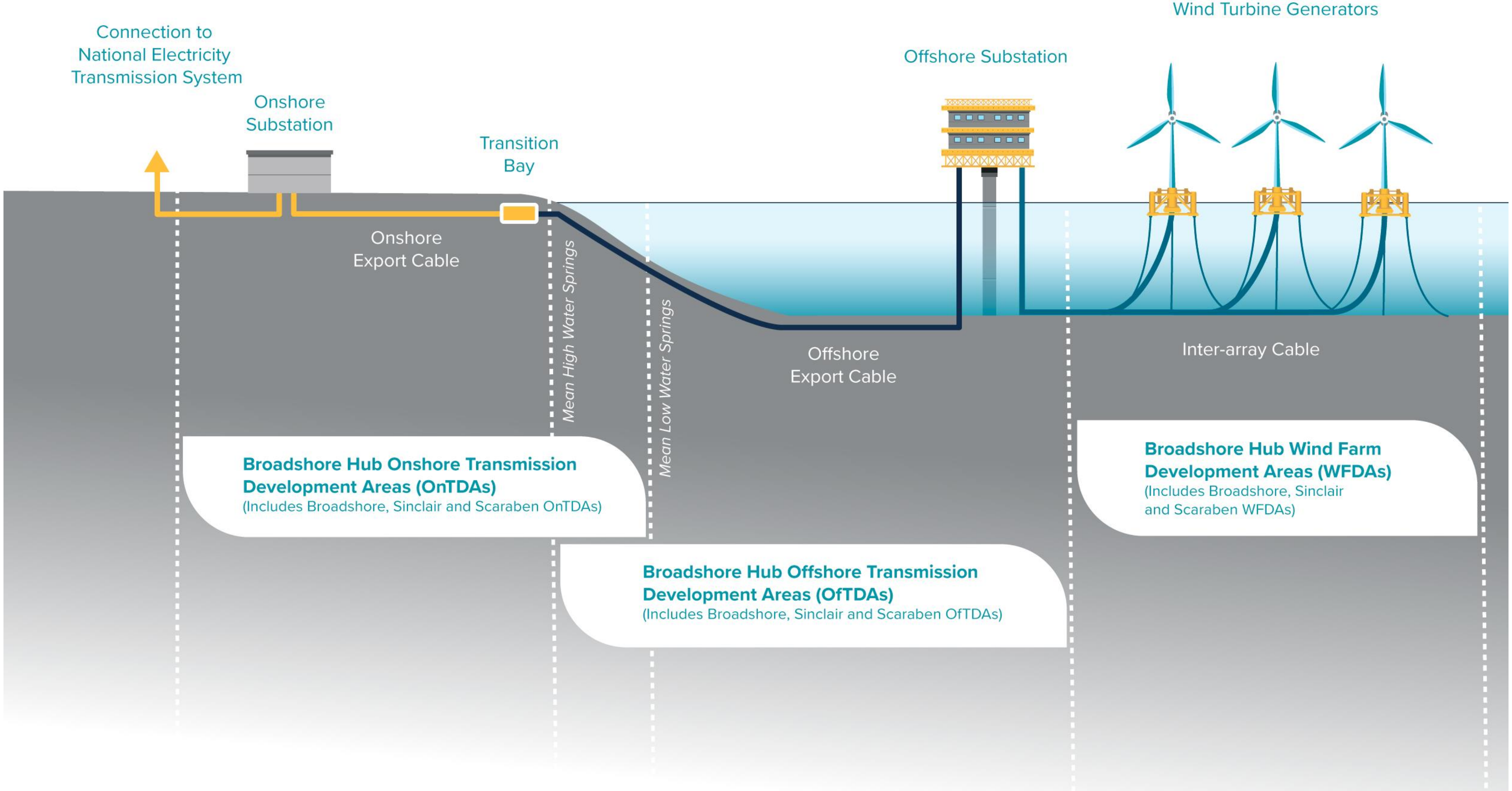
Plate 1.1: Overview of the Broadshore Hub Development Areas



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1.4 Consents Strategy

14. The Applicants will seek the following consents from MD-LOT for the Broadshore WFDA; the Sinclair WDFA; and the Scaraben WFDA:

- s.36 consent under the Electricity Act 1989; and
- Marine Licence under the Marine and Coastal Access Act 2009 (MCAA) (applicable to Scottish offshore waters between 12 nautical miles (nm) and 200 nm).

15. A single EIA process will be undertaken that will support each individual consent application. Each consent application will be accompanied by the Broadshore Hub WFDAs EIA Report, which will present an assessment of likely significant effects on the environment for the following scenarios:

- **Overall Broadshore Hub WFDAs**: An assessment that will consider the construction, operation and maintenance, and decommissioning of the Broadshore Hub WFDAs infrastructure, and assess on a Broadshore Hub basis the likely significant effects should all three WFDAs be built out.
- **WFDA specific:** An assessment that will consider the construction, operation and maintenance, and decommissioning of each individual WFDA (i.e., the Broadshore WFDA, or the Sinclair WFDA or the Scaraben WFDA), and assess on a WFDA specific basis the likely significant effects of each individual WFDA should one be built in isolation.

16. This approach will ensure a complete impact assessment is undertaken of the overall Broadshore Hub WFDAs if they are delivered at the same time; or for each individual WFDA if they are delivered in isolation. Further details on the Broadshore Hub EIA Report structure are outlined in **Section 4.9, Chapter 4: Approach to Scoping and Environmental Impact Assessment**.

17. As noted in **Paragraph 3**, separate consent applications will be submitted for the Broadshore Hub OfTDAs and the Broadshore Hub OnTDAs, each subject to individual EIA processes in accordance with the relevant EIA regulations. Cumulative effects between the Broadshore Hub WFDAs, the Broadshore Hub OfTDAs and the Broadshore Hub OnTDAs will be considered within each respective EIA Report (including the Broadshore Hub WFDAs EIA Report) to ensure a full project assessment is undertaken. Cumulative effects will also be assessed for the Broadshore Hub alongside other projects and plans in the wider area. Further details on the methodology for the EIA is discussed in **Chapter 4: Approach to Scoping and Environmental Impact Assessment**.

18. The consent and licence requirements for each project and each Development Area are summarised in **Table 1.2**.

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Table 1.2: Consent and Licence Applications Required for each Project and each Development Area

	WFDAs		OfTDAs		OnTDAs
Broadshore Project	Section 36 Consent [1]	Marine Licence [2]	Marine Licence [3] (within 12 nm from the coast)	Marine Licence [2] (12 to 200 nm from the coast)	Planning Permission in Principle [4]
Sinclair Project	Section 36 Consent [1]	Marine Licence [2]	Marine Licence [3] (within 12 nm from the coast)	Marine Licence [2] (12 to 200 nm from the coast)	Planning Permission in Principle [4]
Scaraben Project	Section 36 Consent [1]	Marine Licence [2]	Marine Licence [3] (within 12 nm from the coast)	Marine Licence [2] (12 to 200 nm from the coast)	Planning Permission in Principle [4]
Supporting EIA	Broadshore Hub WFDAs EIA Report		Broadshore Hub OfTDAs EIA Report		Broadshore Hub OnTDAs EIA Report

[1] Consent under the Electricity Act 1989

[2] Licence under the MCAA 2009

[3] Licence under the Marine (Scotland) Act 2010

[4] Permission under the Town and Country Planning (Scotland) Act 1997

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1.5 Broadshore Hub Overview

19. As discussed above, the Broadshore Project, Scaraben Project and Sinclair Project (collectively referred to as the Broadshore Hub for the purpose of this Scoping Report), each comprise a WFDA, an OfTDA and an OnTDA.

20. Within each WFDA (shown in **Figure 1.1 in Appendix 1**) every WTG is supported by either a floating substructure anchored to the seabed by a SKS, or a fixed bottom substructure. The electricity generated by the WTGs will be conveyed through a series of IACs which connect each WTG to one or more offshore substation (possibly via one or more subsea cable hub).

21. Within each OfTDA, interconnector cables will connect multiple offshore substations (if more than one offshore substation is used). Electricity will be transmitted to shore via offshore export cables which are typically buried where ground conditions allow, and which will run from the offshore substation(s) to landfall(s).

22. Within each OnTDA, the offshore export cables will transition to onshore export cables within a buried transition bay. From there the onshore export cables will connect to a new onshore substation(s) and subsequently to the National Electricity Transmission System in the vicinity of Peterhead (anticipated to be confirmed in early 2024).

23. All stages of the lifespan of the Broadshore Hub WFDAs have been considered in this Broadshore Hub WFDAs Scoping Report, from construction to operation and maintenance to decommissioning. Refer to **Chapter 3: Project Description** for further detail on the Broadshore Hub WFDAs infrastructure and proposed activities.

24. A summary of the Broadshore Project, Sinclair Project and Scaraben Project are briefly described individually below (refer to **Chapter 3: Project Description** for further details). It should be noted that the Broadshore Hub WFDAs EIA Report will confirm the maximum number of WTGs and their physical size (which will be dependent on the anticipated technology available on the market at the time of construction). A number of floating substructure and SKS options, and (subject to water depth and ground conditions) fixed bottom substructures are being considered. Additional WTGs may also be developed within the WFDAs for overplanting purposes.

1.5.1 Broadshore Project

25. The Broadshore WFDA (shown in **Figure 1.1 in Appendix 1**) is located approximately 47 km north of Fraserburgh and covers an area of 134 km^2. The Broadshore WFDA will have a seabed lease for up to 60 years and an anticipated operational life of between 25 years and 50 years.

26. The Broadshore WFDA will comprise between 32 and 60 WTGs (depending on the size of the WTGs) with fixed bottom and/or floating substructures, and will be capable of exporting approximately 900 MW of renewable energy to the National Electricity Transmission System.

27. The key ambition of the Broadshore Project is to successfully build and operate an offshore wind farm to help reach Scotland's net zero targets in the face of the climate emergency (see **Chapter 2: Policy and Legislative Context**), and realise the benefits of a sustainable energy source which improves energy security and reduces costs to the consumer.

28. The Broadshore Applicant is collaborating with local and national agencies to train and upskill the workforce by formulating specific enterprise and skill development programmes. Works are ongoing with the Energy Skills Partnership to upskill and re-skill the existing work force and also with Edinburgh Science to promote the industry via education programmes, STEM (science, technology, engineering and mathematics) projects and funding.

29. In relation to local supply chain, the Broadshore Project's ambition is to spend £1.24 billion within the Scottish supply chain during its development, construction and operation[6], with a commitment of £832 million (Broadshore Offshore Wind Farm, 2023). Broadshore Applicants' approach to supply chain development is one of 'shared value' - a combination of project competitiveness and sustainable development of the Scottish offshore wind supply chain.

1.5.2 Sinclair Project

30. The Sinclair WFDA (shown in **Figure 1.1 in Appendix 1**) is located approximately 61 km north of Fraserburgh, and covers an area of 25 km^2. A change to the Sinclair WFDA is under consideration but not yet confirmed, as discussed in further detail in **Section 3.10.3** in **Chapter 3: Project Description**. The original and proposed revised Sinclair WFDA boundaries are shown in **Figure 1.2 in Appendix 1**. Whilst both boundaries fall within the Broadshore Hub WFDAs Scoping Boundary[7] (ensuring the Scoping Opinion applies to both boundaries), only the final agreed Sinclair WFDA will be assessed within the Broadshore Hub WFDAs EIA Report. The Sinclair WFDA will have a seabed lease for a period of up to 25 years and an anticipated operational life of between 25 years and 50 years.

31. The design envelope is the same as the Broadshore WFDA, as presented in **Chapter 3: Project Description**. The key difference is that the Sinclair WFDA will comprise between three and six WTGs (depending on the size of the WTGs) on fixed bottom and/or floating substructures, and will be capable of exporting approximately 99.5 MW of renewable energy to the National Electricity Transmission System.

32. The key ambition of the Sinclair Project is to contribute to Scotland's net zero targets, as well as trialling innovations that will be beneficial to the BlueFloat Energy | Renantis partnership's 3.1 gigawatt (GW) ScotWind portfolio and the wider offshore floating wind farm industry by providing confidence and an incentive to the local supply chain for investment and business cases.

[6] Based on development, manufacturing and fabrication, installation and the first 6 years of operations (Broadshore Offshore Wind Farm, 2023).

[7] The boundary within which the Broadshore Hub Wind Farm Development Areas are located for the purpose of the Broadshore Hub WFDAs Scoping Report.

1.5.3 Scaraben Project

33. The Scaraben WFDA (shown in **Figure 1.1 in Appendix 1**) is located approximately 58 km north of Fraserburgh and covers an area of 33 km^2 The Scaraben WFDA will have a seabed lease for a period of up to 25 years and an anticipated operational life of between 25 years and 50 years.

34. The design envelope is the same as the Broadshore WFDA, as presented in **Chapter 3: Project Description**. The key difference is that the Scaraben WFDA will comprise between three and six WTGs (depending on the size of the WTGs) on fixed bottom and/or floating substructures, and will be capable of exporting approximately 99.5 MW of renewable energy to the National Electricity Transmission System.

35. Similar to the Sinclair Project, the key ambition of the Scaraben Project is to contribute to Scotland's net zero targets, as well as trialling innovations that will be beneficial to the BlueFloat Energy | Renantis partnership's 3.1 gigawatt (GW) ScotWind portfolio and the wider offshore floating wind farm industry by providing confidence and an incentive to the local supply chain for investment and business cases.

1.6 Purpose of this Scoping Report

36. This Broadshore Hub WFDAs Scoping Report has been prepared to support a request for a formal Scoping Opinion in relation to the WFDAs for the Broadshore, Sinclair and Scaraben Projects from MD-LOT, acting on behalf of the Scottish Ministers. Responses from statutory and non-statutory consultees to this Scoping Report are expected to inform the Scoping Opinion, which will in turn, inform the Broadshore Hub WFDAs EIA Report.

37. The purpose of this Broadshore Hub WFDAs Scoping Report is to provide stakeholders with information on the activities and infrastructure that will be associated with the Broadshore Hub WFDAs and allow for engagement with stakeholders on the key issues to be addressed in the Broadshore Hub WFDAs EIA Report, as well as the baseline data sources and assessment methodologies to be used to inform the Broadshore Hub WFDAs EIA Report.

38. **Table 1.3** summarises the information requirements set out in the EIA Regulations[8] and where these can be found in this Broadshore Hub WFDAs Scoping Report.

[8] In respect to the s.36 consent applications: The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017; and in respect to the Marine Licence(s) applications: The Marine Works (Environmental Impact Assessment) Regulations 2007.

Table 1.3: Scoping Requirements of the EIA Regulations and where the Information is included in this Broadshore Hub WFDAs Scoping Report

EIA Regulation Topic Requirement	Location in this Broadshore Hub WFDAs Scoping Report
Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017	
A description of the location of the development, including a plan sufficient to identify the land.	**Chapter 3: Project Description** provides a description of the Broadshore Hub WFDAs and a plan of the Broadshore Hub WFDAs is provided in **Figure 1.1** in **Appendix 1**. The proposed alternative boundary for the Sinclair WFDA is shown in **Figure 1.2** in **Appendix 1**.
A brief description of the nature and purpose of the development and of its likely significant effects on the environment.	**Chapter 3: Project Description** includes a description of the nature of the Broadshore Hub WFDAs, and **Chapter 2: Policy and Legislative Context** provides a description of the purpose. A description of likely significant effects is provided in **Chapters 5 to 19**. Reference should also be made to **Appendix 2: NCMPA Screening Report** and the **Broadshore Hub WFDAs HRA Screening Report (**BlueFloat | Renantis Partnership**,** 2024**)**.
Any such other information or representations as the developer may wish to provide or make.	The proposed approach to EIA for the Broadshore Hub WFDAs is provided in **Chapters 5** to **19**.
Marine Works (Environmental Impact Assessment) Regulations 2007	
A chart, plan or map sufficient to identify the location of the regulated activity and of other activities to be carried out in the course of the project.	**Chapter 3: Project Description** provides a description of the Broadshore Hub WFDAs and a plan of the Broadshore Hub WFDAs is provided in **Figure 1.1** in **Appendix 1**. The proposed alternative boundary for the Sinclair WFDA is shown in **Figure 1.2** in **Appendix 1**.
A brief description of the specific characteristics of the regulated activity and the project, including their nature, purpose, location and technical capacity.	**Chapter 3: Project Description** includes a description of the nature of the Broadshore Hub WFDAs, and **Chapter 2: Policy and Legislative Context** provides a description of the purpose.
An explanation of the likely significant effects of the regulatory activity and the project on the environment.	A description of likely significant effects is provided in **Chapters 5 to 19**. Reference should also be made to **Appendix 2: NCMPA Screening Report** and the **Broadshore Hub WFDAs HRA Screening Report**.

39. Within this Broadshore Hub WFDAs Scoping Report, potential environmental impacts associated with the Broadshore Hub WFDAs are considered. These include impacts which are proposed to be scoped out' of the Broadshore Hub WFDAs EIA Report due to no likely significant effect in EIA terms or no impact-receptor pathways identified. Agreement with stakeholders will be sought through this Broadshore Hub WFDAs Scoping Report to determine final impacts to be scoped in and scoped out of the Broadshore Hub WFDAs EIA Report (see **Chapter 4: Approach to Scoping and Environmental Impact Assessment**) and agree assessment methods and approaches to be used when undertaking the assessments. The potential impacts and mitigation proposed are based on the Broadshore Hub WFDAs boundaries and should the boundaries change, this will be

reflected in the EIA. If any changes are considered to change the Scoping Opinion, this will be highlighted in the EIA Report.

40. Scoping occurs before the Broadshore Hub WFDAs are at an advanced or fixed stage of engineering design. This ensures that relevant stakeholder feedback obtained via the Scoping Opinion can be used to inform the ongoing design evolution of the Broadshore Hub WFDAs. The resultant Broadshore Hub WFDAs EIA Report will be based upon the Scoping Opinion received in response to the formal request.

41. Guidance on the approach to EIA has been provided to date though ongoing consultation with MD-LOT and NatureScot, including a Scoping Workshop held with stakeholders on 13th September 2023 (see **Table 4.1** in **Chapter 4: Approach to Scoping and Environmental Impact Assessment**). Additional pre-scoping consultation has been undertaken with the Scottish Fishermen's Federation and Scottish White Fish Producers Association to inform this Broadshore Hub WFDAs Scoping Report. Consultee feedback received to date has been considered in drafting this Broadshore Hub WFDAs Scoping Report. The information presented in this Broadshore Hub WFDAs Scoping Report aims to inform stakeholders on the Broadshore Hub WFDAs and the approach to assessment to assist in undertaking a robust and proportionate EIA for the Broadshore Hub WFDAs.

42. The Applicants welcome the opportunity for engagement with stakeholders and feedback on the approach and the scope of the Broadshore Hub WFDAs EIA Report as part of the formal Scoping Opinion and throughout the EIA process.

1.7 The Applicants and Environmental Impact Assessment Project Team

1.7.1 The Applicants

43. The Broadshore Project, Sinclair Project and Scaraben Project are being developed by Broadshore Offshore Wind Farm Limited, Sinclair Offshore Wind Farm Limited and Scaraben Offshore Wind Farm Limited, respectively, each of which are funded by the BlueFloat Energy | Renantis partnership (the 'partnership').

44. In addition to the Broadshore Hub, the partnership is also developing the 1,200 MW Bellrock Offshore Wind Farm and the 1,000 MW Stromar Offshore Wind Farm (in conjunction with Ørsted), both of which are located in the northern North Sea.

45. The partnership aims to contribute to a world leading floating offshore wind industry in the United Kingdom (UK), combining innovative technology with a plan to attract and grow a skilled Scottish workforce and stimulate a thriving local supply chain. BlueFloat Energy's knowledge and experience in developing floating offshore wind projects combined with Renantis' track record in global project development and community engagement ensure the partnership is well placed to deliver world class floating offshore projects.

1.7.2 Environmental Impact Assessment Project Team

46. Royal HaskoningDHV has been instructed by the Applicants to lead (through their Edinburgh office) the EIA for the Broadshore Hub WFDAs. This includes informing and preparing the initial review of the key environmental issues associated with the construction, operation and maintenance, and decommissioning of Broadshore Hub WFDAs infrastructure as part of the scoping process and reports.

47. Pursuant to the EIA Regulations, the Broadshore Hub WFDAs EIA Report will be prepared by competent experts and will outline the relevant expertise or qualifications of the experts.

48. Royal HaskoningDHV is registered with the Institute of Environmental Management and Assessment (IEMA) and its Environmental Impact Assessment Quality Mark scheme. The scheme allows organisations that lead the co-ordination of EIAs in the UK to make a commitment to excellence in their EIA activities and have this commitment independently reviewed.

49. A number of specialist consultancies are also providing expert input into the Broadshore Hub WFDAs Scoping Report and future Broadshore Hub WFDAs EIA Report, as presented in **Table 1.4** in **Section 1.8** and below.

- **Chapter 10: Commercial Fisheries** - NiMa Consultants Limited, Scotland based marine environmental consultants specialising in commercial fisheries impact assessment.
- **Chapter 11: Shipping and Navigation** - Anatec Limited, Scotland based offshore marine consultants. The senior team members at Anatec, including those leading on the Broadshore Hub WFDAs, have over 25 years of experience in offshore marine risk. This includes undertaking Navigational Risk Assessments and EIA Reports for the vast majority of previous offshore wind farm projects in the UK and are currently working on multiple ScotWind projects, and wind farm extension projects.
- **Chapter 12: Aviation and Radar** - Cyrrus Limited has been providing expert advice to many airports and aviation authorities since 1999. Working with airports and wind energy developers in the UK and Republic of Ireland, Cyrrus has extensive experience working on EIAs for offshore wind farm developers. Cyrrus is an approved procedure design organisation recognised by the UK Civil Aviation Authority, as such Cyrrus have the internal capacity to assess any applicable Instrument Flight Procedures that may be impacted by wind farms.
- **Chapter 15**: **Seascape and Landscape Visual Impact Assessment** - Chartered Members of the Landscape Institute at LUC (Land Use Consultants Limited). LUC's landscape team has extensive experience of EIA for a wide range of development types. LUC is one of the UK's leading consultancies in the field of seascape, landscape and visual assessment for onshore and offshore wind development, with experience on projects across the UK over the last 15 years.
- **Chapter 16: Socioeconomics, Tourism and Recreation** - BiGGAR Economics Limited is an economic development consultancy based in Edinburgh, that has assessed the socioeconomic impact of over two hundred renewable energy projects across the UK and Ireland.

1.8 Structure of this Scoping Report

50. The structure of the Broadshore Hub WFDAs Scoping Report is set out in **Table 1.4** below.

51. Alongside the submission of this Broadshore Hub WFDAs Scoping Report, a Habitats Regulations Appraisal (HRA) Screening Report is submitted for the Broadshore Hub WFDAs (**Broadshore Hub WFDAs HRA Screening Report**).

Table 1.4: Structure of this Broadshore Hub WFDAs Scoping Report

<table>
<tr><th>Chapter</th><th>Author</th><th>Overview</th></tr>
<tr><td>Chapter 1 – Introduction</td><td>Royal HaskoningDHV</td><td>This chapter introduces the Broadshore Hub WFDAs, the Applicants, and the EIA team, provides overviews of the Broadshore Project, Sinclair Project and Scaraben Project along with their objectives, and outlines the purpose of this Broadshore Hub WFDAs Scoping Report.</td></tr>
<tr><td>Chapter 2 – Policy and Legislative Context</td><td>Royal HaskoningDHV</td><td>This chapter sets out the need for the Broadshore Hub WFDAs and the relevant policy and legislative context.</td></tr>
<tr><td>Chapter 3 – Project Description</td><td>Royal HaskoningDHV</td><td>This chapter provides a description of the key infrastructure that comprise the Broadshore Hub WFDAs.</td></tr>
<tr><td>Chapter 4 – Approach to Scoping and Environmental Impact Assessment</td><td>Royal HaskoningDHV</td><td>This chapter describes the proposed EIA methodology and demonstrates the measures taken to progress a proportionate EIA. This chapter also details the approach to consultation.</td></tr>
<tr><td>Chapter 5 – Marine Geology, Oceanography and Physical Processes</td><td>Royal HaskoningDHV</td><td rowspan="8">Each technical chapter covers:
▪ An outline of the relevant legislation, policy and guidance;
▪ Consultation undertaken to date;
▪ The proposed assessment methodology;
▪ An outline of the baseline characterisation;
▪ Scoping of potential impacts and significant effects, including embedded mitigation;
▪ Identification of potential cumulative and transboundary effects; and
▪ Questions posed to consultees.</td></tr>
<tr><td>Chapter 6 – Benthic Ecology</td><td>Royal HaskoningDHV</td></tr>
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Chapter	Author	Overview
Chapter 13 – Marine Infrastructure and Other Users	Royal HaskoningDHV	
Chapter 14 – Marine Archaeology and Cultural Heritage	Royal HaskoningDHV	
Chapter 15 – Seascape and Landscape Visual Impact	LUC	
Chapter 16 – Socioeconomics, Tourism and Recreation	BiGGAR Economics	
Chapter 17 – Climate Change	Royal HaskoningDHV	
Chapter 18 – Offshore Air Quality	Royal HaskoningDHV	
Chapter 19 – Major Accidents and Disasters	Royal HaskoningDHV	
Chapter 20 – Summary and Next Steps	Royal HaskoningDHV	Provides a summary of the approach taken to scoping and the key findings of the Broadshore Hub WFDAs Scoping Report.
Appendix 1 - Figures	Royal HaskoningDHV	Contains supporting figures.
Appendix 2 – Marine Protected Area (MPA) Screening Report	Royal HaskoningDHV	Provides a screening of Nature Conservation Marine Protected Area sites
Appendix 3 – Mitigation Register	Royal HaskoningDHV	Sets out the mitigation proposed for the Broadshore Hub WFDAs.
Appendix 4 – Marine Mammals Existing Environnent	Royal HaskoningDHV	Outline of the baseline characterisation for marine mammals.
Appendix 5 – Approach to Marine Mammals and Underwater Noise	Royal HaskoningDHV	Proposed approach to assessment of underwater noise impacts on marine mammals.
Appendix 6 – Apportioning Breeding Season Impacts to SPA Seabird Populations	Royal HaskoningDHV	Apportions breeding season impacts associated with the Broadshore Hub WFDAs to the qualifying features of breeding seabird colony Special Protection Areas.

1.9 References

BlueFloat | Renantis Partnership, (2024). Broadshore Hub Wind Farm Development Areas Habitats Regulations Screening Report.

Broadshore Offshore Wind Farm (2023). Supply Chain Development Statement (SCDS) Outlook. SCDS as of April 2023. Document Number: FR_BRO_SUP_GEN_0002, Rev 2.0. Available at: https://www.crownestatescotland.com/sites/default/files/2023-07/broadshore-offshore-wind-farm-scds-outlook-july-2023-update.pdf

Broadshore Offshore Windfarm (2023) Project website, available at: https://www.broadshorewind.co.uk/

2 Policy and Legislative Context

2.1 Introduction

52. This chapter provides an overview of the policy and legislative context for the Broadshore Hub Wind Farm Development Areas (WFDAs) as it applies to the Environmental Impact Assessment (EIA) and consenting process. The Applicants adopt a policy-led approach to EIA and consenting by providing an overview of the applicable legislative framework and identifying this within the strategic policy context for the Broadshore Hub WFDAs and outlining the applicable policy framework to guide proportionate assessment in the Broadshore Hub WFDAs EIA Report.

53. The purpose of this chapter is to explain the need for the Broadshore Hub, and to help inform the scope of the Broadshore Hub WFDAs EIA Report and demonstrate compliance with all legislative and policy requirements.

54. This chapter sets out a summary of the policy and legislative context for the Broadshore Hub WFDAs, in relation to:

- Need for the Broadshore Hub, in the context of Scottish, United Kingdom (UK) and international climate change policy, and energy security (**Section 2.2**);
- Scottish consenting legislation, including the legal basis for the consent applications required to construct, operate and maintain and decommission the Broadshore Hub WFDAs, and supporting EIA (**Section 2.5** and **Section 2.6**);
- International obligations and policy relating to climate change and the role of reducing greenhouse gas emissions (**Section 2.2.4**);
- Scottish and UK climate change and energy policy and legislation (**Section 2.2.4**); and
- Other nature conservation legislation and consenting requirements relevant to the Broadshore Hub WFDAs (**Section 2.7** and **Section 2.8**).

55. In addition to considering relevant legislation and policy, this Broadshore Hub WFDAs Scoping Report has been informed by the 'Marine Scotland Consenting and Licensing Guidance for Offshore Wind, Wave and Tidal Energy Applications' (2018). Any updates to this guidance will similarly be used to inform the Broadshore Hub WFDAs EIA Report. Please refer to **Chapter 4: Approach to Scoping and Environmental Impact Assessment** for further details on guidance.

56. Chapter specific policy and legislation is provided in the relevant technical chapters within this Broadshore Hub WFDAs Scoping Report. Any updated guidance, policy and legislation will be considered within the Broadshore Hub WFDAs EIA Report as appropriate.

2.2 Need for the Project

2.2.1 Overview

57. The UK requires a range of energy generation infrastructure to ensure it has a secure and economical energy supply, can meet its binding commitments to address climate change and can adopt renewable technologies as a significant proportion of its energy generation mix. Offshore wind, as a source of renewable energy, offers Scotland a wide range of benefits including reducing greenhouse gas emissions, supporting economic growth, and improving energy security.

58. The emissions of greenhouse gases have been identified as a significant source of anthropogenic climate change (Intergovernmental Panel on Climate Change; IPCC,2018). The burning of fossil fuels such as coal and gas for electricity production has been established as a significant greenhouse gas emission source. Development of renewable energy for electricity production is presented as a solution to reducing carbon dioxide (CO_2) emissions and the resulting anthropogenic climate change. To enable the development of renewable energy for electricity production, numerous climate change protocols and agreements and renewable energy policies and legislation have been implemented. These are discussed in **Section 2.2.4**, and include:

- The Kyoto Protocol, 1997;
- The Paris Agreement, 2015;
- The Climate Change (Scotland) Act 2009, amended by the Climate Change (Emissions Reduction Targets) (Scotland) Act 2019;
- The Climate Change (Annual Targets) (Scotland) Order 2011; and
- The North Sea Transition Deal, 2021.

59. The Scottish Government, along with many other governments across the world, declared a climate emergency in 2019, outlining the need for swift and decisive action to limit the warming of the planet by 1.5 degrees Celsius compared to 1990 levels. In Scotland, the net zero target is to be achieved by 2045 (the Climate Change (Scotland) Act 2009). This ambitious 2045 target reflects the Scottish Government's acknowledgement of the climate change emergency.

60. Scotland is considered to have the most abundant natural wind resource in Europe with around 25% of the continent's wind resource (Scottish Government, 2021). Acknowledging the available wind resource and offshore wind development opportunity, the Scottish and UK Governments have committed to ensuring that offshore wind is a leading contributing source of renewable electricity to the UK National Grid.

61. In October 2021, the UK Government published the Net Zero Strategy (Department for Business, Energy and Industrial Strategy; BEIS, 2021), which sets out its intended pathway for decarbonisation over the period until 2037, the end of the Sixth Carbon Budget (Climate Change Committee; CCC, 2020) period, on the way to Net Zero by 2050. The Net Zero Strategy sets a clear and credible range for emissions reduction in each sector of the economy.

62. The UK is one of the few countries with emissions targets in line with the long-term temperature goal of the Paris Agreement. CCC's most recent progress report (CCC, 2023) records that emissions in 2021 bounced back to some extent after COVID-19 but remain 9% below 2019 levels, and emissions in 2022 were 0.8% higher than 2021. The report also tracks progress and highlights risks to the delivery of the UK Net Zero Strategy.

63. The Broadshore Hub will contribute towards Scottish and UK renewable energy demands and targets, and has the potential to supply enough renewable electricity to power over one million homes[9] and avoid the production of over 1.6 million tonnes[10] of carbon dioxide per year from the equivalent generation of electricity from fossil fuels. The continued development of offshore wind within Scotland, including the advancement of floating wind farms in deeper waters further offshore is therefore critical to ensuring that Scotland and the UK can meet their binding energy and climate change targets.

64. **Sections 2.2.2, 2.2.3** and **2.2.4** below, respectively set out the background to the three projects which form the Broadshore Hub, as well as climate change and renewable energy policy relevant to the Broadshore Hub.

2.2.2 ScotWind Leasing

65. The ScotWind Offshore Wind leasing round (hereafter referred to as 'ScotWind') managed by Crown Estate Scotland (CES) is a major milestone in Scotland's journey towards Net Zero. ScotWind's objective was to help Scotland achieve its net-zero emissions target by 2045, by granting property rights for the seabed in Scottish waters for new commercial scale offshore wind projects in a way that was fair and transparent. In doing so, ScotWind facilitates and encourages development of the low-carbon energy generation needed to meet the world-leading targets committed to in The Climate Change (Emissions Reduction Targets) (Scotland) Act 2019.

66. CES announced 17 ScotWind projects in January 2022 and entered seabed option to lease agreements with these projects (including Broadshore Offshore Wind Farm Limited[11]) in April 2022. In August 2022, the ScotWind clearing process led to a further three projects being offered option agreements. In total, there are now 20 ScotWind projects confirmed with a total capacity of up to 27.6 gigawatts (GW) and committing £28.8 billion expenditure in Scotland's supply chain, which will help create thousands of jobs and transform the Scottish economy (Crown Estate Scotland, 2023a).

67. CES will offer a full seabed lease to each ScotWind project once developers have secured the necessary consents, grid connection and finance. The ScotWind process is 'plan-led', therefore all projects are sited in areas defined within the Sectoral Marine Plan (SMP) for Offshore Wind Energy (Scottish Government, 2020), which was subject to plan-level Strategic Environmental Assessment (SEA) (Scottish Government, 2019a), Habitats Regulations Appraisal (HRA) (Scottish Government, 2019b) and socioeconomic assessment (Scottish Government, 2019c) throughout its preparation. The seabed lease for Broadshore WFDA will last for up to 60 years.

[9] www.broadshorewind.co.uk
[10] www.broadshorewind.co.uk
[11] Previously known as 'Orion Offshore Wind Farm Limited'.

2.2.3 Innovation and Targeted Oil and Gas Leasing

68. Following ScotWind, CES announced the Innovation and Targeted Oil and Gas (INTOG) leasing round in Scottish waters, which aimed to attract investment in innovative offshore wind projects as well as to help decarbonise North Sea oil and gas operations to help achieve the targets of the North Sea Transition Deal. INTOG will also further stimulate innovation in Scotland's offshore wind sector, create additional supply chain opportunity, assist companies to enter the renewable energy market, and support Scotland's net-zero ambitions (CES, 2023b).

69. The INTOG process allowed developers to apply for seabed rights to develop offshore wind projects in one of two categories:

- Innovation (IN): small scale innovative projects of 100 megawatts (MW) or less; or
- Targeted Oil and Gas (TOG): supplying renewable electricity directly to oil and gas infrastructure.

70. CES announced 13 successful applicants (five for IN and eight for TOG categories) in November 2022 and each were offered Exclusivity Agreements in March 2023. Sinclair Offshore Wind Farm Limited and Scaraben Offshore Wind Farm Limited entered Exclusivity Agreements in May 2023. Marine Directorate's INTOG SMP is due for completion in 2024 with an Initial Plan Framework (IPF) adopted in February 2022 (Scottish Government 2022), building upon the 2020 SMP-OWE in Scottish Waters (Scottish Government, 2020). If, as expected, these projects are included in the final INTOG SMP an option agreement will be offered by CES to the Applicants. The seabed lease for the Sinclair WFDA and the Scaraben WFDA will last for up to 25 years.

2.2.4 Climate Change and Renewable Energy Policy

71. **Table 2.1** sets out the relevant legislation, policy and directives at Scottish, UK, European and international level relevant to the Broadshore Hub WFDAs with respect to climate change and energy needs.

72. A climate change assessment will be provided as part of the Broadshore Hub WFDA EIA Report, setting out the contribution the Broadshore Hub WFDAs will make to the aims and targets set out in the policy documents below. See **Chapter 17: Climate Change** for more details on the approach to climate change assessment.

Table 2.1: Climate Change and Energy Legislation, Policy and Directives

Legislation, Policies and Directives	Summary
Scotland	
National Planning Framework 4, 2023	The National Planning Framework 4 (NPF4) sets out Scotland's spatial principles, regional priorities, national developments and national planning policy. NPF4 presents Sustainable Places, Liveable Places and Productive Places to achieve national outcomes including benefits to the environment, communities, and health. The NPF4 contains a notable focus on tackling both the climate and nature crises.

Legislation, Policies and Directives	Summary
	There is a strong preference for developments which meet the Scottish Government's aims for net zero emissions by 2045, and halting biodiversity loss by 2030/restoring and regenerating biodiversity by 2045. Projects which evidence low and zero-carbon design and expansion of renewable energy generation will therefore be encouraged, such as the Broadshore Hub WFDAs. Strategic renewable electricity generation and transmission infrastructure is highlighted as a key national strategic development, required to support the delivery of 'sustainable places'. Renewable energy and transmission infrastructure (such as the Broadshore Hub) is highlighted to improve energy security and reduce emissions, whilst providing employment and opportunities for local communities.
Draft Energy Strategy and Just Transition Plan, 2023	The Draft Energy Strategy and Just Transition Plan sets out policy positions and key ambitions for Scotland's energy future, including more than 20 GW additional renewable electricity onshore and offshore by 2030. The Plan contains a route map of actions to deliver a net zero energy system to supply affordable, resilient and clean energy to Scotland by 2045 and benefit employment. The Plan aims to transform and expand the energy generation sector in Scotland by working with the UK Government.
The Climate Change Plan, Third Report on Proposals and Policies (2018-2032), Updated 2021	The Climate Change Plan sets out the path to a low carbon economy while helping to deliver sustainable economic growth. It sets out how Scotland can achieve a 75% reduction in greenhouse gas emissions by 2030, and net-zero by 2045. The Climate Change Plan presents proposals and policies to meet Scotland's annual emissions targets to 2032, with decarbonisation related to pathways including the electricity system.
Scotland's Offshore Wind Policy Statement, 2020	The Offshore Wind Policy Statement confirmed the Scottish Government's intent to see offshore wind play a key role in decarbonisation and Scotland's net zero commitment and suggests as much as 11 GW of offshore wind could be delivered by 2030 in Scottish waters alone.
Sectoral Marine Plan (SMP) for Offshore Wind Energy, 2020	The SMP for Offshore Wind Energy identifies sustainable areas for the future development of commercial-scale offshore wind energy in Scotland, including a spatial strategy to inform the seabed leasing process for the purposes of offshore wind energy. This built on the first SMP which was adopted in 2011, and the draft wind, wave and tidal plan in 2013, and was developed in accordance with the Scottish National Marine Plan (SNMP). The Plan is undergoing review to reflect the ScotWind and INTOG leasing round and is anticipated to be published in 2024.
Sectoral Marine Plan Offshore Wind for Innovation and Targeted Oil and Gas Decarbonisation: Initial Plan Framework, 2022	The Initial Plan Framework (IPF) outlines the process for development of the SMP for INTOG Decarbonisation. The IPF also sets out the areas that will be used for future seabed leasing. The Plan is undergoing review to reflect the ScotWind and INTOG leasing round and is anticipated to be published in 2024.
Energy Strategy: Position Statement, 2021	The Energy Strategy provides an overview of the key priorities of the Scottish Government for the short to medium-term in ensuring a green economic recovery from COVID-19. The key principles set out in Scotland's Energy Strategy are a whole system view, an inclusive energy transition and a smarter local energy model, and the Scottish Government continues to abide by this.

Legislation, Policies and Directives	Summary
Climate Change (Scotland) Act 2009, amended by the Climate Change (Emissions Reduction Targets) (Scotland) Act 2019	The Climate Change (Scotland) Act 2009 was implemented to reduce the greenhouse gas emissions in Scotland (UK Government, 2009). The Climate Change (Annual Targets) (Scotland) Order 2011 outlines the targets for 2023-2027. The Climate Change (Scotland) Act 2009 and The Climate Change (Emissions Reduction Targets) (Scotland) Act 2019 (Sections 1-3) include Scotland's commitments to reducing greenhouse gas emissions.
Scottish Energy Strategy, 2017	In 2017, the Scottish Government published Scotland's Energy Strategy: The Future of Energy in Scotland, which set a vision for how the energy system in Scotland would look in 2050. Since the publication, the Scottish Government has committed to achieving targets of net zero greenhouse gas emissions by 2045 and a 75% reduction by 2030. This involves supplying 50% of Scotland's energy requirements from renewable sources and increasing energy productivity by 30% across the Scottish economy by 2030.
Electricity Generation Policy Statement, 2013	The Electricity Generation Policy Statement 2013 examines the way in which Scotland generates electricity. The Scottish Government's policy states that Scotland's generation mix should deliver a secure source of electricity supply at an affordable cost which can be largely decarbonised by 2030 and achieves the greatest possible economic benefit and competitive advantage for Scotland.
United Kingdom	
British Energy Security Strategy 2022	The British Energy Security Statement (published April 2022) outlines a plan for creating a resilient energy system in response to rising global energy prices partly attributed to geopolitical events such as the war in Ukraine. The statement outlined the UK Governments ambition to deliver up to 50 GW of offshore wind by 2030, including five GW of floating wind technology. The UK Government also presented amendments to the planning process for offshore wind projects to streamline the consenting process. Following this, the UK Energy Security Bill (published in July 2022) was presented to the UK Parliament to follow on from the commitments that had been outlined in the British Energy Security Statement. The UK Government is aiming to legislate the Offshore Wind Environmental Improvement Package Measures which outlines the efficiency measures presented in the British Energy Security Statement. This includes the UK Government's intent to agree a list of approved compensatory measures for use where required by offshore wind farm to compensate for environmental effects on the national site network. The Energy Security Bill (now known as the Energy Bill) is currently going through the final stages in the House of Commons.
UK Climate Change Strategy 2021- 2024	The UK Climate Change Strategy will support UK exporters and suppliers through the transition to net zero by increasing support to clean growth and climate adaptation, reducing greenhouse gas emissions and understanding and mitigating climate-related financial risks. The Strategy highlights the importance of transforming the financial system to boost innovation and transition away from high carbon sectors.

Legislation, Policies and Directives	Summary
North Sea Transition Deal, 2021	The North Sea Transition Deal between the UK Government and the UK's offshore oil and gas sector will help to deliver net-zero by 2050. The Deal will enable the oil and gas sector to drive the energy transition by developing and deploying a range of new technologies. The deal introduced targets to reduce greenhouse gas emissions from upstream oil and gas activities through Supply Decarbonisation, against a 2018 baseline, by 10% in 2025, 25% in 2027 and 50% in 2030, while reducing carbon emissions to net zero by 2050. The deal also aims to facilitate the use of carbon capture technologies, the use of hydrogen, and aims to transform the supply chain and support jobs.
Offshore Wind Sector Deal, Updated 2020	The Offshore Wind Sector Deal will drive the transformation of offshore wind generation, making it part of a low-cost, low-carbon, flexible grid system. Offshore wind may be able to contribute up to 30 GW of generating capacity by 2030.
Energy White Paper: Powering our Net Zero Future, 2020	The Energy White Paper addresses the transformation of the energy system to promote clean, resilient economic growth and deliver net-zero emissions by 2050. The Energy White Paper puts in place a strategy for the wider energy system that transforms energy for a cleaner greener future, supports a green recovery and grows the economy, and creates a fair deal for consumers.
Climate Change Act 2008, amended by the 2050 Target Amendment Order 2019	The Climate Change Act 2008 sets legally binding targets for the UK to reduce carbon dioxide emissions by at least 80% by 2050, from 1990 levels. This was amended by the Climate Change Act 2008 (2050 Target Amendment) Order 2019 which introduced a target for at least 100% reduction in greenhouse gas emissions (compared to 1990 levels) in the UK by 2050.
Energy Act, 2023	The Energy Act 2023 aims to transform the UK's energy system by strengthening energy security, supporting the delivery of net zero by 2050, and ensuring household bills are affordable in the long-term
Energy Act 2013	The Energy Act 2013 aims to facilitate investment in electricity generation contributing towards the legally binding emissions reduction targets, to meet statutory 2030 decarbonisation targets. The Act also aimed to reform the electricity market. The reformed electricity market aims to deliver the low carbon energy and reliable supplies that the UK needs, while minimising costs to consumers. This Act introduced the Contracts for Difference (CfD) funding mechanism and transition arrangement for investments under the Renewables Obligation scheme.
Energy Act 2004	The Energy Act 2004 established a Renewable Energy Zone (REZ) adjacent to the UK's territorial waters to enable the creation of designated leasing areas for developers to bid for the development of renewable energy. The Act additionally implemented statutory decommissioning requirements for offshore renewable energy installations and associated transmission infrastructure (described further in **Section 2.8.1**) and a Safety Zone scheme (described further in **Section 2.8.2**).

Legislation, Policies and Directives	Summary
European Union	
European Union (Withdrawal) Act 2018	Following the UK's exit from the EU, the UK Government committed to implement international environmental obligations in accordance with the European Union (Withdrawal) Act 2018 and to maintain environmental commitments and legislation already made (UK Government, 2018). On this basis, the existing EU renewable energy targets for the UK, including the EU Renewable Energy Directive 2009/28/EC, will remain applicable.
European Union Renewable Energy Directive (Revised), 2018	The Revised Renewable Energy Directive (2018/2001/EU) entered into force in 2018 set the target to achieve a minimum of 32% share of renewable energy consumption within the EU. Member States commit to the renewable energy consumption target as part of integrated national energy and climate plans, pursuant to Regulation (EU) 2018/1999 of the European Parliament and of the Council.
International	
Paris Agreement (Conference of Parties; COP 21), 2015	The Paris Agreement had an overarching goal to hold the increase in the global average temperature to below 2°C above pre-industrial levels, and binds all parties to prepare, communicate and maintain a Nationally Determined Contribution to this effect. From 2023 and every five years thereafter, a global stock-take will assess collective progress. The commitment to the Paris Agreement was reaffirmed at the Glasgow Climate Change Conference in 2021 (COP26) and at Sharm el-Sheikh Climate Change Conference (COP27) in 2022.
Kyoto Protocol, 1997	The Kyoto Protocol requires signatory countries to limit and reduce greenhouse gases in accordance with agreed individual targets. The Kyoto Protocol was formally adopted on 11th December 1997, first entering into force on 16th February 2005 (United Nations Framework Convention on Climate Change; UNFCCC, 2023). The UK Government adopted the commitments outlined in the Kyoto Protocol through the Climate Change Act 2008 and Climate Change (Scotland) Act 2009.
United Nations Framework Convention on Climate Change (UNFCCC), 1992	The UNFCCC aims to stabilise greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system, and is the foundation for later landmark agreements, including the Kyoto Protocol and Paris Agreement.

2.3 Marine Planning Policy

73. In Scotland, marine planning policy is used to inform decisions made under the relevant consenting legislation, e.g., for the purposes of obtaining a Marine Licence. A summary of marine planning policy relevant to the Broadshore Hub WFDAs is given in **Table 2.2**

Table 2.2: Summary of Marine Planning Policy

Policy	Summary
Scotland's National Marine Plan, 2015	Scotland's National Marine Plan (SNMP) was published in March 2015. The purpose of the SNMP is to set out strategic policies for the sustainable development of Scotland's marine resources out to 200 nm. It also provides a strategic framework for marine licensing decisions. The SNMP outlines objectives relating to offshore wind and marine renewable energy which intend to maximise the sustainable development of offshore wind by creating economic benefits through increasing a domestically competitive supply chain whilst contributing to decarbonisation targets. The SNMP is currently being updated with the SNMP 2 anticipated to be published in 2024.
Regional Marine Plans	A total of 11 Scottish Marine Regions have been created under the Scottish Marine Regions Order 2015 which cover sea areas extending out to 12 nm. Regional Marine Plans for each Marine Region will be developed by Marine Planning Partnerships to allow more local ownership and decision making. The Marine Planning Partnership relevant to the Broadshore Hub WFDAs is the Moray Firth Coastal Partnership. No Regional Marine Plan is developed for the Moray Firth Marine Region at the time of writing.
UK Marine Policy Statement, 2011	In March 2011, the UK Marine Policy Statement (MPS) was published for the purposes of section 44 of the Marine and Coastal Access Act 2009 (UK Government, 2009). The MPS was established to partially facilitate and support the formulation of Marine Plans in accordance with the marine objectives (HM Government, 2011), including to promote sustainable economic development; enable the UK's move towards a low-carbon economy, to mitigate the causes of climate change and ocean acidification and adapt to their effects; ensure a sustainable marine environment which promotes healthy, functioning marine ecosystems and protects marine habitats, species and heritage assets; and contribute to the societal benefits of the marine area, including the sustainable use of marine resources to address local social and economic issues.
Marine Strategy Framework Directive	The EU Marine Strategy Framework Directive (Directive 2008/56/EC) was established to protect the marine environment by seeking to achieve Good Environmental Status (GES) in Europe's seas by 2020. This Directive was transposed into UK law by the Marine Strategy Regulations 2010 and remains applicable after EU Exit, under the Marine Environment (Amendment) (EU Exit) Regulations 2018.

2.4 Local Planning Policy

2.4.1 The Town and Country Planning (Scotland) Act 1997

74. The Town and Country Planning (Scotland) Act 1997 provides the framework for Local Development Plans (LDPs) and includes detail on many of the procedures to be followed in preparing plans. The LDPs are most relevant to the Broadshore Hub OnTDAs, which are subject to separate onshore planning applications and will be assessed in a separate EIA Report.

75. This Broadshore Hub WFDAs Scoping Report focuses on the Broadshore Hub WFDAs only, with a separate Scoping Report planned to cover the Broadshore Hub OnTDAs. Further details on the Broadshore Hub development areas and the consent strategy is provided in **Chapter 1: Introduction**.

76. **Section 2.4.2** below sets out local development plans which are relevant to the Broadshore Hub as a whole.

2.4.2 Aberdeenshire Local Development Plan 2023

77. The Aberdeenshire LDP (Aberdeenshire Council, 2023) was formally adopted in January 2023. The plan aims to help develop a strong and resilient economy whilst maintaining a high quality of life and environment with new sustainable development. The Plan sets out the purpose of planning "to manage the development and use of land in the long-term public interest".

78. Climate Change – C2 Renewable Energy policies are relevant to the Broadshore Hub WFDAs:

- Policy C2.1 - Supports solar, wind, biomass and hydro-electricity developments that are in appropriate sites and of the appropriate design.
- Policy C2.2 - Looks at how wind energy developments will be approved in appropriate locations taking account of the spatial framework mapping. The 'Strategic Landscape Capacity Assessment for Wind Energy in Aberdeenshire Final Report' (Aberdeenshire Council, 2014) remains valid.
- Policy C2.3 All wind farms must be appropriately sited and designed and avoid unacceptable environmental effects, taking into account the cumulative effects of existing and approved wind turbines.
- Policy C2.4 - Turbines must not compromise health and safety or adversely affect aircraft or airfields (including radar and air traffic control systems, flight paths and Ministry of Defence low flying areas) and/or telecommunications.
- Policy C2.8 requires other renewable energy developments to relate well to the source of the renewable energy required for operation and satisfactory steps must be taken to mitigate any negative impacts on affected properties.

79. The Planning (Scotland) Act 2019 removes the need for the preparation of Strategic Development Plans. Strategic planning matters will be set out in the NPF4 which was adopted on 13 February 2023. On 13 February the Aberdeen City and Shire Strategic Development Plan 2023 and their associated supplementary guidance ceased to have effect. LDPs are no longer required to be consistent with the Strategic Development Plans.

2.5 Consenting Legislation

80. The following consents and licences are required for each project within the Broadshore Hub WFDAs:

- Section 36 (s.36) consent under the Electricity Act 1989 (**Section 2.5.1**); and
- Marine Licence for marine renewable energy projects under the Marine and Coastal Access Act 2009 (MCAA) (**Section 2.5.2**).

81. Where additional licences are required for pre-construction or operational works, these will be sought from the relevant consenting authority at the appropriate time.

82. As discussed in **Chapter 1: Introduction,** separate s.36 consents, and Marine Licences will be sought for the Broadshore WFDA, Sinclair WFDA and Scaraben WFDA.

2.5.1 Electricity Act 1989

83. The Electricity Act 1989 created the legal framework for privatising the electricity industry. The Act allowed the establishment of new electricity companies, required to ‘develop and maintain an efficient, co-ordinated and economical system of electricity supply’, and ‘to facilitate competition in the supply and generation of electricity’. Under s.36, the Act establishes the licencing regime for the construction of generation stations.

84. For generating stations (such as the Broadshore Hub WFDAs), which are situated in Scottish offshore waters or the Scottish REZ (waters between 12 nm and 200 nm) with a proposed installed capacity of 50 MW and above, consent is required from Scottish Ministers (facilitated by Marine Directorate - Licensing Operations Team (MD-LOT)) under s.36 of the Electricity Act 1989.

85. The s.36 consent grants permission for the construction and operation of generation stations in the Scottish offshore region, including Wind Turbine Generators (WTGs) and their substructures and station keeping systems (SKS) and auxiliary infrastructure (such as inter-array cables (IACs) and subsea cable hub(s)) which comprises the Broadshore Hub WFDAs. Separate s.36 applications will be submitted for the Broadshore WFDA, the Sinclair WFDA and the Scaraben WFDA.

2.5.2 Marine and Coastal Access Act 2009

86. A Marine Licence is also required under the MCAA 2009. The MCAA sets out the requirements for Marine Licencing in Scottish waters between 12 nm and 200 nm, to be obtained prior to construction, alteration or improvement of any works, deposit of any substance or objects in or over the sea, or on or under the seabed, or to carry out activities such as dredging. As such, a Marine Licence will be sought for activities listed under Part 4 (Marine Licencing) of the MCAA 2009 where required in order to construct the Broadshore Hub WFDAs. A separate Marine Licence application will be submitted for the Broadshore WFDA, the Sinclair WFDA and the Scaraben WFDA.

87. In Scottish waters, Marine Licences are administered by MD-LOT.

2.6 Environmental Impact Assessment Regulations

88. The requirement to undertake EIA was originally established under the EIA Directive (2011/92/EU, as amended by Directive 2014/52/EU) (as transposed into UK law) and continues to be applicable through the Marine Environment (EU Exit) (Scotland) (Amendment) Regulations 2019, which came into force on EU Exit Day (31 January 2020). As such, the EIA Directive remains relevant to the EIA process in Scotland and is relevant to any s.36 or Marine Licence applications in Scottish waters if a project is likely to have a significant effect on the environment due to its size, nature or location.

89. The following legislation implements the EIA Directive into Scottish law:

- The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017, which requires an EIA to support s.36 consent applications (**Section 2.6.1**);
- The Marine Works (Environmental Impact Assessment) Regulations 2007, which requires an EIA to support Marine Licence applications (**Section 2.6.2**); and
- Town and Country Planning (Environmental Impact assessment) (Scotland) Regulations 2017 (**Section 2.4.1** above).

90. The approach to Scoping and EIA for the Broadshore Hub WFDAs is set out in detail in **Chapter 4: Approach to Scoping and Environmental Impact Assessment**.

2.6.1 The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017

91. Under the Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017, an EIA is required to support electricity generation projects which must apply for consent under s.36 of the Electricity Act 1989. These regulations set out the statutory process and minimum requirements for EIA.

92. Schedule 2 of the Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017 sets out a list of development types for which an EIA may be required, including generating stations, which the Broadshore Hub WFDAs falls under. Where Schedule 2 developments are likely to have a significant effect on the environment due to factors such as its nature, size or location, an EIA Report is required to be prepared and submitted to support such applications.

93. Schedule 2 developments may apply for a screening opinion from the Scottish Ministers to determine whether any development is, or is not, EIA development, and therefore require preparation of an EIA Report. The Applicants have chosen to prepare and submit and EIA Report for the Broadshore Hub WFDAs without prior screening.

94. The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017 s.12 also provide capacity for the Scottish Ministers (facilitated by MD-LOT) to provide a Scoping Opinion (an opinion on the scope of information proposed to be provided within the Broadshore Hub WFDAs EIA Report) if a written request for this is submitted by the Applicants. This document forms the Broadshore Hub WFDAs Scoping Report, which will set out the proposed scope of information to be provided within the Broadshore Hub WFDAs EIA Report, and will form the basis of a Scoping Opinion from MD-LOT.

95. The Scoping Opinion provided by MD-LOT will be applicable to The Electricity Works (EIA) (Scotland) Regulations 2017 and the Marine Works (EIA) Regulations 2007 (**Section 2.6.2**).

2.6.2 The Marine Works (Environmental Impact Assessment) Regulations 2007

96. Under Schedule A2 of the Marine Works (Environmental Impact Assessment) Regulations 2007 (which applies in Scottish offshore waters beyond 12 nm), an EIA is required for wind farms (installations that harness wind power for energy production) if the project in question is likely, because of its size, nature or location to have significant effects on the environment. The Applicants acknowledge the potential for significant environmental effects and will therefore prepare an EIA Report in accordance with these regulations. outside

97. Similarly to the Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017, the Marine Works (Environmental Impact Assessment) Regulations 2007 make provision for a written request for a Scoping Opinion to be provided by MD-LOT.

98. The Scoping Opinion provided by MD-LOT will be applicable to The Marine Works (EIA) Regulations 2007 and The Electricity Works (EIA) (Scotland) Regulations 2017 (**Section 2.6.1**).

2.7 Nature Conservation Legislation and Policy

2.7.1 Habitats Regulations Appraisal

99. In 1992, the EU Directive 92/43/EEC, known as the 'Habitats Directive', was adopted to enable EU member states to meet obligations set out under the Bern Convention. The purpose of the Habitats Directive is to maintain or restore natural habitats and wild species listed in the Annexes (Annex I, II) at Favourable Conservation Status (FCS). Protection to meet FCS is given through designation of European Sites (Special Areas of Conservation (SAC)).

100. In addition, the EU Directive 2009/147/EC, known as the 'Birds Directive', was implemented to provide a framework for conservation and management of wild birds in the EU. Annex I of the Birds Directive provides a list of rare, vulnerable and migratory species, which are protected through the designation of Special Protected Areas (SPAs).

101. These directives are transposed into Scottish law by the Conservation of Offshore Marine Habitats and Species Regulations 2017 (which apply to Marine Licences within the Scottish Offshore region).

102. Together, with changes enacted by the Conservation of Habitats and Species Amendment (EU) Exit) Regulations 2019 (the 'EU Exit Regulations') this regulation is known as the 'Habitats Regulations'. The Habitat Regulations require a Habitats Regulations Appraisal (HRA) to be undertaken where a project could affect a designated site (SPAs, SACs, proposed or candidate SPAs and SACs or Ramsar Sites), either individually or in combination with other plans or projects, in view of the site's conservation objectives. Please see **Chapter 4: Approach to Scoping and Environmental Impact Assessment** for further details on the HRA approach and process.

103. In accordance with the above-mentioned HRA Regulations, the Applicants are undertaking the relevant assessments to inform an Appropriate Assessment undertaken by MD-LOT. A standalone **Broadshore Hub WFDAs HRA Screening Report** (BlueFloat | Renantis Partnership, 2024) (Stage 1 of the HRA) for the Broadshore Hub WFDAs has been prepared and submitted for consideration alongside this Broadshore Hub WFDAs Scoping Report, and a Report to Inform Appropriate Assessment (RIAA) will be submitted alongside the Broadshore Hub WFDAs EIA Report and application documentations for the Broadshore Hub WFDAs. Separate HRA Screening Reports and RIAAs will also be submitted for the Broadshore Hub OnTDA and Broadshore Hub OfTDA.

2.7.2 Nature Conservation Marine Protected Area Assessment

104. Scotland designates Nature Conservation Marine Protected Areas (NCMPAs) in offshore waters between 12 nm and 200 nm under the MCAA 2009. MPAs are designated to protect biodiversity and heritage, with specific focus on protected features (species, habitats, large scale features or geomorphological features).

105. Under the MCAA 2009, provisions are made for the relevant public authority (in this instance, MD-LOT) to consider whether a licensable activity is capable of affecting (other than insignificantly) a protected feature in a NCMPA or any ecological or geomorphological process on which the conservation of any protected feature in a NCMPA is dependant.

106. In order to assess whether there is any significant risk of the licensable activity hindering the achievement of the conservation objectives of a given NCMPA, a NCMPA Assessment should be completed.

107. A NCMPA Screening Report, covering Stage 1, has been prepared and submitted for consideration in **Appendix 2** of this Broadshore Hub WFDAs Scoping Report. **Appendix 2: NCMPA Screening Report** has been prepared in line with the guidance provided in the Marine Scotland Nature Conservation Marine Protected Areas: Draft Management Handbook (2013). Further details on the methodology for the NCMPA assessment are provided in **Chapter 4: Approach to Scoping and Environmental Impact Assessment** and **Appendix 2: NCMPA Screening Report**.

2.7.3 European Protected Species

108. Annex IV of the Habitats Directive sets out a list of animals and plants that are considered European Protected Species (EPS) and protected under the Habitat Regulations. Under the Habitat Regulations, it is unlawful to:

- Deliberately capture, injure or kill an EPS;
- Deliberately disturb an EPS; or
- Damage or destroy a breeding site or resting place of an EPS.

109. However, it may be lawful to carry out certain activities which are likely to cause disturbance or injury to EPS, if an EPS licence is sought. This process is detailed in **Chapter 4: Approach to Scoping and Environmental Impact Assessment**.

110. As part of early project development, the Applicants provided EPS Risk Assessments to MD-LOT in relation to EPS licence applications to undertake geophysical surveys within the Broadshore Hub WFDAs. MD-LOT determined that no EPS licence was required for this purpose. The Applicants will apply for further EPS licences as appropriate should these be required in the future.

2.7.4 Basking Sharks

111. Basking sharks *Cetorhinus maximus* are a Priority Marine Feature (PMF) in Scotland's seas, and are protected under Schedule 5 of the Wildlife and Countryside Act 1981 and under Part 3 and Schedule 6 of the Nature Conservation (Scotland) Act 2004. Under these protections, it is prohibited to kill, injure or take by any method basking sharks and any other species listed in Schedule 5, or to intentionally or recklessly disturb these species.

112. For commercial survey activities (e.g., geophysical surveys), a licence to disturb basking sharks may be required. The Applicants will apply for a basking shark licence should this be required with MD-LOT as the relevant licensing authority.

113. Further information on basking sharks is provided in **Chapter 7: Fish and Shellfish Ecology**.

2.7.5 Priority Marine Features

114. Since 2014, 81 species and habitats present in the seas around Scotland have been identified as PMFs. The list, which was developed by Marine Scotland (now Marine Directorate), the Joint Nature Conservation Committee and Scottish Natural Heritage (now NatureScot) covers species and habitats that are a priority for conservation in Scotland, including intertidal and continental shelf habitats, deep sea habitats, mammals, fish, shellfish and other invertebrates. Please refer to **Chapter 6: Benthic Ecology; Chapter 7: Fish and Shellfish Ecology; and Chapter 8: Marine Mammals**.

2.7.6 Biodiversity Enhancement

115. Scottish Government Policy, including the National Marine Plan and NPF4 (Scottish Government, 2023), contain an emphasis on tackling the nature crises through developments making a contribution towards both halting biodiversity loss and supporting biodiversity and marine enhancement. The Broadshore Hub as a whole will consider the impacts on biodiversity, and implement measures to quantify and restore affected habitats where possible. Engagement with local environmental groups and the appropriate authorities will be key to identifying key areas which could be subject to enhancement measures. With reference to guidance and policy in place at the time, nature-based solutions will be considered where appropriate.

2.8 Other Consenting Requirements

2.8.1 Decommissioning

116. Sections 105 to 114 of the Energy Act 2004 set out statutory requirements in relation to the decommissioning of Offshore Renewable Energy Installations (OREI) and associated electrical lines. The Scottish Ministers may require a costed decommissioning programme for OREIs in Scottish waters to be submitted for approval. Scottish Ministers further have the power to determine specific approaches to decommissioning, including stipulating the form, timing and size of financial securities required.

117. The document ‘Decommissioning of Offshore Renewable Energy Installations in Scottish Waters or in the Scottish part of the REZ under The Energy Act 2004: Guidance Notes for Industry (in Scotland)’ was published by Marine Scotland in July 2022 (Scottish Government, 2022). This guidance document sets out the policy and legislative framework; decommissioning requirements in Scotland; requirements for Decommissioning Programmes; environmental and safety considerations; and financial considerations. Decommissioning Programmes are expected to contain information on decommissioning standards, financial security, residual liability and industrial cooperation and collaboration.

118. Section 5 of the Guidance Note (Marine Scotland, 2022) states that “an indication of the decommissioning proposals should be included as part of the statutory consenting or licensing process so that the feasibility of removing the infrastructure can be assessed as part of the application process”.

2.8.2 Safety Zone Applications

119. Section 95 of the Energy Act 2004 sets out that Safety Zones could be established for any phase of an offshore renewable energy project in designated areas, where it is appropriate for safety reasons. Safety Zones are intended to ensure the safety of the renewable energy installation or other installations in the vicinity during construction, operation, extension or decommissioning.

120. Safety Zones may exclude non-offshore wind farm vessels from navigating through a designated area for a specific period. The Broadshore Hub WFDAs EIA Report will include an assessment of the proposed approach to Safety Zones at the point of application. The total number of Safety Zones to be established at the same time has not been yet defined. It is anticipated that the following applications will be made:

- An application will be made post-consent for Safety Zones including up to 500 m around each WTG and substructure during its construction.
- An application will be made post-consent for Safety Zones including up to 50 m around each installed WTG and substructure during its pre-commissioning.
- An application will be made post-consent for Safety Zones including up to 500 m around each WTG and substructure during major maintenance during operation.
- An application will be made prior to commencement of decommissioning for Safety Zones including up to 500 m around each WTG and substructure during its decommissioning.

2.9 Scoping Questions to Consultees

121. The following questions are posed to consultees to help them frame and focus their response to the approach to scoping and EIA for the Broadshore Hub WFDAs, which will in turn inform the Scoping Opinion:

- Considering the Scottish Government consultation paper "Tackling the Nature Emergency – strategic framework for biodiversity" - can any advice be provided around expected levels of biodiversity enhancement that might be expected for offshore works in addition to embedded and additional mitigation?

2.10 References

Aberdeen City and Shire Strategic Development Planning Authority, (2020). 'Aberdeen City and Shire Strategic Development Plan'. Available at: http://publications.aberdeenshire.gov.uk/dataset/b5991364-41ff-4827-b5d4-06aa48c0616a/resource/27bcc9ff-8b5f-4dc3-b322-519f9800ac2c/download/abdnandshirestrategicdevplanfinal2020.pdf

Aberdeenshire Council (2014). 'Strategic Landscape Capacity Assessment for Wind Energy in Aberdeenshire Final Report'. Available at: https://www.aberdeenshire.gov.uk/media/11378/section1introductionaslcassessmentmarch2014.pdf

Aberdeenshire Council (2023). 'Aberdeenshire Local Development Plan 2023'. Available at: https://www.aberdeenshire.gov.uk/planning/plans-and-policies/ldp-

2023/#:~:text=The%20Local%20Development%20Plan%202023,of%20the%20Local%20Development%20Plan.

BlueFloat | Renantis Partnership, (2024). Broadshore Hub Wind Farm Development Areas Habitats Regulations Screening Report.

BEIS (2020a). 'Offshore wind: Sector Deal'. Available at: https://www.gov.uk/government/publications/offshore-wind-sector-deal

BEIS (2020b). 'Energy white paper: Powering our net zero future'. Available at: https://www.gov.uk/government/publications/energy-white-paper-powering-our-net-zero-future

BEIS (2021a). 'Net Zero Strategy: Build Back Greener'. Available at: https://www.gov.uk/government/publications/net-zero-strategy

BEIS (2021b). 'North Sea Transition Deal'. Available at: https://www.gov.uk/government/publications/north-sea-transition-deal

BEIS (2022b). 'Energy Security Bill'. Available at: https://www.gov.uk/government/collections/energy-security-bill

BEIS, (2022a). 'British energy security strategy'. Available at: https://www.gov.uk/government/publications/british-energy-security-strategy/british-energy-security-strategy

Climate Change Committee, (2023) 'Progress in reducing emissions – 2023 Report to Parliament'. Available at: https://www.theccc.org.uk/wp-content/uploads/2023/06/Progress-in-reducing-UK-emissions-2023-Report-to-Parliament-1.pdf

Crown Estate Scotland, (2023a). 'Briefing: ScotWind Leasing for offshore wind'. Available at: https://www.crownestatescotland.com/resources/documents/scotwind-briefing-november-2022#:~:text=Without%20ScotWind%20enabling%20a%20pipeline,investment%20would%20not%20be%20possible.&text=This%20revenue%20will%20be%20passed%20to%20the%20Scottish%20Government%20for%20public%20spending.&text=ScotWind%20is%20an%20opportunity%20to,for%20a%20clean%20energy%20future.

Scottish Government (2020). 'Sectoral marine plan for offshore wind energy'. Available at: https://www.gov.scot/publications/sectoral-marine-plan-offshore-wind-energy/

Scottish Government (2022). 'Sectoral marine plan - offshore wind for innovation and targeted oil and gas decarbonisation: initial plan framework'. Available at: https://www.gov.scot/publications/initial-plan-framework-sectoral-marine-plan-offshore-wind-innovation-targeted-oil-gas-decarbonisation-intog/

Scottish Government (2023). 'Tackling the Nature Emergency - strategic framework for biodiversity: consultation'. Available at: https://www.gov.scot/publications/tackling-nature-emergency-consultation-scotlands-strategic-framework-biodiversity/

3 Project Description

3.1 Introduction

122. This chapter provides an overview of the Broadshore Hub Wind Farm Development Areas (WFDAs) and describes the main infrastructure to be included within the Broadshore Hub WFDAs Section 36 (s.36) and Marine Licence applications. It also provides an overview of the main activities that will be undertaken during construction, operation and maintenance, and decommissioning of the Broadshore Hub WFDAs' infrastructure under the s.36 consents and Marine Licences.

123. As discussed in **Chapter 1: Introduction**, separate Scoping Reports and consent applications will be submitted for the Broadshore Hub Offshore Transmission Development Areas (OfTDAs) and the Broadshore Hub Onshore Transmission Development Areas (OnTDAs) in due course. Whilst there is a geographic overlap between the boundaries of the Broadshore Hub WFDAs and the Broadshore Hub OfTDAs, infrastructure within the Broadshore Hub OfTDAs (i.e. offshore substation(s)) is outside of the scope of this Broadshore Hub WFDAs Scoping Report and subsequent consent applications. To ensure a comprehensive EIA is undertaken, the Broadshore Hub WFDAs Cumulative Effects Assessment (CEA) will consider the Broadshore Hub OfTDA and Broadshore Hub OnTDA (**Chapter 4: Approach to Scoping and Environmental Impact Assessment**).

3.2 Design Envelope Approach

124. A parameter-based design envelope approach will be adopted within the Broadshore Hub WFDAs EIA Report. The design envelope will set out a minimum and maximum design scenario for each design parameter. These parameters will be further refined once more detailed engineering studies have been undertaken (which includes site-specific data).

125. The design envelope will include all relevant technical, spatial and temporal elements of the Broadshore Hub WFDAs, and the proposed methodology to be employed for construction, operation and maintenance, and decommissioning.

126. In each of the technical chapters of the Broadshore Hub WFDAs EIA Report the receptor specific worst-case scenario will be determined from the design envelope parameters and then assessed. Further details of the use of a design envelope are provided in **Chapter 4: Approach to Scoping and Environmental Impact Assessment**. This is considered a standard approach and is widely accepted by stakeholders and regulators, and is necessary to ensure the necessary design flexibility at this early stage of project development. Further details of the use of a design envelope are provided in **Chapter 4: Approach to Scoping and Environmental Impact Assessment**.

127. The information presented in this chapter outlines the options and flexibility required by the Applicants and the range of potential design, location and activity parameters upon which the scoping of impacts is based. The final detailed design will lie within the parameters of the design envelope, enabling detailed design work to be undertaken post-consent whilst retaining the validity of the Broadshore Hub WFDAs EIA Report.

128. The need for flexibility in the consent is a key aspect of any large development but is particularly significant for offshore wind farm projects where technology is evolving. The design envelope must therefore provide sufficient flexibility to enable the Applicants and their supply chain to use the most up to date, efficient and economical technology and techniques in the construction, operation and maintenance, and decommissioning of the Broadshore Hub WFDAs' infrastructure, without affecting the surrounding environment to a greater extent than the worst-case scenarios assessed in the Broadshore Hub WFDAs EIA Report.

129. The design envelope has already been refined in the preparation of this Scoping Report. For instance, spar type floating substructures have been removed from the design envelope as their draught requirements are not compatible with Scottish ports and the Broadshore Hub WFDAs metocean characteristics. The refinement of the design envelope will continue throughout the EIA process and will be described in the EIA Report.

130. Guidance has been prepared by Marine Scotland and the Energy Consents Unit on using the design envelope approach for applications under s.36 of the Electricity Act 1989 where flexibility is required in applications (Scottish Government, 2022a). This guidance will be referred to when refining the design envelope to inform the EIA.

3.3 Project Infrastructure

3.3.1 Broadshore Hub Wind Farm Development Areas

131. The Broadshore Hub WFDAs is located approximately 47 km north of Fraserburgh, as shown in **Figure 1.1** in **Appendix 1**. The Broadshore Hub WFDAs will comprise of:

- Wind turbine generators (WTGs) with fixed bottom and/or floating substructures (**Section 3.4**);
- Station keeping systems (SKS) for each floating substructure, including mooring lines and anchoring systems (**Section 3.5**);
- Inter-array cables (IAC), subsea cable hub(s) and associated cable protection (**Section 3.7**); and
- Scour protection for fixed bottom substructures and/or floating substructure anchoring points (**Section 3.8**).

132. Where appropriate, differences in the design envelope for the individual Broadshore WFDA, Sinclair WFDA and Scaraben WFDA have been highlighted.

133. Key site parameters for the Broadshore WFDA, the Sinclair WFDA and the Scaraben WFDA are presented in **Table 3.1.**

Table 3.1: Broadshore Hub WFDAs Parameters

Parameter/Unit	WFDA		
	Broadshore WFDA	Sinclair WFDA	Scaraben WFDA
Distance from shore (km)	47	61	58
Area (km^2)	134	25	33
Water depth (m from Mean Sea Level)	-55 to -100	-90 to -110	-90 to -110
Crown Estate Scotland Lease Period (years)	Up to 60	Up to 25	Up to 25
Operational life (years)	25 to 50	25 to 50	25 to 50

3.3.2 Wind Turbine Generators

134. The WTGs convert wind energy into electrical energy. Each WTG is a complex system composed of a high number of components. The main components are:

- Rotor assembly, composed of three blades and a hub;
- Nacelle, containing the generator, shaft and gearbox (if applicable), power electronic converter and transformer; and
- Tower containing lifting equipment and, if applicable, the switchgear.

135. Technology develops rapidly and the available sizes of turbines are expected to increase over the coming years. The WTG parameters are reflective both of today's technology and up to what the Applicants consider could be achievable by 2035. The final WTG model(s) that will be used for the Broadshore Hub will be selected post-consent.

136. The EIA will be undertaken using a number of WTG parameters ensuring the worst-case is assessed for each receptor. The key features are illustrated in **Plate 3.1** and WTG design envelope for the Broadshore Hub WFDAs is outlined in **Table 3.2** of this Broadshore Hub WFDAs Scoping Report.

Plate 3.1: Key Features of a Typical Floating Offshore Unit

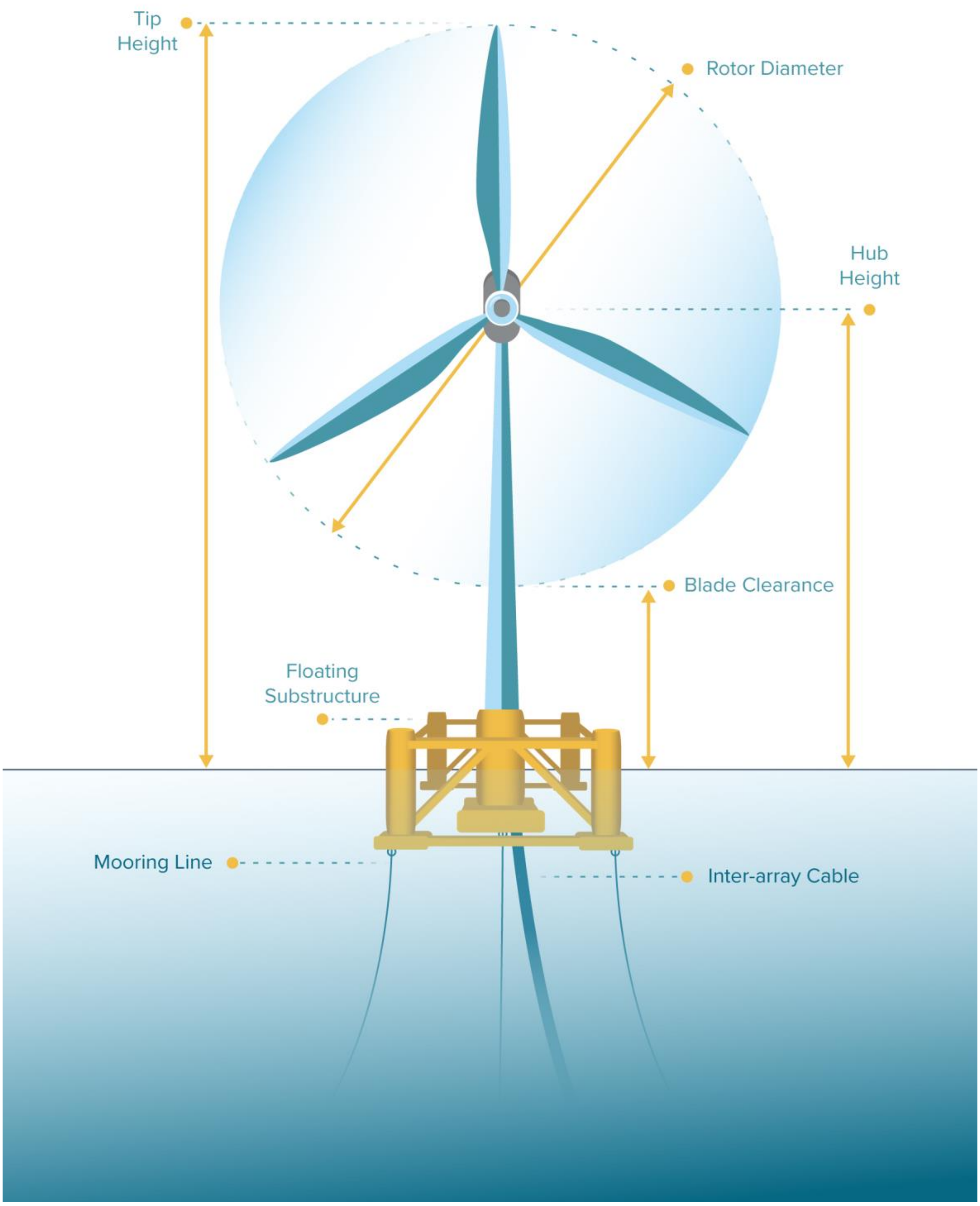

Table 3.2: Wind Turbine Generator Design Envelope

Parameter	Minimum	Maximum
WTG capacity (MW) [1]	15	28
Number of WTGs – Broadshore WFDA [1], [2]	32	60
Number of WTGs – Sinclair WFDA [1], [2]	3	6
Number of WTGs – Scaraben WFDA [1], [2]	3	6
WTG rotor diameter (m)	236	330
Minimum blade tip clearance above Mean High Water Springs (MHWS) (m) [3]	22	N/A
Maximum blade tip height (m) Lowest Astronomical Tide (LAT)	N/A	400 m
Minimum WTG spacing (m, approximate)	1,000 (all directions)	N/A
Safety Zone radius required around WTG (pre-commissioning) (m, approximate) [4]	50	50
Safety Zone radius required around WTG (active construction) (m, approximate) [4]	500	500
Safety Zone radius required around WTG (major maintenance) (m, approximate) [4]	500	500

[1] The minimum WTG capacity corresponds to the maximum number of WTGs and vice versa.

[2] Additional capacity may also be developed within the each WFDA for overplanting purposes.

[3] As per Marine Guidance Note (MGN) 654. The minimum air gap for the Broadshore Hub WFDAs will be informed by technical studies and will be defined in the Broadshore Hub WFDAs EIA Report.

[4] The Broadshore Hub WFDAs EIA Report will include an assessment of the proposed approach to Safety Zones at the point of application. The total number of Safety Zones to be established at the same time has not been yet defined.

3.4 Wind Turbine Generator Substructures

137. The Broadshore Hub WFDAs will use WTGs installed upon fixed bottom substructures (FBSSs) and/or floating substructures (FSSs). The final selection of substructure and associated SKS (discussed in **Section 3.5**) will depend on factors including but not limited to seabed conditions, water depth, wave, wind and tidal conditions, health and safety, economics and procurement approach. As site conditions vary across the Broadshore Hub WFDAs it is possible that more than one substructure or SKS type is used. A summary matrix of substructures and SKS options are provided in **Section 3.6**. Together, the WTG and FSS are referred to as 'floating offshore unit' (FOU).

138. The Broadshore Hub WFDAs EIA Report will consider different substructure and associated SKS based on the worst-case design parameters, **Sections 3.4.1** and **3.4.2** below discuss FSS and FBSS options in turn.

3.4.1 Floating Substructures

139. FSSs require an appropriate SKS, comprising of mooring lines and anchors which will attach the FSSs to the seabed, providing stability and maintaining the FSS within its excursion limit. SKSs options are detailed in **Section 3.5. Table 3.3** outlines the key parameters required for scoping in relation to FSSs. The parameters presented are considered worst-case and will be further refined as more detailed engineering studies are undertaken. To date, the FSS option that has been scoped out is the traditional spar type FSS. **Plate 3.2** provides a schematic of each FSS under consideration.

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Plate 3.2: Floating Substructure Options

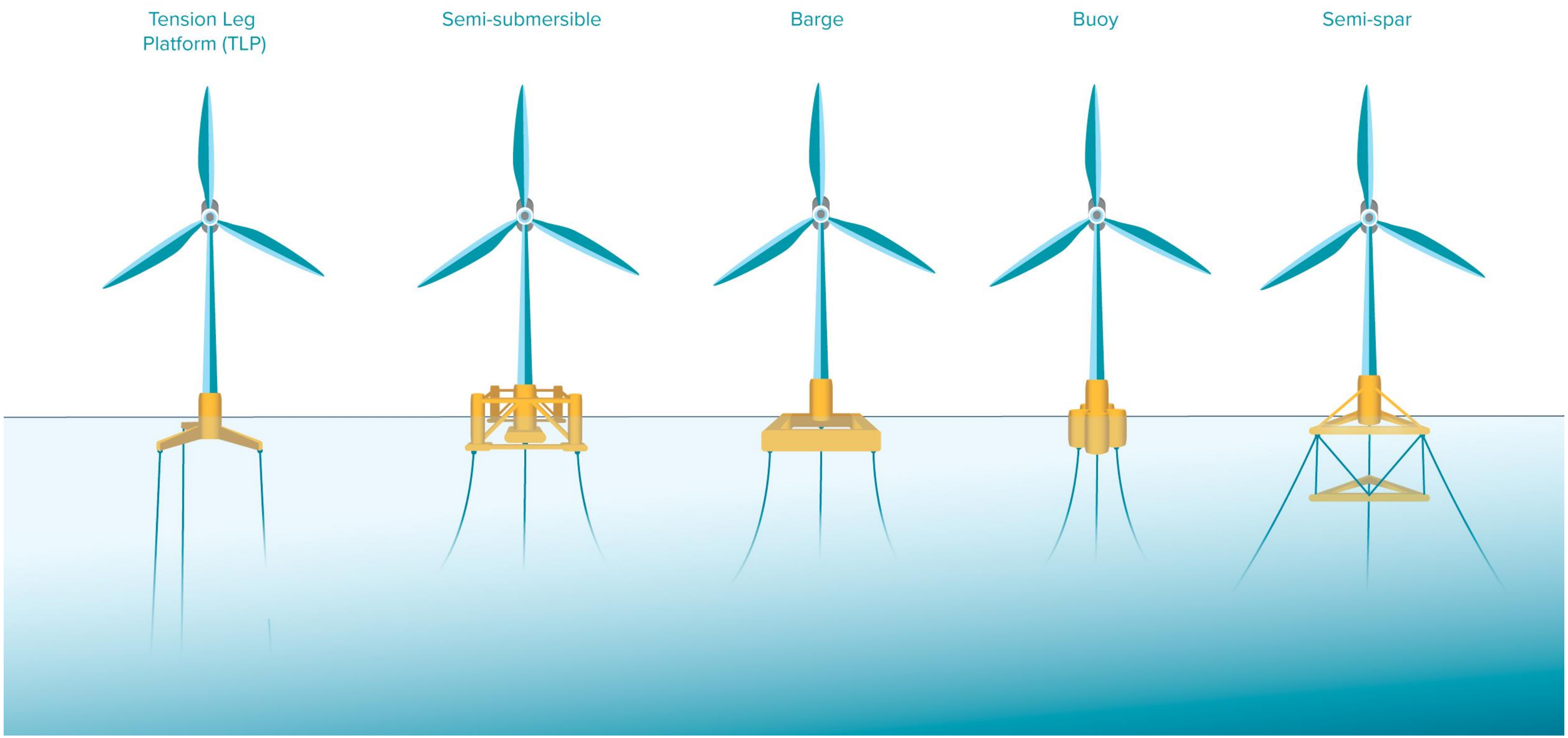

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Table 3.3: Floating Substructure Design Envelope

Parameter (per FOU)	Minimum	Maximum
Footprint at sea surface (m x m)	60 x 60	140 x 140
Height of FSS (m)	15	60
Excursion limit off substructure[1] (m)	N/A	140
[1] Extent to which the floating substructure may offset from the design coordinates due to external conditions (e.g. wind and metocean)		

3.4.1.1 Tension Leg Platform

140. A tension leg platform (TLP) is a highly buoyant semi-submerged structure, which maintains its position and stability through the opposite forces of excess buoyancy in the FSS and the highly tensioned tendons anchored to the seabed.

141. It is anticipated that the WTG installation on a TLP would take place at an assembly port but there are some FSS concepts which may not offer sufficient stability for an integrated FOU transportation operation to a WFDA. However, if WTG integration onto the FSS was expected to be performed at the Broadshore Hub WFDAs, this operation would require installation equipment and methodologies (e.g., a floating crane installing a WTG on a floating substructure within the Broadshore Hub WFDAs) which are yet to be fully developed and deployed for commercial scale floating wind projects. In addition, major component replacement during the operational and maintenance phase would be more challenging for this technology if the FOU required a tow back to port for repair. A TLP may however lend itself to floating maintenance operations given the concept’s good stability characteristics.

3.4.1.2 Semi-submersible Platform

142. Semi-submersible platforms are buoyancy-stabilised structures which float semi-submerged and maintain position via a SKS. These structures usually consist of a set of three or more columns connected via bracings or pontoons with heave plates, however designs may vary. Semi-submersible platform designs can use a wide range of SKSs. WTG integration is likely to take place at an assembly port and subsequent transfer to and installation at the Broadshore Hub WFDAs is typically achieved using tugs and anchor handling vessels (AHVs).

3.4.1.3 Barge

143. Barge technology offers low draught but a very large water-plane area, which provides the distributed buoyancy by which the platform achieves stability.

144. Generally, barge substructures comprise of a single hull, but variations of barge FSSs exist such as twin hulled barge concepts. Barges tend to be more susceptible to wave loading than other technology types due to the large water-plane areas.

145. Like semi-submersible technology, barges can use a variety of SKS technology and are capable of WTG integration at an assembly port.

3.4.1.4 Buoy (Modified Spar-buoy)

146. This form of FSS is currently less developed in the market, although it has some unique benefits. These FSSs are a modified form of a traditional spar but have a much shallower draught and much larger water plane area than their traditional spar counterparts. They behave like semi-submersibles during T&I activities, operations, and WTG integration but they achieve stability, via a low centre of gravity and high centre of buoyancy, over a wider footprint than a traditional spar.

147. Unlike spars which typically require large draughts (both at the assembly port and in operation), buoys tend to have draughts comparable to semi-submersibles, which improves port access and other challenges associated with deep draughts. In addition, it also allows for WTG integration at an assembly port and the transport of a fully integrated FOU to the Broadshore Hub WFDAs.

3.4.1.5 Semi-spar Platform

148. This is a subset of traditional spar form of FSS also known as a hybrid spar. They are typically split into two structures, one highly buoyant structure supporting the WTG, and another structure/mass suspended below the support structure which acts to lower the centre of gravity. Coupled together they act like a traditional spar.

149. Semi-spars offer the advantages of traditional spars in terms of stability and reduced water plane area. However, also including the additional benefits of other FSS options like, WTG integration at the assembly port and integrated T&I operations.

150. However, the use of a counterweight does provide challenges and complications regarding installation, tow to shore maintenance activities and decommissioning, as lowering and raising of the suspended structure/mass is a difficult marine operation to undertake.

3.4.2 Fixed Bottom Substructures

151. The FBSSs are installed into the seabed prior to the integration of the WTGs on the FBSS.

152. The following sections outline the different types of FBSS that could be selected for the Broadshore Hub WFDAs. **Table** 3.4 outlines the parameters for FBSSs, while **Plate 3.3** shows a diagram of each FBSS under consideration.

Plate 3.3: Fixed Bottom Substructure Options

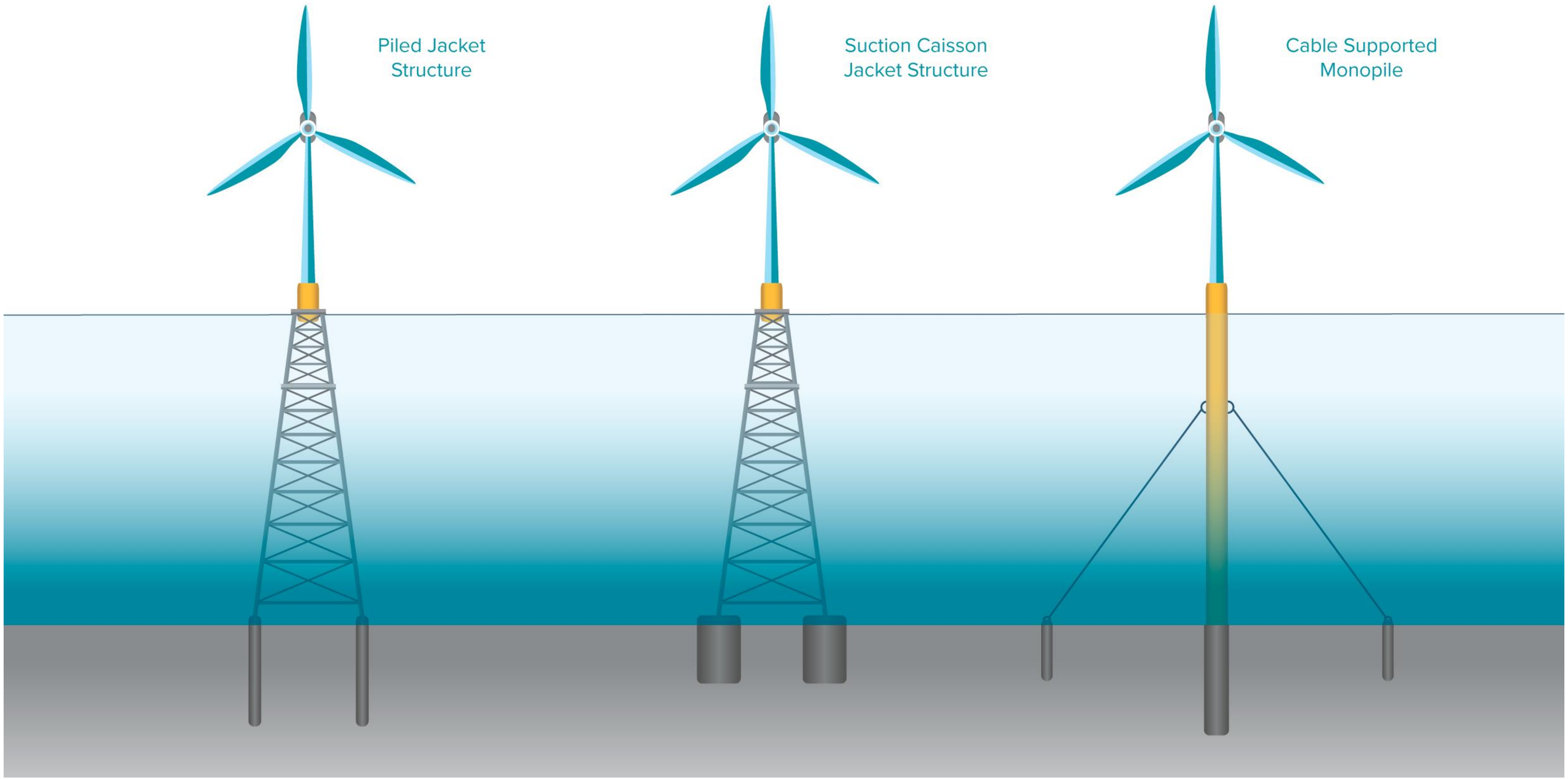

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Table 3.4: Fixed Bottom Substructures Design Envelope

Parameter (per FOU)	Minimum	Maximum
Maximum FBSS footprint (m x m)	-	60 x 60
Piled Jacket Structure		
Number of legs	3	4
Maximum footprint (m)	-	50 x 50
Number of pin piles	-	8
FBSS piled jacket – pin pile diameter (m)	-	4
FBSS piled Jacket – pile blow energy (kilojoules (kJ))	N/A	4,000
Suction Caisson Jackets		
Number of legs	3	4
Maximum footprint (m)	-	60 x 60
Cable Supported Monopiles		
Monopile diameter (m)	10	16
Monopile blow energy (kJ)	To be determined, subject to further design	

3.4.2.1 Piled Jacket Structure

153. Piled jacket structures are formed of a steel lattice construction, which comprises of steel members and welded joints. There is no separate transition piece with a jacket structure, with the whole jacket structure being constructed as an entirely integrated unit. The jacket structure is attached to the seabed by pin piles which are attached to the jacket feet and either driven and/or drilled into the seabed, depending on the geotechnical conditions of the seabed.

3.4.2.2 Suction Caisson Jacket Structure

154. The suction caisson jacket structure differs from the piled jacket structure by the method in which the jacket is attached to the seabed. Suction caissons are typically hollow steel canisters, capped at the top and open at the bottom and attached underneath the legs of the jacket. The structure is installed by lowering it onto the prepared seabed and a pipe running through each caisson unit begins to pump/suck water out of each unit. As this happen, and as a result of the generated suction force, the buckets get pressed/pulled down into the seabed.

155. Once the required penetration depth has been achieved the pump is switched off and grout is injected under the bucket to fill the remaining airgap and ensure contact between soil within the bucket and the top of the bucket. Suction caisson jackets do not require to be drilled or hammered into the seabed.

3.4.2.3 Cable Supported Monopile

156. Monopiles consist of a pile typically fabricated from steel, typically driven into the seabed using methods such hammering or vibrating but could also be drilled and grouted for example. Given the Broadshore Hub WFDAs' water depths and potential scale of WTG to be installed, traditional monopile FBSS are not considered a viable option for the projects. Cable supported monopiles, also known as fully restrained platforms, include aspects of the monopile foundation design, and mooring and anchor systems to provide stability to the monopile. This enables the use of well-established monopile technology in deeper waters without significantly increasing the weight of the foundation (e.g. increasing the cost and complexity of construction, transport and installation).

157. The anchors for the additional restraining equipment would also be required to be attached to the seabed using a suitable solution dependant on the site characteristics (e.g. pin piles which are hammered or drilled).

3.5 Station Keeping System

158. To maintain the position of an FOU, it is necessary to connect the FSS to the seabed via a SKS. The SKS generally comprises mooring lines and anchors, which also provide stability to the FOU with various degrees of influence based on the system deployed. The mooring line and anchor design envelopes are outlined in **Table 3.5** and Table 3.6 respectively**.**

159. There are several types of mooring configuration and anchoring solutions which are available for floating substructures. **Section 3.5.1** outline the types of mooring configuration considered for the WFDAs and **Section 3.5.2** outlines the various types of anchors being considered.

160. In addition to the mooring lines and anchors there are several ancillary elements not described in detail here, which are deployed as part of the SKS. These include, but may not be limited to:

- Buoyancy elements;
- Clump weights;
- Shackles and connectors; and
- Tensioners.

161. The design of the SKS depends on the site characteristics and the technology being used. It is possible that different mooring and anchor solutions may be used across the Broadshore Hub WFDAs. This will be dependent on the site characteristics (i.e. ground conditions) and determined during the design development.

3.5.1 Mooring Lines

162. Mooring lines are connected to the FSS at various points or a single point (depending on the mooring system and/or the FSS concept).

163. Mooring lines for FSS purposes can be made of several different materials in various forms, for example:

- Steel (e.g. chain, sheathed spiral strand wire rope, steel pipe); and
- Synthetic rope (e.g. polyester, nylon, high modulus polyethylene).

164. The mooring types within the design envelope are illustrated in **Plate 3.4** below.

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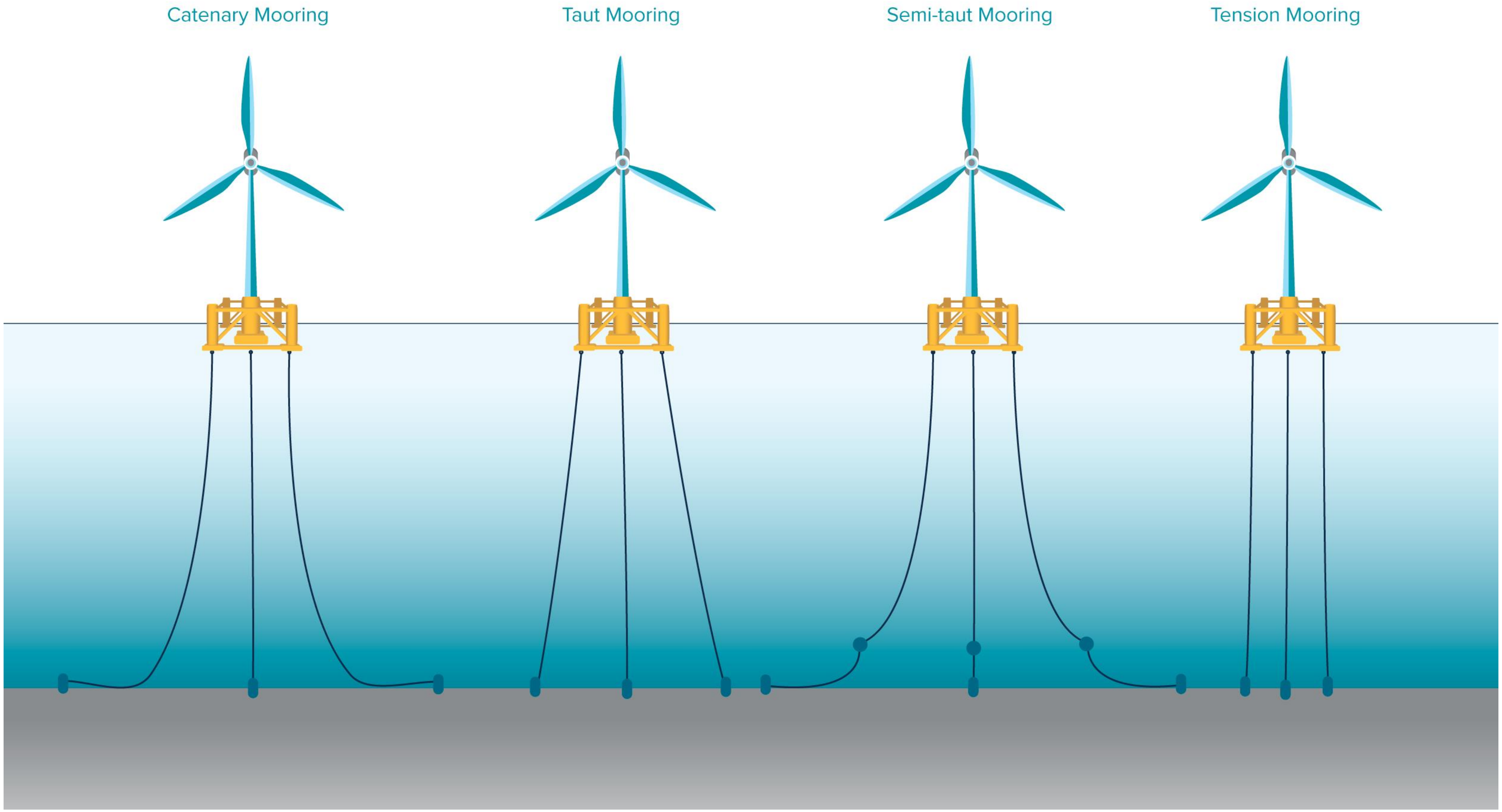
Plate 3.4: Example of Mooring Configurations



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3.5.1.1 Catenary Mooring

165. This configuration uses free hanging chain, whereby the weight leads to the catenary shape through the water column between the FSS and the anchor. There is a section of chain resting on the seabed prior to termination at a suitable anchor, meaning the anchors will generally only experience horizontal loading. Generally, the weight of the chain resists excursions and provides stability.

166. The length of the catenary system is typically six to eight times the water depth. This system works well in water depths up to 300 m.

3.5.1.2 Taut Mooring

167. This configuration uses lines which are tensioned between the substructure and anchors until taut. The tension and flexibility in the lines are used to provide stability and control excursions. As the mooring is taut, the mooring line does not make contact with the seabed.

168. In this configuration the load on the anchor is both vertical and horizontal, therefore pile or suction anchors are most likely to be used. It has a shorter length than a catenary system, at approximately two times the water depth. This system works well in a wide range of water depths.

3.5.1.3 Semi-taut Mooring

169. This configuration uses chain at the top and bottom of the mooring line, and rope in the mid-section forming a combination of a taut and catenary system. Buoyancy modules are used to lift the rope off the seabed and prevent damage to these sections, however, there remains some seabed contact with this mooring option.

170. The semi-taut solution, being a mix of taut and catenary systems, mean the anchors suitable for catenary systems can be used.

3.5.1.4 Tension Mooring

171. This type of system is used by TLP. Due to the vertical loading and high tension on these systems, tendons with low strain and high strength are used, which are typically steel pipe or chain but synthetic ropes or sheathed spiral strand wire rope could be used.

3.5.1.5 Shared Mooring

172. A shared mooring system is a system where adjacent FSSs share anchor points. These systems are innovative and offer potential cost benefits and potential environmental benefits. Unlike the other SKS forms, this system will most likely only have three lines per FSS, with each of those lines connected to a buoy, with a line running vertically down from the buoy to an anchor with vertical tension capacity (i.e. a suction or driven type pile).

Table 3.5: Moorings Design Envelope

Parameter (per WTG)	Minimum	Maximum
Number of mooring lines	N/A	12

173. Seabed footprints relating to the mooring system will be provided in the Broadshore Hub WFDAs EIA Report.

3.5.2 Anchors

174. The anchor is the connection point between the mooring system and the seabed. Consideration needs to be given to the mooring system and site-specific ground conditions and their associated properties. These are important considerations in selection of the anchor type used. A brief description of the anchor types considered for the WFDAs is given in this section. **Plate 3.5** illustrates various types of anchors being considered with the Broadshore Hub WFDAs.

Plate 3.5: Different Anchor Types Being Considered for the Broadshore Hub WFDA

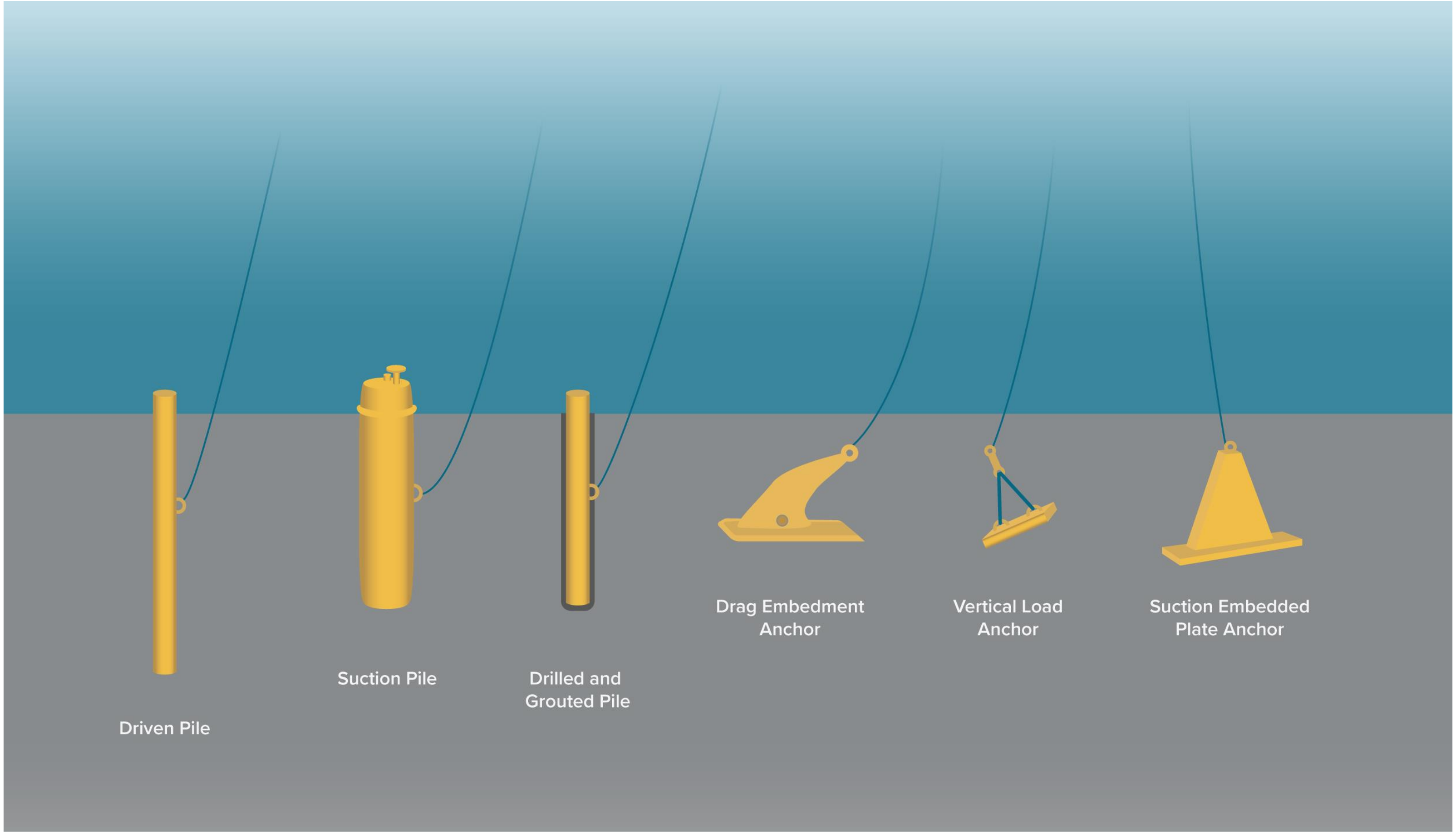

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Table 3.6: Anchor Design Envelope

Parameter (per WTG)	Minimum	Maximum
Number of anchors per floating substructure	N/A	12

Table 3.7: Pile Anchor Design Envelope

Parameter (per WTG)	Minimum	Maximum
Anchor driven pile diameter (m)	N/A	3.5
Anchor driven pile length (m)	20	35
Anchor driven pile hammer energy (kJ)	N/A	3000

3.5.2.1 Driven Piles

175. Driven piles are steel tubes and are typically used for anchoring purposes in hard or challenging soil conditions. The pile is typically driven to the required penetration depth via an impact or vibratory hammer. These types of anchors can be used to support both vertical and horizontal loads.

3.5.2.2 Suction Piles

176. In suitable soil types (typically clays/sands) it may be possible to use suction piles (also known as suction caisson/buckets, suction cans). These use the same technique as outlined in **Section 3.4.2.2** to embed into the seabed. As with the driven pile, these anchors are good for both horizontal and vertical load resistance.

3.5.2.3 Drilled and Grouted Piles

177. Drilled and grouted piles are similar to driven piles and also typically used in hard soil conditions. However, these anchors (piles) are installed through drilling a void into the seabed to a target depth and then grouting in-situ to seal the connection between the pile and the surrounding ground.

3.5.2.4 Drag Embedment Anchors

178. Drag embedment anchors (DEA) work by being dragged across the seabed, embedding themselves to the required depth. They are best suited for use with catenary and semi-taut mooring systems due to the fact that they support horizontal loading. They work well in sediments which contain a significant proportion of clay and when fully submerged in the seabed.

3.5.2.5 Vertical Load Anchors

179. Vertical load anchors (VLAs) are similar to DEAs in that they are installed by dragging the anchor across the seabed. However, these anchors are capable of bearing both vertical and horizontal loads.

3.5.2.6 Suction Embedded Plate Anchors

180. Suction embedded plate anchors (SEPLA) are similar to VLAs but are installed using a suction embedment method similar to the suction pile.

3.6 Summary of Substructure, Mooring and Anchor Systems

181. A summary of the potential WTG types, detailing potential compatible configurations of associated substructure types, mooring, and anchor options is presented in **Table 3.8** and **Table 3.9** below. **Table 3.8** and **Table 3.9** also identify which options would require scour protection and/or piling activities.

Table 3.8: Summary Matrix of Floating Substructure Type and Associated Station Keeping System Infrastructure

Substructure Type	Mooring Options	FSS Anchor Options	Scour Protection	Impact Piling
Tension leg platform (TLP)	Tension mooring	Driven piles	Yes	Yes
		Drilled and grouted piles	Yes	No
		Suction piles	Yes	No
Semi-submersible Barge Buoy (modified spar-buoy) Semi-spar	Taut mooring	Driven piles	Yes	Yes
		Drilled and grouted	Yes	No
		Suction piles	Yes	No
	Catenary Semi-taut	Driven piles	Yes	Yes
		Drilled and grouted	Yes	No
		Suction piles	Yes	No
		Drag embedment/vertical load/suction embedded plate	No	No
	Shared mooring	Driven piles	Yes	Yes
		Drilled and grouted	Yes	No
		Suction piles	Yes	No

Table 3.9: Summary Matrix of Fixed Bottom Substructure Type

Substructure Type	Mooring Options	FBSS Options	Scour Protection	Impact Piling
Piled jacket	N/A	Pin piles • Driven • Drilled and grouted	Yes	Yes, when driven
Suction caisson jacket	N/A	Suction caissons	Yes	No
Cable supported monopile	Taut lines between the monopile and anchor piles	Monopile • Driven • Drilled and grouted Anchor Piles supporting the taut lines • Driven • Drilled and grouted Suction caissons	Yes	Yes, when driven (monopile and anchor piles)

3.7 Cables

182. Cables are a vital infrastructure, responsible for conducting the electricity generated by the WTGs to the OFSS for export to shore. The Broadshore Hub WFDAs will utilise IACs to conduct electricity between WTGs in a string and the last WTG to the OFSS, with the potential use of subsea cable hub(s) depending on the IAC design layout.

183. The Broadshore Hub OfTDAs consent applications will consider interconnector cables and offshore export cables.

184. No cable crossings of third-party cables are anticipated within the Broadshore Hub WFDAs. Cables, and proposed burial and protection methods, are discussed in the following sections.

3.7.1 Inter-array Cables

185. The IACs are armoured cables containing electrical and fibre optic cores, which link the wind turbines to each other and/or to the subsea cable hub(s) and/or the offshore substation(s) and include dynamic IAC and static IAC sections. It is typical for WTGs to be connected together via strings or loops of IACs, dependent on the electrical design selected.

186. Currently, the typical voltage rating of an IAC is 66 kV, however due to the increasing WTG capacity the supply chain is developing IACs with a voltage rating of 132 kV. These higher voltage IACs are therefore also being considered at this stage.

187. The IAC footprint, i.e., total length of cable to be installed multiplied by width of seabed to be affected during the installation, is not yet determined and will be specified within the Broadshore Hub WFDAs EIA Report.

188. For FBSS, static IAC risers are typically used, as these are attached to the jackets or monopiles. For FSS, due to the nature (and movement) of the structure, dynamic IACs are also required. Each IAC (between FOUs) will be a single IAC but will comprise both static (on the seabed) and dynamic (moving within the water column) sections connected together to form one continuous cable. The dynamic IAC section is designed to accommodate the dynamic movement of the FSS.

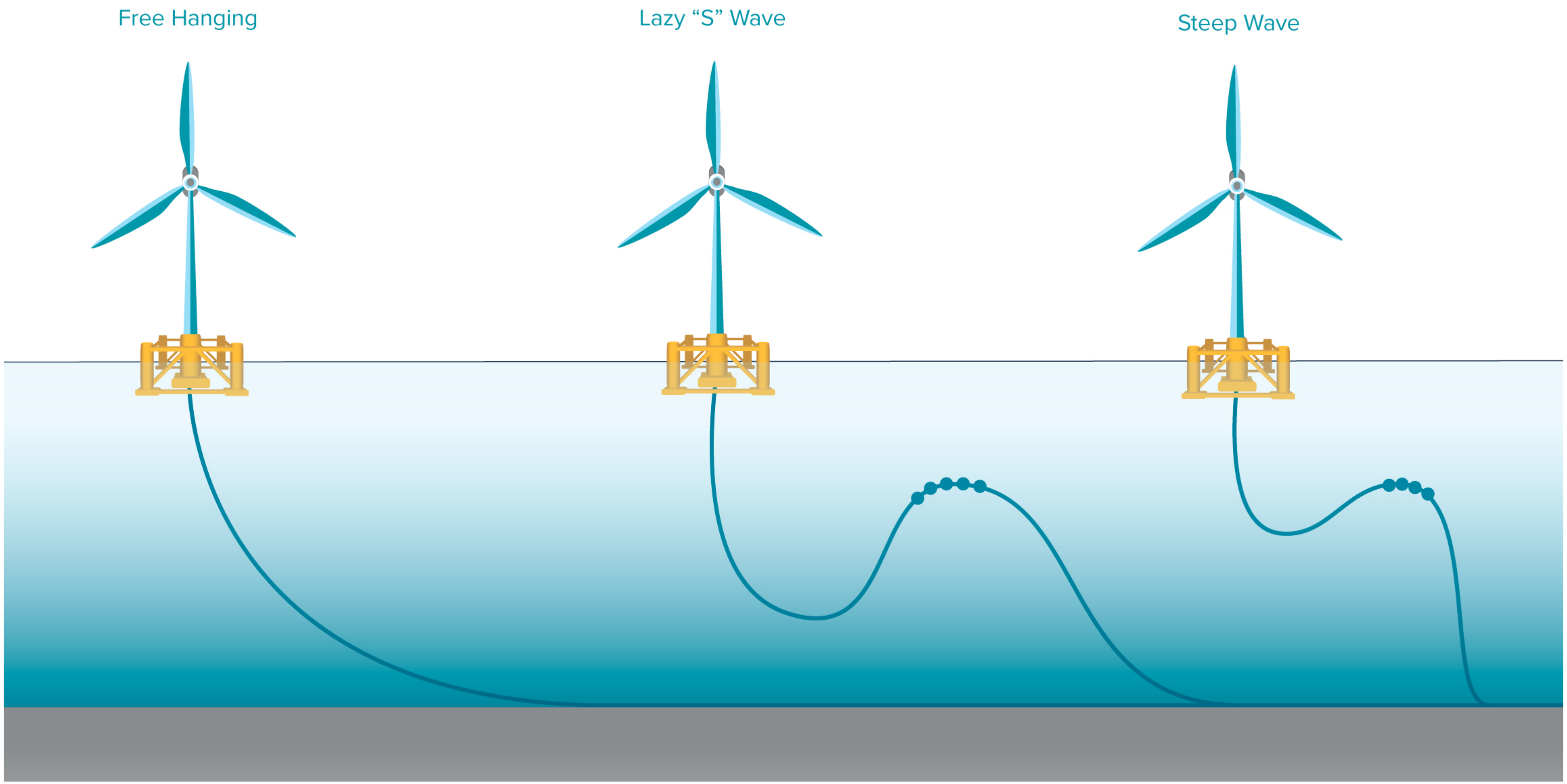
189. The section of the IAC from the WTG and approaching the OFSS (i.e., the riser section) can be either dynamic or static, depending on the type of OFSS selected (i.e., fixed and/or floating).

190. Dynamic IACs can be deployed in various configurations, depending on a number of factors such as water depth and on-site conditions. These configurations may include:

- Free hanging;
- Lazy “S” wave; and
- Steep wave.

191. The lazy “S” wave configuration is the configuration most commonly associated with floating wind applications. However, further detailed design is required to define the most suitable configuration for the Broadshore Hub WFDAs. **Plate 3.6** provides an overview of the potential IAC configuration options.

Plate 3.6: Dynamic Inter-array Cable Configuration Options



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192. Dynamic cable configurations require a number of auxiliary cable items, designed to help reduce fatigue and protect the cable, such as:

- Buoyancy modules;
- Bend stiffeners;
- Bend restrictors;
- Abrasion protection at the touchdown point; and
- Connector (joining the dynamic IAC to the static IAC).

193. At the point where the dynamic cable comes into contact with the seabed, the touchdown point, it essentially transitions to being a laid static cable, usually via a connector. Cable protection may be applied to the static IAC. In addition, clump weights/ballast and tethering anchors may be used to hold the cable in position.

194. Should the static section of the IACs require burying or protection this would be subject to further studies and a Cable Burial Risk Assessment (CBRA), particularly for the portion of cable that comes into contact with the seabed after the touchdown point (see **Section 3.7.2**).

195. Prior to any installation on the seabed, it is likely that seabed preparation activities will be required. This would involve activities such as boulder and sand wave clearance and management of Unexploded Ordnance (UXO). These are outlined in **Section 3.9.2**.

3.7.2 Cable Burial and Protection

196. The IAC static sections may be surface laid or buried. Should any portion of the IAC require burial, cable burial methods include jet trenching, mechanical trenching, cable ploughing and mass flow excavator. The exact cable installation, burial and protection methodology and measure will be selected post-consent and will be informed by the CBRA. A detailed CBRA will be prepared where IACs are proposed to be buried to determine the target burial depth. The burial depths may vary and will be dependant on risk and ground conditions. The CBRA will also highlight instances where adequate burial cannot be achieved and alternative protection is needed. The maximum width of seabed affected by installation per cable and volume of material to be deployed for cable protection will be presented within the Broadshore Hub WFDAs EIA Report.

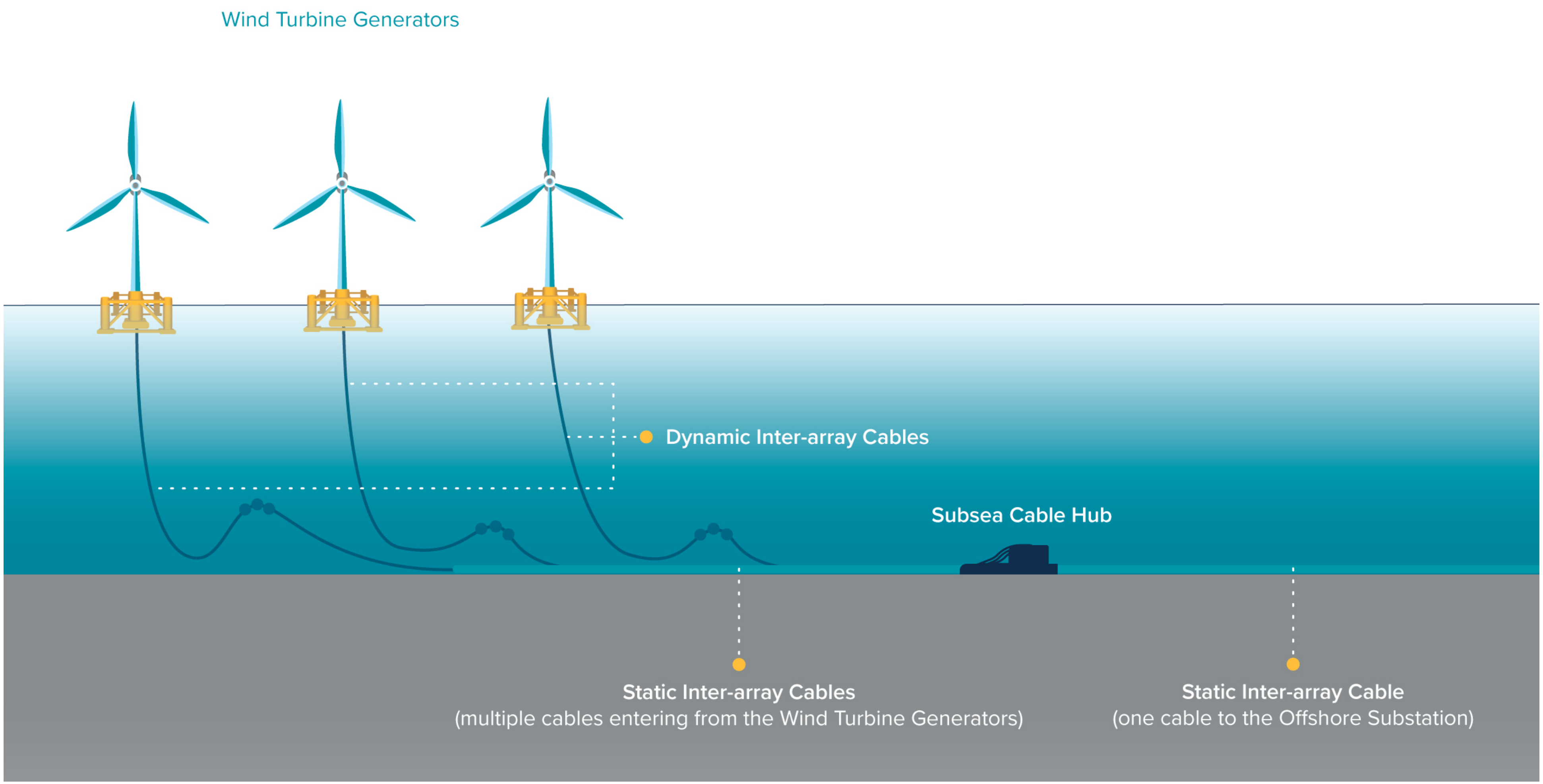
197. Where it is not possible to achieve the required burial depth, either due to seabed conditions or crossing of third party pipes/cables, then further external cable protection may be required. The type of cable protection selected will be dependent on various factors, for example seabed and sediment conditions, the physical processes present and health and safety considerations associated with installation, maintenance and decommissioning. Cable protection may include concrete mattresses, rock placement/rock bags, grout bags and cast iron shells (articulated pipes).

3.7.3 Subsea Cable Hub

198. A subsea cable hub is designed to allow the connection of multiple WTGs into one subsea cable hub using IACs. It is a point where a number of the IACs gather together and transition to an IAC which then connects to the, OFSS for onward export.

199. The aim of the subsea cable hub(s) is to increase the flexibility in design and construction, reduce cost, and increase power availability. Subsea cable hubs are included as a potentially innovative technology, and therefore it is considered prudent to make allowance for these innovative technologies. The number of subsea cable hub(s) and their footprints will be defined within the Broadshore Hub WFDAs EIA Report and is subject to further engineering studies. **Plate 3.7** provides an image of what a potential subsea cable hub system may look like.

Plate 3.7: Example of a Subsea Cable Hub



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3.8 Scour Protection

200. Sediment transport where the sediment is soft enough to be mobilised can lead to scour, the formation of scour holes, around infrastructure installed on or in the seabed (e.g., substructures, anchors, subsea equipment). The depth of scour is dependent on the shape of the infrastructure installed, the characteristics of the seabed sedimentology and metocean (e.g. waves and currents) conditions.

201. Scour created around infrastructure can, in turn, lead to additional fatigue, wear and tear to the installed infrastructure. In the worst-case, it can lead to failures and need for complex corrective maintenance campaigns. Therefore, the use of scour protection, both in terms of volume and material, is an important consideration for projects. Commonly used scour protection types and those which are under consideration for the Broadshore Hub WFDAs includes concrete mattresses, graded rock placement/rock bags, grout bags, and artificial frond mats. **Table 3.10** outlines these main types of scour protection.

Table 3.10: Scour Protection Design Envelope

Parameter	Minimum	Maximum
Scour Protection (Concrete Mattresses, Graded Rock Placement/Rock Bags, Grout bags, and Artificial Frond Mats) [1]		
FSS anchor scour protection (m^2) – per driven pile	75	241
FSS anchor scour protection (m^2) – per suction pile	N/A	265
FBSS scour protection footprint (m^2) [2] – per WTG	N/A	8,500
Artificial fronds		
FBSS scour protection footprint	Will be further evaluated as part of the design process	
[1] Type and volume of scour protection is subject to the infrastructure installed and site-specific conditions. [2] Accounts for a radial footprint of up to 20 m and assuming a jacket foundation.		

3.9 Construction Timeline

3.9.1 Project Timeline

202. The Broadshore Hub WFDAs are at an early stage of development, therefore, the details provided below are indicative.

203. The timing and commencement of pre-construction and construction activities is subject to a number of variables including the grid connection dates, award of necessary consents (onshore

and offshore), securing project financing, and supply chain and port availability, and procurement and contract award.

204. Construction works for the Broadshore Hub WFDAs could start up to seven years after consent award. The Applicants will seek a suitable consent validity date from Scottish Ministers and MD-LOT within the consent applications in due course.

3.9.2 Pre-construction Works

205. Pre-construction works are activities undertaken prior to formal commencement of construction. For the Broadshore Hub WFDAs, pre-construction activities include:

- Geophysical, geotechnical and visual surveys, which are typically carried out to inform on UXO, bedform and mapping of boulders, bathymetry, topography and subsurface layers.
- Seabed preparation, required prior to construction commencing to allow for the for successful laying of infrastructure on the seabed (e.g. cables, SKSs, FBSS). This is particularly important for cable laying works where sand wave and boulder clearance may need to be undertaken to provide a flat seabed free from obstructions and mobile sediments.

206. UXO on or in the seabed may exist as a result of previous conflict or munition dumping and, if present, poses a significant health and safety hazard. Therefore, UXO must be appropriately managed (e.g. identification of potential UXOs through undertaking desktop studies, geophysical surveys, and field investigations; avoiding potential UXOs through micro-siting, and ultimately relocation (if applicable and allowed as an option), or disposal in situ. If UXO clearance is considered necessary (including field investigation and disposal in situ), separate Marine License application(s) will be made prior to UXO clearance works, with an accompanying assessment of UXO clearance effects on relevant receptors.

207. Detailed layout design works need to be undertaken prior to conducting a the detailed UXO survey, in order to ensure the UXO survey is targeted in the areas where infrastructure is to be placed. A desktop UXO Threat and Risk Assessment for the Broadshore, Sinclair and Scaraben WFDAs was undertaken by 6 Alpha Associates (2023) based only on historical records. This assessment resulted in an overall UXO risk rating of low, although there remains the potential for some UXO be present. This will be confirmed as the understanding of the Broadshore Hub WFDAs evolve through geophysical surveys.

208. The hierarchy of UXO clearance techniques, in order of preference, are:

- Avoid (through micro-siting of infrastructure);
- Move UXO without clearing it (if applicable and accepted as an option);
- Remove the UXO without clearing it (if applicable and accepted as an option);
- Low-order deflagration if above options not suitable/unsafe; and
- High-order clearance, if low-order deflagration not possible, or in the unlikely event that low-order deflagration was unsuccessful.

209. Pre-construction activities will be considered as appropriate within the technical chapters of the Broadshore Hub WFDAs EIA Report under construction phase impacts. While UXO clearance will be subject to a separate Marine Licence(s), an indicative assessment of potential impacts will be included for relevant receptors (e.g. benthic ecology, fish and shellfish ecology, and marine mammals).

3.9.3 Construction

210. To complete the construction of the Broadshore Hub WFDAs' infrastructure, a number of activities must be undertaken. An outline list (in no specific order) is provided below for both FSS and FBSS. This will be developed and defined as the Broadshore Hub WFDAs progresses.

211. The construction phase of the Broadshore WFDA is anticipated to take between two to three years. Note that these durations are indicative and the final durations will be subject to a number of factors, such as substructure construction methods, weather conditions, availability of resources and supply chain arrangements, among others factors. The construction phase of the Sinclair WFDA and Scaraben WFDA are anticipated to take between one to two years each depending on factors noted above.

3.9.3.1 Floating Substructure Construction

212. Following the pre-construction activities described in **Section 3.9.2**, general activities for installation of FSS are as follows:

- Pre and post-installation surveys across all offshore activities during construction, to plan and confirm offshore site suitability and infrastructure positions;
- Installation of the SKS (transported to the site and pre-laid at the installation locations, prior to the installation of the FOU);
- Towing of FOU (i.e. WTG and FSS which have been integrated at the port/ harbour), using an appropriate vessel, to the Broadshore Hub WFDAs from port/harbour or wet storage location;
- If WTG and FSS integration does not take place at the assembly port, the FSSs will be towed to the Broadshore Hub WFDAs site and integrated with the WTG in situ using a suitable crane vessel;
- FOU installation and commissioning, including the deployment of scour protection (i.e. hooking up the FOU to the pre-installed mooring system and IAC, then undertaking the necessary testing);
- IAC and subsea cable hub(s) (if adopted) installation, including seabed preparation, cable burial and protection (where required); and
- Commissioning and snagging.

3.9.3.2 Fixed Bottom Substructure Construction

213. Following pre-construction activities, general activities for installation of FBSSs are as follows:

- Pre and post-installation surveys across all offshore activities during construction, to plan and confirm offshore site suitability and infrastructure positions;
- Foundation installation, including the deployment of scour protection;
- IAC and subsea cable hub(s) (if adopted) installation, including seabed preparation, cable burial and protection (where required);
- WTG installation and commissioning: WTG components will be loaded onto an appropriate vessel and transported to site for installation. The WTG tower is installed first followed by the nacelle and blades. The WTGs will then undergo the required testing and commissioning; and
- Commissioning and snagging.

3.9.3.3 Construction Vessels

214. Typical vessels used during an offshore wind farm construction include:

- Survey vessels;
- Anchor handling tug supply (AHTS) vessels;
- Tow tug vessels;
- Cable installation vessels (PLGR, lay and burial);
- Remotely operated vehicle (ROV) support vessels;
- Scour protection installation vessels;
- Heavy lift vessels (HLV);
- Jack-up vessels (JUV);
- Support vessels;
- Service and commissioning vessels;
- Guard vessels;
- Service operation vessels (SOV);
- Crew transfer vessel (CTV); and
- Accommodation vessels.

3.9.4 Operation and Maintenance

215. The operational phase is anticipated to be between 25 and 50 years for the Broadshore Hub WFDAs[12].

[12] The Broadshore WFDA seabed lease is up to 60 years, and the Sinclair WFDA and Scaraben WFDA seabed leases are both up to 25 years. The Broadshore, Sinclair and Scaraben WFDAs' operational life is between 25 and 50 years. At the end of the operational life, any repowering will be subject to separate consents.

216. At this stage of the development, the overall operation and maintenance strategy is not finalised. Details such as the equipment to be procured and the operation and maintenance base location are currently not known, as is to be expected at this early stage of development.

217. Operation and maintenance activities will comprise of preventative and corrective maintenance. Further details will be provided in the Broadshore Hub WFDAs EIA Report.

218. It is envisaged that that routine preventative and corrective maintenance activities will take place using the following vessels and transport:

- SOVs (potentially with daughter crafts);
- CTVs;
- Survey vessels;
- Helicopters;
- Drones;
- Unmanned surface vessel (USV); and
- ROV support vessels.

219. Major repairs requiring large component replacements and extensive remedial works will require additional vessels and logistics. These may involve replacement of WTG components (e.g. generator, blades, gearbox, etc.) or entire WTGs or repairs to the FOU, cables or mooring systems.

220. Major component exchanges for floating wind projects, may take place in situ at the Broadshore Hub WFDAs or at a suitable port/sheltered waters.

221. Specialist HLVs and/or JUVs may be used for major repairs that can be carried out in-situ. If the unit is to be repaired at shore, the activities may involve decoupling the FOU from its cable and mooring system and towing to a suitable port for the corrective maintenance to take place. For this purpose, AHTS, tow tugs, guard vessels, and other support vessels may be required.

3.9.5 Decommissioning

222. It is a requirement under Section 105 of the Energy Act 2004 that developers of offshore wind farm projects prepare a Decommissioning Programme for approval by Scottish Ministers.

223. The Decommissioning Programme must consider good industry practice, guidance and legislation for decommissioning works which includes anticipated costs and financial securities.

224. The Decommissioning Programme will be consulted on by stakeholders and is reviewed throughout the lifetime of the Broadshore Hub WFDAs. Further details will be provided in the Broadshore Hub WFDAs EIA Report.

3.10 Site Selection and Consideration of Alternatives

225. This section provides an overview of the site selection process and consideration of alternatives to date for the Broadshore WFDA, Sinclair WFDA and Scaraben WFDA. The Broadshore Hub WFDAs EIA Report will outline the stages of site selection and will set out any refinements to the project design envelope that have taken place as a result of the EIA process or in response to consultation and stakeholder feedback. The main alternatives that have been considered as part of this process will also be presented.

3.10.1 Broadshore Project

3.10.1.1 Broadshore Wind Farm Development Area

226. In November 2017, Crown Estate Scotland (CES) announced their intention to run a further leasing round for commercial scale offshore wind energy projects in Scottish Waters.

227. To inform the spatial development of this leasing round, Marine Scotland (now Marine Directorate), as Planning Authority for Scotland's seas undertook a planning exercise from June 2018 to identity areas of search (AoS) (Marine Scotland Science, 2018b) for offshore wind development. The study considered various geospatial data layers to carry out a multi-criteria analysis depicting both opportunity (such as average wind speed or existing grid connections) and constraints (such as fishing activity, shipping traffic or environmental sensitivities). These AoS were subsequently refined through several iterations of Opportunity and Constraint Analysis, and consultation and engagement with key sectoral stakeholders and Scottish Ministers.

228. This informed the draft Sectoral Marine Plan for Offshore Wind (the draft SMP) which was published for consultation between December 2019 and March 2020 (Marine Scotland, 2018a). The draft SMP identified the seventeen most sustainable areas (known as Draft Plan Options) for the future development of commercial-scale offshore wind energy in Scotland.

229. The ScotWind Leasing Process was subsequently launched by CES in June 2020, allowing developers to apply for the rights to develop and operate offshore wind farms in Scottish waters within defined areas (known as Draft Plan Options) as defined by the draft SMP.

230. In October 2020, the final Sectoral Marine Plan (SMP) for Offshore Wind Energy (SMP) (Scottish Government, 2020) was published, providing the strategic framework for CES's ScotWind seabed leasing round. The SMP identified sustainable areas (known as Plan Options) for the development of commercial-scale offshore wind energy projects. The SMP was subject to a Sustainability Appraisal (SA) throughout its preparation, comprising the following key documents:

- Strategic Environmental Assessment (SEA) (Scottish Government, 2019);
- Habitats Regulations Appraisal (HRA) (Scottish Government, 2019);
- Social and Economic Impact Assessment (SEIA) (Scottish Government, 2019); and
- Draft SMP: Regional Locational Guidance (Scottish Government 2020).

231. During the ScotWind application period, the Broadshore Offshore Wind Farm Limited (Broadshore Applicant) undertook comprehensive desktop studies to select the sites to bid on within the ScotWind leasing auctions, considering environmental, construction and commercial matters.

232. CES subsequently announced the outcome of its ScotWind Leasing process in January 2022 and awarded the Broadshore Applicant seabed rights for the NE6 Option Area for the development of the Broadshore Project.

233. Whilst the SMP and CES leasing process defined the boundary of the Broadshore WFDA shown in **Figure 1.1** in **Appendix 1**, the Broadshore Applicant will continue to review development constraints during the EIA process and consider revisions to the Broadshore WFDA boundary where appropriate.

3.10.1.2 Grid Connection and Landfall(s)

234. As noted in **Chapter 1: Introduction**, the Broadshore Applicant's working assumption is that the Broadshore Project will connect into the National Electricity Transmission System in the vicinity of Peterhead. The OfTDA and OnTDA are yet to be defined and will be consented separately to the Broadshore WFDA.

3.10.2 Sinclair Wind Farm Development Area and Scaraben Wind Farm Development Area

235. The Innovation and Targeted Oil and Gas (INTOG) Seabed Leasing Process launched in August 2022 allowed developers to apply for seabed rights for small scale innovative offshore wind projects of less than 100MW and for projects connected to oil and gas installations, to reduce carbon emissions associated with those sites. Different from the ScotWind Leasing process discussed above in **Section 3.10.1**, no POs were provided, rather INTOG exclusion areas were identified and no INTOG project could be located within 5 km of a ScotWind option area (unless permitted by the ScotWind project) and could not be within 5 km of another INTOG application. Notwithstanding this, the selection of the Sinclair WFDA and Scaraben WFDA application sites (under the small scale innovative offshore wind projects category) were identified by Sinclair Offshore Wind Farm Limited (Sinclair Applicant) and Scaraben Offshore Wind Farm Limited (Scaraben Applicant).The Sinclair Applicant and Scaraben Applicant investigated the selection of potential innovation sites and considered environmental, construction and commercial matters in addition to potential synergy opportunities with the Broadshore Project. This resulted in the selection of preferred sites that were put forward for bidding. Agreement was obtained from the Broadshore Applicant to allow the Sinclair Project and Scaraben Project to be developed within 5 km of the Broadshore Project.

236. In March 2023, the Sinclair Applicant and Scaraben Applicant secured Exclusivity Agreements to develop the Sinclair WFDA and Scaraben WFDA in the innovation category of the INTOG leasing round.

237. Whilst innovation projects are not accounted for in the SMP, the Scottish Government is (at the time of submitting this Scoping Report) developing a Sectoral Marine Plan for Offshore Wind Energy for INTOG (SMP-INTOG), to facilitate the spatial policy planning for INTOG projects.

3.10.2.1 Grid Connection and Landfall(s)

238. As noted in **Chapter 1: Introduction**, the Sinclair and Scaraben Applicants' working assumption is that the Sinclair Project and Scaraben Project will connect into the National Electricity Transmission System in the vicinity of Peterhead. The OfTDAs and OnTDAs are yet to be defined and will be consented separately to the WFDAs.

3.10.3 Further Design Envelope Refinement

239. Refinement of the WFDA boundaries, design and consideration of alternatives is an iterative process throughout the scoping and EIA process. The project design envelope (including, where appropriate, WFDA boundaries) for the Broadshore WFDA, Sinclair WFDA and Scaraben WFDA will be refined as more detailed site-specific information becomes available, further stakeholder engagement is undertaken and the EIA progresses.

240. Due to the INTOG application rules, the Sinclair WFDA and the Scaraben WFDA were separated by five km at the application stage. The Sinclair INTOG application noted that if both Sinclair and Scaraben were successful, then the Applicants would seek to move Sinclair adjacent to Scaraben. Discussions are underway with CES to progress this boundary change. The original and proposed revised Sinclair WFDA boundaries are shown in **Figure 1.2** in **Appendix 1.** Both fall within the Broadshore Hub WFDAs Scoping Boundary and both are approximately the same footprint in size. One Sinclair WFDA will be selected and assessed within the Broadshore Hub WFDAs EIA Report.

3.11 References

Alpha Associates (2023). Broadshore Offshore Wind Farm – Unexploded Ordnance Threat and Risk Assessment.

Marine Scotland (2018a). Offshore Wind Sectoral Marine Plan Scoping Consultation. Available at: https://consult.gov.scot/marine-scotland/offshore-wind-scoping/

Marine Scotland Science (2018b) Scoping 'Areas of Search' Study for offshore wind energy in Scottish Waters, 2018. Published on 13 June 20018. Available on Supporting documents - Search areas for offshore wind energy: scoping study - gov.scot (www.gov.scot)

Maritime and Coastguard Agency (2021). MGN 654 (M+F) Offshore Renewable Energy Installations (OREI) safety response. Available at: https://www.gov.uk/government/publications/mgn-654-mf-offshore-renewable-energy-installations-orei-safety-response

Scottish Government (2022a). Guidance for applicants on using the design envelope for applications under Section 36 of the Electricity Act 1989. Available online at: https://www.gov.scot/publications/guidance-applicants-using-design-envelope-applications-under-section-36-electricity-act-1989/documents

Scottish Government. (2022b). Sectoral marine plan for offshore wind energy. Available at: https://www.gov.scot/publications/sectoral-marine-plan-offshore-wind-energy/pages/4/

Scottish Government (2021) Sectoral Marine Plan for Offshore Wind for Innovation and Targeted Oil and Gas Decarbonisation (INTOG) Planning Specification and Context Report. Version August 2021. Available on: sectoral_marine_plan_for_offshore_wind_for_intog_-_project_spec-context_report_-_confidential_-_25_august_2021.pdf

Scottish Government (2020). Sectoral marine plan for offshore wind energy. Marine Directorate. Published 28 October 2020. ISBN 9781800042421. Available on: 3. Plan development process and assessment of potential impacts - Sectoral marine plan for offshore wind energy - gov.scot (www.gov.scot)

4 Approach to Scoping and Environmental Impact Assessment

4.1 Overview of Environmental Impact Assessment

241. An Environmental Impact Assessment (EIA) is a process for identifying the likely significant environmental effects of the construction, operation and maintenance, and decommissioning of a proposed development and outlining how the severity of a potential significant effect could be reduced to an acceptable level. Effects can be positive or negative. An EIA Report will be submitted to the Marine Directorate - Licensing Operations Team (MD-LOT) setting out the Applicants' assessment of likely significant environmental effects, to support consent applications (see **Chapter 1: Introduction**) and acts to inform the decision-making process for determining Section 36 (s.36) consents and Marine Licences.

242. This chapter describes the principles of EIA and the approach being taken to identify and evaluate likely significant effects of the Broadshore Hub Wind Farm Development Areas (WFDAs) on the physical, biological and human environment. This chapter also details the stakeholder consultation and engagement that will be undertaken as part of the EIA process. Overviews of the proposed methodologies for Cumulative Effects Assessment (CEA), Habitats Regulations Appraisal (HRA) and Marine Protected Areas (MPA) Assessment are also presented.

243. Where the assessment methodology for a receptor deviates from the assessment methodology presented in this chapter (due to guidance or legislation), the receptor specific methodology is presented within the receptor's technical chapter. This is relevant for:

- **Chapter 11: Shipping and Navigation;**
- **Chapter 15: Seascape and Landscape Visual Impact;**
- **Chapter 16: Socioeconomics, Tourism and Recreation;**
- **Chapter 17: Climate Change;** and
- **Chapter 19: Major Accidents and Disasters.**

4.1.1 Environmental Impact Assessment Process

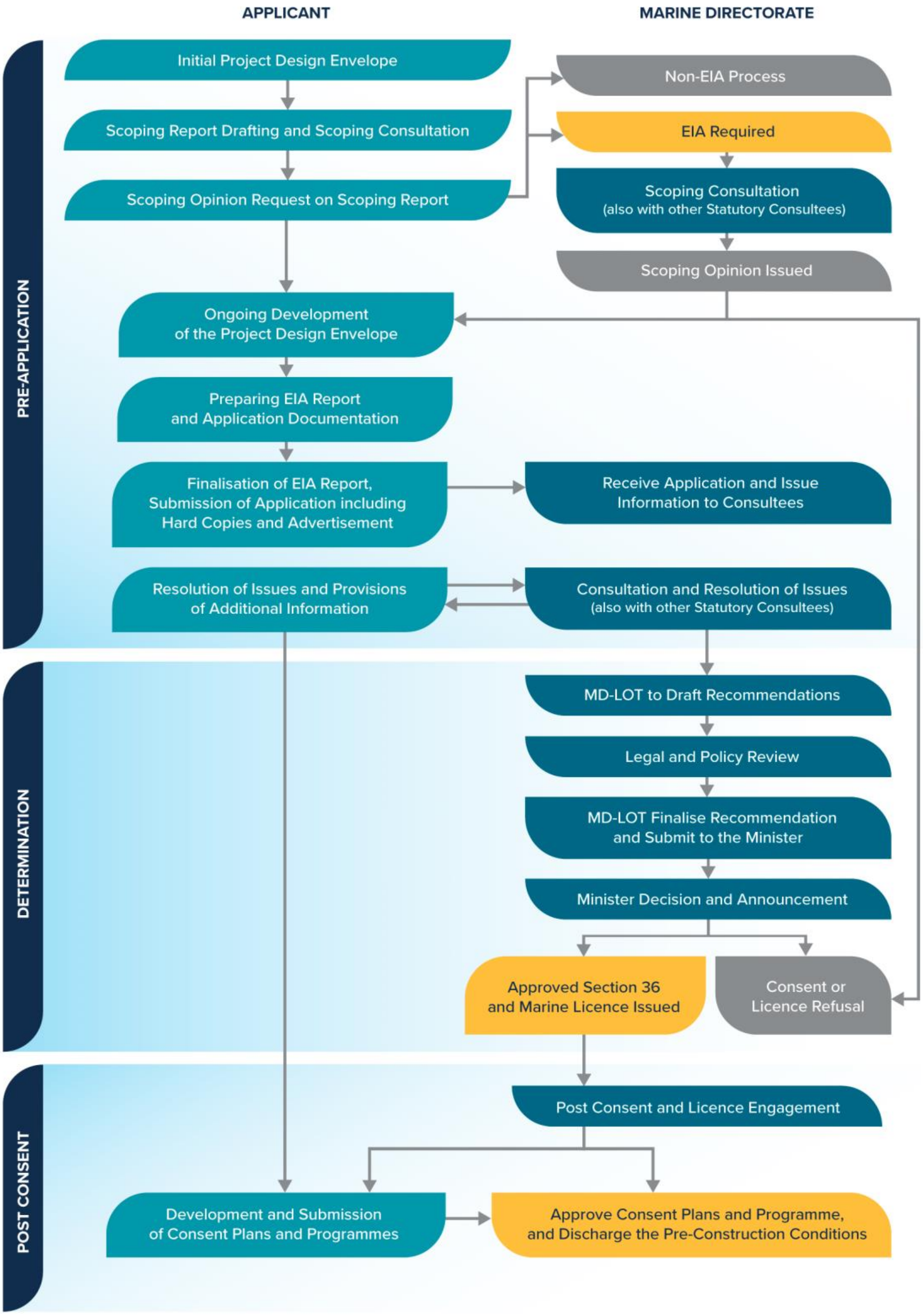
244. The overall EIA process is delivered through several clearly defined stages[13], namely scoping, consultation, environmental assessment and reporting, determination and post-consent monitoring:

- **Scoping** involves the production of a Scoping Report (this document; Broadshore Hub WFDAs Scoping Report) to request a formal Scoping Opinion from Scottish Ministers.
- **Consultation** is being undertaken in the pre-application phase to inform the design and assessment of the Broadshore Hub WFDAs.
- **EIA Report** will be prepared which considers the responses to consultation, and which includes the results of the EIA for each receptor.
- **Determination** involves the examination of each Broadshore Hub WFDAs EIA Report by the competent authority, after which they must reach their reasoned conclusion on the likely significant effects of the Broadshore Hub WFDAs on the environment. The competent authority must publish their 'decision notice'.
- **Monitoring** may be undertaken during the pre-construction, construction and operational phases of the Broadshore Hub WFDAs. This may be a requirement as part of the decision notice.

245. **Plate 4.1** provides an overview of the stages involved in the s.36 and Marine License process and illustrates how the EIA Scoping stage fits within this process.

[13] Offshore Renewable Energy projects requiring Section 36 consent fall under Schedule 2 of the Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017. Schedule 2 developments may apply for a screening opinion from the Scottish Ministers to determine whether any development is, or is not, EIA development, and therefore require preparation of an EIA Report. The Applicants have chosen to prepare and submit and EIA Report for the Broadshore Hub WFDAs without prior screening.

Plate 4.1: Stages of the Licensing Process in Scottish Waters



246. The EIA process involves understanding the proposed construction, operation and maintenance, and decommissioning activities of the Broadshore Hub WFDAs, and the environment within which the Broadshore Hub WFDAs will be located. The potential impacts of the Broadshore Hub WFDAs are then evaluated to determine the resulting potential effects of the Broadshore Hub WFDAs upon the receiving environment/receptors and the significance of those effects.

247. For the purposes of this Broadshore Hub WFDAs Scoping Report and the Broadshore Hub WFDAs EIA Report, the term ‘impacts’ is used to describe the changes that arise as a result of the Broadshore Hub WFDAs (for example, underwater noise during piling or vessel activity) and the term ‘effects’ are the consequences of those changes (for example, disturbance of marine mammals).

248. Schedule 4 of the Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017 and Schedule 3 of the Marine Works (Environmental Impact Assessment) Regulations 2007 (together referred to as the ‘EIA Regulations’) states that the description of the likely significant effects should cover the direct effects and any indirect, secondary, cumulative, transboundary, short-term, medium-term and long-term, permanent and temporary, positive and negative effects of the development. For receptors which are scoped in, these potential effects will be assessed in full in the EIA technical chapters listed in **Section 4.9**.

249. Where potential impacts are likely to result in significant effects, specific measures would need to be undertaken to reduce or remove such impacts (mitigation measures). Mitigation measures can either take the form of changes to the design of the Broadshore Hub WFDAs (embedded or design mitigation), or implementation of additional mitigation to avoid or reduce significant effects through the application of industry standard measures, specific controls implemented by environmental management or through additional survey or study programmes. The EIA process also regularly requires the identification of measures to monitor (and validate or otherwise) the predicted effects of the proposed development in the long term.

4.1.2 Environmental Impact Assessment Scoping

250. This Broadshore Hub WFDAs Scoping Report has been prepared to support a request for a Scoping Opinion for the Broadshore Hub WFDAs from MD-LOT, on behalf of the Scottish Ministers. This Broadshore Hub WFDAs Scoping Report identifies which potential impacts and receptors will be assessed as part of the Broadshore Hub WFDAs EIA Report, based on an initial understanding of the Broadshore Hub WFDAs design and environmental baseline and identifies the receptors and potential impacts which can be scoped out of the EIA Report. It also reports the methodologies which will be used for the assessment, as per industry best practice and receptor-specific guidelines, as set out in **Chapters 5 – 19**.

251. Under the EIA Regulations, once a request for a Scoping Opinion has been issued to the Scottish Ministers for consideration, they are required to consult with the consultation bodies (as defined under Regulation 2(1) of the Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017; and Regulation 2(1) of the Marine Works (Environmental Impact Assessment) Regulations 2007).

252. Effective scoping enables agreement to be reached on the likely environmental effects and the assessment methodologies to be taken forward and reported in much greater detail in the Broadshore Hub WFDAs EIA Report. This Broadshore Hub WFDAs Scoping Report defines the scope of the assessment and focuses on the key issues. It also provides an opportunity for early interaction with stakeholders, strengthening the assessment evidence base and allowing active participation of interested parties in project development and decision-making. This can in turn improve project design, environmental performance and social acceptability.

253. This Broadshore Hub WFDAs Scoping Report has been prepared as a single document which relates to the Broadshore WFDA, the Sinclair WFDA and the Scaraben WFDA (collectively, the Broadshore Hub WFDAs). The Scoping Opinion will relate to the Broadshore Hub WFDA, but as agreed with MD-LOT (**Table 4.1**) will apply equally to the Broadshore WFDA, the Sinclair WFDA and the Scaraben WFDA individually.

4.1.3 Environmental Impact Assessment Scoping Boundary

254. The Broadshore Hub WFDAs Scoping Boundary assessed within this Broadshore Hub WFDAs Scoping Report is shown within **Figure 1.1** in **Appendix 1** and incorporates the boundaries of the:

- Broadshore WFDA;
- Sinclair WFDA[14]; and
- Scaraben WFDA.

255. It should be noted that separate Scoping Reports will be produced for the Broadshore Hub Offshore Transmission Development Areas (OfTDAs) and Onshore Transmission Development Areas (OnTDAs) which will be subject to separate consent applications.

4.1.4 Design Evolution Process

256. The EIA process allows opportunities for environmental concerns to be addressed within the design of the Broadshore Hub WFDAs. Typically, a number of refinements to the design envelope take place prior to consent applications being submitted for approval, to account for environmental constraints and representations received. This iterative design process is a fundamental element of the EIA and for the Broadshore Hub WFDAs and will develop following feedback via the Scoping Opinion and other engagement with stakeholders, including local communities.

257. The iterative design process integrates the advice and experience of the environmental receptor experts that undertake the scoping and impact assessments for the Broadshore Hub WFDAs EIA Report in regular liaison with the Applicants' development team. This ensures that design evolution is informed by a project-wide understanding of environmental sensitivities such that the mitigation hierarchy is adhered to throughout the development of the Broadshore Hub WFDAs and the wider Broadshore Hub.

[14] Including a proposed revised boundary for the Sinclair WFDA as shown in **Figure 1.2 in Appendix 1.**

258. Environmental and social considerations have been central to the evolution of the Broadshore Hub WFDAs to date, as informed by a combination of stakeholder engagement, EIA surveys and technical studies. The design evolution process undertaken to date is evidenced in **Chapter 3: Project Description**.

4.2 Guidance and Best Practice

259. The assessment of potential effects in the Broadshore Hub WFDAs EIA Report will use the below standard guidance to assist with the production of a robust and proportionate EIA, in particular:

- Scottish Government (2017). Planning Circular 1/2017: Environmental Impact Assessment Regulations;
- Scottish Government (2013). Planning Advice Note (PAN) 1/2013 Environmental Impact Assessment;
- Scottish National Heritage (SNH) (2018). A Handbook on Environmental Impact Assessment;
- Marine Scotland (2018). Marine Scotland Consenting and Licensing Guidance: For Offshore Wind, Wave and Tidal Energy Applications[15];
- Marine Scotland (2022). Guidance for Applicants on using the Design Envelope for Applications under Section 36 of the Electricity Act 1989;
- Scottish Government (2023). National Planning Framework 4 (NPF4);
- Chartered Institute for Ecology and Environmental Management (CIEEM, 2018). Guidelines for Ecological Impact Assessment in the UK and Ireland. Terrestrial, Freshwater, Coastal and Marine;
- Institute of Environmental Management and Assessment (Institute of Environmental Management and Assessment (IEMA), 2017). Delivering Proportionate EIA. A Collaborative Strategy for Enhancing UK EIA Practice;
- Centre for Environment, Fisheries and Aquaculture (Cefas) (2004). Offshore Wind Farms: Guidance Note for EIA in Respect of Food and Environmental Protection Act (FEPA) and Coast Protection Act (CPA) Requirements;
- RenewableUK (2013). Guiding Principles for Cumulative Impacts Assessment in Offshore Wind Farms;
- OSPAR (Convention for the Protection of the Marine Environment of the North-East Atlantic) (2009). Assessment of the Environmental Impacts of Cables;
- European Commission (2017). EIA of Projects – Guidance on the preparation of the EIAR. (Office for Official Publications of the European Communities 2017);

[15] Note the Applicants are aware that the Marine Directorate is currently consulting on updates to this guidance. Any updated guidance will be considered in the Broadshore Hub WFDAs EIA Report.

- European Commission (1999). Guidelines for the Assessment of Indirect and Cumulative Impacts as well as Impact Interactions;
- Cefas (2012). Guidelines for Data Acquisition to Support Marine Environmental Assessments of Offshore Renewable Energy Projects;
- Maclean et al. (2009). A Review of Assessment Methodologies for Offshore Windfarms (OWFs) (Collaborative Offshore Wind Research into The Environment (COWRIE) METH-08-08);
- IEMA (2015). IEMA Environmental Impact Assessment Guide to Shaping Quality Development;
- Planning Inspectorate (2019). Advice Note Seventeen: Cumulative effects assessment relevant to nationally significant infrastructure projects (NSIPs) (Version 2); and
- The Cumulative Effects Framework, which is under development by MD-LOT and NatureScot will be considered for use in the Broadshore Hub WFDAs EIA Report (for relevant receptors) when available.

4.3 Consultation and Stakeholder Engagement

4.3.1 Introduction

260. Regular engagement with stakeholders is key to the successful delivery of the EIA process for the Broadshore Hub WFDAs. In advance of the formal submission of the Broadshore Hub WFDAs EIA Report, statutory and non-statutory consultation and engagement will be carried out to allow stakeholders and local communities the opportunity to provide feedback on all aspects of the Broadshore Hub WFDAs, and inform the scope of studies, surveys and assessments being undertaken, and influence the project design. This is in accordance with relevant legislation, best practice and guidance, and will build on feedback provided by MD-LOT's consultees in the Scoping Opinion.

4.3.2 Engagement to Date

261. Stakeholder engagement undertaken to support early planning of the Broadshore Hub WFDAs and pre-scoping activities has been undertaken through virtual and in-person meetings, workshops, and wider industry events. The purpose of these meetings was to provide general Broadshore Hub updates, including programme and survey updates; identify potential collaboration opportunities; identify and discuss potential constraints with environmental, social and economic receptors; and receive notification of any forthcoming regulatory guidance or updates.

262. In addition, the Applicants held a Broadshore Hub WFDAs Scoping Workshop with MD-LOT, Marine Directorate Marine Analytical Unit (MD-MAU), Marine Directorate Science, Evidence Data and Digital (MD-SEDD) team and NatureScot in September 2023 to present the approach to scoping and impact assessment of the Broadshore Hub WFDAs and to gain feedback on key receptors and the key impact assessment methodologies to be adopted. Information packages for all technical receptors covered in this Broadshore Hub WFDAs Scoping Report were provided for the Broadshore Hub WFDAs Scoping Workshop, with a number of breakout sessions held for more

detailed discussion. Technical chapter-specific consultation from the workshop is presented in the technical chapters of this Broadshore Hub WFDAs Scoping Report.

263. The CEA, NCMPA and HRA methodologies were also discussed in the Scoping Workshop (refer to **Table 4.1** for agreements from the Scoping Workshop).

264. Stakeholders engaged on environmental, consenting or policy matters relating to the Broadshore Hub WFDAs to date are:

- Aberdeenshire Council;
- Crown Estate Scotland (CES);
- Fisheries associations (Scottish Fishermen's Federation, Scottish Whitefish Producers Association and the North and East Coast Regional Inshore Fisheries Group);
- Fishers in the Peterhead and Fraserburgh area;
- Maritime and Coastguard Agency (MCA);
- MD-LOT (including MD-MAU and MD-SEDD);
- NatureScot;
- North East Ornithology Group (NEOG) Developers Forum;
- Northern Lighthouse Board (NLB); and
- The Royal Society for the Protection of Birds (RSPB).

265. Agreements to date are summarised in **Table 4.1.** Receptor specific consultation is provided in each technical chapter (**Chapters 4 to 19** of this Broadshore Hub WFDAs Scoping Report).

Table 4.1: Consultation to Date for the Broadshore Hub WFDAs

Stakeholder	Date/Document	Agreement/Discussion
Fishers (Peterhead and Fraserburgh area)	9th and 10th May 2023	Consultation events held with fishers in the Peterhead and Fraserburgh area to gain stakeholder feedback to support the Applicants' understanding of fishing activities in the WFDAs and the OfTDAs, and influence the Applicants' offshore export cable routing and landfall(s) site selection studies.
MD-LOT	13th September 2023, Scoping Workshop	The Scoping Opinion will relate to the Broadshore Hub WFDAs, but will apply equally to the Broadshore WFDA, the Sinclair WFDA and the Scaraben WFDA individually.
NatureScot	13th September 2023, Scoping Workshop	The 'Nature Conservation Marine Protected Area Management Handbook' is currently being updated but will not be published in time to inform the Broadshore Hub WFDAs EIA process. NatureScot further advised the need to clearly present any overlap of the Broadshore Hub infrastructure or activities with features of Nature Conservation Marine Protected Areas (NCMPAs) and consideration should be given to impacts on the features' conservation objectives.

Stakeholder	Date/Document	Agreement/Discussion
MD-LOT	13th September 2023, Scoping Workshop	The Cumulative Effects Framework is currently in (draft) beta version, with final version anticipated to be published around the end of 2023, therefore should be available to inform the EIA.
MD-LOT	13th September 2023, Scoping Workshop	MD-LOT are currently considering acceptability of a six month cut off period for any other projects/plans considered quantitatively in the CEA, with the aim to provide consistent approach across all Scottish projects in progress.
NatureScot	13th September 2023, Scoping Workshop	Regarding the approach to having one Broadshore Hub WFDA HRA Screening Report for each project comprising the Broadshore Hub WFDAs, NatureScot confirmed the HRA Screening Report will need to be very clear on the impacts for each WFDA on its own, as well as the combination of WFDAs within the Broadshore Hub.
Fisheries associations	26th September 2023	Engagement with Scottish Fishermen's Federation, Scottish Whitefish Producers Association and the North and East Coast Regional Inshore Fisheries Group to provide project updates and discussion on proposed Sinclair boundary change (**Section 3.10** in **Chapter 3: Project Description** and **Figure 1.2** in **Appendix 1**).
MCA and NLB	6th December 2023	Engagement with MCA and NLB to present the vessel traffic survey requirements and Navigational Risk Assessment (NRA) methodology across the Broadshore Hub WFDAs.

4.3.3 Future Engagement

266. In line with the EIA Regulations, MD-LOT will consult on this Broadshore Hub WFDAs Scoping Report once it has been received by the Scottish Ministers. This consultation is required to obtain advice and feedback from statutory consultees on the potential effects which should be scoped in or scoped out of the EIA, and screened in or out of the NCMPA assessment and HRA. This feedback will be presented in the Scoping Opinion.

267. In addition, the Applicants will make this Broadshore Hub WFDAs Scoping Report available on its websites to further promote the Scoping consultation process. Whilst the formal Scoping consultation process is undertaken by MD-LOT, the Applicants will be actively consulting with the wider stakeholder base in parallel.

268. The Applicants will continue to engage with statutory stakeholders, non-statutory stakeholders and local communities throughout the development phase of the Broadshore Hub WFDAs, including during the EIA process. This includes continuing with the established recurring meetings with stakeholder groups detailed above, and local communities. The Broadshore Hub WDFAs EIA Report will provide further detail on consultation undertaken, including the outcomes of the community engagement events.

269. The Applicants will record all stakeholder feedback received during the development phase of the Broadshore Hub WFDAs. If requested by MD-LOT, a Gap Analysis will be submitted with each consent application and will log relevant stakeholder and environmental representations. The Gap Analysis will explain how these have been addressed in the Broadshore Hub EIA Report, creating an audit trail of how each stakeholder representation has been considered in the development and design of the Broadshore Hub WFDAs.

270. Whilst the Broadshore Hub WFDAs fall outside 12 nm and therefore the Marine Licensing (Pre-application Consultation) (Scotland) Regulations 2013 (the 'PAC Regulations') do not apply, the Applicants will nevertheless adopt the principles of PAC for the Broadshore Hub WFDAs to ensure communities are aware of the Broadshore Hub WFDAs being consent applications are finalised and submitted.

271. In advance of the EIA Report submission, the Applicants will hold at least one pre-application consultation event in the form of a public exhibition, where stakeholders and members of the public can engage with and provide comment on the Broadshore Hub WFDAs to the Applicants. Prior to the public exhibition(s), notifications will be provided to the NLB, the MCA, the Scottish Environment Protection Agency, Aberdeenshire Council and NatureScot, plus any delegate for a relevant marine region. Notices will also be published in local newspapers detailing information on the event and description of the Broadshore Hub WFDAs, thus following the principles of the PAC regulations.

4.4 Proportionate Environmental Impact Assessment

272. Scoping is intended to inform a proportional and robust approach to assessment through early-stage evaluation and reporting of identified likely significant effects in the EIA Report. This proactive Scoping process allows for a robust Broadshore Hub WFDAs EIA Report whilst focusing on environmental impacts which could give rise to likely significant effects.

273. Therefore, where appropriate, this Broadshore Hub WFDAs Scoping Report seeks to scope out environmental receptors and specific impacts under an aspect from further assessment with suitable justification and evidence provided. This will focus the assessment on key likely significant effects and ensure the EIA for the Broadshore Hub WFDAs is proportionate in accordance with PAN 1/2013 (Scottish Government, 2013) and IEMA's Delivering Proportionate EIA guidance document (IEMA, 2017).

274. The following key tools/approaches have been adopted at the Scoping stage to assist in the delivery of a proportionate EIA:

- Use of existing evidence base; and
- Inclusion of embedded environmental measures, informed by good and standard practices.

275. Only potentially significant impacts have been 'scoped in' to the EIA.

4.4.1 Design Envelope

276. A parameter-based design envelope approach will be adopted within the Broadshore Hub WDFAs EIA Report, as detailed in **Section 3.2**. The design envelope will set out a minimum and maximum design scenario for each design parameter. The design envelope will include all relevant technical, spatial and temporal elements of the Broadshore Hub WFDAs, and the proposed methodology to be employed for construction, operation and maintenance, and decommissioning. These parameters will enable technical specialists to accurately assess the Broadshore Hub WFDAs whilst retaining sufficient flexibility to accommodate further refinement during the detailed design stage once the Broadshore Hub WFDAs have been consented.

277. The design envelope approach allows the Broadshore Hub WFDAs to be assessed on a reasonable receptor specific worst-case scenario basis. The reasonable worst-case scenario defined for any given parameter may vary by technical aspect, depending on how the parameter can be expected to interact with the receptor being considered. This is considered a standard approach and is widely accepted by stakeholders and regulators, and is necessary to ensure the necessary design flexibility at this early stage of project development.

278. The information presented in **Chapter 3: Project Description** outlines the options and flexibility required by the Applicants and the range of potential design, location and activity parameters upon which the scoping of impacts is based. The final detailed design will lie within the parameters of the design envelope, pre-construction detailed design work to be undertaken post-consent whilst retaining the validity of the Broadshore Hub WFDAs EIA Report.

279. The need for flexibility in the consent is a key aspect of any large development but is particularly significant for offshore wind farm projects where technology is evolving. The design envelope must therefore provide sufficient flexibility to enable the Applicants and their supply chain to use the most up to date, efficient and economical technology and techniques in the construction, operation and maintenance, and decommissioning of the Broadshore Hub WFDAs' infrastructure, without affecting the surrounding environment to a greater extent than the worst-case scenarios assessed in the Broadshore Hub WFDAs EIA Report.

280. Guidance has been prepared by Marine Scotland and the Energy Consents Unit on using the design envelope approach for applications under s.36 of the Electricity Act 1989 where flexibility is required in applications (Scottish Government, 2022). This guidance will be referred to when refining the design envelope to inform the EIA.

281. The description of the Broadshore Hub WFDAs will be further refined as stakeholder engagement progresses and the design continues to evolve.

4.4.2 Human Health

282. The requirement to consider human health within the EIA process was made explicit in both The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017 and amendments to the Marine Works (Environmental Impact Assessment) Regulations 2007. 'Health', for the purposes of this Scoping Report, follows the definition set by the World Health Organisation: "a state of complete physical, mental and social wellbeing and not merely the absence of disease or infirmity" (World Health Organisation, 2020).

283. Whilst it is recognised that human health considerations are more prevalent for the Broadshore Hub OnTDAs EIA Report, this Broadshore Hub WFDAs Scoping Report includes the following chapters which will consider impacts to human health as appropriate:

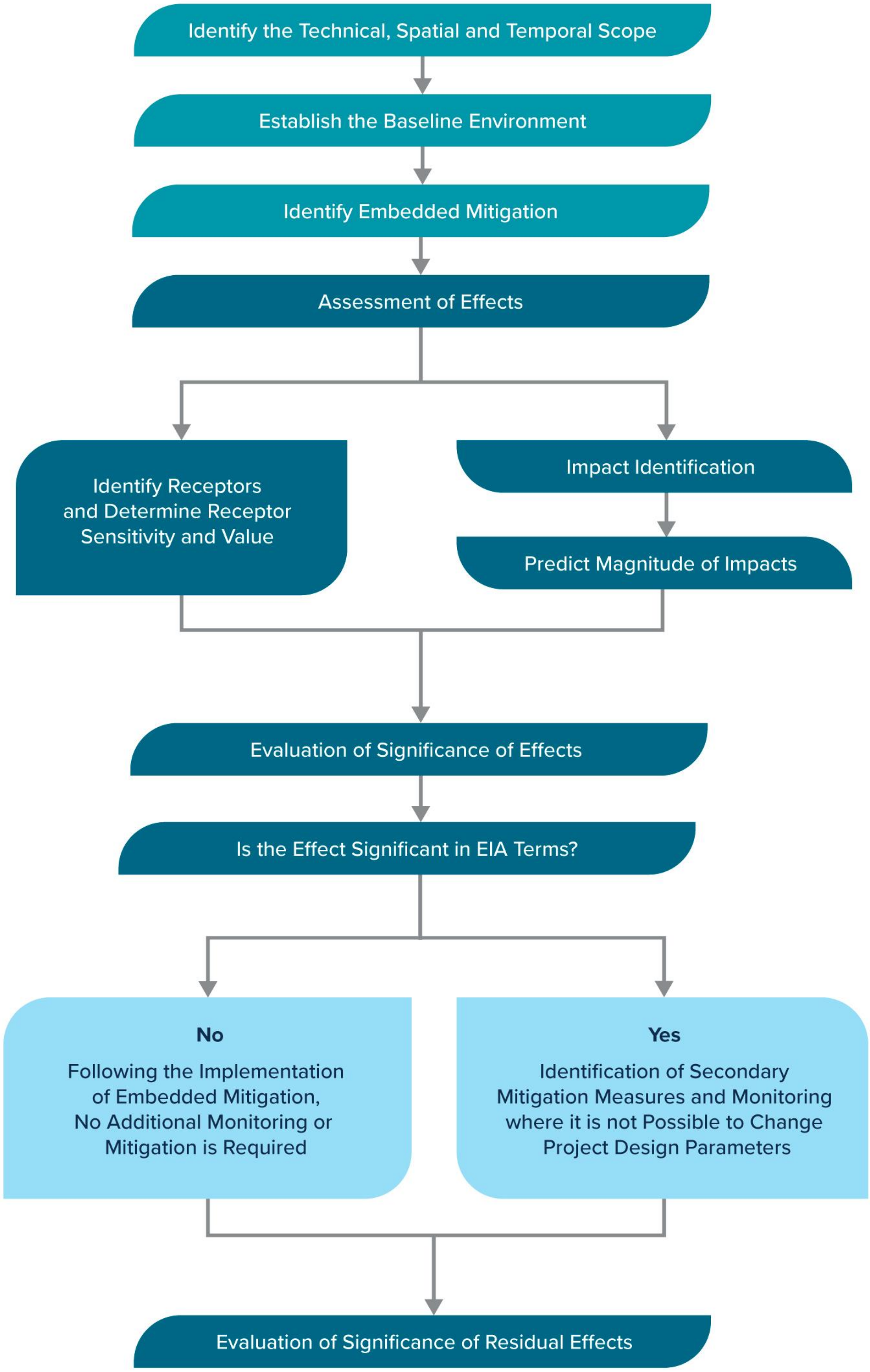
- **Chapter 5: Marine Geology, Oceanography and Physical Processes;**
- **Chapter 11: Shipping and Navigation;**
- **Chapter 12: Aviation and Radar;**
- **Chapter 13: Marine Infrastructure and Other Users;**
- **Chapter 15**: **Seascape and Landscape Visual Impact Assessment;**
- **Chapter 16: Socioeconomics, Tourism and Recreation;**
- **Chapter 17: Climate Change;**
- **Chapter 18: Offshore Air Quality; and**
- **Chapter 19: Major Accidents and Disasters.**

284. Consequently, a stand-alone human health chapter within the Broadshore Hub WFDAs EIA Report is not proposed.

4.5 Assessment Methodology

285. This section provides an overview of the proposed methodology approach for EIA, in line with the approach set out in **Plate 4.2**.

Plate 4.2: Overview of Environmental Impact Assessment Methodology



4.5.1 Identify the Technical, Spatial and Temporal Scope

4.5.1.1 Technical Scope

286. The technical scope covered by this Broadshore Hub WFDAs Scoping Report is outlined in the respective chapters. Justification is provided for the individual approach and scoping of matters to be considered in the assessment for each environmental aspect. The technical scope also details the approach to baseline data collection and assessment methodologies. **Chapter 20: Summary and Next Steps** provides a summary table of impacts and effects to be scoped in and out of the Broadshore Hub WFDAs EIA Report.

4.5.1.2 Spatial Scope

287. The geographical context within which the Broadshore Hub WFDAs are located is shown in **Figure 1.1** in **Appendix 1**. The spatial scope for each technical assessment will depend on the nature of the potential effects and the location of receptors that could be affected by the Broadshore Hub WFDAs construction, operation and maintenance, and decommissioning. The study area relevant to each environmental receptor is described in each respective technical chapter where appropriate. The spatial scope of the technical assessments will therefore take account of:

- Relevant guidance;
- The physical area of the Broadshore Hub WFDAs;
- The nature of the baseline environment; and
- The manner and extent to which environmental effects may occur within the Broadshore Hub WFDAs or beyond its boundaries.

288. The study area for any given receptor may need to be refined in consultation with relevant consultees to ensure they still adequately reflect the area of potential influence for likely significant environmental effects.

4.5.1.3 Temporal Scope

289. The temporal scope refers to the time periods over which impacts and effects may be experienced by environmental receptors, and this will be defined further for each aspect in discussion with relevant consultees. The EIA will assess potential impacts and effects during the construction, operation and maintenance, and decommissioning phases of the Broadshore Hub WFDAs.

290. While there is potential for impacts from the physical presence of operational infrastructure (i.e. WTGs) during the construction phase of the Broadshore Hub WFDAs, these impacts will increase incrementally as the Broadshore Hub WFDAs construction progresses, until the final infrastructure is installed. It is proposed that these impacts are therefore scoped out from further consideration in relation to the construction and decommissioning phases to avoid double counting of potential impacts, but are included under the operation and maintenance phase, as appropriate.

291. Environmental effects will be compared to the current environmental baseline and will also take into consideration the projected future baseline (i.e., the theoretical situation that would exist in the absence of the Broadshore Hub WFDAs) where possible. For example, predictable changes such as climate change, or changes that can be expected based on reasonable assumptions and modelling calculations, will be taken into account. Each environmental chapter of the Broadshore Hub WFDAs EIA Report will define the baseline (current and future where possible) against which the environmental effects of the Broadshore Hub WFDAs will be assessed. The baseline conditions which will be assessed for each environmental aspect are outlined in the technical chapters of this Broadshore Hub WFDAs Scoping Report.

4.5.2 Establish the Baseline Environment

292. To assess the potential impacts and effects of the Broadshore Hub WFDAs, it is necessary to determine the environmental conditions that currently exist within the Broadshore Hub WFDAs Scoping Boundary and in the wider study areas. These are known as the existing baseline conditions.

293. The study area and approach which will be used to establish baseline conditions for each environmental receptor will vary depending on the receptor and is set out within its respective technical chapter. Baseline conditions will be determined using the results of site-specific surveys and investigations or desk-based data searches, or a combination of these, as appropriate.

4.5.3 Assessment of Effects

294. This section sets out the framework methodology for the assessment with each technical chapter providing details of how the methodology has been applied for that receptor. To provide a consistent framework and system of common tools and terms, a matrix approach will be used to frame and present the judgements made. For each receptor considered in the EIA, the most relevant and latest guidance or best practice will be used and, therefore, definitions of sensitivity and magnitude are tailored to each receptor. These definitions are detailed fully in each technical chapter.

295. The impact assessment will consider the potential for impacts and effects during the construction, operation and maintenance, and decommissioning phases of the Broadshore Hub WFDAs. As required by the EIA Regulations, only effects that are likely to be significant require detailed assessment.

296. Impacts can be classified as follows:

- Direct impacts: occurring at the same time and place as the action or activity.
- Indirect impacts: experienced by a receptor that is removed (e.g., in space or time) from the direct impact (e.g., noise impacts upon fish which are a prey resource for fish or mammals).
- Inter-relationships between impacts (where different impacts interact to affect a single receptor, which may need to be brought together from assessments presented in separate chapters) and interactions between impacts (where impacts assessed in each chapter have the potential to interact with one another).

- Cumulative impacts: these may occur as a result of the Broadshore Hub WFDAs in conjunction with other existing or planned projects within the study area for each receptor, including other offshore wind farms.

297. Mitigation and/or monitoring to manage impacts will then be considered where required and commitments made by the Applicants as appropriate. The potential impacts and mitigation proposed in this Broadshore Hub WFDAs Scoping Report are based on the Broadshore Hub WFDAs boundaries and should the boundaries change, this will be reflected in the EIA. If any changes are considered to change the Scoping Opinion, this will be highlighted in the EIA Report.

4.5.3.1 Impact Identification

298. Where appropriate to do so, the assessment has used the conceptual 'source-pathway-receptor' model. The model identifies potential impacts resulting from the proposed activities on the environment and sensitive receptors within it. This process provides an easy-to-follow assessment route between impact sources and potentially sensitive receptors ensuring a transparent impact assessment. The aspects of this model are defined as follows:

- Source – the origin of a potential impact (i.e., an activity such as piling and a resultant effect e.g. noise resulting from the piling works).
- Pathway – the means by which the effect of the activity could impact a receptor (e.g., for the example above, disturbance/injury to nearby species).
- Receptor – the element of the receiving environment that is impacted (this could either be a component of the physical, ecological or human environment, e.g., for the above example, species susceptible to noise impacts).

299. Where a different approach has been necessary to reflect the specific assessment requirements of a particular receptor, this is described in the corresponding technical chapter in this Broadshore Hub WFDAs Scoping Report.

4.5.3.2 Determine Receptor Sensitivity and Value

300. The characterisation of the existing environment helps to determine the receptor sensitivity in order to assess the potential impacts upon it.

301. Receptor value considers whether, for example, the receptor is rare, has protected or threatened status, importance at local, regional, national or international scale, and in the case of biological receptors whether the receptor has a key role in the ecosystem function.

302. The ability of a receptor to adapt to change, tolerate, and/or recover from potential effects is key in assessing its sensitivity to the effect under consideration. For ecological receptors tolerance could relate to short term changes in the physical environment, for human environment receptors tolerance could relate to displacement effects and therefore effects upon economics or safety. It also follows that the capacity to recover will be a key consideration in determining receptor sensitivity.

303. The overall receptor sensitivity is determined by considering a combination of value, adaptability, tolerance and recoverability. This is achieved through applying known research and information on the status and sensitivity of the feature under consideration coupled with professional judgement and past experience.

304. Expert judgement is particularly important when determining the sensitivity of receptors. For example, an Annex II species (under the Habitats Directive[16]) would have a high inherent value but may be tolerant to an impact or have high recoverability. In this case, sensitivity should reflect the ecological robustness of the species and not necessarily default to its protected status. Example definitions of the different sensitivity levels for a generic receptor are given in **Table 4.2**.

Table 4.2: Example Definition of Different Sensitivity Levels for a Generic Receptor

Sensitivity	Definition
High	Individual receptor has very limited or no capacity to avoid, adapt to, accommodate or recover from the anticipated impact.
Medium	Individual receptor has limited capacity to avoid, adapt to, accommodate or recover from the anticipated impact.
Low	Individual receptor has some tolerance to accommodate, adapt or recover from the anticipated impact.
Negligible	Individual receptor is generally tolerant to and can accommodate or recover from the anticipated impact.

305. In addition, for some assessments the value of a receptor may also be an element to add to the assessment where relevant, for instance if a receptor is designated or has economic value.

306. Example definitions of the value levels for a generic receptor are given in **Table 4.3.**

Table 4.3: Example Definitions of the Value Levels for a Generic Receptor

Value	Definition
High	Internationally/nationally important (for example internationally or nationally protected site)
Medium	Regionally important/regionally protected site
Low	Locally important/rare but with high potential for mitigation
Negligible	Not considered to be important (for example common or widespread)

[16] The Directives have been transposed into Scottish Law by various regulations, those of relevance to the Broadshore Hub WFDAs include the Conservation of Offshore Marine Habitats and Species Regulations 2017 (which apply to marine licences and s.36 applications within Scottish waters beyond 12 nm). These are hereafter referred to as the Habitats Regulations.

307. The terms 'high value' and 'high sensitivity' are not necessarily linked within a particular impact and it is important not to inflate impact significance specifically because a feature is valued'. For example, a receptor could be of high value (e.g. an Annex I habitat) but have a low or negligible physical/ecological sensitivity to an effect.

4.5.3.3 Predicting Magnitude of Impact

308. The magnitude of change affecting a receptor that would result from the Broadshore Hub WFDAs will be identified on a scale from minor alterations or change, up to major changes or the total or substantial loss of the receptor. For certain environmental effects, the magnitude of change would be related to guidance on levels of acceptability (for example, for air quality or noise), and is therefore based on numerical parameters. For others it will be a matter of professional judgement to determine the magnitude of change, using descriptive terminology. The relevant guidance for each receptor is discussed in the technical chapters of this Broadshore Hub WFDAs Scoping Report**.**

309. The magnitude and probability of an impact occurring will be established through consideration of:

- Scale or spatial extent (small scale to large scale or a few individuals to most of the population);
- Duration (short term to long term);
- Likelihood of impact occurring;
- Frequency; and
- Nature of change relative to the baseline.

310. The categorisation of magnitude of impact will vary for specific pathways, receptors and technical assessments. Example definitions of the magnitude levels for a generic receptor are given in **Table 4.4.**

Table 4.4: Example Definitions of the Magnitude Levels for a Generic Receptor

Value	Definition
High	Fundamental, permanent/irreversible changes, over the whole receptor, and/or fundamental alteration to key characteristics or features of the particular receptor's character or distinctiveness.
Medium	Considerable, permanent/irreversible changes, over the majority of the receptor, and/or discernible alteration to key characteristics or features of the particular receptor's character or distinctiveness.
Low	Discernible, temporary (throughout project duration) change, over a minority of the receptor, and/or limited but discernible alteration to key characteristics or features of the particular receptor's character or distinctiveness.
Negligible	Discernible, temporary (for part of the project duration) change, or barely discernible change for any length of time, over a small area of the receptor, and/or slight alteration to key characteristics or features of the particular receptor's character or distinctiveness.

4.5.3.4 Evaluation of Significance of Effects

311. Once the technical chapters have defined the sensitivity of each receptor and the magnitude of potential impacts (based on expert judgement), the significance of effects matrix in **Table 4.5** is applied. This matrix will determine the significance of the adverse and positive effects. All technical chapters will apply the significance of effects matrix, unless otherwise specified in the technical chapters.

312. In EIA terms, major and moderate adverse effects are deemed to be significance, and as such, may require mitigation. Whilst minor effects are not significant in their own right, these may contribute to significant effects cumulatively or through interactions. Each technical chapter sets out receptor-specific guidance that will be used to assess the significance of effects.

Table 4.5: Matrix for Evaluating the Significance of an Effect

Sensitivity	Magnitude				
	High	Medium	Low	Negligible	No Change
High	Major	Major	Moderate	Minor	No effect
Medium	Major	Moderate	Minor	Negligible	No effect
Low	Moderate	Minor	Minor	Negligible	No effect
Negligible	Minor	Negligible	Negligible	Negligible	No effect

Table 4.6: Definitions of Effect Significance

Effect Significance	Definition
Major	Very large or large change in receptor condition, both adverse or beneficial, which are likely to be important considerations at a regional or district level
Moderate	Intermediate change in receptor condition, which are likely to be important considerations at a local level.
Minor	Small change in receptor condition, which may be raised as local issues but are unlikely to be important in the decision-making process.
Negligible	No discernible change in receptor condition.
No Effect	No change in receptor condition; therefore, no effect

4.5.3.5 Identify Mitigation Measures and Monitoring

313. For each environmental aspect, the EIA process will systematically identify and assess impacts and effects and take into consideration potential changes to the project design parameters to reduce the severity of an effect or, where that is not possible, environmental mitigation and monitoring measures that will be adopted in the development, operation and decommissioning of the Broadshore Hub WFDAs. These measures include avoidance, best practice and design commitments. IEMA issued 'Shaping Quality Development' in November 2015 and 'Delivering Quality Development' in July 2016. In accordance with these guidance documents, three types of mitigation will be identified and used within the EIA Report:

- **Primary mitigation:** modifications to the location or design made during the pre-application phase that are an inherent part of the Broadshore Hub WFDAs. These measures are treated as an inherent part of the Broadshore Hub WFDAs. This includes the adoption of methods and equipment for seabed preparation which have been designed to minimise the potential for sediment suspension and dispersal.
- **Secondary mitigation:** actions that will require further activity in order to achieve the anticipated outcome. The effectiveness of such measures will be assessed within the EIA Report and appropriate mitigation will be secured by a consent condition. This may include seasonal restrictions on certain construction activities being undertaken to minimise impacts on a migratory species.
- **Tertiary mitigation:** actions that would occur with or without input from the EIA. These include actions that will be undertaken to meet other existing legislative requirements, or actions that are standard practices used to manage commonly occurring environmental effects. These measures are treated as an inherent part of the Broadshore Hub WFDAs. This includes development and adherence to management plans, such as a Marine Pollution Contingency Plan and Environmental Management Plan.

314. Primary and tertiary mitigation are considered to be 'embedded' mitigation. The assessment of the likely significant environmental effects for the pre-mitigation scenario will take such mitigation into account in determining the magnitude of change.

315. Following assessment of the likely significant effects of the Broadshore Hub WFDAs, any further mitigation measures (secondary mitigation) will be outlined within the individual chapters of the Broadshore Hub WFDAs EIA Report. These mitigation measures will further reduce a negative effect or enhance a positive effect.

316. The EIA Regulations require, where appropriate, the monitoring of potential significant adverse effects. Where monitoring arrangements are proposed as part of the mitigation set out, this will be detailed within each of the technical chapters of the Broadshore Hub WFDAs EIA Report, and the results of any monitoring will be shared with the relevant stakeholders as appropriate.

317. Environmental mitigation and monitoring measures will also be recorded in the Broadshore Hub WFDAs EIA Report and a Mitigation Register to enable them to be secured (where required) and implemented. Opportunities will be provided for stakeholders to provide feedback on the commitments as part of the planned stakeholder engagement exercises. **Appendix 3: Mitigation Register** sets out a range of embedded mitigation measures included in this Broadshore Hub WFDAs Scoping Report.

4.5.3.6 Assessment of Residual Effects

318. Following the application of any necessary secondary mitigation measures to reduce the severity of potential negative effects, the significance of residual effects will then be assessed for each potential impact following the guidance outlined above in **Section 4.5.3**.

4.5.4 Inter-related Effects

319. The Broadshore Hub WFDAs EIA Report will also consider the potential for:

- Inter-relationships between impacts: where different impacts interact to affect a single receptor, which may need to be brought together from assessments presented in separate chapters. The offshore assessments are largely receptor based (e.g., marine mammals, fish ecology) and as such inter-relationships are covered as an integral part of the assessment. There is the potential for these separate impacts to interact, spatially and temporally, to create inter-related effects on a receptor and where this is the case this is identified and assessed. For example, impacts on fish and shellfish ecology can lead to changes in prey resource for marine mammals and birds, and can also affect commercial fisheries through the disturbance of commercially important fish and shellfish resources and subsequent displacement or disruption of fishing activity.
- Interactions between impacts: where impacts assessed in each chapter have the potential to interact with one another. Impacts will be assessed relative to each development phase (a 'phase assessment' i.e., construction, operation or decommissioning) to see if (for example) multiple construction impacts affecting the same receptor could increase the level of effect upon that receptor. Following this, a 'lifetime assessment' will be undertaken where necessary which will consider the potential for impacts to affect receptors across all development phases.

320. It should be noted that the inter-related effects assessment only considers the effects from the Broadshore Hub WFDAs, with effects from other projects considered within the CEA.

4.6 Approach to Cumulative Effects Assessment

321. The CEA considers the impacts arising from the Broadshore Hub WFDAs alone as well as cumulatively with other relevant plans, projects and activities. Following a CEA screening exercise (**Section 4.6.2**), the CEA considers the combined effect of the Broadshore Hub WFDAs in combination with the effects from a number of different projects on the same receptor or resource.

322. The CEA is essential to identify foreseeable developments or activities with which the Broadshore Hub WFDAs may interact, resulting in cumulative impact. Cumulative impacts may arise from all phases (construction, operation and maintenance, and decommissioning) of the Broadshore Hub WFDAs.

323. Schedule 3 of the Marine Works (Environmental Impact Assessment) Regulations 2007 and Schedule 4 of the Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017 require that cumulative effects of the development should be described in the Broadshore Hub WFDAs EIA Report. Planning Circular 1/2017 (Scottish Government, 2017) and PAN 1/2013 (Scottish Government, 2013) also set out this requirement. There is currently no specific Scottish guidance on the methodological framework for assessing cumulative effects in general. PAN 1/2013 acknowledges that "*assessment methods for cumulative impacts and interactions vary"* and that it is a *"matter of professional judgement to ensure the relevant projects and activities – and their environmental effects – are identified, taking into account the circumstances of the individual proposal and its location*".

324. The CEA for the Broadshore Hub WFDAs will be undertaken in accordance with the relevant guidance set out in **Section 4.2,** specifically Planning Inspectorate (2019[17]), and will be updated with relevant information from the Cumulative Effects Framework (relevant only to marine mammals and ornithology) when this is made publicly available (**Table 4.1**).

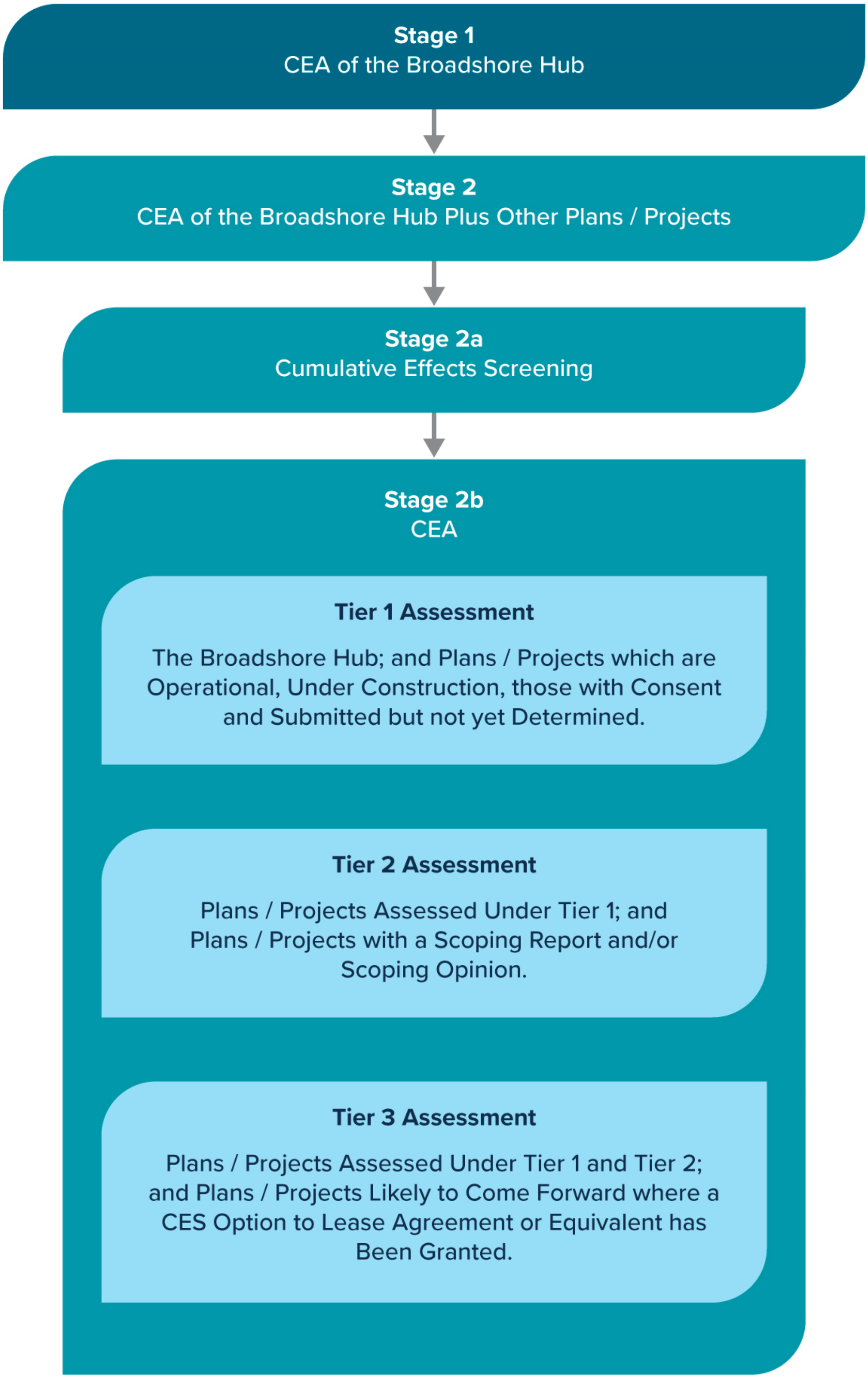
325. The Broadshore Hub WFDAs EIA Report will consider the potential effects which may arise from the construction, operation and maintenance and decommissioning of the Broadshore Hub WFDAs, as a whole, and for site-specific effects associated with the individual Broadshore WFDA, Sinclair WFDA and Scaraben WFDA.

326. The CEA will be considered in two stages (as shown in **Plate 4.3**)

- **Stage 1:** CEA of the Broadshore Hub (i.e., the Broadshore Hub WFDAs, the Broadshore Hub OfTDAs and the Broadshore Hub OnTDAs) (**Section 4.6.1**).
- **Stage 2:** CEA of the Broadshore Hub (i.e., the Broadshore Hub WFDAs, the Broadshore Hub OfTDAs and the Broadshore Hub OnTDAs), alongside other plans or projects which fall into the criteria listed above. Stage 2 is separates into two separate steps; Stage 2a: Cumulative Effects Screening (**Section 4.6.2**), and Stage 2b: Cumulative Effects Assessment (**Section 4.6.3**).

[17] This guidance is considered most robust and appropriate for the Broadshore Hub WFDAs, in the absence of the Cumulative Effects Framework.

Plate 4.3: Cumulative Effects Assessment Staged Approach



4.6.1 Stage 1: Cumulative Effects Assessment of the Broadshore Hub

327. As the Broadshore Hub encompasses onshore elements (e.g. the Broadshore Hub OnTDA), the CEA approach, including its temporal and spatial scope will be agreed with Aberdeenshire Council as well as MD-LOT to ensure a consistent project-wide approach. Sufficient information concerning the proposed offshore and onshore export cable will be included in the Broadshore Hub WFDAs EIA Report to understand the cumulative effects of the Broadshore Hub.

328. A CEA between two of the three projects within the Broadshore Hub WFDAs will not be undertaken as the combination of any two of the projects would already be captured within the CEA for the whole Broadshore Hub.

329. Temporary mooring of floating substructures and/or floating offshore units (FOUs) (known as 'wet storage') will be undertaken at port(s) or dedicated mooring locations under consents and Marine Licence(s) as required, of the relevant ports/storage locations. The port(s) where turbines will be assembled and the wet storge locations are yet to be confirmed and will depend on a number of factors including capacity and availability.

330. The Applicants' position is that the Broadshore Hub WFDAs EIA Report will not include consideration of earlier manufacturing activities, port activities (e.g. WTG assembly), or 'wet storage' of the FOUs. Those do not form part of the Broadshore Hub WFDAs or activities for which consent is sought. Where those activities constitute development requiring a new planning permission, or requiring a Marine Licence, that would need to be applied for separately by the relevant party seeking such consent and would need to be accompanied by any appropriate environmental assessment required. Therefore, wet storage of FOUs will be included within the CEA section along with other projects and plans.

4.6.2 Stage 2a: Cumulative Effects Screening

331. In accordance with the above guidance documents, other plans or projects that are deemed likely to go ahead or are going ahead, and for which sufficient information is available, will be taken forward for consideration. For the purposes of the CEA, the criteria of other plans or projects that are proposed for consideration include those:

- Already constructed;
- Under construction;
- Permitted application(s), but not yet implemented;
- Submitted application(s) not yet determined; and
- Plans and projects which are "reasonably foreseeable" including:
- Projects in Scottish waters;
- Projects in English waters, or other non-UK parts of the North Sea if considered to be relevant, have connectivity, or the potential of a cumulative effect;
- Any potential project that had submitted a Scoping Report up to six months prior to submission of the Broadshore Hub WFDAs consent application date; and
- Offshore wind and non-wind projects.

332. The initial 'long list' of plans or projects will be developed based on the above criteria, and will be screened for each potential impact-receptor pathway using the following process:

- **Conceptual overlap:** an impact-receptor pathway (in EIA terms) describes an impact which has the potential to directly or indirectly affect the receptor(s) in question.
- **Physical overlap:** ability for impacts arising from the Broadshore Hub WFDAs to overlap with those from other plans or projects on a receptor basis. An overlap of the physical extents of the impacts arising from the two (or more) projects/plans must be established for a cumulative effect to arise. There are exceptions to this for certain mobile receptors that are potentially subject to impacts from multiple plans or projects.
- **Temporal overlap:** for a cumulative effect to arise from two or more plans or projects, a temporal overlap of impacts arising from each must be established. Some impacts are active only during certain phases of development (e.g. piling noise during construction). However, the absence of a strict overlap may not necessarily mean there is no potential for cumulative effect, as receptors may become further affected by additional, non-temporally overlapping projects.

333. The cumulative effects screening stage will be undertaken by experienced specialists, using current guidance and best practice. After review of the long list, the remaining projects or plans are taken forward to the assessment stage. This refined short list of projects will be agreed with stakeholders and Scottish Ministers via MD-LOT as part of ongoing consultation in the post-Scoping phase.

4.6.3 Stage 2b: Cumulative Effects Assessment

334. At the assessment stage, information is gathered on plans or projects taken forward from the screening stage. Where the likely significant effects (as defined by the EIA Regulations) for the Broadshore Hub WFDAs alone are assessed as negligible, or where an effect is predicted to be highly localised, these will not be considered within the Broadshore Hub WFDAs CEA, as it is considered that there would be no potential for cumulative effects with other plans or projects.

335. A tiered approach will be used when undertaking Stage 2b of the CEA of the Broadshore Hub WFDAs, which provides a framework for placing relative weight upon the potential for each plan or project to be included in the CEA, based upon the plans or project's current stage of maturity and certainty in the design or effects. Projects or plans will be assessed in Stage 2b using the following tiers:

- **Tier 1 assessment**: the Broadshore Hub, plus projects which are operational, under construction, those with consent and submitted but not yet determined.
- **Tier 2 assessment:** all plans/projects assessed under Tier 1, plus those projects with a Scoping Report and/or Scoping Opinion.
- **Tier 3 assessment:** all plans/projects assessed under Tier 1 and Tier 2, plus those projects likely to come forward where a CES Option to Lease Agreement or equivalent has been granted.

336. All other relevant plans or projects that are publicly available six months prior to submission of the Broadshore Hub WFDAs application will be considered in the CEA.

337. The CEA methodology will follow the methodology described in **Section 4.5**, where possible, for consistency throughout the EIA. Where potential cumulative environmental effects have been identified, these will be considered further in the relevant environmental impact assessments in the Broadshore Hub WFDAs EIA Report.

338. It is expected that the following activity types will be considered in the CEA of the Broadshore Hub WFDAs based on maximum Zone of Influences (ZoIs) identified from the relevant technical assessments detailed within this Broadshore Hub WFDAs Scoping Report:

- Marine disposal and dredging sites;
- Energy (including offshore wind, wave and tidal projects (including INTOG projects), cables, Carbon Capture and Storage (CCS) and Underground Coal Gasification (UCG));
- Oil and gas infrastructure;
- Cables and pipelines;
- Ports and harbours; and
- Military, aviation and radar.

339. The Applicants will seek agreement with MD-LOT and Aberdeenshire Council on the list of projects and/or plans to be included in the CEA as part of ongoing post-Scoping consultation.

4.7 Transboundary Effects

340. Transboundary effects arise when impacts from a development within one European Economic Area (EEA) state's[18] territory significantly affects the environment or interests of another EEA state(s). The EIA Directive, and thus the relevant EIA Regulations, requires the assessment of transboundary effects. This Broadshore Hub WFDAs Scoping Report will therefore identify any relevant transboundary impacts that will need to be considered within the EIA.

341. The United Nations Economic Commission for Europe Convention on EIA in a Transboundary Context (the 'Espoo Convention') presents the need to consider transboundary effects and requires assessments to be extended across borders between Parties of the Convention when a planned activity may cause significant adverse transboundary impacts. The Espoo Convention has been transposed into Scottish EIA law by way of Regulation 29 of the Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017, and Regulation 18 of the Marine Works (Environmental Impact Assessment) Regulations 2007. These Regulations set out the processes for consultation and notification. In the event that a project is considered to cause significant

[18] Following the exit of the UK from the European Union (EU) in December 2020, the UK is no longer an EEA state. However, for the purposes of assessing potential transboundary effects, the approach outlined above has been followed for the Broadshore Hub WFDAs.

transboundary effects, the EIA Regulations 2017 require Scottish Ministers to engage with the affected EEA State and invite them to participate in consultation.

342. The assessment of potential transboundary effects will consider the following elements:

- Characteristics of the Broadshore Hub WFDAs;
- Location of the Broadshore Hub WFDAs, including proximity to relevant EEA States;
- Environmental context/importance, for example any EEA protected areas which may be affected by the Broadshore Hub WFDAs;
- Potential pathways of effect;
- The extent of potential effects;
- The scale of the potential effect, to consider magnitude, probability, duration, frequency and recoverability; and
- Cumulative impacts.

343. As detailed in the technical chapters**,** the following receptors may experience transboundary impacts from the Broadshore Hub WFDAs:

- **Chapter 8: Marine Mammals;**
- **Chapter 9: Offshore Ornithology;**
- **Chapter 10: Commercial Fisheries;**
- **Chapter 11: Shipping and Navigation;**
- **Chapter 16: Socioeconomics, Tourism and Recreation; and**
- **Chapter 17: Climate Change**.

344. Where applicable, consideration of transboundary effects will follow the standard approach to EIA with regards to sensitivity, magnitude, and significance. The assessment will be presented within each technical chapter of the Broadshore Hub WFDAs EIA Report where relevant.

4.8 Related Environmental Assessments

4.8.1 Habitats Regulations Appraisal

345. HRA is a precautionary, rigorous and legally binding procedure to protect Scotland's European sites. HRA considers the potential for Likely Significant Effects (LSE) to arise as a result of a plan or project, which may affect the integrity of the national site network and their associated qualifying features, and can involve up to nine stages (NatureScot, 2023):

- **Stage 1 – What is the plan or project?** This stage requires the Applicants to provide the competent authority with sufficient information about the Broadshore Hub WFDAs to carry out an HRA.
- **Stage 2: Is the plan or project directly connected with or necessary to site management for nature conservation?** This test is to identify and remove from further assessment those proposals which are clearly necessary to, or of value to, or inevitable as part of, management of the site for its qualifying interest. All qualifying interests should be considered. If the proposal does not meet these criteria then Stage 3 is considered.
- **Stage 3: Is the plan or project (either alone or in combination with other plans or projects) likely to have a significant effect on a European site?** This is essentially a screening stage to determine whether or not appropriate assessment is required. It is important to consider any connectivity between the proposal and each of the qualifying interests, i.e. are there processes or pathways by with the proposal may influence the site's interest directly or indirectly? If there is doubt or a lot of detail is required to justify screening out, a likely significant effect should be concluded and Stage 4 should be undertaken. The effects of the projects should be considered 'in combination' with the effects of other projects and plans on the same European site. Stages 1, 2 and 3 are included in the **Broadshore Hub WFDAs HRA Screening Report** (BlueFloat | Renantis Partnership, 2024). As per the EIA consenting strategy detailed in **Chapter 1: Introduction**, a separate HRA will be undertaken for the Broadshore WFDA, the Sinclair WFDA and the Scaraben WFDA, and will also consider the Broadshore Hub WFDAs and the Broadshore Hub as a whole.
- **Stage 4: Inform an appropriate assessment of the implications for the site in view of its conservation objectives:** Where a plan or project is considered to have a likely significant effect on the qualifying interest(s) of a European site an appropriate assessment is required. The competent authority carries out the appropriate assessment with advice from NatureScot. A Report to Inform the Appropriate Assessment (RIAA) will be included with the Broadshore Hub WFDAs consent applications.
- **Stage 5: Can it be ascertained that the proposal will not adversely affect the integrity of the site?** For the Broadshore Hub WFDAs to be consented, the appropriate assessment must ascertain that they will not adversely affect the integrity of a European site alone or in combination with other plans and projects. Conclusions must be based on there being no reasonable scientific doubt as to the absence of adverse effects. The integrity of the site only applies to the qualifying interests and is directly linked to the conservation objectives for the site.

346. Stages 6 to 9 are only considered in exceptional circumstances where it cannot be ascertained that the plan or project will not adversely affect the integrity of a European site.

- **Stage 6: Are there alternative solutions?** If it cannot be ascertained that the proposal will not adversely affect the integrity of a European site it can only proceed if there are no alternative solutions AND there are imperative reasons of overriding public interest (IROPI). Considering alternative solutions, this requirement is set out in regulation 29 of the offshore Habitats Regulations. Guidance suggests alternative solutions could include alternative locations or routes; different scales or designs of development; alternative processes; or other different, practicable approaches which would have a lesser impact. If there are alternative solutions to the proposal, consent cannot be given. There is then no need to move on to assess whether or not IROPI applies. If alternatives are provided it may be necessary to repeat Stages 1-5. If there are no alternative solutions, stages 7 to 9 should be considered.

- **Stage 7: Would a priority habitat or species be adversely affected?** There are no priority species (as defined in the Habitats Directive) in Scotland's SACs and the Birds Directive does not refer to 'priority' species. Priority habitats that are qualifying interests of SACs in Scotland are provided on NatureScot's website. These habitats are given a greater level of protection under regulation 29 of the offshore Habitats Regulations. Consideration needs to be taken as to whether priority habitat in Scotland would be adversely affected.
- **Stages 8 and 9: Are there imperative reasons of overriding public interest?** Where it cannot be ascertained that a plan or project will not adversely affect the integrity of a European site, and there are no alternative solutions, a plan or project can only proceed if there is an IROPI case for doing so (regulation 29 of the offshore Habitats Regulations). Scottish Ministers must be consulted. Where a priority habitat could be affected, IROPI are limited to those reasons outlined in regulation 29. These must relate to human health, public safety, beneficial consequences of primary importance to the environment, or any other IROPI subject to the opinion of the Scottish Ministers. Where a plan or project is to proceed for IROPI Scottish Ministers have a duty to secure any compensatory measures necessary to ensure the overall coherence of the UK site network is protected (regulation 36 of the Habitats Regulations).

4.8.2 Nature Conservation Marine Protected Area Assessment

347. As set out in **Chapter 2: Policy and Legislative Context,** Nature Conservation Marine Protected Areas (NCMPAs) in Scotland are designated under the Marine (Scotland) Act 2010 within 12 nm, and under the Marine and Coastal Access Act 2009 in offshore waters between 12 nm and 200 nm. NCMPAs are designated to protect biodiversity and heritage, with specific focus on protected features (species, habitats, large scale features or geomorphological features). A **NCMPA Screening Report** for the Broadshore Hub WFDAs is presented in **Appendix 2** of this Broadshore Hub WFDAs Scoping Report.

348. The Broadshore Hub WFDAs EIA Report will assess the potential for impacts on NCMPAs, informed by engagement with MD-LOT as the competent authority, and NatureScot, and any other relevant information deemed appropriate. At the Scoping Workshop held in September 2023 for the Broadshore Hub WFDAs, NatureScot confirmed that the 'Nature Conservation Marine Protected Area Management Handbook' is currently being updated should be published in time to inform the Broadshore Hub WFDAs EIA process **(Table 4.1**). NatureScot further advised the need to clearly present any overlap of the Broadshore Hub infrastructure or activities with features of NCMPAs and consideration should be given to impacts on the features' conservation objectives.

350. There are two stages to the NCMPA Assessment:

- **Stage 1: Initial Screening -** will first identify whether the activity is capable of affecting the protected features of a NCMPA. Subsequently, the initial screening will determine whether the activity is capable of affecting, other than insignificantly, the protected features of a NCMPA. Stage 1 is provided in **Appendix 2: NCMPA Screening Report.**
- **Stage 2: Main Assessment -** where a project may have a significant risk of hindering the achievement of an MPA's conservation objectives, the EIA Report for the project will include the necessary information to inform a NCMPA assessment. The NCMPA assessment is undertaken by the Public Authority (Scottish Ministers for Marine Licenses and s.36 consents) in consultation with NatureScot/Joint Nature Conservation Committee (JNCC).

4.8.3 European Protected Species Risk Assessments

351. As described in **Chapter 2: Policy and Legislative Context**, under the Habitats Regulations, it is unlawful to:

- Deliberately capture, injure or kill a European Protected Species (EPS);
- Deliberately disturb an EPS; and/or
- Damage or destroy a breeding site or resting place of an EPS.

352. It may be lawful to carry out certain activities which are likely to cause disturbance or injury to EPS, if an EPS licence is obtained. EPS licences for licensable activities (e.g. geophysical surveys) will be granted by MD-LOT on behalf of Scottish Ministers, subject to three tests being met:

- **Test 1:** The reason for the licence must relate to one of the purposes specified in Conservation of Offshore Marine Habitats and Species Regulations 2017 (for activities within 12 – 200 nm).
- **Test 2:** There is no satisfactory alternative to undertaking the licensable activity.
- **Test 3**: the proposed licensable activity must not be detrimental to maintaining the species at 'favourable conservation status'.

353. As part of early project development, the Applicants have provided EPS Risk Assessments to MD-LOT in relation to EPS licence applications to undertake geophysical, geotechnical and environmental surveys within the Broadshore Hub WFDAs. MD-LOT and NatureScot determined that no EPS licence was required for this purpose. The Applicants will apply for further EPS licences, as appropriate, should these be required in the future.

4.9 Structure and Content of the Environmental Impact Assessment Report

354. As outlined in **Section 1.3**, separate consents will be sought for the Broadshore WFDA; the Sinclair WDFA; and the Scaraben WFDA. Each consent application will be accompanied by the Broadshore Hub WFDAs EIA Report, which will present an assessment of likely significant effects on the environment in the following scenarios:

- **Broadshore Hub WFDAs**: An overall Broadshore Hub WFDAs assessment that will consider the construction, operation and maintenance, and decommissioning of the Broadshore Hub WFDAs (i.e., the Broadshore WFDA, Sinclair WFDA and Scaraben WFDA together), and assess on a Broadshore Hub WFDAs basis the likely significant effects if all three WFDAs are built out.
- **WFDA specific**: A WFDA specific assessment that will consider the construction, operation and maintenance, and decommissioning of each individual WFDA (i.e., the Broadshore WFDA, or the Sinclair WFDA or the Scaraben WFDA), and assess on a WFDA specific basis the likely significant effects of each individual WFDA if it were built in isolation.

356. The Broadshore Hub WFDAs EIA Report will be submitted in a series of volumes as shown in **Plate 4.4**, and as described below:

- **Non-Technical Summary (NTS)**: Each consent application will be accompanied by a Broadshore WFDA NTS, a Sinclair WFDA NTS or a Scaraben WFDA NTS, each presenting the key findings of their respective EIA in a clear and concise format.
- **Volume 1 - Broadshore Hub WFDAs EIA: Technical Chapters**: A single document common to all applications, presenting the introductory chapters and the impact assessment technical chapters of the Broadshore Hub WFDAs. The impact assessment chapters will be based on the maximum design envelope and therefore the worst-case scenario for each receptor topic. The WFDA design parameters for the Broadshore WFDA, Sinclair WFDA and Scaraben WFDA individually will be no greater than that for the Broadshore Hub WFDAs.
  - Each impact assessment chapter will present the assessment of the Broadshore Hub WFDAs, followed by a concise assessment for the Broadshore WFDA, the Sinclair WFDA and the Scaraben WFDA. Due to their nature, the greenhouse gas assessment in **Chapter 17: Climate Change** and the SEIA in **Chapter 16: Socioeconomics, Tourism and Recreation** will be based on the overall Broadshore Hub WFDAs; individually the Broadshore WFDA, Sinclair WFDA and Scaraben WFDA; and also for the three projects individually (i.e., the Broadshore Project, Sinclair Project, and Scaraben Project).
  - The CEA will consider the impacts arising from the Broadshore Hub WFDAs, the Broadshore Hub OfTDAs and the Broadshore Hub OnTDAs collectively, to allow for a full Broadshore Hub assessment, as well as cumulatively with other relevant plans, projects and activities (as set out in **Section 4.6**). The Broadshore WFDA, Sinclair WFDA and Scaraben WFDA will not be considered individually within the CEA.
- **Volume 2 - Broadshore Hub WFDAs EIA: Figures**: A single document common to all applications, presenting the figures supporting the Broadshore Hub WFDAs EIA.
- **Volume 3 - Broadshore Hub WFDAs EIA: Technical Appendices**: A single document common to all applications, presenting technical appendices supporting the Broadshore Hub WFDAs EIA.
- **Volume 4 (a – c) - WFDA Summary EIA**: Each consent application will be accompanied by a Broadshore WFDA Summary EIA, a Sinclair WFDA Summary EIA or Scaraben WFDA Summary EIA, each presenting a summary of the impact assessments and commitments (i.e. mitigation and monitoring) and also a summary of the HRA and NCMPA Assessments.
- **RIAA**: A single RIAA common to all applications informing the second stage of the HRA for the Broadshore Hub WFDAs, followed by concise information informing the second stage of the HRA for the for the Broadshore WFDA, the Sinclair WFDA and the Scaraben WFDA.
- **Other supporting documentation:** Presenting the MPA Assessment, Pre-application Consultation, and other documentation to support the WFDA application.

Plate 4.4: Structure of the Broadshore Hub WFDAs EIA Report and Supporting Documentation to the Applications

4.10 Scoping Questions to Consultees

357. The following questions are posed to consultees to help them frame and focus their response to the approach to scoping and EIA for the Broadshore Hub WFDAs, which will in turn inform the Scoping Opinion:

- Do consultees agree that there should be one overall Broadshore Hub WFDAs assessment and then summaries for the Broadshore WFDA, Sinclair WFDA and Scaraben WFDA individually?

- Do consultees agree with the proposed methodology for identifying and assessing significant effects?
- Do consultees agree that a stand-alone human health chapter is not required within the EIA?
- Do consultees agree that the proposed methodology for assessing cumulative effects is appropriate for identifying significant effects?
- Do consultees agree that any potential project that had submitted a Scoping Report up to six months prior to submission of the Broadshore Hub WFDAs consent application date is acceptable?
- Do consultees have any comment on the proposed change to the Sinclair WFDA boundary?
- Do you have any other matters or information sources that you wish to present?

4.11 References

6 Alpha Associates Ltd (2023). Broadshore Offshore Wind Farm; Unexploded Ordnance Threat and Risk Assessment. Project No.: 50012_1

BlueFloat | Renantis Partnership, (2024). Broadshore Hub Wind Farm Development Areas Habitats Regulations Screening Report.

Bochert and Zettler. (2006). Effect of Electromagnetic Fields on Marine Organisms. Chapter 14 in Offshore Wind Energy; Research on Environmental Impacts.

Boles, L. C. and Lohmann, K. J. (2003). True navigation and magnetic maps in spiny lobsters. Nature, 421(6918), 60-63.

Centre for Environment, Fisheries and Aquaculture Science (Cefas) (2012). Guidelines for Data Acquisition to Support Marine Environmental Assessments of Offshore Renewable Energy Projects. Available at: https://tethys.pnnl.gov/sites/default/files/publications/CEFAS_2012_Eenvironmental_Assessment_Guidance.pdf

Centre for Environment, Fisheries and Aquaculture Science, (2012). Guidelines for data acquisition to support marine environmental assessments of offshore renewable energy projects. Available at: https://tethys.pnnl.gov/sites/default/files/publications/CEFAS_2012_Eenvironmental_Assessment_Guidance.pdf

Centre for Environment, Fisheries and Aquaculture, (2004). ‘Offshore Wind Farms: Guidance Note for EIA in Respect of Food and Environmental Protection Act (FEPA) and Coast Protection Act (CPA) Requirements’. Available at: https://www.cefas.co.uk/publications/files/windfarm-guidance.pdf

Chartered Institute for Ecology and Environmental Management (CIEEM) (2018). Guidelines for Ecological Impact Assessment in the UK and Ireland Terrestrial, Freshwater, Coastal and Marine.

Available at: https://cieem.net/wp-content/uploads/2018/08/ECIA-Guidelines-2018-Terrestrial-Freshwater-Coastal-and-Marine-V1.1Update.pdf.

Chartered Institute for Ecology and Environmental Management, (2018). 'Guidelines for Ecological Impact Assessment in the UK and Ireland. Terrestrial, Freshwater, Coastal and Marine'. Available at: https://cieem.net/wp-content/uploads/2018/08/ECIA-Guidelines-2018-Terrestrial-Freshwater-Coastal-and-Marine-V1.2-April-22-Compressed.pdf

Dannheim, J., Bergström, L., Birchenough, S.N., Brzana, R., Boon, A.R., Coolen, J.W., Dauvin, J.C., De Mesel, I., Derweduwen, J., Gill, A.B. and Hutchison, Z.L., (2020). Benthic effects of offshore renewables: identification of knowledge gaps and urgently needed research. ICES Journal of Marine Science, 77(3), pp.1092-1108.

EMODnet (2023). EMODnet broad-scale seabed habitat map for Europe (EUSeaMap). Available from: https://emodnet.ec.europa.eu/geoviewer/

European Commission, (1999). 'Guidelines for the Assessment of Indirect and Cumulative Impacts as well as Impact Interactions'. Available at: https://tethys.pnnl.gov/sites/default/files/publications/European-Commission-1999.pdf

European Commission, (2017). 'Environmental impact assessment of projects. Guidance on the preparation of the environmental impact assessment report'. Available: https://op.europa.eu/en/publication-detail/-/publication/2b399830-cb4b-11e7-a5d5-01aa75ed71a1/language-en

EUSeaMap (2021). EUSeaMap (2021) Broad-Scale Predictive Habitat Map - EUNIS classification. Available at: https://emodnet.ec.europa.eu/en/seabed-habitats. Fugro EMU Ltd (2014). Captain EOR Project, UKCS Block 13/22a: WE8b Environmental Baseline Survey and Habitat Assessment Report. Volume 2: Captain D & BLPB to Area D Routes Habitat Assessment. J35025-RES8bV2(0).

Fugro (2021a). Site survey Captain UKCS Block 13/22a. Fugro report No. 210272, Habitat Assessment Report.

Fugro (2021b). Site Survey Captain UKCS Block 13/22a. Fugro report No. 210272, Environmental Baseline Report.

Fugro EMU Ltd (2015a). Captain EOR Project, UKCS Block 13/22a: WE8b Environmental Baseline Survey and Habitat Assessment Report. Volume 6: Captain BLPB Habitat Assessment. J35025-RES8bV6(1).

Fugro EMU Ltd (2015b). Captain EOR Project, UKCS Block 13/22a: WE8b Environmental Baseline Survey and Habitat Assessment Report. Volume 5: Captain BLPB Environmental Baseline Survey. J35025-RES8bV5(0).

Gibb, N., Tillin, H.M., Pearce, B. and Tyler-Walters H. (2014). Assessing the sensitivity of Sabellaria spinulosa to pressures associated with marine activities. JNCC report No. 504.

Gill, A. B. and Bartlett, M., (2010). Literature review on the potential effects of electromagnetic fields and subsea noise from marine renewable energy developments on Atlantic salmon, sea trout and European eel. Scottish Natural Heritage, Commissioned Report No. 401.

Heinisch P., and Wiese. K. (1987). Sensitivity to Movement and Vibration of Water in the North Sea Shrimp Crangon Crangon: Journal of Crustacean Biology Vol. 7, No. 3 pp. 401-413 Published by: The Crustacean Society.

Herrnkind, W. F. and McLean, R. (1971). Field studies of homing, mass emigration, and orientation in the spiny lobster, Panulirus argus. Annals of the New York Academy of Sciences, 188(1), 359-376.

Institute of Environmental Management and Assessment, (2015). 'IEMA Environmental Impact Assessment Guide to Shaping Quality Development'. Available at: https://www.iaia.org/pdf/wab/IEMA%20Guidance%20Documents%20EIA%20Guide%20to%20Shaping%20Quality%20Development%20V6.pdf

Institute of Environmental Management and Assessment, (2017). 'Delivering Proportionate EIA. A Collaborative Strategy for Enhancing UK Environmental Impact Assessment Practice'. Available: https://www.iema.net/resources/reading-room/2017/07/18/delivering-proportionate-eia

Ithaca Energy (2022). The Captain EOR Stage 2 Phase II Project Environmental Statement (online). Department for Business, Energy and Industrial Strategy (BEIS) Reference No. ES/2022/007. Available from: https://assets.publishing.service.gov.uk/media/63037a668fa8f5372c7a5d23/Captain_EOR_Stage_2_Phase_II_ES_Redacted.pdf

Joint Nature Conservation Committee (JNCC) (2001). Marine Monitoring Handbook. Available at https://data.jncc.gov.uk/data/ed51e7cc-3ef2-4d4f-bd3c-3d82ba87ad95/marine-monitoring-handbook.pdf.

Joint Nature Conservation Committee (JNCC) (2012). Identification of Priority Marine Features in Scotland's seas. JNCC Report No. 462. Aberdeen.

Joint Nature Conservation Committee (JNCC) (2014). JNCC clarifications on the habitat definitions of two habitat Features of Conservation Importance: Mud habitats in deep water, and Sea-pen and burrowing megafauna communities. Peterborough, UK.

Kröncke I. (2011). Changes in Dogger Bank macrofauna communities in the 20th century caused by fishing and climate. Estuarine, Coastal and ShelfScience 94: 234-245.

Künitzer A., Basford D., Craeymeersch J.A., Dewarumez J.M., Dörjes J., Duineveld G.C.A., Eleftheriou A., Heip C., Herman P., Kingston P., Niermann U., Rachorm E., Rumohr H. & de Wilde P.A.J. (1992). The benthic infauna of the North Sea: species distribution and assemblages. ICES Journal of Marine Science 49: 127-143.

Lindeboom, H., Kouwenhoven, H., Bergman, M., Bouma, S., Brasseur, S., Daan, R., Fijn, R., de Haan, D., Dirksen, S., van Hal, R., Hille Ris Lambers, R., ter Hofstede, R., Krijgsveld, K., Leopold, M. and Scheidat, M. (2011) Short-term ecological effects of an offshore windfarm in the Dutch coastal zone; a compilation. Environmental Research Letters, 6(3).

Linley, E, A. S., Wilding, T. A, Black, K., Hawkins, A. J. S. and Mangi, S. (2007). Review of the reef effects of offshore wind farm structures and their potential for enhancement and mitigation. Report from PML Applications Ltd and the Scottish Association for Marine Science to the Department for Business, Enterprise and Regulatory Reform (BERR), Contract No: RFCA/005/0029P.

Lohmann, K., Pentcheff, N., Nevitt, G., Stetten, G., Zimmer-Faust, R., Jarrard, H. and Boles, L. C. (1995). Magnetic orientation of spiny lobsters in the ocean: experiments with undersea coil systems. The Journal of experimental biology, 198(10), 2041-2048.

Lovell J.M, Findlaya M.M, Moateb R M and Yanc H.Y (2005).The hearing abilities of the prawn Palaemon serratus. Comparative Biochemistry and Physiology, Part A 140 89 –100.

Maclean et al., (2009). ‘A Review of Assessment Methodologies for Offshore Windfarms’. Available at: https://tethys.pnnl.gov/sites/default/files/publications/Maclean-et-al-2009.pdf

Maclean I.M.D., Wright L.J., Showler D.A. and Rehfisch M.M. (2009). A Review of Assessment Methodologies for Offshore Wind farms (COWRIE METH-08-08). Available at: https://tethys.pnnl.gov/sites/default/files/publications/Maclean-et-al-2009.pdf.

Marine Biological Association (2023). The Marine Life Information Network (MarLIN). Available at: https://www.marlin.ac.uk/species

Marine Scotland (2015). Scotland’s National Marine Plan: A Single Framework for Managing Our Seas. Available at: https://www.gov.scot/binaries/content/documents/govscot/publications/strategy-plan/2015/03/scotlands-national-marine-plan/documents/00475466-pdf/00475466-pdf/govscot%3Adocument/00475466.pdf

Marine Scotland (2018a). Scoping ‘Areas of Search’ Study for offshore wind energy in Scottish Waters. Available at: https://www.gov.scot/publications/scoping-areas-search-study-offshore-wind-energy-scottish-waters-2018/documents/

Marine Scotland (2018b). Marine Scotland Consenting and Licensing Guidance For Offshore Wind, Wave and Tidal Energy Applications. Available at: https://www.gov.scot/publications/marine-scotland-consenting-licensing-manual-offshore-wind-wave-tidal-energy-applications/documents/

Marine Scotland, (2018) ‘Marine Scotland Consenting and Licensing Guidance for Offshore Wind, Wave and Tidal Energy Applications’. Available at: https://www.gov.scot/binaries/content/documents/govscot/publications/advice-and-guidance/2020/02/marine-licensing-applications-and-guidance/documents/guidance/guidance-manual-for-offshore-wind-wave-and-tidal-energy-application/guidance-manual-for-offshore-wind-wave-and-tidal-energy-application/govscot%3Adocument/Guidance%2BManual%2Bfor%2BOffshore%2BWind%252C%2BWave%2Band%2BTidal%2BEnergy%2BApplication.pdf

NatureScot (2022). Guidance on Marine non-native species . Available at: https://www.nature.scot/professional-advice/land-and-sea-management/managing-coasts-and-seas/marine-non-native-species

NatureScot (2023) Habitats Regulations Appraisal (HRA). Available at: https://www.nature.scot/professional-advice/planning-and-development/environmental-assessment/habitats-regulations-appraisal-hra

Normandeau, Exponent, T. Tricas, and A. Gill. (2011). Effects of EMFs from Undersea Power Cables on Elasmobranchs and Other Marine Species. U.S. Dept. of the Interior, Bureau of Ocean Energy Management, Regulation, and Enforcement, Pacific OCS Region, Camarillo, CA. OCS Study BOEMRE 2011-09.

OSPAR (2008). OSPAR List of Threatened and/or Declining Species and Habitats (OSPAR Reference Number: 2008-6). Available at: https://www.ospar.org/site/assets/files/1505/08-06e_ospar_list_species_and_habitats.doc

OSPAR (2010). OSPAR Background Document for Seapen and Burrowing megafauna Communities (OSPAR ref. no. 481/2010) [Online]. Microsoft Word - P00481_Seapen and burrowing megafauna.doc (ospar.org)

OSPAR (2013). Background Document on Sabellaria spinulosa reefs. Available at: https://www.ospar.org/documents?d=7342

OSPAR Commission, (2009). ‘Assessment of the environmental impacts of cables’. Available at: https://qsr2010.ospar.org/media/assessments/p00437_Cables.pdf

Planning Inspectorate (2019). ‘Advice Note Seventeen: Cumulative effects assessment relevant to nationally significant infrastructure projects (version 2)’. Available at: https://infrastructure.planninginspectorate.gov.uk/legislation-and-advice/advice-notes/advice-note-17/

RenewableUK, (2013). ‘Cumulative Impact Assessment Guidelines. Guiding Principles For Cumulative Impacts Assessment In Offshore Wind Farms’. Available at: https://tethys.pnnl.gov/sites/default/files/publications/Cumulative-Impact-Assessment-Guidelines.pdf

Scottish Government (2012). Non-native species: code of practice. ISBN 9781780459301. Available at: https://www.gov.scot/publications/non-native-species-code-practice/.

Scottish Government, (2017). ‘PAN 1/2013: Environmental Impact Assessment regulations’. Available at: https://www.gov.scot/publications/planning-advice-note-1-2013-environmental-impact-assessment/

Scottish Government, (2017). ‘Planning Circular 1/2017: Environmental Impact Assessment regulations’. Available at: https://www.gov.scot/publications/planning-circular-1-2017-environmental-impact-assessment-regulations-2017/

Scottish Government, (2023). National Planning Framework 4. Available at: https://www.gov.scot/publications/national-planning-framework-4/

Scottish Government. (2022). Guidance for applicants on using the design envelope for applications under Section 36 of the Electricity Act 1989. Available online at: https://www.gov.scot/publications/guidance-applicants-using-design-envelope-applications-under-section-36-electricity-act-1989/documents

Scottish Natural Heritage, (2018). 'Environmental Impact Assessment Handbook'. Available at: https://www.nature.scot/sites/default/files/2018-05/Publication%202018%20-%20Environmental%20Impact%20Assessment%20Handbook%20V5.pdf

SNH (2017) SNH Commissioned Report 406: Descriptions of Scottish Priority Marine Features (PMFs).

SSER (2022). Berwick Bank Wind Farm Offshore Environmental Impact Assessment Report.

Tomanová, K. and Vácha, M. (2016). The magnetic orientation of the Antarctic amphipod *Gondogeneia antarctica* is cancelled by very weak radiofrequency fields. Journal of Experimental Biology, 219(11), 1717-1724.

Tyler-Walters, H., James, B., Carruthers, M. (eds.), Wilding, C., Durkin, O., Lacey, C., Philpott, E., Adams, L., Chaniotis, P.D., Wilkes, P.T.V., Seeley, R., Neilly, M., Dargie, J. & Crawford-Avis, O.T. (2016). Descriptions of Scottish Priority Marine Features (PMFs). Scottish Natural Heritage Commissioned Report No. 406.

Tyler-Walters, H., Tillin, H.M., d'Avack, E.A.S., Perry, F. and Stamp, T. (2018). Marine Evidence-based Sensitivity Assessment (MarESA) – A Guide. Marine Life Information Network (MarLIN). Marine Biological Association of the United Kingdom, Plymouth, 91 pp.

Ugolini, A. and Pezzani, A. (1995). Magnetic compass and learning of the Y, axis (sea-land) direction in the marine isopod Idotea baltica basteri. Animal behaviour, 50(2), 295-300.

Walker, R, Weiss, L, Froján, C. and Basteri, D. (2009). Strategic Review of Offshore Wind Farm Monitoring Data Associated with FEPA Licence Conditions: Benthic Ecology. (Report No. ME1117). Report by Centre for Environment Fisheries and Aquaculture Science (CEFAS).

Walker, R., Judd, A., Warr, K., Doria, L., Pacitto, S., Vince, S. and Howe, L., (2010). Strategic review of offshore wind farm monitoring data associated with FEPA licence conditions: Underwater Noise. Center for Environment, Fisheries, and Aquaculture Science (Cefas).

Ware, S.J., & Kenny, A.J. (2011). Guidelines for the conduct of benthic studies at marine aggregate extraction sites. Cefas, Lowestoft (UK). Project Code: MEPF, 8, P75.

Wilhelmsson, D., Malm, T., Thompson, R., Tchou, J., Sarantakos, G., McCormick, N., Luitjens, S., Gullström, M, Patterson Edwards, J. K., Amir, O. and Dubi, A. (2010). Greening Blue Energy: Identifying and managing the biodiversity risks and opportunities of offshore renewable energy. International Union for Conservation of Nature (IUCN) [online]. Available from: https://www.actuenvironnement.com/media/pdf/news-22257-etude-uicn.pdf.

World Health Organisation (2020). Basic documents.49th ed. Geneva: World Health Organization.

5 Marine Geology, Oceanography and Physical Processes

5.1 Introduction

358. This chapter considers the scope of potential impacts of the construction, operation and maintenance, and decommissioning phases of the Broadshore Hub Wind Farm Development Areas (WFDAs) infrastructure on marine geology, oceanography and physical processes (including water quality).

359. This chapter provides an overview of the existing environment and sets out the proposed methodology and approach to assessing effects on marine geology, oceanography and physical processes (including water quality) in the Broadshore Hub WFDAs Environmental Impact Assessment (EIA) Report. This chapter has been prepared by Royal HaskoningDHV.

360. This chapter should be read in conjunction with the following chapters of the Broadshore Hub WFDAs Scoping Report:

- **Chapter 6: Benthic Ecology;**
- **Chapter 7: Fish and Shellfish Ecology;**
- **Chapter 8: Marine Mammals;**
- **Chapter 10: Commercial Fisheries;**
- **Chapter 13: Marine Infrastructure and Other Users;**
- **Chapter 14: Marine Archaeology and Cultural Heritage;** and
- **Chapter 17: Climate Change.**

361. The marine geology, oceanography and physical processes assessment is likely to have key inter-relationships with the above receptors, which will be considered appropriately where relevant in the Broadshore Hub WFDAs EIA Report.

5.2 Legislation, Policy and Guidance

362. **Table 5.1** describes the relevant policy and guidance used to inform the assessment of potential impacts on marine geology, oceanography and physical processes for the Broadshore Hub WFDAs. The overarching policy and legislation driving this development are described in **Chapter 2: Policy and Legislative Context.**

Table 5.1: Summary of Relevant Policy and Guidance for Marine Geology, Oceanography and Physical Processes

Relevant Policy or Guidance	Relevance to the Assessment
Policy	
The Marine Policy Statement (HM Government, 2011) provides the high-level approach to marine planning and general principles for decision making that contribute to achieving this vision. It also sets out the framework for environmental, social, and economic factors that need to be considered in marine planning.	The key reference is in Section 2.6.8.6 which states: "…Marine plan authorities should not consider development which may affect areas at high risk and probability of coastal change unless the impacts upon it can be managed. Marine plan authorities should seek to minimise and mitigate any geomorphological changes that an activity or development will have on coastal processes, including sediment movement." For water quality, the key reference is Section 2.6.4.1 which states: "Developments and other activities at the coast and at sea can have adverse effects on transitional waters, coastal waters and marine waters. During the construction, operation and decommissioning phases of developments, there can be increased demand for water, discharges to water and adverse ecological effects resulting from physical modifications to the water environment. There may also be an increased risk of spills and leaks of pollutants into the water environment and the likelihood of transmission of invasive non-native species, for example through construction equipment, and their impacts on ecological water quality need to be considered."
Scotland's National Marine Plan (Scottish Government, 2015) details strategic policies for the sustainable development of Scotland's marine resources out to 200 nautical miles.	Policy GEN 8 Coastal process and flooding states: "Developments and activities in the marine environment should be resilient to coastal change and flooding, and not have unacceptable adverse impact on coastal processes or contribute to coastal flooding." Paragraph 4.36 states: "Marine planners and decision makers should also be satisfied that activities and developments will be resilient to risks from coastal change and flooding over their lifetime and will not have an unacceptable impact on coastal change. They should seek to ensure that any geomorphological changes that an activity or development bring about in coastal processes, including sediment movement and wave patterns, are minimised, and mitigated, bearing in mind the potential impact on commercial interests such as fisheries and conservation of the natural environment and key coastal heritage sites. Developments which may affect areas at high risk and increase the probability of coastal change should not be permitted unless the impacts upon the area can be managed effectively." GEN 12 Water quality and resource: "Developments and activities should not result in a deterioration of the quality of waters to which the Water Framework Directive (WFD), Marine Strategy Framework Directive or other related Directives (as transposed into UK legislation) apply. Note that the WFD does not apply to the Broadshore Hub WFDAs given they are located 47 km offshore and therefore outside of WFD jurisdiction. However, the Marine Strategy Framework Directive will apply – see below." Paragraph 4.67 states: "The Marine Strategy Framework Directive introduces requirements for targets on contamination and eutrophication for marine waters out to 200 nautical miles." When published, Scotland's National Marine Plan 2 will also be considered and is assumed to supersede the existing National Marine Plan.
Aberdeenshire Local Development Plan	Policy R1.3 states: "In the coastal zone development must require a coastal location or there must be clear social, economic, environmental or community benefits arising. In either case there must be no coalescence of coastal developments or adverse impacts on natural coastal processes or habitats." Policy R1.4 states: "We will approve development associated with coastal protection works where it is evidenced that the works respect natural processes and there will be no significant adverse impact on coastal processes or habitats, and that the development will not result in increased coastal erosion or flooding on the coastline. The full range of protection works and management options

Relevant Policy or Guidance	Relevance to the Assessment
	should be considered over the lifetime of the development to futureproof against relevant climate change projections.”
International Convention for Prevention of Marine Pollution by Ships (MARPOL)	MARPOL is the main international convention covering prevention of pollution of the marine environment by ships from operational or accidental causes. It is a combination of two treaties adopted in 1973 and 1978 respectively and updated by amendments through the years. The Convention covers all the technical aspects of pollution from ships, except the disposal of waste into the sea by dumping, and applies to ships of all types, although it does not apply to pollution arising out of the exploration and exploitation of sea-bed mineral resources.
Guidance	
Centre for Environment Fisheries and Aquaculture Science (Cefas) (2004)	Offshore Wind Farms: Guidance Note for Environmental Impact Assessment in respect of Food and Environmental Protection Act (FEPA) and Coast Protection Act (CPA) requirements: Version 2
Department for Business, Enterprise and Regulatory Reform (BERR) (2008)	Review of Cabling Techniques and Environmental Effects applicable to the Offshore Windfarm Industry
Lambkin et al. (2009)	Coastal Process Modelling for Offshore Windfarm Environmental Impact Assessment
Cefas (2011)	Guidelines for Data Acquisition to Support Marine Environmental Assessments of Offshore Renewable Energy Projects
Marine Scotland Pre-disposal Sampling Guidance Version 2 – November 2017	Sampling and Analysis Relating to Sea Disposal of Dredged Material – the guidance includes Action Levels for contaminants to assist in assessing risk to the water environment

5.3 Consultation

363. **Table 5.2** describes the consultation undertaken to date relevant to marine geology, oceanography and physical processes for the Broadshore Hub WFDAs.

Table 5.2: Consultation Relevant to Marine Geology, Oceanography and Physical Processes

Consultee	Date/Document	Comment	How Comment is Addressed
NatureScot	13th September 2023, Scoping Workshop (email post-workshop 12th October 2023)	We are content with the physical processes receptors identified, which include features from the Loch of Strathbeg Site of Special Scientific Interest (SSSI)/Ramsar, Waters of Philorth Local Nature Reserve (LNR), and the Southern Trench Nature Conservation Marine Protected Area (NCMPA). Both the Loch of Strathbeg SSSI/Ramsar and the Waters of Philorth LNR are located approximately 47 km from the Broadshore Hub WFDAs. As such, these sites may be outside the potential maximum distance of effects from waves and tides. To determine whether this is the case, the Broadshore Hub WFDAs Scoping Report could consider analysis from other Offshore Wind Farm EIAs, including similarities/differences between the developments (i.e. number of turbines, substructure type, location, etc), maximum distance of effects reported and the analysis approach used.	Information on designated sites is provided in **Section 5.4.10**. Potential impacts to these sites will be considered as appropriate in the Broadshore Hub WFDAs EIA Report, where these are scoped in for further consideration (see **Section 5.4.10**). Other scoping reports from projects in the wider region have been reviewed and considered in the preparation of this chapter.
		Noting the point above, NatureScot is content for the use of numerical modelling to assess impacts on receptors from changes in waves, where required.	Noted. As set out in **Section 5.7**, numerical wave modelling will be undertaken.
		NatureScot is content with the proposed non-modelling approach using the Source-Pathway-Receptor (S-P-R) conceptual model for tidal currents, sediment dispersion and stratification. However, the Broadshore Hub WFDAs Scoping Report should provide more detail around the assessment approach. NatureScot advise that other recent Offshore Wind Farm EIAs have made use of spreadsheet-based (non-modelling) empirical equations.	Noted. The Applicants do not propose to use spreadsheet-based (non-modelling) empirical equations at this time. **Section 5.7** sets out the proposed approach to impact assessment, including use of S-P-R conceptual model and wave model.

5.4 Existing Environment

5.4.1 Study Area

364. Details of the location of the Broadshore Hub WFDAs are set out within **Chapter 3: Project Description**. The marine geology, oceanography and physical processes study area is defined by the distance over which impacts from all the offshore infrastructure may occur and by the location of any receptors that may be affected by those potential impacts.

365. The marine geology, oceanography and physical processes study area is shown in **Figure 5.1** in **Appendix 1**) and includes a tide-parallel 10 km wide buffer around the Broadshore Hub WFDAs Scoping Boundary. The marine geology, oceanography and physical processes study area accounts for the potential local and regional effects on physical and sedimentary processes.

5.4.2 Data and Information Sources

366. **Table 5.3** outlines the existing primary data that has been used to inform this chapter and will also be used to inform the Broadshore Hub WFDAs EIA Report.

Table 5.3: Summary of Existing Data and Information Sources for Marine Geology, Oceanography and Physical Processes

Dataset	Year(s)	Description
EMODnet	2020	Bathymetry
BERR Atlas	2007	Tidal currents
BERR Atlas	2001-2008	Waves
British Geological Survey (BGS)	Pre-1985	Seabed sediments
Cefas	1998-2015	Suspended sediment concentrations
OSPAR Quality Status Reports (QSR)	Latest report 2023	Region II – Greater North Sea. Concentrations of contaminants in sediments/overall pollution status of each region.

367. In addition to the data in **Table 5.3**, **Table 5.4** describes the surveys that will support the assessment in the Broadshore Hub WFDAs EIA Report. This data is not available to inform this Broadshore Hub WFDAs Scoping Report but will be available to support the EIA.

Table 5.4: Summary of Site-specific Surveys for Marine Geology, Oceanography and Physical Processes

Survey	Spatial Coverage	Survey Year/Timing
Geophysical survey (bathymetry and shallow geology)	Broadshore Hub WFDAs Scoping Boundary	Mid-August – mid-September 2023
Environmental survey (grab sampling and particle size analysis)	Broadshore Hub WFDAs Scoping Boundary	Mid-August – end-August 2023
Geotechnical survey (sediment contaminant analysis)	25 samples across the Broadshore Hub WFDAs Scoping Boundary	Scheduled mid-November 2023 to mid-January 2024
Metocean survey (wave and currents)	Broadshore Hub WFDAs Scoping Boundary	April 2023 to April 2024 (potentially extending to April 2025)

5.4.3 Bathymetry

368. The minimum and maximum depths across the marine geology, oceanography and physical processes study area are approximately 54 m below Lowest Astronomical Tide (LAT) and 121 m below LAT, respectively (**Figure 5.2** in **Appendix 1**). The bathymetry was derived from the EMODnet dataset (2020).

5.4.4 Shallow Geology

369. The shallow (Quaternary) geology of the study area is soft mud between 5 m and 20 m thick (BGS, 1988) (**Figure 5.3** in **Appendix 1**). The marine geology, oceanography and physical processes study area also includes areas of diamicton.

5.4.5 Tidal Currents

370. BERR (2008) modelled peak flows for mean spring tides of between approximately 0.35 m/s and 0.46 m/s across the study area (**Figure 5.4** in **Appendix 1**).

5.4.6 Waves

371. The most frequent waves across the study area are from the north-east. BERR (2008) described annual mean significant wave heights of 1.9 m to 2.03 m (**Figure 5.5** in **Appendix 1**).

5.4.7 Bedload Sediment and Transport

372. BGS (1985) mapped muddy sand across the northern third of the Broadshore Hub WFDAs Scoping Boundary and sand across the southern two thirds (**Figure 5.6** in **Appendix 1**). Muddy sand continues into the northern part of marine geology, oceanography and physical processes study area, with areas of slightly gravelly sand in the southern part of the study area.

5.4.8 Suspended Sediment Concentrations

373. Cefas (2016) mapped the spatial distribution of average annual suspended sediment concentrations across the UK continental shelf between 1998 and 2015. The marine geology, oceanography and physical processes study area is characterised by values between 0.685 mg/l and 0.835 mg/l (**Figure 5.7** in **Appendix 1**). Large areas of the northern North Sea are characterised by similar suspended sediment concentrations, with values becoming greater in shallower water towards the coast.

5.4.9 Sediment and Water Quality

374. OSPAR is the mechanism by which 15 Governments & the EU cooperate to protect the marine environment of the North-East Atlantic[19]. Recognising the importance of clean, healthy, and productive seas to this region and to the world, OSPAR has committed to systematic periodic assessments of the drivers of degradation, the multiple pressures exerted on marine systems including the monitoring of chemicals in sediments and nutrients in the water. These assessments are reported in QSR (OSPAR, 2023a). OSPAR has divided its Maritime Area into five regions; the Broadshore Hub WFDAs are located in Region II – Greater North Sea.

375. The QSR 2023 highlights that concentrations of many of the most serious hazardous substances, such as polychlorinated biphenyls (PCBs), polyaromatic hydrocarbons (PAHs) and organochlorine insecticides, have decreased substantially compared with the 1980s and 1990s (OSPAR, 2023b). The last four assessments have described a steady improvement in the eutrophication status of three OSPAR Regions including the Greater North Sea region. The first assessment covering the period 1990 – 2000 was characterised by poor conditions in much of the North Sea (QSR 2000). With respect to hazardous substances, in most cases, the trends for assessed hazardous organic substances are downward, and most OSPAR Regions are also seeing a decline in heavy metal pollution. In the last two decades the downward trends have been smaller than in former decades, when decreases were driven by the elimination of large industrial point sources of contamination. Most metals follow the same pattern, but in the more populated OSPAR Regions (Greater North Sea being one) upward trends are seen in some places for selected substances such as mercury.

376. In terms of seabed use which may impact on sediment and water quality, there are four dry holes and a gas/condensate well within the Broadshore Hub WFDAs Scoping Boundary, all of which were decommissioned in the 1990s. The Broadshore Hub WFDAs are also located south of the Captain oil field and relatively close to Blake and Ross Fields to the east, all of which are producing.

[19] OSPAR started in 1972 with the Oslo Convention against dumping and was broadened to cover land-based sources of marine pollution and the offshore industry by the Paris Convention of 1974. These two conventions were unified, updated and extended by the 1992 OSPAR Convention.

377. For further information on these oil fields refer to **Chapter 13: Marine Infrastructure and Other Users**.

5.4.10 Designated Sites

378. Designated sites include sites which are designated for the protection and conservation of marine habitat and species that have the potential to be affected by the Broadshore Hub WFDAs and thus are more sensitive to impacts upon marine geology, oceanography and physical processes. These designated sites are shown in **Figure 5.8** in **Appendix 1** and include:

- Loch of Strathbeg SSSI/Ramsar/GCR;
- Waters of Philorth LNR;
- Southern Trench NCMPA containing sea-bed sediment that is a habitat for sandeel;
- Geological and geomorphological features that are not currently protected under an environmental designation (e.g. sand banks, rock reefs); and
- Shelf sea stratification, nutrient fluxes and primary production.

5.5 Potential Impacts

379. During the construction phase of the Broadshore Hub WFDAs, there is the potential for the installation of the floating substructures (FSSs), fixed bottom substructures (FBSSs) (seabed preparation), station keeping systems (SKS), subsea cable hub(s) and inter-array cables (IACs) to disturb sediment, potentially resulting in changes in suspended sediment concentrations and/or seabed levels.

380. During the operational phase of the Broadshore Hub WFDAs, there is potential for the presence of the floating substructures, fixed bottom substructures, SKS subsea cable hubs and IACs to cause changes to the tidal and wave regimes due to physical blockage effects. These changes could potentially affect the sediment regime and/or seabed morphology. In addition, there is potential for disturbance of the seabed during maintenance activities.

5.5.1 Embedded Mitigation Measures

381. The following embedded mitigation measures are proposed:

- Where seabed preparation is required (e.g. levelling) methods and equipment that have been designed to minimise potential for sediment suspension and dispersal will be adopted;
- Development of, and adherence to a Cable Plan (CaP) setting out detailed IAC installation methods and techniques (based on final project design);
- A detailed Cable Burial Risk Assessment (CBRA) will be prepared where IACs are buried to confirm the extent to which cable burial can be achieved. The burial depths may vary and will be dependent on risk and ground conditions. The CBRA will also highlight instances where adequate burial cannot be achieved and alternative protection is needed; and

- Development of and adherence to a Marine Pollution Contingency Plan (MPCP).

382. With respect to accidental spills and pollution events from vessels required for the installation and operation of the Broadshore Hub WFDAs, the Applicants are committed to embedded mitigation to reduce the risks of these occurring as far as practicable (i.e. undertaking construction works in adherence with all relevant best practice guidance and legislation). All vessels must comply with the International Convention for the Prevention of Pollution from Ships (MARPOL) 73/78 for example. An outline Environmental Management Plan (EMP) or similar will be drafted and included within the application documents which commits the Applicants to ensuring that all works would be undertaken in line with best practice for working in the marine environment. Accidental spills and pollution events would therefore not be considered further within the Broadshore Hub WFDAs EIA Report.

383. The existing decommissioned oil and gas wells identified within the Broadshore Hub WFDAs and potential for associated contaminated drill cuttings will be considered during the definition of Broadshore Hub WFDAs design and layout. Engagement will be undertaken with North Sea Transitional Authority (NSTA) and the respective oil and gas operators, and an offset may be applied to reduce any potential remobilisation of contaminated sediments if required, to be defined via a structured risk assessment approach.

5.6 Scoping of Potential Impacts

384. **Table 5.5** outlines the potential impacts which are proposed to be scoped in or out of the Broadshore Hub WFDAs EIA Report. This may be refined as additional information and data become available.

5.6.1 Potential Impacts Scoped In

5.6.1.1 Impacts on Bedload Sediment Transport and Seabed Morphological Change

385. Construction of the Broadshore Hub WFDAs will not change the shallow geology within the Broadshore Hub WFDAs other than in the case of local effects associated with the FSS, FBSS and SKS and IAC installations. However, there is the potential for changes in seabed morphology due to construction activities (e.g. seabed preparation/sandwave clearance). Hence, these potential impacts will be assessed as part of the Broadshore Hub WFDAs EIA Report and are therefore scoped in for the construction and decommissioning phase.

386. Minimal impacts can be expected on the prevailing bedload sediment transport conditions, both within wind farm sites as well as further afield, provided that the FSSs, FBSSs and SKSs are adequately spaced (which will vary depending on the details of the FSSs, FBSSs and SKSs and wind farm layout). Impacts on sediment transport are expected to be local to the areas immediately surrounding the individual FSSs, FBSSs and SKSs in the form of seabed scour where the sediment is soft enough to be mobilised. Scour at each FSS, FBSS and SKS will be assessed as part of the Broadshore Hub WFDAs EIA Report using well-established empirical methods applied to offshore wind farms elsewhere.

387. Should IACs be buried, there would be no impact on bedload sediments and sediment transport. However, it is possible that cable protection would be required at locations where the seabed is characterised by harder geology which prevents or restricts IAC burial. The impacts that cable protection may have primarily relate to the potential for interruption of sediment transport and the footprint presented on the seabed. These impacts will be assessed as part of the Broadshore Hub WFDAs EIA Report and are therefore scoped in for operation.

5.6.1.2 Impacts on Suspended Sediment Concentrations and Transport

388. Potential impacts during construction include temporary disturbance of the seabed due to the installation activities for FSSs, FBSSs, SKSs, IACs and subsea cable hub(s) (including seabed preparation, and, if buried, ploughing/trenching and cable burial) which release sediment into the water column resulting in increased suspended sediments and changes to seabed levels. These potential impacts will be assessed as part of the Broadshore Hub WFDAs EIA Report and are therefore scoped in for construction and decommissioning.

389. There is potential for sediments to be re-suspended by scouring. Consideration will be given to likely changes in suspended sediment concentrations due to scour during the operational phase within the Broadshore Hub WFDAs EIA Report and are therefore also scoped in for operation.

390. Depending on the SKS adopted, the seabed in the vicinity of the FSSs may be swept by the catenary action of the mooring lines. If there is sediment present on the seabed in these areas (rather than exposed bedrock) then this will be entrained into suspension in the water column. These impacts will be assessed as part of the Broadshore Hub WFDAs EIA Report and are therefore scoped in during operation.

5.6.1.3 Impacts on Contaminant Concentrations as a Result of Changes to Suspended Sediment Concentrations

391. Disturbance of bed sediments could give rise to increases in chemical contaminants within the water column if bound to bed sediment particles. Site-specific information will be collected to determine both particle size (muddier sediments are at higher risk of containing contaminants) and chemical contaminant concentrations. This data will be assessed as part of the Broadshore Hub WFDAs EIA Report and therefore this potential impact is scoped in for all phases.

5.6.1.4 Operational Impacts on Waves and Tidal Currents

392. Potential impacts during operation could occur due to the physical presence of infrastructure (i.e. FSSs, FBSSs, SKSs, subsea cable hub(s) and moorings, and any IAC protection above the seabed), which may result in local changes to tidal currents and waves due to physical blockage effects. These changes could potentially affect the sediment transport regime and/or seabed morphology. These impacts will be assessed as part of the Broadshore Hub WFDAs EIA Report and are therefore scoped in during operation.

5.6.2 Potential Impacts Scoped Out

5.6.2.1 Construction Impacts on Wave and Tidal Currents

393. Whilst there is potential for the physical presence of construction plant and offshore infrastructure to impact upon the wave and tidal current regimes, these impacts would increase incrementally as the Broadshore Hub WFDAs infrastructure is constructed with the greatest potential impacts resulting from the completed Broadshore Hub WFDAs. These impacts are therefore considered under **Section 5.6.1.4** for the operational phase and are therefore scoped out from further consideration in relation to the construction phase and decommissioning phase to avoid double counting.

5.6.2.2 Impacts on Seabed Morphology due to Indentations on the Seabed from Installation Vessels

394. There is potential for certain vessels used during installation of the FSSs, FBSSs, SKSs, IACs and subsea cable hub(s) to directly impact the seabed. This applies for those vessels that utilise jack-up legs or anchors to hold station and to provide stability for a working platform. Where legs or anchors (and associated chains) have been placed on the seabed and then removed, there is potential for an indentation to remain, proportional to the dimensions and drag (if any) of the object. However, the disturbance footprint would be limited in scale and any impacts would be temporary in nature with indentations infilling through natural processes over the course of a few days to months. These potential effects are therefore scoped out from further consideration in the Broadshore Hub WFDAs EIA Report for all phases.

5.6.2.3 Impacts on Water Column Stratification Influencing Nutrient Fluxes and Primary Production

395. The main potential impact on stratification is changes to near-field mixing due to FSS, FBSS and SKS wake effects and the potential for destabilising local water column stratification (i.e. those restricted to the area inside and immediately outside the Broadshore Hub WFDAs) driven by interaction of the tidal (hydrodynamic) processes with the FSSs, FBSSs and SKSs.

396. Research undertaken by Scottish Association for Marine Science (SAMS) Enterprise (2023) demonstrates that stratification at the Broadshore WFDA is weak and nutrient availability is not limited, largely due to well-mixed surface waters entering the Broadshore WFDA from the Pentland Firth. The weaker stratification prevents the development of a subsurface chlorophyll maximum, therefore enhanced mixing due to the floating substructure is unlikely to greatly enhance nutrients at the surface or provide the conditions to enhance primary production. Any enhanced mixing due to the presence of floating substructure at the Broadshore WFDA will disperse to the south and east due to residual currents and become weaker with time. Given the proximity of the Sinclair and Scaraben WFDAs to the Broadshore WFDA, the conclusions are also considered valid for the Sinclair WFDA and Scaraben WFDA. Hence, potential impacts are scoped out from further consideration for all phases.

5.6.3 Potential Cumulative Effects

397. The Cumulative Effect Assessment (CEA) will be based on a Zone of Influence (ZoI) identified during the Broadshore Hub WFDAs impact assessment, which will define the geographical extent within which effects of the Broadshore Hub WFDAs are expected to occur. The CEA will consider cumulative impacts with projects and plans within the ZoI, including the Broadshore Hub OfTDAs. The CEA will follow the general methodology set out in **Chapter 4: Approach to Scoping and Environmental Impact Assessment**.

5.6.4 Potential Transboundary Effects

398. It is proposed to scope out transboundary effects on marine geology, oceanography and physical processes, recognising that the Broadshore Hub WFDAs are approximately 180 km from the Exclusive Economic Zone (EEZ) of Norway. Given that the likely effects will be restricted to near-field change, coupled with their location at distance from the EEZ boundary, there would be no pathway for transboundary effects.

5.6.5 Summary of Potential Marine Geology, Oceanography and Physical Processes Scoped In or Out

399. **Table 5.5** outlines the marine geology, oceanography and physical processes impacts which are proposed to be scoped in or out of the Broadshore Hub WFDAs EIA Report.

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Table 5.5: Summary of Potential Impacts Scoped In (✓) or Scoped Out (x) for Marine Geology, Oceanography and Physical Processes

Potential Impact	Receptor(s)	Description of Potential Effect	Scoped In or Scoped out? (✓ or X)			Embedded Mitigation Measures
			Construction	Operation and Maintenance	Decommissioning	
Impacts on suspended sediment concentrations and transport	Southern Trench NCMPA and other designated sites if appropriate (Section **5.4.10**) Non-designated sand banks and rock reefs	Disturbance of the seabed due to the installation activities for the FSSs, FBSSs and SKSs and buried IACs, could potentially release sediment into the water column resulting in increased suspended sediment concentrations and changes to seabed levels from deposition.	✓	✓	✓	Mitigation as detailed in **Section 5.5.1**
Impacts on chemical contaminant concentrations associated with increases in suspended sediment	Water quality	Release of chemical contamination can occur as a result of suspended seabed sediments.	✓	✓	✓	Mitigation as detailed in **Section 5.5.1**
Impacts on tidal currents and waves	Southern Trench NCMPA and other designated sites if appropriate (Section **5.4.10**) Non-designated sand banks and rock reefs	The physical presence of the Broadshore Hub WFDAs' infrastructure could result in changes to tidal currents and waves due to physical blockage effects.	x	✓	x	None

Potential Impact	Receptor(s)	Description of Potential Effect	Scoped In or Scoped out? (✓ or X)			Embedded Mitigation Measures
			Construction	Operation and Maintenance	Decommissioning	
Impacts on bedload sediment transport and seabed morphological change	Southern Trench NCMPA and other designated sites if appropriate (Section **5.4.10**) Non-designated sand banks and rock reefs	The physical presence of the Broadshore Hub WFDAs' infrastructure could result in changes to bedload sediment transport due to changes in tidal currents and waves.	✓	✓	✓	None
Indentations on the seabed due to installation and decommissioning vessels	Southern Trench NCMPA and other designated sites if appropriate (Section **5.4.10**) Non-designated sand banks and rock reefs	Vessels that utilise jack-up legs or anchors to hold station during installation could directly impact the seabed through creation of indentations.	x	x	x	N/A
Impacts on water column stratification influencing nutrient fluxes and primary production	Shelf sea stratification	The physical presence of Broadshore Hub WFDAs' infrastructure could result in destabilisation of the local water column stratification.	x	x	x	N/A

5.7 Proposed Approach to Impact Assessment

400. Within the marine geology, oceanography and physical processes chapter of the Broadshore Hub WFDAs EIA Report, the overall impact assessment for the Broadshore Hub WFDAs will be presented first. Following this, a summary of each WFDA will be given (Broadshore WFDA, Sinclair WFDA, Scaraben WFDA). Please refer to **Chapter 4: Approach to Scoping and Environmental Impact Assessment**.

401. As part of the EIA process, the existing environment with respect to marine geology, oceanography and physical processes will be described, including, but not limited to the following:

- Bathymetry;
- Shallow geology;
- Tidal currents;
- Waves;
- Seabed sediment distribution;
- Bedload sediment transport;
- Suspended sediment transport;
- Seabed contaminant concentrations;
- Morphological change; and
- Anticipated trends in baseline conditions.

402. The assessment of effects on marine geology, oceanography and physical processes will be based on a S-P-R conceptual model, whereby the source is the initiator event, the pathway is the link between the source and the receptor impacted, and the receptor is the receiving entity. An example of this type of conceptual model is provided by seabed preparation which disturbs sediment on the seabed (source). This sediment is then transported by tidal currents until it settles back to the seabed (pathway). The deposited sediment could change the composition and elevation of the seabed (receptor).

403. For assessment of tidal currents, sediment transport and stratification, the use of numerical modelling is disproportionate to the potential effect that would occur, and the S-P-R conceptual model approach is preferred. However, to investigate waves and provide a baseline for prediction of changes due to the Broadshore Hub WFDAs, a wave model will be run. Wave conditions will be simulated using the spectral model MIKE21-SW. The model simulates the growth, decay and transformation of wind-generated waves and swell in offshore and coastal areas. MIKE21-SW is a state-of-the-art numerical tool for prediction and analysis of wave climates in offshore and coastal areas.

404. The assessment of sediment quality and the potential risk to water quality will be based on the use of recognised sediment quality guidelines.

405. The receptors proposed for inclusion in the assessment are:

- Southern Trench NCMPA containing seabed sediment that is a habitat for sandeels; and
- Geological and geomorphological features that are not currently protected under an environmental designation (e.g. sand banks).

406. The impact assessment will incorporate a combination of the sensitivity of the receptor, its value (if applicable) and the magnitude of the change to determine a significance of effect.

5.8 Scoping Questions to Consultees

407. The following questions are posed to consultees to help frame and focus their response to this scoping exercise for marine geology, oceanography and physical processes, which will in turn inform the Scoping Opinion:

- Do you agree with the sensitive receptor categories?
- Do you agree with numerical modelling of waves?
- Do you agree with conceptual evidence-based assessment of tidal currents, sediment dispersion and stratification?
- Do you have any other matters or information sources that you wish to present?

5.9 References

BERR (Department for Business, Enterprise and Regulatory Reform) (2008). Atlas of UK Marine Renewable Energy Resources: Atlas Pages. A Strategic Environmental Assessment Report, March 2008, 19pp.

BGS (British Geological Survey) (1985). Bosies Bank. Sheet 58oN-02o W. 1:250 000 Series. Sea Bed Sediments.

Cefas (2004). Offshore Wind Farms: Guidance Note for Environmental Impact Assessment in respect of Food and Environmental Protection Act (FEPA) and Coast Protection Act (CPA) requirements. Available: https://www.cefas.co.uk/publications/files/windfarm-guidance.pdf

Cefas (2012). Guidelines for data acquisition to support marine environmental assessments of offshore renewable energy projects. Available: https://tethys.pnnl.gov/sites/default/files/publications/CEFAS_2012_Eenvironmental_Assessment_Guidance.pdf

Cefas (Centre for Environment Fisheries and Aquaculture Science) (2016). Suspended Sediment Climatologies around the UK. Report for the UK Department for Business, Energy and Industrial Strategy offshore energy Strategic Environmental Assessment programme.

Gov.UK (2020). UK Marine Policy Statement. Available: https://www.gov.uk/government/publications/uk-marine-policy-statement

Lambkin et al., (2009). Coastal Process Modelling for Offshore Windfarm Environmental Impact Assessment. Available: https://tethys.pnnl.gov/sites/default/files/publications/COWRIE_Coastal_Process_Modelling.pdf

Marine Scotland (2017). Pre-disposal Sampling Guidance Version 2. Available at: https://www.gov.scot/binaries/content/documents/govscot/publications/advice-and-guidance/2020/02/marine-licensing-applications-and-guidance/documents/guidance/pre-disposal-sampling-guidance/pre-disposal-sampling-guidance/govscot%3Adocument/Pre-disposal%2Bsampling%2Bguidance.pdf

OSPAR (2023a). Quality Status Reports. Available at: https://oap.ospar.org/en/ospar-assessments/quality-status-reports/

OSPAR (2023b). QSR 2023 – Synthesis Report. Available at: https://oap.ospar.org/en/ospar-assessments/quality-status-reports/qsr-2023/synthesis-report/

SAMS (Scottish Association for Marine Science) Enterprise (2023). Understanding the impacts of floating turbine structures on shelf sea stratification, nutrient fluxes and primary production. Report to Renantis/BlueFloat Energy/Orsted.

Scottish Government (2015). Scotland's National Marine Plan. Available: https://www.gov.scot/publications/scotlands-national-marine-plan/

6 Benthic Ecology

6.1 Introduction

408. This chapter considers the scope of potential impacts of the construction, operation and maintenance, and decommissioning phases of the Broadshore Hub Wind Farm Development Areas (WFDAs) on benthic ecology.

409. This chapter provides an overview of the existing environment and further sets out the methodology and approach to assessing effects on benthic ecology in the Broadshore Hub WFDAs Environmental Impact Assessment (EIA) Report. Benthic ecology involves all habitats and species associated with the benthic environment, which includes shellfish. This chapter has been prepared by Royal HaskoningDHV.

410. This chapter should be read in conjunction with the following chapters of the Broadshore Hub WFDAs Scoping Report:

- **Chapter 5: Marine Geology, Oceanography and Physical Processes;**
- **Chapter 7: Fish and Shellfish Ecology;**
- **Chapter 9:** Offshore Ornithology**;**
- **Chapter 10: Commercial Fisheries;**
- **Chapter 13: Marine Infrastructure and Other Users; and**
- **Chapter 19: Major Accidents and Disasters.**

411. The benthic ecology assessment is likely to have key inter-relationships with the above receptors, which will be considered appropriately where relevant in the Broadshore Hub WFDAs EIA Report.

6.2 Legislation, Policy and Guidance

412. **Table 6.1** sets out the legislation, policy and guidance which have been considered in the preparation of this chapter, and will be considered within the Broadshore Hub WFDAs EIA Report where appropriate. The overarching policy and legislation relevant to the Broadshore Hub WFDAs is described in **Chapter 2: Policy and Legislative Context**.

413. The UK Marine Policy Statement (His Majesty's (HM) Government, 2011) represents a UK wide policy context within which Marine Plans will be developed. The Scottish Government has produced a National Marine Plan (Scottish Government, 2015) in accordance with these UK policies. This plan provides a high-level approach to marine planning and general principles for decision making. The objective 'Living within environmental limits' covers points relevant to benthic ecology, and requires that:

- Biodiversity is protected, conserved and where appropriate recovered and loss has been halted;
- Healthy marine and coastal habitats occur across their natural range and are able to support strong, biodiverse biological communities and the functioning of healthy, resilient and adaptable marine ecosystems; and
- Our oceans support viable populations of representative, rare, vulnerable, and valued species.

414. Within Scotland's National Marine Plan are a range of strategic policies for which management decisions will be made across the main marine sectors. These policies include general overarching policies, and policies specific to offshore wind and marine renewable energy. The following general policies apply to this benthic ecology assessment:

- "*General Policy (GEN) 9 Natural heritage: Development and use of the marine environment must:*

  (a) Comply with legal requirements for protected areas and protected species.

  (b) Not result in significant impact on the national status of Priority Marine Features.

  (c) Protect and, where appropriate, enhance the health of the marine area.
- *GEN 10 Invasive non-native species: Opportunities to reduce the introduction of invasive non-native species to a minimum or proactively improve the practice of existing activity should be taken when decisions are being made; and*
- *GEN 13 Noise: Development and use in the marine environment should avoid significant adverse effects of man-made noise and vibration, especially on species sensitive to such effects.*"

415. Scotland's National Marine Plan has identified a list of 81 Priority Marine Features (PMFs) (Tyler-Waters et al., 2016). These PMFs are species and habitats considered to be of greatest marine nature conservation importance in Scottish territorial waters and are considered under threat. Several of these PMFs include benthic habitats potentially present within the benthic study area.

Table 6.1: Summary of Relevant Legislation, Policy and Guidance for Benthic Ecology

Relevant Legislation, Policy or Guidance	Relevance to the Assessment
Legislation	
The Conservation of Offshore Marine Habitats and Species Regulations 2017 (referred to as the "Offshore Marine Regulations 2017").	Applies to Marine Licence and s.36 consent applications within Scottish waters beyond 12 nautical miles (nm).
The Wildlife and Countryside Act (1981)	Provides a list of threatened species for which killing, injuring or taking by any method is prohibited.
Nature Conservation (Scotland) Act 2004, Part 3 and Schedule 6.	Makes amendments to the Wildlife and Countryside Act (1981), strengthening the legal protection for threatened species to include 'reckless' acts.
The Convention on the Conservation of European Wildlife and Natural Habitats (the Bern Convention; 1979).	Promotes national policies for the conservation of wild flora, wild fauna and natural habitats.
Convention for the Protection of the Marine Environment of the North-East Atlantic (the 'OSPAR Convention') 1992.	Provides a legal framework to protect and conserve maritime ecosystems through the prevention and elimination of pollution from offshore sources.
Convention on Biological Diversity 1992	Provides a legal framework to develop national strategies, plans or programmes for the conservation and sustainable use of biological diversity.
Policy	
The Scottish Biodiversity Strategy (post-2020: statement of intent)	Reiterates the commitment (and desire to enhance) the 2020 Challenge for Scotland's Biodiversity (response to the Aichi Targets set by the United Nations Convention on Biological Diversity, and the EU's Biodiversity Strategy for 2020) and supplements Scotland's Biodiversity: It's in Your Hands (2004).
The Scottish Government National Marine Plan (2015)	The following general policies apply to this benthic ecology assessment: • *"General Policy (GEN) 9 Natural heritage: Development and use of the marine environment must:* *a) Comply with legal requirements for protected areas and protected species.* *b) Not result in significant impact on the national status of Priority Marine Features.* *c) Protect and, where appropriate, enhance the health of the marine area."* • *"GEN 13 Noise: Development and use in the marine environment should avoid significant adverse effects of man-made noise and vibration, especially on species sensitive to such effects."*

Relevant Legislation, Policy or Guidance	Relevance to the Assessment
Guidance	
Joint Nature Conservation Committee (JNCC), Marine Monitoring Handbook, (JNCC, 2001).	These guidelines have been produced to promote good practice in marine monitoring.
Ware, S.J. & Kenny, A.J. (2011) Guidelines for the Conduct of Benthic Studies at Marine Aggregate Extraction Sites, 2nd ed. Marine Aggregate Levy Sustainability Fund (MALSF).	This guidance has been produced to accompany any dredging application and designed to promote a comprehensive and consistent approach to the assessment of the benthic environment (i.e. sediments and associated benthic fauna).
Cefas, Guidelines for Data Acquisition to Support Marine Environmental Assessments for Offshore Renewable Energy Projects (Cefas, 2012).	These guidelines assist in the design, review and implementation of environmental data collection and analytical activities associated with all stages of offshore renewable energy developments.
Guidance and publications from Scottish Natural Heritage (SNH) and Marine Scotland on Priority Marine Features (PMF) and Marine Protected Area (MPA) search features (Tyler-Waters et al., 2016).	Provides guidance on the PMF and MPA features.
Chartered Institute for Ecology and Environmental Management (CIEEM), Guidelines for Ecological Impact Assessment in the UK and Ireland Terrestrial, Freshwater, Coastal and Marine. (CIEEM, 2018).	This guidance provides practical advice for all professionals involved with ecological evaluation and assessment for proposed developments in terrestrial, freshwater, marine and coastal environments.
NatureScot guidance on marine invasive non-native species (NatureScot, 2023).	Provides guidance on Invasive Non-Native Species (INNS) known to threaten Scotland.
Guidance on Non-Native Species, approved by the Scottish Parliament (Scottish Government, 2012).	

6.3 Consultation

416. Consultation undertaken to date for the Broadshore Hub WFDAs relevant to benthic ecology is provided in **Table 6.2** below.

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Table 6.2: Consultation Relevant to Benthic Ecology

Consultee	Date/Document	Comment	How Comment is Addressed
NatureScot	31st March 2023, Email response to benthic sampling plan for the Broadshore Hub WFDA	Content with the proposed benthic sampling plan for benthic surveys which follows standard approaches.	Noted.
		The number and type of samples is appropriate for the site, as is the sampling methodology. NatureScot recommends that survey data is collected and stored in line with standard data protocols (e.g. MEDIN, where appropriate) so that they can be archived in a suitable data store.	Noted. Where possible, all data outputs will be compliant with the Marine Environmental Data and Information Network (MEDIN) data standards and therefore aligned to internationally recognised data standards.
		It is noted that eDNA samples will be collected from the water column, which NatureScot assumes will be for fish rather than benthic species. NatureScot recommends the use of eDNA surveys within the offshore windfarm array area and export cable corridor route to help provide information on fish prey species and priority marine features (PMFs). Whilst it is still a novel technique, NatureScot considers this will provide more suitable information than from carrying out trawl surveys and may even be able to be combined with a benthic survey campaign. NatureScot notes the intention to discuss further with stakeholders once the data is analysed and NatureScot would appreciate sight of any technical reports covering the eDNA sampling and analysis.	eDNA samples taken from the water column will be analysed for fish rather than benthic species. The results of the analysis of the eDNA samples are not going to be used to directly inform the benthic impact assessment in Broadshore Hub WFDAs EIA Report, but instead to add context to the baseline and to derive insights if they exist. The Applicants will share any technical reports with MSS and NatureScot. The Applicants are not proposing to undertake trawl surveys.
Marine Scotland Science (MSS)	27th March 2023, email	MSS recommend offsetting some of the drop down camera (DDC) stations from the grab stations for a better coverage of the site overall.	Noted, these have been offset where possible.

Consultee	Date/Document	Comment	How Comment is Addressed
		If there are opportunities for the data to be used for quantitative analysis then images taken at regular intervals would add value e.g., if regular images are taken in addition to images of key species for biotope descriptions.	The intention of the survey is as a characterisation for EIA (not a baseline survey for monitoring), therefore still images will be taken only when species of interest are seen. It is highly unlikely that the sample stations would be able to be reproduced exactly for future surveys therefore the Applicants do not consider such imagery to be useful for detecting change over time in any quantitative manner.
		Asked for further detail on the eDNA sampling design and analysis (e.g., which primers will be used? How will the eDNA output be compared to the macrofauna indices?).	Detailed information on eDNA sampling design and analysis methodology was provided on 2nd June 2023 via email (Survey Note Response).
		Recommend taking more than 13 eDNA samples to get a more comprehensive picture of diversity and community composition across the site.	Given that the eDNA survey outputs will not be used to inform the EIA, but to provide context to the baseline only, the Applicants do not advocate taking additional eDNA samples across the site. The benthic survey (drop down video and grab sampling) covered 121 sample locations across the Broadshore Hub WFDAs. In total, samples from 20 stations were collected.
		Early results from eDNA surveys have shown that some benthic invertebrate species can be detected from water samples, but sediment samples from grabs are recommended for benthic biodiversity assessments. If grab samples are being taken anyway, could the eDNA sampling extend to sediment samples also to get a more complete picture of biodiversity at each station?	eDNA sampling was extended to include sediment samples, with eDNA samples from each grab sampling station collected, where possible. The results of the analysis of the eDNA samples will not be used to directly inform the benthic impact assessment in Broadshore Hub WFDAs EIA Report, but instead to add context to the baseline and to derive insights if they exist. Results will be provided to MSS and NatureScot separately for information and future applications, and eDNA sampling from sediment samples will be donated to the Planning Offshore Wind Strategic Environmental Impact Decisions (POSEIDON) project.
		JNCC have published guidance on DNA-based approaches for marine monitoring (Wort et al. 2022) and guidance for end users on DNA methods development and project assessment (Jones et al. 2020).	Noted.

Consultee	Date/Document	Comment	How Comment is Addressed
		MSS are planning to undertake a project to collect and analyse eDNA samples on the east coast of Scotland, although this has not been scoped yet. If there are any opportunities to take additional samples at the Broadshore Offshore Wind Farm site whilst at sea, then there is a possibility that these could be analysed at a later date to add value to both projects.	Noted.
NatureScot	13th September 2023, Scoping Workshop (email post-workshop 12th October 2023)	We are content with the proposed approach and methodology, including the proposed benthic study area, which is appropriate and consistent with other Offshore Wind Farms. It would be useful to better understand the reasoning behind collecting eDNA samples but not using these to inform the EIA, although NatureScot welcomes the collaboration with the POSEIDON project.	The benthic baseline will be characterised based on the benthic survey results (drop-down video and grab sampling) which is considered a standard approach. While the eDNA analysis may add context to the baseline characterisation, it will not be used to directly inform the benthic impact assessment, as it is unclear how eDNA survey outputs (non-quantitative) would be incorporated and considered alongside (semi-quantitative) standard methodologies.
		No comment on additional desk-based data sources.	Noted.
		The list is titled 'Potential impacts for scoping in/out'. NatureScot advises that the only impact to be scoped out is accidental pollution. Otherwise, NatureScot is content that the list includes all potential impacts NatureScot would expect to be scoped in.	The list presented at the workshop provided an indicative overview of potential impacts that may or may not be 'scoped in' to the EIA only, and did not propose a final list of impacts to be scoped in or out and any supporting rationale. Potential impacts to be scoped out are discussed in **Section 6.6.2** for the different phases of the Broadshore Hub WFDAs. The reasoning for scoping out each impact in the relevant phase is provided in this section.

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6.4 Existing Environment

6.4.1 Study Area

417. The benthic study area covers a total of 1,220 km^2. It includes the Broadshore Hub WFDAs Scoping Boundary with a buffer of 10 km. The buffer will be refined during the EIA process, with reference to the maximum distance of one tidal ellipse within the surrounding area of the Broadshore Hub WFDAs Scoping Boundary, using information from the marine geology, oceanography and physical processes chapter in the Broadshore Hub WFDAs EIA Report. Underwater noise modelling will also be taken into account when refining the benthic study area.

418. The extent of the benthic study area will provide a regional context on benthic ecology and also cover potential impacts outside of the Broadshore Hub WFDAs Scoping Boundary (see **Figure 6.1** in **Appendix 1**).

6.4.2 Data and Information Sources

419. Baseline data for the Broadshore Hub WFDAs EIA Report will be reviewed from the sources as detailed in **Table 6.3**. In addition to these sources, consultation with relevant stakeholders will be carried out and considered as appropriate in the Broadshore Hub WFDAs EIA Report (see **Section 6.3**).

Table 6.3: Summary of Key Data and Information Sources for Benthic Ecology

Dataset	Description
Marine Protected Areas	Marine Protected Area reports from NatureScot.
Priority Marine Habitats	Priority marine habitats information from NatureScot and JNCC.
North Sea benthic data	National Biodiversity Network (NBN) Atlas (https://nbnatlas.org/).
North Sea benthic data	UKSeamap 2010 Interactive Map (https://jncc.gov.uk/our-work/marine-habitat-data-product-ukseamap/).
North Sea habitats	European Marine Observation and Data Network (EMODnet) Seabed Habitats, data ranging from 2004 – 2014 (https://emodnet.ec.europa.eu/en/seabed-habitats).
North Sea benthic data	Marine Life Information Network (MarLIN) (https://www.marlin.ac.uk/).
North Sea habitats	NatureScot Habitat Map of Scotland (HabMoS) (https://www.environment.gov.scot/our-environment/habitats-and-species/habitat-map-of-scotland/).
North Sea benthic and intertidal habitats	MAGIC interactive map (https://magic.defra.gov.uk/)

6.4.2.1 Site-specific Surveys

420. In addition to the data utilised in **Table 6.3**, the following site-specific survey data will be used to inform the Broadshore Hub WFDAs EIA Report, as shown in **Table 6.4**.

Table 6.4: Site-specific Surveys for Benthic Ecology

Dataset	Spatial Coverage	Survey Year	Description
Broadshore Hub WFDAs geophysical survey, e.g. Side-Scan Sonar (SSS) and Multi-Beam Echosounder (MBES)	Broadshore Hub WFDAs Scoping Boundary	2023	The geophysical survey is used to help inform the broadscale habitat mapping and provide context to the benthic ecology baseline. MBES is used to obtain high resolution bathymetry data to map the seabed and it's features, whilst the SSS is used to provide information of the texture and nature of the seabed to identify bedforms and geological features.
Broadshore Hub WFDAs benthic survey, e.g. drop-down video and grab sampling	Broadshore Hub WFDAs Scoping Boundary	2023	Benthic survey data from the Broadshore Hub WFDAs will provide context on the habitat types present in the Broadshore Hub WFDAs, and this will provide context to the benthic ecology baseline. In addition, Particle Size Analysis (PSA) data will be gathered from grab samples to also inform the baseline. This will be discussed further in the Broadshore Hub WFDAs EIA Report and assessed against Cefas Action Levels.
Broadshore Hub WFDAs eDNA water samples	Broadshore Hub WFDAs Scoping Boundary	2023	eDNA samples have been collected from the Broadshore Hub WFDAs and it is anticipated these will be used to provide context to the baseline, but not intended to use this data to inform the EIA directly. Results will be provided to MSS and NatureScot separately for information and future use, and eDNA sampling from sediment samples will be donated to the POSEIDON project. The eDNA survey methodology sent to NatureScot and the Marine Directorate (and MSS) for comment on the 8th March 2023.

6.4.3 Background

421. The Broadshore Hub WFDAs are located approximately 47 km north of Fraserburgh. The benthic species present within the area around the Broadshore Hub WFDAs are largely correlated with the substrate type and associated hydrodynamic conditions. This section provides information on the benthic species and habitats within the vicinity of the benthic study area.

422. The Broadshore Hub WFDAs are located next to the Captain oil field and in the vicinity of the Blake and Ross fields, all of which are producing. For further information, please refer to **Chapter 13: Marine Infrastructure and Other Users**.

6.4.4 Subtidal Ecology

423. Site-specific benthic surveys (**Table 6.4**) were undertaken in 2023 to characterise the benthic ecology within the Broadshore Hub WFDAs. This data will inform the Broadshore Hub WFDAs EIA Report. Survey methods were agreed with MD-LOT and NatureScot prior to commencement (**Table 6.2**).

424. To inform this Broadshore Hub WFDAs Scoping Report, the predictive seabed habitats derived from EUSeaMap (EMODnet, 2023) have been used and will be ground-truthed against the outputs of the benthic surveys in the Broadshore Hub WFDAs EIA Report (see **Table 6.4**). The EUSeaMap (EMODnet, 2023) provides broad-scale modelling to predict habitats within the North Sea based on known environmental characteristics which are cross-checked with extant survey data.

425. The British Geological Survey (BGS) (2020) broadscale habitat map shows that the majority of the benthic study area is predicted to comprise of deep circalittoral sand (A5.27) with a smaller section at the northern end of the Broadshore Hub WFDAs being deep circalittoral mud (A5.37). Outside of the Broadshore Hub WFDAs but within the benthic study area to the southern edge there is also a small area of deep circalittoral coarse sediment (A5:15) and a small patch of deep circalittoral mud (A5.37) (**Figure 6.2** in **Appendix 1**).

426. The European Nature Information System (EUNIS) (EMODnet, 2023) habitat types have also been reviewed alongside the EUSeaMap and show that the majority of the benthic study area is predicted to comprise of Atlantic offshore circalittoral sand (MD52). There is also a small section at the Northern edge of the Broadshore Hub WFDAs predicted to be Atlantic offshore circalittoral mud (MD62) (**Figure 6.3** in **Appendix 1**).

427. In summary, it is expected that the dominant subtidal benthic communities relating to the Broadshore Hub WFDAs Scoping Boundary are highlighted in **Table 6.5.**

Table 6.5: Summary of Benthic Habitats within the Benthic Study Area

Habitat	Source	Description
Deep circalittoral sand (A5.27)	BGS (2020)	Offshore (deep) circalittoral habitats with fine sands or non-cohesive muddy sands. Very little data is available on these habitats. However, they are likely to be more stable than their shallower counterparts and characterised by a diverse range of polychaetes, amphipods, bivalves and echinoderms.
Deep circalittoral mud (A5.37)	BGS (2020)	In mud and cohesive sandy mud in the offshore circalittoral zone, typically below 50-70 m, a variety of faunal communities may develop, depending upon the level of silt/clay and organic matter in the sediment. Communities are typically dominated by polychaetes but often with high numbers of bivalves such as *Thyasira spp*., echinoderms and foraminifera.
Deep circalittoral coarse sediment (A5.15):	BGS (2020)	Offshore (deep) circalittoral habitats with coarse sands and gravel or shell. This habitat may cover large areas of the offshore continental shelf although there is relatively little quantitative data available. Such habitats are quite diverse compared to shallower versions of this habitat and generally characterised by robust infaunal polychaete and bivalve species. Animal communities in this habitat are closely related to offshore mixed sediments and in some areas settlement of *Modiolus modiolus* larvae may occur and consequently these habitats may occasionally have large numbers of juvenile *M. modiolus*. In areas where the mussels reach maturity their byssus threads bind the sediment together, increasing stability and allowing an increased deposition of silt leading to the development of the biotope *Modiolus modiolus* beds with *Chlamys varia*, sponges, hydroids and bryozoans on slightly tide-swept very sheltered Atlantic circalittoral mixed substrata.
Atlantic offshore circalittoral sand (MD52)	EMODnet (2023)	Sand and muddy sand in the Atlantic circalittoral. Includes clean fine sands with less than 5% silt/clay in deeper water which is characterised by a wide range of echinoderms (in some areas including the pea urchin *Echinocyamus pusillus*), polychaetes and bivalves. This habitat is generally more stable than shallower, infralittoral sands and consequently supports a more diverse community. Also, circalittoral non-cohesive muddy sands with the silt content of the substratum typically ranging from 5% to 20% supports animal-dominated communities characterised by a wide variety of polychaetes, bivalves such as *Abra alba* and *Nucula nitidosa*, and echinoderms such as *Amphiura spp, Ophiura spp*., and *Astropecten irregularis*. These circalittoral habitats tend to be more stable than their infralittoral counterparts and as such support a richer infaunal community.
Atlantic offshore circalittoral mud (M62)	EMODnet (2023)	The seapens *Virgularia mirabilis* and *Pennatula phosphorea* are characteristic of this biotope complex together with the burrowing anemone *Cerianthus lloydii* and the ophiuroid *Amphiura spp*. The relatively stable conditions often lead to the establishment of communities of burrowing megafaunal species, such as *Nephrops norvegicus*.

428. Within the area of deep circalittoral mud (A5.37) at the northern part of the benthic study area, there is the PMF; offshore deep sea muds (**Figure 6.2** and **Figure 6.3** in **Appendix 1**). The importance of this habitat is shown in **Table 6.6**.

Table 6.6: Priority Marine Features Located within the Benthic Study Area

Habitat	Location	Characteristics (Tyler-Walters et al., 2016)
Offshore deep sea muds	Northern corner of Broadshore Hub WFDAs Scoping Boundary	Offshore deep sea muds support a wealth of biological diversity despite often appearing as featureless environments. The most common larger surface-dwelling animals are the echinoderms, including sea cucumbers, brittlestars and sea urchins. Other mobile species in or on the seabed include various types of 'worms', sea spiders, molluscs, crustaceans and fish species. Bathymetry, current velocity, bottom water-mass distribution and particle size of the mud (clay, silty or sandy) all have a significant influence on the distribution and composition of the seabed communities present. This habitat also includes the Atlantic and Arctic bathyal and abyssal sediments which occur off the continental slope in Scotland.
Offshore subtidal sand and gravels	Northern corner of Broadshore Hub WFDAs Scoping Boundary	Sand and gravel sediments are the most common subtidal habitat around the coast of the British Isles. Offshore sands and gravels are more stable than their shallower equivalents with diverse infaunal communities dominated by polychaetes, hatchet shells (OCS.GlapThyAmy), and small bivalves; e.g. the little tellin (OCS.HeloPkef). Offshore fine to muddy sands support a diversity of tube building polychaetes, burrowing brittlestars and bivalves (OSa.OfusAfil and OSa.MalEdaf), while the sea urchin occurs in medium sands (CFiSaEpusOborApri) and amphipods and hooded shrimp in fine sands (CFiSa.ApriBatPo). Mobile predators include flatfish, starfish and crabs (including hermit crabs). This habitat also includes the Atlantic and Arctic bathyal and abyssal sediments which occur off the continental slope in Scotland.

429. Marine Scotland [now Marine Directorate] has identified 11 of the 81 PMFs to have further management measures to protect the most vulnerable PMFs in Scottish inshore waters. As these are within 6 nm of the shore there are unlikely to be indirect impacts from the Broadshore Hub WFDAs. However, the Broadshore Hub WFDAs EIA Report will review any potential links and assess if required (see **Section 6.2**).

430. The site-specific surveys include sampling for potential contaminated sediments throughout the Broadshore Hub WFDAs Scoping Boundary. Samples will be analysed and assessed against the Cefas Action Levels **Figure 6.4** in **Appendix 1** presents the sampling locations.

431. The Captain oil field, which lies just at the northern section of the benthic study area, produced an Environmental Statement in 2022 which utilised benthic survey data from 2014, 2015 and 2021 (Fugro, 2014, 2015a, 2015b, 2015, 2021a, 2021b; Ithaca Energy, 2022). The survey data noted the baseline environment to be deep circalittoral mud (A5.37) with sections of deep circalittoral mixed sediment (A5.45).

432. The Fugro (2015a, 2015b, 2021a, 2021b) surveys also noted the OSPAR listed threated habitat of 'sea pen and burrowing megafauna communities' to be present, with the densities ranging from occasional to frequent using the SACFOR abundance scale (JNCC, 2015). There was also one small section of stony reef present.

433. It is important to note that the surveys undertaken at the Captain oil field were to the northern part of the benthic study area and not within the footprint of the Broadshore Hub WFDAs.

6.4.5 Designations

434. The benthic study area contains no designated areas protected for the benthic habitats and the species they support. The nearest designated areas relevant to benthic ecology, within 100 km are outlined in **Table 6.7**, with the Southern Trench Nature Conservation Marine Protected Area (NCMPA) being described further in **Section 6.4.5.1**.

Table 6.7: Designated Sites for Benthic Ecology within 100 km of the Broadshore Hub WFDAs Scoping Boundary

Site	Distance (km) from Broadshore Hub WFDAs Scoping Boundary	Designated Features Assessed
Southern Trench (MPA)	24	Burrowed mud Fronts Shelf deeps Quaternary of Scotland (subglacial tunnel valleys and moraines) Submarine mass movement (slide scars)
Turbot Bank (MPA)	89	Sandeels, *Ammodytes marinus*

6.4.5.1 Southern Trench Nature Conservation Marine Protected Area

435. The Southern Trench NCMPA is located on the east coast of Scotland in the outer Moray Firth and is designated to protect minke whale, burrowed mud, fronts and shelf deeps. Fronts in the Southern Trench are created by mixing of warm and cold waters, which creates an area of high productivity, attracting a number of predators to the area. Minke whale are attracted by the fish species brought to the area by the fronts, as well as the abundance of sandeels in the soft sands. NatureScot advise that, in order to conserve minke whale, the risk of injury and death should be minimised, access to resources within the site should be maintained, and supporting features should also be conserved, such as the benthic habitats present.

6.5 Potential Impacts

436. The potential impacts from the Broadshore Hub WFDAs during the construction, operation and maintenance, and decommissioning phases are outlined below and summarised in **Table 6.88**. Sensitivities of the benthic habitats and communities will be assessed for each of these phases on the basis of expert judgement and reference to Marine Evidence-Based Sensitivity Assessments (MarESA) (Tyler-Walters et al., 2018) available on the MarLIN website.

437. In addition, the potential for cumulative and transboundary effects (see **Sections 6.6.3** and **6.6.4**), as well as inter-relationships and interactions between effects for the Broadshore Hub WFDAs will also be determined and assessed.

6.5.1 Potential Impacts During Construction

438. Potential impacts during the construction phase of the Broadshore Hub WFDAs could arise from disturbance of the seabed during the installation of floating substructures (FSS) and their station keeping systems (SKS) (i.e., anchors and moorings), fixed bottom substructures (FBSS), subsea cable hub(s), inter-array cables (IACs) and associated cable protection and pre-construction works (including any seabed preparation, boulder clearance and UXO investigation/clearance[20]), and the use of vessels for any associated activities.

439. These impacts include:

- Physical disturbance and temporary loss of seabed habitat;
- Increased Suspended Sediment Concentrations (SSC) and sediment re-deposition;
- Underwater noise and vibration;
- Accidental release of pollutants;
- Remobilisation of existing contaminated sediments;
- Introduction of INNS from marine traffic; and
- Potential impacts on designated sites.

440. Effects which span the life of the Broadshore Hub WFDAs (e.g. permanent habitat loss) will be considered as part of the operational phase assessment and are therefore not considered in the construction phase assessment to avoid duplication.

[20] A separate Marine License application(s) will be made prior to UXO clearance works, with an accompanying assessment of UXO clearance effects on benthic ecology. The assessment included in the Broadshore Hub WFDAs EIA Report will be indicative only.

6.5.2 Potential Impacts During Operation and Maintenance

441. Potential impacts during operation and maintenance will typically result from the physical presence of infrastructure on the seabed (i.e. moorings, FBSS, IAC and any cable protection, and subsea cable hub(s)) which will result in permanent habitat loss. Maintenance activities also have the potential to result in temporary impacts, similar to those occurring during construction, but smaller in extent and therefore of a lower magnitude.

442. These impacts include:

- Physical disturbance and temporary loss of seabed habitat;
- Permanent habitat loss;
- Increased suspended sediments and sediment re-deposition;
- Electromagnetic Fields (EMF);
- Colonisation of introduced substrate;
- Re-mobilisation of existing contaminated sediments;
- Accidental release of pollutants;
- Introduction of INNS from marine traffic;
- Underwater noise and vibration; and
- Potential impacts on designated sites.

6.5.3 Potential Impacts During Decommissioning

443. It is anticipated that the decommissioning impacts would be similar in nature to those of construction (**Section 6.5.1**), although the magnitude of impact is likely to be lower. For example, where construction may require drilling of substructures piles and/or seabed preparation, decommissioning would likely require cutting of substructures piles to seabed level and may potentially result in less seabed disturbance than construction.

6.5.4 Embedded Mitigation Measures

444. There are existing decommissioned oil and gas wells identified within the Broadshore Hub WFDAs (see **Figure 13.2** in **Chapter 13: Marine Infrastructure and Other Users**) and potential for associated contaminated drill cuttings will be considered during the definition of Broadshore Hub WFDAs design and layout. Engagement will be undertaken with NSTA and the respective oil and gas operators, and an offset may be applied to reduce any potential remobilisation of contaminated sediments if required, to be defined via a structured risk assessment approach.

445. The Applicants commit to undertaking construction works in adherence with all relevant best practice guidance and legislation and will prepare all necessary plans in advance of construction activities, including Cable Plan (CaP), Environmental Management Plan (EMP), Invasive Non-Native Species Management Plan (INNSMP) and Marine Pollution Contingency Plan (MPCP).

446. All vessels must comply with the International Convention for the Prevention of Pollution from Ships (MARPOL) 73/78. The EMP will ensure all works are undertaken in line with best practice for working in the marine environment, and an INNSMP will be developed to include provisions for invasive non-native species (INNS) management. An MPCP will set out the provisions and response procedures in the event of pollution incidents (i.e. hydrocarbon release). These will be consulted with relevant stakeholders prior to the start of construction.

447. The potential risk of spreading or introducing INNS will be also mitigated by employing biosecurity measures in accordance with the following relevant regulations and guidance:

- MARPOL sets out appropriate vessel maintenance; and
- Adherence by contractors to the Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR) and the International Convention for the Control and Management of Ships' Ballast Water and Sediments (BWM Convention, 2004), which provide global regulations to control the transfer of potentially invasive species.

448. Where seabed preparation is required (e.g. seabed levelling), methods and equipment that have been designed to minimise potential for sediment suspension and dispersal will be adopted.

449. A CaP will be developed and adhered to. The CaP will confirm planned IAC routing, burial (if any), and any additional protection if required, and will set out methods for post-installation IAC monitoring. Selection of IAC (if buried) installation methods and equipment most suitable for seabed conditions designed to minimise sediment suspension into the water column.

6.6 Scoping of Potential Impacts

6.6.1 Potential Impacts Scoped In

6.6.1.1 Construction

450. The potential impacts on benthic ecology from activities carried out during the construction phase that are proposed to be scoped in for further assessment in the Broadshore Hub WFDAs EIA Report are set out in **Section 6.6.1.1.1** to **6.6.1.1.3.**

6.6.1.1.1 Physical Disturbance and Temporary Loss of Seabed Habitat

451. There is the potential for direct physical disturbance of the seabed and temporary habitat loss caused during the installation of the FBSS and/or SKS (i.e., anchors and moorings), subsea cable hub(s), IACs and associated cable protection and ancillary equipment (including any seabed preparation, boulder clearance and UXO investigation/clearance). Disturbance can potentially be caused by the following:

- Securing of FSS and FBSS to the seabed could include a selection of the following types of piles and anchors:

  - Driven piles, suction piles, drilled and grouted anchors, drag embedment anchors, vertical load anchors, or suction embedded plate anchors.
- Scour protection for the FBSS, subsea cable hub(s), and SKS anchors could include:
  - Graded rock placement/rock bags, concrete mattresses, grout bags or artificial (frond) mattresses.
- Installation of the IACs could include the following burial techniques (if buried):
  - Jet trenching, mechanical trenching, cable ploughing, and mass flow excavator.
- Cable protection for the IACs could include the following:
  - Cable burial, concrete mattresses, rock placement, grout bags, cast iron shells.

452. Areas affected by piling, mooring and cable installation are likely to see some movement and ongoing disturbance will be assessed as part of the operation phase, see **Section 6.6.1.2.1**. However, this will be assessed in depth once the design details are known.

453. The presence of mooring lines could provide protection to the seabed around each structure for the lifetime of the Broadshore Hub WFDAs (between 25 and 50 years[21]), where the mooring line does not drag on the seabed. This is because fishing activities (which have the potential to disturb the seabed) and other marine traffic may be restricted within the Broadshore Hub WFDAs for safety reasons. However, as discussed above, the movement and ongoing disturbance from mooring lines may have an operational impact and is discussed in **Section 6.6.1.2.1**.

454. The magnitude of the potential impact will be assessed based upon the outcomes of **Chapter 5: Marine Geology, Oceanography and Physical Processes** (i.e., the footprint of impact from construction activities). The magnitude of the impact of physical disturbance and temporary loss of seabed habitat will be considered in terms of a worst-case scenario (i.e. maximum area affected) at any one location.

6.6.1.1.2 Increased Suspended Sediment Concentrations and Sediment Re-deposition

455. Construction activities have the potential to cause mobilisation of sediments in the water column and an increase in SSC. Such concentrations have the potential to affect benthos through blockage of filter feeders and/or smothering sessile species. Given that the substrate at the Broadshore Hub WFDAs is generally more stable supporting a more diverse benthic community (**Section 6.4.4**), it is likely that the benthic communities are not habituated to smothering from natural events and are therefore likely to be more sensitive to such impacts.

456. The magnitude of the potential impact will be based upon the outcomes of **Chapter 5: Marine Geology, Oceanography and Physical Processes**. The magnitude of the impact of sediment plumes and smothering on benthic receptors will be considered in terms of a worst-case scenario

[21] The Broadshore WFDA seabed lease is up to 60 years, and the Sinclair WFDA and Scaraben WFDA seabed leases are both up to 25 years. The Broadshore, Sinclair and Scaraben WFDAs' operational life is between 25 and 50 years. At the end of the operational life, any repowering will be subject to separate consents.

(i.e. maximum area effected, the maximum concentration of the plume/duration of smothering and the maximum thickness of deposited material) at any one location. Effects will be assessed in relation to background SSC levels and natural variations and seasonal changes. The nature, type and duration of potential construction activities will be considered to determine the magnitude of impacts.

6.6.1.1.3 Remobilisation of Existing Contaminated Sediments

457. Sediment disturbance could lead to the mobilisation of contaminants (if present) that could be harmful to benthic communities. The Broadshore Hub WFDAs benthic study area is within the footprint of eight oil and gas licence blocks (13/17c, 13/17b, 13/18, 13/21b, 13/22a, 13/23c, 13/28a, 13/28c) (see **Figure 13.2**[22] in **Appendix 1**), where there is the potential for contaminants being adsorbed and contained within sediments, which may be released following disturbance. Potential contaminants include the discharge of chemicals under the OSPAR Harmonised Mandatory Control System (HMCS), and other contaminants such as drill cuttings and flare drop out.

458. The existing decommissioned oil and gas wells identified within the Broadshore Hub WFDAs and potential for associated contaminated drill cuttings will be considered during the definition of Broadshore Hub WFDAs design and layout. Engagement will be undertaken with NSTA and the respective oil and gas operators, and an offset may be applied to reduce any potential remobilisation of contaminated sediments if required, to be defined via a structured risk assessment approach.

459. Levels of sediment contamination will be determined through the benthic survey campaigns (see **Table 6.4**) and assessed against the Cefas Action Levels. Potential impacts related to the remobilisation of contaminants are currently scoped in for assessment. However, should the results of benthic sampling demonstrate low levels of sediment contamination, the Applicants would seek to scope these out of further assessment through agreement with stakeholders in future consultation.

6.6.1.2 Operation and Maintenance

460. The potential impacts on benthic ecology from activities carried out during the operation and maintenance phase that are scoped in for further assessment in the Broadshore Hub WFDAs EIA Report are set out in **Section 6.6.1.2.1** to **6.6.1.2.6**.

6.6.1.2.1 Physical Disturbance and Temporary Loss of Seabed Habitat

461. There is potential for ongoing physical disturbance of the seabed during the operation phase from maintenance activities, such as indentations on the seabed from jack-up vessels required for IAC repairs or reburial. In general, the effects from planned maintenance should be temporary, localised and smaller in scale than during construction. Therefore, it is proposed that temporary physical disturbance of the seabed due to operation and maintenance activities should be ‘scoped in’ to the Broadshore Hub WFDAs EIA Report.

[22] Note the marine infrastructure and other users study area is 10 nm and therefore differs from the benthic study area which is 10 km.

462. Note that physical disturbance and temporary loss of seabed habitat from substructure movement will also be included within the assessment of permanent habitat loss as the movements can be seen as a consistent occurrence and therefore permanent (see **Section 6.6.1.2.2**).

6.6.1.2.2 Permanent Habitat Loss

463. Permanent habitat loss will occur in the footprint of all anchors associated with SKS, FBSS substructures, IACs and its protection (where the rock protection is situated on a sediment habitat) and subsea cable hub(s). There may also be some loss over time associated with scour around the mooring and substructure footprints. During operation, some disturbance on the seabed may occur during movement and drag of catenary chains and IAC in response to physical conditions.

464. Data from the baseline environment would be used to assess what area of habitat loss would occur and what specific habitat type/species would be affected, see **Section 6.4** for the proposed EIA methodology that would be used. It is proposed to scope in permanent habitat loss during the operational phase into the Broadshore Hub WFDAs EIA Report for further consideration.

6.6.1.2.3 Increased Suspended Sediments and Sediment Re-deposition

465. It is anticipated that the effects from suspended sediment concentrations from operation and maintenance activities such as IAC repairs and vessel movements will be small scale and temporary, and less than the same impact during construction.

466. There is also the possibility for catenary action of mooring lines and dynamic inter-array cables to entrain sediment into suspension in the water column.

467. Therefore, any potential impacts related to the suspension of fine sediments during operation and maintenance have been 'scoped in' to the Broadshore Hub WFDAs EIA Report.

6.6.1.2.4 Electromagnetic Fields

468. Potential impacts of EMF from operational cables will be considered. A comparison of EMF field strength across 10 different cables (buried/unburied) and wind farms (Normandeau et al., 2011) suggests that EMF may be detectable above background levels up to 10 m from the vicinity of the cable. However, this decreases at lower voltages and where cable protection measures, including burial, are used. Any impacts are likely to be highly localised, as EMFs are strongly attenuated and decrease as an inverse square of distance from the cable (Gill and Barlett, 2010). A more recent study by BOEM (2016), found that EMFs produced by cables have also been shown to reduce to background levels approx. 1 m from the cable. Additionally, Hutchison et al. (2021) found that the closer the DC cables bundled together are, the smaller the extent of the deviation from the geomagnetic field, indicating a degree of cancellation.

469. EMF generated by subsea cables and IACs has the potential to affect benthic receptors in close proximity to such infrastructure. However, there is limited information on the effects of EMF on benthic receptors, with the majority of research concentrated on fish. A recent study by Hutchinson et al., (2020) demonstrated behavioural changes in American lobsters *Homarus americanus* during the presence of EMFs. However, this species is not present within the regional benthic subtidal ecology study area.

470. Similarly, other benthic invertebrates have been shown to use the earth's magnetic fields for navigation, such as the amphipods *Idotea baltica basteria* and *Gondogenia antarctica*, and crustacean, the spiny lobster *Panulirus argus* (Herrnkind and McLean, 1971, Lohmann et al., 1995, Ugolini and Pezzani, 1995, Boles and Lohmann, 2003, Tomanová and Vácha, 2016). However, Bochert and Zettler (2006) studied the effects of EMF on the survival and physiology of various crustaceans, marine worms, and echinoderms in the context of a variety of cables associated with offshore wind farms in the Baltic Sea and demonstrated no significant effects for any species after three months of exposure.

471. Furthermore, there were no differences between benthic community assemblages observed in visual surveys of wind farm subsea cables and their peripheral areas (Wilhelmsson et al., 2010). Finally, the presence of diverse and seemingly healthy benthic communities on existing offshore wind farm structures indicates that EMF is unlikely to cause a long-term significant effect upon benthic receptors (Linley et al., 2007; Walker et al., 2009). In addition, a recent review of evidence of the effect of EMF on benthic receptors undertaken for Berwick Bank (SSER, 2022) indicated that any effects, should any occur at all, would affect a very limited area (e.g. in the immediate vicinity of cables) and, therefore, would not lead to significant adverse effects.

472. There is currently potential for cables to be surface laid, surface laid with protection or buried. Therefore, on the basis of the information presented here, it is proposed to scope this impact in for further consideration within the Broadshore Hub WFDA's EIA.

6.6.1.2.5 Colonisation of Introduced Substrate

473. The subsea infrastructure is expected to be colonised by a range of species leading to a localised increase in biodiversity. However, there is the potential for some of these species to appear from further afield that do not normally occur in the Broadshore Hub WFDAs and for these species to be INNS. The presence of the infrastructure would also provide habitat for mobile species and serve as a refuge for fish. This is likely to represent a change from the baseline ecology (**Section 6.4.4**) which is unlikely to support hard surfaces for attachment. Overall, the area available for colonisation would be low and to date there is no evidence of significant changes of the seabed beyond the vicinity of the substructure or mooring structures due to the installation of windfarm infrastructure (Lindeboom et al., 2011).

474. However, given the change in habitat type from soft sediment dominated area to small areas of hard substrate this effect will be 'scoped in' to the Broadshore Hub WFDAs EIA Report for further consideration.

6.6.1.2.6 Remobilisation of Existing Contaminated Sediments

475. As discussed in **Section 6.6.1.1.3**, contamination data has been collected in the Broadshore Hub WFDAs (survey locations shown in **Figure 5.7)**. The surveys could indicate whether there are significant levels of chemicals within the sediments that could potentially be disturbed and have harmful effects on the benthic ecology. It is important to note that the sandy nature of the offshore sediments does reduce this risk.

476. Levels of sediment contamination will be determined through the benthic survey campaigns (see **Table 6.4**) and assessed against the Cefas Action Levels. Potential impacts related to the remobilisation of contaminants are currently scoped in for assessment. However, should the results

of benthic sampling demonstrate low levels of sediment contamination, the Applicants would seek to scope these out of further assessment through agreement with stakeholders in future consultation.

6.6.1.3 Decommissioning

477. It is anticipated that the potential decommissioning impacts would be similar in nature to those of construction, although the magnitude of impact will vary. Even though limited seabed preparation will be required, it is thought that infrastructure will have been colonised by benthic species and the removal of such infrastructure could have a larger effect than that seen at construction. It is important to note that given the timeframe of the Broadshore Hub WFDAs (25 to 50 years), the baseline environment is likely to have changed and therefore decommissioning cannot be fully assessed at this stage.

478. Note that the magnitude of impact for underwater noise would also be reduced in decommissioning due to the lack of piling.

479. The same potential impacts identified for construction are therefore scoped in for decommissioning (as per **Section 6.6.1** and **Table 6.88**). In addition, permanent habitat loss is proposed to be 'scoped in' to the Broadshore Hub WFDAs EIA Report for further assessment. (**Section 3.9.5** in **Chapter 3: Project Description**).

6.6.2 Potential Impacts Scoped Out

6.6.2.1 Construction

480. The potential impacts on benthic ecology from activities carried out during the construction phase that are proposed to be scoped out from further assessment in the Broadshore Hub WFDAs EIA Report are set out in Section **6.6.2.1.1** to **6.6.2.1.4**.

6.6.2.1.1 Underwater Noise and Vibration

481. Research into the effects of underwater noise in relation to benthic ecology is ongoing. However, it is likely that there is habituation to noise created by the existing shipping in the area around the Broadshore Hub WFDAs (AIS, 2019). Vessel traffic noise is unlikely to cause significant effects on benthic receptors and will therefore be scoped out.

482. There may be reactions from some benthic species to episodic noise such as that from pile driving (Lovell et al., 2005; Heinisch and Weise, 1987). Any effect is likely to be localised and temporary. Dannheim et al., (2020) acknowledge that even though there is evidence to suggest a change in behaviour for some benthic species, the effects of noise and vibration is a priority area for future research as it is not known if changes to population structure and distribution may be affected long term. The latest research will be considered and presented within the Broadshore Hub WFDAs EIA Report.

483. Any Unexploded Ordnance (UXO) clearance required ahead of construction would also have small spatial and temporal impacts due to the nature of the activity. An UXO survey will be completed prior to UXO clearance works. The exact type, size and number of possible detonations and duration of UXO clearance operations is therefore not known at this stage. This means that any

assessments for UXO clearance in the Broadshore Hub WFDAs EIA Report will be for information only and are not part of the application. A separate Marine License application(s) will be made prior to UXO clearance works, with an accompanying assessment of UXO clearance effects on benthic ecology. The assessment included in the Broadshore Hub WFDAs EIA Report will be indicative only.

484. A desk-based UXO Threat and Risk Assessment for the Broadshore Hub WFDAs has been conducted which has assessed the likelihood of encountering a threat, in accordance with the risk assessment methodology, as low. Although, there is evidence of prospective UXO contamination at the benthic study area (6 Alpha Associates Ltd, 2023). A summary of this report can be seen in **Section 8.6.1.1.1.1** of **Chapter 8: Marine Mammals**.

485. In conclusion, there is potential that piling may provide a source and pathway to benthic receptors. However, the effect of this is thought to be negligible and therefore it is proposed that potential noise and vibration effects should be scoped out of the Broadshore Hub WFDAs EIA Report.

6.6.2.1.2 Accidental Release of Pollutants

486. Accidental spills and pollution events can occur from vessels and installation techniques required for the installation and operation of the windfarm.

487. As discussed in **Section 6.5.4**, all vessels must comply with the International Convention for the Prevention of Pollution from Ships (MARPOL) 73/78. A EMP or similar will also be put in place and implemented to ensure all works are undertaken in line with best practice for working in the marine environment. A Marine Pollution Contingency Plan (MPCP) will set out the provisions and response procedures in the event of pollution incidents (i.e. hydrocarbon release).

488. As a result of these embedded mitigation measures, it is considered that the risk to the marine environment resulting from a spill is low and with the appropriate management measures in place, should a spill occur, the vessel Shipboard Oil Pollution Emergency Plan (SOPEP) and the MPCP will be in place to mitigate any consequences. Therefore, it is considered that no significant effect would occur and as a result of these mitigation measures, it is proposed that this impact is scoped out of the Broadshore Hub WFDAs EIA Report.

6.6.2.1.3 Introduction of Invasive Non-native Species from Marine Traffic

489. The potential risk of spreading or introducing INNS will be mitigated by employing biosecurity measures in accordance as discussed in **Section 6.5.4**. These commitments would be secured in the EMP via a condition in the Marine License application. The EMP will be agreed with relevant stakeholders prior to the start of construction. Additionally, an INNSMP will be developed to include provisions for INNS management.

490. With the appropriate mitigations in place, it is expected that the risk of INNS being introduced would be reduced. Therefore, it is proposed that with this embedded mitigation, introduction of marine

INNS from vessel traffic during the construction phase is scoped out[23] of the Broadshore Hub WFDAs EIA Report.

6.6.2.1.4 Potential Impacts on Designated Sites

491. The benthic study area does not directly overlap any designated sites (see **Section 6.4.4**). Secondary impacts on benthic habitats extends to an approximate distance of a tidal ellipse from the source, to ensure that all potential secondary effects are captured. As shown in **Chapter 5: Marine Geology, Oceanography and Physical Processes**, the extent of the tidal ellipse will be assessed during the next stage of the EIA process. As the closest distance of any protected site is 24 km away, it is expected that this distance falls outside of the benthic study area, depending on the tidal ellipse data as mentioned above. Therefore, impacts on designated sites is proposed to be scoped out of the Broadshore Hub WFDAs EIA Report.

492. See the **Broadshore Hub WFDAs HRA Screening Report** (BlueFloat | Renantis Partnership, 2024) for further information on SACs and SPAs and **Appendix 2: NCMPA Screening** of this Broadshore Hub WFDAs Scoping Report for MPAs.

6.6.2.2 Operation and Maintenance

493. The potential impacts on benthic ecology from activities carried out during the operation and maintenance phase that are scoped out from further assessment in the Broadshore Hub WFDAs EIA Report are set out in **Section 6.6.2.2.1** to **6.6.2.2.4**.

6.6.2.2.1 Accidental Release of Pollutants

494. The potential impacts from pollution events from operational vessels are not considered to result in significant effects on benthic receptors. The potential impacts will be to a lesser degree than in the construction phase, due to fewer vessels required during operation. Embedded mitigation measures to reduce spillage risk and establish appropriate management measures described in **Section 6.6.2.1.2** will also cover the Broadshore Hub WFDAs operation phase. Therefore, it is proposed that this impact is scoped out of the Broadshore Hub WFDAs EIA Report.

6.6.2.2.2 Introduction of Invasive Non-native Species from Marine Traffic

495. The potential impacts from the introduction of marine INNS from operational vessels are not considered to result in significant effects on benthic receptors. The potential impacts will be to a lesser degree than in the construction phase, due to fewer vessels required during operation. Embedded mitigation measures related to biosecurity in the marine environment described in **Section 6.6.2.1.3** will also cover the Broadshore Hub WFDAs operation phase. Biosecurity commitments would be implemented through the EMP, to be consulted with relevant stakeholders prior to the start of construction. Additionally, an INNSMP will be developed to include provisions for INNS management Therefore, it is proposed that this impact is scoped out[24] of the Broadshore Hub WFDAs EIA Report for the operation and maintenance phase.

[23] This does not include consideration of towing of floating substructures from ports outside the UK – it is assumed that FOUs would be towed from a UK-based port.

[24] It is assumed that FOUs would be towed from a UK-based port.

6.6.2.2.3 Underwater Noise and Vibration

496. Noise and vibration generated by the operational wind turbines can be conducted through the tower and FSS/FBSS or moorings into the water. Monitoring studies of underwater noise from fixed bottom operational turbines have shown the noise levels from North Hoyle, Scroby Sands, Kentish Flats and Barrow wind farms to be only marginally above ambient noise levels (Walker et al., 2010).

497. Other underwater noise sources during operation (e.g. vessel traffic) are unlikely to cause significant effects on benthic receptors due to the limited spatial and temporal extent of impacts to the receptors. There is no evidence to suggest this low level of noise and vibration has a significant effect on benthic ecology.

498. As piling will be completed during the construction phase, any underwater noise and vibration impacts during the operation phase are unlikely to cause significant effects on benthic receptors and therefore are proposed to be scoped out of the Broadshore Hub WFDAs EIA Report for the operation phase.

6.6.2.2.4 Potential Impacts on Designated Sites

499. As outlined in **Section 6.6.2.1.4**, the designated site is far enough away to have limited impacts, with the nearest being 24 km (**Table 6.7**). Therefore, it is proposed to also scope out this impact during the operational phase.

6.6.2.3 Decommissioning

500. The same potential impacts identified for construction are expected to be scoped out for decommissioning (as per **Section 6.6.2.1** and **Table 6.8)**. Except for the following two impacts which are proposed to be scoped in due to the lifetime of the project and its potential effects when removing infrastructure:

- Permanent habitat loss; and
- Colonisation of introduced substrate.

6.6.3 Potential Cumulative Effects

501. There is potential for cumulative effects to arise in which other projects or plans could act collectively with the Broadshore Hub WFDAs to affect benthic ecology receptors. Therefore, cumulative effects related to benthic ecology are ‘scoped in’ to the Broadshore Hub WFDAs EIA Report for all stages.

502. The CEA will follow the standard approach outlined in **Chapter 4: Approach to Scoping and Environmental Impact Assessment**. The CEA will be considered in two stages; a CEA of the of the whole Broadshore Hub (i.e., the Broadshore Hub WFDAs, the Broadshore Hub OfTDAs and the Broadshore Hub OnTDAs), followed by a CEA of the whole Broadshore Hub alongside other plans or projects.

503. Offshore wind farm projects and other activities (such as oil and gas operations) relevant to the assessment of cumulative effects on benthic ecology will be identified through a screening exercise. The potential effects considered in the CEA will be in line with those described for the project-alone assessment, though it is possible that some will be screened out on the basis that the impacts are highly localised (i.e. they occur only within the Broadshore Hub WFDAs) or where management measures in place for the Broadshore Hub WFDAs and other projects will reduce the risk of effects happening.

504. The CEA for benthic ecology will specifically consider cumulative noise effects, habitat loss and changes to seabed habitat.

505. The types of plans and projects to be taken into consideration are:

- Marine Renewable Energy (MRE) developments;
- Licenced disposal sites;
- Planned construction sub-sea cables and pipelines;
- Oil and gas exploration and development;
- Carbon Capture Storage activities; and
- UXO clearance.

6.6.4 Potential Transboundary Effects

506. Due to the localised and small-scale nature of the impacts on benthic ecology means that significant transboundary effects are considered to be unlikely due to the nearest maritime boundary being approximately 180 km away. It is, therefore, proposed that transboundary benthic effects are scoped out from further consideration within the Broadshore Hub WFDAs EIA Report.

6.6.5 Summary of Benthic Ecology Impacts Scoped In or Out

507. **Table 6.8** outlines the impacts benthic ecology which are proposed to be scoped in or out of the Broadshore Hub WFDAs EIA Report. These may be refined through consultation activities and as additional project information and site-specific data become available.

Table 6.8: Summary of Potential Impacts Scoped In (✓) or Scoped Out (x) for Benthic Ecology

Potential Impact	Receptor(s)	Description of Potential Effects	Scoped In or Scoped Out? (✓ or x)			Embedded Mitigation Measures
			Construction	Operation and Maintenance	Decommissioning	
Physical disturbance and temporary habitat loss of seabed habitat	All benthic ecology and habitats, as described in **Section 6.4**.	Physical direct disturbance of the seabed and temporary habitat loss from Broadshore Hub WFDAs infrastructure.	✓	✓	✓	Development of, and adherence to, a Cable Plan (CaP), will ensure that best practice cable installation methods are used to minimise seabed unnecessary seabed disturbance and sediment suspension.
Permanent habitat loss		Permanent habitat loss from Broadshore Hub WFDAs infrastructure.	x	✓	✓	None
Increased SSC and sediment re-deposition		Mobilisation of sediments in the water column from Broadshore Hub WFDAs activities.	✓	✓	✓	Development of, and adherence to, an appropriate EMP and a CaP, will ensure that best practice cable installation methods are used to minimise seabed unnecessary seabed disturbance and sediment suspension.
Remobilisation of existing contaminated sediments		Sediment disturbance could lead to mobilisation of contaminants that are harmful to benthic communities.	✓*	✓*	✓*	None
Introduction of INNS from marine traffic		Risk of spreading INNS through vessel traffic, i.e., from ballast water.	x	x	x	Biosecurity commitments would be implemented through the EMP. The EMP will be consulted with relevant stakeholders prior to the start of construction. An INNSMP will be developed to include provisions for INNS management.

Potential Impact	Receptor(s)	Description of Potential Effects	Scoped In or Scoped Out? (✓ or x)			Embedded Mitigation Measures
			Construction	Operation and Maintenance	Decommissioning	
Underwater noise and vibration		Increased noise from Broadshore Hub WFDAs activities such as increased vessels, piling and potential UXO clearance.	x	x	x	None
EMF		Operational cable emitting EMF which can be harmful to benthic communities.	x	✓	x	A CaP will be prepared where IACs are buried to confirm the extent to which cable burial can be achieved.
Colonisation of introduced substrate		Broadshore Hub WFDAs infrastructure being colonised by benthic communities.	x	✓	✓	None
Potential impacts on designated sites		Broadshore Hub WFDAs activities effects on designated sites for benthic ecology.	x	x	x	None
Accidental release of pollutants		Accidental spills and pollution events occurring from vessels and installation techniques required.	x	x	x	Development and adherence to, a Environmental Management Plan (EMP), including a Marine Pollution Contingency Plan (MPCP). In addition, adherence by contractors to Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR), IMO, and MARPOL (International Convention for the Prevention of Pollution from Ships) guidelines for preventing pollution at sea.
*Remobilisation of contaminated sediments will be scoped out if site-specific sediment samples reveal low contaminant levels						

6.7 Proposed Approach to Impact Assessment

508. In combination with guidance from CIEEM (2018), the EIA Regulations provide a framework for the methodology to be adopted in the Broadshore Hub WFDAs EIA Report to assess the potential effects on benthic habitat receptors.

509. Due to the complexity of ecological system processes and the uncertainty of some impacts and efficacy of some mitigation measures, experienced professional judgement also plays a key role in the evaluation of features and in determining significance of effects. The impact assessment methodology for the benthic ecology chapter will follow that which is described in **Chapter 4: Approach to Scoping and Environmental Impact Assessment**, as well as the guidance documents presented in **Section 6.5.4**.

510. Within the benthic ecology chapter of the Broadshore Hub WFDAs EIA Report, the overall impact assessment for the Broadshore Hub WFDAs will be presented first. Following this, a summary of each WFDA will be given (i.e. Broadshore WFDA, Sinclair WFDA, Scaraben WFDA).

511. Specific to marine ecology, the CIEEM (2019) guidelines will be followed in order to identify Important Ecological Features (IEFs). Assessments of the identified IEFs will be presented in the baseline characterisation of each relevant technical section. To reflect receptor specific interests, the CIEEM (2019) guidelines will be used to produce criteria defining the value of each IEF and will include specific consideration of PMFs within the benthic study area.

512. The assessment of the potential effects upon the benthos will be cross-referenced, where relevant, to the assessments for **Chapter 5: Marine Geology, Oceanography and Physical Processes**. The impact assessment, in common with other receptors, will consider the following:

- Magnitude/extent: the size or amount of impact – e.g. area of seabed directly or indirectly affected;
- Sensitivity of receptors;
- Duration: time for recovery (may vary with receptor sensitivity) and duration of activity causing an effect;
- Reversibility of the impact; and
- Timing and frequency.

513. Regarding the characterisation of the benthic subtidal ecology baseline, a combination of MarESA (Tyler-Walters et al., 2018) and Feature Activity Sensitivity Tool (FeAST) will be utilised to inform the sensitivity of benthic receptors in the effects assessment section of the benthic ecology chapter. The framework determines sensitivity based on resistance (tolerance) and resilience (recoverability), which are defined as:

- Resistance: the likelihood of damage (termed intolerance or resistance) due to a pressure; and
- Resilience: the rate of (or time taken for) recovery (termed recoverability, or resilience) once the pressure has abated or been removed.

514. Site-specific surveys as set out in **Table 6.4** will also be carried out to inform vulnerability and sensitivity assessments.

515. There are some areas within the Broadshore Hub WFDAs where the presence of PMFs is predicted, but these are not considered as the most vulnerable receptors within the benthic communities and there are no other sensitive areas noted, as per the most vulnerable PMFs identified by Marine Scotland (**Section 6.5**). However, if the site-specific surveys report any sensitive or protected habitats/species within the benthic study area, micro-siting where practicable may be an option as additional mitigation.

516. The approach to CEA and are detailed in **Sections 6.6.3** and **6.6.4** respectively, as well as **Chapter 4: Approach to Scoping and Environmental Impact Assessment**.

6.8 Scoping Questions to Consultees

517. The following questions are posed to consultees to help them frame and focus their response to the benthic ecology scoping exercise, which will in turn inform the Scoping Opinion:

- Do you agree with the characterisation of the existing environment?
- Have all benthic ecology impacts resulting from the Broadshore Hub WFDAs been identified in the Broadshore Hub WFDAs Scoping Report?
- Do you agree with the benthic ecology impacts that have been scoped in for/out from further consideration within the Broadshore Hub WFDAs EIA Report?
- Have all the relevant data sources been identified in the Broadshore Hub WFDAs Scoping Report?
- Do you agree with the proposed approach to assessment in the Broadshore Hub WFDAs EIA Report?
- Do you have any other matters or information sources that you wish to present?

6.9 References

6 Alpha Associates Ltd (2023). Broadshore Offshore Wind Farm; Unexploded Ordnance Threat and Risk Assessment. Project No.: 50012_1

BlueFloat | Renantis Partnership, (2024). Broadshore Hub Wind Farm Development Areas Habitats Regulations Screening Report.

Bochert and Zettler. (2006). Effect of Electromagnetic Fields on Marine Organisms. Chapter 14 in Offshore Wind Energy; Research on Environmental Impacts.

Boles, L. C. and Lohmann, K. J. (2003). True navigation and magnetic maps in spiny lobsters. Nature, 421(6918), 60-63.

Centre for Environment, Fisheries and Aquaculture Science (Cefas) (2012). Guidelines for Data Acquisition to Support Marine Environmental Assessments of Offshore Renewable Energy Projects. Available at: https://tethys.pnnl.gov/sites/default/files/publications/CEFAS_2012_Eenvironmental_Assessment_Guidance.pdf

Chartered Institute for Ecology and Environmental Management (CIEEM) (2018). Guidelines for Ecological Impact Assessment in the UK and Ireland Terrestrial, Freshwater, Coastal and Marine. Available at: https://cieem.net/wp-content/uploads/2018/08/ECIA-Guidelines-2018-Terrestrial-Freshwater-Coastal-and-Marine-V1.1Update.pdf

CIEEM (2018). Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine version 1.2. Chartered Institute of Ecology and Environmental Management, Winchester.

Dannheim, J., Bergström, L., Birchenough, S.N., Brzana, R., Boon, A.R., Coolen, J.W., Dauvin, J.C., De Mesel, I., Derweduwen, J., Gill, A.B. and Hutchison, Z.L., (2020). Benthic effects of offshore renewables: identification of knowledge gaps and urgently needed research. ICES Journal of Marine Science, 77(3), pp.1092-1108.

EMODnet (2023). EMODnet broad-scale seabed habitat map for Europe (EUSeaMap). Available from: https://emodnet.ec.europa.eu/geoviewer/

EUSeaMap (2021). EUSeaMap (2021) Broad-Scale Predictive Habitat Map - EUNIS classification. Available at: https://emodnet.ec.europa.eu/en/seabed-habitats Fugro EMU Ltd (2014). Captain EOR Project, UKCS Block 13/22a: WE8b Environmental Baseline Survey and Habitat Assessment Report. Volume 2: Captain D & BLPB to Area D Routes Habitat Assessment. J35025-RES8bV2(0).

Fugro (2021a). Site survey Captain UKCS Block 13/22a. Fugro report No. 210272, Habitat Assessment Report.

Fugro (2021b). Site Survey Captain UKCS Block 13/22a. Fugro report No. 210272, Environmental Baseline Report.

Fugro EMU Ltd (2015a). Captain EOR Project, UKCS Block 13/22a: WE8b Environmental Baseline Survey and Habitat Assessment Report. Volume 6: Captain BLPB Habitat Assessment. J35025-RES8bV6(1).

Fugro EMU Ltd (2015b). Captain EOR Project, UKCS Block 13/22a: WE8b Environmental Baseline Survey and Habitat Assessment Report. Volume 5: Captain BLPB Environmental Baseline Survey. J35025-RES8bV5(0).

Gibb, N., Tillin, H.M., Pearce, B. and Tyler-Walters H. (2014). Assessing the sensitivity of *Sabellaria spinulosa* to pressures associated with marine activities. JNCC report No. 504.

Gill, A. B. and Bartlett, M., (2010). Literature review on the potential effects of electromagnetic fields and subsea noise from marine renewable energy developments on Atlantic salmon, sea trout and European eel. Scottish Natural Heritage, Commissioned Report No. 401.

Heinisch P., and Wiese. K. (1987). Sensitivity to Movement and Vibration of Water in the North Sea Shrimp Crangon Crangon: Journal of Crustacean Biology Vol. 7, No. 3 pp. 401-413 Published by: The Crustacean Society.

Herrnkind, W. F. and McLean, R. (1971). Field studies of homing, mass emigration, and orientation in the spiny lobster, Panulirus argus. Annals of the New York Academy of Sciences, 188(1), 359-376.

Ithaca Energy (2022). The Captain EOR Stage 2 Phase II Project Environmental Statement (online). Department for Business, Energy and Industrial Strategy (BEIS) Reference No. ES/2022/007. Available from: https://assets.publishing.service.gov.uk/media/63037a668fa8f5372c7a5d23/Captain_EOR_Stage_2_Phase_II_ES_Redacted.pdf

Joint Nature Conservation Committee (JNCC) (2001). Marine Monitoring Handbook. Available at https://data.jncc.gov.uk/data/ed51e7cc-3ef2-4d4f-bd3c-3d82ba87ad95/marine-monitoring-handbook.pdf

Joint Nature Conservation Committee (JNCC) (2012). Identification of Priority Marine Features in Scotland's seas. JNCC Report No. 462. Aberdeen.

Joint Nature Conservation Committee (JNCC) (2014). JNCC clarifications on the habitat definitions of two habitat Features of Conservation Importance: Mud habitats in deep water, and Sea-pen and burrowing megafauna communities. Peterborough, UK.

Künitzer A., Basford D., Craeymeersch J.A., Dewarumez J.M., Dörjes J., Duineveld G.C.A., Eleftheriou A., Heip C., Herman P., Kingston P., Niermann U., Rachorm E., Rumohr H. & de Wilde P.A.J. (1992). The benthic infauna of the North Sea: species distribution and assemblages. ICES Journal of Marine Science 49: 127-143.

Lindeboom, H., Kouwenhoven, H., Bergman, M., Bouma, S., Brasseur, S., Daan, R., Fijn, R., de Haan, D., Dirksen, S., van Hal, R., Hille Ris Lambers, R., ter Hofstede, R., Krijgsveld, K., Leopold, M. and Scheidat, M. (2011) Short-term ecological effects of an offshore windfarm in the Dutch coastal zone; a compilation. Environmental Research Letters, 6(3).

Linley, E, A. S., Wilding, T. A, Black, K., Hawkins, A. J. S. and Mangi, S. (2007). Review of the reef effects of offshore wind farm structures and their potential for enhancement and mitigation. Report from PML Applications Ltd and the Scottish Association for Marine Science to the Department for Business, Enterprise and Regulatory Reform (BERR), Contract No: RFCA/005/0029P.

Lohmann, K., Pentcheff, N., Nevitt, G., Stetten, G., Zimmer-Faust, R., Jarrard, H. and Boles, L. C. (1995). Magnetic orientation of spiny lobsters in the ocean: experiments with undersea coil systems. The Journal of experimental biology, 198(10), 2041-2048.

Lovell J.M, Findlaya M.M, Moateb R M and Yanc H.Y (2005).The hearing abilities of the prawn Palaemon serratus. Comparative Biochemistry and Physiology, Part A 140 89 –100.

Marine Biological Association (2023). The Marine Life Information Network (MarLIN). Available at: https://www.marlin.ac.uk/species

Marine Scotland (2015). Scotland's National Marine Plan: A Single Framework for Managing Our Seas. Available at: https://www.gov.scot/binaries/content/documents/govscot/publications/strategy-plan/2015/03/scotlands-national-marine-plan/documents/00475466-pdf/00475466-pdf/govscot%3Adocument/00475466.pdf

Marine Scotland (2018a). Scoping 'Areas of Search' Study for offshore wind energy in Scottish Waters. Available at: https://www.gov.scot/publications/scoping-areas-search-study-offshore-wind-energy-scottish-waters-2018/documents/

Marine Scotland (2018b). Marine Scotland Consenting and Licensing Guidance for Offshore Wind, Wave and Tidal Energy Applications. Available at: https://www.gov.scot/publications/marine-scotland-consenting-licensing-manual-offshore-wind-wave-tidal-energy-applications/documents/

Marine Scotland (2020). Moray Firth Marine Protection Area - Business and Regulatory Impact Assessment. Available at: https://www.gov.scot/binaries/content/documents/govscot/publications/impact-assessment/2020/12/moray-firth-special-protection-area-business-regulatory-impact-assessment/documents/marine-scotland-moray-firth-marine-protection-area-business-regulatory-impact-assessment/marine-scotland-moray-firth-marine-protection-area-business-regulatory-impact-assessment/govscot%3Adocument/marine-scotland-moray-firth-marine-protection-area-business-regulatory-impact-assessment.pdf

Marine Scotland (2023). Ossian Array Scoping Opinion.

Marine Management Organisation (MMO) (2014). Review of post-consent offshore wind farm monitoring data associated with licence conditions. A report produced for the Marine Management Organisation,pp 194. MMO Project No: 1031. ISBN: 978-1-909452-24-4.

NatureScot (2022). Guidance on Marine non-native species . Available at: https://www.nature.scot/professional-advice/land-and-sea-management/managing-coasts-and-seas/marine-non-native-species

NBN Atlas (2023). National Biodiversity Network Atlas. Available at: https://nbnatlas.org/

Normandeau, Exponent, T. Tricas, and A. Gill. (2011). Effects of EMFs from Undersea Power Cables on Elasmobranchs and Other Marine Species. U.S. Dept. of the Interior, Bureau of Ocean Energy Management, Regulation, and Enforcement, Pacific OCS Region, Camarillo, CA. OCS Study BOEMRE 2011-09.

OSPAR (2008). OSPAR List of Threatened and/or Declining Species and Habitats (OSPAR Reference Number: 2008-6). Available at: https://www.ospar.org/site/assets/files/1505/08-06e_ospar_list_species_and_habitats.doc

OSPAR (2010). OSPAR Background Document for Seapen and Burrowing megafauna Communities (OSPAR ref. no. 481/2010) [Online]. Microsoft Word - P00481_Seapen and burrowing megafauna.doc (ospar.org)

OSPAR (2013). Background Document on Sabellaria spinulosa reefs. Available at: https://www.ospar.org/documents?d=7342

Ossian Offshore Wind Farm Limited (2023). Ossian Array EIA Scoping Report

Scottish Government (2012). Non-native species: code of practice. ISBN 9781780459301. Available at: https://www.gov.scot/publications/non-native-species-code-practice/

Scottish Government (2020). Commercial shellfish | Scotland's Marine Assessment 2020. Available at: https://marine.gov.scot/sma/assessment/commercial-shellfish#top

SNCBs (2022). Joint SNCB Interim Displacement Advice Note. Available at: https://data.jncc.gov.uk/data/9aecb87c-80c5-4cfb-9102-39f0228dcc9a/joint-sncb-interim-displacement-advice-note-2022.pdf

SNH (2017) SNH Commissioned Report 406: Descriptions of Scottish Priority Marine Features (PMFs).

SSER (2022). Berwick Bank Wind Farm Offshore Environmental Impact Assessment Report.

Tomanová, K. and Vácha, M. (2016). The magnetic orientation of the Antarctic amphipod Gondogeneia antarctica is cancelled by very weak radiofrequency fields. Journal of Experimental Biology, 219(11), 1717-1724.

Tyler-Walters, H., James, B., Carruthers, M. (eds.), Wilding, C., Durkin, O., Lacey, C., Philpott, E., Adams, L., Chaniotis, P.D., Wilkes, P.T.V., Seeley, R., Neilly, M., Dargie, J. & Crawford-Avis, O.T. (2016). Descriptions of Scottish Priority Marine Features (PMFs). Scottish Natural Heritage Commissioned Report No. 406.

Tyler-Walters, H., Tillin, H.M., d'Avack, E.A.S., Perry, F. and Stamp, T. (2018). Marine Evidence-based Sensitivity Assessment (MarESA) – A Guide. Marine Life Information Network (MarLIN). Marine Biological Association of the United Kingdom, Plymouth, 91 pp.

Ugolini, A. and Pezzani, A. (1995). Magnetic compass and learning of the Y, axis (sea-land) direction in the marine isopod Idotea baltica basteri. Animal behaviour, 50(2), 295-300.

Walker, R, Weiss, L, Froján, C. and Basteri, D. (2009). Strategic Review of Offshore Wind Farm Monitoring Data Associated with FEPA Licence Conditions: Benthic Ecology. (Report No. ME1117). Report by Centre for Environment Fisheries and Aquaculture Science (CEFAS).

Walker, R., Judd, A., Warr, K., Doria, L., Pacitto, S., Vince, S. and Howe, L., (2010). Strategic review of offshore wind farm monitoring data associated with FEPA licence conditions: Underwater Noise. Center for Environment, Fisheries, and Aquaculture Science (Cefas).

Ware, S.J., & Kenny, A.J. (2011). Guidelines for the conduct of benthic studies at marine aggregate extraction sites. Cefas, Lowestoft (UK). Project Code: MEPF, 8, P75.

Wilhelmsson, D., Malm, T., Thompson, R., Tchou, J., Sarantakos, G., McCormick, N., Luitjens, S., Gullström, M, Patterson Edwards, J. K., Amir, O. and Dubi, A. (2010). Greening Blue Energy: Identifying and managing the biodiversity risks and opportunities of offshore renewable energy. IUCN [online]. Available from: https://www.actuenvironnement.com/media/pdf/news-22257-etude-uicn.pdf

7 Fish and Shellfish Ecology

7.1 Introduction

518. This chapter considers the scope of potential impacts of the construction, operation and maintenance, and decommissioning phases of the Broadshore Hub Wind Farm Development Areas (WFDAs) on fish and shellfish ecology.

519. This chapter provides an overview of the existing environment and further sets out the methodology and approach to assessing effects on fish and shellfish ecology in the Broadshore Hub WFDAs Environmental Impact Assessment (EIA) Report. This chapter has been prepared by Royal HaskoningDHV.

520. This chapter should be read in conjunction with the following chapters of the Broadshore Hub WFDAs Scoping Report:

- **Chapter 6: Benthic Ecology;**
- **Chapter 8: Marine Mammals**; and
- **Chapter 10: Commercial Fisheries.**

521. The fish and shellfish ecology assessment is likely to have key inter-relationships with the above receptors, which will be considered appropriately where relevant in the Broadshore Hub WFDAs EIA Report.

7.2 Legislation, Policy and Guidance

522. **Table 7.1** sets out the relevant legislation, policy and guidance for fish and shellfish ecology that informs this chapter and will inform the fish and shellfish ecology chapter in the Broadshore Hub WFDAs EIA Report where appropriate. The overarching policy and legislation relevant to the Broadshore Hub WFDAs is described in **Chapter 2: Policy and Legislative Context**.

Table 7.1: Summary of Relevant Legislation, Policy and Guidance for Fish and Shellfish Ecology

Relevant Legislation, Policy or Guidance	Relevance to the Assessment
Legislation	
The Conservation of Offshore Marine Habitats and Species Regulations 2017	Applies to Marine Licences and Section 36 applications within the Scottish Offshore region. It applies the same EPS protections for Atlantic sturgeon as above, but applies in waters beyond 12 nautical miles from shore.

Relevant Legislation, Policy or Guidance	Relevance to the Assessment
The Wildlife and Countryside Act 1981	Provides a list of threatened species for which killing, injuring or taking by any method is prohibited. Basking sharks *Cetorhinus maximus* are protected from intentional or reckless disturbance or harassment. If a risk of disturbance or harassment that cannot be removed or sufficiently reduced by using alternatives or mitigation measures, then the activity may still go ahead under licence (Basking Shark Licence).
The Nature Conservation (Scotland) Act 2004, Part 3 and Schedule 6	Makes amendments to the Wildlife and Countryside Act 1981, strengthening the legal protection for threatened species to include 'reckless' acts.
Policy	
The Scottish Biodiversity Strategy (post-2020: statement of intent)	Reiterates the commitment (and desire to enhance) the 2020 Challenge for Scotland's Biodiversity (response to the Aichi Targets set by the United Nations Convention on Biological Diversity, and the EU's Biodiversity Strategy for 2020) and supplements Scotland's Biodiversity: It's in Your Hands (2004).
The Scottish Wild Salmon Strategy (2022)	Sets out the vision, objectives and priority themes to ensure the protection and recovery of Scottish Atlantic wild salmon populations.
The Scottish Government National Marine Plan (2015)	The following general policies apply to this fish and shellfish ecology assessment: *"General Policy (GEN) 9 Natural heritage: Development and use of the marine environment must:* *a) Comply with legal requirements for protected areas and protected species.* *b) Not result in significant impact on the national status of Priority Marine Features.* *c) Protect and, where appropriate, enhance the health of the marine area."* *"GEN 13 Noise: Development and use in the marine environment should avoid significant adverse effects of man-made noise and vibration, especially on species sensitive to such effects."* Within the Wild Salmon and Diadromous Fish section of the National Marine Plan, there is a policy stating that: *"The impact of development and use of the marine environment on diadromous fish species should be considered in marine planning and decision-making processes."*. It is acknowledged however that *"there is uncertainty around the likelihood and severity"* of wind energy impacts and *"continued efforts to better understand potential impacts should be encouraged*".

Relevant Legislation, Policy or Guidance	Relevance to the Assessment
Guidance	
Guidelines for Ecological Impact Assessment (EcIA) in the UK and Ireland. Terrestrial, Freshwater, Coastal and Marine (Chartered Institute for Ecology and Environmental Management; CIEEM, 2018) (latest update 2022)	These Guidelines have been produced to promote good practice in EcIA relating to terrestrial, freshwater, coastal and marine environments in the UK and Ireland.

7.3 Consultation

523. **Table 7.2** describes the consultation undertaken to date relevant to fish and shellfish ecology for the Broadshore Hub WFDAs.

Table 7.2: Consultation Relevant to Fish and Shellfish Ecology

Consultee	Date/Document	Comment	How Comment is Addressed
Marine Scotland Science (MSS)	27th March 2023, email	Asked MSS asked for further detail on the eDNA sampling design and analysis (e.g., which primers will be used? How will the eDNA output be compared to the macrofauna indices?).	Detailed information on eDNA sampling design and analysis methodology was provided on 2nd June 2023 via email (Survey Note Response).
MSS	27th March 2023, email	JNCC have published guidance on DNA-based approaches for marine monitoring (Wort et al. 2022) and guidance for end users on DNA methods development and project assessment (Jones et al. 2020).	Noted.
MSS	27th March 2023, email	MSS are planning to undertake a project to collect and analyse eDNA samples on the east coast of Scotland, although this has not been scoped yet. If there are any opportunities to take additional samples at the Broadshore WFDA whilst at sea, then there is a possibility that these could be analysed at a later date to add value to both projects.	Noted.
MD-LOT and NatureScot	13th September 2023, Scoping Workshop	NatureScot agreed with the proposed approach to the study areas as set out in **Section 7.4.1**. MD-LOT noted that diadromous fish may migrate west-east, so some north coast rivers, to the west of the Broadshore Hub WFDA may need consideration.	Study areas as agreed in Scoping Workshop are set out in **Section 7.4.1.** In the case of Atlantic salmon, riverine Special Areas of Conservation (SAC) across the north coast of Scotland are considered in **Section 7.4.5**, in acknowledgement of the potential for Atlantic salmon to migrate in an east-west direction along Scotland's northern coast.

Consultee	Date/Document	Comment	How Comment is Addressed
MD-LOT and NatureScot	13th September 2023, Scoping Workshop	NatureScot and MD-LOT agreed with the baseline data sources, with suggestions to add River Wick tracking studies and consider “Developing Essential Fish Habitat maps for fish and shellfish species in Scotland”.	River Wick tracking studies and Developing Essential Fish Habitat maps for fish and shellfish species in Scotland are included in the data sources (**Table 7.3**) and will be considered in the Broadshore Hub WFDAs EIA Report.
MD-LOT and NatureScot	13th September 2023, Scoping Workshop	Make clear whether basking shark is included in Fish and Shellfish or Marine Mammals.	Basking shark are considered in **Section 7.4.3** and will be considered in the fish and shellfish assessment in the Broadshore Hub WFDAs EIA Report.
MD-LOT and NatureScot	13th September 2023, Scoping Workshop	NatureScot agreed that Popper et al. (2014) and proposed stationary/fleeing proposals were acceptable and sked for consideration of spawning cod as a stationary receptor.	Spawning cod will be treated as stationary receptors. The approach to moving and stationary receptors for noise modelling is discussed in **Section 7.7**.
MD-LOT and NatureScot	13th September 2023 Scoping Workshop	NatureScot queried whether eDNA sampling would be used to inform the baseline for the Broadshore Hub WFDAs EIA Report.	eDNA samples have been collected and it is anticipated these will be used to provide context to the baseline. It is considered that use of fisheries landings data (available from Marine Directorate) will provide a more robust characterisation of the sites as there are many years of data generated from landings that occur in multiple months throughout each year. This creates a sufficient level of temporal coverage to avoid the potential skew in data that can result from single sampling snapshots in time (i.e a single scientific survey campaign). The results of the analysis of the eDNA samples will therefore not be used directly to inform the EIA, but instead to add context to the landings data and to derive insights if they exist.

Consultee	Date/Document	Comment	How Comment is Addressed
			Results will be provided to MSS and NatureScot separately for information and future applications, and eDNA sampling from sediment samples will be donated to the Planning Offshore Wind Strategic Environmental Impact Decisions (POSEIDON) project.
MD-LOT and NatureScot	13th September 2023, Scoping Workshop	NatureScot current view agrees that consideration of migratory fish is not needed in the Habitats Regulations Appraisal (HRA) for the Broadshore Hub WFDAs, but should be considered in the Broadshore Hub WFDAs EIA Report.	Diadromous fish are considered in **Section 7.4.3.1,** and will be assessed further in the Broadshore Hub WFDAs EIA Report, but not in the HRA.
MD-LOT and NatureScot	13th September 2023, Scoping Workshop	MD-LOT and NatureScot agreed with the proposed approach to assessing the effects of Electromagnetic Fields (EMF), which is to rely on modelling undertaken by other projects and studies for comparable cables to inform likely field strengths arising from the Broadshore Hub WFDAs inter-array cables (IACs), where possible.	EMF impacts are scoped in for operation (**Section 7.6.1.2.7**). Modelling studies from other projects will be obtained and used to determine likely field strengths arising from Broadshore Hub WFDAs.

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7.4 Existing Environment

7.4.1 Study Area

524. The distribution and abundance of fish and shellfish populations is spatially and temporally variable, therefore for the purposes of the fish and shellfish ecology baseline characterisation, two fish and shellfish study areas are defined. These are shown in **Figure 7.1** in **Appendix 1** and described here:

- The fish and shellfish study area is defined as the International Council for the Exploration of the Sea (ICES) statistical rectangle that overlaps with the Broadshore Hub WFDAs Scoping Boundary (ICES rectangle 45E9).
- The fish and shellfish Northern North Sea study area encompasses the fish and shellfish study area and a surrounding area defined by the boundary of the northern North biogeographic region (CP2), as identified in the Review of Marine Nature Conservation (RMNC) (2004). This also encompasses waters of the Forth and Tay, North-East, and Moray Firth Scottish Marine Regions (SMR). The Northern North Sea study area provides a wider context for the fish species and populations, and will be used specifically to inform assessments of those impacts affecting fish and shellfish receptors over long distances (e.g. underwater noise).

7.4.2 Data and Information Sources

525. **Table 7.3** sets out the information and data sources which have been considered during the production in the preparation of this chapter, and will be considered within future the Broadshore Hub WFDAs EIA Report a where relevant matters are scoped in.

Table 7.3: Summary of Key Data and Information Sources for Fish and Shellfish Ecology

Dataset	Year(s)	Description
Spatial patterns and trends in abundance of larval sandeels in the North Sea: 1950–2005 (Lynam et al., 2013)	1950-2005	Continuous Plankton Recorder (CPR) data on larval *Ammodytes marinus* (sandeel) abundance in the North Sea over the period 1950-2005, averaged over ICES rectangles.
A verified distribution model for the lesser sandeel *Ammodytes marinus* (Langton et al., 2021)	2021	A species distribution model (hurdle model) to predict the occurrence and density of sandeels in the North Sea.
International Herring Larvae Survey	2013-2023	The ICES programme of international herring larval surveys in the North Sea provides annual quantitative estimates of herring larval abundance in Scottish waters.
Updating Fisheries Sensitivity Maps in British Waters (Aires et al., 2014)	2014	Modelled probability of larvae presence for various fish species.

Dataset	Year(s)	Description
Mapping the spawning and nursery grounds of selected fish for spatial planning (Ellis et el., 2012)	2012	Mapped extents of spawning and nursery grounds of various fish species, using the original maps produced by Coull et al. (1998), updated with newer data on larvae, juvenile, and egg abundance.
Review of migratory routes and behaviour of Atlantic salmon, sea trout and European eel in Scotland's coastal environment: implications for the development of marine renewables (Malcolm et al., 2010)	2010	A review of migratory routes and behaviour of Atlantic salmon, sea trout and European eel in Scotland's coastal environment, and the implications for marine developments.
Fisheries sensitivity maps in British Waters (Coull et al., 1998)	1998	Mapped extents of the spawning and nursery grounds of various commercially important fish species and the relative intensity and duration of spawning.
Marlin fish and shellfish sensitivity reports. https://www.marlin.ac.uk/activity/pressures_report	N/A	Marlin's Marine Evidence Based Sensitivity Assessment (MarESA) sensitivity assessments examine the biology or ecology of a fish or shellfish species, compile the evidence of the effect of a given pressure on the species, assess the likely sensitivity of the species to the pressure against standard scales, documenting the evidence used.
Marine Scotland: Salmon fishery statistics, including rod catch data	2022	A summary of salmon rod and net catch data for the 2021 fishing season.
National Biodiversity Network (NBN) Atlas species assemblage data	2023	The NBN Atlas is a species occurrence data portal, combining 995 datasets from 165 data partners at the time of writing.
Consenting documents for nearby projects, including Buchan, Moray West, Moray East, and Beatrice offshore wind farms (OWF).	Various	Impact assessment and site survey reports for relevant OWF projects.
Developing Essential Fish Habitat maps for fish and shellfish species in Scotland Report (Franco et al., 2022)	2022	Modelled extent of essential fish habitat in Scottish waters for 16 species in offshore waters.
River Wick Atlantic salmon smolt tracking (McIlvenny et al., 2021)	2016	Acoustic telemetry tracking of Atlantic salmon smolts in coastal waters surrounding the mouth of the River Wick.

7.4.2.1 Site-specific Surveys

526. In addition to the data utilised in **Table 7.3**, the following site-specific survey data will be used to inform the Broadshore Hub WFDAs EIA Report, as shown in **Table 7.4**.

Table 7.4: Overview of Site-specific Surveys

Site-specific Surveys	Year(s)	Description
Broadshore Hub WFDAs benthic survey e.g. drop-down video and grab sampling	2023	Benthic survey data from the Broadshore Hub WFDAs will provide context on the habitat types present in the Broadshore Hub WFDAs, and this will provide context to the fish and shellfish baseline. In addition, the Particle Size Analysis (PSA) data from grab samples will be used to inform the baseline for herring spawning and sandeel habitat suitability. This will be discussed further in the Broadshore Hub WFDAs EIA Report and assessed against Cefas Action Levels for contaminants.
Broadshore Hub WFDAs eDNA water samples	2023	eDNA samples have been collected from the Broadshore Hub WFDAs and it is anticipated these will be used to provide context to the baseline. It is not intended to use this data to inform the EIA directly. Results will be provided to MSS and NatureScot separately for information and future use, and eDNA sampling from sediment samples will be donated to the POSEIDON project. The eDNA survey methodology was sent to NatureScot and the Marine Directorate (and MSS) for comment on the 8th March 2023.
Broadshore Hub WFDAs offshore aerial surveys	March 2022 – April 2024	Site-specific offshore aerial surveys have been undertaken across the Broadshore WFDA and Sinclair & Scaraben WFDAs, ongoing until 2024.

527. In addition, noise modelling will be undertaken as part of the EIA process. Site-specific noise modelling will be undertaken to inform the assessment of underwater noise impacts on fish and shellfish receptors, using Popper et al. (2014) to define impact thresholds.

7.4.3 Fish Assemblage

528. The fish and shellfish study area includes demersal, pelagic, diadromous, and elasmobranch fish species, including commercial and non-commercial species. Demersal species include cod *Gadus morhua*, haddock *Melanogrammus aeglefinus*, whiting *Merlangius merlangus*, plaice *Pleuronectes platessa*, lemon sole *Microstomus kitt* and sandeel *Ammodytidae spp*. Pelagic species include herring *Clupea harengus*, mackerel *Scomber scrombus* and sprat *Sprattus sprattus*. Elasmobranch species, such as spotted ray *Raja montagui*, thornback ray *Raja clavata*, tope shark *Galeorhinus galeus*, small-spotted catshark *Scyliorhinus canicula*, spurdog *Squalas acanthias*, thorny skate *Amblyraja radiata* and cuckoo ray *Leucoraja naevus*, among others, have been observed in the fish and shellfish study area (Coull, et al., 1998; Daan et al., 2005; Baxter et al., 2011; Ellis et al., 2012). Many of these species are of conservation importance either nationally or internationally; conservation designations are listed in **Table 7.7**.

529. In addition, many of these species form important prey resources for marine mammals and seabirds. For this reason, the findings of the fish and shellfish assessment will be considered in the marine mammals and offshore ornithology chapters in the Broadshore Hub WFDAs EIA Report.

530. Basking sharks are listed as 'Endangered' on the International Union for Conservation of Nature (IUCN) Red List. There is a marked seasonality in basking shark sightings in UK waters, with almost all surface sightings occurring on the English and Scottish west coast over summer months. The NBN atlas collates basking shark sightings datasets, and in the period 2011-2021 in relation to the Broadshore Hub WFDAs, no sightings have been recorded within 30 km of the Broadshore Hub WFDAs Scoping Boundary (NBN, 2023). During the offshore aerial surveys, one shark species was recorded in the Sinclair and Scaraben WFDA offshore aerial survey area.

531. The mean annual landings of key fish species landed by commercial vessels over the period 2018-2022 within the fish and shellfish study area are listed in **Table 7.5.**

Table 7.5: Mean Annual Quantity (tonnes) and Value (GBP) of Species Landed from ICES Rectangle 45E9 (Study Area) for All Species where Landings were Greater Than or Equal to 3 tonnes Over the Period 2018-2022 (Marine Management Organisation (MMO), 2023)

Species	Scientific	Quantity (tonnes)	Value (GBP)
Mackerel	*Scomber scombrus*	1,023	1,239,345
Haddock	*Melanogrammus aeglefinus*	582	575,441
Nephrops (Norway Lobster)	*Nephrops norvegicus*	277	854,886
Whiting	*Merlangius merlangus*	250	300,527
Monkfish or Anglerfish	*Lophiidae sp.*	219	679,468
Herring	*Clupea harengus*	121	48,095
Edible crab	*Cancer pagurus*	75	204,585
Cod	*Gadus morhua*	68	179,886
Plaice	*Pleuronectes platessa*	25	29,292
Squid	*Loligo spp.*	23	87,433
Saithe	*Pollachius virens*	22	23,441
Witch	*Glyptocephalus cynoglossus*	19	19,588
Lesser Spotted Dogfish	*Scyliorhinus canicula*	19	4,885
Gurnards – Grey	*Eutrigla gurnardus*	14	7,199
Hake	*Merluccius merluccius*	14	27,112
Ling	*Molva molva*	11	16,367
Mixed Squid and Octopi	*Loliginidae, Ommastrephidae*	8	31,213
Megrim	*Lepidorhombus spp.*	6	18,619
Lemon Sole	*Microstomus kitt*	6	18,674
King Scallops	*Pecten maximus*	6	10,713
Halibut	*Hippoglossus hippoglossus*	3	28,385
Cuckoo Ray	*Leucoraja naevus*	3	1,405

7.4.3.1 Diadromous Species

7.4.3.1.1 Diadromous Fish Species

532. Fish species are considered to be diadromous if they migrate from saltwater to freshwater to spawn (anadromous migrants) or if they migrate from freshwater to saltwater to spawn (catadromous migrants). Relevant diadromous species that are likely to pass through the fish and shellfish Northern North Sea study area during their spawning migrations, or during foraging and maturation stages of their life cycles are:

- Atlantic salmon *Salmo salar*;
- Sea trout *Salmo trutta*;
- Sea lamprey *Petromyzon marinus*;
- River lamprey *Lampetra fluviatilis*; and
- European eel *Anguilla anguilla*.

533. Atlantic salmon, sea trout, river lamprey and sea lamprey are all anadromous, and as such have predominantly marine adult life phases with spawning and nursery grounds located in freshwater rivers. The European eel is catadromous, so migrates from freshwater river systems to spawn in saltwater. All of these species will be scoped in for further assessment.

534. Whilst protected sites designated for Annex II diadromous fish, and their distance to the Broadshore Hub WFDAs are set out in **Table 7.6**, other non-designated river systems have populations of diadromous fish that may pass through the Broadshore Hub WFDAs, for example the River Ugie which outflows at Peterhead has an active Atlantic salmon fishery.

535. Allis shad *Alosa alosa* and twaite shad *Alosa fallax* (which are also Annex II diadromous fish) have no known populations in north-east Scotland to justify an assessment. Scottish shad are thought to have a spawning population in the Solway Firth which is beyond any expected ZoI of the Broadshore Hub WFDAs. For this reason, shad species are scoped out of further assessment.

7.4.3.1.2 Freshwater Pearl Mussel

536. Freshwater pearl mussel is a designated feature of a number of SACs on the east coast of Scotland (see **Table 7.6**). Whilst not itself a diadromous species, the long-term survival of the freshwater pearl mussel depends ultimately upon diadromous fish host availability (Skinner et al., 2003). Juvenile Atlantic salmon and sea trout are host fish of the larval stage of freshwater mussels (called glochidia), which attach themselves to fish gill filaments in the fast-flowing sections of rivers over July to September. Therefore, healthy populations of juvenile salmonid (salmon and sea trout) fry and parr are required to ensure pearl mussel survival over winter before they detach from the gills and settle on the substrate in May and early June.

537. Due to this potential for secondary impacts on freshwater pearl mussel from impacts on salmonid fish, it is scoped in for further assessment. If no significant impacts are found for salmonid species, then logically there can be no pathway for significant effect upon pearl mussel and this will be key to the assessment.

7.4.4 Shellfish Assemblage

538. Shellfish stock populations, and their structure, are not well understood across the UK (Scottish Government, 2020). Commercial landings data are a primary source of information regarding their distribution. Nephrops, edible crab, squid, octopus, and king scallop have consistently high annual landings with the fish and shellfish study area (**Table 7.5**). The site-specific surveys for benthic characterisation undertaken in 2023 will be used to further inform the baseline for shellfish.

7.4.5 Designated Sites

539. The fish and shellfish study area does not overlap with any designated site for fish or shellfish features. Given that a number of riverine UK SACs are designated for diadromous fish species, which can undertake extensive marine migrations, those sites that fall within the fish and shellfish Northern North Sea study area are considered (**Table 7.6**). Also considered are those sites where individuals from the population may migrate past the Broadshore Hub WFDAs as part of their life cycle. Marine Protected Areas (MPAs) which are designated for non-migratory fish and shellfish features are screened in if within 75 km from the Broadshore Hub WFDAs (to account for worst-case noise impact ranges). These sites are designated for protection from development and other activities that may affect their conservation objectives.

540. Although not designated specifically for a fish or shellfish feature, the Southern Trench NCMPA is highlighted due to the conservation management requirement to ensure that the prey availability for local Minke whale *Balaenoptera acutorostrata* is maintained within the NCMPA. Any impacts on prey fish species such as sandeel and herring within the Southern Trench NCMPA may cause changes in availability of prey to the minke whale features. Impacts on minke whale are discussed further in **Appendix 2: NCMPA Screening Report**.

541. Given the distance to the designated sites from the Broadshore Hub WFDAs, there is no pathway for direct impacts upon them (i.e. to the habitat supporting the fish species). Therefore, only impacts upon the fish themselves outside the sites will be considered in the EIA Report.

Table 7.6: Summary of Sites Designated for Fish and Shellfish Species Scoped in for Further Assessment

Designated Site Receptor	Fish and Shellfish Qualifying Features	Justification	Distance from Broadshore Hub WFDAs “as the fish swims” (i.e. not moving over land)
Southern Trench MPA	Not designated for fish or shellfish, but these receptors are prey for designated Minke whale features.	A nationally designated site (MPA)	24 km south
Berriedale and Langwell Waters SAC	Atlantic salmon	An internationally designated site (SAC)	94 km west
River Dee SAC	Atlantic salmon Freshwater pearl mussel	An internationally designated site (SAC)	114 km south

Designated Site Receptor	Fish and Shellfish Qualifying Features	Justification	Distance from Broadshore Hub WFDAs “as the fish swims” (i.e. not moving over land)
River Thurso SAC	Atlantic salmon	An internationally designated site (SAC)	115 km north-west
River Evelix SAC	Freshwater pearl mussel	An internationally designated site (SAC)	136 km west
River Oykel SAC	Atlantic salmon Freshwater pearl mussel	An internationally designated site (SAC)	150 km west
River Naver SAC	Atlantic salmon Freshwater pearl mussel	An internationally designated site (SAC)	159 km north-west
River Borgie SAC	Atlantic salmon Freshwater pearl mussel	An internationally designated site (SAC)	159 km north-west
River South Esk SAC	Atlantic salmon Freshwater pearl mussel	An internationally designated site (SAC)	170 km south
River Tay SAC	Atlantic salmon River lamprey Brook lamprey Sea lamprey	An internationally designated site (SAC)	250 km south-west
River Spey SAC	Atlantic salmon Freshwater pearl mussel Sea lamprey	An internationally designated site (SAC)	260 km south
River Tweed SAC	Atlantic salmon River lamprey Brook lamprey Sea lamprey	An internationally designated site (SAC)	263 km south
Little Gruinard River SAC	Atlantic salmon	An internationally designated site (SAC)	296 km north-west
River Teith SAC	Atlantic salmon River lamprey Brook lamprey Sea lamprey	An internationally designated site (SAC)	300 km south-west

Designated Site Receptor	Fish and Shellfish Qualifying Features	Justification	Distance from Broadshore Hub WFDAs "as the fish swims" (i.e. not moving over land)
River Kerry SAC	Freshwater pearl mussel	An internationally designated site (SAC)	322 km north-west
River Moriston SAC	Atlantic salmon Freshwater pearl mussel	An internationally designated site (SAC)	416 km anti-clockwise around coast

7.4.6 Spawning and Nursery Grounds

542. Spawning and nursery habitats for a variety of fish species are found within the North Sea. Species likely to be spawning in the vicinity of the fish and shellfish study area are listed in **Table 7.7.**

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Table 7.7: Spawning Grounds, Nursery Grounds, and Conservation Designations, of Fish and Shellfish Species Overlapping the Fish and Shellfish Study Area

Species	Spawning	Nursery	Conservation Designations
Pelagic species			
Sprat	Undetermined intensity (Coull et al., 1998))	Undetermined intensity (Coull et al., 1998))	N/A
Herring	No overlap	Low intensity (Ellis et al., 2012)	Potential Mitigation Factor, International Union for Conservation of Nature (IUCN) (vulnerable), Scottish Biodiversity List (SBL)
Mackerel	No overlap	Low intensity (Ellis et al., 2012)	PMF, IUCN (least concern), SBL
Demersal species			
Blue Whiting	No overlap	Low intensity (Ellis et al., 2012)	PMF, IUCN (least concern), SBL
Haddock	No overlap	Undetermined intensity (Coull et al., 1998))	IUCN (vulnerable)
Saithe	No overlap	No overlap	PMF
European Hake	No overlap	Low intensity (Ellis et al., 2012)	SBL
Anglerfish	No overlap	High intensity (Ellis et al., 2012)	PMF, SBL
Plaice	Low intensity (Ellis et al., 2012)	Low intensity (Ellis et al., 2012)	IUCN (least concern), SBL
Ling	No overlap	Low intensity (Ellis et al., 2012)	PMF, SBL
Lemon sole	Undetermined intensity (Coull et al., 1998))	Undetermined intensity (Coull et al., 1998))	N/A

Species	Spawning	Nursery	Conservation Designations
Cod	Low intensity (Ellis et al., 2012)	Low intensity (Ellis et al., 2012)	PMF, Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR) species, IUCN (vulnerable), SBL
Whiting	Low intensity (Ellis et al., 2012) Undetermined intensity (Coull)	High intensity (Ellis et al., 2012) Undetermined intensity (Coull)	PMF, SBL
Sandeel	Low intensity (Ellis et al., 2012)	Low intensity (Ellis et al., 2012)	PMF, SBL
Norway Pout	Lower intensity (Coull et al., 1998))	Undetermined intensity (Coull et al., 1998)	PMF, SBL
Shellfish			
Nephrops	Undetermined intensity (Coull et al., 1998)	Undetermined intensity (Coull et al., 1998)	N/A
Elasmobranchs			
Basking shark	No overlap	No overlap	SBL, OSPAR, PMF, IUCN Red List, Wildlife and Countryside Act, Bern Convention, Bonn Convention
Tope shark	No overlap	No overlap	IUCN (vulnerable), SBL
Common skate	No overlap	No overlap	Scottish Nature Conservation MPA search feature (marine life stages), OSPAR, PMF, SBL
Spotted Ray	No overlap	Low intensity (Ellis et al., 2012)	OSPAR, IUCN (Least concern)
Spurdog	No overlap	Low intensity (Ellis et al., 2012)	Scottish Nature Conservation MPA search feature (marine life stages), PMF, OSPAR, IUCN (Vulnerable), SBL

7.5 Potential Impacts

543. A range of potential impacts on fish and shellfish ecology have been identified which may occur during the construction, operation and maintenance, and decommissioning phases of the Broadshore Hub WFDAs.

7.5.1 Potential Impacts During Construction

544. Potential impacts during the construction phase of the Broadshore Hub WFDAs could arise from disturbance of the seabed during the installation of substructures and/or station keeping systems (SKS) (i.e., anchors and moorings), subsea cable hub(s), inter-array cables (IACs) and any associated cable protection and ancillary equipment (including any seabed preparation, boulder clearance and UXO investigation/clearance[25], and the use of vessels for any associated activities.

545. These impacts include:

- Physical disturbance and temporary loss of habitat;
- Increased Suspended Sediment Concentrations (SSC) and sediment re-deposition;
- Remobilisation of existing contaminated sediments;
- Accidental release of pollutants;
- Introduction of Invasive Non-Native Species (INNS) from marine traffic;
- Underwater noise and vibration;
- Changes in fishing activity; and
- Vessel collision for basking shark.

546. Impacts which span the life of the Broadshore Hub WFDAs[26] (e.g. permanent habitat loss) will be considered as part of the operation and maintenance phase assessment (see **Section 7.5.2**) and are therefore not considered in the construction phase assessment to avoid duplication. It will be highlighted in the operation and maintenance section that impacts such as permanent habitat loss begin to occur in construction and potentially continue after decommissioning.

7.5.2 Potential Impacts During Operation and Maintenance

547. Potential impacts during operation and maintenance will mostly result from loss of habitat and changes to seabed substrata from the physical presence of infrastructure (i.e. substructures and

[25] A separate Marine License application(s) will be made prior to UXO clearance works, with an accompanying assessment of UXO clearance effects on fish and shellfish ecology. The assessment included in the Broadshore Hub WFDAs EIA Report will be indicative only.

[26] The Broadshore WFDA seabed lease is up to 60 years, and the Sinclair WFDA and Scaraben WFDA seabed leases are both up to 25 years. The Broadshore, Sinclair and Scaraben WFDAs' operational life is between 25 and 50 years. At the end of the operational life, any repowering will be subject to separate consents.

any IAC protection above the seabed). The presence of hard infrastructure introduces new hard substrate habitat to the seabed. The presence of SKS in the water column may cause entanglement of fishing gear, which in turn may present a risk of secondary entanglement of fish species. Maintenance activities may result in disturbance to seabed habitats, these would be similar to those during construction but at a lower magnitude and frequency of occurrence. Impacts scoped in for further assessment are:

- Permanent habitat loss;
- Physical disturbance and temporary loss of habitat
- Increased SSC and sediment re-deposition.
- Remobilisation of existing contaminated sediments;
- Accidental release of pollutants;
- Introduction of INNS from marine traffic;
- Underwater noise and vibration;
- Secondary entanglement with floating substructures (FSSs);
- Electromagnetic Fields (EMF);
- Introduction of hard substrate; and
- Changes in fishing activity.

7.5.3 Potential Impacts During Decommissioning

548. It is anticipated that the decommissioning impacts would be similar in nature to those of construction (**Section 7.5.1**), although the magnitude of impact is likely to be lower. For example, where construction may require drilling of piles and/or seabed preparation, decommissioning would likely require cutting of piles to seabed level and may potentially result in less seabed disturbance than construction.

7.5.4 Embedded Mitigation Measures

549. The following embedded mitigation measures proposed include:

- Implementation of soft-start and ramp-up measures for piling, to be set out in a Piling Strategy (PS);
- Development of, and adherence to a Marine Pollution Contingency Plan (MPCP);
- Where seabed preparation is required (e.g. levelling), methods and equipment that have been designed to minimise potential for sediment suspension and dispersal will be adopted;
- Development of, and adherence to, a Cable Plan (CaP). The CaP will confirm planned cable routing, burial, and any additional protection, and will set out methods for post-installation cable monitoring. Fish and shellfish receptors will be considered in the drafting of the CaP;

- Adherence by contractors to the Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR), and the International Convention for the Prevention of Pollution from Ships (MARPOL) guidelines for preventing pollution at sea;
- The International Convention for the Control and Management of Ships' Ballast Water and Sediments (BWM Convention, 2004) will be adhered to, which provides global regulations to control the transfer of potentially invasive species;
- The Scottish Marine Wildlife Watching Code (Scottish Natural Heritage (SNH), 2017) approach will be followed (with respect to basking sharks); and
- Development of Unexploded Ordnance (UXO) Threat and Risk Assessment, and preferred use of low noise UXO clearance techniques where possible (see **Section 3.9.2** for details).
- An Invasive Non-Native Species Management Plan (INNSMP) will be developed to include provisions for invasive non-native species (INNS) management.
- During operation, periodic inspections, as part of the asset integrity campaign, will include visual surveys and identification of debris and gear entangled to the WFDAs infrastructure**.** This will provide further understanding on the potential for the debris and ghost fishing gears to be caught in the WFDA infrastructure, increasing the risk for entanglement. Note this is in the early stages of development and will be further refined during the EIA process.

550. An Environmental Management Plan (EMP) or similar will also be implemented to ensure the above mitigations are captured and all works are undertaken in line with best practice for working in the marine environment. The commitments would be secured in the EMP via a condition in the Marine Licence application. The EMP will be agreed with relevant stakeholders prior to the start of construction.

7.6 Scoping of Potential Impacts

7.6.1 Potential Impacts Scoped In

7.6.1.1 Construction

551. The impacts scoped in for further assessment during construction are:

- Physical disturbance and temporary loss of habitat;
- Increased SSC and sediment re-deposition;
- Remobilisation of existing contaminated sediments if present;
- Underwater noise and vibration;
- Changes in fishing activity; and
- Vessel collision for basking shark.

552. These impacts are further discussed in **Sections 7.6.1.1.1** to **7.6.1.1.6**.

7.6.1.1.1 Physical Disturbance and Temporary Loss of Habitat

553. Demersal fish and shellfish including the egg and larval stages of certain species, may be particularly sensitive to direct physical disturbance during the construction phase from the installation of the Broadshore Hub WFDAs infrastructure (substructures/SKS, subsea cable hub(s), scour protection and IACs). This will especially be the case if disturbance coincides with key spawning or migration periods. The level of effect will be dependent upon the habitat in question, its distribution in the wider area and the presence of a species that is reliant on that habitat.

7.6.1.1.2 Increased Suspended Sediment Concentrations and Sediment Re-deposition

554. During construction activities there may be a temporary increase in suspended sediment concentrations and deposition. Suspended sediment has the potential to impair respiratory, filter feeding or reproductive functions, including the disruption of migration/spawning activity. Sediment deposition, especially if it changes the characteristics of the existing seabed sediments, could affect the quality of spawning and nursery habitats.

7.6.1.1.3 Remobilisation of Existing Contaminated Sediments

555. Sediment disturbance could lead to the mobilisation of contaminants (if present) that could be harmful to fish and shellfish communities. The Broadshore Hub WFDAs fish and shellfish study area is within the footprint of oil and gas areas (Captain, Ross, Blake, Cromarty) (see **Figure 13.2**[27] in **Appendix 1**), where there is the potential for contaminants being adsorbed and contained within sediments, which may be released following disturbance. It should be noted however that all of

[27] Note the marine infrastructure and other users study area is 10 nm and therefore differs from the fish and shellfish study area which is defined by ICES rectangle 45E9.

these areas lie outside the footprint of the Broadshore Hub WFDAs. Potential contaminants include the discharge of chemicals under the OSPAR HMCS, and other contaminants such as drill cuttings and flare drop out.

556. The existing decommissioned oil and gas wells identified within the Broadshore Hub WFDAs and potential for associated contaminated drill cuttings will be considered during the definition of Broadshore Hub WFDAs design and layout. Engagement will be undertaken with NSTA and the respective oil and gas operators, and an offset may be applied to reduce any potential remobilisation of contaminated sediments if required, to be defined via a structured risk assessment approach.

557. Potential impacts related to the resuspension of contaminants are currently scoped in for assessment. However, should the results of benthic sampling demonstrate low levels of sediment contamination, the Applicants would seek to scope these out of further assessment through agreement with stakeholders in future consultation.

7.6.1.1.4 Underwater Noise and Vibration

558. The Broadshore Hub WFDAs will use WTGs installed upon either Fixed Bottom Support Structures (FBSSs) and/ or FSSs. Regardless of the method chosen, it is possible that pile driving may be used to fix infrastructure to the seabed. See **Chapter 3: Project Description** for further detail of the design parameters under consideration. Underwater noise generated by pile driving and other construction activities such as seabed preparation, dredging, rock dumping, UXO clearance, cable installation, and vessel presence may result in disturbance and displacement of fish species and have the potential to affect spawning behaviour, nursery areas and migration patterns.

7.6.1.1.5 Changes in Fishing Activity

559. The construction of offshore infrastructure could result in changes to fishing activity within the Broadshore Hub WFDAs but also in the wider area due to potential displacement of fishing activity into other areas. This could in turn result in changes to commercially targeted fish stocks. Further discussion on impacts to the fishing industry is provided in **Chapter 10: Commercial Fisheries**.

7.6.1.1.6 Vessel Collision for Basking Shark

560. Given that unusually high numbers of basking shark have been reported as sighted on the north-east coast of Scotland in 2023 (The Scotsman, 2023), the risk of project vessels colliding with this species warrants further exploration and assessment in the EIA. Given their large size, the fact they spend a high proportion of time at the surface feeding, and often do not to actively swim away from vessels, they have a high sensitivity to collision risk compared to other fish and shellfish species. Collision risk will be assessed for the construction phase as a worst-case, given the higher number of vessels onsite at any one time during construction. However, the finding of this assessment will also apply during the other phases of the Broadshore Hub WFDAs, as similar level of effects (considering lower ship passage frequency, but longer duration in operation and maintenance) is anticipated.

7.6.1.2 Operation and Maintenance

561. The impacts scoped in for further assessment during operation and maintenance are:

- Permanent habitat loss;
- Physical disturbance and temporary loss of habitat;
- Increased SSC and sediment re-deposition;
- Remobilisation of existing contaminated sediments;
- Underwater noise and vibration;
- Secondary entanglement with FSSs;
- EMFs;
- Introduction of hard substrate; and
- Changes in fishing activity.

562. These impacts are further discussed in **Sections 7.6.1.2.1** to **7.6.1.2.10**.

7.6.1.2.1 Permanent Habitat Loss

563. The presence of infrastructure on the seabed (including any IAC protection) would result in a relatively small footprint of lost habitat in the context of the habitat from the surrounding region. Depending on whether the infrastructure is removed or left in-situ at the decommissioning stage this impact is either long term or permanent habitat loss. The level of effect will be dependent upon the habitat in question, its distribution in the wider area and the presence of a species that is reliant on that habitat. As a worst-case scenario, it is assumed it would be permanent habitat loss unless the infrastructure is removed during decommissioning.

7.6.1.2.2 Physical Disturbance and Temporary Loss of Habitat

564. Some operation and maintenance activities will cause physical disturbance of the seabed. These activities will include excavating and lifting buried cables for repair, and maintenance of cable rock protection through the addition of new rock. Whilst these activities are expected to result in localised impacts and be sporadic in nature, the impact is scoped in for further assessment to be addressed when the likely operation and maintenance activities and their schedules are more clearly known.

7.6.1.2.3 Increased Suspended Sediment Concentration and Sediment Re-deposition

565. Small volumes of sediment could be re-suspended during maintenance activities; the volumes would be lower than for construction. It is not expected that there would be significant effects, however the impact is ‘scoped in’ to allow for further justification with full baseline information.

7.6.1.2.4 Remobilisation of Existing Contaminated Sediments

566. Potential impacts related to the resuspension of contaminants are currently scoped in for assessment. Any re-suspension would be lower than for construction given that the volumes of sediment resuspended would be lower than for construction. However, should the results of benthic sampling demonstrate low levels of sediment contamination, the Applicants would seek to scope

these out of further assessment in the Broadshore Hub WFDAs EIA Report through agreement with stakeholders in future consultation.

7.6.1.2.5 Underwater Noise and Vibration

567. The main source of noise during operation (in addition to ambient noise) originates from the WTG gearbox and generator, noise generated by SKS and IACs (e.g. cable ‘snapping’), in addition to any surface vessels undertaking operation and maintenance activities. Operational noise impacts are considered highly unlikely to cause physical damage to fish or shellfish species (Nedwell et al., 2007a, b; MMO, 2014) and it follows that any significant behavioural disturbance would be limited to the area immediately surrounding the wind turbine, however the impact is ‘scoped in’ to allow for further justification with full baseline information.

7.6.1.2.6 Secondary Entanglement with Floating Substructures

568. Whilst the mooring infrastructure itself is not anticipated to cause an entanglement risk for fish and shellfish species, there is a potential for snagged anthropogenic debris such as fishing gear to cause secondary entanglement. This will be assessed further in the Broadshore Hub WFDAs EIA Report.

569. During operation, periodic inspections, as part of the asset integrity campaign, will include visual surveys and identification of debris and gear entangled to the WFDAs infrastructure. This will may be undertaken by use of a Remotely Operated Vehicle (ROV). In the case of any fishing gear/debris caught in the infrastructure, it will be removed when safe to do so. In turn, this will reduce the potential for secondary entanglement of fish.

7.6.1.2.7 Electromagnetic Fields

570. Subsea electrical cabling, and dynamic and static IACs in the water column produces EMFs which may affect fish and shellfish behaviours. This may be of particular relevance to electrosensitive species such as elasmobranchs, or species which use the earth’s geomagnetic field to orient themselves for migration.

7.6.1.2.8 Introduction of Hard Substrate

571. Concrete and steel structures may be colonised by a range of benthic invertebrate species, potentially increasing ecological diversity and with the potential to act as fish aggregating devices. This may have knock on effects on localised predator-prey dynamics. The potential effect on fish and shellfish species will be dependent on the substructure used, and the volume and type of scour protection used.

7.6.1.2.9 Changes in Fishing Activity

572. The operation and maintenance of the Broadshore Hub WFDAs’ infrastructure could result in changes to fishing activity within the fish and shellfish study area but also in the wider area due to potential displacement of fishing activity into other areas. This could result in changes in fish and shellfish populations in the fish and shellfish study area, both within and outside the Broadshore Hub WFDAs footprint.

7.6.1.2.10 Vessel Collision for Basking Shark

573. Given that unusually high numbers of basking shark have been anecdotally reported as sighted on the north-east coast of Scotland in 2023 (The Scotsman, 2023), the risk of project vessels colliding with this species warrants further exploration and assessment in the EIA. Given their large size, the fact they spend a high proportion of time at the surface feeding, and often do not to actively swim away from vessels, they have a high sensitivity to collision risk compared to other fish and shellfish species. Collision risk will be assessed for the construction phase as a worst-case, given the higher number of vessels onsite at any one time during construction. However, the finding of this assessment will also apply during the other phases of the Broadshore Hub WFDAs, as similar level of effects (considering lower ship passage frequency, but longer duration in operation and maintenance) is anticipated.

7.6.1.3 Decommissioning

574. It is anticipated that the decommissioning impacts would be similar in nature to those of construction, although the magnitude of impact is likely to be lower. For this reason, all impacts scoped in for construction are also scoped in for decommissioning.

7.6.2 Potential Impacts Scoped Out

7.6.2.1 All Phases

7.6.2.1.1 Accidental Release of Pollutants

575. Pollution could be accidentally released from vessels, equipment, and machinery associated with the construction, operation and maintenance, and decommissioning phases of the Broadshore Hub WFDAs. However, the potential risk of accidental release of pollutants is sufficiently minimised by designed in mitigation measures (**Section 7.5.4**) and is proposed to be scoped out of the assessment for all phases of the Broadshore Hub WFDAs. All vessels must comply with the International Convention for the Prevention of Pollution from Ships (MARPOL) 73/78. Am Environmental Management Plan (EMP) or similar will also be put in place and implemented to ensure all works are undertaken in line with best practice for working in the marine environment.

7.6.2.1.2 Introduction of Invasive Non-native Species from Marine Traffic

576. The potential risk of spreading or introducing INNS will be mitigated by employing biosecurity measures in accordance as discussed in **Section 7.5.4**. These commitments would be secured in the EMP via a condition in the Marine Licence application(s). The EMP will be agreed with relevant stakeholders prior to the start of construction. Additionally, an INNSMP will be developed to include provisions for INNS management.

577. With the appropriate mitigations in place, it is expected that the risk of INNS being introduced would be reduced. Therefore, it is proposed that with this embedded mitigation, introduction of marine INNS from vessel traffic during the construction phase is scoped out of the Broadshore Hub WFDAs EIA Report.

7.6.2.2 Construction and Decommissioning

7.6.2.2.1 Electromagnetic Fields

578. For phases of the Broadshore Hub WFDAs where power is not being generated, no EMF will be produced by IACs. It is acknowledged that the impact of EMF begins with commissioning, which takes place during the construction phase – to avoid duplicating assessments, the full extent of this impacts will be assessed in the operation and maintenance section. EMF is therefore scoped out for construction and decommissioning.

7.6.2.2.2 Permanent Habitat Loss

579. It is acknowledged that the impact of permanent habitat loss begins in construction and continues through decommissioning – to avoid duplicating assessments the full extent of this impacts will assessed in the operation and maintenance section, with a clear acknowledgement that it spans the duration of the Broadshore Hub WFDAs.

7.6.2.2.3 Introduction of Hard Substrate

580. It is acknowledged that the impact of introduction of hard substrate begins in construction and continues through decommissioning – to avoid duplicating assessments the full extent of this impact will assessed in the operation and maintenance section, with a clear acknowledgement that they span the duration of the Broadshore Hub WFDAs.

7.6.2.2.4 Secondary Entanglement with Floating Substructures

581. Floating wind turbine infrastructure will not be present long enough during construction, and will not remain after decommissioning, to cause a risk of anthropogenic debris (i.e. fish net) entanglement to cause a secondary entanglement (or 'ghost fishing' impact). Secondary entanglement will be assessed for the operation and maintenance phase (**Section 7.6.1.2.6**).

7.6.3 Potential Cumulative Effects

582. There may be potential for cumulative impacts to occur on fish and shellfish ecology due to works associated with other projects/plans and activities. The broad approach to assessment of potential cumulative impacts is set out in **Chapter 4: Approach to Scoping and Environmental Impact Assessment**.

583. The effects of the Broadshore Hub WFDAs will firstly be considered cumulatively with all other development areas of the Broadshore Hub (i.e., the Broadshore Hub WFDAs, the Broadshore Hub Offshore Transmission Development Area (OfTDAs) and the Onshore Transmission Development Areas (OnTDAs), including landfall(s) locations and offshore substation(s) and offshore export cables).

584. Secondly, the effects of the Broadshore Hub will be assessed cumulatively with other plans and projects.

585. Offshore wind projects and other activities (such as oil and gas operations) relevant to the assessment of cumulative impacts on fish and shellfish ecology will be identified through a

screening exercise. Where potential impacts are highly localised (i.e. they occur only within the Broadshore Hub WFDAs) or where management measures in place for the Broadshore Hub WFDAs and other projects will reduce the risk of impacts occurring, it is proposed that these impacts likely will not have potential interactions with Broadshore Hub WFDAs alone impacts.

586. Details of the approach to screening other plans and projects is set out in **Chapter 4: Approach to Scoping and Environmental Impact Assessment**.

587. Noise propagation modelling for the Broadshore Hub WFDAs will be used to determine the Zone of Influence (ZoI) for long range effects associated with loud noise sources such as piling, and UXO clearance. This ZoI will be used to determine whether other projects or plans have the potential to combine with Broadshore Hub WFDAs alone noise impacts in a cumulative way.

588. The cumulative assessment for fish and shellfish will specifically consider cumulative noise impacts.

7.6.4 Potential Transboundary Effects

589. The distribution of fish and shellfish species is independent of national geographical boundaries. The Broadshore Hub WFDAs EIA Report will be undertaken taking account of the distribution of fish stocks and populations irrespective of national jurisdictions. As a result, it is considered that a fish and shellfish ecology specific assessment of transboundary effects is not required.

590. Whilst noise modelling for the Broadshore Hub WFDAs is not yet available at the time of writing, based on experience of previous recent OWF projects, the worst-case impact ranges for fish and shellfish receptors result from piling noise, with no OWF to date finding maximum impact ranges greater than 75 km. A 75 km worst-case impact range for underwater noise would not reach other jurisdictions.

7.6.5 Summary of Fish and Shellfish Ecology Impacts Scoped In and Out

591. A summary of potential impacts scoped in and out from further assessment in the Broadshore Hub WFDAs EIA Report is provided in **Table 7.8** below.

Table 7.8: Summary of Potential Impacts Scoped In (✓) or Scoped Out (x) for Fish and Shellfish Ecology

Potential Impact	Receptor(s)	Description of Potential Effect	Scoped In or Scoped Out? (✓ or x)			Embedded Mitigation Measures
			Construction	Operation and Maintenance	Decommissioning	
Physical disturbance and temporary loss of habitat	Fish (pelagic, demersal, diadromous, elasmobranch), shellfish, spawning and nursery grounds, designated sites	There is potential for temporary habitat loss and physical disturbance to the water column, seabed, and directly on fish and shellfish receptors during operations.	✓	✓	✓	Development of, and adherence to a CaP, will ensure that best practice cable installation methods are used where the IAC is to be buried to minimise seabed unnecessary seabed disturbance and sediment suspension.
Permanent habitat loss	As above	The presence of substructures or SKS on the seabed and any cable protection will result in a footprint of lost habitat from the pre-existing habitat type.	X*	✓	X*	None
Increased SSC and sediment re-deposition	As above	During Broadshore Hub WFDAs activities there may be a temporary increase in suspended sediment concentrations and deposition. Suspended sediment may impair the physiology and behaviour of receptors. Sediment deposition may bury or smother receptors.	✓	✓	✓	Development of, and adherence to a CaP, will ensure that best practice cable installation methods are used to minimise seabed unnecessary seabed disturbance and sediment suspension.

Potential Impact	Receptor(s)	Description of Potential Effect	Scoped In or Scoped Out? (✓ or x)			Embedded Mitigation Measures
			Construction	Operation and Maintenance	Decommissioning	
Remobilisation of existing contaminated sediments	As above	If harmful contaminants are present within the seabed, then these may be released due to activities on the seabed.	✓**	✓**	✓**	None
Underwater noise and vibration	As above	Activities across all phases of the Broadshore Hub WFDAs will produce underwater noise. Impacts on sound sensitive receptors can range from temporary behavioural effects to mortality.	✓	✓	✓	Soft start and/or ramp up procedure may allow some sound sensitive fish to move away from the noise source.
EMFs	As above	Broadshore Hub WFDAs cables that carry electrical currents (i.e. IACs) will produce EMFs during power generation in the operation and maintenance phase. EMFs may affect fish and shellfish behaviour or physiology.	X	✓***	X	A CaP will be prepared where IACs are buried to confirm the extent to which the IAC burial can be achieved.
Secondary entanglement with floating substructures	As above	Anthropogenic debris such as discarded or lost fishing gear may snag on FOU infrastructure.	X	✓	X	None

Potential Impact	Receptor(s)	Description of Potential Effect	Scoped In or Scoped Out? (✓ or x)			Embedded Mitigation Measures
			Construction	Operation and Maintenance	Decommissioning	
		This snagged gear may in turn cause entanglement of fish and shellfish species.				
Introduction of hard substrate	As above	Subsurface artificial structures placed on the seabed or within the water column (e.g. substructures) are expected to be colonised by a range of marine species during the operation and maintenance phase. This could lead to localised increases in biodiversity and potential changes in prey/predator interactions.	X*	✓	X*	None

Potential Impact	Receptor(s)	Description of Potential Effect	Scoped In or Scoped Out? (✓ or x)			Embedded Mitigation Measures
			Construction	Operation and Maintenance	Decommissioning	
Changes in fishing activity	As above	The construction of offshore infrastructure could result in changes to fishing activity, and resultant changes to fish and shellfish populations, within the Broadshore Hub WFDAs but also in the wider area due to displacement of fishing activity into other areas. This could in turn result in changes to commercially targeted fish stocks	✓	✓	✓	A Fisheries Management and Mitigation Strategy will be developed to reduce displacement where possible.
Vessel collision for basking shark	As above	Basking shark in the fish and shellfish may collide with work vessels associated with the Broadshore Hub WFDAs, causing injury or mortality.	✓	✓	✓	None
Accidental release of pollutants	As above	Pollution could be accidentally released from vessels, equipment, and machinery associated with any phase of the Broadshore Hub WFDAs. However, the potential risk of accidental release of pollutants is minimised	X	X	X	Development and adherence to an Environmental Management Plan (EMP), including a Marine Pollution Contingency Plan (MPCP). In addition adherence by contractors to Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR), IMO, and MARPOL (International Convention for the

Potential Impact	Receptor(s)	Description of Potential Effect	Scoped In or Scoped Out? (✓ or x)			Embedded Mitigation Measures
			Construction	Operation and Maintenance	Decommissioning	
		by designed in mitigation measures and is proposed to be scoped out of the assessment.				Prevention of Pollution from Ships) guidelines for preventing pollution at sea.
Introduction of INNS from marine traffic	As above	Vessels from other locations could transport and release INNS in the fish and shellfish Study Area. However, the potential risk of INNS introduction is minimised by designed in mitigation measures and is proposed to be scoped out of the assessment.	X	X	X	Biosecurity commitments would be secured in the EMP via a condition in the Marine Licence application. The EMP will be agreed with relevant stakeholders prior to the start of construction. An INNSMP will be developed to include provisions INNS management.

* It is acknowledged that the impacts of permanent habitat loss and introduction of hard substrate begin in construction and continue through decommissioning – to avoid duplicating assessments, the full extent of these impacts will be assessed in the operation and maintenance section, with a clear acknowledgement that they span the duration of the Broadshore Hub WFDAs lifetime.

** Remobilisation of contaminated sediments will be scoped out if site-specific sediment samples reveal low contaminant levels.

*** It is acknowledged that the impact of EMF begins with commissioning, which takes place during the construction phase – to avoid duplicating assessments, the full extent of this impacts will be assessed in the operation and maintenance section. EMF is therefore scoped out for construction and decommissioning

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7.7 Proposed Approach to Impact Assessment

592. The impact assessment methodology for the fish and shellfish ecology chapter will follow that which is described in **Chapter 4: Approach to Scoping and Environmental Impact Assessment**, as well as the guidance documents presented in **Section 7.2**. Within the fish and shellfish ecology chapter of the Broadshore Hub WFDAs EIA Report, the overall impact assessment for the Broadshore Hub WFDAs will be presented first. Following this, a summary of each WFDA will be given (Broadshore WFDA, Sinclair WFDA, Scaraben WFDA).

593. A key source of information will be fisheries landings data (see **Section 7.4.2**); these provide both large spatial and temporal coverage, allowing interannual trends to be observed, or for average landings over the previous years to be calculated, thereby minimising the potential for anomalous data collected in a single year to skew the baseline. Desk-based sources set out in **Section 7.4.2** will be complemented with site-specific benthic survey data, which will give information on benthic habitat types and sediment particle size.

594. Diadromous fish will be included in the fish and shellfish ecology impact assessment. A separate section covering sensitivity of and implications of the impact on diadromous fish in each impact assessment will be included in the Broadshore Hub WFDAs EIA Report. Discussion with stakeholders throughout the consultation process will be undertaken to finalise the approach and focus of these impact assessments.

595. Species will be assessed as groups based on shared life-history traits (resulting in broadly shared sensitivities). These groups are elasmobranchs, demersal fish, and pelagic fish. The different sensitivities of these groups arise from general differences in their life history traits (e.g. pelagic fish are less likely to come into contact with localised benthic impacts compared to demersal fish, and elasmobranch may have particular sensitivities to EMF). Sensitivities will be based on Marlin's MarESA database as a starting point (where available). Expert judgement and review scientific literature will also influence determination of sensitivity for fish and shellfish receptors. For feature-pressure combinations that have been assessed by Scottish Government at the time of conducting the EIA, the Feature Activity Sensitivity Tool (FeAST)[28] will be used to further inform receptor sensitivities.

596. Uncertainties around impact magnitudes and significance will be acknowledged where significant knowledge gaps exist in the literature. Scottish Marine Energy Research group (ScotMER) research gaps for fish and shellfish will inform this.

597. Herring and sandeel habitat suitability assessments will be informed by particle size analysis data collected as part of the benthic survey campaign. The assessment will be conducted in line with industry best practice techniques, and in consultation with stakeholders.

598. An estimate of EMF from dynamic IACs will be provided in the Broadshore Hub WFDAs EIA Report, using existing literature, to inform the assessment of potential impacts to fish and shellfish at the estimated level.

[28] https://feature-activity-sensitivity-tool.scot/

599. Site-specific underwater noise modelling will be undertaken for underwater noise sources from the Broadshore Hub WFDAs, including pile driving, seabed preparation, dredging, rock dumping, UXO clearance, IAC installation, and vessel presence, and operational turbine sound. Further detail on noise modelling can be found in **Chapter 8: Marine Mammals**. Sound impacts for fish will be based on the thresholds developed by Popper et al. (2014). Receptors will be treated either as stationary or fleeing, depending on their behaviour and the level of precaution required:

- Sandeel, spawning herring, spawning cod, and eggs treated as stationary receptors; and
- Other species treated as fleeing receptors at 0.5 ms^{-1}. The vessel collision risk assessment for basking shark will be qualitative and based on expert judgement, in consideration of the latest available sightings data for the east coast of Scotland, and the worst-case number of vessel passages anticipated for the Broadshore Hub WFDAs over the construction phase (as a worst-case).

600. The Popper et al. (2014) sound impact thresholds are based on the pressure component of sound. It is acknowledged, however, that many fish and invertebrate species can detect the particle motion component of sound. The propagation of pressure waves through a medium (sound pressure) is the most studied in terms of impacts on marine fauna. In contrast, particle motion, which is the oscillation of individual water molecules that allows the pressure waves to propagate, is understudied and no reliable impact thresholds exist to apply in an EIA context (Popper and Hawkins, 2018). Particle motion will be considered in the Broadshore Hub WFDAs EIA Report qualitatively.

7.8 Scoping Questions to Consultees

601. The following questions are posed to consultees to help them frame and focus their response to the fish and shellfish ecology chapter which will in turn inform the Scoping Opinion:

- Do you agree that the existing data available to describe the fish and shellfish ecology baseline remains sufficient to describe the baseline environment in relation to the Broadshore Hub WFDAs?
- Are there any further desktop datasets which you would recommend are included?
- Do you agree that all potential impacts have been identified for fish and shellfish ecology?
- Do you agree with the potential impacts scoped in and out?
- Do you have any other matters or information sources that you wish to present?

7.9 References

Aires, C., González-Irusta, J.M., and Watret, R. (2014). Updating Fisheries Sensitivity Maps in British Waters. Scottish Marine and Freshwater Science Vol 5 No 10. Edinburgh: Scottish Government, 88pp. DOI: 10.7489/1555-1

CIEEM (2018). Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine version 1.2. Chartered Institute of Ecology and Environmental Management, Winchester.

Coull, K.A., Johnstone, R., and S.I. Rogers (1998). Fisheries Sensitivity Maps in British Waters. Published and distributed by UKOOA Ltd.

Franco A., Smyth K., Thomson S. (2022). Developing Essential Fish Habitat maps for fish and shellfish species in Scotland. Report to the Scottish Government, December 2022.

Langton, R., Boulcott, P. and Wright P. J. (2021). A verified distribution model for the lesser sandeel *Ammodytes marinus*. Marine Ecology Progress Series. Available at: https://doi.org/10.3354/meps13693

Lynam, C. P., Halliday, N. C., Höffle, H., Wright, P. J., van Damme, C. J. G., Edwards, M., and Pitois, S. G. (2013). Spatial patterns and trends in abundance of larval sandeels in the North Sea: 1950–2005. ICES Journal of Marine Science, 70(3), 540–553. Available at: https://doi.org/10.1093/icesjms/fst006

Mcilvenny, J., Youngson, A., Williamson, B. J., Gauld, N. R., Goddijn- Murphy, L., and Del Villar-Guerra, D. (2021). Combining acoustic tracking and hydrodynamic modelling to study migratory behaviour of Atlantic salmon (Salmo salar) smolts on entry into high-energy coastal waters. ICES Journal of Marine Science, 78(7), 2409–2419. Available at: https://doi.org/10.1093/icesjms/fsab111

MMO (2014). Review of post-consent offshore wind farm monitoring data associated with licence conditions. A report produced for the Marine Management Organisation,pp 194. MMO Project No: 1031. ISBN: 978-1-909452-24-4.

MMO (2023). UK Sea Fisheries Annual Statistics Report 2022. Available at: https://www.gov.uk/government/statistics/uk-sea-fisheries-annual-statistics-report-2022

NBN Atlas (2023). National Biodiversity Network Atlas. Available at: https://nbnatlas.org/

Nedwell J. R., Turnpenny A. W. H., Lovell J., Parvin S. J., Workman R., Spinks J. A. L., and Howell D. (2007a). A validation of the dBht as a measure of the behavioural and auditory effects of underwater noise. Subacoustech Report Reference: 34R1231, Published by Department for Business, Enterprise and Regulatory Reform.

Nedwell, J.R, Parvin, S.J, Edwards, B, Workman, R, Brooker, A.G. and Kynoch, J.E. (2007b). Measurements and interpretation of underwater noise during construction and operation of offshore wind farms in UK waters.

Popper, A. N., Hawkins, A. D., Fay, R. R., Mann, D. A., Bartol, S., Carlson, T. J., Coombs, S., Ellison, W. T., Gentry, R. L., Halvorsen, M. B., Løkkeborg, S., Rogers, P. H., Southall, B. L., Zeddies, D. G., and Tavolga, W. N. (2014). Sound Exposure Guidelines. In A. N. Popper, A. D. Hawkins, R. R. Fay, D. A. Mann, S. Bartol, T. J. Carlson, S. Coombs, W. T. Ellison, R. L. Gentry, M. B. Halvorsen, S. Løkkeborg, P. H. Rogers, B. L. Southall, D. G. Zeddies, and W. N. Tavolga (Eds.), ASA S3/SC1.4 TR-2014 (2014). Sound Exposure Guidelines for Fishes and Sea Turtles: A Technical Report prepared by ANSI-Accredited Standards Committee S3/SC1 and registered with ANSI (pp. 33–51). Springer International Publishing. Available at: https://doi.org/10.1007/978-3-319-06659-2_7

Popper, A. N. and Hawkins, A. D., (2018). The importance of particle motion to fishes and invertebrates. The Journal of the Acoustical Society of America, 143(1), pp.470-488.

Scottish Government (2020). Commercial shellfish | Scotland's Marine Assessment 2020. Available at: https://marine.gov.scot/sma/assessment/commercial-shellfish#top

The Scotsman, (2023). An 'exceptional' year on the east coast of Scotland for basking shark sightings. Available at: https://www.dailymotion.com/video/x8om06e

8 Marine Mammals

8.1 Introduction

602. This chapter considers the scope of potential impacts of the construction, operation and maintenance, and decommissioning phases of the Broadshore Hub Wind Farm Development Areas (WFDAs) on marine mammals.

603. This chapter provides an overview of the existing environment and further sets out the methodology and approach to assessing effects on marine mammals in the Broadshore Hub WFDAs Environmental Impact Assessment (EIA) Report. This chapter has been prepared by Royal HaskoningDHV.

604. The marine mammal assessment should be read in conjunction with the following chapters of the Broadshore Hub WFDAs EIA Report:

- **Chapter 6: Benthic Ecology;**
- **Chapter 7: Fish and Shellfish Ecology;**
- **Chapter 9: Offshore Ornithology;** and
- **Chapter 10: Commercial Fisheries**.

605. The marine mammal assessment is likely to have key inter-relationships with the above receptors, which will be considered appropriately where relevant in the Broadshore Hub WFDAs EIA Report.

8.2 Legislation, Policy and Guidance

606. Marine mammal species in the waters surrounding the Broadshore Hub WFDAs are protected by national and international legislation. **Table 8.1** sets out the legislation, policy and guidance which have been considered in the preparation of this chapter, and will be considered within the Broadshore Hub WFDAs EIA Report assessment where appropriate. The overarching policy and legislation relevant to the Broadshore Hub WFDAs is described in **Chapter 2: Policy and Legislative Context**.

Table 8.1: Summary of Relevant Legislation, Policy and Guidance for Marine Mammals

Relevant Legislation, Policy or Guidance	Relevance to the Assessment
Legislation	
Nature Conservation (Scotland) Act, 2004	The Nature Conservation (Scotland) Act 2004 sets out a series of measures designed to conserve biodiversity, and to protect and enhance the biological and geological natural heritage. This Act also provides amendments to the Wildlife and Countryside Act 1981 specifically for Scottish waters, adding that it is an offence to disturb cetacean species (either recklessly or intentionally). This Act also enacts requirements under the Bern Convention 1979.
Marine (Scotland) Act, 2010	This Act provides a framework for the sustainable management of Scotland's seas and one of its key aims is to streamline and simplify the licensing and consenting process for marine projects. Under the Marine (Scotland) Act, the Conservation of Seals Act 1970 have been re-enacted, providing designation of specific seal haul-out sites for protections from intentional or reckless harassment. Under Part 6 of the new act, it is an offence to kill, injure or take a seal at any time of year, except to alleviate suffering or where a licence has been issued to do so by MD-LOT.
The Conservation of Offshore Marine Habitats and Species Regulations, 2017	The Habitats Regulations place an obligation on 'competent authorities' to carry out an appropriate assessment (AA) of any proposal likely to have a significant effect on a European site, to seek advice from Statutory Nature Conservation Bodies (SNCBs) and to reject an application that would have an adverse effect on the integrity of a European site except under very tightly constrained conditions. Under the Habitats Regulations, all cetacean species are defined as European Protected Species (EPS). All seals are listed under Schedule 3 (animals which may not be captured or killed in certain ways).
Policy	
Scotland's National Marine Plan, 2015	The purpose of the National Marine Plan is to set out strategic policies for the sustainable development of Scotland's marine resources out to 200 nm. Of relevance to marine mammals is the strategic priority: "Biodiversity is protected, conserved and, where appropriate, recovered, and loss has been halted."
Guidance	
The Protection of Marine EPS From Injury and Disturbance – Guidance of Scottish Inshore Waters (Marine Scotland, 2020).	This guidance provides advice for marine users who are planning to carry out an activity in the marine environment which has the potential to deliberately or recklessly kill, injure or disturb a marine EPS. It also provides useful information on mitigation for marine mammals.

Relevant Legislation, Policy or Guidance	Relevance to the Assessment
The Protection of Marine EPS From Injury and Disturbance – Guidance For The Marine Area In England And Wales And The UK Offshore Marine Area (Joint Nature Conservation Committee (JNCC) et al., 2010).	The guidance intends to provide a resource for marine users, regulators, advisors and the enforcement authorities when considering whether an offence of disturbing or injuring/killing a marine EPS is likely to occur or to have occurred as a result of an activity.
JNCC Guidelines for Minimising The Risk Of Disturbance And Injury To Marine Mammals Whilst Using Explosives (JNCC, 2010a).	These guidelines outline measures to minimise potential injury and disturbance from the use of explosives from activities such as harbour construction, well-head or platform decommissioning and unexploded ordinance clearance. The draft documents will be considered when developing the mitigation plans. However, as the documents are not yet finalised, the 2010 version is the most recent and current version and is referenced within the scoping document.
DRAFT JNCC Guidelines For Minimising The Risk Of Injury To Marine Mammals From Unexploded Ordnance Clearance In The Marine Environment (JNCC, 2023).	
Statutory Nature Conservation Agency Protocol for Minimising The Risk Of Injury To Marine Mammals From Piling Noise (JNCC, 2010b).	The JNCC guidelines for piling outline a protocol for the mitigation of potential underwater noise impacts arising from pile driving during offshore wind farm construction.
Scottish Marine Wildlife Watching Code (Scottish Natural Heritage (SNH) [now NatureScot], 2017).	The wildlife watching code provides guidelines as to the best practice measures for reducing disturbance to marine mammals by all marine users.
JNCC Guidelines For Minimising The Risk Of Injury To Marine Mammals From Geophysical Surveys (Seismic Survey Guidelines) (JNCC, 2017).	The JNCC guidelines for geophysical surveys outline a protocol for the mitigation of potential underwater noise impacts due to geophysical surveys.
Marine Environment: Unexploded Ordnance Clearance Joint Interim Position Statement (BEIS et al.) (2021).	Outlines the preferred approach to UXO clearance.

8.3 Consultation

607. A Scoping Workshop for the Broadshore Hub WFDAs was held on the 13th September 2023 with Marine Directorate - Licensing Operation Team (MD-LOT) and NatureScot, including a dedicated session on marine mammals. The session aimed to agree the relevance, appropriateness and sufficiency of baseline data, key issues for marine mammals to be considered in the Broadshore Hub WFDAs EIA Report, and the impact assessment approach. **Table 8.2** sets out consultation from this Workshop.

608. Consultation with marine mammal stakeholders will be ongoing during the EIA process and will include discussion of the best available information to use, for example, to agree species density estimates and define reference populations for the assessments.

609. Stakeholders that will be consulted through the EIA process are:

- MD-LOT;
- NatureScot;
- JNCC; and
- Relevant research organisations working in the region (e.g. Natural Environment Research Council Sea Mammal Research Unit (SMRU)).

Table 8.2: Consultation Relevant to Marine Mammals

Consultee	Date/Document	Comment	How Comment is Addressed
NatureScot	13th September 2023, Scoping Workshop	In the near future, conversion factors and line source approach work will be investigated in greater detail.	The INSPIRE model does not use conversion factors as it is based on monitored noise levels and back-propagated to generate estimated source levels for the relevant activities. Due to the size of the database of estimated source levels available to Subacoustech, this modelling methodology performs well against monitored datasets. Refer to **Appendix 5: Approach to Marine Mammals and Underwater Noise**.
		For the approach to Unexploded Ordnance (UXO) clearance, NatureScot recommend low order deflagration only, as per the Regulators Joint Position Statement.	Low order deflagration will be the preferred method for all clearance. There may be instances where deflagration is not possible, and this will be discussed further within the separate UXO clearance Marine Licence application(s).
		The dose response curve for harbour porpoise (Graham 2017) in Southall 2021 is a precautionary method and could be used to assess for minke whale disturbance	While this is considered be to a precautionary approach due to the hearing functions being different for the two species, and the hearing ranges being significantly different, the dose response curve for harbour porpoise will be applied to minke whale (and all dolphin species) as a proxy. Further information on minke whale disturbance is discussed in **Appendix 5: Approach to Marine Mammals and Underwater Noise**.
	Post Scoping Workshop email 12th October 2023	We are content with this semi-empirical approach to subsea noise effect modelling and assessment currently. As raised in the meeting, further work online source and use of conversion factors (JASCO and MD-LOT report) is expected shortly.	Noted.
		In the absence of disturbance thresholds for minke whale, the harbour porpoise dose-response curve can be used. NatureScot recognises that this is potentially over precautionary as porpoise are considered to be particularly responsive to anthropogenic disturbance. Therefore, the number of individuals of other species predicted to experience behavioural disturbance is likely to be an over-estimate.	See above response.

Consultee	Date/Document	Comment	How Comment is Addressed
		NatureScot notes an action to discuss disturbance thresholds with baleen whale experts in academia and the navy. NatureScot is content to review any further information gleaned from this at the Scoping stage, however, in the absence of any robust evidence, NatureScot advises that the harbour porpoise dose-response curve is used for minke whale.	
Marine Directorate – Science Evidence Digital Data (MD-SEDD)	13th September 2023, Scoping Workshop	The Bottlenose dolphin – Coastal East Scotland Management Unit (MU) should be included and that there needs to be some consideration given about how to derive a density estimate based on the population, and using predicted habitat models (as other recent projects have done). SCANS densities will be unlikely to be suitable for the inshore population of bottlenose dolphin.	The Coastal East Scotland MU will be included for bottlenose dolphin, as discussed in **Section 1.5 in Appendix 4: Marine Mammals Existing Environment**. The method for deriving an inshore density estimate will be provided with the Broadshore Hub Offshore Transmission Development Area (OfTDA) Scoping Report to be submitted at a later date (as Broadshore Hub WFDAs Scoping Report is relevant to the Broadshore Hub WFDAs only, which are located outside of inshore areas).
		As much information as possible should be provided in the Scoping Report on what piling parameters were used in the INSPIRE Light modelling.	A full description of the INSPIRE modelling will be included within the EIA Report.
		All potential impacts scoped in for construction should also be scoped in for operation, with the exception of noise from piling.	All relevant impacts from construction have also been scoped in for operation. See **Section 8.6.1.2.**
		Surveys to check for entanglement of gear etc are important, and regular Remotely Operated Vehicle (ROV) checks of the cables seems a sensible approach.	Periodic inspections as part of the asset integrity campaign will include visual surveys and identification of debris entangled to the mooring lines**.** Note these asset integrity plans are in the early stages of development and will be further refined during the EIA process.
		Few marine mammals have been sighted in the aerial surveys; this cannot be relied on as a source of which species might be scoped in.	The scoping in and out of species is based on a full desk-based assessment complemented by outputs of the site-specific surveys (refer to **Appendix 4** for further detail). See **Section 8.4** for a summary of the species intended to be scoped in for further assessment.

8.4 Existing Environment

610. The full existing environment for marine mammals is provided in **Appendix 4: Marine Mammals Existing Environment,** including information on the marine mammals study area and data sources used. A full assessment of the baseline conditions will be undertaken through the EIA process, and will inform, alongside the results of the site-specific aerial surveys, the species to be taken forward for further assessment in the Broadshore Hub WFDAs EIA Report. Following the initial characterisation in **Appendix 4**, it is expected that the key species taken forward for assessment would be:

- Harbour porpoise *Phocoena phocoena*;
- Bottlenose dolphin *Tursiops truncatus*;
- White-beaked dolphin *Lagenorhynchus albirostris*;
- Minke whale *Balaenoptera acutorostrata*;
- Grey seal *Halichoerus grypus*; and
- Harbour seal *Phoca vitulina*.

611. A review of the desk-based literature as given in **Appendix 4** shows that other marine mammal species have been recorded in the region, although in lower number than those listed above. These include Atlantic white-sided dolphin *Lagenorhynchus acutus,* common dolphin *Delphinus delphis,* Risso’s dolphin *Grampus griseus*, killer whale *Orcinus orca* and long-finned pilot whale *Globicephala melas*. The Applicants intend to scope these species out, however, if the results of the second year of site-specific surveys confirm presence of these species within the Broadshore Hub WFDAs, these species will be later scoped in for assessment.

612. It should be noted that all marine mammals will be protected through the mitigations implemented for the Broadshore Hub WDFAs, regardless of whether they are scoped in for full assessment in the EIA. Regarding underwater noise impacts, all species’ hearing groups (porpoise, dolphin, whale and seal) will be included within the underwater noise modelling, and therefore all mitigation will be designed with all species groups in mind, which will ensure the less common species would be mitigated for.

8.4.1 Key Marine Mammal Data for Assessments

613. **Appendix 4: Marine Mammals Existing Environment** provides an initial review of the marine mammal presence at the Broadshore Hub WFDAs.

614. Marine mammal density estimates will be based on the worst-case (highest and most precautionary) estimate for each species. Sources to be used to derive density estimates for cetacean species include the SCANS-IV survey data (Gilles et al., 2023), or data from Waggitt et al. (2019) (**Table 1.3** in **Appendix 4**) and the site-specific surveys. Seal density estimates will be based on the worst-case densities from the Carter et al., (2022) density mapping (**Table 1.4** in **Appendix 4**), or the site-specific surveys if there is sufficient data. See **Section 1.4.1** of **Appendix**

4 for more information on the proposed use of cetacean density data, and **Section 1.4.2** for the proposed use of seal density data.

615. The reference populations for cetacean species will be based on the SCANS-IV North Sea (NS) Management Unit (MU) estimate for harbour porpoise (Gilles et al., 2023), or the Inter-Agency Marine Mammal Working Group (IAMMWG) (2023) estimates for other cetacean species. For seal species, the population estimates will be based on the latest counts from the Special Committee on Seals (SCOS) (2022); the latest estimates are provided in **Table 1.5** of **Appendix 4**, however these will be updated in line with updated SCOS reporting.

616. **Table** 8.3 summarises the cetacean species, density estimates, and reference populations currently available to be used in the assessments. Density estimates are based on the highest for the Broadshore Hub WFDAs. Further information on how the worst-case densities will be derived is provided in **Appendix 4**.

617. These, and other data sources, will be kept under review, and if any appropriate data sources are available to inform the marine mammal EIA they will be incorporated within the assessment. A further review of other data sources will be undertaken within the marine mammals EIA Report, and the worst-case used to inform the assessments, which will include data from the site-specific surveys. If additional relevant information becomes available during the EIA process it will also be considered for use within the assessments.

Table 8.3: Summary of Marine Mammal Species, Density Estimates and Reference Populations to be used in the Impact Assessments (Based on Currently Available Information)

Species	Density Estimate	Reference Population
Harbour porpoise	0.5156/km² (Gilles et al., 2023)	NS MU = 338,918 (Gilles et al., 2023)
Bottlenose dolphin	0.003/km² (Waggitt et al., 2019)	Greater North Sea (GNS) MU = 2,022 (IAMMWG, 2023) Coastal East Scotland MU = 224 (IAMMWG, 2023; Arso Civil et al., 2021)
White-beaked dolphin	0.1775/km² (Gilles et al., 2023)	Celtic and Greater North Sea (CGNS) MU = 43,951 (IAMMWG, 2023)
Minke whale	0.0121/km² (Gilles et al., 2023)	CGNS MU = 20,118 (IAMMWG, 2023)
Grey seal	0.215/km² (Carter *et al*., 2022)	North Coast Orkney (NCO), Moray Firth (MF) & East Scotland (ESc) MUs = 52,354 (SCOS, 2022) NCO, MF, ESc & North-East England (NEE) MUs (as the wider reference population) = 78,267 (SCOS, 2022)
Harbour seal	0.00009/km² (Carter *et al*., 2022)	NCO, MF & ESc MUs = 3,273 (SCOS, 2022)

8.4.2 Protected Sites

618. Designated sites for marine mammals in the north-east Scotland region and east coast of Scotland include the Moray Firth SAC for bottlenose dolphin, Isle of May SAC, Beriwckshire and North Northumberland Coast SAC and Faray and Holm of Faray SAC for grey seal and Dornoch Firth and Morrich More SAC for harbour seal. Information on species' movements, including seal tagging studies, will be reviewed to determine the potential for connectivity of marine mammals from designated sites and the Broadshore Hub WFDAs as part of the Habitats Regulation Appraisal (HRA) screening exercise (**Broadshore Hub WFDAs HRA Screening Report**; BlueFloat | Renantis Partnership, 2024).

619. In addition, the Southern Trench Nature Conservation Marine Protection Area (NCMPA) has been designated for minke whale, and will be considered and assessed as part of the EIA process. The Southern Trench NCMPA is also screened in **Appendix 2: NCMPA Screening Report**.

8.5 Potential Impacts

620. A range of potential impacts on marine mammals have been identified which may occur during the construction, operation and maintenance, and decommissioning phases of the Broadshore Hub WFDAs. These include:

- Underwater noise during UXO clearance[29];
- Underwater noise during geophysical surveys[30];
- Underwater noise during impact piling (hydraulic hammer or vibro-pilling);
- Underwater noise during other substructure or mooring installation options (other than impact piling);
- Underwater noise from other installation activities at the seabed (for example rock placement and cable laying);
- Underwater noise resulting from the presence of vessels during construction and operation and maintenance;
- Underwater noise from operational wind turbines and associated structures (e.g. mooring systems);
- Risk of entanglement (direct and secondary);
- Collision risk with vessels;
- Disturbance at seal haul-out sites;
- Electromagnetic Field (EMF) – direct effects on marine mammals;
- Changes in water quality; and
- Changes to prey availability.

621. **Section 8.6** provides further detail on each, identifies which development phases apply and justifies whether these impacts have been scoped in or out from further assessment.

8.5.1 Embedded Mitigation Measures

622. **Table 8.4** sets out the embedded mitigation measures built into the design of the Broadshore Hub WFDAs, as well as potential additional mitigation measures that may be applied if required at EIA stage. Additional mitigation measures may be implemented where the assessment identifies that an aspect of the Broadshore Hub WFDAs is likely to give rise to significant environmental effect in order to avoid, prevent or reduce effects to acceptable levels.

[29] A separate Marine License application(s) will be made prior to UXO clearance works, with an accompanying assessment of UXO clearance effects on marine mammals. The Broadshore Hub WFDAs EIA Report will include an indicative assessment only.

[30] A European Protected Species licence will be applied for separately, if deemed necessary.

Table 8.4: Embedded Mitigation Measures for Marine Mammals

Parameter	Description of Mitigation Measure
Mitigation to reduce effects from underwater noise	The Piling Strategy (PS) would be developed post-consent, in the pre-construction period and based upon best available information, a detailed ground model, construction methodologies, industry best practice, latest scientific understanding, current guidance and detailed project design, which will include a Marine Mammal Mitigation Protocol (MMMP). • The PS will include details on the soft-start and ramp-up31 requirements, which will be based on modelling results for a variety of soft-start and ramp-up options, as well as engineering constraints and final pile design. • The MMMP for piling would be developed in consultation with the relevant SNCBs and MD-LOT, detailing the proposed mitigation measures to reduce the risk of any physical effects or Permanent Threshold Shift (PTS) to marine mammals during all piling operations. This will include details of any mitigation measure to be put in place, such as soft-start, ramp-up, use of Acoustic Deterrent Devices (ADD), pre- and during piling, to manage the effects of underwater noise to sensitive receptors.
Hierarchy of UXO clearance methods[32]	The hierarchy of UXO clearance techniques, in order of preference, are: • Avoid (through micro-siting of infrastructure); • Move UXO without clearing it (if applicable and accepted as an option); • Remove the UXO without clearing it (if applicable and accepted as an option); • Low-order deflagration if above options not suitable/unsafe; and • High-order clearance, if low-order deflagration not possible, or in the unlikely event that low-order deflagration was unsuccessful.
Pollution prevention	As outlined in **Chapter 5: Marine Geology, Oceanography and Physical Processes** the Applicants are committed to the use of best practice techniques and due diligence regarding the potential for pollution throughout all construction, operation and maintenance, and decommissioning activities. This includes compliance with the International Convention for the Prevention of Pollution from Ships (MARPOL) 73/78 and the Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR) and the development of, and adherence to, an Environmental Management Plan (EMP) and Marine Pollution Contingency Plan (MPCP).
Vessel Best Practice Measures	The Scottish Marine Wildlife Watching Code (SNH [now NatureScot], 2017) approach will be followed to minimise the risk of disturbance, by reducing vessel transit speeds and by maintaining speed and course when in the presence of marine mammal species. This code will be followed for all vessels transiting to and from the Broadshore Hub WFDAs. A Vessel Management Plan (VMP) will be developed and implemented to confirm the types and numbers of vessels that will be engaged during the

[31] Please refer to glossary for details on soft-start and ramp up.

[32] If UXO clearance is required, it will be subject to a separate and appropriate Marine Licence(s) application.

Parameter	Description of Mitigation Measure
	different phases of the Broadshore Hub WFDAs, including selection of preferred transit routes to minimise disturbance to protected seal haul-out sites and other sites of relevance to marine mammals, where applicable. In the event of a collision with a marine mammal, this will be reported, and full information of the incident, including the marine mammal species, will be recorded.

623. If required following assessment in the EIA, additional mitigation may be implemented as appropriate to reduce the potential for effects from underwater noise during geophysical surveys. If any geophysical surveys are required, adequate mitigation measures will be in place to minimise the risk of any injury or disturbance to marine mammals, using the standard mitigation procedures as provided in JNCC (2017).

624. Where knowledge gaps are identified, the Applicants will continue to engage with stakeholders and collaborate in appropriate strategic monitoring projects as agreed through ScotMER and other similar working groups,

8.6 Scoping of Potential Impacts

625. The potential impacts from the Broadshore Hub WFDAs during the construction, operation and decommissioning phases are outlined below and summarised in **Table 8.5**. All of the potential impacts screened in for further assessment will be related to the potential area of impact, using marine mammal density information (as discussed in **Section 8.4.1**) to determine the number of marine mammals that could potentially be impacted, and assessed in the context of the relevant reference populations in order to identify the potential for any population effects.

8.6.1 Potential Impacts Scoped In

8.6.1.1 Construction

626. The potential impacts on marine mammals during construction, and scoped in for further assessments in the Broadshore Hub WFDAs EIA Report are:

- Underwater noise impacts;
- Collision risk with construction vessels;
- Disturbance at seal haul-out sites; and
- Changes to prey availability (including from habitat loss and EMF).

627. Each of these impacts is discussed in further detail below.

8.6.1.1.1 Underwater Noise Impacts

628. Underwater noise can cause both physiological (e.g. lethal, physical injury and threshold shifts) and behavioural (e.g. disturbance, behavioural response and masking of communication) impacts on marine mammals (e.g. Southall, 2021; Stöber & Thomsen, 2019).

629. The key potential impacts on marine mammals during construction are expected to be those resulting from underwater noise. Activities that have the potential to generate underwater noise associated with the construction of the Broadshore Hub WFDAs are:

- Clearance of UXO, if required;
- Geophysical surveys;
- Piling for anchors of fixed bottom substructures and/or floating substructures ;
- Non-impact piling installation of fixed bottom substructures and/or floating substructures SKS(depending on method used);
- Other construction activities such as seabed preparation, cable laying and rock placement; and
- Use of vessels.

630. For all underwater noise impacts, where possible (i.e. where there are modelling PTS ranges for an activity, or where a quantitative approach to disturbance is undertaken), the number of each marine mammal species within the potential areas of effect will be determined. This would be based on the modelled/derived effect areas through the underwater noise modelling, and the marine mammal densities as outlined in **Section 8.4.1**. The number of marine mammals at risk would then be assessed as a proportion of the overall population numbers, and the magnitude level determined as set out in **Table 8.6**.

631. Where a quantitative approach is not possible, a qualitative assessment will be undertaken, based on a literature review of the potential effect (e.g. reports of marine mammal behavioural reactions to certain noisy activities).

8.6.1.1.1.1 Clearance of UXO

632. Prior to construction, there is the potential for UXO clearance to be required in line with the UXO clearance hierarchy presented in **Table 8.4**. If required, underwater deflagration or detonation could be undertaken.

633. The potential effects of underwater explosions on marine mammals include: (1) physical injury from direct or indirect blast wave effect of the high amplitude shock waves and sound wave produced by underwater detonation, which could result in immediate or eventual mortality; (2) auditory impairment (from exposure to the acoustic wave), resulting in a permanent hearing loss (PTS); or (3) behavioural change, such as disturbance to feeding, mating, breeding, and resting (Richardson *et al.* , 1995; Ketten, 2004; von Benda-Beckmann et al. , 2015). The potential for underwater noise impacts from UXO clearance is therefore scoped in for further assessment, although as noted below, this will be provided as an indicative assessment only.

634. A UXO Threat and Risk Assessment for the Broadshore Hub WFDAs was undertaken by 6 Alpha Associates (2023). This assessment resulted in an overall UXO risk rating of low, although there is the potential for some UXO be present. The UXO listed by the UXO Threat and Risk Assessment as being potentially present are:

- 53.3 cm G7e Torpedo 7/G7a Torpedo 7 (Net Explosive Quality (NEQ) = 364 kg);
- 50 cm G7 Torpedo (NEQ = 254 kg);
- Mark XVII Mine (NEQ = 227 kg);
- Type H Mark II Mine (NEQ = 145 kg);
- 12.75 " Stingray Torpedo (NEQ = 58.5 kg);
- AIM-120 AMRAAM (NEQ = 20 kg); and
- 8.8 cm Naval Projectile (NEQ = 1.42 kg).

635. If UXO clearance is required, a separate Marine License application(s) will be made prior to UXO clearance works, with an accompanying assessment of UXO clearance effects on marine mammals. This is to ensure that assessments are made on the best available information at the time, including the size of UXO expected to require clearing.

636. A detailed UXO survey will be completed prior to UXO clearance taking place (and in the post-consent/pre-construction phase). Therefore, the number of possible detonations and duration of UXO clearance operations that could be required will not be known at the time of the Broadshore Hub WFDAs EIA Report submission. For the Broadshore Hub WFDAs EIA Report, an indicative and conservative assessment will be undertaken, based on the best available information from contractors, other offshore wind farm UXO clearance operations and other published information.

637. Underwater noise modelling will be undertaken on a range of potential UXO devices that may be present in the area, in order to provide an indicative assessment of impacts. Further information on underwater noise modelling is provided in **Appendix 5: Approach to Marine Mammals and Underwater Noise**.

8.6.1.1.1.2 Geophysical Surveys

638. Prior to, during and post construction, there is likely to be the need for geophysical surveys to further investigate and monitor the seabed conditions within the Broadshore Hub WFDA. The specific equipment and associated sound frequencies and pressure levels are currently unknown, although are expected to include a combination of the below:

- Multi-Beam Echo Sounder (MBES);
- Ultra-Short Baseline (USBL);
- Side Scan Sonar (SSS); and
- Sub-Bottom Profiler (SBP).

639. If required, an EPS licence application will be submitted prior to the works. For the purpose of the Broadshore Hub WFDAs EIA, underwater noise modelling will be undertaken for worst-case impact ranges from SBP, as it is anticipated that sound frequencies from MBES and SSS will fall outside the marine mammals hearing ranges, and sound pressure levels from USBL are expected to be low and therefore unlikely to injure or disturb marine mammal species.

640. It is likely that SBPs would require mitigation as per the JNCC (2017) guidelines. USBL would also likely require mitigation, while MBES and SSS are generally outside of marine mammal hearing ranges and therefore unlikely to injure or disturb marine mammal species, and are unlikely to require mitigation. However, all potential sources will be further assessed within the EIA.

8.6.1.1.1.3 Impact Piling for Fixed Bottom and/or Floating Substructures

641. A range of substructures are being considered for the WTGs. Those that will require impact piling are[33]:

- Floating substructures (anchoring):
  - Anchor driven piles:
    - Up to twelve anchor driven piles per floating substructure;
    - Either impact driven or vibro-piled; and
    - Estimated at 3.5 m diameter, 20-35 m long, and requiring a hammer energy of up to 3,000 kJ.
- Fixed bottom substructures:
  - Jacket (tripod or quadrapod):
    - Either three or four legs per fixed bottom substructure, with up to two pin piles per leg (i.e., up to eight pin piles for each substructure);
    - Up to 4 m diameter pile, requiring a hammer energy of up to 4,000 kJ; and
    - Piles could be impact or drill piled.
  - Cable supported monopile:
    - Estimated pile diameter of 16 m.

642. Please refer to **Chapter 3: Project Description** (**Section 3.4 and Section 3.6**) for full details on piled substructure and anchoring options, respectively.

643. Impact piling has been established as a source of high level underwater noise (Parvin et al., 2006; Thomsen et al., 2006; Nedwell et al., 2007; Robinson et al., 2012; Kastelein et al., 2015, 2016). The potential for underwater noise impacts from piling is therefore scoped in for further assessment, although the number of piles and parameters will be confirmed at later date.

644. Underwater noise modelling will be undertaken to determine the potential impacts on marine mammals during piling. The underwater noise modelling will include modelling for threshold shifts

[33] Information to be refined prior to underwater noise modelling being undertaken

(PTS) using the Southall et al., (2021) thresholds for marine mammals. Further information on underwater noise modelling is provided in **Appendix 5: Approach to Marine Mammals and Underwater Noise**.

645. For the potential for disturbance effects on marine mammals due to impact piling:

- The dose response curve from Graham et al. (2017) would be used to determine the potential for disturbance for harbour porpoise, dolphin species, and minke whale.
- The dose response curve from Whyte et al. (2020) would be used to determine the potential for disturbance for grey seal and harbour seal.

646. Further information on the approach to disturbance assessments (from impact piling) is provided in **Section 3.1** of **Appendix 5: Approach to Marine Mammals and Underwater Noise**.

647. Population modelling may also be undertaken to determine the population level consequences of disturbance due to piling at the Broadshore Hub WFDAs. For any marine mammal species where it has been identified there is the potential for a significant disturbance impact following the disturbance assessments as outlined above, population modelling will be undertaken (where possible[34]). The population modelling would be used to determine whether the number of animals disturbed would cause a population level effect.

8.6.1.1.1.4 Non-impact Substructure Installation Techniques

648. A range of non-impact piled substructure options are being considered. This will be refined through the EIA process, but are currently expected to include (and therefore be included within the underwater noise modelling):

- Floating substructure anchoring:
  - Suction piles;
  - Drilled and grouted piles;
  - Drag embedment anchors;
  - Vertical load anchors; and
  - Suction embedded plate anchors.
- Fixed bottom substructure:
  - Suction caisson jacket; with either three or four legs (i.e. up to four suction caissons per substructure).

649. Please refer to **Chapter 3: Project Description** (**Section 3.4** and **Section 3.6**) for full details on piled substructure and anchoring installation techniques, respectively.

[34] Population modelling is currently only possible for harbour porpoise, bottlenose dolphin, minke whale, grey seal and harbour seal

650. Underwater noise modelling will be undertaken to determine the potential impacts on marine mammals during the above listed anchor/substructure installation options. The underwater noise modelling will include modelling for permanent threshold shifts (PTS). Further information on underwater noise modelling is provided in **Appendix 5: Approach to Marine Mammals and Underwater Noise**.

651. A desk-based review of similar activities will be undertaken to inform the potential for disturbance in all marine mammal species, which will include the 4 km disturbance range from other offshore wind farm construction activities provided by Benhemma-Le Gall et al., (2021).

8.6.1.1.1.5 Other Construction Activities and Vessels

652. Other sources of underwater noise associated with offshore wind farm construction include seabed preparation, rock placement, IAC installation (including cable burial (if applicable) and protection), installation of mooring lines and vessel activity.

653. There are no clear indications that underwater noise caused by the installation of sub-sea cables poses a high risk of harming marine fauna (OSPAR, 2009). The potential risk of PTS in marine mammals as a result of cable installation (including cable burial and protection if required) activity is highly unlikely. However, the need for a quantitative assessment of auditory injury will be reviewed after project specific underwater noise modelling has been conducted.

654. The potential for any disturbance from underwater noise during cable installation or other activities associated with offshore wind farm construction will be scoped in for further assessment.

655. During the construction phase, there will be an increase in the number of vessels associated with installation of the Broadshore Hub WFDAs (i.e., station keeping systems, substructures, IACs, etc). Where possible, vessel movements to and from any port will be incorporated within existing vessel routes and therefore any increase in disturbance as a result of underwater noise from vessels during construction is likely to be focused within the Broadshore Hub WFDAs.

656. The types of vessels that could be on site during construction could include (see complete list in **Section 3.9.3.3: Construction Vessels**):

- Support vessels;
- Anchor handling tug supply (AHTS) vessels;
- Cable installation vessels (PLGR, lay & burial);
- Scour protection installation vessels;
- Heavy lift vessels (HLV);
- Jack-up vessels (JUV);
- Service operation vessels (SOV);
- Crew transfer vessel (CTV);
- Guard vessel; and
- Accommodation vessels.

657. Noise levels reported by Malme et al. (1989) and Richardson et al. (1995) for large vessels, typically those being used during construction, indicate that any physical or auditory damage to marine mammals is unlikely. However, the noise levels could be sufficient to cause local disturbance of sensitive marine mammals in the immediate vicinity of the vessel, depending on ambient noise levels, or could cause a cessation in foraging activity (e.g. Pirotta et al., 2015). The need for a quantitative assessment will be reviewed after project specific underwater noise modelling has been conducted.

658. A determination of the type and number of vessels to be used during the construction period will be taken into account and the likely noise emissions from those vessels will be given consideration to determine the potential impact of vessel noise on marine mammals. In addition, consideration will also be given to existing vessel activity in and around the Broadshore Hub WFDAs. The increase in vessel movements during construction will be put into the context of current vessel movements in and around the Broadshore Hub WFDAs.

659. The number of marine mammals that could be potentially disturbed as a result of underwater noise during construction from activities, other than piling and vessel movements, will be assessed, based on the type of activity and potential area of disturbance.

8.6.1.1.2 Vessel Interaction (Collision Risk)

660. As noted in **Section 8.6.1.1.1.5**, there will be an increase in vessel presence during the construction phase, which could lead to a potential increase in the risk of vessel collision with marine mammals. The risk of vessel collision is associated with the vessels within the Broadshore Hub WFDAs, as well as those vessels in transit to and from the WFDA. Despite the potential for marine mammals to detect and avoid vessels, vessel strikes are known to occur (Wilson et al., 2007; Schoeman *et al*., 2020).

661. The increased risk of collision with marine mammals during construction has been scoped in and will be assessed in the EIA, taking into account the most recent and robust research, guidance and information available.

662. A literature review will be undertaken to determine the sensitivity of each marine mammal species to vessel collisions (and their ability to avoid vessels), alongside a review of the risk of collision due to the type, size, and speed of vessels associated with the Broadshore Hub WFDAs. The assessment of the potential impact of vessel interaction will take into account the type and estimated number of vessels to be used during the construction period and the potential collision risk associated with those vessels.

663. The increase in vessel movements during construction will also be put into the context of current vessel movements in and around the Broadshore Hub WFDAs.

664. As noted in **Section 8.5.1**, vessel best practice measures will be followed, which will reduce the potential for any vessel collision with marine mammals.

8.6.1.1.3 Disturbance at Seal Haul-Out Sites

665. Disturbance from vessel transits to and from the Broadshore Hub WFDAs and the construction/integration port(s) has the potential to disturb seals at haul-out sites, depending on the route and proximity to the haul-out sites. The Broadshore Hub WFDAs Scoping Report is focused on the Broadshore Hub WFDAs only, and therefore potential for disturbance to haul-out sites due to activity in the export cable corridor and landfall(s) is not included in this Scoping Report. This impact will be considered within the Broadshore Hub OfTDAs Scoping Report and (where relevant) the Broadshore Hub OnTDAs Scoping Report.

666. The potential for any disturbance of seals at or from seal haul-out sites during construction (due to vessel transits) has been scoped in and will be assessed in the EIA, taking into account the most recent and robust research, guidance and information available. The port(s) to be used for construction works will be identified post consent. Potential ports may be shortlisted within the EIA Report.

667. The likelihood of increased vessels near to the locations of nearby seal haul-out sites will be used to determine the level of potential disruption and behavioural impact caused to the seals. A literature review of the latest research and evidence of disturbance at seal haul-out sites will be undertaken to determine the potential magnitude and sensitivity of effect.

668. The duration of the construction vessels movement to and from the site will be based on the worst-case scenario, taking into account the possible phasing options and scenarios. The increase in vessel movements during construction will be put into the context of current vessel movements in and around the Moray Firth.

8.6.1.1.4 Changes to Prey Resource

669. **Chapter 7: Fish and Shellfish Ecology** outlines the potential impacts on fish species and therefore the prey resource for marine mammals during construction.

670. The potential for any changes to the prey resource for marine mammals during construction will be assessed further in the EIA. Impacts will be based on the assessments in the fish and shellfish ecology chapter of the Broadshore Hub WFDAs EIA Report.

671. The fish species present at the Broadshore Hub WFDAs that could potentially be affected during construction will be determined by reference to a number of existing data sources. The potential impacts on known prey species for each marine mammal receptor will be assessed based on the results of the fish and shellfish ecology impact assessment, including underwater noise modelling based on the appropriate realistic worst-case scenarios for these receptors. The assessment will consider the known dependence of each marine mammal species to those prey species and the potential impact on energy demands should prey species be displaced.

672. A literature review of the latest research and evidence of marine mammal sensitivities to changes in prey species will be undertaken, and will be considered alongside the results of the assessments to prey species to determine the potential magnitude and sensitivity of the impact.

8.6.1.2 Operation and Maintenance

673. The potential impacts for marine mammals during operation and maintenance, and scoped in for further assessments in the Broadshore Hub WFDAs EIA, are:

- Underwater noise impacts:
  - Due to operational WTGs and fixed bottom substructures and floating offshore unit (FOU) noise (including noise from cables and mooring lines);
  - Due to operation and maintenance activities; and
  - Due to presence of vessels.
- Entanglement with mooring lines and dynamic inter-array cables;
- Collision risk with operation and maintenance vessels;
- Disturbance at seal haul-out sites;
- EMF effects; and
- Changes to prey availability (including from habitat loss and EMF).

674. Each of these impacts is discussed in further detail below.

8.6.1.2.1 Underwater Noise Impacts

675. Potential sources of underwater noise during the operation and maintenance phase include:

- Operational noise from WTGs and/or from movement of floating substructure moorings on the seabed;
- Operation and maintenance activities underwater, such as underwater surveys, preventive and corrective maintenance to substructures and SKS, IAC repairs (including re-burial and any additional rock placement; and
- Operation and maintenance vessel activity.

8.6.1.2.1.1 Operational WTG and Fixed Bottom Substructure and/or FOU Noise

676. The low-level noise generated during operation is likely to be detected by marine mammals only at short distances over background noise levels and below levels which would elicit a response. The overall effect of the operational noise and the ability of marine mammals to perceive this noise will be largely dependent on ambient noise levels and wind speed (Risch et al., 2023).

677. The main sources of sound generated during the operation of WTG are aerodynamic and mechanical. The mechanical noise is from the nacelle at the top of the WTG tower. As the WTG blades rotate, vibrations are generated that travel down the WTG tower and radiate into the surrounding water column and seabed (Tougaard et al., 2009; 2020; Nedwell et al., 2003). The resulting sound is described as continuous and non-impulsive and is characterized by one or more tonal components that are typically at frequencies below 1 kHz. The frequency content of the tonal

signals is determined by the mechanical properties of the wind turbine and does not change with wind speed (Madsen et al., 2006). Noise levels generated above the water surface are low enough that no significant airborne sound will pass from the air to the water (Godin, 2008).

678. Tougaard et al. (2020), reviewed the available measurements of underwater noise from different WTG during operation and found that source levels were at least 10–20 dB lower than vessel noise in the same frequency range. A simple multi-turbine model indicated that cumulative noise levels could be elevated up to a few kilometres from a wind farm under very low ambient noise conditions. However, the noise levels were well below ambient levels unless very close to the individual turbines in locations with high ambient noise from shipping or high wind speeds (Tougaard et al., 2020).

679. There are few studies into the sound levels associated with floating wind farms, and whether they differ to the noise levels associated with fixed, ongoing research is currently being conducted. One study that will be used to inform the potential for marine mammal effects due to operational FOU noise (at floating wind farms) is the FORTUNE (Floating Offshore Wind Turbine Noise) project (Risch et al., 2023).

680. Noise emissions from floating offshore wind turbines at Kincardine and Hywind Scotland were concentrated in the frequencies below 200 Hz and showed distinct tonal features, likely related to rotational speed, between 50 and 80 Hz at Kincardine and 25 and 75 Hz at Hywind Scotland (Risch et al., 2023). The measured received levels are similar to those measured for operational noise from fixed offshore wind turbines at comparable distances. Emitted noise levels showed strong positive correlations with wind speed and slightly weaker positive correlations with wave height (Risch et al., 2023).

681. There is also the potential for a noise that has been associated with cable ‘thrums’ and/or cable ‘snaps’ to be present during the operation of the FOUs at floating offshore wind farms resulting from dynamic IAC suspended within the water column, and potentially also noise resulting from the movement of mooring lines (Risch et al., 2023). It should be noted that it is likely this cable snap noise is likely to be isolated to the particular environmental conditions of where it was recorded. However, as the source of this ‘cable snap’ noise is as of yet not well understood as to the source or the cause, it is not possible to rule out that it will occur during the operational phase.

682. The potential for underwater noise impacts due to operational FOU noise will be scoped into the assessment.

683. Depending on the estimated sound source from an operational FOU, underwater noise modelling may be undertaken for the potential for PTS, using the non-impulsive thresholds as set out in **Table 2.2** in **Appendix 5**.

684. There is no indication of any disturbance or exclusion of small cetaceans or seals around fixed foundation wind farm sites during operation (Tougaard et al., 2005; Scheidat et al., 2011). Data collected suggests that behavioural responses for harbour porpoise and seal may only occur up to a few hundred metres away for fixed foundations (Touggard et al., 2009; McConnell et al., 2012) and for floating foundations (Risch et al., 2023). Tagged harbour seals have been recorded within operational wind farm sites and the movements of several of the seals suggest foraging behaviour around fixed wind turbine structures (Russell et al., 2014). Harbour porpoise have also been

reported to increase their foraging activity close to offshore structures (<200m) compared to further away (2,500m) (Fernandez-Betelu et al., 2022). A full review of the latest research will be undertaken as part of the EIA, including any reporting on harbour porpoise presence and foraging at operational wind turbines as part of the PrePARED (Predators & Prey around Renewable Energy Developments) project.

685. It is proposed that disturbance from the underwater noise of operational turbines at the Broadshore Hub WFDAs will be based on the latest evidence and research, using a desk-based approach to the assessment.

8.6.1.2.1.2 Operation and Maintenance Activities and Vessel Activity

686. The Broadshore Hub WFDAs EIA Report will set out an indicative overview of requirements for any preventive and corrective maintenance work. However underwater noise impacts associated with any work required are expected to be lower than those during construction, although they would be undertaken periodically over a longer time frame (and during the lifetime of the Broadshore Hub WFDAs). Vessel presence within the Broadshore Hub WFDAs, as well as those vessels in transit to and from the Broadshore Hub WFDAs are anticipated during the operational period.

687. The potential for disturbance from underwater noise during the operation and maintenance phase will be based on the underwater noise modelling and assessment of similar activities for the construction phase (**Section 8.6.1.1.1.5**).

688. The potential impacts associated with underwater noise during operation and maintenance (including PTS, disturbance and behavioural effects and impacts on prey species) are scoped in and will be considered further in the EIA, taking into account the most recent and robust research, guidance and information available.

689. As outlined in **Section 8.6.1.1.1.5**, noise generated from activities such as cable laying is not expected to be sufficient to cause PTS or other injury to marine mammals. The need for a quantitative assessment will be reviewed after project specific underwater noise modelling has been conducted. Disturbance is likely to be the main potential noise impact from operation and maintenance activities.

8.6.1.2.2 Entanglement

690. Depending on the method used, there is the perceived potential for entanglement in the mooring lines of the floating structures. To date, there have been no recorded instances of marine mammal entanglement from mooring systems of renewable devices (Sparling et al., 2013; Isaacman and Daborn, 2011), or for anchored (Floating Production Storage and Offloading) FPSO vessels in the oil and gas industry (Benjamins et al., 2014) with similar mooring lines as proposed for floating turbine structures. However, entanglement in fishing gear is known to occur in Scottish waters, and there is therefore the potential for a risk of secondary entanglement (i.e., entanglement in ghost fishing gears entangled in the subsea infrastructure).

691. The options for the floating substructure and mooring lines, if required, are;

- Floating substructures:
  - Tension leg platform;
  - Semi-submersible;
  - Barge;
  - Buoy; and
  - Semi-spar.
- Mooring lines:
  - Catenary;
  - Taut;
  - Semi-taut;
  - Tension; and
  - Shared.

692. The mooring lines may be formed of chain, synthetic rope, or sheathed spiral strand wire-ropes. Please refer to **Chapter 3: Project Description** for full details on floating substructures and mooring line options under consideration.

693. The level of risk to become entangled varies with species (Benjamins et al., 2014). The varying factors include body size, flexibility of movement, the ability to detect mooring lines, and the feeding ecology of the species.

694. Toothed whales have a lower risk than baleen whales, primarily due to their small size and manoeuvrability. Seal species have a similar risk level to small toothed cetaceans, with an increase in manoeuvrability.

695. The potential for direct entanglement is considered to be very low risk, given the design of the mooring lines and dynamic cables. Therefore, the potential for direct entanglement has been scoped out (see **Section 8.6.2.2**). However, there the potential for secondary entanglement, whereby anthropogenic debris, such as the lost, abandoned or discarded fishing gear and other marine debris is caught in the mooring lines and poses a risk to marine mammals transiting through. The potential for secondary entanglement has been scoped in and will be assessed further in the EIA.

696. During operation, periodic inspections, as part of the asset integrity campaign, will include visual surveys and identification of debris and gear entangled to the WFDAs infrastructure**.** This will provide further understanding on the potential for the debris and ghost fishing gears to be caught in the WFDA infrastructure, increasing the risk for marine mammal entanglement. Note this is in the early stages of development and will be further refined during the EIA process. The impact assessment for entanglement will be based on a qualitative assessment of the latest research and data on entanglement of marine mammals.

8.6.1.2.3 Vessel Interaction (Collision Risk)

697. As outlined for construction, the increased risk of collision with marine mammals will be given further consideration in the EIA. It is anticipated that the impacts associated with vessel activities at any one time during operation and maintenance would be less than those during the construction phase, due to the lower number of vessels, although vessels would be in the area periodically for the full lifetime of the Broadshore Hub WFDAs which may pose a greater risk over time.

698. The increased risk of collision with marine mammals during operation has been scoped in and will be assessed in the EIA, taking into account the most recent and robust research, guidance and information available.

699. The operation and maintenance port(s) to be used for the Broadshore Hub WFDAs will not be known until post-consent. Vessel movements to and from any port will be incorporated within existing vessel routes where possible, however, there is an increased risk for any vessel interaction within the Broadshore Hub WFDAs as well as during transit to and from site.

700. The same assessment methodology as outlined in **Section 8.6.1.1.2** will be undertaken.

8.6.1.2.4 Disturbance at Seal Haul-Out Sites

701. As outlined for construction (**Section 8.6.1.1.3**), depending on the vessel routes, there is the potential for disturbance at seal haul-out sites. It is anticipated that the impacts associated with vessel activities at any one time during operation and maintenance would be less than those during the construction phase, and the magnitude of impact (number of vessels) is likely to be lower and spatial extent may vary according to the ports(s) used.

702. There is no potential for any direct disturbance as a result of activities within the Broadshore Hub WFDAs, due to the distance to the nearest known seal haul-out sites. However, depending on the location of the operation and maintenance port(s) and potential transit routes for vessels there is the potential for associated disturbance.

703. The potential for any disturbance of seals at or from seal haul-out sites during operation has been scoped in and will be assessed in the EIA, taking into account the most recent and robust research, guidance and information available.

8.6.1.2.5 Impacts of EMF

704. Many marine organisms have evolved sensory abilities to use electric and magnetic cues in essential aspects of life history, such as prey detection, predatory behaviour, and navigation and these behaviours may be impacted by EMF emissions in the water column (Hutchison et al., 2020).

705. Subsea electrical cabling produces EMFs which have the potential to effect marine mammals both directly and indirectly through prey interaction pathways - in particular for non-buried IACs (either dynamic IACs at the water column, or static IACs on the seabed). A detailed Cable Burial Risk Assessment will be prepared where IACs are buried to confirm the extent to which cable burial can be achieved.

706. Studies indicate that magnetic fields decrease rapidly with vertical and horizontal distance from subsea cables, and that the reduction is greater the deeper cables are buried (Normandeau et al., 2011).

707. Although it is assumed that marine mammals are capable of detecting small differences in magnetic field strength, this is unproven and is based on circumstantial information. There is also, at present, no evidence to suggest that existing subsea cables influence cetacean movements, and there are no regulatory thresholds or guidelines that define acceptable levels of EMF emissions into the marine environment (Copping et al., 2020).

708. Harbour porpoise are known to move in and out of the Baltic Sea, over several buried subsea HVDC cables in the Skagerrak and western Baltic Sea with no apparent effect to their migratory movements. There is also no evidence to suggest that seal species respond to EMF (Gill et al., 2005

709. As a precautionary approach the potential for EMF to impact on marine mammal and their prey species is scoped in for further assessment in the EIA. The impact assessment will be based on a desk-based review of the potential effects of EMF, and the estimated EMF emissions for the Broadshore Hub WFDAs.

8.6.1.2.6 Changes to Prey Resource

710. **Chapter 7: Fish and Shellfish Ecology** outlines the potential impacts on fish species and therefore the prey resource for marine mammals during operation and maintenance.

711. The potential for any changes to the prey resource for marine mammals during operation and maintenance has been scoped in and will be assessed further in the EIA. Impacts will be based on the assessments in the fish and shellfish ecology chapter of the Broadshore Hub WFDAs EIA Report.

712. The proposed approach for the assessment of changes to prey resources during operation and maintenance will be the same as for construction (as outlined in **Section 8.6.1.1.4**). Key research papers to be used to inform this assessment could include the Physics-to-Ecosystem Level Assessment of Impacts of Offshore Windfarms Project as part of the Offshore Wind Evidence & Change Programme (if available); one aim of which is to study the predator-prey interactions within operational wind farms.

8.6.1.3 Decommissioning

713. During decommissioning the potential impacts are anticipated to be similar to those for the construction phase, depending on the methods used.

714. Potential impacts on marine mammals associated with the decommissioning stage(s) will be assessed, based on the potential impacts associated with construction; however, a further assessment will be carried out ahead of any decommissioning works to be undertaken taking account of known information at that time, including all relevant guidelines and requirements.

715. The potential impacts during decommissioning of the Broadshore Hub WFDAs that will be assessed for marine mammals are:

- Underwater noise impacts:
  - Resulting from the noise associated with substructure and SKS removal (e.g. cutting); and
  - Due to presence of vessels.
- Collision risk with vessels;
- Disturbance at seal haul-out sites; and
- Changes to prey availability.

716. The proposed approach for the assessment of potential impacts during decommissioning will follow the same proposed methodology outlined for similar activities during construction (as outlined in **Section 8.6.1.1**).

8.6.2 Potential Impacts Scoped Out

8.6.2.1 Construction

717. Prior to the operation and maintenance phase, there is limited pathway of effect for underwater noise from operational WTGs and fixed bottom substructures and FOUs, entanglement (both direct and secondary), and impacts of EMF. While there exists the potential for these impacts to affect marine mammals during construction, these impacts will increase incrementally as the Broadshore Hub WFDAs is constructed and commissioned with the greatest potential impacts resulting from the completed Broadshore Hub WFDAs. These impacts are therefore scoped out from further consideration in relation to the construction and decommissioning phases to avoid double counting but is assessed under operation and maintenance (see **Section 8.6.1.2**).

718. With regard to changes to water quality, the increases in suspended sediments and for the accidental release of contamination during construction has the potential to impact marine mammals, and their prey. The potential for water quality changes will be determined in the marine geology, oceanography and physical processes chapter of the Broadshore Hub WFDAs EIA Report, including the best practice and management measures that would be put in place. Any changes to water quality would be localised and short lived, and the potential for any impacts from changes in water quality on marine mammals is not expected to be significant. Potential impacts on marine mammals related to changes in water quality during construction are therefore scoped out from assessment in the EIA.

8.6.2.2 Operation and Maintenance

719. No UXO clearance, piling or other substructure installation options will be required during the operation and maintenance phase, and therefore, there is no pathway of effect. The key potential construction impacts of underwater noise during UXO clearance and piling are not considered be relevant to the operation and maintenance phases, therefore they have been scoped out of the assessment for operation of the Broadshore Hub WFDAs. The potential for direct entanglement is

considered to be very low risk, given the design of the mooring lines and dynamic cables. Therefore, the potential for direct entanglement has been scoped out.

720. Potential impacts to marine mammals related to changes in water quality during operation are scoped out for assessment. As with construction, any changes to water quality would be localised and short lived and best practice and management measures would be put in place.

8.6.2.3 Decommissioning

721. No UXO clearance, piling or other substructure installation options will be required during the decommissioning phase, and therefore, there is no pathway for effect for underwater noise. Similarly, at decommissioning, there will be no pathway of effect for underwater noise from operational WTGs as turbines will not be operational. At decommissioning, dynamic cables/cables in the water column will be removed, removing the pathway of effect for entanglement (both direct and secondary) and impacts of EMF. Therefore, these impacts are scoped out from further assessment for the decommissioning phase.

722. Potential impacts to marine mammals related to changes in water quality during decommissioning are scoped out for assessment. As with construction, any changes to water quality would be localised and short lived and best practice and management measures would be put in place.

8.6.3 Potential Cumulative Effects

723. The CEA will identify where the predicted effects of the construction, operation and maintenance and decommissioning of the Broadshore Hub could interact with effects from different plans or projects within the same region, and have the potential for generate a cumulative effect on marine mammals.

724. The effects of the Broadshore Hub WFDAs will firstly be considered cumulatively with all other aspects of the Broadshore Hub (i.e., the WFDAs, the OfTDAs and the OnTDAs of the three projects). Secondly, the effects of the whole Broadshore Hub will be assessed cumulatively with other plans and projects. Please see **Chapter 4: Approach to Scoping and Environmental Impact Assessment** for full details.

725. The potential cumulative effects that will be assessed further in the Broadshore Hub WFDAs EIA are those that are assessed as having a minor adverse significance or higher, and the key impacts to be considered are expected to be:

- Underwater noise;
- Vessel interaction; and
- Entanglement.

8.6.4 Potential Transboundary Effects

726. There is a significant level of marine development being undertaken or planned by EU Member States and others (i.e. Norway, Denmark, Germany, Belgium and the Netherlands) in the North Sea. Populations of marine mammals are highly mobile and there is potential for transboundary effects, especially when considering noise effects. Transboundary effects are scoped into the EIA.

727. Transboundary effects will be assessed, where possible, in consultation with developers and other stakeholders in other countries to obtain up to date project information to feed into the assessment.

728. Transboundary effects will be assessed, as with the other cumulative effects, for the relevant cetacean MUs. For seal species, the potential for connectivity with other countries will be based on existing tagging studies for each species, and will include a review of tagging studies undertaken in the UK as well in European countries. The potential for transboundary effects will be addressed by considering the reference populations and potential linkages to international designated sites as identified through telemetry studies for seals and ranges and movements of cetacean species.

729. The assessment of the effect on the integrity of the transboundary European sites as a result of effects on the designated marine mammal populations will be undertaken and presented in the information for the Habitats Regulations Appraisal (HRA).

8.6.5 Summary of Potential Marine Mammals Impacts Scoped In or Out

730. **Table 8.5** presents a summary of the impacts to be scoped in and out for each phase of the Broadshore Hub WFDAs.

Table 8.5: Summary of Potential Impacts Scoped In (✓) or Out (x) for Marine Mammals

Potential Impact	Receptor(s)	Description of Potential Effect	Scoped In or Out? (✓ or x)			Embedded Mitigation Measures
			Construction	Operation and Maintenance	Decommissioning	
Underwater noise during UXO clearance	All marine mammal species	The potential effects of underwater explosions on marine mammals include: (1) physical injury from direct or indirect blast wave effect of the high amplitude shock waves and sound wave produced by underwater detonation, which could result in immediate or eventual mortality; (2) auditory impairment (from exposure to the acoustic wave), resulting in a permanent hearing loss ; or (3) behavioural change, such as disturbance to feeding, mating, breeding, and resting.	✓	x	x	UXO mitigation hierarchy
Underwater noise during geophysical surveys	All marine mammal species	Underwater noise can cause both physiological (e.g. lethal, physical injury and PTS) and behavioural (e.g. disturbance, behavioural response impacts on marine mammals.	✓	✓	x	N/A
Underwater noise during piling	All marine mammal species	Underwater noise can cause both physiological (e.g. lethal, physical injury and PTS) and behavioural (e.g. disturbance, behavioural response impacts on marine mammals.	✓	x	x	MMMP for piling
Underwater noise during other substructure installation activities (other than impact piling)	All marine mammal species	Underwater noise can cause both physiological (e.g. lethal, physical injury and PTS) and behavioural (e.g. disturbance, behavioural response impacts on marine mammals.	✓	x	x	None expected to be required.

Potential Impact	Receptor(s)	Description of Potential Effect	Scoped In or Out? (✓ or x)			Embedded Mitigation Measures
			Construction	Operation and Maintenance	Decommissioning	
Underwater noise from other activities (for example rock placement and IAC laying)	All marine mammal species	Underwater noise can cause both physiological (e.g. lethal, physical injury and PTS) and behavioural (e.g. disturbance, behavioural response) impacts on marine mammals.	✓	✓	✓	None expected to be required.
Underwater noise and presence of vessels	All marine mammal species	Underwater noise can cause both physiological (e.g. lethal, physical injury and PTS) and behavioural (e.g. disturbance, behavioural response) impacts on marine mammals.	✓	✓	✓	Vessel best practice measures
Underwater noise from operational WTGs and floating turbine substructure moorings on the seabed	All marine mammal species	Underwater noise can cause both physiological (e.g. lethal, physical injury and PTS) and behavioural (e.g. disturbance, behavioural response) impacts on marine mammals.	X	✓	x	None expected to be required.
Direct entanglement	All marine mammal species	The potential for direct entanglement is considered to be very low risk, given the design of the mooring lines and dynamic cables.	X	X	X	N/A
Secondary entanglement	All marine mammal species	Risk to marine mammals due to secondary entanglement (where fishing gear is caught in floating structures and mooring lines or dynamic cables, and marine mammals become entangled in that fishing gear).	X	✓	x	N/A
Collision risk with vessels	All marine mammal species	Increased vessel collision risk due to increased presence of vessels.	✓	✓	✓	Vessel best practice measures

Potential Impact	Receptor(s)	Description of Potential Effect	Scoped In or Out? (✓ or x)			Embedded Mitigation Measures
			Construction	Operation and Maintenance	Decommissioning	
Disturbance at seal haul-out sites	Grey seal and harbour seal	Increased activity near seal haul-out sites as a result of transiting vessels could have the potential to disturb seals. Potential for disturbance from vessels transiting to and from the Broadshore Hub WFDAs only.	✓	✓	✓	Vessel best practice measures
EMF – direct effects on marine mammals	All marine mammal species	IACs may cause impacts to marine mammals through the emission of EMF into the environment.	X	✓	x	None expected to be required.
Changes in water quality	All marine mammal species	Accidental release of contaminants, increased suspended sediment, or mobilisation of sediment contaminants if contained in those sediments could have potential to impact on marine mammals directly or indirectly through effects on prey.	X	x	x	EMP and MPCP
Changes to prey availability	All marine mammal species	Potential impacts on fish could affect prey availability for marine mammals. Potential pathways of impact include physical disturbance and temporary loss of seabed habitat; increased suspended sediment concentrations and sediment re-deposition; changes in water quality and underwater noise.	✓	✓	✓	None expected to be required.

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8.7 Proposed Approach to Impact Assessment

731. The impact assessment for marine mammals will follow the approach set out in **Chapter 4: Approach to Scoping and Environmental Impact Assessment**. The sections below set out further details around the approach to impact assessments specific to marine mammals.

732. **Appendix 5: Approach to Marine Mammals and Underwater Noise** sets out the proposed approach to assessment for disturbance from underwater noise.

733. Within the marine mammals chapter of the Broadshore Hub WFDAs EIA Report, the overall impact assessment for the Broadshore Hub WFDAs will be presented first. Following this, a summary of each WFDA will be given (i.e. the Broadshore WFDA, the Sinclair WFDA and the Scaraben WFDA).

8.7.1 Data to be used in Impact Assessments

734. The key baseline data sources to be utilised in the assessments would be the density estimate for each species and the reference population for each species (see **Table 8.3** for summary of data sources). See **Appendix 4: Marine Mammals Existing Environment** for the initial review of density data sources and reference populations.

735. Following the full baseline review and the full site-specific aerial data being available, all density estimates would be collated, and as a precautionary approach, the worst-case (highest) estimate for each species would be used to inform the assessment, so it’s therefore a precautionary approach.

736. The density and reference population estimates currently available are provided in each species section, as well as a summary of the proposed data to be used in the impact assessments. This is indicative only, as a full baseline review is yet to be undertaken, and the site-specific aerial surveys are not yet complete.

8.7.2 Sensitivity

737. The sensitivity of a receptor is determined through its ability to accommodate change and on its ability to recover if it is affected. The sensitivity level of marine mammals to each type of effect is justified within the effect assessment and is dependent on the following factors:

- Adaptability – The degree to which a receptor can avoid or adapt to an effect;
- Tolerance – The ability of a receptor to accommodate temporary or permanent change without a significant adverse effect;
- Recoverability – The temporal scale over and extent to which a receptor will recover following an effect; and
- Value – A measure of the receptor importance, rarity and worth (as outlined below).

738. Definitions of sensitivity levels for marine mammals will follow those set out in **Table 4.2** in **Chapter 4: Approach to Scoping and Environmental Impact Assessment**.

8.7.3 Ecological Value

739. The 'value' of the receptor forms an important element within the marine mammals assessment, for instance, if the receptor is a protected species, or habitat, or has an economic value. It is important to understand that high value and high sensitivity are not necessarily linked within a particular effect. A receptor could be of high value but have a low or negligible physical/ecological sensitivity to an effect. Similarly, low value does not equate to low sensitivity and is judged on a receptor by receptor basis.

740. In the case of marine mammals, most species are protected by a number of international commitments as well as European and UK law and policy. All cetaceans in UK waters are EPS and, therefore, are internationally important. Harbour porpoise, bottlenose dolphin, grey seal and harbour seals are also afforded international protection through the designation of Natura 2000 sites. As such, all species of marine mammal can be considered to be of high value. The value will be considered, where relevant, as a modifier for the sensitivity assigned to the receptor, based on expert judgement. The definitions of value will follow those set out in **Table 4.3** in **Chapter 4: Approach to Scoping and Environmental Impact Assessment**.

8.7.4 Magnitude

741. The thresholds for defining the potential magnitude of impact that could occur from a particular effect will be determined using expert judgement, current scientific understanding of marine mammal population biology, and JNCC et al. (2010) guidance on disturbance to EPS species. The JNCC et al. (2010) EPS guidance suggests definitions for a 'significant group' of individuals or proportion of the population for EPS species. As such this guidance has been considered in defining the thresholds for magnitude of impacts (**Table 8.6**).

742. The JNCC et al., (2010) guidance provides some indication on how many animals may be removed from a population without causing detrimental effects to the population at Favourable Conservation Status (FCS). The JNCC et al., (2010) guidance also provides limited consideration of temporary effects, with guidance reflecting consideration of permanent displacement.

743. Temporary effects are considered to be of medium magnitude at greater than 5% of the reference population. JNCC et al., (2010) guidance considered 4% as the maximum potential growth rate in harbour porpoise, and the 'default' rate for cetaceans. Therefore, beyond natural mortality, up to 4% of the population could theoretically be permanently removed before population growth could be halted. In assigning 5% to a temporary effect in this assessment, consideration is given to uncertainty of the individual consequences of temporary disturbance.

744. Permanent effects with a greater than 1% of the reference population being affected within a single year will be considered to be high in magnitude in this assessment. This is based on ASCOBANS and Defra advice (Defra, 2003; ASCOBANS, 2015) relating to effects from fisheries by-catch (i.e. a permanent effect) on harbour porpoise. A threshold of 1.7% of the relevant harbour porpoise population above which a population decline is inevitable has been agreed with Parties to ASCOBANS, with an intermediate precautionary objective of reducing the effect to less than 1% of the population (Defra, 2003; ASCOBANS, 2015).

745. For population modelling there are currently no specific potential biological removal limits in place, therefore there are currently no specific thresholds to determine whether a population level effect would be significant in EIA terms. See **Appendix 5: Approach to Marine Mammals and Underwater Noise** for the proposed approach and further information on how the potential for significant population level effects has been defined for the Broadshore Hub WFDAs.

Table 8.6: Definitions of Levels of Magnitude for Marine Mammals

Magnitude	Definition
High	Permanent irreversible change to exposed receptors or feature(s) of the habitat which are of particular importance to the receptor. Assessment indicates that more than 1% of the reference population are anticipated to be exposed to the effect. OR Long-term effect for 10 years or more, but not permanent (e.g. limited to operational phase of the projects). Assessment indicates that more than 5% of the reference population are anticipated to be exposed to the effect. OR Temporary effect (e.g. limited to the construction phase of development) to the exposed receptors or feature(s) of the habitat which are of particular importance to the receptor. Assessment indicates that more than 10% of the reference population are anticipated to be exposed to the effect.
Medium	Permanent irreversible change to exposed receptors or feature(s) of the habitat of particular importance to the receptor. Assessment indicates that between 0.01% and 1% of the reference population anticipated to be exposed to effect. OR Long-term effect for 10 years or more, but not permanent (e.g. limited to operational phase of the projects). Assessment indicates that between 1% and 5% of the reference population are anticipated to be exposed to the effect. OR Temporary effect (e.g. limited to the construction phase of development) to the exposed receptors or feature(s) of the habitat which are of particular importance to the receptor. Assessment indicates that between 5% and 10% of the reference population anticipated to be exposed to effect.

Magnitude	Definition
Low	Permanent irreversible change to exposed receptors or feature(s) of the habitat of particular importance to the receptor. Assessment indicates that between 0.001% and 0.01% of the reference population anticipated to be exposed to effect. OR Long-term effect for 10 years or more, but not permanent (e.g. limited to operational phase of the projects). Assessment indicates that between 0.01% and 1% of the reference population are anticipated to be exposed to the effect. OR Intermittent and temporary effect (e.g. limited to the construction phase of development) to the exposed receptors or feature(s) of the habitat which are of particular importance to the receptor. Assessment indicates that between 1% and 5% of the reference population anticipated to be exposed to effect.
Negligible	Permanent irreversible change to exposed receptors or feature(s) of the habitat of particular importance to the receptor. Assessment indicates that less than 0.001% of the reference population anticipated to be exposed to effect. OR Long-term effect for 10 years or more (but not permanent, e.g. limited to lifetime of the projects). Assessment indicates that less than 0.01% of the reference population are anticipated to be exposed to the effect. OR Intermittent and temporary effect (limited to the construction phase of development or project timeframe) to the exposed receptors or feature(s) of the habitat which are of particular importance to the receptor. Assessment indicates that less than 1% of the reference population anticipated to be exposed to effect.

8.7.5 Assessment of Significance

746. The definitions of effect significance to be used for the marine mammals impact assessment are provided in **Table 8.7**.

Table 8.7: Effect Significance Definitions

Significance	Definition
Major	Very large or large change in receptor, either adverse or beneficial, which are important at a population (national or international) level because they contribute to achieving national or regional objectives, or, expected to result in exceedance of statutory objectives and/or breaches of legislation.
Moderate	Intermediate or large change in receptor, which may to be important considerations at national or regional population level. Potential to result in exceedance of statutory objectives and/or breaches of legislation.

Significance	Definition
Minor	Small change in receptor, which may be raised as local issues but are unlikely to be important at a regional population level.
Negligible	No discernible change in receptor.

8.7.6 Approach to CEA

8.7.6.1 Screening Area

747. The CEA screening areas for marine mammals are based on their respective MUs, as discussed in **Section 1.5** in **Appendix 4.** For the marine mammal species considered through Broadshore Hub WFDAs Scoping Report, the following MUs will be used as the CEA screening area:

- Harbour porpoise within the NS MU;
- Bottlenose dolphin within the GNS and Coastal East Scotland MUs;
- White-beaked dolphin and minke whale within the CGNS MU:
  - Note that, due to the large size of this MU, projects and plans will be considered only if they are located within the NS MU or GNS area, in order to provide a more realistic while still precautionary list of projects that may have an impact on the same population as the Broadshore Hub WFDAs; and
  - If Atlantic white-sided dolphin, common dolphin, Risso's dolphin, killer whale and/or long-finned pilot whale are scoped in for further assessment, this same CEA screening area will be used.
- Grey seal and harbour seal within the Coastal East Scotland, NCO, and MF MUs.

8.7.6.2 Screening for CEA

748. The methodology set out in **Chapter 4: Approach to Scoping and Environmental Impact Assessment** will be followed with respect to the CEA for marine mammals.

749. The plans and projects that will be considered in the CEA are those that are:

- Located in the relevant marine mammal MUs (as described in **Section 8.4.1**); and
- If there is the potential for cumulative impacts during the construction, operational or decommissioning of the proposed project.

750. The marine mammal CEA will consider projects, plans and activities which have sufficient information available to undertake the assessment, in line with the approach set out in **Chapter 4: Approach to Scoping and Environmental Impact Assessment**.

752. With the final list of projects that will be used for the CEA assessment, project specific data will be collected from EIA Report and HRA , such as:

- Densities of marine mammals used;
- Impact ranges used for assessments;
- The number of individuals expected to be disturbed from the projects as well as the Broadshore Hub WFDAs; and
- The number of individuals expected to be at risk of PTS prior to mitigation, and the number at risk of vessel collision.

753. For the potential for disturbance from piling, the data collected from other projects and the assessments for the Broadshore Hub WFDAs will be totalled for the assessment, and the magnitude of impact (and potential for significance) will be determined based on the methods as set out in **Sections 8.7.1** to **8.7.5** (e.g. more than 5% of the population disturbed is significant). For any species where the magnitude is medium or high for significant disturbance, population modelling using either Interim Population Consequences of Disturbance (iPCoD) will be undertaken, as set out in **Section 3.3** in **Appendix 5.**

754. Where project specific data is not available, a generalised approach would be used to determine the number of marine mammals potentially at risk of disturbance. This will be based on wider density estimates (e.g. SCANS-IV (Gilles et al*.,* 2023)) for cetaceans, and Carter et al., (2022) for seal species. Generalised disturbance ranges (such as the reported 25 km potential disturbance range for seals (Russell *et al.,* 2016)) will be used to determine the number of individuals at risk of disturbance.

8.9 Scoping Questions to Consultees

755. The following questions are posed to consultees to help them frame and focus their response to the marine mammals scoping exercise, which will in turn inform the Scoping Opinion:

- Do agree with the proposed data sources? Are there any further data sources to be aware of?
- Do you agree with the marine mammal species to be scoped in, the reference populations, and the densities to be used for assessments, as presented in **Table 8.3**?
- Do you agree with the impacts to be scoped in during construction?
- Do you agree with the impacts to be scoped in during operation?
- Do you agree with the impacts to scoped in during decommissioning?
- Do you agree with the approach to underwater noise modelling, and the thresholds to be used?
- Do you agree with the proposed approaches to assess the potential for disturbance due to underwater noise?
- Do you agree with the approach to cumulative assessments, and the use of population modelling?
- Do you have any other matters or information sources that you wish to present?

8.10 References

6 Alpha Associates (2023). UXO Threat and Risk Assessment for the Broadshore WFDA.

Arso Civil, M., Quick, N., Mews, S., Hague, E., Cheney, B. J., Thompson, P. M., & Hammond, P. S. (2021). Improving understanding of bottlenose dolphin movements along the east coast of Scotland. Final report. Report number SMRUC-VAT-2020-10 provided to European Offshore Wind Deployment Centre (EOWDC).

ASCOBANS (2015). Recommendations of ASCOBANS on the Requirements of Legislation to Address Monitoring and Mitigation of Small Cetacean Bycatch. October 2015.

Benhemma-Le Gall, A., Graham, I.M., Merchant, N.D. and Thompson, P.M. (2021). Broad-Scale Responses of Harbor Porpoises to Pile-Driving and Vessel Activities During Offshore Windfarm Construction. Front. Mar. Sci. 8:664724. Doi: 10.3389/fmars.2021.664724

BlueFloat | Renantis Partnership, (2024). Broadshore Hub Wind Farm Development Areas Habitats Regulations Screening Report.

Department for Business, Energy and Industrial Strategy (BEIS), Marine Management Organisation (MMO), JNCC, Natural England, the Offshore Petroleum Regulator for Environment and Decommissioning (OPRED), the Department of Agriculture, Environment and Rural Affairs (DAERA), NatureScot, Marine Scotland, and Natural Resources Wales. (2021). Marine environment: unexploded ordnance clearance joint interim position statement. Available from:

https://www.gov.uk/government/publications/marine-environment-unexploded-ordnance-clearance-joint-interim-position-statement/marine-environment-unexploded-ordnance-clearance-joint-interim-position-statement.

Benjamins, S., Harnois, V., Smith, H.C.M., Johanning, L., Greenhill, L., Carter, C. and Wilson, B. (2014). Understanding the potential for marine megafauna entanglement risk from marine renewable energy developments. Report number: 791. Available at: https://marine.gov.scot/data/snh-commissioned-report-791-understanding-potential-marine-megafauna-entanglement-risk

Carter, M.I.D., Boehme, L., Cronin, M.A., Duck, C.D., Grecian, W.J., Hastie, G.D., Jessopp, M., Matthiopoulos, J., McConnell, B.J., Miller, D.L., Morris, C.D., Moss, S.E.W., Thompson, D., Thompson, P.M. and Russell, D.J.F. (2022). Sympatric Seals, Satellite Tracking and Protected Areas: Habitat-Based Distribution Estimates for Conservation and Management. Front. Mar. Sci. 9:875869.

Copping, A.E, Freeman, M.C. and Overhus, D.M. (2020). Risk retirement for environmental effects of marine renewable energy. US Department of Energy, Pacific Northwest National Laboratory.

Department for Environment, Food and Rural Affairs (Defra) (2003). UK small cetacean bycatch response strategy. Department for Environment, Food and Rural Affairs. March 2003.

Fernandez-Betelu O, Graham IM and Thompson PM (2022) Reef effect of offshore structures on the occurrence and foraging activity of harbour porpoises. Front. Mar. Sci. 9:980388. Doi: 10.3389/fmars.2022.980388.

Gill, A.B., Gloyne-Phillips, I., Neal, K.J. and Kimber, J.A. (2005). The potential effects of electromagnetic fields generated by sub-sea power cables associated with offshore windfarm developments on electrically and magnetically sensitive marine organisms – a review. COWRIE 1.5 Electromagnetic Fields.

Gilles, A., Authier, M., Ramirez-Martinez, N.C., Araújo, H., Blanchard, A., Carlström, J., Eira, C., Dorémus, G., FernándezMaldonado, 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., 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. 64 pp. https://tinyurl.com/3ynt6swa

Godin, O. A. (2008). Sound transmission through water–air interfaces: New insights into an old problem. Contemporary Physics, 49(2), 105-123.

Graham, I.M., Farcas, A., Merchant, N.D., Thompson, P. (2017). Beatrice Offshore Wind Farm: An interim estimate of the probability of porpoise displacement at different unweighted single-pulse sound exposure levels. Prepared by the University of Aberdeen for Beatrice Offshore Windfarm Ltd. 5

Hutchison, Z.L., LaFrance Bartley, M., Degraer, S., English. P., Khan, A., Livermore, J., Rumes, B., King, J.W. (2020). Offshore wind energy and benthic habitat changes: Lessons from Block Island Wind Farm, USA. Oceanography, 33:58-69.

IAMMWG. (2023). Review of Management Unit boundaries for cetaceans in UK waters (2023). JNCC Report 734, JNCC, Peterborough, ISSN 0963-8091. https://hub.jncc.gov.uk/assets/b48b8332-349f-4358-b080-b4506384f4f7

Isaacman, L. and Daborn, G. (2011). Pathways of Effects for Offshore Renewable Energy in Canada. Report to Fisheries and Oceans Canada. Acadia Centre for Estuarine Research (ACER) Publication No. 102, Acadia University, Wolfville, NS, Canada. 70 pp.JNCC, DAERA, and NE (2020) Guidance for assessing the significance of noise disturbance against Conservation Objectives of harbour porpoise SACs. Available from: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/889842/SACNoiseGuidanceJune2020.pdf

JNCC (2010a). JNCC guidelines for minimising the risk of injury to marine mammals from using explosives. Available at: https://data.jncc.gov.uk/data/24cc180d-4030-49dd-8977-a04ebe0d7aca/JNCC-Guidelines-Explosives-Guidelines-201008-Web.pdf

JNCC (2010b). Statutory nature conservation agency protocol for minimising the risk of injury to marine mammals from piling noise. Available at: https://hub.jncc.gov.uk/assets/31662b6a-19ed-4918-9fab-8fbcff752046

JNCC (2017). JNCC guidelines for minimising the risk of injury to marine mammals from geophysical surveys. Available at: https://data.jncc.gov.uk/data/e2a46de5-43d4-43f0-b296-c62134397ce4/jncc-guidelines-seismicsurvey-aug2017-web.pdf

JNCC (2023). DRAFT guidelines for minimising the risk of injury to marine mammals from unexploded ordnance clearance in the marine environment. Available at: https://jncc.gov.uk/media/8419/draft-marine-mammal-guidelines-unexploded-ordnance.pdf

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

Kastelein, R. A., Gransier, R., Marijt, M. A. T., and Hoek, L. (2015). "Hearing frequency thresholds of harbor porpoises (*Phocoena phocoena*) temporarily affected by played back offshore pile driving sounds," J. Acoust. Soc. Am. 137, 556–564.

Kastelein, R.A., Helder-Hoek, L., Covi, J. and Gransier, R. (2016). Pile driving playback sounds and temporary threshold shift in harbour porpoises (*Phocoena phocoena*): Effect of exposure duration. J. Acoustic. Soc. Am. 139 (5): 2842-2851.

Ketten, D.R. (2004). Experimental measures of blast and acoustic trauma in marine mammals (ONR Final Report N000149711030).

Madsen, P.T., Wahlberg, M., Tougaard, J., Lucke, K. and Tyack, A.P., (2006). Wind turbine underwater noise and marine mammals: implications of current knowledge and data needs. Marine ecology progress series, 309, pp.279-295.

Malme, C.I., Miles, P.R., Miller, G.W., Richardson, W.J., Roseneau, D.G., Thomson, D.H. and Greene, C.R. (1989). Analysis and ranking of the acoustic disturbance potential of petroleum industry activities and other sources of noise in the environment of marine mammals in Alaska. Final Report No. 6945 to the US Minerals Management Service, Anchorage, AK. BBN Systems and Technologies Corp. Available at: <http://www.mms.gov>.

Marine Scotland (2020). Guidance for Scottish Inshore Waters for the protection of Marine European Protected Species from injury and disturbance. https://www.gov.scot/binaries/content/documents/govscot/publications/advice-and-guidance/2020/07/marine-european-protected-species-protection-from-injury-and-disturbance/documents/marine-european-protected-species-guidance-july-2020/marine-european-protected-species-guidance-july-2020/govscot%3Adocument/EPS%2Bguidance%2BJuly%2B2020.pdf

McConnell, B., Lonergan, M. and Dietz, R. (2012). Interactions between seals and offshore wind farms. The Crown Estate. ISBN: 978-1-906410-34-5.

Moray East Ltd, (2012). Environmental Statement Technical Appendix 4.4 A Marine Mammals Baseline. Available at: https://www.morayeast.com/application/files/8015/8014/0685/Appendix-4-4-A-Marine-Mammals-Baseline.pdf

Nedwell, J.R, Parvin, S.J., Edwards, B., Workman, R., Brooker, A.G and Kynoch J.E. (2007). Measurement and interpretation of underwater noise during construction and operation of offshore windfarms in UK waters. Report for COWRIE by Subacoustech.

Normandeau, Exponent, T. Tricas, and A. Gill. (2011). Effects of EMFs from Undersea Power Cables on Elasmobranchs and Other Marine Species. U.S. Dept. of the Interior, Bureau of Ocean Energy Management, Regulation, and Enforcement, Pacific OCS Region, Camarillo, CA. OCS Study BOEMRE 2011-09.

North Atlantic Marine Mammal Commission. (2020). Estimates of Cetacean Abundance in the North Atlantic of Relevance to NAMMCO. NAMMCO Scientific Publications 11. https://doi.org/10.7557/3.5732

OSPAR (2009). Overview of the impacts of anthropogenic underwater sound in the marine environment. London: OSPAR Commission Biodiversity Series. Publication no. 441/2009. 133 pp.

Pangerc, T., Theobald, P., Wang, L., Robinson, Stephen., and Lepper, P. (2016). Measurement and characterisation of radiated underwater sound from a 3.6 mw monopile wind turbine. The Journal of the Acoustical Society of America, 140(4):2913– 2922, 2016. doi: 10.1121/1.4964824. URL https://doi.org/10.1121/1.4964824.

Parvin, S.J., Nedwell, J.R. and Workman, R. (2006). Underwater noise impact modelling in support of the London Array, Greater Gabbard and Thanet offshore wind farm developments. Report to CORE Ltd by Subacoustech, report ref: 710R0517.

Pike, D. G., Gunnlaugsson, T., Desportes, G., Mikkelsen, B., Víkingsson, G., & Bloch, D. (2019). Estimates of the relative abundance of long-finned pilot whales (*Globicephala melas*) in the

Northeast Atlantic from 1987 to 2015 indicate no long-term trends. NAMMCO Scientific Publications, 11.

Pirotta, E., Merchant, N.D., Thompson, P.M., Barton, T.R. and Lusseau, D., 2015. Quantifying the effect of boat disturbance on bottlenose dolphin foraging activity. Biological Conservation, 181, pp.82-89.

Richardson, J., Greene, C.R., Malme, C.I. and Thomson, D.H. (1995). Marine Mammals and Noise. San Diego California: Academic Press.

Risch, D., Favill, G., Marmo, B., vanGeel, N., Benjamins, S., Thompson, P, Wittich, A., & Wilson, B. (2023). Characterisation of underwater operational noise of two types of floating offshore wind turbines. Available at https://supergen-ore.net/uploads/resources/Fortune_Report_Final.pdf

Robinson S. P., Theobald P.D. and Lepper P. A., (2012). UW208. Underwater noise generated from marine piling. ECUA 2012 11th European Conference on Underwater Acoustics. Session UW: Underwater Acoustics.

Russell, D.J.F., Hastie, G.D., Thompson, D., Janik, V.M., Hammond, P.S., Scott-Hayward, L.A.S., Matthiopoulos, J., Jones, E.L. and McConnell, B.J. (2016). Avoidance of wind farms by harbour seals is limited to pile driving activities. Journal of Applied Ecology: doi: 10.1111/1365-2664.12678.

Russell, D.J.F. and McConnell, B.J. (2014). Seal at-sea distribution, movements and behaviour. Report to DECC. URN: 14D/085. March 2014 (final revision).

Scheidat, M., Tougaard, J., Brasseur, S., Carstensen, J., van Polanen Petel, T., Teilmann, J., and Reijnders, P. (2011). Harbour porpoise (*Phocoena phocoena*) and wind farms: a case study in the Dutch North Sea. Environ. Res. Lett. 6 (April-June 2011) 025102.

Schoeman RP, Patterson-Abrolat C and Plön S (2020) A Global Review of Vessel Collisions With Marine Animals. Front. Mar. Sci. 7:292. doi: 10.3389/fmars.2020.00292.

Scottish Government (2018). Marine Scotland Consenting and Licensing Guidance for Offshore Wind, Wave and Tidal Energy Applications. Available at: https://www.gov.scot/binaries/content/documents/govscot/publications/consultation-paper/2018/10/marine-scotland-consenting-licensing-manual-offshore-wind-wave-tidal-energy-applications/documents/00542001-pdf/00542001-pdf/govscot%3Adocument/00542001.pdf

Scottish Government (2015). Scotland's National Marine Plan: A Single Framework for Managing Our Seas. Available at: https://www.gov.scot/binaries/content/documents/govscot/publications/strategy-plan/2015/03/scotlands-national-marine-plan/documents/00475466-pdf/00475466-pdf/govscot%3Adocument/00475466.pdf

Scottish Government (2014). Scottish Planning Policy. Available at: https://www.gov.scot/binaries/content/documents/govscot/publications/advice-and-guidance/2014/06/scottish-planning-policy/documents/scottish-planning-policy/scottish-planning-policy/govscot%3Adocument/scottish-planning-policy.pdf

Scottish National Heritage (SNH) (2016). Assessing collision risk between underwater turbines and marine wildlife. SNH guidance note.

SNH (2017). The Scottish Marine Wildlife Watching Code. Available from: https://www.nature.scot/sites/default/files/2017-06/Publication%202017%20-%20The%20Scottish%20Marine%20Wildlife%20Watching%20Code%20SMWWC%20-%20Part%201%20-%20April%202017%20%28A2263518%29.pdf

Stöber, U. and Thomsen, F., 2019. Effect of impact pile driving noise on marine mammals: A comparison of different noise exposure criteria. The Journal of the Acoustical Society of America, 145(5), pp.3252-3259.

Southall, B.L., (2021). Evolutions in marine mammal noise exposure criteria. Acoust. Today, 17(2).

Southall, B.L., Nowacek, D.P., Bowles, A.E., Senigaglia, V., Bejder, L. and Tyack, P.L. (2021). Marine Mammal Noise Exposure Criteria: Assessing the Severity of Marine Mammal Behavioural Responses to Human Noise. Aquatic Mammals, 47(5), 421-464.

Southall, B.L., Finneran, J.J., Reichmuth, C., Nachtigall, P.E., Ketten, D.R., Bowles, A.E., Ellison, W.T., Nowacek, D.P. and Tyack, P.L., (2019). Marine mammal noise exposure criteria: updated scientific recommendations for residual hearing effects. Aquatic Mammals, 45(2), pp.125-232.

Sparling, C.E., Coram, A.J., McConnell, B., Thompson, D., Hawkins, K.R. and Northridge S.P. (2013). Paper Three: Mammals. Wave & Tidal Consenting Position Paper Series.

Special Committee on Seals (SCOS) (2022) Scientific Advice on Matters Related to the Management of Seal Populations: 2022 Natural Environment Research Council Special Committee on Seals (SCOS). http://www.smru.st-andrews.ac.uk/files/2023/09/SCOS-2022.pdf

Thomsen, F., Lüdemann, K., Kafemann, R. and Piper, W. (2006). Effects of offshore windfarm noise on marine mammals and fish, on behalf of COWRIE Ltd.

Tougaard, J., Henriksen, O.D. and Miller, L.A., 2009. Underwater noise from three types of offshore wind turbines: Estimation of impact zones for harbor porpoises and harbor seals. The Journal of the Acoustical Society of America, 125(6), pp.3766-3773.

Tougaard, J., Hermannsen, L. and Madsen, P.T. (2020). How loud is the underwater noise from operating offshore wind turbines?. The Journal of the Acoustical Society of America, 148(5), pp.2885-2893.;

Tougaard, J., Carstensen, J., Wisch, M.S., Teilmann, J., Bech, N., Skov, H. and Henriksen, O.D. (2005). Harbour porpoises on Horns reef—effects of the Horns Reef Wind farm. Annual Status Report 2004 to Elsam. NERI, Roskilde (Also available at: www.hornsrev.dk).

von Benda-Beckmann, A.M., Aarts, G., Özkan Sertlek, H., Lucke, K., Verboom W.C., Kastelein, R.A., Ketten, D.R., van Bemmelen, R., Lam, F,A., Kirkwood, R.J. and Ainslie, M.A. (2015). Assessing the Impact of Underwater Clearance of Unexploded Ordnance on Harbour Porpoises (*Phocoena phocoena*) in the Southern North Sea. Aquatic Mammals 2015, 41(4), 503-523.

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., (2019). Distribution maps of cetacean and seabird populations in the North-East Atlantic. Journal of Applied Ecology, 57(2), pp.253-269.

Whyte, K. F., Russell, D. J., Sparling, C. E., Binnerts, B., and Hastie, G. D. (2020). Estimating the effects of pile driving sounds on seals: Pitfalls and possibilities. The Journal of the Acoustical Society of America, 147(6), 3948-3958.

Wilson, B. Batty, R. S., Daunt, F. and Carter, C. (2007). Collision risks between marine renewable energy devices and mammals, fish and diving birds. Report to the Scottish Executive. Scottish Association for Marine Science, Oban, Scotland, PA37 1QA.

9 Offshore Ornithology

9.1 Introduction

756. This chapter considers the scope of potential impacts of the construction, operation and maintenance, and decommissioning phases of the Broadshore Hub Wind Farm Development Areas (WFDAs) on offshore ornithology. This chapter provides an overview of the existing environment and sets out the proposed methodology and approach to assessing effects on offshore ornithology in the Broadshore Hub WFDAs Environmental Impact Assessment (EIA) Report.

757. This chapter has been prepared by Royal HaskoningDHV.

758. Offshore ornithology is a key potential constraint for Offshore Wind Farms (OWFs) due to the potential for collisions with operating turbines, displacement of seabirds from offshore waters (which, for example, may be important for foraging) and barrier effects to migration and commuting routes. While individual developments may have relatively small predicted effects, as more OWFs are taken forward, the cumulative impacts of multiple projects may have the potential to lead to population-level effects on seabirds.

759. The offshore ornithology assessment will consider potential impacts on seabirds and other bird (migratory) species from the Broadshore Hub WFDAs. This will be informed by analysis of site-specific survey data and detailed understanding of the seasonal distribution and movements of seabirds and migratory birds in the Moray Firth and North Sea. Consideration will be given to the potential impacts on seabirds and migratory bird species in the context of their regional populations, as well as to the potential for connectivity and potential impact of the Broadshore Hub WFDAs to statutory designated nature conservation sites which have birds listed as qualifying features, including Special Protection Areas (SPAs), proposed SPAs (pSPAs) and Ramsar sites.

760. The offshore ornithology assessment should be read in conjunction with the following chapters of the Broadshore Hub WFDAs EIA Report:

- **Chapter 5: Marine Geology, Oceanography and Physical Processes;**
- **Chapter 6: Benthic Ecology;** and
- **Chapter 7: Fish and Shellfish Ecology.**

761. The offshore ornithology assessment is likely to have key inter-relationships with the above receptors, which will be considered appropriately where relevant in the Broadshore Hub WFDAs EIA Report.

9.2 Legislation, Policy and Guidance

762. **Table 9.1** sets out the legislation, policy and guidance which have been considered in the preparation of this chapter and will be considered within the Broadshore Hub WFDAs EIA Report assessment where appropriate. The overarching policy and legislation relevant to the Broadshore Hub WFDAs is described in **Chapter 2: Policy and Legislative Context**.

Table 9.1: Summary of Relevant Legislation and Guidance for Offshore Ornithology

Relevant Legislation, Policy or Guidance	Relevance to the Assessment
Legislation	
The Conservation of Habitats and Species Regulations 2017	Known as the 'Habitats Regulations', this legislation transposes Council Directive 92/43/EEC (the Habitats Directive) and the European Directive (2009/147/EC) on the conservation of wild birds (The Birds Directive) into UK law. The Habitats Regulations provides for the designation and protection of 'European Sites', including Special Protection Areas (SPAs) for birds listed under Annex I of the Birds Directive. The Habitats Regulations convey a statutory requirement for local planning authorities to undertake a 'Habitats Regulations Appraisal' (HRA) of the potential impacts of plans and projects, including development proposals, on European Sites. The UK has no direct obligations under the Habitats Directive following the UK's exit from the EU, however, The Conservation (Natural Habitats, &c.) (EU Exit) (Scotland) (Amendment) Regulations 2019 (effective from 1st January 2021) provides that Scotland has legal obligations to continue to maintain the standards required by the EU Habitats and Wild Birds Directives, subject to minor changes.
Ramsar sites	Under Scottish Government policy, Ramsar sites are also protected under the same statutory regimes as SPAs, although there is no need to consider Ramsar sites separately if they overlap with SPAs. Ramsar sites are wetlands of international importance designated under the Ramsar Convention (adopted in 1971 and came into force in 1975), providing a framework for the conservation and wise use of wetlands and their resources.
The Wildlife and Countryside Act 1981	This legislation provides for the legal protection of all wild birds in Great Britain, special protection measures for Schedule 1 bird species during the breeding season, and also for the protection of Sites of Special Scientific Interest (SSSIs).
Guidance	
Chartered Institute of Ecology and Environmental Management (CIEEM) (2018) Guidance for Ecological Impact Assessment (EcIA) in the UK and Ireland – Terrestrial, Freshwater, Coastal and Marine.	Standard good practice guidance for ecological evaluation and assessment for proposed developments in terrestrial, freshwater, marine and coastal environments.

Relevant Legislation, Policy or Guidance	Relevance to the Assessment
Joint Nature Conservation Committee (JNCC) (2017) Joint Statutory Nature Conservation Bodies (SNCB) Interim Displacement Advice Note.	Guidance on how to present assessment information on the extent and potential consequences of seabird displacement from offshore wind developments
JNCC (2014) Joint SNCB Response to the Marine Scotland Science Avoidance Rate Review	Recommended Collision Risk Modelling (CRM) avoidance rates from the Marine Scotland Science (MSS) avoidance rate report.
NatureScot Guidance Notes to support Offshore Wind Applications: Marine Ornithology (with those available at the time of writing being NatureScot 2023a – 2023k) *The Cumulative Effects Framework (CEF) will be adopted when published.*	Core resource to inform offshore wind development proposals in Scotland. Includes guidance notes on collision risk modelling, displacement assessment, apportioning and Population Viability Analysis

9.3 Consultation

763. A Scoping Workshop for the Broadshore Hub WFDAs was held on the 13th September 2023 with Marine Directorate - Licensing Operation Team (MD-LOT) and NatureScot, and included discussion on offshore ornithology. The discussion aimed to agree the relevance, appropriateness and sufficiency of baseline data, key issues for inclusion in the Broadshore Hub WFDAs EIA Report, and the impact assessment and cumulative effects approach. **Table 9.2** sets out consultation from this workshop.

Table 9.2: Consultation Relevant to Offshore Ornithology

Consultee	Date/Document	Comment	How Comment is Addressed
NatureScot and MD-LOT [MS-LOT at the time]	February to March 2022, consultation on Method Statements for offshore aerial surveys	Advise was given on the focal species and alignment of survey approaches with those for adjacent lease option awards to facilitate future CEA.	Comments from NatureScot and MD-LOT have been considered in the scope of work for the offshore aerial survey. The methodology adopted is described in **Section 9.4.1.**
NatureScot, MD-LOT and Marine Directorate Science Evidence Data Digital (MD-SEDD)	13th September 2023, Scoping Workshop	NatureScot sought clarity on overlapping Broadshore WFDA aerial survey area, the Sinclair WFDA and Scaraben WFDA aerial survey area (i.e. where the respective WFDA buffers overlap).	**Figure 9.1** in **Appendix 1** shows individual WFDAs: the Broadshore WFDA aerial survey area, and the Sinclair and Scaraben WFDAs aerial survey area.
		NatureScot commented they were content with the survey data presented and that it was helpful to gain an overview of the baseline at this point.	Summary data of bird abundances from the first year of baseline surveys are presented in **Section 9.4.5**.
		NatureScot advised that no species should be screened out of the EIA and Habitats Regulations Appraisal (HRA) based on a single year of data. The Applicants queried whether it would be acceptable to screen out species based on the first year of survey data and state that this is 'subject to a second year of survey'. This would ensure that if the patterns/findings in the second year of survey are (as expected) consistent with the first year, then the text and assessment within the EIA and HRA are valid and can be promptly finalised. This minimises the risk of extensive revisions being required as a result of the second year data. NatureScot indicated this will be considered further to ensure consistency with their previous advice to other projects but ideally species should be taken forward for consideration on a precautionary basis, with the results of	Species proposed for consideration in the EIA and HRA assessment are described in **Section 9.4**. Further species may be included depending on the results of the second year of surveys. Further consideration and explanation of this approach has been given within the **Broadshore Hub WFDAs HRA Screening Report** (BlueFloat | Renantis Partnership, 2024) with screening out of any species that are scarce or absent in the first year of baseline survey data only undertaken where the available evidence on wider distribution and ecology supports this.

Consultee	Date/Document	Comment	How Comment is Addressed
		the second year to determine how far forward the species is taken in the EIA and HRA assessment.	
		The Applicants queried the need for model-based density estimation, advising that this approach may not make a meaningful difference compared with design-based density estimation. NatureScot advised the use of MRSea (for model-based density estimation) to ensure consistency and comparability with other wind farm projects and has set out circumstances in their guidance which could justify not using it.	The proposed approach to density estimation is outlined in **Section 9.7.1**.
		The Applicants requested that NatureScot confirm their current advice regarding avoidance rates. NatureScot advised that an update to existing guidance is due around November 2023.	The proposed approach to collision risk assessment and consideration of avoidance rates is outlined in **Section 9.7.6.**
		The Applicants requested an update on the Cumulative Effects Framework (CEF). MD-SEDD were unable to give a specific timeframe for its release.	The proposed approach to assessing cumulative effects is outlined in **Section 9.6.3.**
		NatureScot indicated that guidance on breeding season apportioning is imminent although the expectation is that this will not be a significant departure from the NatureScot advice given to the Berwick Bank Offshore Wind Farm during the RoadMap process for that project (SSE Renewables, 2022).	The proposed approach to apportioning is outlined in **Section 9.7.4** (with attention given to the potential limitations that could now exist with the MD Apportioning Tool).

Consultee	Date/Document	Comment	How Comment is Addressed
		NatureScot indicated that principles on how to account for Highly Pathogenic Avian Influenza (HPAI) in assessments will be produced but were unable to give a specific timeframe for release. In the absence of specific guidance, any commentary/context regarding HPAI provided in the EIA and HRA will be considered key by NatureScot.	The proposed approach to considering HPAI in the assessment is outlined in **Section 9.7.8**.
		NatureScot advised that the updated Sectoral Marine Plan for Offshore Wind will be released between the **Broadshore Hub WFDAs HRA Screening Report** submission and the EIA/HRA Report submissions, and NatureScot will work with the Applicants to help minimise the amount of extra work required when the second year of survey data is available.	The **Broadshore Hub WFDAs HRA Screening Report** sets out the proposed approach to HRA screening.
		NatureScot acknowledged the Applicant's commentary that the data presented on the densities and abundance of the key seabird species in the offshore aerial survey area from the first year of surveys included dead birds in the sample, which should have been omitted before the density/abundance estimates were derived. The dead birds (which are assumed to result largely or entirely from HPAI) accounted for ca.10% of the number of records in some cases.	The density and abundance estimates affected by the inclusion of dead birds are to be re-calculated for EIA/HRA with dead birds omitted.

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9.4 Existing Environment

764. This section provides a summary of general baseline characteristics of seabirds in the vicinity of the Broadshore Hub WFDAs during their respective breeding and non-breeding periods (the periods as defined by NatureScot (2020)). For the purposes of this scoping exercise, the baseline has been informed by available data from the Broadshore Hub WFDAs' year one aerial survey programme (i.e. for the period between March 2022 and February 2023 inclusive) (as detailed in **Section 9.4.1** below) and the locations and qualifying features of nearby terrestrial and marine SPAs. Due to the availability of only a single year of data from the two-year aerial survey programme, this is not intended to be a comprehensive review of the baseline conditions of the offshore aerial survey area. Instead, this information should be viewed as a broad-level summary of the survey findings to date, which aids the process of identifying the likely key issues for the Broadshore Hub WFDAs in relation to offshore ornithology. The baseline conditions of the offshore aerial survey area presented within the Broadshore Hub WFDAs EIA Report and Broadshore Hub WFDAs RIAA will be based on two years of aerial survey data.

765. The Broadshore Hub WFDAs lie within the North Sea. The North Sea is important for seabirds throughout the year, providing foraging grounds for seabirds breeding in adjoining coastal areas during the breeding season, from colonies further afield in the non-breeding season, and for sub-adult birds throughout the year. Overall, at least 20 seabird species breed on coastal areas around the North Sea (International Council for the Exploration of the Sea (ICES), 2021). Coastal areas of the Moray Firth form an integral unit that is important for populations of wintering and passage wildfowl (BirdLife International, 2023). This is reflected by multiple terrestrial and marine SPA designations, the largest of which is Moray Firth SPA (NatureScot, 2020). In addition, at their closest point the Broadshore Hub WFDAs lie approximately 47 km north of Fraserburgh, with the wider Aberdeenshire coastline supporting a number of internationally important breeding and non-breeding sites for seabird species, some of which will occur within the Broadshore Hub WFDAs.

766. Baseline data collected from the offshore aerial survey area during the first year of surveys are summarised below for the breeding and non-breeding seasons.

9.4.1 Study Areas

9.4.1.1 Offshore Regional Study Area

767. The offshore regional study area is defined by the area within which breeding and non-breeding seabirds could be impacted by the Broadshore Hub WFDAs. The summarised survey data are presented separately for each of the Broadshore WFDA aerial survey area and the Sinclair and Scaraben WFDAs aerial survey area and, given the overlap between these two areas (**Figure 9.1** in **Appendix 1I**), the summed abundances for each species will exceed the overall abundance within the offshore aerial survey area.

768. During the breeding season, many seabird species have large foraging ranges which can in some cases extend several hundred kilometres from their colonies. Therefore, some seabird colonies may have connectivity with the Broadshore Hub WFDAs despite being located a significant distance away. Screening of European designated sites with qualifying seabird colonies (SPAs, pSPAs and Ramsar sites) for potential connectivity to the Broadshore Hub WFDAs has been undertaken and is detailed within the **Broadshore Hub WFDAs HRA Screening Report**. Published foraging ranges were obtained from Woodward et al. (2019), in accordance with NatureScot guidance (2023c), to determine the offshore regional study area for breeding seabirds. These will be used in both the project-alone EIA and cumulative assessments to identify SPA populations and other seabird breeding colonies whose foraging ranges may overlap with the Broadshore Hub WFDAs.

769. Outside the breeding season, seabirds are not constrained by colony location and can range widely within UK seas and beyond, depending on the species involved. For seabirds from SPA colonies during the non-breeding season, Furness (2015) has been used to determine which colonies have connectivity to the Broadshore Hub WFDAs using Biologically Defined Minimum Population Scales (BDMPS), as advised by NatureScot (2023d) (e.g. see the **Broadshore Hub WFDAs HRA Screening Report** for those colony populations associated with SPAs). The exceptions to this are guillemot and herring gull, which are considered to remain in the broad vicinity of breeding colonies during the non-breeding season (Buckingham et al., 2022; Wernham et al., 2002) and therefore the offshore regional study areas for these species are considered to be the same as for the breeding season (Woodward et al., 2019).

9.4.1.2 Offshore Aerial Survey Area

770. The ‘offshore aerial survey area’ comprises collectively the:

- Broadshore WFDA aerial survey area, being the Broadshore WFDA (134 km^2) plus a 4 km buffer, totalling 367 km^2; and
- Sinclair and Scaraben WFDAs aerial survey area (being a preliminary area defined prior to the Sinclair and Scaraben WFDA boundaries being further refined as part of the INTOG seabed lease application process[35]) (141 km^2) plus a 4 km buffer, totalling 396 km^2.

771. For the purposes of this Broadshore Hub WFDAs Scoping Report, baseline data from the offshore aerial survey area are presented separately for the Broadshore WFDA aerial survey area and Sinclair and Scaraben WFDAs aerial survey area (**Figure 9.1** in **Appendix 1**).

772. Aerial surveys commenced in March 2022 and will be completed in February 2024, with a single survey carried out in each calendar month (i.e. a total of 24 monthly surveys encompassing two full breeding periods and two full non-breeding periods). The offshore aerial surveys comprise 14 transects spaced 2 km apart, providing approximately 12.5% coverage of the Broadshore Hub WFDAs and buffers. Both the Broadshore WFDA aerial survey area, and the Sinclair and Scaraben WFDAs aerial survey area have been surveyed together, as a single survey, each month during the first year of surveys, and this approach will continue for the second year (assuming suitable

[35] Whilst the Sinclair and Scaraben WFDA boundaries were subsequently refined, the Sinclair and Scaraben WFDAs aerial survey area was maintained for completeness.

environmental conditions). The complete dataset will be used to characterise the baseline in the Broadshore Hub WFDAs EIA Report and inform the likely offshore ornithology assessment pathways (including collision risk, displacement and barrier effects, habitat loss and indirect effects on prey), as identified in the recently published series of NatureScot guidance notes on undertaking ornithological assessment for offshore windfarms[36].

773. The four km buffer is an appropriate size to provide a robust ornithological baseline for the assessment, and is predicted to encompass areas in and beyond which construction, operation and maintenance, and decommissioning effects are expected to occur for key bird species recorded during the offshore aerial surveys. Species which are known to be subject to displacement and barrier effects over distances greater than four km, most notably red-throated diver *Gavia stellata,* have not been recorded during the offshore aerial surveys so far and would not be expected to occur in significant numbers during the remaining surveys on the basis of known habitat-associations (e.g. red-throated divers are strongly associated with shallow, inshore, waters (O'Brien et al., 2008; Furness, 2015)).

774. The proposed offshore export cable corridor beyond the four km buffer is not included in the offshore aerial survey area and will be considered in a separate scoping report (the Broadshore Hub Offshore Transmission Development Areas (OfTDAs) Scoping Report).

9.4.2 Data and Information Sources

775. **Table 9.3** sets out the information and data sources which have been considered in the preparation of this chapter and will be considered within the Broadshore Hub WFDAs EIA Report assessment where appropriate.

Table 9.3: Summary of Key Data and Information Sources for the Offshore Ornithology Assessment

Dataset	Year(s)	Description
British Trust for Ornithology (BTO) Seabird Monitoring Programme (https://app.bto.org/seabirds/public/index.jsp)	2023	Breeding seabird colony numbers and breeding success rates.
Defra MAGIC website (https://magic.defra.gov.uk/magicmap)	2023	Locations of statutory designated sites (SPAs, SSSIs, Ramsar sites).
Furness (2015) Non-breeding season populations of seabirds in UK waters: Population sizes for BDMPS	2015	Key information source for biogeographic population estimates for non-breeding seabirds in UK waters.
Garthe, S. and Hüppop, O. 2004. Scaling Possible Adverse Effects of Marine Wind Farms on Seabirds: Developing and Applying a Vulnerability Index	2004	Used to inform likely vulnerability of species to different potential effects of offshore wind farms, including susceptibility to disturbance and provision of nocturnal activity factor scores for use in the sCRM.

[36] Available at: https://www.nature.scot/professional-advice/planning-and-development/planning-and-development-advice/renewable-energy/marine-renewables/advice-marine-renewables-development

Dataset	Year(s)	Description
Furness, R. W., Wade, H. M., and Masden, E. A. (2013). Assessing vulnerability of marine bird populations to offshore wind farms. Journal of Environmental Management, 119, 56-66	2013	Used to inform likely vulnerability of species to different potential effects of offshore wind farms, including susceptibility to disturbance and provision of nocturnal activity factor scores for use in the sCRM.
Horswill and Robinson (2015) Review of Seabird Demographic Rates and Density Dependence	2015	Provides survival and productivity rates for assessment of impacts on seabird populations.
Johnston et al., (2014a) Modelling flight heights of marine birds to more accurately assess collision risk with offshore wind turbines Johnston, A., Cook, A.S.C.P., Wright, L.J., Humphreys, E.M. and Burton, N.H.K. (2014b) Corrigendum. Journal of Applied Ecology, 51, doi: 10.1111/1365-2664.12260	2014	Recommended reference for generic seabird flight heights within the sCRM tool.
MacGregor et al., (2018) A Stochastic Collision Risk Model for Seabirds in Flight	2018	Recommended model for undertaking CRM.
NatureScot SiteLink (https://sitelink.nature.scot/home)	2023	Information on SPAs and other designated sites in Scotland.
NatureScot. (2018). Interim Guidance on apportioning impacts from marine renewable developments to breeding seabird populations in SPAs https://www.nature.scot/doc/interim-guidance-apportioning-impacts-marine-renewable-developments-breeding-seabird-populations	2018	Estimation of apportioning of breeding season impacts to SPA colony populations for seabird species. To be used on some species at least.
NatureScot (2020) Guidance Note 9: Guidance to support Offshore Wind Applications: Seasonal periods for Birds in the Scottish Marine Environment	2020	Recommended seasonal periods when waterfowl and seabird species should be considered in relation to offshore wind developments.
NatureScot (2023a) Guidance Note 1: Guidance to support Offshore Wind Applications: Marine Ornithology - Overview	2023	Overview of NatureScot guidance to inform assessment of offshore wind development proposals on marine ornithology in Scotland.
NatureScot (2023a) Guidance Note 2: Guidance to support Offshore Wind Applications: Advice for Marine Ornithology Baseline Characterisation Surveys and Reporting	2023	Guidance on expectations for the collection, analysis and presentation of data, and baseline reporting.
NatureScot (2023c) Guidance Note 3: Guidance to support Offshore Wind Applications: Marine Birds – Identifying theoretical connectivity with breeding site Special Protection Areas using breeding season foraging ranges	2023	Recommended matrices and reference sources for determining theoretical connectivity with breeding seabird European designated sites.

Dataset	Year(s)	Description
NatureScot (2023d). Guidance Note 4: Guidance to Support Offshore Wind Applications: Ornithology – Determining Connectivity of Marine Birds with Marine Special Protection Areas and Breeding Seabirds from Colony SPAs in the Non-Breeding Season.	2023	Guidance for determining theoretical connectivity with European designated sites during the non-breeding season for wintering waterfowl and seabirds.
NatureScot (2023e). Guidance Note 5: Guidance to support Offshore Wind Applications: Recommendations for marine bird population estimates	2023	Advice for estimating marine bird populations at breeding colonies and marine SPAs.
NatureScot (2023f). Guidance Note 6: Guidance to support Offshore Wind Applications – Marine Ornithology Impact Pathways for Offshore Wind Developments	2023	Key impact pathways that should be considered as part of the EIA and HRA of offshore wind development proposals.
NatureScot (2023g). Guidance Note 7: Guidance to support Offshore Wind Applications: Marine Ornithology – Advice for assessing collision risk of marine birds	2023	Recommended approach to CRM including advised biological parameters, avoidance rates and presentation of results.
NatureScot (2023h). Guidance Note 8: Guidance to support Offshore Wind Applications: Marine Ornithology Advice for assessing the distributional responses, displacement and barrier effects of Marine birds	2023	Guidance on assessing displacement and barrier effects on seabirds, recommended species and approaches.
NatureScot (2023k). Guidance Note 11: Guidance to support Offshore Wind Applications: Marine Ornithology – Recommendations for Seabird Population Viability Analysis (PVA)	2023	Advice on thresholds for undertaking PVA, recommended time periods and parameters, and metrics to be presented in EIA and HRA.
Ozsanlav-Harris et al., (2022). Review of data used to calculate avoidance rates for collision risk modelling of seabirds	2022	Review and re-calculation of seabird avoidance rates recommended by Cook (2021).
Searle, et al., (2018). Finding out the fate of displaced birds. Scottish Marine and Freshwater Science. 9(8): 149	2018	User guide for SeabORD, a tool to help estimate the cost to individual seabirds due to displacement and barrier effects from offshore wind developments.
Searle et al., (2019). A Population Viability Analysis Modelling Tool for Seabird Species	2019	Recommended tool to model potential effects of collision and displacement mortality on populations of key seabird species from relevant breeding colonies.
SNCBs (2022). Joint SNCB Interim Displacement Advice Note. https://data.jncc.gov.uk/data/9aecb87c-80c5-4cfb-9102-39f0228dcc9a/joint-sncb-interim-displacement-advice-note-2022.pdf	2022	Advice on use of matrix approach in predicting displacement effects on seabird species from offshore wind farms during the operational period.
Woodward et al., (2019). Desk-based revision of seabird foraging ranges used for HRA screening	2019	Key reference for representative foraging range statistics for seabirds around breeding colonies.

Dataset	Year(s)	Description
Wildfowl and Wetlands Trust (WWT) (2014). Strategic Assessment of Collision Risk of Scottish Offshore Wind Farms to Migrating Birds	2014	Standard reference for migratory bird collision risk assessments.
EIA and HRA assessments and post-consent monitoring reports and data pertaining to the existing Moray Firth Wind Farms (e.g. Trinder 2023 and documents at Moray Firth Regional Advisory Group (MFRAG) | Marine Scotland Information)	Various	Seabird populations, predicted wind farm impacts and monitoring of seabird responses to operational wind farms within the Moray Firth region.

9.4.3 Breeding Season

776. Baseline data collected from the offshore aerial survey area during the first year of surveys indicate that, overall, the most abundant species during months associated with their respective breeding periods (as defined by NatureScot, 2020) are, in descending order of abundance:

- Guillemot *Uria aalge*;
- Black-legged kittiwake *Rissa tridactyla* (hereafter 'kittiwake');
- Northern fulmar (hereafter 'fulmar');
- Atlantic puffin *Fratercula arctica* (hereafter 'puffin');
- Gannet *Morus bassanus*; and
- Razorbill *Alca torda*.

777. Each of the above species were recorded in all, or all but one, months of their defined breeding season, with similar patterns of abundance recorded in both the Broadshore WFDA and the Sinclair and Scaraben WFDAs aerial survey area (see **Table 9.4** and **Table 9.5**).

778. Of the three auk species (i.e. guillemot, razorbill and puffin), guillemot was the most abundant during the breeding season and was present throughout the offshore aerial survey area, with the highest abundance occurring during August (coincident with likely post-breeding dispersal) and slightly greater overall abundance in the Sinclair and Scaraben WFDAs aerial survey area (**Table 9.4** and **Table 9.5**; HiDef, 2023a,b). The relatively high abundance during August may indicate that the offshore aerial survey area is used as a moult site during post-breeding dispersal when birds are flightless, although few adult-chick pairs were recorded compared to the total number of individuals observed (HiDef, 2023a,b) suggesting the offshore aerial survey area may also be frequented by sabbatical birds or failed breeders.

779. Puffin was not recorded during the April survey but was otherwise present throughout the breeding season and widespread across the offshore aerial survey area, with greater abundance in the Broadshore WFDA aerial survey area. The highest numbers of puffin were recorded during the May 2022 survey; this coincides with the species' egg-hatching window and may suggests birds are utilising the offshore aerial survey area to forage during the chick-rearing period (HiDef, 2023a,b).

780. Razorbill was the least abundant of the auk species but was still widely distributed, with a slightly greater abundance in the Broadshore WFDA aerial survey area. There was an absence of razorbill observations in May, which is coincident with the egg-laying period when birds may be more constrained to breeding colonies. The highest razorbill abundance was recorded during July, when a large proportion of birds were recorded sitting on the water; this corresponds to the post-breeding flightless period when birds are no longer associated with colonies. It also suggests the offshore aerial survey area is used by razorbills to raft and forage (HiDef, 2023a,b).

781. Kittiwake was the second most abundant species overall, after guillemot, in both the Broadshore WFDA and Sinclair and Scaraben WFDAs aerial survey areas, with similar abundance in both of these areas. The high abundance of kittiwake (relative to other species) during the breeding season was attributable in large part to the marked peak in the number of records occurring during the June survey, for which the estimated densities were approximately five to 10 times higher than in other survey months at both the Broadshore WFDA and Sinclair and Scaraben WFDAs aerial survey areas. The reasons for this marked peak are unknown but could be due to utilisation of the offshore aerial survey area for foraging by birds during the chick-rearing phase (HiDef 2023a,b), or conceivably it could be a consequence of early colony desertion due to high breeding failure rates, possibly caused by HPAI.

782. Gannet was widespread throughout the offshore aerial survey area during the breeding season, with greater abundance in the Sinclair and Scaraben WFDAs aerial survey area, although gannet abundance was consistently low during the early breeding season months within the Broadshore WFDA aerial survey area during the species' post-breeding migration period (October), and in the Sinclair and Scaraben WFDAs aerial survey area during the return migration period (December).

783. Fulmar was also widespread throughout the offshore aerial survey area during the breeding season with greater abundance recorded in the Sinclair and Scaraben WFDAs aerial survey area. Relatively high numbers were recorded during July, which is coincident with the chick-rearing phase (HiDef, 2023a,b); another peak in abundance was noted in November within the Broadshore WFDA aerial survey area, during the species' non-breeding period.

784. The relatively high abundance of auks, kittiwake, fulmar, and gannet (compared to other species) during the breeding season within the offshore aerial survey area is consistent with the presence of internationally important breeding seabird colonies around the Moray Firth and the Caithness and Aberdeenshire Coasts which support these species, including Troup, Pennan and Lion's Heads SPA (Scottish Natural Heritage (SNH), 2009a), Buchan Ness to Collieston Coast SPA (SNH, 2009b), and East Caithness Cliffs SPA (SNH, 2017) (with the location of these SPAs shown in **Figure 9.2** in **Appendix 1**).

785. Modelled at-sea utilisation distributions for SPA populations during the late incubation and chick-rearing periods, as based on GPS tracking data, show that for kittiwake, the south-western extent of the offshore aerial survey area borders areas predicted to be relatively heavily used by foraging kittiwake, as defined by the top 5% of the Getis-Ord hotspot analyses (Cleasby et al., 2018; 2020). However, the actual Broadshore Hub WFDAs lie outside this core area, whilst the entire offshore aerial survey area is also outside the area defined by the top 1% of the Getis-Ord hotspot analyses. Visual inspection of these modelled at-sea distributions suggests that the main overlap of the offshore aerial survey area with the core kittiwake foraging areas is most likely to relate to birds from the Troup, Pennan and Lion's Head SPA and, to a lesser extent, from the Buchan Ness to Collieston Coast SPA (Cleasby et al., 2018; 2020). Thus, it seems likely that a proportion of kittiwakes in the offshore aerial survey area during the late incubation/chick-rearing period are likely to breeding adults, including birds from Troup, Pennan and Lion's Heads SPA (**Figure 9.2** in **Appendix 1**).

786. Modelled at-sea utilisation distributions for guillemot and razorbill show the offshore aerial survey area falls outside of the core hotspot areas of these species during the late incubation/chick-rearing period, although it is within (or adjacent to in the case of guillemot) the further extents of the predicted foraging ranges, as defined by the Maximum-Curvature (Cleasby et al., 2018; 2020). Compared with kittiwake, the modelled utilisation distributions show that guillemot and razorbill favour areas closer to the coast during the late incubation and chick-rearing periods; this is consistent with their published foraging ranges being smaller than for kittiwake (Woodward et al., 2019). This suggests that waters closer to the coast will hold higher densities of breeding adults of these species, whilst a higher proportion of individuals recorded within the offshore aerial survey area may be non-breeding birds. The modelled distributions also support the likelihood that the marked August peak in guillemot abundance in the offshore aerial survey area is associated with post-breeding dispersal, as opposed to foraging adults which are still attending the colony.

787. Based on published generic and site-specific foraging ranges for gannet (Woodward et al., 2019; NatureScot, 2023c), which indicate that gannets may often commute distances of several hundred kilometres between the breeding colony and foraging areas, the offshore aerial survey area lies within the distance regularly travelled by foraging adult gannets from a number of UK breeding colonies, including Troup, Pennan and Lion's Heads SPA (which contains Scotland's largest mainland gannet colony, although the SPA is not designated for this species) and Forth Islands SPA (i.e. the Bass Rock colony) (see the **Broadshore Hub WFDAs HRA Screening Report**). Many gannets recorded within the offshore aerial survey area during the breeding season are likely to be breeding adults from Troup, Pennan and Lion's Heads SPA, given its relative proximity, in conjunction with the tendency of gannets from different colonies to occupy relatively exclusive foraging ranges (Wakefield et al., 2013). Tracking data from Forth Islands SPA suggest that the offshore aerial survey area is on the periphery of the main foraging areas of gannets from this colony (Lane et al., 2020).

788. Fulmar has one of the largest distances regularly travelled from breeding colonies of all UK seabirds (with the mean maximum foraging range (+ 1 Standard Deviation (SD)) being 542 km (+ 658) - Woodward et al., 2019) and the offshore aerial survey area falls within the foraging range of a significant proportion of fulmar breeding colonies in the UK and Ireland (see the **Broadshore Hub WFDAs HRA Screening Report**). Based on the foraging range of puffin (Woodward et al., 2019), the offshore aerial survey area falls within the distance regularly travelled from puffin breeding colonies on the north and east coasts of Scotland. The nearest colony is at Troup, Pennan

and Lion's Heads SPA, 50.6 km to the south, although numbers at this colony are small (and puffin is not a qualifying feature of this SPA). The closest SPA for which puffin is a qualifying feature is the North Caithness Cliffs SPA, located 75.8 km to the north-west of the Broadshore Hub WFDAs.

789. Other species recorded occasionally or in small numbers (monthly counts of 20 or fewer) within the offshore aerial survey area during their respective breeding seasons (as defined by NatureScot, 2020) were, in descending order of abundance:

- Arctic tern *Sterna paradisaea;*
- Common tern *Sterna hirundo;*
- European storm-petrel *Hydrobates pelagicus;*
- Herring gull *Larus argentatus*;
- Great black-backed gull *Larus marinus;*
- Little gull *Hydrocoloeus minutus;*
- Arctic skua *Stercorarius parasiticus;*
- Great skua *Stercorarius skua;* and
- Manx shearwater *Puffinus puffinus.*

790. Arctic tern and common tern were recorded during August only; the timing of these records and published mean maximum (+1 SD) foraging range of these species (Woodward et al., 2019; NatureScot, 2023c) indicates that these were likely birds on passage rather than breeding adult birds on a foraging trip or 'in-transit' from a colony. Individual Arctic skua, Manx shearwater and great skua were recorded in May, July and August respectively. The offshore aerial survey area falls within the breeding season foraging ranges for both great skua and Manx shearwater from a number of colonies (Woodward et al., 2019; NatureScot 2023c; see also the **Broadshore Hub WFDAs HRA Screening Report**), the timing and rarity of the records suggests that these were also birds on passage rather than breeding adult birds from a colony. This is consistent with evidence from other studies indicating that breeding adults of these species are unlikely to occur within the offshore aerial survey area during the breeding season (Waggitt et al., 2019; Dean et al., 2015). Other gull species recorded may have originated from breeding colonies but were recorded occasionally (less than 10 records) and at low densities across the offshore aerial survey area.

9.4.4 Non-breeding Season

791. Baseline data collected from the offshore aerial survey area during the first year of surveys indicate that, overall, the most abundant species during months associated with their respective non-breeding seasons were, in descending order of abundance:

- Guillemot;
- Fulmar;
- Herring gull;
- Gannet;

- Kittiwake;
- Puffin;
- Great black-backed gull; and
- Razorbill.

792. As for the breeding season, guillemot was the most abundant species within the offshore aerial survey area during the non-breeding season. It was more than twice as abundant in the Sinclair and Scaraben WFDAs aerial survey area than the Broadshore WFDA aerial survey area, and was present in greatest numbers (during the non-breeding season) in September, with numbers declining to lower levels typical of the rest of the non-breeding season by October (in the Broadshore WFDA aerial survey area) and November (in the Sinclair and Scaraben WFDAs aerial survey area) (**Table 9.4** and **Table 9.5**; HiDef 2023a,b). Razorbill and puffin were significantly less abundant than guillemot and did not occur in all months; puffin was relatively evenly distributed across the offshore aerial survey area whereas the majority of razorbill records came from the Sinclair and Scaraben WFDAs aerial survey area.

793. Higher numbers of large gulls were recorded compared with the breeding season, with herring gull the most abundant of these species, particularly in the Sinclair and Scaraben WFDAs aerial survey area. Conversely, kittiwake (although recorded in all survey months) was present in significantly lower numbers compared with the breeding season, with slightly higher abundance in the Sinclair and Scaraben WFDAs aerial survey area (**Table 9.5**). In addition to the gull species listed above, small numbers of common gull *Larus canus* and lesser black-backed gull *Larus fuscus* were recorded. Common gull was present in very low densities in September, November and December 2022, and two lesser black-backed gulls were recorded in December 2022 only (HiDef, 2023a,b).

794. Fulmar was present in all surveys, and at levels of overall abundance that were similar to those recorded during the breeding season (albeit that they were more evenly distributed between the Broadshore WFDA and the Sinclair and Scaraben WFDAs aerial survey areas). The overall abundance of gannet during the non-breeding season was slightly higher than during the breeding season, with peaks in abundance in October (most marked on the Broadshore WFDA aerial survey area) and December (most marked on the Sinclair and Scaraben WFDAs aerial survey area) likely indicative of autumn and spring passage movements, respectively (HiDef 2023a,b; Furness, 2015).

795. No divers, grebes or sea ducks, such as eider *Somateria mollissima*, scaup *Aythya marila*, long-tailed duck *Clangula hyemalis* and common scoter *Melanitta nigra* were recorded in the offshore aerial survey area during the first year of surveys. These species winter in internationally important numbers close to the Moray Firth coast (and are qualifying features of Moray Firth SPA) where they forage for fish, crustaceans and other prey on or close to the seabed. Diving activity varies among species but average foraging dive depths for most are shallower than 15 m (Marine Scotland, 2020). Sea depth and distance from the coast account for the absence of divers, grebes and sea ducks from the offshore aerial survey area.

9.4.5 Summary of First Year Survey Data

796. Based upon the currently available data from the first year of baseline offshore aerial surveys, the six most frequently recorded species in the offshore aerial survey area were guillemot, kittiwake, puffin, fulmar, gannet and razorbill. Subject to the findings from the second year of the offshore aerial surveys, this suggests that these are likely to be the key species scoped in for detailed assessment in the Broadshore Hub WFDAs EIA Report.

797. A summary of the occurrence and estimated abundance of seabird species recorded in the offshore aerial survey area during the first year of surveys is presented in **Table 9.4** and **Table 9.5**. Due to raw data being provided separately for the Broadshore WFDA aerial survey area and the Sinclair and Scaraben WFDAs aerial survey area, the estimated abundance and confidence intervals have been provided in two separate tables. For the Broadshore Hub WFDAs EIA Report, survey data from year one and year two will be presented and analysed appropriately in order to support separate Section 36 (s.36) and Marine Licence applications for the Broadshore WFDA alone, Sinclair WFDA alone and Scaraben WFDA alone.

Table 9.4: Occurrence and Abundance of Seabird Species Recorded in the Broadshore WFDA Aerial Survey Area during the First Year of Baseline Surveys *

Species	Breeding Season		Non-Breeding Season **	
	No. Surveys Where Species Was Recorded	Mean Abundance Estimate (with 95% Confidence Interval) ***	No. Surveys Where Species Was Recorded	Mean Abundance Estimate (with 95% Confidence Interval)
Arctic skua	1	2 (0-6)	0	0 (0-0)
Arctic tern	1	63 (16-120)	0	0 (0-0)
Common gull	0	0 (0-0)	2	4 (0-9)
Common tern	1	10 (1-21)	0	0 (0-0)
European storm-petrel	1	3 (0-10)	0	0 (0-0)
Fulmar	6	368 (276-463)	6	434 (260-638)
Gannet	7	111 (57-175)	5	176 (93-265)
Great black-backed gull	1	2 (0-5)	6	47 (16-86)
Guillemot	5	3,876 (2,329-5,736)	7	1,233 (899-1,603)
Herring gull	1	2 (0-6)	4	79 (13-174)
Kittiwake	5	1,194 (650-1,894)	7	144 (68-241)
Puffin	4	682 (452-927)	3	59 (26-95)
Razorbill	4	126 (39-236)	4	36 (7-76)

Notes:

* Data are presented as apportioned estimates and are inclusive of records identified to a broad group level only which are then apportioned to relevant species. Guillemot, razorbill and puffin abundance estimates have also been corrected for availability bias.

** The non-breeding season covers the migration period, flightless moult period, winter period, pre-breeding attendance, and the period when species are not present in significant numbers, as defined by NatureScot (2020).

*** For the purpose of this preliminary presentation of the aerial survey data, values for the mean abundance and confidence intervals are derived by taking the average of these as calculated for the estimate from each individual monthly survey.

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Table 9.5: Occurrence and Abundance of Seabird Species Recorded in the Sinclair and Scaraben WFDAs Aerial Survey Area during the First Year of Baseline Surveys *

Species	Breeding Season		Non-Breeding Season **	
	No. Surveys Where Species Was Recorded	Mean Abundance Estimate (with 95% Confidence Interval) ***	No. Surveys Where Species Was Recorded	Mean Abundance Estimate (with 95% Confidence Interval)
Arctic skua	1	2 (0-6)	0	0 (0-0)
Arctic tern	1	62 (21-112)	0	0 (0-0)
Common gull	0	0 (0-0)	2	7 (0-16)
Common tern	1	15 (5-27)	0	0 (0-0)
European storm-petrel	1	3 (0-8)	0	0 (0-0)
Fulmar	6	588 (355-874)	6	513 (273-839)
Gannet	7	171 (66-318)	5	332 (150-527)
Great black-backed gull	3	7 (0-20)	7	169 (60-316)
Great skua	1	2 (0-4)	0	0 (0-0)
Guillemot	5	4,234 (2,624-6,150)	7	2,798 (2,135-3,508)
Herring gull	3	15 (2-36)	4	323 (175-485)
Kittiwake	5	1,078 (476-1,746)	7	204 (106-332)
Lesser black-backed gull	0	0 (0-0)	1	3 (0-7)
Little gull	0	0 (0-0)	1	2 (0-5)
Manx shearwater	1	1 (0-4)	0	0 (0-0)
Puffin	4	540 (356-747)	4	70 (35-108)
Razorbill	4	99 (30-188)	4	63 (17-128)

Notes:

* Data are presented as apportioned estimates and are inclusive of records identified to a broad group level only which are then apportioned to relevant species. Guillemot, razorbill and puffin abundance estimates have also been corrected for availability bias.

** The non-breeding season covers the migration period, flightless moult period, winter period, pre-breeding attendance, and the period when species are not present in significant numbers, as defined by NatureScot (2020).

Species	Breeding Season		Non-Breeding Season **	
	No. Surveys Where Species Was Recorded	Mean Abundance Estimate (with 95% Confidence Interval) ***	No. Surveys Where Species Was Recorded	Mean Abundance Estimate (with 95% Confidence Interval)
*** For the purpose of this preliminary presentation of the aerial survey data, values for the mean abundance and confidence intervals are derived by taking the average of these as calculated for the estimate from each individual monthly survey.				

9.4.6 European Designated Sites

798. Screening of European designated sites with qualifying bird species (SPAs, pSPAs and Ramsar sites) for potential connectivity to the Broadshore Hub WFDAs has been undertaken and is detailed within the **Broadshore Hub WFDAs HRA Screening Report**. There is potential for connectivity with a wide range of the breeding seabird colonies in the UK, particularly those on the north and east coasts of Scotland, and it is recognised that there will be many colonies within European designated sites that could be impacted by both project-alone effects and in-combination effects with other developments. The **Broadshore Hub WFDAs HRA Screening Report** provides full details of the relevant designated sites and features which are considered to have connectivity with the Broadshore Hub WFDAs and identifies the potential effect pathways, so enabling the determination of sites and features for which a likely significant effect cannot be excluded. The subsequent Report to Inform Appropriate Assessment (RIAA) will inform the appropriate assessment for those sites and features for which an LSE cannot be excluded.

799. Theoretical breeding season connectivity with qualifying features of seabird colony SPAs will be defined by species' breeding season theoretical foraging ranges, using the mean maximum plus one standard deviation as defined by Woodward et al. (2019) in most instances (but noting the exceptions for guillemot, razorbill and gannet highlighted in NatureScot Guidance Note 3 (NatureScot, 2023c). Outside the breeding season, most seabirds disperse away from their breeding colonies, and there is potential for connectivity with a greater range of qualifying features from seabird colony SPAs than during the breeding season. Consideration of the potential for non-breeding season effects associated with the Broadshore Hub WFDAs will be based upon information on BDMPS presented in Furness (2015), as advised in NatureScot Guidance Note 4 (NatureScot, 2023d). As noted above in **Section 9.4.1.1**, the exceptions to this will be guillemot and herring gull, which have been shown to remain in the broad vicinity of breeding colonies during the non-breeding season (Buckingham et al., 2022; Wernham et al., 2002) and therefore the colonies with connectivity to the Broadshore Hub WFDAs for these species are the same as for the breeding season (Woodward et al., 2019).

9.4.6.1 Apportioning to Special Protected Area Breeding Colonies

800. As part of the Applicants' scoping[37] approach for the Broadshore Hub WFDAs, breeding season apportioning of key species to SPA breeding colonies has been undertaken using the approach detailed in the NatureScot Interim Guidance (NatureScot, 2018) (**Appendix 6: Apportioning Breeding Season Impacts to SPA Seabird Populations**). This provides an estimate of the relative importance of different SPA populations in contributing to the populations of the key species in the Broadshore Hub WFDAs during the breeding season, and hence the basis for apportioning the breeding season impacts to these SPA populations. The breeding season apportioning undertaken as part of scoping was focused on the following six species:

- Gannet;
- Herring gull;
- Kittiwake;
- Guillemot;
- Razorbill; and
- Puffin.

801. This was on the basis that the above species are frequently those of main concern in the assessments for offshore wind farm projects in Scottish (and UK) North Sea waters (e.g. ABPmer 2019), there are important SPA populations of each of these species with connectivity to the Broadshore Hub WFDAs (as detailed in the **Broadshore Hub WFDAs HRA Screening Report**), and (with the exception of fulmar) they also encompass the species which were recorded in greatest abundance during the first breeding season of the offshore aerial surveys. The detailed outputs from the apportioning exercise (as well as approach and methods) are presented in **Appendix 6: Apportioning Breeding Season Impacts to SPA Seabird Populations**, with the main findings for each species summarised below.

802. The apportioning exercise estimated that 69.5% of adult gannets present in the Broadshore Hub WFDAs during the breeding season originated from SPA populations. Forth Islands SPA was identified as making the single greatest contribution, with approximately 33% of adult gannets during the breeding season estimated to originate from this SPA. Seven other SPAs designated for this species and considered to have potential connectivity with the Broadshore Hub WFDAs, including St Kilda SPA and Noss SPA, each contributed less than 10% (**Table 3.1** in **Appendix 6: Apportioning Breeding Season Impacts to SPA Seabird Populations**). As expected, based upon the proximity of the different gannet colonies to the Broadshore Hubs WFDAs (see **Section 9.4.3** above), the vast majority of non-SPA birds are estimated to derive from the Troup Head colony (**Table A1** in **Appendix 6: Apportioning Breeding Season Impacts to SPA Seabird Populations**). This colony is estimated to account for 27% of the adult gannets present on the Broadshore Hubs WFDAs. However, it is likely that the apportionment calculation underestimates the importance of this colony (and likely overestimates the importance of the Forth Islands SPA

[37] The Applicants have adopted an 'enhanced scoping' approach within certain Broadshore Hub WFDAs Scoping Report chapters reflecting a wider breath of knowledge or data availability on these technical chapters. More detailed information has been presented within these chapters than would typically be expected within a scoping report.

population) because the calculation takes no account of known behavioural information, and specifically the tendency of gannets from different colonies to occupy relatively exclusive foraging ranges (Wakefield et al., 2013). At a distance of 64.2 km from the Broadshore Hub WFDAs[38], Troup Head is less than half the distance from the Broadshore Hub WFDAs than the next closest colony (and is a quarter of the distance of the Forth Islands SPA from the Broadshore Hub WFDAs) (**Table A1** in **Appendix 6: Apportioning Breeding Season Impacts to SPA Seabird Populations**). Given this, it seems likely that the Broadshore Hub WFDAs will lie within the core foraging range of the Troup Head colony, with usage by gannets from other colonies lower than predicted by the apportionment calculation because of the tendency for the colonies to occupy relatively exclusive ranges. This is supported by the fact that the tracking data from the Forth Islands SPA suggests that the Broadshore Hub WFDAs is on the periphery of the main foraging areas of gannets from the Forth Islands SPA (Lane et al., 2020).

803. Three SPAs – Buchan Ness to Collieston Coast SPA, Troup, Pennan and Lion's Heads SPA, and East Caithness Cliffs SPA – were estimated to contribute 36.3%, 20.4% and 11.0% of adult herring gulls present in the Broadshore Hub WFDAs during the breeding season, respectively. No other SPAs designated for herring gull[39] were identified as having potential connectivity to the Broadshore Hub WFDAs during the breeding season (**Table 3.2** in **Appendix 6: Apportioning Breeding Season Impacts to SPA Seabird Populations**).

804. Over 90% of adult kittiwakes present in the Broadshore Hub WFDAs during the breeding season were estimated to originate from SPA colonies designated for this species[39]. Troup, Pennan and Lion's Heads SPA contributed the greatest proportion of kittiwakes (32.0%) followed by East Caithness Cliffs SPA (26.5%) and Buchan Ness to Collieston Coast SPA (13.7%). Eighteen other SPAs designated for this species contributed less than 7% of birds each, with the majority contributing less than 1% each (**Table 3.3** in **Appendix 6: Apportioning Breeding Season Impacts to SPA Seabird Populations**).

805. Approximately 96% of adult guillemots recorded in the Broadshore Hub WFDAs during the breeding season were attributed to SPA populations[39]. East Caithness Cliffs SPA was identified as contributing almost half of all adult guillemots (44.5%) with birds from Troup, Pennan and Lion's Heads SPA also making up a significant proportion (18.5%). Nine other SPAs designated for this species, including Fowlsheugh SPA and North Caithness Cliffs SPA, each contributed less than 10% of birds (**Table 3.4** in **Appendix 6: Apportioning Breeding Season Impacts to SPA Seabird Populations**).

806. Over 84% of adult puffins recorded in the Broadshore Hub WFDAs during the breeding season were attributed to SPA populations[39], with the majority originating from two colonies – Sule Skerry and Sule Stack SPA (41%) and Forth Islands SPA (32.5%). Six other SPAs designated for this species, including Fair Isle SPA and Foula SPA, each contributed less than 4% of adult puffins present during the breeding season (**Table 3.5** in **Appendix 6: Apportioning Breeding Season Impacts to SPA Seabird Populations**).

[38] As measured for apportioning (i.e. as the by-sea distance from the centre of the colony to the centre of the Broadshore Hub WFDAs.

[39] Including where the species is a named component of a breeding seabird assemblage feature (as opposed to a qualifying feature in its own right).

807. Approximately 78% of adult razorbills present in the Broadshore Hub WFDAs during the breeding season were estimated to originate from SPA colonies designated for this species[39]. East Caithness Cliffs SPA was identified as contributing almost half of all adult razorbills (47%) with birds from Troup, Pennan and Lion's Heads SPA also making up a significant proportion (16.2%). Four other SPAs designated for this species, including Fowlsheugh SPA and North Caithness Cliffs SPA, each contributed less than 10% of birds (**Table 3.6** in **Appendix 6: Apportioning Breeding Season Impacts to SPA Seabird Populations**).

808. Based on the above details it is clear that the apportionment exercise highlights the importance of breeding seabird colony SPAs on the north-east coast of the Scottish mainland in terms of the potential project alone effects. Thus, two SPAs (East Caithness Cliffs SPA and Troup, Pennan and Lion's Heads SPA) are identified as being among the two to three SPAs with the highest apportionment values for four of the six species considered (i.e. herring gull, kittiwake, guillemot and razorbill). These are also two of the closest breeding seabird colony SPAs to the Broadshore Hub WFDAs.

809. In some cases, the apportionment values for the East Caithness Cliffs SPA and the Troup, Pennan and Lion's Head SPA suggest that as much as 25 – 50% of the project-alone effects would be attributed to the populations from one or other of these two SPAs (whilst for kittiwake the values are close to 30% for each of these two SPAs). The Buchan Ness to Collieston Coast SPA, Fowlsheugh SPA, North Caithness Cliffs SPA, Forth Islands SPA and Sule Skerry and Sule Stack SPA were also identified as being relatively important in terms of the estimated apportionment values for at least some species. For several of the SPA populations associated with high apportionment estimates, the predicted in-combination effects from existing projects have been identified as being of sufficient scale to prevent a conclusion of no Adverse Effect on Integrity (AEoI) (in respect of the HRA). Thus, the ScotWind plan-level HRA considered that this is potentially the case for kittiwake at the East Caithness Cliffs SPA and Fowlsheugh SPA, for gannet at the Forth Islands SPA and for razorbill at the Fowlsheugh SPA (ABPmer 2019). More recently, the assessment for the Berwick Bank Wind Farm (RPS and Royal HaskoningDHV, 2022) concluded that it was not possible to exclude AEoI for in-combination effects (under at least some of the impact scenarios considered) for:

- Kittiwake at the East Caithness Cliffs SPA, Troup, Pennan and Lion's Head SPA, Buchan Ness to Collieston Coast SPA and Fowlsheugh SPA;
- Guillemot at the Fowlsheugh SPA;
- Razorbill at the East Caithness Cliffs SPA and Fowlsheugh SPA; and
- Puffin at the Forth Islands SPA.

9.5 Potential Impacts

810. A range of potential impacts on offshore ornithology receptors have been identified which may occur during the construction, operation and maintenance, and decommissioning phases of the Broadshore Hub WFDAs:

- Temporary disturbance and displacement associated with construction, operation and maintenance and decommissioning activities, including vessel traffic;
- Indirect impacts, such as changes in prey distribution, availability or abundance caused by sea/seabed disturbance, increase in subsea noise levels;
- Indirect impacts from Unexploded Ordinance (UXO) clearance;
- Disturbance and displacement from the physical presence of wind turbine generators (WTGs) and associated maintenance activities;
- Barriers to movement;
- Collision with the rotor blades of WTGs; and
- Entanglement with subsea mooring lines for floating substructures and any associated debris and ghost nets that may become attached to these mooring lines.

811. **Section 9.7** below sets out the reasons for scoping these impacts in and out from further assessment in the Broadshore Hub WFDAs EIA Report.

9.5.1 Embedded Mitigation Measures

812. Embedded mitigation measures committed to at this time include:

- Development of and adherence to a Marine Pollution Contingency Plan (MPCP); and
- Adherence to the Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR).

813. Full consideration will be given to the potential to minimise any impacts via the adoption of appropriate additional mitigation measures, where required. At this stage it is not possible to identify the full range of mitigation measures that may be adopted, but examples of measures that could be considered (depending on predicted impacts and feasibility) include:

- Incorporation of an increased air gap into WTG design to reduce collision rates between seabirds and operational WTGs. Since most seabirds fly close to the sea surface, increasing the air gap between the lower blade tip and the sea surface reduces collision risk (flight height is a key input parameter to collision risk models). Technical and economic constraints will also influence the extent of this air gap;

- Reducing the footprint of the Broadshore Hub WFDAs to reduce the area of potential displacement and barrier effects; and
- Reducing the boundary or amending the WTG layout of the Broadshore Hub WFDAs (for example, avoiding areas of particular importance for foraging seabirds).

814. The options for adopting such mitigation measures will be kept under review during the assessment process.

9.6 Scoping of Potential Impacts

9.6.1 Potential Impacts Scoped In

815. The key construction, operation and maintenance, and decommissioning impacts that have been 'scoped in' to the assessment are outlined below and in **Table 9.6** together with a description of any additional supporting analyses (e.g. modelling) that will be required to enable a full assessment of the impacts.

9.6.1.1 Construction Impacts

816. The key potential impact during construction is likely to come from disturbance and consequent displacement of birds due to construction activities. There is the potential for noise and visual disturbance to birds from the presence, movements and lighting of vessels, helicopters (if used), and other vehicles during the installation of offshore infrastructure within the Broadshore Hub WFDAs. Construction disturbance and displacement will be temporary and localised around areas that are the focus of construction activity at a given time. Other impacts to be assessed include potential changes to prey distribution and abundance (including prey-supporting benthic habitats) and impacts associated with cable installation, in accordance with NatureScot Guidance Note 6 (NatureScot, 2023f). The potential risk posed by UXO clearance will also be considered in case these are required.

817. The exact type, size and number of possible detonations and duration of UXO clearance operations, if required, are not known at this stage. This means that any assessments for UXO clearance in the Broadshore Hub WFDAs EIA Report will be indicative and for information only and are not part of the application. Separate Marine License application(s) will be made prior to UXO clearance works, with an accompanying assessment of UXO clearance effects.

9.6.1.2 Operation and Maintenance Impacts

818. The key potential operation and maintenance impacts are considered to be collision risk, disturbance and displacement, and barrier effects. These effects are likely to be greater for some species than others; for example, in reviewing studies of seabird avoidance responses to OWFs, Dierschke et al. (2016) identified species which strongly or almost completely avoid OWFs (divers and gannets), species showing less consistent displacement (auks, Manx shearwater, little gull and Sandwich tern *Sterna sandvicensis*), and species weakly (red-breasted merganser *Mergus serrator*, several gulls) or strongly (cormorant *Phalacrocorax carbo* and shag *Gulosus aristotelis*)

attracted to OWFs. For birds which regularly encounter the Broadshore Hub WFDAs, for example breeding seabirds making foraging trips from nearby colonies, displacement may affect survival rates through reduced energy intake from foraging if birds are displaced from preferred feeding areas, and/or increased energy expenditure due to avoidance of the Broadshore Hub WFDAs, causing increased flight distances and time during regular commuting flights to and from the colony. There is also the potential risk of entanglement associated with mooring lines and any associated debris and ghost nets that may get attached to those. This is of particular concern for deep-diving species such as auks. Displacement and disturbance associated with vessels and maintenance activity and indirect impacts on seabirds via any changes to prey availability and prey-supporting benthic habitats will also be considered.

819. Birds which are not displaced and fly through an OWF at a height encompassed by the rotating blades will be at risk of collision with operational WTGs. Collisions are likely to result in direct mortality. The risk of collision is likely to be greater for some species than others, although studies indicate collisions are generally rare events (e.g. Skov et al., 2018), hence assessment involves modelling the risk of collision for individual species.

9.6.1.3 Decommissioning Impacts

820. During decommissioning the potential impacts are anticipated to be similar to those described above for the construction phase.

9.6.2 Potential Impacts Scoped Out

821. The key potential operation impacts of collision risk, disturbance and displacement from WTGs and maintenance vessels, barrier effects and entanglement are not considered be relevant to the construction and decommissioning phases, therefore they have been scoped out of the assessment for the construction and decommissioning stages of the Broadshore Hub WFDAs. The risk from UXO clearance is considered to be a construction impact only, therefore this potential impact has been scoped out of the operation and decommissioning phase assessments.

9.6.3 Potential Cumulative Effects

822. The CEA for offshore ornithology will follow the general methodology set out in **Chapter 4: Approach to Scoping and Environmental Impact Assessment**. The CEA will be considered in two stages; a CEA of the of the whole Broadshore Hub (i.e., the Broadshore Hub WFDAs, the Broadshore Hub OfTDAs and the Broadshore Hub OnTDAs), followed by a CEA of the whole Broadshore Hub alongside other plans or projects.

823. For each impact screened in for cumulative assessment, the plans/projects with potential to contribute to the impact will be identified and assessed as per the impact assessment methodology for project-alone impacts. Based on experience from other OWF projects, it is expected that the cumulative assessment will focus on cumulative displacement/barrier effects and cumulative collision risk due to the presence of offshore infrastructure when considered alongside other OWF projects, during the operational phase only.

824. The cumulative impact assessment will focus (as a minimum) on the cumulative effects with Moray West, Moray East and Beatrice OWFs to the west, as well as other proposed OWFs in the outer Moray Firth and adjacent waters of the North Sea including Caledonia, Stromar, Buchan, MarramWind and Green Volt. Additional projects located in Scottish and English waters will be ‘scoped in’ to the cumulative assessment for breeding seabirds based on the foraging ranges as advised by NatureScot (2023f) (primarily the mean-maximum foraging ranges (+1 SD) from Woodward et al. 2019), between colonies and the relevant developments. When considering the predicted collision and displacement impacts from other projects, the most recent assessments or consented design variations will be used, rather than designs for the original consented OWFs.

825. The non-breeding season cumulative assessment, for species that migrate or disperse from their breeding colonies, will include relevant developments within the BDMPS region (Furness, 2015). However, for guillemot and herring gull which do not disperse as widely in the non-breeding season (Buckingham et al., 2022; Wernham et al., 2002), the assessment will be based on other developments within these species’ mean maximum foraging ranges (+1 SD) from the Broadshore Hub WFDAs.

826. Should the proposed CEF be published by the Marine Directorate within a timeframe that aligns with the Broadshore Hub WFDAs EIA programme, the methods recommended by the CEF will be considered for use within the cumulative assessment for offshore ornithology.

9.6.4 Potential Transboundary Effects

827. The Broadshore Hub WFDAs EIA Report will consider whether there are any non-UK seabird colonies with potential connectivity to the Broadshore Hub WFDAs during the breeding season (within mean maximum foraging range +1 SD) and non-breeding season. Any potential impacts on birds from non-UK seabird colonies during operation and maintenance will be addressed in the EIA.

9.6.5 Summary of Potential Offshore Ornithology Impacts Scoped In and Out

828. **Table 9.6** outlines the offshore ornithology impacts which are proposed to be scoped in or out of the Broadshore Hub WFDAs EIA Report.

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Table 9.6: Summary of Potential Impacts Scoped In (✓) or Scoped Out (x) for Offshore Ornithology Construction (C), Operation and Maintenance (O) and Decommissioning (D) Phases

Potential impact	Scoped In or Scoped Out? (✓ or x)			Justification	Data Collection and Analysis Required to Characterise the Baseline Environment	Summary of Proposed Approach to Assessment
	C	O&M	D			
Temporary disturbance and displacement	✓	✓	✓	The presence of vessels associated with construction, operation/maintenance and/or decommissioning works may temporarily disturb and/or displace seabirds present in the vicinity of works. This has the potential to affect productivity and/or survival.	Offshore ornithology abundance estimates from offshore aerial surveys will be used to estimate the numbers of birds potentially disturbed/displaced.	Potential impacts will be assessed using best practice methodologies and with reference to the latest published information.
Indirect impacts	✓	✓	✓	Indirect impacts on seabirds may occur as a result of changes in prey distribution, availability or abundance, caused by construction, operation/maintenance and decommissioning activities that disturb the sea/seabed or increase subsea noise levels.	The use of site-specific baseline data is not proposed.	Potential impacts will be assessed using best practice methodologies and with reference to the latest published information.
Indirect impacts from UXO clearance	✓	x	x	The potential for physical injury and death to diving seabirds below water at time of detonation. The reduction or disruption of prey availability due to detonations may cause reduced energy intake affecting seabird productivity and/or survival. This may be mitigated by the use of deflagration methods and low-order clearance.	The use of site-specific baseline data is not proposed.	Potential impacts will be assessed using best practice methodologies and with reference to the latest published information.

Potential impact	Scoped In or Scoped Out? (✓ or x)			Justification	Data Collection and Analysis Required to Characterise the Baseline Environment	Summary of Proposed Approach to Assessment
	C	O&M	D			
Disturbance and displacement from the physical presence of WTGs and associated maintenance activities	x	✓	x	The presence of operational WTGs and maintenance activities associated with their operation may disturb seabirds and displace them from their foraging or resting areas. This has the potential to affect productivity and/or survival.	Offshore ornithology abundance estimates from offshore aerial surveys will be used to estimate the numbers of birds potentially impacted.	Potential impacts will be assessed using best practice methodologies and with reference to the latest published information. For any population for which it is required, PVA will be used to assess the consequences of predicted impacts at the population level.
Barrier to movement	x	✓	x	The presence of operational WTGs may result in additional energy and/or time expenditure as migrating or commuting seabirds fly longer distances either over, under, or around the Broadshore Hub WFDAs. This has the potential to affect productivity and/or survival.	Offshore ornithology abundance estimates from offshore aerial surveys will be used to estimate the numbers of birds potentially impacted.	Potential impacts will be assessed using best practice methodologies and with reference to the latest published information. For any population for which it is required, PVA will be used to assess the consequences of predicted impacts at the population level.

Potential impact	Scoped In or Scoped Out? (✓ or x)			Justification	Data Collection and Analysis Required to Characterise the Baseline Environment	Summary of Proposed Approach to Assessment
	C	O&M	D			
Collision with WTGs	x	✓	x	Collisions between seabirds and operational WTGs will result in direct mortality. This will result in reductions in seabird numbers and potentially affect population breeding success. This will be mitigated by the selection of an appropriate air gap between the sea surface and the lowest part of the rotor swept area. This air gap has not yet been selected but will be informed by the results of the preliminary CRM and considering technical and economic constraints.	Offshore ornithology abundance estimates from offshore aerial surveys will be used to estimate the numbers of birds potentially impacted.	Potential impacts will be estimated using best practice methodology (e.g. sCRM). For any population for which it is required, PVA will be used to assess the consequences of predicted impacts at the population level
Entanglement with subsea infrastructure, specifically debris that may become attached to the mooring lines of floating substructures	x	✓	x	With the advent of floating offshore wind, the potential for entanglement of diving seabirds with associated subsea infrastructure during the operation and maintenance period has been raised.	Offshore ornithology abundance estimates from offshore aerial surveys will be used to estimate the numbers of birds potentially impacted.	Potential impacts will be assessed using best practice methodologies and with reference to the latest published information.

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9.7 Proposed Approach to Impact Assessment

829. The impact assessment for offshore ornithology will be undertaken in accordance with industry standard guidance (e.g., CIEEM, 2018) and based on the methodology described in **Chapter 4**: **Approach to Scoping and Environmental Impact Assessment**. Within the offshore ornithology chapter of the Broadshore Hub WFDAs EIA Report, the overall impact assessment for the Broadshore Hub WFDAs will be presented first. Following this, a summary of each WFDA will be given (Broadshore WFDA, Sinclair WFDA, Scaraben WFDA).

830. The EIA baseline will identify the seasonal use of the offshore aerial survey area by the bird species recorded during the full 24 months of surveys (due to be completed in February 2024). Detailed analyses of survey data will provide density and abundance estimates (with associated confidence intervals and levels of precision) for key ornithological receptors within the Broadshore Hub WFDAs together, Broadshore WFDA, Sinclair WFDA, Scaraben WFDA, and respective surrounding buffer zones.

831. The offshore ornithology EIA chapter will be supported by a technical report which will provide full details of the approaches that underpin key areas of the assessment. These will include density estimation, apportioning, approach to displacement and barrier effects, CRM and PVA. The following sections provide an overview of key considerations which are relevant to each of the key assessment subjects.

9.7.1 Density Estimation

832. It is considered that design-based methods are likely to provide abundance and density estimates of seabirds within the Broadshore Hub WFDAs and buffers which are suitable for the purposes of characterising the baseline characteristics. NatureScot (2023b) recommends that a list of species for which model-based population estimates (using the MRSea package) would be generated should be agreed through scoping (and informed by the survey reports). However, as discussed in the Ossian Array EIA Scoping Report (Ossian Offshore Wind Farm Limited (OWFL) 2023), recent experience in applying model-based approaches to the estimation of seabird densities using offshore survey data appears to demonstrate no advantages over design-based methods, and work undertaken for the Berwick Bank OWF demonstrated that the monthly density estimates for a range of the key seabird species, as derived by design-based and model-based approach, were generally very similar (Harker et al., 2022). However, it was noted that some of the model-based estimates were unrealistic due to spatial and temporal gaps in survey coverage, and stochasticity within the modelling process meant that markedly different outputs could be generated from different model runs based on identical inputs and parameters. Consequently, the Berwick Bank OWF application relied upon the outputs from the design-based density estimates.

833. Furthermore, the baseline survey data for the Berwick Bank OWF are, in many ways, considerably better suited to producing model-based density estimates than are those from the offshore aerial survey area. This is because density estimates for the Berwick Bank OWF were derived from an area which (at almost 4,000 km^2) is more than five times greater than the Broadshore Hub WFDAs

offshore aerial survey area, with overall bird abundance across the relevant area also being substantially greater for the Berwick Bank OWF (e.g. the estimated abundances of guillemot and kittiwake (the two most abundant species in the Broadshore Hub WFDAs offshore aerial survey area) in the case of the Berwick Bank OWF are an order of magnitude greater than those estimated from the first year of surveys within the Broadshore Hub WFDAs offshore aerial survey area – **Table 9.4** and **Table 9.5**). Thus, sample size, the potential for spatial variation in bird densities and the potential for variation in possible environmental co-variates are all substantially greater in the case of the Berwick Bank OWF survey data. In addition, the fact that the Berwick Bank OWF survey area is considerably closer to the coast than the Broadshore Hub WFDAs offshore aerial survey area also means that environmental gradients that might correlate with variation in bird densities are more likely to occur within the Berwick Bank OWF survey area.

834. Given the above, there appears to be little evidence or indications from previous experience to suggest that model-based density estimation will offer any benefits over design-based density estimation (and may in fact increase risk of erroneous estimation) in the case of the offshore aerial survey area.

835. However, given the NatureScot guidance (and assuming that there are no changes to this guidance ahead of undertaking the work to derive baseline bird densities), it is proposed to use model-based approaches for the most abundant species, subject to suitable model-performance. Based on the first year of the aerial survey data, this is expected to be guillemot, kittiwake, fulmar and puffin. Design-based density estimates would also be generated for these species, as well as for all other species for which sample sizes are deemed adequate. Density estimates will be derived for each of birds in flight, birds on the water and all birds for the appropriate spatial areas (e.g. WFDA alone, WFDA plus two km buffer).

9.7.2 Seasonality

836. The length of the breeding and non-breeding periods varies between seabird species. For seabird species potentially sensitive to the impacts of the Broadshore Hub WFDAs, the breeding and non-breeding periods that will be used in the assessment will follow the seasonal definitions provided by NatureScot Guidance Note 9 (2020). These are provided in **Table 9.7** for species recorded during the first year of aerial baseline surveys.

Table 9.7: Seasonal Definitions of Seabirds Recorded during the First Year of Surveys (NatureScot, 2020)

Species	Breeding	Post-breeding	Winter	Pre-breeding
Arctic skua	May to August	-	-	-
Arctic tern	May to August	-	-	-
Common gull	April to August	-	September to February	March
Common tern	May to mid-September	-	-	-
European storm-petrel	Mid-May to October	-	-	-
Fulmar	April to mid-September	-	Mid-September to March	
Gannet	Mid-March to September	-	October to mid-February	Mid-February to mid-March
Great black-backed gull	April to August	-	September to February	March
Great skua	Mid-April to mid-September	-	-	Early April
Guillemot	April to mid-August	Late August; flightless moult August to mid-October	September to January	February to March
Herring gull	April to August	-	September to February	March
Kittiwake	Mid-April to August	-	September to March	Early April
Lesser black-backed gull	Mid-March to August	-	September to mid-March	-
Little gull	-	-	August to mid-April	-
Manx shearwater	April to mid-October	-	-	-
Puffin	April to mid-August	Late August	September to mid-March	Late March; flightless moult February to mid-March
Razorbill	April to mid-August	Late August; flightless moult mid-August to November	September to February	March

9.7.3 Seabird Populations, Foraging Ranges and Connectivity

837. Estimates of breeding seabird population sizes will be obtained from the Seabird Monitoring Programme online database (BTO, 2023) and non-breeding seabird population sizes will be taken from Furness (2015). Where species that require assessment are not included in the Furness report, other appropriate sources will be referenced. For guillemot and razorbill, the population size estimates in the Seabird Monitoring Programme are presented as the number of individuals counted at the colony, however this is considered to represent an underestimate of the number of breeding birds at each colony. It is therefore proposed that a conversion factor of 1.34 will be used to ‘correct’ the counts as presented in the Seabird Monitoring Programme , subject to agreement with NatureScot.

838. The recommended foraging ranges for seabirds around breeding colonies (Woodward et al., 2019; NatureScot, 2023c) will be used to determine potential connectivity between SPA and non-SPA colonies and the Broadshore Hub WFDAs. These are presented in

839. **Table** 9.8 for species recorded during the first year of baseline surveys along with the metric to be used in the assessment. For most species, the metric recommended by NatureScot is the Mean Maximum (MM) foraging range plus one standard deviation (MM +1 SD); where there is insufficient data to calculate this, then the maximum will be used followed in preference by the mean. For gannet, the site-specific maximum foraging range will be used to assess impacts on Forth Islands SPA and St Kilda SPA, as advised by NatureScot (2023c), and for guillemot and razorbill colonies south of the Pentland Firth, the MM + SD will be used excluding Fair Isle values, as presented in Woodward et al. (2019).

Table 9.8: Foraging Ranges and Recommended Assessment Metrics for Seabird Species Recorded during the First Year of Baseline Surveys (Woodward et al. 2019; NatureScot 2023c)

Species	Foraging Range (km)	Metric
Arctic skua	2.7	Mean + SD
Arctic tern	25.7 (±14.8)	MM + SD
Common gull	50	Max/MM
Common tern	18 (±8.9)	MM + SD
European storm-petrel	336	Max/MM
Fulmar	542.3 (±657.9)	MM + SD
Gannet	315.2 (±194.2)*	MM + SD
Great black-backed gull	73	Max/MM
Great skua	443.3 (±487.9)	Max/MM
Guillemot	55.5 (±39.7)**	MM + SD
Herring gull	58.8 (±26.8)	MM + SD
Kittiwake	156.1 (±144.5)	MM + SD
Lesser black-backed gull	127 (±109)	MM + SD
Little gull	N/A	N/A
Manx shearwater	1346.8 (±1018.7)	MM + SD
Puffin	137.1 (±128.3)	MM + SD
Razorbill	73.8 (±48.4)	MM + SD
Notes: * Site-specific maximum values to be used in relation to Forth Islands SPA and St Kilda SPA. ** Excludes Fair Isle data. For colonies in the Northern Isles the MM + SD including the Fair Isle data will be used (i.e., 153.7 km and 164.6 km for guillemot and razorbill, respectively).		

9.7.4 Apportioning

840. For the assessment of impacts on different seabird breeding colonies (particularly SPA populations) it is necessary to apportion the potential impact predicted for the development between colonies and across age classes and seasons. In the breeding season, age class apportioning will be based on the proportions of adults and immatures derived from site-specific survey data where this is feasible (e.g. gull species and gannet) and from the estimated stable age structure as derived from population models for other species (notably the auks).

841. As part of an enhanced scoping approach for the Broadshore Hub WFDAs, breeding season apportioning of key species to SPA breeding colonies has been undertaken using the approach detailed in the NatureScot Interim Guidance (NatureScot, 2018); refer to **Section 9.4.6.1**. It is understood that NatureScot Guidance Note 10, when published, will set out NatureScot's advice for apportioning the breeding season impacts to the seabird colonies identified as having potential connectivity to the Broadshore Hub WFDAs. It is anticipated that the advice in Guidance Note 10 is likely to recommend the use of the NatureScot Interim Guidance (NatureScot 2018) and also the Marine Directorate's Apportioning Tool (Butler et al., 2020) for this purpose (noting that the latter can only be used for kittiwake, guillemot, razorbill and shag). The Marine Directorate's Apportioning Tool also relies on the estimates of colony population sizes derived from the Seabird 2000 census (Mitchell et al., 2004). It is unclear whether changes in the relative sizes of colony populations since 2000 may render the Marine Directorate Apportioning Tool obsolete (particularly given the potential for differential effects of HPAI on colony population sizes). Recent consultation with NatureScot has confirmed that the Marine Directorate Apportioning Tool is currently unavailable and is unlikely to become readily available until the CEF is published[40].

842. Subject to there being no evidence for marked differential trends in seabird colony population sizes since the Seabird 2000 census, and assuming availability of the Marine Directorate Apportioning Tool, it is considered likely that breeding season apportioning for the assessment will be undertaken using the Marine Directorate Apportioning Tool for kittiwake, guillemot and razorbill, and the NatureScot Interim Guidance for other species.

843. Apportioning during the non-breeding season will use the information presented in Furness (2015) on BDMPS, with the exception of guillemot and herring gull. Estimates of the numbers of birds within the relevant BDMPS from different colony populations are provided for both adult and immature age classes. Guillemot and herring gull are considered to disperse less widely from the breeding area during the non-breeding season in comparison to other species. For this reason, guillemot and herring gull apportioning during the non-breeding season will follow the same approach used for these species during the breeding season.

9.7.5 Displacement and Barrier Effects

844. It is proposed that displacement and barrier effects will be assessed using the SNCB-recommended matrix-based approach (SNCBs, 2022) for all relevant species during each of the defined species-specific seasonal periods, potentially in conjunction with the SeabORD tool (Searle et al., 2018) for the relevant species (see below).

845. The matrix-based approach has been used to assess displacement and barrier effects in all recent UK OWF applications (including the Moray Firth projects, the revised designs of the Forth and Tay projects, the Berwick Bank OWF and the Green Volt project in Scottish waters). For each species, the matrix-based approach provides estimates of effects based on an assumed species-specific displacement rate and an assumed rate(s) of mortality amongst the displaced birds. The approach does not distinguish between the impacts from displacement and barrier effects, with it being assumed that effects from both pathways are incorporated within the estimates that are derived.

[40] NatureScot email of 27th June 2023 re Apportioning question for NatureScot for Bellrock and Broadshore Offshore Wind Farms

846. Recently published NatureScot guidance on assessing displacement and barrier effects on seabirds (Guidance Note 8; NatureScot 2023h) recommends use of both the matrix method and the SeabORD modelling tool (Searle et al., 2018). However, SeabORD can only be used to assess puffin, guillemot, razorbill and kittiwake during the chick-rearing (breeding) season; all other seasons and species require the matrix approach. Work undertaken for the Berwick Bank OWF application investigated the use of the SeabORD model and concluded that due to high levels of uncertainty (in terms of key assumptions) and sensitivity of outputs to key input parameters, it is not a suitable tool for deriving the concise, transparent and comparable predictions required for general use for impact assessments (Vallejo et al., 2022). Thus, there appear to be serious concerns over the potential value of the SeabORD tool for the purposes of undertaking assessments and over the reliability of the outputs.

847. However, given the NatureScot guidance (and subject to further experience relating to the suitability of the SeabORD tool which may emerge in the interim period), it is proposed to consider use of SeabORD to assess breeding season impacts from displacement and barrier effects for puffin, guillemot, razorbill and kittiwake. The matrix-based approach will be used for the other seasonal periods relevant to these species and for the other species for which assessment of displacement effects is required.

848. Based on the first year of survey data, the species that will be ‘scoped in’ to the displacement and barrier effects assessment are gannet, kittiwake, guillemot, razorbill and puffin. Displacement rates and mortality rate ranges for use with matrix-based approach presented in NatureScot Guidance Note 8 (NatureScot, 2023h) will be used unless this advice changes in the interim period (**Table 5.25**). Consideration will also be given to the use of alternative rates based upon the findings from recent reviews of the evidence-base on displacement rates and the findings from recent post-consent monitoring undertaken at the Beatrice OWF in the Moray Firth region (APEM, 2020; Trinder, 2023). Should the second year of survey data indicate there are other species that require assessment, proposed displacement and mortality rates for these species will be discussed and agreed with relevant consultees.

Table 9.9: Displacement Rates and Mortality Rate Ranges to be used with the Matrix-Based Approach (NatureScot, 2023h)

Species	Displacement Rate	Mortality Rate (Breeding Season)	Mortality Rate (Non-Breeding Season)
Auks – guillemot, razorbill and puffin	60%	3% and 5%	1% and 3%
Gannet	60%	1% and 3%	1% and 3%
Kittiwake	30%	1% and 3%	1% and 3%

849. To inform the displacement assessment, seabird densities will be based on estimates derived from the full two years of baseline data. The mean peak population abundances of each species within the site boundary and an appropriate buffer (i.e. 2 km for those species currently scoped in) for each seasonal period will be derived from these estimated densities. In relation to the seasonal periods for guillemot and razorbill, consideration will be given as to whether there is justification for taking into account likely post-breeding dispersal when defining these periods for the purposes of

estimating displacement effects, as well as deriving these estimates in strict accordance with the seasonal periods as defined in the NatureScot (2023h) guidance. Seasonal estimates will be combined to assess impacts over the whole year.

9.7.6 Collision Risk Modelling

850. The sCRM model (MacGregor et al., 2018) will be used to estimate the potential collision risk to key species due to the operation of the Broadshore Hub WFDAs WTGs, as recommended in NatureScot Guidance Note 7 (NatureScot, 2023g). Specifically, the 2022 update of the sCRM (Caneco, 2022) will be used to produce both stochastic and deterministic predictions of collision mortality (as outlined in the NatureScot guidance).

851. Due to the difficulties in estimating bird flight height from aerial imagery, it is anticipated that generic flight data (Johnston et al., 2014) will be used. The sCRM will be run using Option 2 (Basic model) (and possibly also Option 3 (Extended model))[41], which is reliant on generic published flight height distributions. The CRMs will consider a range of turbine scenarios, including realistic worst-case and most likely scenario for each CRM species, as advised by NatureScot. Based on discussions with NatureScot at the Scoping Workshop, it is anticipated that Guidance Note 7 will be updated soon to reflect new advice on the recommended avoidance rates, taking account of the findings of Ozsanlev-Harris et al. (2023). It is expected that these avoidance rates will be used for the Broadshore Hub WFDAs assessment.

852. Based on the results of the first year of baseline surveys, the species proposed for inclusion in the assessment of collision risk are gannet, kittiwake, herring gull and great black-backed gull. Further species may be included (subject to further consultation with NatureScot) depending on the results of the second year of surveys; this could include Arctic tern, common tern and lesser black-backed gull. Morphological and behavioural parameters to be used in the sCRM, including bird length, wing span, flight speed/type and nocturnal activity, have been derived from NatureScot Guidance Note 7 (NatureScot, 2023g) and are provided in **Table 9.10** (noting that some of these may change following the imminent revision of this guidance note). Flight speeds and nocturnal activity scores were obtained from Alerstam (1997) and Garthe and Hüppop (2004) respectively except for gannet, for which these parameters were obtained from Pennycuick (1997) and Furness et al. (2018) respectively.

Table 9.10: Species Biological Parameters to be used in the Stochastic Collision Risk Modelling

Species	Flight Speed (m/s)	Nocturnal Activity Factor	Body Length (m)	Wingspan (m)	Flight Type	% Flights Upwind
Gannet	14.9 (±0)	0.08 (±0.10)	0.94 (±0.0325)	1.72 (±0.0375)	Gliding	50
Kittiwake	13.1 (±0.40)	NatureScot to be consulted	0.39 (±0.005)	1.08 (±0.0625)	Flapping	50

[41] Option 3 will only be run if such instruction is included in the revised guidance and for those species for which there is an advised avoidance rate for use with this option.

Species	Flight Speed (m/s)	Nocturnal Activity Factor	Body Length (m)	Wingspan (m)	Flight Type	% Flights Upwind
Herring gull	12.8 (±1.80)	NatureScot to be consulted	0.6 (±0.0225)	1.44 (±0.03)	Flapping	50
Great black-backed gull	13.7 (±1.20)	NatureScot to be consulted	0.71 (±0.035)	1.58 (0.0375)	Flapping	50

853. Potential collision mortality for migratory non-seabird species (including ducks, geese and raptors) will also be assessed. It is understood that an updated review of migratory routes and vulnerabilities across the UK is currently being prepared on behalf of Marine Directorate and Crown Estate Scotland, which includes the development of a stochastic migration CRM tool (known as mCRM) to enable quantitative assessment of risks to migratory species. It is proposed that the mCRM tool is used, subject to review and whether it becomes available in sufficient time within the EIA programme of works. Should this tool not become available, then it is anticipated that the approach would be to rely on the existing report on strategic assessment of collision risk of Scottish offshore wind farms to migrating birds (WWT, 2014) supplemented with qualitative assessment for any relevant species which are not included,

9.7.7 Population Viability Analysis

854. It is proposed that the Natural England PVA tool (Searle et al., 2019) will be used to model the potential effects of collision and displacement mortality on populations of key seabird species from relevant breeding colonies. In accordance with NatureScot guidance (NatureScot, 2023k), PVAs will focus on birds where the assessed mortality exceeds a 0.02 percentage point change to adult annual survival rates, with PVAs run over 25-year and 50-year periods. However, the 0.02 percentage point change in adult mortality may not be appropriate for all species due to interspecific variation in annual survival, therefore, further consideration and consultation on this with stakeholders may be necessary (e.g. in view of the outcomes from recent submissions which have relied on this threshold).

855. No recovery period will be applied within the PVAs, and impacts will be applied to all age-classes in agreement with the age apportioning approach, with sabbatical rates of adult birds also being included[42]. The two-ratio metrics, which are generally termed 'Counterfactual (ratio) of final Population Size' (CPS) and 'Counterfactual (ratio) of Population Growth Rate' (CPGR) will be presented and used to draw conclusions on the model outputs.

856. The most up to date population data from the Seabird Monitoring Programme database (BTO, 2023) will be used to provide baseline colony population sizes in the PVA, and species demographic data for use in the PVAs will be obtained from Horswill and Robinson (2015) except

[42] It is proposed to use sabbatical rates of 35% for large gull species, 10% for gannet and kittiwake, and 7% for guillemot, razorbill and puffin, in accordance with recent offshore wind farm assessments in Scottish waters (e.g. RPS and Royal HaskoningDHV, 2022).

where other sources are deemed more appropriate (e.g. population-specific studies and as used for the PVAs undertaken for the Berwick Bank OWF (DMP Statistical Solutions and HiDef, 2022)).

9.7.8 Highly Pathogenic Avian Influenza

857. The ongoing HPAI outbreak has the potential to result in significant impacts on seabird populations and has potential to increase the level of uncertainty within the ornithological assessment of the Broadshore Hub WFDAs. At present, it is unclear how the impacts of HPAI will be addressed in the assessment. In the absence of specific NatureScot guidance on the matter, recent advice provided by Marine Directorate and NatureScot to Ossian OWFL recommends a precautionary assessment is undertaken in light of HPAI, taking into account Natural England interim guidance (Marine Scotland, 2023, Natural England 2022). This is likely to require consultation with NatureScot to aid consideration of how the species and colonies of concern, and their densities at sea during certain seasonal periods, may have been affected with HPAI.

858. It is likely that a significant proportion of the assessment in relation to HPAI will be qualitative, although some quantitative assessment may be possible if up to date (post-2022) seabird colony numbers become available in sufficient time to enable their consideration within the assessment, and particularly how they relate to baseline survey data. Consultation will be undertaken with NatureScot and other stakeholders to seek an agreed approach.

9.8 Scoping Questions to Consultees

859. The following questions are posed to consultees to help them frame and focus their response to the offshore ornithology scoping exercise, which will in turn inform the Scoping Opinion:

- Do you agree that the site-specific data that will be available following completion of the two years of offshore aerial surveys will be sufficient to describe the baseline for offshore ornithology?
- Do you agree that the scope of the offshore aerial surveys (including coverage of the aerial survey areas and transect separation) is acceptable?
- Do you agree with the buffer and transects used for the offshore aerial surveys?
- Do you agree with the potential impacts that have been scoped in for the construction, operation and maintenance, and decommissioning phases of the Broadshore Hub WFDAs in relation to offshore ornithology?
- Do you agree that the examples of potential mitigation measures are appropriate and suitably encapsulate the means to mitigate potential impacts from the Broadshore Hub WFDAs on seabird populations?
- Do you agree with the sources suggested for defining seabird seasons, estimating populations and foraging ranges, and apportioning?
- Do you agree with the approach outlined for density estimation (recognising the potential issues outlined above with the model-based approach) and the list of seabird species expected to be included for model-based density estimates as based upon the currently available baseline data?

- Do you agree with the approach outlined for collision risk modelling and with the sources suggested for deriving the seabird parameters to be used in the sCRM (as detailed in **Table** 9.10)?
- Specifically, in relation to use of the sCRM, can consultees confirm whether:
  - The same mean avoidance rate is to be applied to the outputs from the stochastic and deterministic runs of the sCRM, for a given species and model option (noting that the values given in Table 1 of Appendix 1 of the relevant NatureScot guidance note are for use with Band (2012) as opposed to deterministic runs of the sCRM)?
  - The parameters values identified in Table 9.10 for use with the sCRM are to be used for both the stochastic and deterministic model runs (noting that the values given in Table 1 of Appendix 1 of the relevant NatureScot guidance note are for use with Band (2012) as opposed to deterministic runs of the sCRM)?
  - Confirmation on the values to be used for those parameters identified in Table 2 of Appendix 1 of the relevant NatureScot guidance note as requiring consultation with NatureScot (e.g. nocturnal activity values for several of the key species)?
- Do you consider the species-specific displacement rates presented in NatureScot guidance for matrix-based assessments are also appropriate for SeabORD?
- Do you agree with the sources suggested for deriving demographic rates for species populations to be used in PVA, including the use of colony-specific information (as derived for the Berwick Bank OWF) when considered more appropriate?
- Do you agree the need for further discussion on the implications of the ongoing HPAI outbreak and to agree an approach to incorporate HPAI impacts into the assessment?
- Do you have any other matters or information sources that you wish to present?

9.9 References

ABPmer (2019). Sectoral Marine Plan for Offshore Wind Energy. Strategic Habitats Regulations Appraisal (HRA): Screening and Appropriate Assessment Information Report - Final. Sectoral Marine Plan for Offshore Wind Energy: Strategic Habitat Regulations Appraisal: Screening and Appropriate Assessment Information Report - Final (www.gov.scot)

Alerstam, T., Rosén, M., Bäckman, J., Ericson, P.G.P. and Hellgren, O. (2007). Flight Speeds among Bird Species: Allometric and Phylogenetic Effects. PLOS Biology 5, e197.

APEM (2022). Review of evidence to support auk displacement and mortality rates in relation to offshore wind farms. APEM Scientific Report P00007416. Ørsted, January 2022, Final, 49.

BlueFloat | Renantis Partnership, (2024). Broadshore Hub Wind Farm Development Areas Habitats Regulations Screening Report.

British Trust for Ornithology (2023) Seabird Monitoring Programme. Available at: https://app.bto.org/seabirds/public/index.jsp

Buckingham, L., Bogdanova, M.I., Green, J.A., Dunn, R.E., Wanless, S., Bennett, S., Bevan, R.M., Call, A., Canham, M., Corse, C.J., Harris, M.P., Heward, C.J., Jardine, D.C., Lennon, J., Parnaby, D., Redfern, C.P.F., Scott, L., Swann, R.L., Ward, R.M., Weston, E.D., Furness, R.W., Daunt, F. (2022). Interspecific variation in non-breeding aggregation: a multi-colony tracking study of two sympatric seabirds. Marine Ecology Progress Series. 684: 181-197.

Butler, A., Carroll, M., Searle, K., Bolton, M., Waggitt, J., Evans, P., Rehfisch, M., Goddard, B., Brewer, M., Burthe, S. & Daunt, F. (2020). Attributing seabirds at sea to appropriate breeding colonies and populations. Scottish Marine and Freshwater Science, 11(8), 140pp.

CIEEM (2018). Guidelines for ecological impact assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine. Chartered Institute of Ecology and Environmental Management, Winchester.

Cleasby, I.R., Owen, E., Wilson, L.J. and Bolton, M. (2018). Combining habitat modelling and hotspot analysis to reveal the location of high-density seabird areas across the UK. RSPB Research Report No. 63. RSPB Centre for Conservation Science.

Cleasby, I.R., Owen, E., Wilson, L., Wakefield, E.D., O'Connell, P. and Bolton, M. (2020). Identifying important at-sea areas for seabirds using species distribution models and hotspot mapping. Biological Conservation 241, 108375.

Dean, B., Kirk, H., Fayet, A., Shoji, A., Freeman, R., Leonard, K., Perrins, C. and Guilford, T. (2015). Simultaneous multi-colony tracking of a pelagic seabird reveals cross-colony utilization of a shared foraging area. Marine Ecology Progress Series, 538, 239–248

DMP Statistical Solutions UK Limited and HiDef Aerial Surveying Ltd (2022). *Berwick Bank Wind Farm Offshore Environmental Impact Assessment. Appendix 11.6: Ornithology Population Viability Analysis Technical Report*. Available at: be40331.pdf (marine.gov.scot).

Furness, R. (2015). Non-breeding season populations of seabirds in UK waters: Population sizes for Biologically Defined Minimum Population Scales (BDMPS). Natural England Commissioned Report 164.

Furness, R.W., Garthe, S., Trinder, M., Matthiopoulos, J., Wanless, S. and Jeglinski, J. (2018). Nocturnal flight activity of northern gannets Morus bassanus and implications for modelling collision risk at offshore wind farms.Environmental Impact Assessment Review 73, 1–6.

Garthe, S. and Hüppop, O. (2004). Scaling possible adverse effects of marine wind farms on seabirds: developing and applying a vulnerability index. Journal of Applied Ecology 41, 724–734.

Harker, J., Humphries, G. and Harvey, J. (2022). Berwick Bank Wind Farm Offshore Environmental Impact Assessment. Appendix 11.1: Baseline Ornithology Technical Report.

HiDef (2023a). Digital video aerial surveys of seabirds and marine megafauna at BlueFloat Energy and Renantis partnership Broadshore: Annual Report March 2022 to February 2023

HiDef (2023b). Digital video aerial surveys of seabirds and marine megafauna at BlueFloat and Renantis partnership Scaraben and Sinclair INTOG: Annual Report March 2022 to February 2023

Horswill, C. & Robinson, R. A. 2015. Review of seabird demographic rates and density dependence. JNCC Report No. 552. Joint Nature Conservation Committee, Peterborough.

ICES (2021) Greater North Sea Ecoregion. Available at: https://www.ices.dk/advice/ESD/Pages/Greater-North-Sea-State-Seabirds.aspx

JNCC (2017). Joint SNCB Interim Displacement Advice Note.

Johnston, A., Cook, A.S.C.P., Wright, L.J., Humphreys, E.M. and Burton, N.H.K. (2014). Modelling flight heights of marine birds to more accurately assess collision risk with offshore wind turbines. Journal of Applied Ecology 51, 31–41.

MacGregor, R.M., King, S., Donovan, C.R., Caneco, B. and Webb, A. (2018). A Stochastic Collision Risk Model for Seabirds in Flight.

Marine Scotland (2020). Moray Firth Marine Protection Area - Business and Regulatory Impact Assessment. Available at: https://www.gov.scot/binaries/content/documents/govscot/publications/impact-assessment/2020/12/moray-firth-special-protection-area-business-regulatory-impact-assessment/documents/marine-scotland-moray-firth-marine-protection-area-business-regulatory-impact-assessment/marine-scotland-moray-firth-marine-protection-area-business-regulatory-impact-assessment/govscot%3Adocument/marine-scotland-moray-firth-marine-protection-area-business-regulatory-impact-assessment.pdf

Marine Scotland (2023). Ossian Array Scoping Opinion.

Mitchell, P.I., Newton, S.F., Ratcliffe, N. & Dunn, T.E. (2004). Seabird Populations of Britain and Ireland, JNCC, Peterborough, ISBN 0 7136 6901 2.

Natural England (2022). Highly Pathogenic Avian Influenza (HPAI) outbreak in seabirds and Natural England advice on impact assessment (specifically relating to offshore wind).

NatureScot (2018). Interim Guidance on apportioning impacts from marine renewable developments to breeding seabird populations in SPAs. Available at: https://www.nature.scot/doc/interim-guidance-apportioning-impacts-marine-renewable-developments-breeding-seabird-populations

NatureScot (2020). Guidance Note 9: Guidance to support Offshore Wind Applications: Seasonal periods for Birds in the Scottish Marine Environment.

NatureScot (2023a). Guidance Note 1: Guidance to support Offshore Wind Applications: Marine Ornithology – Overview.

NatureScot (2023b). Guidance Note 2: Guidance to support Offshore Wind Applications: Advice for Marine Ornithology Baseline Characterisation Surveys and Reporting.

NatureScot (2023c). Guidance Note 3: Guidance to support Offshore Wind Applications: Marine Birds – Identifying theoretical connectivity with breeding site Special Protection Areas using breeding season foraging ranges.

NatureScot (2023d). Guidance Note 4: Guidance to Support Offshore Wind Applications: Ornithology – Determining Connectivity of Marine Birds with Marine Special Protection Areas and Breeding Seabirds from Colony SPAs in the Non-Breeding Season.

NatureScot (2023e). Guidance Note 5: Guidance to support Offshore Wind Applications: Recommendations for marine bird population estimates.

NatureScot (2023f). Guidance Note 6: Guidance to support Offshore Wind Applications – Marine Ornithology Impact Pathways for Offshore Wind Developments.

NatureScot (2023g). Guidance Note 7: Guidance to support Offshore Wind Applications: Marine Ornithology – Advice for assessing collision risk of marine birds.

NatureScot (2023h). Guidance Note 8: Guidance to support Offshore Wind Applications: Marine Ornithology Advice for assessing the distributional responses, displacement and barrier effects of Marine birds.

NatureScot (2023k). Guidance Note 11: Guidance to support Offshore Wind Applications: Marine Ornithology – Recommendations for Seabird Population Viability Analysis (PVA).

Pennycuick, C. (1997). Actual and “optimum” flight speeds: field data reassessed. J. Exp. Biol. 200, 2355.

O'Brien, S. H., Wilson, L. J., Webb, A., & Cranswick, P. A. (2008). Revised estimate of numbers of wintering Red-throated Divers *Gavia stellata* in Great Britain. *Bird Study*, *55*(2), 152-160.

Ossian Offshore Wind Farm Limited (2023). Ossian Array EIA Scoping Report

Ozsanlav-Harris, L., Inger, R. & Sherley, R. (2022). Review of data used to calculate avoidance rates for collision risk modelling of seabirds. JNCC Report 732 (Research & review report), JNCC, Peterborough, ISSN 0963-8091. Published March 2023.

RPS and Royal HaskoningDHV (2022). Berwick Bank Wind Farm: Report to Inform Appropriate Assessment. Available at: https://marine.gov.scot/sites/default/files/221220_-_eor0766_berwick_bank_wind_farm_-_riaa_part_3_spa_assessment_-_signed.pdf.

Searle, K.R., Mobbs, D.C., Butler, A., Furness, R.W., Trinder, M.N., Daunt, F. (2018). Finding out the fate of displaced birds. Scottish Marine and Freshwater Science. 9(8): 149.

Searle, K., Mobbs, D., Daunt, F., & Butler, A. (2019). A Population Viability Analysis Modelling Tool for Seabird Species. Centre for Ecology & Hydrology report for Natural England. Natural England Commissioned Report NECR274

Skov, H., Heinänen, S., Norman, T., Ward, R.M., Méndez-Roldán, S. & Ellis, I. (2018). ORJIP Bird Collision and Avoidance Study. Final report – April 2018. The Carbon Trust. United Kingdom. 247 pp.

SNCBs (2022). Joint SNCB Interim Displacement Advice Note. Available at: https://data.jncc.gov.uk/data/9aecb87c-80c5-4cfb-9102-39f0228dcc9a/joint-sncb-interim-displacement-advice-note-2022.pdf

SNH (2009a). Troup, Pennan and Lion's Head SPA Citation (including Marine Extension).

SNH (2009b). Buchan Ness to Collieston Coast SPA Citation (including Marine Extension).

SNH (2017). East Caithness Cliffs SPA Citation (including Marine Extension).

SSE Renewables (2022). Berwick Bank Wind Farm Offshore Environmental Impact Assessment. Appendix 11.8: Offshore and Intertidal Ornithology Road Map. beb0ab1.pdf (marine.gov.scot)

Vallejo, G., Robbins, J., Hickey, J., Moullier, A., Slater, S. and Dinwoodie, I. (2022). Berwick Bank Wind Farm Offshore Environmental Impact Assessment. Appendix 11.4, Annex H: Sensitivity Analysis of Parameters and Assumptions in the SeabORD model.

Waggit, J. J., Evans, P. G. H., Andrade, J., Banks, A. N., Boisseau, O., Bolton, M., Bradbury, G., Brereton, T., Camphuysen, C. J., Durinck, J., Felce, T., Fijn, R.C., Garcia-Baron, I., Garthe, S., Geelhoed, S. C. V., Gilles, A., Goodall, M., Haelters, J., Hamilton, S., Hartny-Mills, L., Hodgins, N., James, K., Jessopp, M., Kavanagh, A. S., Leopold, M., Lohrengel, K., Louzao, M., Markones, N., Martínez-Cedeira, J., Cadhla, O. Ó ., Perry, S. L., Pierce, G. J., Ridoux, V., Robinson, K. P., Begoña Santos, M., Saavedra, C., Skov, H., Stienen, E. W. M., Sveegaard, S., Thompson, P., Vanarmen, N., Wall, D., Webb, A., Wilson, J., Wanless, S. and Hiddink, J. G. (2019). Distribution maps of cetacean and seabird populations in the North-East Atlantic. Journal of Applied Ecology 57:253–269.

Wakefield, E.D., Owen, E., Baer, J., Carroll, M.J., Daunt, F., Dodd, S.G., Green, J.A., Guilford, T., Mavor, R.A., Miller, P.I., Newell, M.A., Newton, S.F., Robertson, G.S., Shoji, A., Soanes, L.M., Votier, S.C., Wanless, S. and Bolton, M. (2017). Breeding density, fine-scale tracking, and large-scale modeling reveal the regional distribution of four seabird species. Ecological Applications 27, 2074–2091

Wernham, C.V.,Toms, M. P., Marchant, J. H., Clark, J. A., Siriwardena, G. M., & Baillie, S. R. (eds.) 2002. The Migration Atlas: Movements of the Birds of Britain and Ireland. Poyser, London.

Woodward, I., Thaxter, C.B., Owen, E., Cook, A.S.C.P. (2019). Desk-based revision of seabird foraging ranges used for HRA screening. BTO Research Report 724.

WWT (2014). Strategic Assessment of Collision Risk of Scottish Offshore Wind Farms to Migrating Birds. Scottish Marine and Freshwater Science Report, Vol. 5 No. 12.

10 Commercial Fisheries

10.1 Introduction

860. This chapter considers the scope of potential impacts of the construction, operation and maintenance, and decommissioning phases of the Broadshore Hub Wind Farm Development Areas (WFDAs) on commercial fisheries.

861. This chapter provides an overview of the existing environment and further sets out the methodology and approach to assessing effects on commercial fisheries in the Broadshore Hub WFDAs Environmental Impact Assessment (EIA) Report. This chapter has been prepared by NiMa Consultants Limited.

862. For the purpose of this Broadshore Hub WFDAs Scoping Report, 'commercial fishing' is defined as any form of fishing activity legally undertaken where the catch is sold for taxable profit.

863. This commercial fisheries chapter should be read in conjunction with the following chapters in the Broadshore Hub WFDAs Scoping Report:

- **Chapter 7: Fish and Shellfish Ecology;**
- **Chapter 11: Shipping and Navigation;** and
- **Chapter 19: Major Accidents and Disasters.**

864. This commercial fisheries chapter is likely to have key inter-relationships with the above receptors, which will be considered where relevant in the Broadshore Hub WFDAs EIA Report.

10.2 Legislation, Policy and Guidance

865. **Table 10.1** sets out the legislation, policy and guidance which have been considered in the preparation of this chapter, and will be considered within the Broadshore Hub WFDAs EIA Report where appropriate. The overarching policy and legislation relevant to the Broadshore Hub WFDAs is described in **Chapter 2: Policy and Legislative Context**.

Table 10.1: Summary of Relevant Legislation, Policy and Guidance for Commercial Fisheries

Relevant Legislation, Policy or Guidance	Relevance to the Assessment
Policy	
National Marine Plan (NMP) (Scottish Government, 2015)	Contains sector-specific policies relevant to offshore wind and commercial fisheries.

Relevant Legislation, Policy or Guidance	Relevance to the Assessment
Sectoral Marine Plan (SMP) (Scottish Government, 2020)	Identifies plan option areas for offshore wind farm development and identifies key consenting issues associated with development.
Regional Marine Plan (RMP) (in progress)	Will focus on regional marine planning and conservation issues and will be developed in line with the NMP and SMP.
Guidance	
Good Practice Guidance for assessing fisheries displacement by other licensed marine activities (Xodus, 2022)	In addition to the general approach and guidance outlined in **Chapter 4: Approach to Scoping and Environmental Impact Assessment**, the assessment of potential impacts on commercial fisheries receptors will also comply with the listed guidance documents where they are relevant to this chapter.
Best Practice Guidance for Fishing Industry Financial and Economic Impact Assessments (United Kingdom Fisheries Economic Network and Seafish, 2012)	
Fisheries Liaison with Offshore Wind and Wet Renewables group (FLOWW) Recommendations for Fisheries Liaison: Best Practice guidance for offshore renewable developers (FLOWW, 2014 and noted to be currently in the process of being updated; Department for Business, Enterprise and Regulatory Reform; BERR, 2008)	
FLOWW Best Practice Guidance for Offshore Renewables Developments: Recommendations for Fisheries Disruption Settlements and Community Funds (FLOWW, 2015)	
Options and opportunities for marine fisheries mitigation associated with wind farms (Blyth-Skyrme, 2010a)	
Developing guidance on fisheries Cumulative Impact Assessment for wind farm developers (Blyth-Skyrme, 2010b)	
Guidelines for data acquisition to support marine environmental assessments of offshore renewable energy projects. Contract report: ME5403 (Cefas, 2012)	
Fisheries Liaison Guidelines - Issue 6 (UK Oil and Gas, 2015)	
Fishing and Submarine Cables - Working Together (International Cable Protection Committee, 2009)	
Offshore Wind Farms - Guidance Note for Environmental Impact Assessment in respect of Food and Environmental Protection Act (FEPA) and Coast Protection Act (CPA) requirements (Cefas), Marine Consents and Environment Unit (MCEU), DEFRA and Department of Trade and Industry (DTI), 2004)	

10.3 Consultation

866. Consultation undertaken to date for the Broadshore Hub WFDAs relevant to commercial fisheries is provided in **Table 10.2** below.

Table 10.2: Consultation Relevant to Commercial Fisheries

Consultee	Date/Document	Comment	How Comment is Addressed
Marine Directorate – Licensing Operations Team (MD-LOT) & Marine Directorate – Science, Evidence, Data and Digital (MD-SEDD)	13th September 2023, Scoping Workshop	MD-SEDD advised that heatmaps have been published on the National Marine Plan Interactive (NMPi) for small fishing boats (<12m in length).	Noted, the data will be utilised in developing the commercial fisheries baseline and presented in the Commercial Fisheries Technical Report in the Broadshore Hub WFDAs EIA Report.
	13th September 2023, Scoping Workshop	MD-SEDD agreed that proposed baseline data sources are acceptable. MD-SEDD advised that recently representatives from fishing industry have been requesting that 10 years data is used (to account for impacts of COVID-19).	Long term environmental and climatic changes may be expected to be detectable within a five-year time series but may benefit from longer-term analysis dependant on the target species (for example, where king scallop (*Pecten maximus*) are a relevant target species, analysis of landings across a seven to ten-year period is proposed to capture the cyclical nature of their productivity and associated fishery). Inclusion of such longer-term analysis will be informed by ongoing stakeholder consultation. See **Section 10.4.2** for further information.
Scottish Fishermen's Federation (SFF) and Scottish White Fish Producers Association (SWFPA)	20th March 2023 1st August 2023 26th September 2023	Request for early consultation with local fishers. Raised concerns regarding the interaction of the Sinclair WFDA and Scaraben WFDA with nephrops fishing grounds. The methodology for commercial fisheries in the Broadshore Hub WFDAs Scoping Report was discussed on 26th September 2023, and forwarded post-meeting. Fishers were invited to	Early consultation held with local fishers on 9th and 10 May 2023. A change to the Sinclair WFDA boundary is under consideration but not yet confirmed. The original and proposed revised Sinclair WFDA boundaries are shown in **Figure 1.2** in **Appendix 1**. Whilst both boundaries fall within the Broadshore Hub WFDAs Scoping Boundary (ensuring the Scoping Opinion applies to both boundaries), only the final Sinclair WFDA boundary will be assessed

Consultee	Date/Document	Comment	How Comment is Addressed
		comment prior to finalisation of the Broadshore Hub WFDAs Scoping Report.	within the Broadshore Hub WFDAs EIA Report The proposed change would minimise interaction with the nephrops fishing grounds, as shown in **Figure 10.4** in **Appendix 1.** Comments are invited from all interested parties on the alternative Sinclair WFDA boundary.
Local fishers	9th May 2023 10th May 2023	Consultation events held in Peterhead and Fraserburgh respectively, to discuss fisher activity within and around the Broadshore Hub WFDAs and a number of options for the Broadshore Hub Offshore Transmission Development Area (OfTDAs).	Fishers provided information on their activities around the Broadshore Hub WFDAs and Broadshore Hub OfTDAs which the Applicants will consider in the site selection process. A change to the Sinclair WFDA boundary is under consideration but not yet confirmed. The original and proposed revised Sinclair WFDA boundaries are shown in **Figure 1.2** in **Appendix 1**. Whilst both boundaries fall within the Broadshore Hub WFDAs Scoping Boundary (ensuring the Scoping Opinion applies to both boundaries), only the final Sinclair WFDA boundary will be assessed within the Broadshore Hub WFDAs EIA Report.

10.4 Existing Environment

10.4.1 Study Area

867. The Broadshore Hub WFDAs is located within the southwest portion of the International Council for the Exploration of the Seas (ICES) Division 4a (northern North Sea) statistical area; within UK exclusive economic zone (EEZ) waters. For the purpose of recording commercial fisheries landings, ICES Division 4a is divided into statistical rectangles, of which the Broadshore Hub WFDAs overlaps with 45E8. For the purposes of this Broadshore Hub WFDAs Scoping Report, the commercial fisheries local study area comprises ICES rectangle 45E8.

868. While the commercial fisheries study areas illustrated in **Figure 10.1** of **Appendix 1** focuses on the Broadshore Hub WFDAs overlap with ICES rectangles, a wider regional study area will be considered for consideration of displacement impacts within the Broadshore Hub WFDAs EIA

Report. It is proposed that the commercial fisheries regional study area will also include those ICES rectangles immediately adjacent to the commercial fisheries local study area, as indicated in **Figure 10.1** of **Appendix 1**.

10.4.2 Data and Information Sources

869. **Table 10.3** sets out the information and data sources which have been considered in the preparation of this chapter, and will be considered within the Broadshore Hub WFDAs EIA Report where relevant matters are scoped in.

Table 10.3: Summary of Key Data and Information Sources for Commercial Fisheries

Dataset	Year(s)	Description
UK annual fisheries landings statistics Marine Management Organisation (MMO), 2018 to 2022 (MMO, 2023a) and 2011 to 2017 (MMO, 2018).	2018 to 2022 2011 to 2017	Fisheries landings data for registered fishing vessels landing to their home nation ports. Note that the most recent data has been presented in this Broadshore Hub WFDAs Scoping Report, but that longer term datasets will be analysed within the Broadshore Hub WFDAs EIA Report.
UK Vessel Monitoring System (VMS) data MMO, 2020 (MMO, 2023b)	2020	VMS data for fishing vessels greater than 15 m in length. Note that UK vessels ≥12 m in length have VMS on board, however, to date, the MMO provide amalgamated VMS datasets for ≥15 m vessels only. VMS data sourced from MMO displays the first sales value (£) of catches. Note that the most recent data has been presented in this Broadshore Hub WFDAs Scoping Report, but that longer term datasets will be analysed within the Broadshore Hub WFDAs EIA Report.
EU annual fisheries landings statistics Scientific, Technical and Economic Committee for Fisheries (STECF), 2004 to 2016 (EU DCF, 2020)	2004 to 2016	Fisheries landings data for registered fishing vessels landing to their home nation ports.
EU VMS data ICES, 2016 to 2020 (ICES, 2022)	2016 to 2020	VMS data for fishing vessels greater than 12 m in length. VMS data sourced from ICES displays the surface Swept Area Ratio of catches by different gear types and covers EU (including UK) registered vessels 12 m and over in length. Surface Swept Area Ratio indicates the number of times in an annual period that a demersal fishing gear makes contact with (or sweeps) the seabed surface. Surface Swept Area Ratio provides a proxy for fishing intensity.
Fisheries datasets Marine Scotland National Marine Plan Interactive (NMPi), various publication dates (Marine	Various temporal coverage	Fisheries datasets available from the Marine Scotland MAPS NMPi, including ScotMap data and heatmaps for activity by small fishing boats (<12m in length).

Dataset	Year(s)	Description
Scotland MAPS NMPI, 2023)		
Fishing vessel route density data European Maritime Safety Agency (EMSA, 2023)	2019 to 2022	Fishing vessel route density, based on vessel Automatic Identification System (AIS) positional data. AIS is required to be fitted on fishing vessels ≥15 m length. Note that the most recent data has been presented in this Broadshore Hub WFDAs Scoping Report, but that longer term datasets will be analysed within the Broadshore Hub WFDAs EIA Report.
Sectoral Marine Plan (Scottish Government, 2020)	Various temporal coverage	Description of regional commercial fisheries activity.
Fisheries activity mapping in the North and East Coast Regional Inshore Fisheries Group (RIFG) area (North Atlantic Fisheries College (NAFC) Marine Centre University of Highlands and Islands (UHI), 2021)	Various temporal coverage	Mapping of fishing activity and critical habitats of key species within 12 nautical miles (nm) of the coast in the North and East Coast RIFG area.

870. It should be noted that the quantitative datasets identified in **Table 10.3** may not capture all commercial fisheries activity in the commercial fisheries study areas. For instance, the VMS datasets only covers vessels ≥12 m (ICES data) or ≥15 m (MMO data) in length. Note that UK vessels ≥12 m in length have VMS on board, however, to date, the MMO provide amalgamated VMS datasets for ≥15 m vessels only.

871. However, in addition to VMS data, other published data does provide a useful insight into commercial fisheries activity undertaken in inshore areas and by smaller vessels not captured by VMS data (e.g., ScotMap inshore fisheries mapping and heatmaps for small fishing boats, <12m in length from the NMPi) and will be utilised where appropriate. Consultation with fisheries stakeholders and industry is expected to further inform assessment in the Broadshore Hub WFDAs EIA Report.

872. Consultation with representatives of fishermen's associations and organisations will be undertaken to seek to corroborate the findings of desk-based baseline data analysis and to provide insight into specific fishing grounds and activity of any vessels active in the area. Consultation will also be important to inform gear specifications for vessels active in the commercial fisheries study areas, which will allow a full understanding of how different vessels and different gear configurations may be affected.

873. Variations and trends in commercial fisheries activity are an important aspect of the baseline assessment and is the principal reason for considering up to five years of key baseline data, and

longer timeseries where possible. Available landings data spans the period of the COVID-19 pandemic, which is understood to have temporarily affected market demand and supply chains. Furthermore, changes in fishing patterns resulting from the withdrawal of the UK from the EU would also be reflected in data sets for 2021 onwards. Long term environmental and climatic changes may be expected to be detectable within the five-year time series but may benefit from longer-term analysis dependant on the target species. Inclusion of such longer-term analysis will be informed by stakeholder consultation.

10.4.3 Commercial Fisheries in the Local and Regional Study Areas

874. An understanding of the commercial fisheries baseline environment within the commercial fisheries study areas has been developed from utilisation of the available literature and data sources presented in **Section 10.4.2**. This section includes a description of the commercial fish targeted by vessels registered in UK, Norway, Sweden, Denmark and Ireland and landed into UK ports (for all vessels) and non-UK ports (for UK vessels only).

10.4.3.1 Local Study Area

875. Landings from the commercial fisheries local study area had an annual average landings value of approximately £4.4 million across the years 2018 to 2022 (MMO, 2023a), with landings values peaking in 2019 at £9.5 million and being at their lowest in 2020 at £2.5 million (likely due to a combination of COVID-19 restrictions and the UK EU-exit). Over the same time period, the annual average weight of landings from the commercial fisheries local study area was just under 2,500 tonnes, peaking at approximately 7,000 tonnes in 2019.

876. Landings of demersal finfish species dominated the catch from the commercial fisheries local study area, accounting for 45% of the total landed value and 46% of landed weight (based on 2018-2022 data from MMO, 2023a). Landings of pelagic fish species accounted for 29% of the total landed value, and shellfish species for 26.5%. Scottish vessels were responsible for the majority (86%) of landings, with landings also being made by vessels registered in England and to a much lesser extent vessels registered in Sweden, Norway and Northern Ireland. The main landing ports local to the Broadshore Hub WFDAs include (but are not limited to) Fraserburgh, Peterhead, Macduff and Buckie.

877. **Plate 10.1** and **Plate 10.2** show the top 12 species landed from the commercial fisheries local study area by value and weight respectively, from 2018 to 2022 (MMO, 2023a).

878. **Plate 10.3** shows the landed value over the same period from the commercial fisheries local study area by nation of vessel registration and gear type. The key species landed are mackerel *Scomber scombrus*, nephrops *Nephrops norvegicus*, monkfish *Lophius budegassa* and *L. piscatorius*, haddock *Melanogrammus aeglefinus*, whiting *Merlangius merlangus*, cod *Gadus morhua* and brown crab *Cancer pagurus*.

879. Over the five-year period analysed, mackerel landings were only recorded in significant quantities in 2019 (value of £6.2 million). The significant annual variation in landings of mackerel represent patterns typical for pelagic species that swim in fast moving shoals and may not be specifically linked to areas or habitats when caught in the water column. First sales value and weight of nephrops landings have fluctuated over the 2018 to 2022 period, with an annual landed value of £350,000 in 2020 and of £1 million in 2019. Across the 2013 to 2017 time series, landings of

nephrops similarly fluctuated, having an average annual value of £590,000 and ranging from £177,000 in 2013 to £976,000 in 2016. Landed values and weights of monkfish and haddock have also been variable across the time period, with five-year averages of £679,000 and £575,000 respectively.

880. Landing statistics indicate that 95% of landings by value from the commercial fisheries local study area are made by vessels over 15 m in length, with the majority of landings by value being made by vessels between 18 m and 24 m length.

881. Landing trends per month will be analysed within the Broadshore Hub WFDAs EIA Report for individual species at both an ICES rectangle level, and by port of landing to identify which fleet and fishery operate at specific times of the year.

Plate 10.1: Top Twelve Species by Value (First Sales in Great British Pound) from 2018 to 2022 Landed from the Commercial Fisheries Local Study Area for Vessels Registered in UK, Norway, Sweden, Denmark and Ireland, Landing into UK Ports (data source: MMO, 2023a)

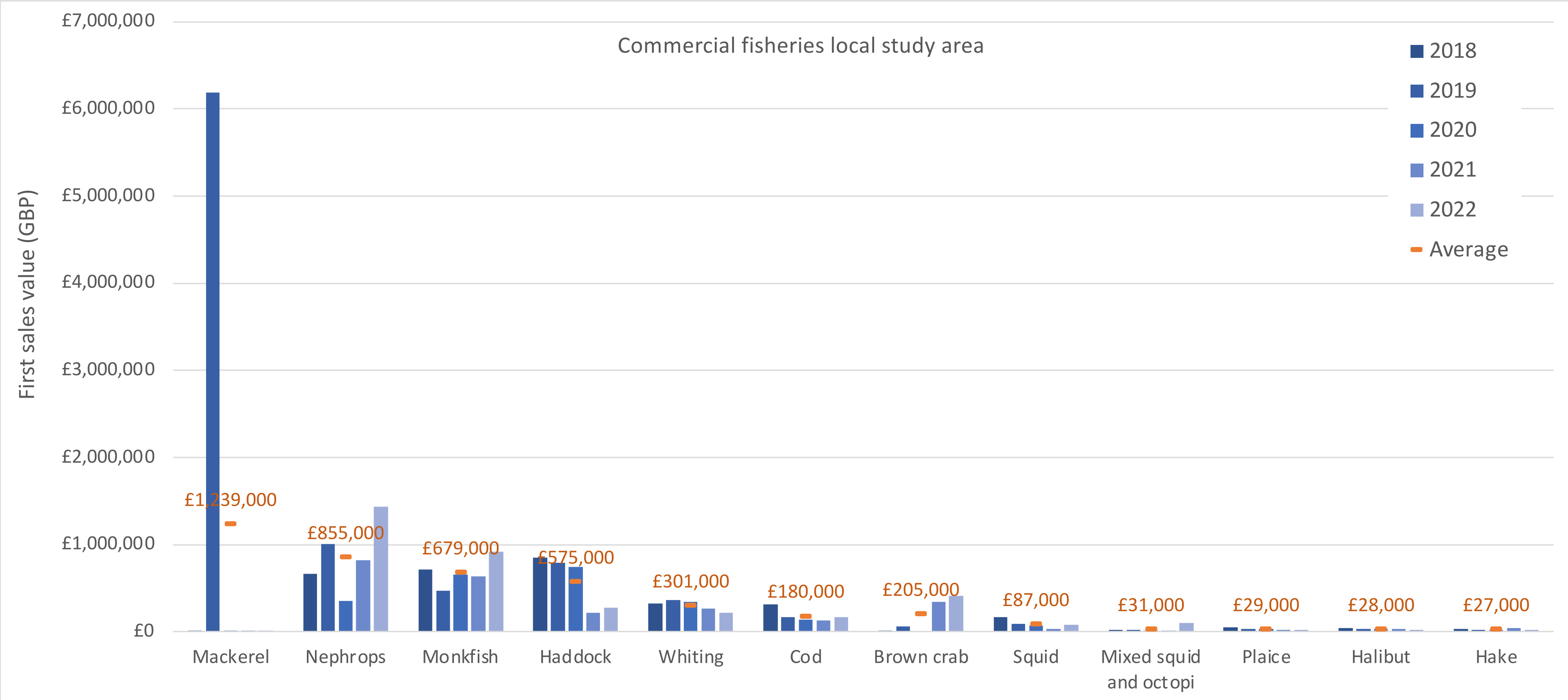


Plate 10.2: Top Twelve Species by Weight (Tonnes) from 2018 to 2022 Landed from the Commercial Fisheries Local Study Area for Vessels Registered in UK, Norway, Sweden, Denmark and Ireland, Landing into UK Ports (data source: MMO, 2023a)

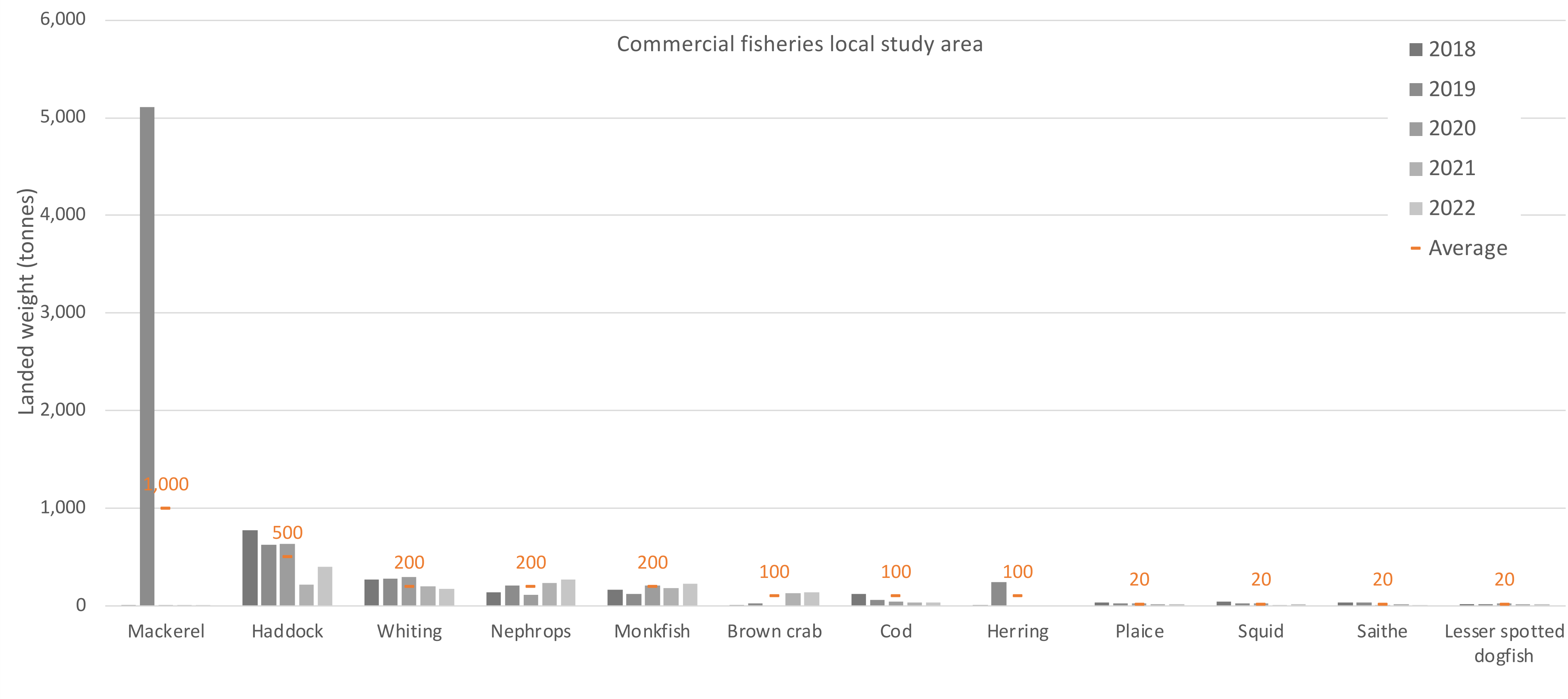
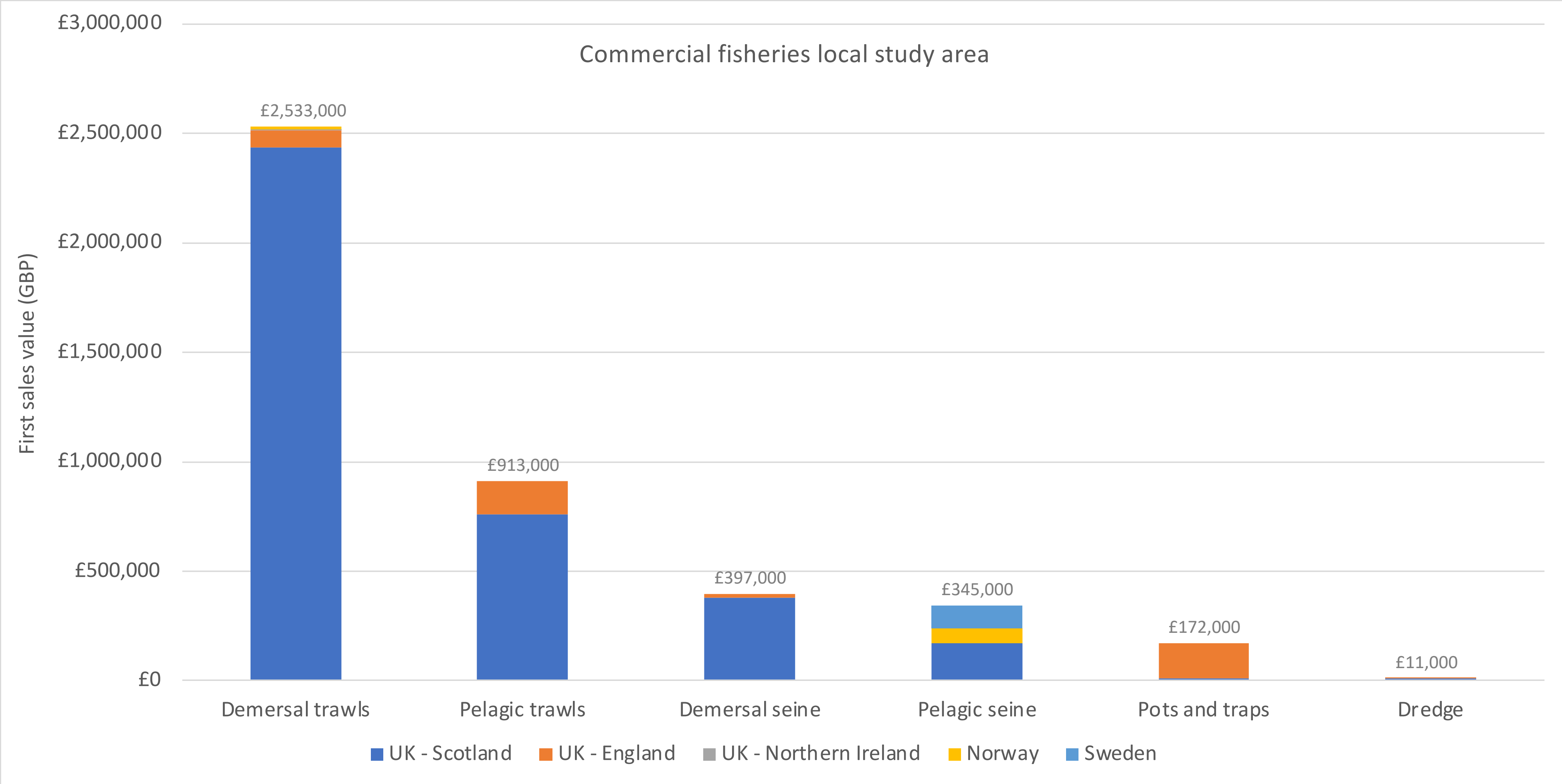


Plate 10.3: Average Landed Value from 2018 to2022 (First Sales in Great British Pound) from the Commercial Fisheries Local Study Area by Nation and Gear Type for Vessels Registered in UK, Norway, Sweden, Denmark and Ireland, Landing into UK Ports (data source: MMO, 2023a)



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10.4.3.2 Regional Study Area

882. **Plate 10.4** and **Plate 10.5** show the top 12 species landed from the commercial fisheries regional study area by value and weight respectively, from 2018 to 2022 (MMO, 2023a).

883. **Plate 10.6** shows the landed value over the same period from the commercial fisheries regional study area by vessel nationality and gear type. Key target species and active gear types are broadly aligned with those in the commercial fisheries local study area, with pelagic trawl and purse seine used to target mackerel and demersal trawls used to target Nephrops, haddock and mixed demersal fish species, and pots used to target brown crab. Within the commercial fisheries regional study area, landings data additionally indicates the presence of vessels deploying dredge gear to target king scallop *Pecten maximus*.

884. Landings data for non-UK vessels catching in the commercial fisheries regional study area and landing into UK ports indicates the potential for fishing activity by Norwegian, Swedish, Danish and Irish vessels. The majority of non-UK fleet activity is focused on purse seine fishery targeting mackerel.

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Plate 10.4: Top Twelve Species by Value (First sales in Great British Pound) from 2018 to 2022 Landed from the Commercial Fisheries Regional Study Area for Vessels Registered in UK, Norway, Sweden, Denmark and Ireland, Landing into UK Ports (data source: MMO, 2023a)

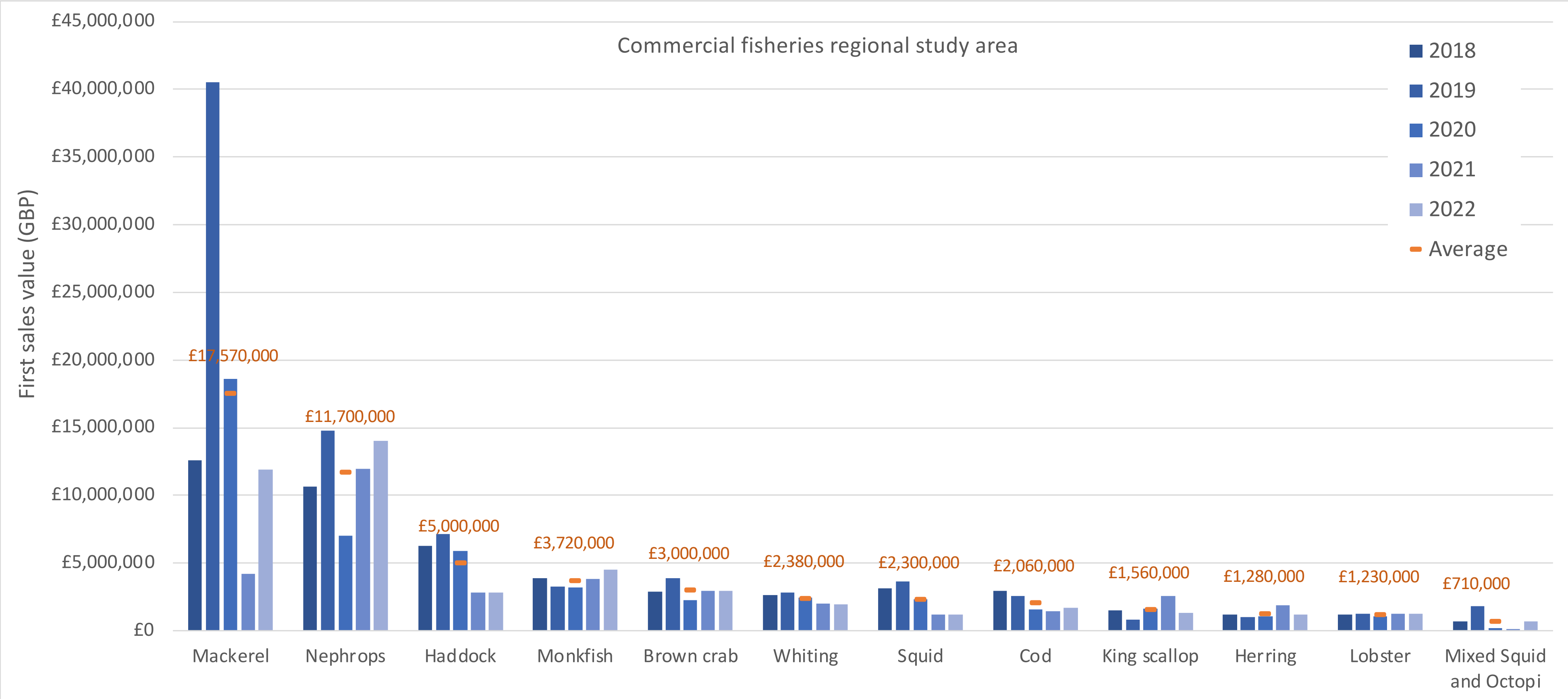


Plate 10.5: Top Twelve Species by Weight (tonnes) from 2018 to 2022 Landed from the Commercial Fisheries Regional Study Area for Vessels Registered in UK, Norway, Sweden, Denmark and Ireland, Landing into UK Ports (data source: MMO, 2023a)

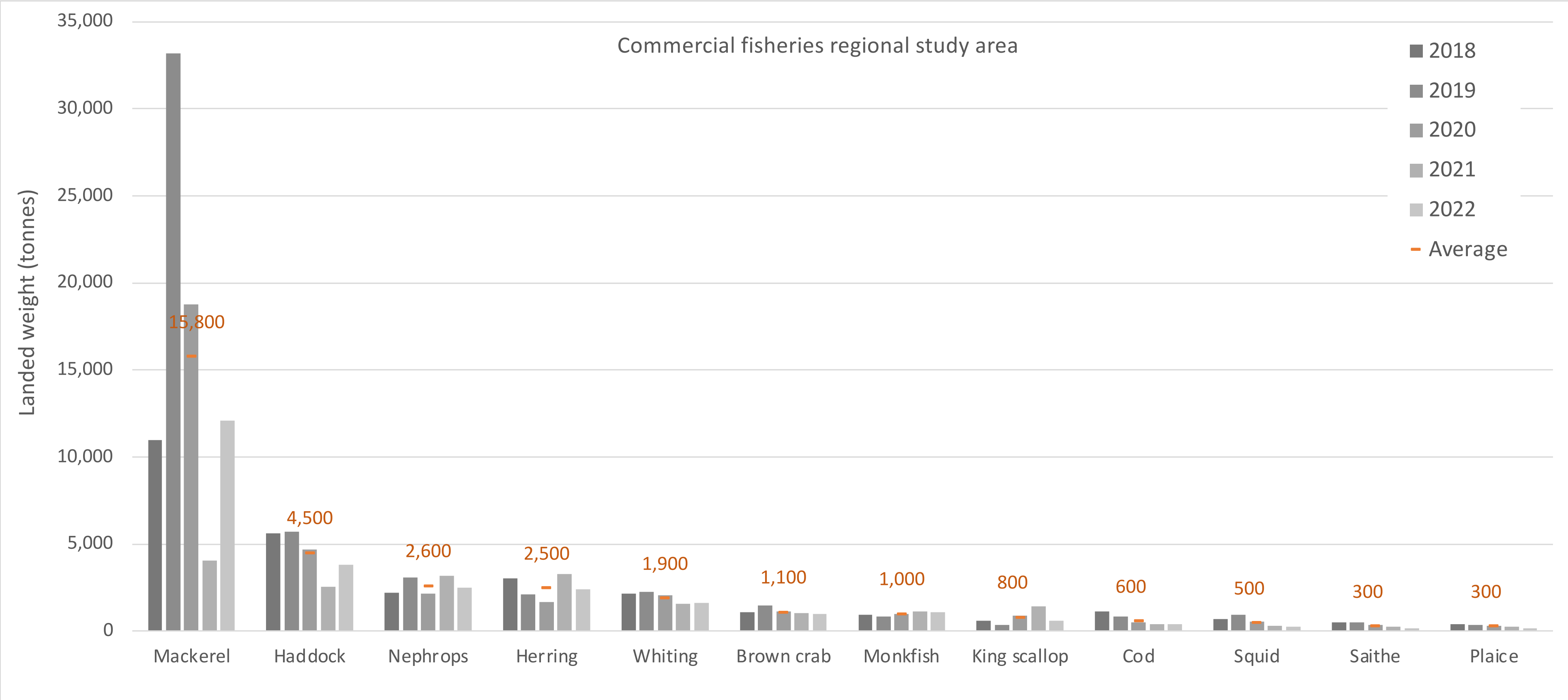
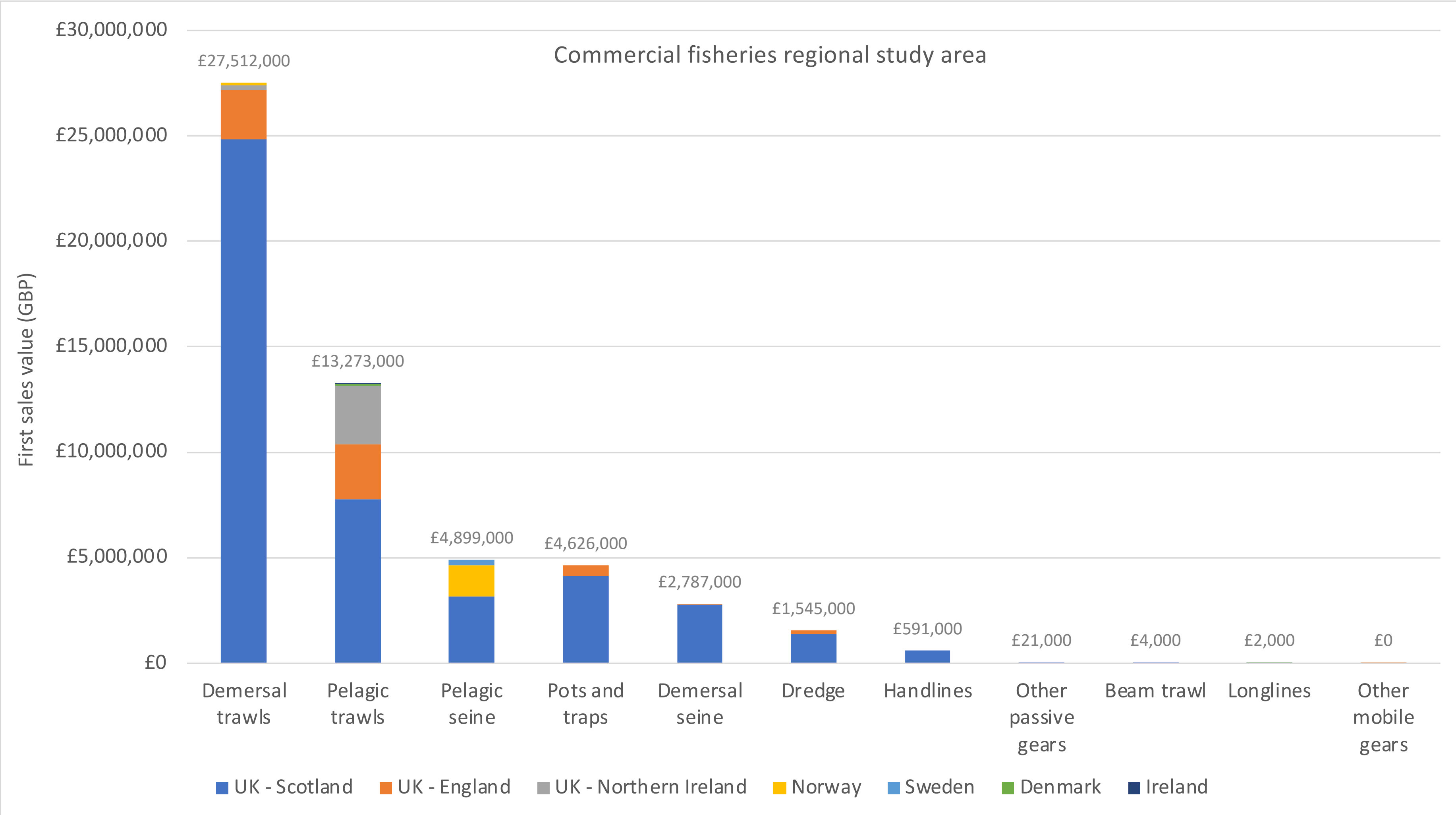


Plate 10.6: Average Landed Value (2018-2022) from the Commercial Fisheries Regional Study Area by Nation and Gear Type for Vessels Registered in UK, Norway, Sweden, Denmark and Ireland, Landing into UK Ports (data source: MMO, 2023a)



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885. In addition to landings data, spatial data describing fishing activity is available, including AIS fishing vessel route density data. AIS is required to be fitted on fishing vessels ≥15 m length. The data presented in **Figure 10.2** in **Appendix 1** is specific to fishing vessels and indicates the route density per square km during 2022. This data does not distinguish between transiting vessels and active fishing but does provide a useful source to corroborate fishing grounds. Data indicates fishing vessel presence within the Broadshore Hub WFDAs, with sustained fishing vessel presence immediately east of the Broadshore Hub WFDAs. Activity is noted along the edges of the Broadshore Hub WFDAs Scoping Boundary, specifically the north-east, east and south-east boundaries.

886. VMS and spatial data to map fishing activity is available for UK and EU fleets. VMS data sourced from ICES displays the surface Swept Area Ratio of catches by different gear types and covers EU (including UK) registered vessels 12 m and over in length. Surface Swept Area Ratio indicates the number of times in an annual period that a demersal fishing gear makes contact with (or sweeps) the seabed surface. Surface Swept Area Ratio provides a proxy for fishing intensity and has been analysed to determine an average annual Swept Area Ratio based on data from 2016 to 2020. **Figure 10.3** in **Appendix 1** presents demersal otter trawl fishing activity within the commercial fisheries regional study area. The fishing ground identified within AIS data immediately east of the Broadshore Hub WFDAs is also evidenced within the VMS data for demersal otter trawl. This is understood to be a nephrops ground (also shown **Figure 10.4** in **Appendix 1**) in that is routinely targeted as part of the Moray Firth functional unit fishery[43].

887. VMS data from the MMO is presented in **Figure 10.5** in **Appendix 1** for UK demersal otter trawl vessels 15m and over in length. This data corroborates the ICES VMS dataset, indicating an active fishery within the northern portion of the Broadshore Hub WFDAs, as well as in the very south.

888. VMS data for the dredge fishery is presented in **Figure 10.6** and **Figure 10.7** in **Appendix 1** from the ICES and MMO datasets respectively. The MMO data is presented for the annual period of 2016, because this represents the highest level of activity in the 2016 to 2020 timeseries. Dredge activity is primarily immediately west of the Broadshore Hub WFDAs, with a hot-spot of activity in the very southern section of the Broadshore Hub WFDAs.

889. VMS data is also presented for the pelagic trawl fleet (**Figure 10.8** in **Appendix 1**) indicating activity across the commercial fisheries regional study area; and for the potting fleet (**Figure 10.9** in **Appendix 1**), which shows limited activity across the Broadshore Hub WFDAs.

890. The mapped spatial data presented in **Appendix 1** is aligned with that presented in the University of the Highlands and Islands (UHI) study, which mapped fisheries and habitats in the North and East Coast RIFG area (Shelmerdine and Mouat, 2021).

[43] As discussed in **Section 3.10.3** in **Chapter 3: Project Description**, a change to the Sinclair WFDA is under consideration but not yet confirmed. The original and proposed revised Sinclair WFDA boundaries are shown in **Figure 10.4** in **Appendix 1**, which shows that the boundary change would significantly reduce overlap with nephrops grounds.

10.4.4 Commercial Fisheries Receptors

891. The key commercial fisheries receptors within the commercial fisheries study areas are identified as follows:

- UK, Norwegian and Swedish pelagic trawlers and purse seiners targeting mackerel;
- UK demersal otter trawlers targeting nephrops, haddock, monkfish, squid and mixed demersal species;
- UK demersal seine targeting haddock, whiting, cod, monkfish and mixed demersal;
- UK potters targeting brown crab; and
- UK dredgers targeting king scallop.

10.5 Potential Impacts

892. The following potential impacts on commercial fisheries are considered in this scoping exercise:

- Reduction in access to, or exclusion from established fishing grounds during construction, operation and maintenance, and decommissioning;
- Displacement leading to gear conflict and increased fishing pressure on adjacent grounds during construction, operation and maintenance, and decommissioning;
- Disturbance of commercially important fish and shellfish resources leading to displacement or disruption of fishing activity during construction, operation and maintenance, and decommissioning;
- Increased vessel traffic associated with the Broadshore Hub WFDAs within fishing grounds leading to interference with fishing activity during construction, operation and maintenance, and decommissioning;
- Additional steaming to alternative fishing grounds for vessels that would otherwise fish within the Broadshore Hub WFDAs during construction, operation and maintenance, and decommissioning; and
- Physical presence of infrastructure and potential exposure of that infrastructure leading to gear snagging during the operation and maintenance phase.

893. **Chapter 7: Fish and Shellfish Ecology** considers impacts on the ecology of fish and shellfish, including species of commercial interest.

894. **Chapter 11: Shipping and Navigation** considers impacts on the navigational safety aspects of fishing activity.

10.5.1 Embedded Mitigation Measures

895. As part of the design process for the Broadshore Hub WFDAs, a number of designed-in measures have been proposed to reduce the potential for impacts on environmental and socioeconomic receptors. These are presented below and in **Appendix 3: Mitigation Register** and will likely evolve over the development process as the EIA progresses and in response to stakeholder consultation.

- Development of and adherence to a Cable Plan (CaP). The CaP will confirm planned cable routing, burial (if applicable) and any additional protection and will set out methods for post-installation cable monitoring.
- A detailed Cable Burial Risk Assessment (CBRA) will be prepared where IACs are proposed to be buried to determine the target burial depth. The burial depths may vary and will be dependant on risk and ground conditions. The CBRA will also highlight instances where adequate burial cannot be achieved and alternative protection is needed.
- Development of and adherence to a Fisheries Management and Mitigation Strategy (FMMS). The FMMS will set out the means of ongoing fisheries liaison through construction and operational phases of the Broadshore Hub WFDAs and detail any mitigation measures to be put in place to limit effects on commercial fisheries activity.
- Development of, and adherence to, a Marine Pollution Contingency Plan (MPCP).
- Appointment of a Fisheries Liaison Officer (FLO). The FLO will support ongoing liaison and ensure clear communication between the Applicants and commercial fisheries during construction phase.
- Development of and adherence to a Navigational Safety Plan (NSP). The NSP will describe measures put in place by the Broadshore Hub WFDAs related to navigational safety, including information on Safety Zones, charting, construction buoyage, temporary lighting and marking, and means of notification of Broadshore Hub WFDAs activity to other sea users (e.g., via Notice to Mariners). Where appropriate, guard vessels will be used to ensure adherence with Safety Zones or advisory passing distances
- Advance warning and accurate location details of construction, maintenance and decommissioning operations, associated Safety Zones and advisory passing distances will be given via Notices to Mariners and Kingfisher Bulletins.
- All offshore infrastructure associated with the Broadshore Hub WFDAs will be appropriately marked on UK Hydrographic Office Admiralty charts.
- Development of and adherence to a Lighting and Marking Plan (LMP). The LMP will confirm compliance with legal requirements with regards to shipping, navigation and aviation marking and lighting. Failures of the lighting and marking in the Broadshore Hub WFDAs will be appropriately reported and rectified as soon as practicable. Interim hazard warnings will be put in place as required.
- Development and adherence to a Development Specification and Layout Plan (DSLP).
- Adherence to best practice guidance with regards to fisheries liaison and procedures in the event of interactions between the Broadshore Hub WFDAs and fishing activities (e.g., FLOWW, 2014; 2015).

- Participation in any fisheries working group to assist with liaison between the Applicants and the fishing community.
- Application for and use of Safety Zones during construction and major repairs. Where appropriate, guard vessels will also be used to ensure adherence with Safety Zones or advisory passing distances, as defined by risk assessment, to mitigate any impact which poses a risk to surface navigation during construction, operation and maintenance, and decommissioning phases. Such impacts may include partially installed structures or cables, extinguished navigation lights or other unmarked hazards. The Broadshore Hub WFDAs EIA Report will include an assessment of the proposed approach to Safety Zones at the point of application. The total number of safety zones to be established at the same time has not been yet defined.
- Any objects dropped on the seabed during works associated with the Broadshore Hub WFDAs which may pose a hazard will be reported in line with MD-LOT procedures (Marine Scotland, 2020) and objects will be recovered where they pose a hazard to other marine users and where recovery is possible.
- Development of, and adherence to, a Vessel Management Plan (VMP). The VMP will set out the numbers, types and specifications of vessels to be used during construction, as well as how vessel management will be coordinated.
- Development of a Navigational Risk Assessment (see **Chapter 11: Shipping and Navigation** for details).
- Development of, and adherence to, an Emergency Response Cooperation Plan (ERCoP).
- The Applicants will ensure compliance with the Regulatory Expectations on Moorings for Floating Wind and Marine Devices (MCA and Health and Safety Executive, 2017).
- Marine coordination will be implemented to manage project vessels throughout construction, maintenance, and decommissioning periods.
- Broadshore Hub WFDAs vessels will ensure compliance with international marine regulations as adopted by the Flag State, including the COLREGs (International Maritime Organisation; IMO, 1972/77) and SOLAS (IMO, 1974).

896. As a result of the commitment to implement these measures, and to align the Broadshore Hub WFDAs with various standard sectoral practices and procedures, the embedded mitigations are considered inherently part of the design of the Broadshore Hub WFDAs and have, therefore, been included in the consideration of potential impacts presented in **Section 10.7**.

897. The requirement and feasibility of any additional mitigation measures will be dependent on the significance of the effects upon commercial fisheries and will be consulted upon with statutory consultees throughout the EIA process.

10.6 Scoping of Potential Impacts

898. The sections below set out an initial assessment of the likelihood of effects on commercial fisheries due to Broadshore Hub WFDAs activities for the scoping stage of the EIA process. The assessment is based on a combination of the following: the definition of the Broadshore Hub WFDAs at the scoping stage; embedded mitigation (as set out in **Section 10.5.1**); the level of understanding of the baseline at the scoping stage; the existing evidence base for commercial fisheries effects due to Broadshore Hub WFDAs activities; relevant policy; and the professional judgement of qualified commercial fisheries specialists.

10.6.1 Potential Impacts Scoped In

899. **Table 10.4** sets out those impacts on commercial fisheries that are proposed to be 'scoped in' to the Broadshore Hub WFDAs EIA Report, accompanied by a justification for this.

Table 10.4: Impacts 'Scoped In' to the Commercial Fisheries Chapter in the Broadshore Hub WFDAs EIA Report

Impact	Justification
Construction (and Decommissioning)	
Temporary reduction in access to, or exclusion from established fishing grounds	Installation and decommissioning activities have potential to create loss of fishing opportunities. This effect is expected to be localised and short term; furthermore, the operational range of relevant fleets will not typically be limited to the Broadshore Hub WFDAs.
Temporary displacement of fishing activity leading to gear conflict and increased fishing pressure on adjacent grounds	Any reduced access to fishing grounds creates the potential for displacement of fishing activity. This effect is expected to be short-term and the operational range of relevant fleets will not typically be limited to the Broadshore Hub WFDAs.
Disturbance of commercially important fish and shellfish resources leading to displacement or disruption of fishing activity	Installation and decommissioning activities may lead to disturbance of commercially important fish and shellfish resources, which in turn may result in displacement or disruption of a range of fishing activity. Assessment will be informed by the outcomes of the fish and shellfish ecology impact assessment, and it will be assumed that commercial fisheries will be affected as a result of any loss of resources.
Increased vessel traffic associated with the Broadshore Hub WFDAs within fishing grounds leading to interference with fishing activity	Movement of vessels associated with the Broadshore Hub WFDAs adding to the existing volume of marine traffic in the area, may lead to interference of fishing activity. Assessment will be informed by the outcomes of the shipping and navigation impact assessment and Navigational Risk Assessment (NRA)
Physical presence of infrastructure and potential exposure of that infrastructure leading to gear snagging	The presence of partially constructed infrastructure (e.g. IAC/scour protection, subsea cable hub(s)) and other seabed obstacles, may pose a snagging risk to fishing vessels, which could result in loss or damage to fishing gear.

Impact	Justification
Operation and Maintenance	
Long term reduction in access to, or exclusion from established fishing grounds	The presence of offshore infrastructure within the Broadshore Hub WFDAs may result in a loss or restricted access to fishing grounds during the operation and maintenance phase. As floating offshore wind is a relatively new technology, there is limited information available on the scale of this impact. Access to fishing grounds within the Broadshore Hub WFDAs will be dependent on turbine spacing, turbine layout, floating substructure type and station keeping system (SKS) design. In particular, the mooring associated with the SKS and the dynamic IAC design may affect the ability of commercial fishing fleets in deploying fishing gear.
Displacement leading to gear conflict and increased fishing pressure on adjacent grounds	Any reduced access to fishing grounds creates the potential for displacement of fishing activity. This impact is expected to be medium-long term and the operational range of relevant fleets will not typically be limited to the Broadshore Hub WFDAs.
Disturbance of commercially important fish and shellfish resources leading to displacement or disruption of fishing activity	Operation and maintenance of the Broadshore Hub WFDAs may lead to disturbance of commercially important fish and shellfish resources, including electromagnetic fields from IACs, and changes to habitat, and therefore displace or disrupt a range of fishing activity. Assessment will be informed by the outcomes of the fish and shellfish ecology impact assessment, and it will be assumed that commercial fisheries will be affected as a result of any loss of resources.
Increased vessel traffic associated with the Broadshore Hub WFDAs within fishing grounds leading to interference with fishing activity	Movement of vessels associated with operation and maintenance of the Broadshore Hub WFDAs adding to the existing volume of marine traffic in the area, may lead to interference of fishing activity. Assessment will be informed by the outcomes of the shipping and navigation impact assessment and NRA.
Physical presence of infrastructure and potential exposure of that infrastructure leading to gear snagging	The presence of infrastructure associated with operation and maintenance (e.g. IAC/scour protection, subsea cable hub(s)) and other seabed obstacles, may pose a snagging risk to fishing vessels, which could result in loss or damage to fishing gear. The extent of impact may vary depending upon the project design. Standard industry practice and protocol (e.g., seabed infrastructure will be buried and/or marked on nautical charts) will minimise the risk of gear snagging, but it remains likely to be an area of industry concern. Safety aspects associated with this impact, including damage to property and vessel stability, will be considered within the shipping and navigation impact assessment.

10.6.2 Potential Impacts Scoped Out

900. **Table 10.5** sets out those impacts on commercial fisheries that are proposed to be scoped out of the Broadshore Hub WFDAs EIA Report, accompanied by a justification for this.

Table 10.5: Impacts Scoped Out of the Commercial Fisheries Chapter in the Broadshore Hub WFDAs EIA Report

Impact	Justification
Construction (and Decommissioning)	
Additional steaming to alternative fishing grounds for vessels that would otherwise cross through the Broadshore Hub WFDAs	This impact will be localised to Safety Zones and therefore limited deviations to steaming routes are expected. Given adequate notification, it is expected that vessels, which typically have an operational range beyond that of the Broadshore Hub WFDAs (as indicated by VMS data presented above), will be in a position to avoid temporary construction/decommissioning areas with no or minimal impact on their steaming times. As such, the impact has been scoped out of the Broadshore Hub WFDAs EIA Report.
Operation and Maintenance	
Additional steaming to alternative fishing grounds for vessels that would otherwise cross through the Broadshore Hub WFDAs	This impact will be localised to Safety Zones associated with temporary maintenance works on installed structures and advisory safe distances from infrastructure and therefore limited deviations to steaming routes are expected. Given adequate notification, it is expected that vessels, which typically have an operational range beyond that of the Broadshore Hub WFDAs (as indicated by VMS and ScotMap data presented above), will be in a position to avoid temporary maintenance areas around installed infrastructure with no or minimal impact on their steaming times. As such the impact has been scoped out of the Broadshore Hub WFDAs EIA Report.

10.6.3 Potential Cumulative Effects

901. **Chapter 4: Approach to Scoping and Environmental Impact Assessment** details how potential cumulative impacts will be assessed through a Cumulative Effects Assessment (CEA) and gives examples of the projects which are likely to be included in that assessment.

902. Offshore wind projects and other activities, such as subsea cables and pipelines, relevant to the assessment of cumulative impacts on commercial fisheries will be identified through a screening exercise. The potential impacts considered in the cumulative assessment as part of the Broadshore Hub WFDAs EIA Report will be in line with those described for the project-alone assessment, though it is possible that some will be screened out on the basis that the impacts are highly localised (i.e., they occur only within Broadshore Hub WFDAs boundaries) or where management measures in place for the Broadshore Hub WFDAs and other projects will reduce the risk of impacts occurring. Key potential cumulative impacts are expected to result from a loss or restricted access to established fishing grounds and displacement of fishing activity.

903. A number of ScotWind projects will be included within the CEA, as well as the Broadshore Hub OfTDAs. The latest information available for each of the projects 'scoped in' to the CEA will be reviewed, including scoping reports, to understand the potential impact of these projects cumulatively with the Broadshore Hub WFDAs.

904. The CEA for commercial fisheries will consider the maximum adverse design scenario for each of the projects, plans and activities in line with the methodology outlined in **Chapter 4: Approach to Scoping and Environmental Impact Assessment**. A study area of the northern North Sea (ICES division 4a) is proposed for the commercial fisheries CEA.

10.6.4 Potential Transboundary Effects

905. Transboundary impacts are 'scoped in' to the assessment and will be considered based on any potential displacement of fishing activity into the Norwegian EEZ, which is expected to be highly unlikely based on data reviewed within this Broadshore Hub WFDAs Scoping Report.

10.6.5 Summary of Potential Commercial Fisheries Impacts Scoped In or Out

906. **Table 10.6** outlines the commercial fisheries impacts which are proposed to be scoped in and scoped out from the Broadshore Hub WFDAs EIA Report.

Table 10.6: Summary of Potential Impacts Scoped In (✓) or Scoped Out (x) for Commercial Fisheries

Potential Impact	Receptor(s)	Description of Potential Effect	Scoped In or Scoped Out? (✓ or x)			Embedded Mitigation Measures
			Construction	Operation and Maintenance	Decommissioning	
Reduction in access to, or exclusion from established fishing grounds	Commercial fishing fleets identified in **Section 10.5**	Broadshore Hub WFDAs activities have potential to create loss of fishing opportunities	✓	✓	✓	Mitigation measures as set out in **Section 10.5.1**
Displacement leading to gear conflict and increased fishing pressure on adjacent grounds	Commercial fishing fleets identified in **Section 10.5**	Any reduced access to fishing grounds creates the potential for displacement of fishing activity	✓	✓	✓	
Disturbance of commercially important fish and shellfish resources leading to displacement or disruption of fishing activity	Commercial fishing fleets identified in **Section 10.5**	Broadshore Hub WFDAs activities may lead to disturbance of commercially important fish and shellfish resources and therefore displace or disrupt a range of fishing activity	✓	✓	✓	
Increased vessel traffic associated with the Broadshore Hub WFDAs within fishing grounds leading to interference with fishing activity	Commercial fishing fleets identified in **Section 10.5**	Movement of vessels associated with the Broadshore Hub WFDAs adding to the existing volume of marine traffic in the area, may lead to interference of fishing activity	✓	✓	✓	
Additional steaming to alternative fishing grounds for vessels that would otherwise fish within the Broadshore Hub WFDAs;	Commercial fishing fleets identified in **Section 10.5**	This effect will be localised to Safety Zones associated with temporary maintenance works on installed structures and therefore limited deviations to steaming routes are expected	x	x	x	

Potential Impact	Receptor(s)	Description of Potential Effect	Scoped In or Scoped Out? (✓ or x)			Embedded Mitigation Measures
			Construction	Operation and Maintenance	Decommissioning	
Physical presence of infrastructure and potential exposure of that infrastructure leading to gear snagging	Commercial fishing fleets identified in **Section 10.5**	Standard industry practice and protocol (e.g., seabed infrastructure will be buried and/or marked on nautical charts) will minimise the risk of gear snagging, but it remains likely to be an area of industry concern	✓	✓	✓	

10.7 Proposed Approach to Impact Assessment

10.7.1 Guidance

907. In addition to the general approach and guidance outlined in **Chapter 4: Approach to Scoping and Environmental Impact Assessment**, the assessment of potential impacts on commercial fisheries receptors will also comply with the guidance documents presented in **Table 10.1**.

10.7.2 Data Sources

908. Detailed analysis of baseline datasets will be undertaken within the Broadshore Hub WFDAs EIA Report to characterise long-term (i.e., over several years) patterns in commercial fisheries activity across the commercial fisheries study areas and predict potential impacts upon future commercial fishing activities. Data sources include those set out within **Table 10.3**.

909. Consultation with the commercial fishing industry will be undertaken in order to ground-truth available baseline data and gain further understanding of commercial fisheries activity by smaller vessels across the inshore portion of the commercial fisheries study areas. Consultation will be undertaken with a number of relevant stakeholders, including the following:

- Scottish Fishermen's Federation (SFF);
- Scottish White Fish Producers Association (SWFPA);
- North and East Coast Regional Inshore Fisheries Group;
- Other local fishermen's associations and existing commercial fisheries working groups;
- Individual fishermen as identified by the FLO/other means; and
- Any Norwegian and EU Member State representative organisations as identified during baseline data analysis.

910. Analysis of data and the results of consultation will provide an extended baseline characterisation of the commercial fisheries study areas, which will underpin and inform the impact assessment.

911. No site-specific surveys are proposed to inform the commercial fisheries chapter in the Broadshore Hub WFDAs EIA Report.

10.7.3 Assessment Methodology

912. The EIA will follow the general approach outlined in **Chapter 4: Approach to Scoping and Environmental Impact Assessment** of this Broadshore Hub WFDAs Scoping Report. Within the commercial fisheries chapter of the Broadshore Hub WFDAs EIA Report, the overall impact assessment for the Broadshore Hub WFDAs will be presented first. Following this, a summary of each WFDA will be given (i.e. the Broadshore WFDA, Sinclair WFDA, and the Scaraben WFDA).

913. Definitions specific to commercial fisheries in relation to assessing the sensitivity of the receptor and magnitude of an impact will be provided to frame the assessment.

914. Where relevant, the impact assessment will be informed by the outcomes of the fish and shellfish ecology and shipping and navigation assessments.

915. Impacts will be assessed for each relevant fleet/fishery 'scoped in' to the Broadshore Hub WFDAs EIA Report.

10.8 Scoping Questions to Consultees

916. The following questions are posed to consultees to help them frame and focus their response to the commercial fisheries scoping exercise, which will in turn inform the Scoping Opinion:

- Do you agree with the study areas defined for commercial fisheries?
- Do you agree with the data sources to be used to characterise the commercial fisheries baseline within the Broadshore Hub WFDAs EIA Report?
- Are there any additional data sources or guidance documents that should be considered?
- Do you agree that the embedded mitigation measures described provide a suitable means for managing and mitigating the potential effects of the Broadshore Hub WFDAs on commercial fisheries receptors?
- Do you agree with the scoping in and out of impact pathways in relation to commercial fisheries?
- Do you agree with the proposed assessment methodology for commercial fisheries?
- Do you have any other matters or information sources that you wish to present?

10.9 References

Blyth-Skyrme, R.E., (2010a). Options and opportunities for marine fisheries mitigation associated with windfarms. Final report for Collaborative Offshore Wind Research into the Environment contract FISHMITIG09. COWRIE (Collaborative Offshore Wind Research Into the Environment) Ltd, London. 125 pp.

Blyth-Skyrme, R.E., (2010b). Options and opportunities for marine fisheries mitigation associated with windfarms: Summary report for COWRIE contract FISHMITIG09. COWRIE Ltd, c/o Nature Bureau, Newbury, UK. 8pp.

Centre for Environment, Fisheries and Aquaculture Science (Cefas) (2012). Guidelines for data acquisition to support marine environmental assessments of offshore renewable energy projects. Contract report: ME5403.

Department for Business, Enterprise and Regulatory Reform (BERR) (2008). Fisheries Liaison with Offshore Wind and Wet Renewables Group (FLOWW) Recommendations for Fisheries Liaison: Best Practice guidance for offshore renewable developers.

European Maritime Safety Agency (EMSA) (2022). Fishing vessel route density data for annual period of 2021.

European Subsea Cable Association (ESCA) (2018). European Subsea Cable Association Statement on vessels operating in the vicinity of subsea cables.

European Union Data Collection Framework (EU DCF) database (2020). Data by quarter-rectangle: Tables and maps of effort and landings by ICES statistical rectangles for 2012 to 2016. Available at: https://stecf.jrc.ec.europa.eu/web/stecf/dd/effort/graphs-quarter

Fisheries Liaison with Offshore Wind and Wet Renewables group FLOWW (2015). FLOWW Best Practice Guidance for Offshore Renewables Developments: Recommendations for Fisheries Disruption Settlements and Community Funds.

Fisheries Liaison with Offshore Wind and Wet Renewables group FLOWW (2014). FLOWW Best Practice Guidance for Offshore Renewables Developments: Recommendations for Fisheries Liaison. January 2014.

Gray, M., Stromberg, P-L., Rodmell, D., (2016). ‘Changes to fishing practices around the UK as a result of the development of offshore windfarms – Phase 1 (Revised).’ The Crown Estate, 121 pages. ISBN: 978-1-906410-64-3

International Cable Protection Committee (2009). Fishing and Submarine Cables - Working Together.

International Council for the Exploration of the Sea (ICES), (2022). EU-registered vessel VMS data for vessels ≥12m length for 2017. Spatial data layers of fishing intensity/pressure for EU vessels operating within ICES defined Celtic Seas Ecoregion and Greater North Sea Ecoregion.

KIS-ORCA (Kingfisher Information Service – Offshore Renewable and Cable Awareness). Reducing Risks Whilst Fishing. Available at: https://kis-orca.org/safety/reducing-risks-whilst-fishing/

Marine Conservation Agency and Health and Safety Executive (2017). Regulatory Expectations on Moorings for Floating Wind and Marine Devices. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/640962/Regulatory_expectations_on_mooring_devices_from_HSE_and_MCA.PDF

Marine Management Organisation (MMO) (2018). IFISH database with landing statistics data for UK registered vessels for 2011 to 2018 with attributes for: landing year; landing month; vessel length category; country code; ICES rectangle; vessel/gear type; species; live weight (tonnes); and value; and landing year; landing month; vessel length category; country code; vessel/gear type; port of landing; species; live weight (tonnes); and value.

Marine Management Organisation (MMO) (2023a). IFISH database with landing statistics data for UK registered vessels for 2018 to 2022 with attributes for: landing year; landing month; vessel length category; country code; ICES rectangle; vessel/gear type; species; live weight (tonnes); and value; and landing year; landing month; vessel length category; country code; vessel/gear type; port of landing; species; live weight (tonnes); and value.

Marine Management Organisation (MMO) (2023b). Vessel Monitoring System data for non-UK registered vessels for 2020 indicating hours fishing for mobile and static vessels to a resolution of 200th of an ICES rectangle.

Marine Scotland (2020). Guidance on preparing a Fisheries Management and Mitigation Strategy ("FMMS"), DRAFT. Available at fmms_draft_guidance_document_1.pdf (marine.gov.scot)

Marine Scotland MAPS NMPI. Available at: https://marinescotland.atkinsgeospatial.com/nmpi/

Shelmerdine R.L. and Mouat B. (2021): Mapping fisheries and habitats in the North and East Coast RIFG area. NAFC Marine Centre UHI report. pp. 70.

UK Fisheries Economic Network and Seafish (2012). Best Practice Guidance for Fishing Industry Financial and Economic Impact Assessments.

UK Hydrographic Office (UKHO) (2020), The Mariner's Handbook (NP100), 12th Edition.

UK Oil and Gas (2015). Fisheries Liaison Guidelines - Issue 6.

Xodus, (2022). Good Practice Guidance for assessing fisheries displacement by other licensed marine activities.

11 Shipping and Navigation

11.1 Introduction

917. This chapter considers the scope of potential impacts of the construction, operation and maintenance, and decommissioning phases of the Broadshore Hub Wind Farm Development Areas (WFDAs) on shipping and navigation.

918. This chapter provides an overview of the existing environment and sets out the proposed methodology and approach to assessing effects on shipping and navigation in the Broadshore Hub WFDAs Environmental Impact Assessment (EIA) Report. This chapter has been prepared by Anatec Limited.

919. This chapter should be read in conjunction with the following chapters of the Broadshore Hub WFDAs Scoping Report:

- **Chapter 10: Commercial Fisheries;**
- **Chapter 11: Shipping and Navigation; and**
- **Chapter 19: Major Accidents and Disasters.**

920. This shipping and navigation chapter is likely to have key inter-relationships with the above receptors, which will be considered appropriately where relevant in the Broadshore Hub WFDAs EIA Report.

11.2 Legislation, Policy and Guidance

921. **Table 11.1** provides a summary of the relevant policy and guidance which will be used to inform the assessment of potential impacts on shipping and navigation for the Broadshore Hub WFDAs. The overarching policy and legislation relevant to the Broadshore Hub WFDAs is described in **Chapter 2: Policy and Legislative Context**.

Table 11.1: Summary of Relevant Legislation, Policy and Guidance for Shipping and Navigation

Relevant Legislation, Policy or Guidance	Relevance to the Assessment
Legislation	
United Nations Convention on the Law of the Sea (UNCLOS) (United Nations (UN), 1982)	Lays down a comprehensive regime of law and order in the world's oceans and seas establishing rules governing all uses of the oceans and their resources.

Relevant Legislation, Policy or Guidance	Relevance to the Assessment
Convention on the International Regulations for Preventing Collisions at Sea (COLREGs) (International Maritime Organization (IMO), 1972/77)	Establish the navigation rules which must be followed by vessels at sea to prevent a collision incident.
International Convention for the Safety of Life at Sea (SOLAS) (IMO, 1974)	Specifies the minimum standards for the construction, equipment and operation of vessels, compatible with their safety.
Policy	
Scotland's National Marine Plan (Scottish Government, 2015)	Provides a framework for all marine activity in Scottish inshore and offshore waters.
Guidance	
Marine Guidance Note (MGN) 654 Offshore Renewable Energy Installations (OREI): Guidance on UK Navigational Practice, Safety and Emergency Response (Maritime and Coastguard Agency (MCA), 2021)	Highlights issues that shall be considered when assessing the effect on navigational safety from offshore renewable energy developments, proposed in UK internal waters, UK territorial sea, or the UK Exclusive Economic Zone (EEZ).
Revised Guidelines for Formal Safety Assessment (FSA) (International Maritime Organization (IMO), 2018)	A structured and systematic methodology based upon risk analysis and Cost Benefit Analysis (CBA) (if applicable) to reduce impacts to As Low as Reasonably Practicable (ALARP).
International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA) Guidance G1162 on the Marking of Man-Made Offshore Structures (IALA, 2021 (a)) and IALA Recommendation O-139 on the Marking of Man-Made Offshore Structures (IALA, 2021 (b))	Describes lighting and marking requirements for offshore installations to increase safety for passing vessels.
The Royal Yachting Association's (RYA) Position on Offshore Renewable Energy Developments: Paper 1 (of 4) – Wind Energy (RYA, 2019)	Sets out the RYA position in relation to the development of offshore renewable wind energy.

11.3 Consultation

922. Consultation undertaken to date for the Broadshore Hub WFDAs relevant to shipping and navigation is provided in **Table 11.2** below. The Broadshore Hub WFDAs Scoping Report (and subsequent Scoping Opinion) will serve as the start of consultation for the Broadshore Hub WFDAs EIA Report, with dedicated meetings anticipated with key shipping and navigation stakeholders throughout the assessment process, including a Hazard Workshop. An initial list of organisations considered relevant to shipping and navigation consultation is provided in **Section 11.7**.

Table 11.2: Consultation Relevant to Shipping and Navigation

Consultee	Date/Document	Comment	How Comment is Addressed
MD-LOT	13th September 2023, Scoping Workshop (email post-workshop 6th October 2023)	The approach to EIA proposed at the Scoping Workshop seems sensible for shipping and navigation, however the Scottish Ministers' final comments will come via the scoping opinion once MD-LOT has consulted with relevant stakeholders	Noted.
MCA/Northern Lighthouse Board (NLB)	6th December 2023	Engagement with MCA and NLB to present the vessel traffic survey requirements and Navigational Risk Assessment (NRA) methodology across the Broadshore Hub WFDAs.	The NRA will be undertaken in line with the relevant guidance and ongoing engagement with MCA and NLB.

11.4 Existing Environment

923. This section establishes the baseline environment in terms of key navigational features, vessel traffic, and marine incidents, for the purposes of identifying potential impacts which should be 'scoped in' to the Broadshore Hub WFDAs EIA Report.

11.4.1 Study Area

924. The baseline information presented within this chapter has been compiled with reference to a study area defined as a 10 nautical mile (nm) buffer around the Broadshore Hub WFDAs Scoping Boundary as presented in **Figure 11.1** in **Appendix 1**, hereafter referred to as the shipping and navigation study area. This is an industry standard buffer used for shipping and navigation assessments as it captures relevant routeing in the area that may be affected, whilst remaining site-specific to the wind turbine generators (WTGs) and associated substructures, station keeping systems (SKS), and inter-array cables (IACs) associated with the Broadshore Hub WFDAs[44].

[44] This will include the offshore substation(s) as part of the cumulative assessment. Offshore substation(s) do not form part of the WFDAs, and corresponding consent applications, but will be included in the scope of the OfTDAs. The Applicants plan to model the OFSS in the NRA for the Broadshore Hub WFDAs in ongoing consultation with the MCA.

925. Where appropriate, features outside of the shipping and navigation study area such as navigational features, other future offshore developments, and international ports will be considered in the Navigational Risk Assessment (NRA).

11.4.2 Data and Information Sources

926. The data sources that have been used to inform the shipping and navigation chapter of the Broadshore Hub WFDAs Scoping Report are presented in **Table 11.3**.

Table 11.3: Summary of Key Data and Information Sources for Shipping and Navigation

Dataset	Year(s)	Description
Automatic Identification System (AIS) data for the period 1st February – 14th February 2023 sourced from Anatec Ltd.	2023	Characterising vessel traffic movements within and in proximity to the Broadshore Hub WFDAs.
AIS data for the period 1st August – 14th August 2023 sourced from Anatec Ltd.		
United Kingdom Hydrography Office (UKHO) Admiralty Charts 115, 278, and 291	2023	Characterising other navigational features in proximity to the Broadshore Hub WFDAs.
Admiralty Sailing Directions North Sea (West) Pilot NP54	2022	
Marine Accident Investigation Branch (MAIB) incident data	2012-2021	Review of maritime incidents within and in proximity to the Broadshore Hub WFDAs.
Royal National Lifeboat Institution (RNLI) incident data	2011-2020	

927. It is noted that AIS carriage and broadcast is not compulsory for fishing vessels less than 15 m in length, or vessels of less than 300 Gross Tonnage (GT). Therefore, such traffic is likely to be underrepresented within the characterisation of the baseline. However, it is noted that smaller vessels are increasingly observed to utilise AIS voluntarily, given the associated safety benefits. On this basis and noting that AIS is accepted as being comprehensive for other larger vessel types, the available data are considered fit for the purposes of providing the baseline assessment presented in this Broadshore Hub WFDAs Scoping Report.

928. The results of dedicated vessel traffic surveys undertaken on-site will be used to characterise vessel traffic movements in the NRA. A summer survey (14 days 1st to the 14th of August 2023) has been undertaken and a winter survey is planned for early 2024. Both surveys will include the capture of AIS, Radio Detection and Ranging (Radar) and visual observations and collectively will be compliant with the requirements of MGN 654. These dedicated surveys will also be supported by a 12-month AIS analysis.

11.4.3 Key Navigational Features

929. Navigational charts and Sailing Directions pertinent to the Broadshore Hub WFDAs were studied to define charted features or key navigational practices. The key navigational features charted in proximity to the Broadshore Hub WFDAs Scoping Boundary are presented in **Figure 11.2** in **Appendix 1**. The only features within the shipping and navigation study area are three wrecks and a Light Detection and Ranging (LiDAR) buoy used for gathering meteorological and oceanographic (metocean) data.

930. Immediately adjacent to the Broadshore Hub WFDAs Scoping Boundary to the west is D809, one of three military practice and exercise areas (PEXA) in the area. An oil and gas development area intersects the northern extent of the Broadshore Hub WFDAs Scoping Boundary, with pipelines relating to this and other oil and gas infrastructure prevalent to the east. Included in this oil and gas development area is a surface platform and Floating Production Storage and Offloading (FPSO) vessel and a pipeline relating to the Captain oil field approximately one nm to the north of the Broadshore Hub WFDAs Scoping Boundary. In addition, an FPSO relating to the Ross oil field is located approximately seven nm to the southeast of the Broadshore Hub WFDAs Scoping Boundary.

931. The Moray East and Beatrice wind farms are located approximately 22 nm and 28 nm to the west respectively. Also operational, the Hywind wind farm is located 39 nm to the south.

932. Features of the future baseline case include the consented Moray West wind farm (currently under construction), Green Volt wind farm (for which a consent application has been submitted), and Buchan, Stromar, Ayre, MarramWind, and Caledonia wind farms, as well as the Innovation and Targeted Oil and Gas (INTOG) sites (excluding Sinclair and Scaraben), all of which are also in early planning or pre-application.

11.4.4 Vessel Traffic

933. A total of 28 days of AIS data was gathered from onshore receivers from 1st February to 14th February 2023 and from 1st August to 14th August 2023, noting that as per MGN 654 requirements of the completion of 28 days of seasonal vessel traffic data, dedicated vessel traffic surveys are planned (see **Section 11.4.2**).

934. The vessel traffic data collected within the shipping and navigation study area is colour-coded by vessel type and presented in **Figure 11.3** in **Appendix 1**. Vessel deemed as constituting temporary traffic (e.g., vessels involved in surveys or guard work, including for the Moray West wind farm) have been removed on the basis that these are neither representative of the baseline, nor likely to feature in a future case scenario.

935. An average of 19 to 20 unique vessels per day were recorded within the shipping and navigation study area during the 2023 winter survey period, with an average of five unique vessels per day recorded intersecting the Broadshore Hub WFDAs Scoping Boundary. An average of 25 to 26 unique vessels per day were recorded within the shipping and navigation study area during the 2023 summer survey period, with an average of eight to nine unique vessels per day recorded intersecting the Broadshore Hub WFDAs Scoping Boundary. The most frequently recorded vessel types within the shipping and navigation study area during the survey periods were oil and gas vessels (33%), cargo vessels (23%), and fishing vessels (22%). Of the vessels intersecting the

Broadshore Hub WFDAs Scoping Boundary during the survey period, the most commonly recorded were oil and gas vessels (43%), fishing vessels (26%), and cargo vessels (17%).

936. Oil and gas vessel activity was primarily related to the Captain oil field to the north of the Broadshore Hub WFDAs Scoping Boundary, and the Ross oil field to the southeast, and includes routeing to and from Aberdeen. In the case of the activity related to the Captain oil field, such routeing passes north-south through the Broadshore Hub WFDAs Scoping Boundary. Other oil and gas vessels were recorded routeing north-south at the western extent of the Broadshore Hub WFDAs Scoping Boundary between Aberdeen and the Clair oil field and Glen Lyon FPSO, both located much further north.

937. Regular Roll-on/Roll-off passenger (RoPax) routeing was recorded from two Northlink Ferries-operated vessels, with one transiting between Aberdeen and Lerwick, and the other between Aberdeen and Kirkwall. Both vessels recorded, on average, one transit daily, with transits to/from Lerwick passing east of the Broadshore Hub WFDAs Scoping Boundary and transits to/from Kirkwall passing west of the Broadshore Hub WFDAs Scoping Boundary. The frequency of transits shows good agreement with currently published passenger timetables (Northlink Ferries, 2023).

938. Regular Roll-on/Roll-off cargo (RoRo) routeing was recorded, again from two Northlink Ferries-operated vessels. As with the RoPax vessels, one RoRo vessel transited between Aberdeen and Lerwick and the other between Aberdeen and Kirkwall. Both vessels recorded, on average, one transit daily, with similar routeing patterns to the RoPax routeing.

939. Other routeing by commercial vessels is prominent towards the south and west of the shipping and navigation study area, and includes cargo vessels, tankers and passenger vessels.

940. Fishing vessel activity was prevalent to the southeast of the Broadshore Hub WFDAs Scoping Boundary, with behaviour characteristic of active fishing recorded in addition to vessel transit. Gear type could be identified for approximately 92% of fishing vessels, with demersal trawlers (47%) and pair trawlers (26%) the most common types.

11.4.5 Marine Incidents

941. The marine incident data assessed indicates that incident rates within the shipping and navigation study area are generally low. The RNLI data indicated four incidents within the shipping and navigation study area over the ten-year period assessed (2011-2020), of which two were located within the Broadshore Hub WFDAs Scoping Boundary. These incidents occurred in 2015 and 2016, and involved a fire on a fishing vessel, and steering failure on a yacht, respectively.

942. The MAIB data from 2012-2021 indicates that six incidents occurred within the shipping and navigation study area, with none occurring within the Broadshore Hub WFDAs Scoping Boundary. The closest incident recorded from MAIB data occurred four nm to the southwest of the Broadshore Hub WFDAs Scoping Boundary, involving a fishing vessel suffering a machinery failure.

11.5 Potential Impacts

943. There are a number of potential direct and indirect impacts of the Broadshore Hub WFDAs on shipping and navigation during the construction, operation and maintenance, and decommissioning stages.

944. The presence of the Broadshore Hub WFDAs could increase the risk of vessel-to-vessel collision risk (including third party to third party vessel, and third party to project vessel). Vessels may be displaced due to the presence of the Broadshore Hub WFDAs or buoyed construction/decommissioning area and, as such, collision risk between third-party vessels may increase. Also, the increased levels of vessel traffic in the area associated with the construction, operation and maintenance, and decommissioning of WFDAs infrastructure may lead to increased collision risk between a third party and project vessels. The presence of the Broadshore Hub WFDAs and associated activities may also reduce access to local ports and harbours through increased traffic, deviated routes or impacts on auxiliary services.

945. During operation, the presence of surface structures could create new allision risk for powered vessels, drifting vessels and any vessels navigating internally within the Broadshore Hub WFDAs. In addition, should a SKS failure occur, a floating structure may lose station and become a floating hazard to passing vessels.

946. The presence of subsea infrastructure including SKS, subsea cable hub(s), dynamic IACs, or cable protection, if required, may increase under-keel interaction risk, and an increase in the risk of anchor interaction.

947. The Broadshore Hub WFDAs' infrastructure (e.g., WTGs or IACs) may impact equipment onboard vessels, including potential effects of electromagnetic interference from cables.

948. The Broadshore Hub WFDAs' infrastructure and associated activities may reduce emergency response capability due to an increased number of incidents and/or access constraints, including in relation to Search and Rescue (SAR).

949. It is anticipated that decommissioning impacts would be similar in nature to those of construction.

11.5.1 Embedded Mitigation Measures

950. As part of the Broadshore Hub WFDAs design process, a number of embedded mitigation measures will reduce the potential for impacts on shipping and navigation receptors described in **Section 11.5**. As there is a commitment to implement these measures, they are considered inherent to the design of the Broadshore Hub WFDAs. The determination of the significance of risk for each impact will assume the implementation of such measures. Embedded mitigation measures considered for the Broadshore Hub WFDAs are as follows:

- An application will be made post-consent for Safety Zones including up to 500 m around-each WTG and substructure during its construction.
- An application will be made post-consent for Safety Zones including up to 50 m around each installed WTG and substructure during its pre-commissioning.

- An application will be made post-consent for Safety Zones including up to 500 m around each WTG and substructure during major maintenance during operation.
- An application will be made prior to commencement of decommissioning for Safety Zones including up to 500 m around each WTG and substructure during its decommissioning.
- A detailed Cable Burial Risk Assessment (CBRA) will be prepared where IACs are proposed to be buried to determine the target burial depth. The burial depths may vary and will be dependant on risk and ground conditions. The CBRA will also highlight instances where adequate burial cannot be achieved and alternative protection is needed. Any damage, destruction, or decay of cables will be notified to MCA, NLB, Kingfisher, and UKHO no later than 24 hours after discovery.
- All offshore infrastructure associated with the Broadshore Hub WFDAs will be appropriately marked on UKHO Admiralty charts.
- The Applicants will ensure compliance with MGN 654 and its annexes, where applicable, including the completion post-consent of an Emergency Response Cooperation Plan (ERCoP) and SAR Checklist in consultation with the MCA.
- The layout of the WTGs in the Broadshore Hub WFDAs, will be finalised in discussion with the MCA and NLB in order to ensure the specific WTG layout is compatible with potential SAR activity.
- The Applicants will ensure compliance with the Regulatory Expectations on Moorings for Floating Wind and Marine Devices (MCA and HSE, 2017).
- A Development Specification and Layout Plan will be developed post-consent to finalise the WTG layout in consultation with the MCA and NLB.
- Where appropriate, guard vessels will be used to ensure adherence with Safety Zones or advisory passing distances.
- Development of, and adherence to, a Lighting and Marking Plan (LMP). Lights, marks, sounds, signals, and other aids to navigation will be exhibited as required by NLB, MCA, and Civil Aviation Authority (CAA) including the buoyed construction/decommissioning areas. A LMP will be developed and adhered to. Failures of the lighting and marking in the Broadshore Hub WFDAs will be appropriately reported and rectified as soon as practicable. Interim hazard warnings will be put in place as required.
- Marine coordination will be implemented to manage project vessels throughout construction, maintenance, and decommissioning periods.
- A Marine Pollution Contingency Plan (MPCP) will be developed outlining procedures to protect personnel working and to safeguard the marine environment.
- A Navigation Safety Plan (NSP) will be developed post-consent to describe measures put in place relating to navigational safety.
- There will be a minimum blade tip clearance of at least 22 m above Mean Sea Level (MSL).
- Broadshore Hub WFDAs vessels will ensure compliance with international marine regulations as adopted by the Flag State, including the COLREGs (IMO, 1972/77) and SOLAS (IMO, 1974).

- Advanced warning and accurate location details of construction, maintenance, and decommissioning operations, associated Safety Zones and advisory passing distances will be given via Notice to Mariners and Kingfisher Bulletins.
- A Vessel Management Plan (VMP) will be developed post-consent to confirm the types and numbers of vessels that will be engaged in activities associated with the Broadshore Hub WFDAs and to consider vessel coordination including indicative transit route planning.
- Dropped objects on the seabed during works associated with the Broadshore Hub WFDAs which may pose a hazard will be reported in line with Marine Directorate - Licensing Operations Team procedures.
- Development of a Navigation Risk Assessment.

951. The requirement for any additional mitigation measures will be dependent on the significance of risk associated with assessed hazards. The requirement for, and feasibility of, any mitigation measures will be consulted upon with statutory consultees throughout the EIA process.

11.6 Scoping of Potential Impacts

952. A range of potential impacts on shipping and navigation have been identified, which may occur during the construction, operation and maintenance, and decommissioning phases of the Broadshore Hub WFDAs, as described in **Section 11.5**.

953. The impacts that have been 'scoped in' to the assessment at this stage are outlined in **Table 11.4** (below). In line with MGN 654, no impacts are fully scoped out of the assessment at this stage, although some are not considered relevant for particular phases given the mitigation measures which are expected to be in place.

11.6.1 Potential Cumulative Effects

954. The CEA for shipping and navigation will follow the general methodology set out in **Chapter 4: Approach to Scoping and Environmental Impact Assessment.** The CEA will be considered in two stages; a CEA of the of the whole Broadshore Hub (i.e., the Broadshore Hub WFDAs, the Broadshore Hub OfTDAs and the Broadshore Hub OnTDAs), followed by a CEA of the whole Broadshore Hub alongside other plans or projects.

955. All impacts identified on an in-isolation basis will be considered within the NRA for the potential for cumulative effects. Cumulative developments will be assessed based on the most recent publicly available information at the time with a screening exercise undertaken to determine which cumulative developments should be considered and to what degree (through use of a tiering system). Factors which will be considered in the screening exercise include:

- Distance from the Broadshore Hub WFDAs;
- Development status;
- Level of interaction with main commercial routes passing in proximity to the Broadshore Hub WFDAs;

- Consultation feedback; and
- Data confidence level.

956. This method will take international vessel operators and ports into consideration. To sufficiently capture effects, both base-case and future-case scenarios will be applied in terms of deviations for main commercial routes on a cumulative level.

11.6.2 Potential Transboundary Effects

957. Given the international nature of shipping, the in-isolation impact assessment and the cumulative impact assessment will consider vessel routeing to and from international ports by international operators. Therefore, impacts listed in **Section 11.5** may be relevant at a transboundary level.

11.6.3 Summary of Shipping and Navigation Impacts Scoped In and Out

958. A summary of potential impacts scoped in and out from further assessment in the Broadshore Hub WFDAs EIA Report is provided in **Table 11.4** below.

Table 11.4: Summary of Potential Impacts Scoped In (✓) or Scoped Out (x) for Shipping and Navigation

Potential Impact	Receptor(s)	Description of Potential Effect	Scoped In or Scoped Out? (✓ or x)			Embedded Mitigation Measures
			Construction	Operation and Maintenance	Decommissioning	
Increased vessel to vessel collision risk (third party to third party)	All vessels	Vessels may be displaced due to the presence of the Broadshore Hub WFDAs or buoyed construction/decommissioning area and, as such, collision risk between third-party vessels may increase.	✓	✓	✓	Charting of infrastructure, decommissioning plan, fishing liaison, guard vessel(s), lighting and marking, Marine Pollution Contingency Plan (MPCP), promulgation of information.
Increased vessel to vessel collision risk (third party to project vessel)	All vessels	The increased levels of vessel traffic in the area associated with the construction, operation and maintenance, and decommissioning of the Broadshore Hub WFDAs may lead to increased collision risk between a third party and project vessel.	✓	✓	✓	Application for Safety Zones, charting of infrastructure, decommissioning plan, fishing liaison, guard vessel(s), lighting and marking, marine coordination for project vessels, MPCP, NSP, project vessel compliance with international regulations, promulgation of information, VMP.
Creation of vessel to structure allision risk	All vessels	The presence of surface structures will create new allision risk for powered vessels, drifting vessels and any vessels navigating internally within the Broadshore Hub WFDAs.	x	✓	x	Application for Safety Zones during major maintenance, charting of infrastructure, fishing liaison, lighting and marking, marine coordination for project vessels, minimum blade tip clearance, MPCP, project vessel compliance with international regulations, promulgation of information.

Potential Impact	Receptor(s)	Description of Potential Effect	Scoped In or Scoped Out? (✓ or x)			Embedded Mitigation Measures
			Construction	Operation and Maintenance	Decommissioning	
Reduced access to local ports and harbours	All vessels	The presence of the Broadshore Hub WFDAs and associated activities may reduce access to local ports and harbours.	✓	✓	✓	Charting of infrastructure, decommissioning plan, lighting and marking, marine coordination for project vessels, NSP, project vessel compliance with international marine regulations, promulgation of information, VMP.
Loss of station	All vessels	Should a SKS failure occur, a floating structure may lose station and become a floating hazard to passing vessels.	x	✓	x	Charting of infrastructure, compliance with MGN 654, compliance with floating substructure guidance, lighting and marking, promulgation of information.
Reduction in under-keel clearance	All vessels	The presence of subsea infrastructure including SKS, dynamic IACs, or cable protection may increase under-keel interaction risk.	x	✓	x	Cable burial risk assessment, charting of infrastructure, compliance with MGN 654, fishing liaison, MPCP, promulgation of information.
Anchor interaction with SKS or IACs	All vessels	The presence of mooring lines and subsea cables may lead to an increase in the risk of anchor interaction.	x	✓	x	Cable burial risk assessment, charting of infrastructure, compliance with MGN 654, promulgation of information.
Interference with navigation, communications, and position-fixing equipment	All vessels	The Broadshore Hub WFDAs' infrastructure (e.g., WTGs, IACs) may impact equipment onboard vessels, including potential effects of electromagnetic interference from cables.	X	✓	x	Compliance with MGN 654.

Potential Impact	Receptor(s)	Description of Potential Effect	Scoped In or Scoped Out? (✓ or x)			Embedded Mitigation Measures
			Construction	Operation and Maintenance	Decommissioning	
Reduction of Search and Rescue (SAR) capability	All vessels and emergency responders	The Broadshore Hub WFDAs' infrastructure and associated activities may reduce emergency response capability due to an increased number of incidents and/or access constraints, including in relation to SAR.	x	✓	x	Compliance with MGN 654; DSLP, guard vessel(s) as required by risk assessment, lighting and marking, marine coordination; MPCP, project vessel compliance with international marine regulations.

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11.7 Proposed Approach to Impact Assessment

959. Within the shipping and navigation chapter of the Broadshore Hub WFDAs EIA Report, the overall impact assessment for the Broadshore Hub WFDAs will be presented first. Following this, a summary of each WFDA will be given (i.e. the Broadshore WFDA, Sinclair WFDA, and Scaraben WFDA), in line with the approach set out in **Chapter 4: Approach to Scoping and Environmental Impact Assessment.**

960. As required under the MCA methodology (Annex 1 to MGN 654) (MCA, 2021) and in line with international marine risk assessment standards, the IMO FSA (IMO, 2018) approach will be applied to the assessment of effects.

961. The FSA methodology is centred on risk control. The method assesses each hazard (impact) in terms of its frequency of occurrence and the severity of its consequence, to determine its significance as either 'broadly acceptable', 'tolerable' or 'unacceptable.' The FSA methodology risk matrix is shown in **Table 11.5**. Any impact assessed as 'unacceptable' will require additional mitigation measures implemented beyond those considered designed-in to reduce the impact to within 'tolerable with mitigation' or 'broadly acceptable' parameters.

Table 11.5: International Maritime Organization Formal Safety Assessment Risks

Frequency of Occurrence	Frequent	Tolerable with Mitigation	Tolerable with Mitigation	Unacceptable	Unacceptable	Unacceptable
	Reasonably Probably	Broadly Acceptable	Tolerable with Mitigation	Tolerable with Mitigation	Unacceptable	Unacceptable
	Remote	Broadly Acceptable	Broadly Acceptable	Tolerable with Mitigation	Tolerable with Mitigation	Unacceptable
	Extremely Unlikely	Broadly Acceptable	Broadly Acceptable	Broadly Acceptable	Tolerable with Mitigation	Tolerable with Mitigation
	Negligible	Broadly Acceptable	Broadly Acceptable	Broadly Acceptable	Broadly Acceptable	Tolerable with Mitigation
		Negligible	Minor	Moderate	Serious	Major
		Severity of Consequence				

963. The frequency and consequence rankings per hazard will be determined using a number of inputs, notably:

- Quantitative modelling undertaken in the NRA (Anatec's COLLRISK software);
- Outputs of the characterisation of the baseline including vessel traffic surveys;
- Consideration of proposed mitigation measures;
- Lessons learned from other offshore wind farm developments;
- Level of stakeholder concern determined though the hazard log;
- Consultation output; and
- Expert opinion.

964. The following statutory and non-statutory organisations deemed relevant to shipping and navigation will be included in consultation, noting that additional organisations may be included if identified during the NRA process:

- MCA;
- NLB;
- UK Chamber of Shipping;
- RYA Scotland;
- Cruising Association;
- Scottish Fishermen's Federation (SFF);
- Local ports and harbours;
- Regular commercial operators (identified from the vessel traffic survey data); and
- Local marinas and yacht clubs.

11.8 Scoping Questions to Consultees

965. The following questions are posed to consultees to help them frame and focus their response to the shipping and navigation scoping exercise, which will in turn inform the Scoping Opinion:

- Is the legislation, policy and guidance proposed for consideration as part of the Broadshore Hub WFDAs EIA Report (including the NRA) suitable and sufficient?
- Is the study area defined, data sources considered, and proposed data sources to inform the NRA suitable and sufficient?
- Is the methodology outlined for undertaking the risk assessment suitable, including on a cumulative level?

- Have all potential hazards (impacts) due to the presence of the Broadshore Hub WFDAs been identified for shipping and navigation users?
- Are the mitigation measures described suitable and sufficient for managing and mitigating risk associated with the potential hazards?
- Do you have any other matters or information sources that you wish to present?

11.9 References

IALA (2021a). 'Recommendation O-139 on the Marking of Man-Made Offshore Structures'. Saine Germaine en Laye, France: IALA.

IALA (2021b). 'Guidance G1162 on the Marking of Man-Made Offshore Structures'. Saint Germaine en Laye, France: IALA.

IMO (2018). 'Revised Guidelines for Formal Safety Assessment'. London: IMO.

MCA (2021). 'MGN 654 (Merchant and Fishing) Offshore Renewable Energy Installations (OREI) – Guidance on UK Navigational Practice, Safety and Emergency Response'. Southampton: MCA.

Northlink Ferries (2023). '2023 Timetables'. Available at: https://www.northlinkferries.co.uk/booking-info/timetables/

RYA (2019). 'The RYA's Position on Offshore Energy Developments: Paper 1 – Wind Energy'. Southampton: MCA.

UKHO (2022). 'Admiralty Sailing Directions North Sea (West) Pilot, 12th Edition NP54'. Taunton: UKHO.

12 Aviation and Radar

12.1 Introduction

966. This chapter considers the scope of potential impacts of the construction, operation and maintenance, and decommissioning phases of the Broadshore Hub Wind Farm Development Areas (WFDAs) on aviation and radar.

967. This chapter provides an overview of the existing environment and further sets out the methodology and approach to assessing effects on aviation and radar in the Broadshore Hub WFDAs Environmental Impact Assessment (EIA) Report. This chapter has been prepared by Cyrrus Ltd.

968. Wind turbine generators (WTGs) have the potential to cause a variety of adverse effects on aviation and radar receptors. WTGs can impact radars used by civilians and military air traffic controllers because the characteristics of moving turbine blades are similar to the characteristics of aircraft, leading to spurious returns, or clutter, on radar displays. This can affect the safe provision of air traffic services or interfere with tracking of aircraft by the military. WTGs can also have the potential to present a physical obstruction for aviation activities such as military low flying or helicopter Search and Rescue (SAR) operations.

969. Aviation stakeholders potentially affected include the UK Civil Aviation Authority (CAA), the Ministry of Defence (M0D), National Air Traffic Services (NATS), Aberdeen International Airport, Highlands and Islands Airports Limited (HIAL) and offshore helicopter operators such as Bristow Group, who currently delivers the UK SAR contract on behalf of His Majesty's Coastguard (HMC).

970. This chapter should be read in conjunction with the following chapters of the Broadshore Hub WFDAs Scoping Report:

- **Chapter 13: Marine Infrastructure and Other Users;** and
- **Chapter 19: Major Accidents and Disasters**.

971. This aviation and radar chapter is likely to have key inter-relationships with the above receptors, which will be considered appropriately where relevant in the Broadshore Hub WFDAs EIA Report.

12.2 Legislation, Policy and Guidance

972. **Table 12.1** sets out the legislation, policy and guidance which have been considered in the preparation of this chapter, and will be considered within the Broadshore Hub WFDAs EIA Report where appropriate. The overarching policy and legislation relevant to the Broadshore Hub WFDAs is described in **Chapter 2: Policy and Legislative Context**.

Table 12.1: Summary of Relevant Legislation, Policy and Guidance for Aviation and Radar

Relevant Legislation, Policy or Guidance	Relevance to the Assessment
International Civil Aviation Organisation (ICAO) (2022). The convention of International Civil Aviation: Aerodrome Design and Operations, Annex 14.	Includes recommendations for the marking and lighting of WTGs.
Maritime and Coastguard Agency (MCA) (2021). Safety of Navigation: Offshore Renewable Energy Installations (OREIs) – Guidance on UK Navigational Practice, Safety, and Emergency Response. Marine Guidance Note (MGN) 654.	Highlights issues to consider when assessing navigational safety and emergency response, caused by OREI.
CAA (2023) Aeronautical Information Publication (AIP). Civil Aviation Publication (CAP) 032	Contains information on facilities, services, rules, regulations and restrictions in UK airspace.
CAA (2022). Air Navigation Order (ANO) 2016	Aerodromes and Lighting, articles 222 and 223 contain information on the lighting of en route obstacles and offshore wind turbines in UK territorial waters.
CAA (2020). Safeguarding of Aerodromes. CAP 738.	Document offers guidance to those responsible for the safe operation of an aerodrome or a technical site, to help them assess what effects a proposed development or construction might have on that operation.
CAA (2019) Air Traffic Services Safety Requirements. CAP 670.	Highlights the requirements to be met by providers of civil air traffic services (ATS) and other services in the UK in order to ensure that those services are safe for use by aircraft.
CAA (2022). Licensing of Aerodromes. CAP 168.	Sets out the standards required at UK licensed aerodromes relating to management systems, operational procedures, physical characteristics assessment and treatment of obstacles.
CAA (2023). Standards for offshore helicopter landing areas. CAP 437.	Provides the criteria applied by the CAA in assessing offshore helicopter landing areas for worldwide use by helicopters registered in the UK and includes winching area 'best practice' design criteria for WTGs.
CAA (2021). UK Flight Information Services. CAP 774.	Details the suite of ATS which (excluding aerodrome services) are the only services provided in class G airspace within the UK Flight Information Region (FIR) and where notified, elements of which are also provided to Visual Flight Rules flights operating in class E airspace.
CAA (2016). CAA Policy and Guidelines on Wind Turbines. CAP 764.	Details CAA policy and guidelines associated with WTG effects on aviation that aviation stakeholders and wind energy developers need to consider when assessing a development's viability.
CAA (2021) Airspace Change. CAP 1616.	Explains the CAAs regulatory process for changes to airspace.

12.3 Consultation

973. Consultation undertaken to date for the Broadshore Hub WFDAs relevant to aviation and radar is provided in **Table 12.2** below. Following the Scoping Opinion, consultation will be continuous throughout the production of the Broadshore Hub WFDAs EIA Report with relevant stakeholders including UK CAA, the MOD, NATS, Aberdeen International Airport, HIAL and offshore helicopter operators such as Bristow Group, who currently delivers the UK SAR contract on behalf of HMC.

Table 12.2: Consultation Relevant to Aviation and Radar

Consultee	Date/Document	Comment	How comment is Addressed
MD-LOT	13th September 2023, Scoping Workshop	The approach to EIA proposed at the Scoping Workshop seems sensible for aviation and radar, however the Scottish Ministers' final comments will come via the scoping opinion once MD-LOT has consulted with relevant stakeholders.	Noted.

12.4 Existing Environment

12.4.1 Study Area

12.4.1.1 Overview

974. In considering the spatial extent of the aviation and radar study area, the overriding factor is the potential for WTGs within the Broadshore Hub WFDAs to have an effect on civil and military radars, when taking into account the required radar operational ranges. In general, Primary Surveillance Radars (PSRs) installed on civil and military airfields have an operational range between 40 and 60 nautical miles (nm). All radar-equipped airfields within 60 nm of the Broadshore Hub WFDAs are therefore included in this aviation and radar study area. En route radars operated by NATS (En Route) plc (NERL) and military Air Defence (AD) radars are required to provide coverage at ranges in excess of 60 nm. All such radars with potential Radar Line of Sight (RLoS) of WTGs in the Broadshore Hub WFDAs are also included in the aviation and radar study area.

975. The aviation and radar study area is defined by the Broadshore Hub WFDAs footprint, plus an appropriate buffer (to ensure that all airspace in the vicinity of the Broadshore Hub WFDAs is considered within this Broadshore Hub WFDAs Scoping Report). This buffer includes the airspace between the Broadshore Hub WFDAs and the UK mainland, extending from Wick John O'Groats Airport (Wick Airport) to the west-north-west, to Aberdeen International Airport to the south. The aviation and radar study area and the airports and radars within the study area that are under

consideration as part of this Broadshore Hub WFDAs Scoping Report, are shown in **Figure 12.1** in **Appendix 1**.

976. The following criteria have been used to identify receptors within the aviation and radar study area (and are discussed further below):

- Civil Aerodromes;
- MOD;
- NERL Facilities;
- Meteorological radio facilities; and
- Other Aviation Activities.

12.4.1.2 Civil Aerodromes

977. CAP 764 Policy and Guidelines on Wind Turbines (CAA, 2016) states the distances from various aerodromes where consultation is necessary. These distances include:

- Aerodromes with a surveillance radar – within 30 kilometres (km);
- Non-radar equipped licensed aerodromes with a runway of more than 1,100 metres (m) – within 17 km;
- Licensed aerodromes where the WTGs will lie within the airspace coincidental with a published Instrument Flight Procedure (IFP);
- Unlicensed aerodromes with runways of more than 800 m – within four km;
- Unlicensed aerodromes with runways of less than 800 m – within three km;
- Gliding sites – within 10 km; and
- Other aviation activities such as parachute sites and microlite sites – within three km.

978. CAP 764 states that these distances are for guidance purposes only and do not represent ranges beyond which all WTG developments will be approved or within which they will be objected to. For example, aerodromes may utilise their radars at ranges in excess of 30 km. These ranges are intended as a prompt for discussion between aviation stakeholders and developers.

979. As well as examining the technical impact of WTGs on Air Traffic Control (ATC) facilities, it is necessary to consider the physical safeguarding of ATC operations using the criteria laid down in CAP 168 Licensing of Aerodromes (CAA, 2022) to determine whether the WTGs in the Broadshore Hub WFDAs will breach obstacle clearance criteria.

12.4.1.3 Ministry of Defence

980. It is necessary to consider the aviation, AD and other activities of the MOD. This includes:

- MOD airfields, both radar and non-radar equipped;
- MOD AD radars; and
- MOD Practice and Exercise Areas (PEXAs) for both aviation and non-aviation activities.

12.4.1.4 National Air Traffic (En Route) plc Facilities

981. It is necessary to consider the possible effects of WTGs upon the NERL radar systems; a network of primary and secondary radar facilities around the country.

12.4.1.5 Meteorological Radio Facilities

982. WTGs have the potential to adversely affect Meteorological facilities such as weather radars. The Met Office must be consulted by developers for WTG proposals within a 20 km radius zone of any of their UK weather radar sites.

12.4.1.6 Other Aviation Activities

983. Other aviation activities of relevance could include:

- General military low flying operations;
- Military and civilian ‘off-route’ fixed-wing and helicopter operations including SAR missions and offshore helicopter operations in support of the oil and gas industry; and
- Other aviation activity.

12.4.2 Data and Information Sources

984. For the purposes of this Broadshore Hub WFDAs Scoping Report, a desk-based review of existing and known activities was undertaken using relevant spatial and scientific data sources.

985. The data sources that have been used to inform this aviation and radar chapter are presented in **Table 12.3**. The primary sources of aviation data are the UK civil and military AIPs. The AIPs contain details on airspace and en route procedures as well as charts and other air navigation information. These identified data sources will be taken forward and used to inform the subsequent EIA.

Table 12.3: Summary of Key Data and Information Sources for Aviation and Radar

Dataset	Year(s)	Description
CAP 032 UK AIP, CAA	2023	Contains information on facilities, services, rules, regulations, and restrictions in UK airspace. Provides full coverage of the aviation and radar study area.
UK Military AIP, MOD	2023	The main resource for information on flight procedures at all military aerodromes. Provides full coverage of the aviation and radar study area.
Wind Farm self-assessment maps, NATS	2012	Maps provided by NATS to ascertain potential impacts of WTGs on their enroute electronic infrastructure. Provides full coverage of the aviation and radar study area.
Offshore infrastructure data, North Sea Transition Authority (NSTA)	2023	Regularly updated NSTA offshore oil and gas platform shapefiles. Provides full coverage of the aviation and radar study area.
Helideck Certificates, Helideck Certification Authority (HCA).	2023	Regularly updated offshore helideck certifications. Provides full coverage of the aviation and radar study area.
European Meteorological Network (EUMETNET), Operational Programme for the Exchange of Weather Radar Information (OPERA) Database 2023	2023	Contains information for weather station radars throughout the UK. Provides full coverage of the aviation and radar study area.

12.4.3 Civil Aviation

986. The airspace above and adjacent to the Broadshore Hub WFDAs is used by civil and military aircraft and lies within the Scottish Flight Information Region (FIR) for ATC. This airspace is regulated by the UK CAA. The Scottish FIR is adjacent to the Polaris FIR, regulated by CAA Norway, whose boundary is approximately 211 km to the north-east of the Broadshore Hub WFDAs.

987. Airspace is classified as either controlled or uncontrolled and is divided into a number of classes depending on what kind of Air Traffic Service (ATS) is provided and under what conditions. In the UK, there are five classes of airspace, specifically A, C, D, E and G. The first four are controlled airspace while class G is uncontrolled. Within controlled airspace, aircraft are monitored and instructed by ATC. Aircraft within uncontrolled airspace are not subject to ATC instruction but rather operate according to a simple set of regulations. ATC may still provide information, if requested, to ensure flight safety.

988. Aircraft operate under one of two flight rules: Visual Flight Rules (VFR) or Instrument Flight Rules (IFR). VFR flight is conducted with visual reference to the natural horizon while IFR flight requires reference solely to aircraft instrumentation.

989. From sea level to flight level (FL) 105, (approximately 10,500 ft Above Mean Sea Level (AMSL)), the airspace above and in the vicinity of the Broadshore Hub WFDAs is class G uncontrolled

airspace. This airspace is used predominantly by low level flight operations and generally by aircraft flying under VFR. Under VFR flight the pilot is responsible for maintaining a safe distance from terrain, obstacles and other aircraft. Class G airspace has an upper limit of FL195 (approximately 19,500 ft AMSL) along the western extent of the Broadshore Hub WFDAs.

990. Situated approximately 36 km west of the Broadshore Hub WFDAs, is the Moray Firth Transponder Mandatory Zone (TMZ) as shown in **Figure 12.2** in **Appendix 1**. Within a TMZ the carriage and operation of aircraft transponder equipment is mandatory. This enables such aircraft to be detected and tracked by Secondary Surveillance Radar (SSR) systems. The Moray Firth TMZ surrounds the Beatrice Offshore Wind Farm (OWF) and Moray East OWF and is used to mitigate the effect the associated WTGs have on PSR. This zone is active from sea level to FL100 (approximately 10,000 ft AMSL). Subject to the predicted impacts of the Broadshore Hub WFDAs, the establishment of a TMZ over the Broadshore Hub WFDAs is a potential mitigation measure to be considered during the design and EIA process.

991. Covering the majority of the Broadshore Hub WFDAs is class E controlled airspace from FL105 to FL195 (approximately 10,500 to 19,500 ft AMSL respectively) in the form of the Moray Control Area (CTA), which is divided into CTAs 1 to 17. Of these elements it is CTA 3 which overlaps the majority of the Broadshore Hub WFDAs shown in **Figure 12.2** in **Appendix 1.** The section of the Broadshore Hub WFDAs not covered by CTA 3 along the western extent is below uncontrolled class G airspace from sea level to FL195 (approximately 19,500 ft AMSL).

992. Above FL195 is class C controlled airspace in the form of a Temporary Reserved Area (TRA). This airspace, TRA 008B, has an upper vertical limit of FL245 (approximately 24,500 ft AMSL) and is available for use by both military and civil aircraft, though its main purpose is to accommodate VFR military flying activity.

993. The nearest UK civil airport to the Broadshore Hub WFDAs is Wick Airport, located approximately 75 km to the west-north-west of the Broadshore Hub WFDAs. Wick Airport provides daily scheduled flights to Aberdeen International Airport and is regularly used by helicopters operating offshore. Aberdeen International Airport is located approximately 104 km to the south and Inverness Airport 143 km west-south-west of the Broadshore Hub WFDAs. Aberdeen International Airport is Scotland's third busiest airport, and the 16th busiest in the UK.

994. Airports with published IFPs have associated Minimum Sector Altitudes (MSAs). These areas define the minimum safe altitude an aircraft can descend to within a sector defined by a 25 nm radius (46 km). MSAs provide obstacle clearance protection of at least 1,000 ft to aircraft within that area. This provides pilots flying under IFR the reassurance of properly designated obstacle and terrain clearance protection whilst making an approach or landing at an airport in poor visibility. In addition to the MSA centred on 'WCK' Non-Directional Beacon (NDB), there are Terminal Arrival Altitudes (TAAs) published for Wick Airport. A TAA functions similarly to the MSA but specifically for pilots approaching the Airport. The nearest TAA to the Broadshore Hub WFDAs is a sector centred on a designated waypoint known as 'PC31I' Intermediate Approach Fix (IF), with a radius of 25 nm along with a five nm buffer zone. The Wick TAA in the vicinity of the Broadshore Hub WFDAs is 1,800 ft AMSL. As shown in **Figure 12.3** in **Appendix 1**, the Broadshore Hub WFDAs lies 1.8 km outside of the five nm buffer zone of the TAA. Although the Broadshore Hub WFDAs lies outside of the buffer zone, and irrespective of the tip height of the WTGs, Wick Airport may require consultation considering the close proximity of the boundary. Further effects on Wick IFPs

will be determined by specialist analysis and consultation with the Airport and HIAL through the scoping process and during the EIA.

995. Inverness Airport is equipped with both a PSR and SSR system. A preliminary RLoS analysis indicates that Inverness PSR will not have visibility of WTGs with a maximum tip of 400 m AMSL within the Broadshore Hub WFDAs as shown in **Figure 12.4** in **Appendix 1**. WTGs have less effect on SSRs than PSRs provided they are more than 10 km away from an SSR facility. Inverness Airport is located 143.15 km to the west-south-west of the Broadshore Hub WFDAs, therefore WTGs within the Broadshore Hub WFDAs are unlikely to affect the SSR system at Inverness Airport irrespective of the tip height of the WTGs.

996. NERL provides en route civil air traffic services within the Scottish FIR and operates a network of radar facilities to provide en route information for both civil and military aircraft. The closest NERL radar to the Broadshore Hub WFDAs is based at Allanshill, approximately 56 km to the south of the Broadshore Hub WFDAs, followed by Perwinnes PSR which is located approximately 102 km to the south.

997. Preliminary RLoS modelling indicates that all WTGs with a maximum tip height of 400 m AMSL within the Broadshore Hub WFDAs will be fully visible to Allanshill PSR but not to Perwinnes PSR, as presented in **Figure 12.4** in **Appendix 1**. NERL facilities are combined with SSR systems. The SSR facility at Allanshill is 55.5 km away from the nearest extent of the Broadshore Hub WFDAs and therefore unlikely to be affected by WTGs.

998. In summary, there is potential for WTGs in the Broadshore Hub WFDAs to effect Wick IFPs and the NERL PSR facility at Allanshill.

12.4.4 Military Aviation

999. The north-west corner of the Broadshore Hub WFDAs infringes the Moray Firth Danger Area, EGD809S (**Figure 12.6** in **Appendix 1**). Activity in this area includes ordnance, munitions, explosives/unmanned aircraft systems and high energy manoeuvres. The MoD will need to know of any obstacles within the area that could affect these operations.

1000. To the west of the Broadshore Hub WFDAs is the Northern Managed Danger Area (MDA), EGD712D. The MDA is located approximately six km to the west of the Broadshore Hub WFDAs. When active, from FL245 to FL660 (approximately 24,500 to 66,000 ft AMSL respectively), this area is a segregated airspace which accommodates military flight training with activity including high energy manoeuvres.

1001. Located approximately 95 km to the west-south-west of the Broadshore Hub WFDAs is the Tain Danger Area, EGD703. This zone is active from sea level to 15,000 ft AMSL. This area is affiliated with the Tain Air Weapons Range (AWR). Activity within this area includes ordnance, munitions and explosives/unmanned aircraft system, high energy manoeuvres, para dropping and electronic optical hazards.

1002. Situated 25.6 km to the south and 109.5 km to the north-east of the Broadshore Hub WFDAs are the Air to Air Refuelling Areas (AARAs), Area 04 and Area 02 respectively. Area 04 is active from FL70 to FL240 (approximately 7,000 to 24,000 ft AMSL respectively) and Area 02 is active from

FL100 to FL290 (approximately 10,000 to 29,000 ft respectively) and both are permanently available to military air traffic.

1003. Within the vicinity of the Broadshore Hub WFDAs is the Lossiemouth ATC Surveillance Minimum Altitude Area (SMAA) (**Figure 12.5** in **Appendix 1**). SMAAs are a defined area within the vicinity of an aerodrome in which the minimum safe levels allocated by a controller IFR flights with PSR/SSR equipment have been predetermined. The minimum altitude available to ATC for vectoring arriving flights within an SMAA is 1,000 ft above the highest obstacle. Each sector of an SMAA includes an additional five nm buffer zone. Lossiemouth ATC SMAA has a range of 50 nm and the five nm buffer zone infringes the south-west corner of the Broadshore Hub WFDAs. The altitude of this sector is 1,300 ft AMSL. Consultation and coordination between the developer and the MoD will be necessary to determine possible mitigation measures if any are required.

1004. There are no known further PEXAs, including non-aviation activities within the aviation and radar study area. All airspace mentioned above are depicted within **Figure 12.6** and **Figure 12.7** in **Appendix 1**.

1005. The nearest military airfield with a PSR is Royal Air Force (RAF) Lossiemouth, approximately 98 km to the south-west of the Broadshore Hub WFDAs. Preliminary RLoS modelling indicates that WTGs with a maximum tip height of 400 m AMSL within the Broadshore Hub WFDAs will be visible to the Lossiemouth Thales Star NG PSR with the exception of those positioned in the north-east as shown in **Figure 12.7** in **Appendix 1**.

1006. The closest MoD AD radar to the Broadshore Hub WFDAs is Buchan AD PSR, approximately 73 km to the south of the Broadshore Hub WFDAs. Preliminary RLoS modelling indicates that WTGs with a maximum tip height 400 m AMSL will be fully visible across the Broadshore Hub WFDAs, as shown in **Figure 12.7** in **Appendix 1**.

1007. In summary, WTGs within the Broadshore Hub WFDAs have the potential to effect military activity within Moray Firth Danger Area, EGD809S. Furthermore, WTGs may affect Lossiemouth ATC PSR and Bucan AD PSR.

12.4.5 Meteorological Radio Facilities

1008. The closest Met Office weather radar to the Broadshore Hub WFDAs is the Hill of Dudwick, approximately 77 km to the south of the Broadshore Hub WFDAs. Preliminary RLoS modelling indicates that all WTGs with a maximum tip height of 400 m AMSL within the Broadshore Hub WFDAs will be fully visible to Hill of Dudwick weather radar, as shown in **Figure 12.8** in **Appendix 1**. However, the Broadshore Hub WFDAs is located beyond the 20 km safeguarded zone established around weather radars.

12.4.6 Helicopter Main Routing Indicators

1009. Helicopter Main Routing Indicators (HMRI) are a network of offshore routes used by civilian helicopters to navigate over the North Sea in support of oil and gas facilities. Whilst these routes have no lateral dimensions, there must be no obstacles within a two nm buffer of the route centreline. The eastern extent of the Broadshore Hub WFDAs is situated across the centrelines of HMRIs Whiskey, 023, and 026. Furthermore, this extent of the Broadshore Hub WFDAs infringes the two nm buffer zone of HMRI Echo. If any obstacle is planned within two nm of the centreline then consultation is required between the developer and the helicopter operators and the Air Navigation Service Provider (ANSP). All HMRIs within vicinity of the Broadshore Hub WFDAs are depicted within **Figure 12.9** in **Appendix 1**.

12.4.7 Helidecks

1010. There are many offshore helidecks in the vicinity of the Broadshore Hub WFDAs. To achieve a safe operating environment under low visibility, a consultation zone with a nine nm radius is present around each offshore helideck. This means obstacles such as WTGs within this radius must be consulted on with the helideck operators to maintain safe offshore helicopter operations alongside the Broadshore Hub WFDAs. The nearest active oil and gas helidecks to the Broadshore Hub WFDAs are the Captain BLPA, Captain WPPA, Captain Floating Production Storage and Offloading (FPSO) and ROSS. As displayed in **Figure 12.10** in **Appendix 1**, all of these helidecks are located within nine nm of the Broadshore Hub WFDAs and therefore consultation is required.

12.4.8 Search and Rescue

1011. Bristow Group currently operate Search and Rescue operations in the vicinity of the Broadshore Hub WFDAs. For SAR operations to be carried out safely and efficiently, they require developers to fulfil WTGs spacing, marking and lighting requirements set out by the MCA and Northern Lighthouse Board (NLB). The nearest SAR helicopter facility to the Broadshore Hub WFDAs is at Inverness Airport, approximately 144 km to the south-west of the Broadshore Hub WFDAs.

12.5 Potential Impacts

1012. A range of potential impacts on aviation and radar have been identified which may occur during the construction, operation and maintenance and decommissioning phases of the Broadshore Hub WFDAs.

1013. WTGs have the potential to affect aviation and radar (fixed-wing and helicopters), either through their physical dimensions limiting access and affecting safe passage, or through their effects on PSR systems which can affect the safe provision of an ATS.

1014. PSR effects are caused by the characteristics of rotating WTG blades being similar to aircraft leading to spurious clutter on ATC radar displays.

1015. The creation of a new obstacle environment increases the risk of collision for military low flying aircraft, helicopters in support of the oil and gas industry and SAR operations.

1016. Helicopter activities (if any) in support of the Broadshore Hub WFDAs may raise the overall level of traffic in the area and increase the likelihood of aircraft-to-aircraft collision.

12.5.1 Embedded Mitigation Measures

1017. Mitigation measures will be considered throughout the design process of the Broadshore Hub WFDAs. These measures will be included with the design of the Broadshore Hub with the objective to reduce the potential for impact upon the environment. The measures will evolve throughout the development process as the EIA progresses and in response to consultation. The Applicants are committed to the implementation of appropriate embedded mitigation measures as well as standard sectoral practices and procedures.

1018. Included below are those specific embedded mitigation measures considered relevant to aviation and radar receptors. Additional mitigation measures will be considered as necessary as part of the EIA process:

- Development of and adherence to a Light and Marking Plan (LMP). The LMP will confirm compliance with legal requirements with regards to shipping, navigation and aviation marking and lighting;
- Development of and adherence to an Emergency Response and Cooperation Plan (ERCoP). The ERCoP will be prepared in line with MCA guidance and confirms what measures the Broadshore Hub WFDAs has in place to support any emergency response;
- The Applicants will ensure compliance with Marine Guidance Note 654 and its annexes, where applicable, including completion post consent of Search and Rescue (SAR) Checklist in consultation with the Maritime and Coastguard Agency (MCA);
- Appropriate marking of the Broadshore Hub WFDAs on aeronautical charts. This will include provision of the positions and heights of structures to CAA, MOD, and Defence Geographics Centre;
- Aviation lighting and marking, as described in the LMP, will be installed in accordance with Article 223 of the UK ANO 2016 which sets out the mandatory requirements to be followed for lighting of offshore WTGs;
- The layout of the WTGs in the Broadshore Hub WFDAs, will be finalised in discussion with the MCA and NLB in order to ensure the specific WTG layout is compatible with potential SAR activity; and
- Failures of the lighting and marking in the Broadshore Hub WFDAs will be appropriately reported and rectified as soon as practicable. Interim hazard warnings will be put in place as required.

12.6 Scoping of Potential Impacts

12.6.1 Potential Impacts Scoped In

1019. The creation of an obstacle environment is an impact that is scoped in for the construction, operation and maintenance, and decommissioning phases of the Broadshore Hub WFDAs. The construction and decommissioning of the Broadshore Hub WFDAs' infrastructure may involve tall crane vessels creating a physical obstruction. The presence of WTGs could also pose a physical obstruction to low flying aircraft, increasing the risk of collision or requiring aircraft to fly extended routes to avoid obstructions. Specifically, WTGs (depending on tip height) may have a potential effect on Wick Airport IFPs, RAF Lossiemouth ATC, activities within the Moray Firth Danger Area, SAR operations and helicopters involved in offshore oil and gas activities.

1020. Increased air traffic in the area related to activities within the Broadshore Hub WFDAs is an impact scoped in for the construction, operation and maintenance and decommissioning phases of the Broadshore Hub WFDAs. Helicopters involved in all phases of the Broadshore Hub WFDAs may affect existing traffic in the area, increasing the risk of aircraft-to-aircraft collision. Existing air traffic may include military aircraft engaged in activities within the Moray Firth Danger Area, helicopters involved in offshore oil and gas activities, and helicopters involved in SAR operations.

1021. The effect on civil and military PSR systems is scoped in at the construction and operation and maintenance phase of the Broadshore Hub WFDAs. To discriminate wanted aircraft targets from unwanted clutter, PSRs ignore static objects and only display moving targets. PSRs with visibility of rotating WTG blades can mistake them for aircraft and so present them on ATC radar displays as clutter. Controllers may not be able to distinguish aircraft from clutter. WTGs will be gradually commissioned during the construction phase and will continue rotation throughout the operation and maintenance phase, therefore generating clutter.

12.6.2 Potential Impacts Scoped Out

1022. The effect on civil and military PSR systems is scoped out for construction (for the period prior to first energy) and decommissioning phases of the Broadshore Hub WFDAs. In order to discriminate wanted aircraft targets from unwanted clutter, PSRs ignore static objects and only display moving targets. PSRs with visibility of rotating WTG blades can mistake them for aircraft and so present them on ATC radar displays as clutter. Controllers may not be able to distinguish aircraft from clutter. This is only applicable when WTGs begin rotation. Tall construction vessels and cranes that are in RLoS will not be moving fast enough to generate PSR clutter.

1023. Effects in civil and military SSR systems are scoped out for all phases, as NATS do not consider the effects of WTGs on SSR to be material or relevant for WTGs that are beyond approximately 28 km from the nearest SSR facility. Furthermore, CAP 764 states that the effects on SSR "…*are typically only a consideration when the turbines are located very close to the SSR i.e. less than 10 km*". The nearest SSR facility is located at Allanshill, approximately 56 km to the south-west-south of the Broadshore Hub WFDAs.

1024. The nearest MET Office radar is the Hill of Dudwick, located approximately 77 km to the south of the Broadshore Hub WFDAs. WTGs will be significantly beyond the 20 km safeguarded zone established around weather radars and therefore unlikely to have a significant effect despite having full visibility of WTGs within the Broadshore Hub WFDAs. Therefore, effects on weather radars is scoped out for all phases.

12.6.3 Potential Cumulative Effects

1025. The CEA for aviation and radar will follow the general methodology set out in **Chapter 4: Approach to Scoping and Environmental Impact Assessment**. The first stage of the CEA will consider the Broadshore Hub WFDAs with the Broadshore Hub Onshore Transmission Development Areas (OnTDAs) and Offshore Transmission Development Areas (OfTDAs). As the positioning of the offshore substation(s) are unknown at this stage, the Broadshore Hub OfTDAs will be 'scoped in' to the CEA. The distance between the OnTDAs and the WFDAs is considerable enough to scope out cumulative effects.

1026. The cumulative assessment will consider the impacts in combination with other existing and future offshore wind farms and associated aviation activities, including increased collision risk and cumulative impacts on radar. The wind farms and other activities relevant to the assessment will be identified through a screening exercise. Consultation with other offshore wind farm developers in the area will be undertaken to understand what mitigations exist or are planned and how these may affect or harmonise with potential mitigations for the Broadshore Hub WFDAs.

1027. The aviation and radar CEA for the Broadshore Hub WFDAs will consider the maximum adverse design scenario for each adjacent project and any associated activities in line with the methodology.

12.6.4 Potential Transboundary Effects

1028. The potential impacts of WTGs on aviation are localised and the Broadshore Hub WFDAs is completely within UK airspace, with the nearest Norwegian operated airspace located 210.4 km to the north-east. Furthermore, the Broadshore Hub WFDAs is significantly beyond the expected radar coverage from the nearest non-UK airport.

1029. Due to the localised nature of any potential impact, transboundary effects are unlikely to occur and, therefore, it is proposed that these transboundary effects will be scoped out from further consideration within the EIA.

12.6.5 Summary of Aviation and Radar Impacts Scoped In and Out

1030. Taking account of the embedded mitigation measures detailed in **Section 12.5.1**, the impacts that have been ‘scoped in’ to the EIA are outlined in **Table 12.4.**

Table 12.4: Summary of Potential Impacts Scoped In (✓) or Scoped Out (x) for Aviation and Radar

Potential impact	Receptor(s)	Description of Potential Effect	Scoped In or Scoped Out? (✓ or x)			Embedded Mitigation Measures
			Construction	Operation and Maintenance	Decommissioning	
Creation of an aviation obstacle environment	Moray Firth Danger Areas (MoD) Low flying aircraft HIAL (Wick Airport) SAR operations (Bristow Group, HM Coastguard and MCA) Oil and gas industry (Helidecks and HMRIs) RAF Lossiemouth	Construction and decommissioning of the Broadshore Hub WFDAs may involve tall crane vessels creating a physical obstruction. The presence of WTGs could pose a physical obstruction to low flying aircraft, increasing the risk of collision or requiring aircraft to fly extended routes to avoid obstructions. Specifically, WTGs may have a potential effect on Wick Airport IFPs, RAF Lossiemouth ATC, activities within the Moray Firth Danger Area, SAR operations, and helicopters involved in offshore oil and gas activities.	✓	✓	✓	**Section 12.5.1**
Increased air traffic in the area related Broadshore Hub WFDAs' activities	Moray Firth Danger Areas Low flying aircraft SAR Operations (Bristow Group, HM Coastguard and MCA) Oil and industry (Helidecks and HMRIs)	Helicopter traffic involved in all stages of the Broadshore Hub WFDAs could affect existing traffic in the area, increasing the risk of aircraft-to-aircraft collision. Existing traffic may include military aircraft engaged in activities within the Moray Firth Danger Area.	✓	✓	✓	**Section 12.5.1**

Potential impact	Receptor(s)	Description of Potential Effect	Scoped In or Scoped Out? (✓ or x)			Embedded Mitigation Measures
			Construction	Operation and Maintenance	Decommissioning	
Effects on civil and military PSR systems	NERL Allanshill PSR, Lossiemouth ATC PSR, and Buchan AD PSR	To discriminate wanted aircraft targets from unwanted clutter, PSRs ignore static objects and only display moving targets. PSRs that can see rotating blades of WTGs can mistake them for aircraft and so present them on ATC radar displays as clutter. Controllers may not be able to distinguish aircraft from clutter. This is only applicable when WTGs begin rotation. Tall construction vessels and cranes that are in RLoS will not be moving fast enough to generate PSR clutter. WTGs will be gradually commissioned during the construction phase. Effects on civil and military PSR systems is scoped out of the construction period prior to first energy.	✓	✓	x	Mitigation measures to be determined through consultation with NERL and MOD.
Effects on civil and military SSR systems	N/A	NATS do not consider the effects of WTGs on SSR to be material or relevant for WTGs that are beyond approximately 28 km from the nearest SSR facility. Furthermore, CAP 764 states that the effects on SSR "…*are typically only a consideration*	x	x	x	N/A

Potential impact	**Receptor(s)**	**Description of Potential Effect**	**Scoped In or Scoped Out? (✓ or x)**			**Embedded Mitigation Measures**
			Construction	**Operation and Maintenance**	**Decommissioning**	
		when the turbines are located very close to the SSR i.e. less than 10 km". The nearest SSR facility is located at Allanshill.				
Effects on weather radars	N/A	The nearest MET Office radar is the Hill of Dudwick, located approximately 77 km to the south of the Broadshore Hub WFDAs. WTGs will be significantly beyond the 20 km safeguarded zone established around weather radars and therefore unlikely to have a significant effect despite having full visibility of WTGs within the Broadshore Hub WFDAs.	x	x	x	N/A

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12.7 Proposed Approach to Impact Assessment

1031. Within the aviation and radar chapter of the Broadshore Hub WFDAs EIA Report, the overall impact assessment for the Broadshore Hub WFDAs will be presented first. Following this, a summary of each WFDA will be given (i.e. the Broadshore WFDA, Sinclair WFDA and Scaraben WFDA), as set out in **Chapter 4: Approach to Scoping and Environmental Impact Assessment**.

1032. A thorough, desk-based collation and review of the relevant data will be undertaken to inform the subsequent Broadshore Hub WFDAs EIA Report. The EIA process will be informed by further desk-based studies, including RLoS modelling, which will identify and examine in greater detail sensitive aviation and radar receptors. RLoS is determined using radar propagation modelling software and 3D terrain data. Studies will be undertaken in parallel with consultation with relevant stakeholders to provide a detailed understanding of potential impacts. It is expected that the consultation stage will be an iterative process, allowing for any concerns to be addressed during the pre-application phase and in finalising the EIA Report. The aviation and radar assessment will comply with the guidance laid out in documents listed in **Section 12.2**.

1033. In respect of effects to Buchan AD PSR, an Air Defence and Offshore Wind (AD and OW) Windfarm Mitigation Task Force (the Task Force) has been established as a collaborative initiative between MOD, the Department for Energy Security and Net Zero, the Offshore Wind Industry Council, The Crown Estate and Crown Estate Scotland. The aim of the Task Force is to enable the co-existence of UK AD and OW to contribute towards meeting the UK Government's Net Zero target without degrading the nation's AD surveillance capability.

12.8 Scoping Questions to Consultees

1034. The following questions are posed to consultees to help them frame and focus their response to the aviation and radar scoping exercise, which will in turn inform the Scoping Opinion:

- Do you agree with the study area defined in **Section 12.4.1**?
- Do you agree with the list of data sources listen in **Table 12.1**?
- Do you believe the embedded mitigation measures to be suitable?
- Do you agree that all receptors related to aviation and radar have been identified?
- Do you agree with the scoping in and out of impact pathways in relation to aviation and radar?
- Do you agree with the assessment of transboundary effects in relation to aviation and radar?
- Do you agree with the assessment of cumulative effects in relation to aviation and radar?
- Do you have any other matters or information sources that you wish to present?

12.9 References

HCA (2023). Helideck Certificates. Available at: https://www.helidecks.org/information/certificates/ .

NATS (October 2012). Self-assessment maps. Available at: https://www.nats.aero/services-products/catalogue/n/wind-farms-self-assessment-maps/ .

CAA. (February 2016). CAP 764: Policy and Guidelines on Wind Turbines. Available at: https://publicapps.caa.co.uk/docs/33/CAP764%20Issue6%20FINAL%20Feb.pdf .

CAA (June 2019). CAP 670: Air Traffic Services Safety Requirements. Available at: https://publicapps.caa.co.uk/modalapplication.aspx?catid=1&pagetype=65&appid=11&mode=detail&id=9124 .

MoD (January 2020). MoD Obstruction Lighting Guidance. Available at: https://cdn.ymaws.com/www.renewableuk.com/resource/collection/0B792CF1-8B8A-474B-95B6-17886BF724A7/20190002-Windfarm_lighting_review__002_.pdf .

CAA (February 2021). CAP 393: Regulations made under powers in the Civil Aviation Act 1982 and the Air Navigation Order 2016. Available at: https://publicapps.caa.co.uk/docs/33/CAP393%20Regulations%20made%20under%20powers%20in%20the%20Civil%20Aviation%20Act%201982%20and%20the%20Air%20Navigation%20Order%202016.pdf .

CAA (March 2021). CAP1616: Airspace change: Guidance on the regulatory process for changing the notified airspace design and planned and permanent redistribution of air traffic, and on providing airspace information. Available at: https://publicapps.caa.co.uk/modalapplication.aspx?appid=11&mode=detail&id=8127 .

MCA (April 2021). 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/government/uploads/system/uploads/attachment_data/file/1157005/MGN_654.pdf .

MCA (November 2021). Offshore Renewable Energy Installations: Requirements, guidance and operational considerations for SAR and Emergency Response. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1034158/OREI_SAR_Requirements_v3.pdf .

CAA (January 2022). CAP 168: Licensing of Aerodromes. Available at: https://publicapps.caa.co.uk/docs/33/CAP%20168%20Licensing%20of%20Aerodromes%20v12%20c0123%20(004).pdf .

CAA (April 2022). Air Navigation Order 2016/765. Available at: https://www.caa.co.uk/uk-regulations/aviation-safety/civil-aviation-act-1982-the-ano-2016-the-rules-of-the-air-2015-and-the-dg-regulations-2002/the-civil-aviation-air-navigation-order-2016/ .

ICAO (July 2022). Annex 14 - Aerodromes - Volume I - Aerodromes Design and Operations. Available at: https://store.icao.int/en/annex-14-aerodromes .

CAA (February 2023). CAP 437: Standards for Offshore Helicopter Landing Areas. Available at: https://publicapps.caa.co.uk/modalapplication.aspx?appid=11&mode=detail&id=523 .

CAA (June 2023). CAP 032: UK Aeronautical Publication. Available at: https://nats-uk.ead-it.com/cms-nats/opencms/en/Publications/AIP/ .

MOD (June 2023). UK Military Aeronautical Publication. Available at: https://www.aidu.mod.uk/aip/aipVolumes.html .

NSTA (June 2023). NSTA Offshore Zipped Shapefiles ETR89. https://opendata-nstauthority.hub.arcgis.com/documents/-nsta-offshore-zipped-shapefiles-etrs89/about.

13 Marine Infrastructure and Other Users

13.1 Introduction

1035. This chapter considers the scope of potential impacts of the construction, operation and maintenance, and decommissioning phases of the Broadshore Hub Wind Farm Development Areas (WFDAs) on marine infrastructure and other users.

1036. This chapter provides an overview of the existing environment and sets out the proposed methodology and approach to assessing effects on marine infrastructure and other user receptors in the Broadshore Hub WFDAs Environmental Impact Assessment (EIA) Report. This chapter has been prepared by Royal HaskoningDHV.

1037. This chapter should be read in conjunction with the following chapters of the Broadshore Hub WFDAs Scoping Report:

- **Chapter 11: Shipping and Navigation;**
- **Chapter 12: Aviation and Radar; and**
- **Chapter 19 Major Accidents and Disasters.**

1038. This marine infrastructure and other users chapter is likely to have key inter-relationships with the above receptors, which will be considered appropriately where relevant in the Broadshore Hub WFDAs EIA Report.

13.2 Legislation, Policy and Guidance

1039. **Table 13.1** sets out the legislation, policy and guidance which have been considered in the preparation of this chapter, and will be considered within the Broadshore Hub WFDAs EIA Report assessment where appropriate. The overarching policy and legislation relevant to the Broadshore Hub WFDAs is described in **Chapter 2: Policy and Legislative Context**.

Table 13.1: Summary of Relevant Legislation, Policy and Guidance for Marine Infrastructure and Other Users

Relevant Legislation, Policy or Guidance	Relevance to the Assessment
Legislation/National Policy	
National Planning Framework 4 (NPF4) 2023	The NPF4 2023 policies of relevance to marine infrastructure and other users are:

Relevant Legislation, Policy or Guidance	Relevance to the Assessment
	Part 2 – National Planning Policy: - Policy 11 (Energy) - Mentions the development of offshore wind farms and other technologies. Part 3 - Annex B, Policy 3 - Strategic Renewable Electricity Generation and Transmission Infrastructure Part 3 – Annex b, Policy 15 - Industrial Green Transition Zones – Comments on other technologies such as Carbon Storage and hydrogen developments. Annex C – Spatial Planning Priorities
Scotland's National Marine Plan (2015) (Scottish Government, 2015)	The Scottish National Marine Plan sets out strategic policies for the sustainable development of Scotland's marine resources out to 200 nautical miles. The Plan highlights Marine planning policies applicable to infrastructure and other marine users, including interactions with other users: **Development**: Energy developments can displace fishing. The cabling arrays associated with energy and telecoms developments, and other physical infrastructure associated with development, have the potential for short-term displacement of fishing activity during the installation phase. **FISHERIES 2:** The following key factors should be taken into account when deciding on uses of the marine environment and the potential impact on fishing: *The potential effect of displacement on: fish stocks; the wider environment; use of fuel; socio-economic costs to fishers and their communities and other marine users.*
UK Marine Policy Statement (2011) (UK Government, 2011)	The Marine Policy Statement is the framework for preparing Marine Plans and taking decisions affecting the marine environment. It informs the standard approach to planning and decision making regarding Marine Plans. Many sections are of note to infrastructure and marine users, including: "*The evidence base will be developed from a wide range of sources including existing plans, the plan area community, science advisors, statutory and other advisors, industry and other marine users*"
Marine Policy	
Sectoral Marine Plan – Offshore Wind Energy (October 2020)	The plan has been developed in accordance with the National Marine Plan (2015) to address interactions between renewable development and other marine users. Highlights the need to ensure compatibility with other projects and marine users in Scotland, but also for this strategy to minimise the potential adverse effect on other marine users, economic sectors, and the environment.
Scotland's National Marine Plan (2015) - GEN 4 – Co-existence	GEN 4 emphasises the need to co-exist with other marine users in development sectors and activities and requires that cumulative impacts be addressed.
Guidance	

Relevant Legislation, Policy or Guidance	Relevance to the Assessment
European Subsea Cable Association (ESCA) guidelines	The European Subsea Cable Association (ESCA) guideline no.6 'The Proximity of Offshore Renewable Energy Installations & Submarine Cable Infrastructure in UK Waters' provides a framework for collaborative working between the offshore wind farms and subsea cable developments.

13.3 Consultation

1040. Consultation undertaken to date for the Broadshore Hub WFDAs relevant to marine infrastructure and other users is provided in **Table 13.2** below.

Table 13.2: Consultation Relevant to Marine Infrastructure and Other Users

Consultee	Date/Document	Comment	How Comment is Addressed
MD-LOT	13th September 2023, Scoping Workshop (email post-workshop 6th October 2023)	The approach to EIA proposed at the Scoping Workshop seems sensible for marine infrastructure and other users, however the Scottish Ministers' final comments will come via the scoping opinion once MD-LOT has consulted with relevant stakeholders.	Noted.

13.4 Existing Environment

13.4.1 Study Area

1041. The marine infrastructure and other users study area is shown in **Figure 13.1** in **Appendix 1** of this Broadshore Hub WFDAs Scoping Report, and is defined by the Broadshore Hub WFDAs plus a 10 nautical mile (nm) buffer to align with the shipping and navigation study area presented in **Chapter 11: Shipping and Navigation**. The same study area is used in order to capture relevant routeing of vessels associated with other projects/infrastructure in the area that may be affected around the Broadshore Hub WFDAs.

1042. As discussed in **Section 3.10.3** in **Chapter 3: Project Description,** discussions are underway with CES to progress a boundary change for the Sinclair WFDA. The original and proposed revised Sinclair WFDA boundaries are shown in **Figure 1.2** in **Appendix 1.** This boundary change may change the level of potential impact on marine infrastructure and other users.

13.4.2 Data and Information Sources

1043. **Table 13.3** sets out the information and data sources which have been considered in the preparation of this chapter, and will be considered within the Broadshore Hub WFDAs EIA Report assessment where relevant matters are scoped in.

Table 13.3: Summary of Key Data and Information Sources for Marine Infrastructure and Other Users

Dataset	Year(s)	Description
Disposal site location data, Marine Scotland National Marine Plan Interactive (NMPI).	2022	Contains information on disposal site locations.
Historic Aggregate site data and sand gravel resources, (NMPI; Marine Scotland).	2020, 2023	The interactive map provides visual data on the historic locations of aggregate sites and sand gravel resources around the marine infrastructure and other users study area.
Offshore oil and gas activity data, (North Sea Transition Authority; NSTA).	2023	Spatial information on gas and oil infrastructure (gas and oil wells, fields, pipelines and licence blocks)
Offshore wind lease areas, (Crown Estate Scotland, CES).	2023	Represents all current offshore wind farm sites in pre-planning, planning, construction and operational phases in Scottish waters
Innovation and Targeted Oil and Gas (INTOG) application areas (CES).	2023	Represents the successful application areas of the INTOG leasing round.
Wave lease sites and suitable areas for development (NMPI,2013).	2023	Spatial information on wave lease sites granted by CES and areas identified as suitable for development under the Sectoral Marine Plan
Tidal lease sites and suitable areas for development (NMPI, 2013).	2023	Spatial information on tidal lease sites granted by CES and areas identified as suitable for development under the Sectoral Marine Plan
Carbon Capture Storage (CCS) areas, (Acorn; Storegga; NSTA)	2023	Recent information on CCS Acorn Development and CCS licensing areas.
Subsea cables (KIS-ORCA; NMPI, 2023)	2023	Marine cables digital data

1044. No site-specific surveys have been undertaken to inform this chapter. The marine infrastructure and other users baseline characterisation in the Broadshore Hub WFDAs EIA Report will be informed by publicly available data with no further studies or surveys required. However, results from the summer (2023) and winter (planned for winter 2024) vessel traffic surveys will be included and referred to in the baseline characterisation, where appropriate. Further details on these surveys are provided in **Chapter 11: Shipping and Navigation**.

13.4.3 Oil and Gas Infrastructure

1045. Within the marine infrastructure and other users study area, there are 18 oil and gas license blocks. Eight blocks have licensed activity within them (13/17b, 13/17c, 13/18, 13/21b, 13/22a, 13/22b, 13/23c, 13/24a, 13/24b, 13/28b, 13/28c 13/29a and 13/29b,) and ten blocks currently have unlicensed status (13/16, 13/26, 13/27, 12/20, 12/25, 12/30, 13/16, 19/1, 19/2 and 19/3).

1046. In license block 13/22a, the Captain oil and gas field development area intersects the northern extent of the Broadshore Hub WFDAs Scoping Boundary (see **Figure 13.2** in **Appendix 1**). The Captain oil field is operated by Ithaca Energy and includes a surface platform and Floating Production Storage and Offloading (FPSO) vessel. Captain crude oil is offloaded from the FPSO, whilst gas is exported via subsea pipeline to Frigg UK Gas Transportation System, and then on to the St Fergus Gas Terminal.

1047. In addition, the Blake and Ross oil fields are respectively located approximately nine km and 12 km east of the Broadshore Hub WFDAs Scoping Boundary (see **Figure 13.2** in **Appendix 1**). Both fields are operated by Repsol-Sinopec and produce into the Bleo Holm FPSO via subsea infrastructure, which is owned by Bluewater Energy Services (Repsol Sinopec, 2021; Bluewater, 2021). A number of pipelines from the Captain, Blake and Ross oil fields are located within the marine infrastructure and other users study area; the Captain Gas Export Pipeline, the Ross Gas Export Line, Brent A – St. Fergus (Far North Liquids and Associated Gas System; FLAGS), and other pipelines within each of the oil fields (**Figure 13.2** in **Appendix 1**). No pipelines intersect the Broadshore Hub WFDAs Scoping Boundary.

1048. Within the Broadshore Hub WFDAs Scoping Boundary itself, there are six decommissioned (Abandoned Phase 3) wells (**Figure 13.2** in **Appendix 1**).

13.4.4 Offshore Wind Farm Developments

1049. **Figure 13.3** in **Appendix 1** shows the surrounding ScotWind offshore wind farm developments. The closest development is the proposed Buchan Offshore Wind Farm, located approximately 14 km from the Broadshore Hub WFDAs Scoping Boundary, and falls partially within the marine infrastructure and other users study area. The proposed Stromar Offshore Wind Farm is located approximately 17 km from the Broadshore Hub WFDAs Scoping Boundary, and also partially falls within the marine infrastructure and other users study area.

1050. Two other proposed offshore wind developments are present in the wider region, but fall outside the marine infrastructure and other users study area; the MarramWind Offshore Wind Farm, located approximately 42 km from the Broadshore Hub WFDAs Scoping Boundary to the east; and the Caledonia Offshore Wind Farm, located approximately 24 km west.

1051. Other developments in different stages are found west of the Broadshore Hub WFDAs. These are the Moray East Offshore Wind Farm and Moray West Offshore Wind Farm developments, with Moray East being operational (approximately 40 km distance) and Moray West, currently under construction (approximately 55 km distance), and the operational Beatrice Offshore Wind Farm (approximately 51 km distance).

1052. The closest INTOG project is the proposed Salamander Offshore Wind Farm, located approximately 63 km south of the Broadshore Hub WFDAs Scoping Boundary. Green Volt Offshore Wind Farm is located approximately 64 km south-east and is currently awaiting decision on the Section 36 (s.36) consent application.

13.4.5 Carbon Capture Storage

1053. The Acorn CCS licence area is located approximately 6.4 km east from the Broadshore Hub WFDAs Scoping Boundary within the marine infrastructure and other users study area, as shown in **Figure 13.4** in **Appendix 1**. No other CCS licences are located within the marine infrastructure and other users study area. The Applicants will engage with the Acorn project to establish the extent of interaction between the projects.

13.4.6 Ministry of Defence

1054. Information on aviation activity in the vicinity of the Broadshore Hub WFDAs is provided in **Chapter 12: Aviation and Radar**. This includes Ministry of Defence (MoD) aviation activity and designated danger areas (see **Figure 16.6** in **Appendix 1**). The Scoping Opinion for the Caledonia Offshore Wind Farm (Marine Scotland, 2023) highlighted that an area within and to the east of the Caledonia offshore wind farm development zone extends across an area with MoD maritime navigational interests, notably a highly surveyed route that is retained to maintain national defence requirements. The Applicants are consulting with the MoD with respect to any interaction of the Broadshore Hub WFDAs with this route and will include any information received within the Broadshore Hub WFDAs EIA Report.

13.4.7 Other Infrastructure

13.4.7.1 Dredging and Disposal Sites

1055. There are no active offshore dredging or disposal sites identified within the marine infrastructure and other users study area (see **Figure 13.5** in **Appendix 1**), however, a few open disposal sites are located in the wider region. Located within 60 km south of the Broadshore Hub WFDAs off the coast of Banff is the Macduff disposal site. The Fraserburgh disposal site is located 47 km south of the Broadshore Hub WFDAs off the coast of Fraserburgh.

13.4.7.2 Subsea Cables (Utilities)

1056. There are no subsea cables identified within the marine infrastructure and other users study area (see **Figure 13.5** in **Appendix 1**). The closest subsea cable, the SHEFA 2 telecommunications cable is located approximately 39 km to the west of the Broadshore Hub WFDAs. To the west of SHEFA 2 is the Caithness to Moray high-voltage direct current (HVDC) cable, similarly located approximately 39 km to the west of the Broadshore Hub WFDAs at the closest point. Lastly, further north at approximately 48 km from the Broadshore Hub WFDAs is the Shetland HVDC Link.

13.4.7.3 Marine Aggregates and Mining

1057. There are no licences for marine aggregate extraction identified within the marine infrastructure and other users study area (see **Figure 13.5** in **Appendix 1**) or within the wider east Scotland region (Marine Scotland, 2020).

13.4.7.4 Wave and Tidal

1058. There are no wave or tidal projects identified within the marine infrastructure and other users study area (see **Figure 13.5** in **Appendix 1**). The closest wave/tidal project is the operational Mocean Energy Ltd wave power energy converter project approximately 86 km north (East of Deerness) of the Broadshore Hub WFDAs.

13.4.7.5 Aquaculture

1059. There are no aquaculture sites identified within the marine infrastructure and other users study area (see **Figure 13.5** in **Appendix 1**). The north of Scotland coastline is identified as an area where the development of new aquaculture sites is restricted, and where existing aquaculture sites can only be extended (Marine Scotland, 2022). The closest aquaculture site identified is found below Wick, a seaweed harvesting farm located approximately 72 km away from the Broadshore Hub WFDAs.

13.5 Potential Impacts

1060. Construction works associated with the installation of wind turbine generators (WTGs), inter-array cables (IACs) and associated substructures have the potential to result in temporary impacts on marine infrastructure and other users. Such impacts include implementation of Safety Zones around construction vessels which may temporarily affect or restrict access to other infrastructure/projects and displace activity by other marine users.

1061. The presence of permanent offshore infrastructure associated with the Broadshore Hub WFDAs has the potential to impact marine infrastructure and other users (**Paragraph 10601060**), either temporarily or long-term during operation. These impacts may arise as a result of operation and maintenance works carried out for the Broadshore Hub WFDAs.

1062. During decommissioning, it is anticipated that the impacts would be similar to those during construction (**Paragraph 1060**). The detail and scope of the decommissioning works will be determined by the relevant legislation, guidance, and authorities at the time of decommissioning and agreed with the relevant regulator.

13.5.1 Embedded Mitigation Measures

1063. Mitigation measures will be considered throughout the design process of the Broadshore Hub WFDAs and will be included with the objective to reduce the potential impacts associated with the Broadshore Hub WFDAs on the environment.

1064. The following embedded mitigation measures are proposed for marine infrastructure and other users:

- Advance warning and accurate location details of construction, maintenance and decommissioning operations, associated Safety Zones and advisory passing distances will be given via Notices to Mariners and Kingfisher Bulletins.
- All offshore infrastructure associated with the Broadshore Hub WFDAs will be appropriately marked on UK Hydrographic Office Admiralty charts.
- The application of statutory and advisory Safety Zones during construction and potentially for major maintenance activities during the operational phase, if required.
- Development of and adherence to a Navigational Safety Plan and Vessel Management Plan which will detail measures implemented to facilitate safe navigation.
- Development of and adherence to a Cable Plan (CaP).
- Early engagement with any other offshore operators or developers active within the marine infrastructure and other users study area, to facilitate coexistence by coordinating activities.
- Dropped objects on the seabed during works associated with the Broadshore Hub WFDAs which may pose a hazard will be reported in line with Marine Directorate - Licensing Operations Team procedures.
- Development of, and adherence to, a Lighting and Marking Plan (LMP).
- Development of Unexploded Ordnance (UXO) Threat and Risk Assessment.
- Development of, and adherence to, an Emergency Response Cooperation Plan (ERCoP).
- The Applicants will ensure compliance with the Regulatory Expectations on Moorings for Floating Wind and Marine Devices (MCA and Health and Safety Executive, 2017).
- Development of, and adherence to, a Development Specification and Layout Plan (DSLP).
- Where appropriate, guard vessels will be used to ensure adherence with Safety Zones or advisory passing distances.
- Marine coordination will be implemented to manage project vessels throughout construction, maintenance, and decommissioning periods.
- Broadshore Hub WFDAs vessels will ensure compliance with international marine regulations as adopted by the Flag State, including the COLREGs (International Maritime Organisation; IMO, 1972/77) and SOLAS (IMO, 1974).
- The layout of the WTGs in the Broadshore Hub WFDAs, will be finalised in discussion with the MCA and NLB in order to ensure the specific WTG layout is compatible with potential SAR activity.
- Failures of the lighting and marking in the Broadshore Hub WFDAs will be appropriately reported and rectified as soon as practicable. Interim hazard warnings (i.e. Notice to Mariners) will be put in place as required.

13.6 Scoping of Potential Impacts

13.6.1 Potential Impacts Scoped In

1065. Impacts have been scoped in for assessment in the Broadshore Hub WFDAs EIA Report, where there is an identified impact pathway on a marine infrastructure and other user receptor during any of the phases of the Broadshore Hub WFDAs; construction, operation and maintenance and decommissioning.

1066. The following impacts have been scoped in for assessment in the Broadshore Hub WFDAs EIA Report for all development phases, as infrastructure is present within the marine infrastructure and other users study area:

- Potential for restricted access to the Captain, Ross and Blake oil and gas fields and infrastructure and/or disruption to associated activities;
- Potential for restricted access to the Buchan and Stromar Offshore Wind Farm areas and/or disruption to associated activities;
- Potential for restricted access and/or disruption to Acorn CCS development and associated activities; and
- Impacts on MoD maritime navigational interests.

13.6.2 Potential Impacts Scoped Out

1067. The following impacts have been scoped out of assessment in the Broadshore Hub WFDAs EIA Report for all phases of the Broadshore Hub WFDAs, due to no infrastructure/sites being identified within the marine infrastructure and other users study area:

- Impacts on subsea cables (utilities);
- Impacts on dredging and disposal sites; and
- Impacts on other infrastructure (marine aggregate and mining sites; aquaculture; and wave and tidal projects).

13.6.3 Potential Cumulative Effects

1068. There is the potential for cumulative effects to occur as the result of the Broadshore Hub WFDAs activities interacting with other plans and/or projects. This includes cumulative effects with the Broadshore Hub OfTDAs and Broadshore Hub OnTDAs. The Cumulative Effects Assessment (CEA) will follow the methodology set out in **Chapter 4: Approach to Scoping and Environmental Impact Assessment**.

13.6.4 Potential Transboundary Effects

1069. There are no marine infrastructure and other users associated with European Economic Area (EEA) states within the marine infrastructure and other users study area. Therefore, there is no potential for impacts on transboundary receptors, and transboundary effects are scoped out from further consideration in the Broadshore Hub WFDAs EIA Report.

13.6.5 Summary of Marine Infrastructure and Other Users Impacts Scoped In and Out

1070. A summary of potential impacts scoped in and out from further assessment in the Broadshore Hub WFDAs EIA Report is provided in **Table 13.4** below.

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Table 13.4: Summary of Potential Impacts Scoped In (✓) or Scoped Out (x) for Marine Infrastructure and Other Users

Potential impact	Receptor(s)	Description of Potential Effect	Scoped In or Scoped Out? (✓ or x)			Embedded Mitigation Measures
			Construction	Operation and Maintenance	Decommissioning	
Impacts on other offshore wind farms	Buchan Offshore Wind Farm Stromar Offshore Wind Farm	The presence of vessels during construction, maintenance and decommissioning, and the presence of the operational Broadshore Hub WFDAs infrastructure may restrict or disrupt other offshore wind farms and associated activities	✓	✓	✓	Mitigation measures as proposed in **Section 13.5.1**
Impacts on offshore oil and gas operations	Captain, Blake and Ross oil and gas fields	The presence of vessels during construction, maintenance and decommissioning, and the presence of the operational Broadshore Hub WFDAs infrastructure may restrict or disrupt oil and gas developments and associated activities	✓	✓	✓	Mitigation measures as proposed in **Section 13.5.1**
Impacts on CCS sites	Acorn CCS Project	The presence of vessels during construction, maintenance and decommissioning, and the presence of the operational Broadshore Hub WFDAs infrastructure may disrupt CCS developments and associated activities	✓	✓	✓	Mitigation measures as proposed in **Section 13.5.1**
Impacts on subsea cables (utilities)	Telecommunications and other utilities cables	No pathway for effect - the closest subsea cable is the SHEFA 2 telecommunications 39	x	x	x	N/A

Potential impact	Receptor(s)	Description of Potential Effect	Scoped In or Scoped Out? (✓ or x)			Embedded Mitigation Measures
			Construction	Operation and Maintenance	Decommissioning	
		km to the west of the Broadshore Hub WFDAs				
Impacts on dredging and disposal sites	Disposal sites located on the east coast	No pathway for effect - the closest dredging and disposal site is the Fraserburgh disposal site, which is found 47 km from the Broadshore Hub WFDAs	x	x	x	N/A
Impacts on marine aggregate sites	Mining and aggregate sources.	No pathway for effect - there are no aggregate sites in the wider region	x	x	x	N/A
Impacts on MoD maritime navigational interests	MoD Highly Surveyed Areas	The presence of vessels during construction, maintenance and decommissioning, and the presence of the operational Broadshore Hub WFDAs infrastructure may disturb and displace military activities.	✓	✓	✓	Mitigation measures as proposed in **Section 13.5.1**

13.7 Proposed Approach to Impact Assessment

1071. The methodology set out in **Chapter 4: Approach to Scoping and Environmental Impact Assessment** will be followed when preparing the marine infrastructure and other users chapter for the Broadshore Hub WFDAs EIA Report. Within the marine infrastructure and other users chapter of the Broadshore Hub WFDAs EIA Report, the overall impact assessment for the Broadshore Hub WFDAs will be presented first. Following this, a summary of each WFDA will be given (Broadshore WFDA, Sinclair WFDA, Scaraben WFDA).

1072. Consultees will include: offshore wind energy lease holders, oil and gas operators, CCS developers and the MoD. Alongside consultation with relevant stakeholders and owners/operators of identified projects, the 'TCE and CES Agreements and Oil and Gas Licences' (NSTA, 2023) will be considered.

13.8 Scoping Questions to Consultees

1073. The following questions are posed to consultees to help frame and focus their response to this scoping exercise for marine infrastructure and other users, which will in turn inform the Scoping Opinion:

- Do you agree with the data sources used to characterise the marine infrastructure and other users baseline?
- Are there any further desktop datasets which you would recommend are included?
- Have all the potential impacts on marine infrastructure and other users resulting from the Broadshore Hub WFDAs been identified in the Broadshore Hub WFDAs Scoping Report?
- Do you agree with the impacts that have been scoped in (or scoped out) for further assessment in the Broadshore Hub WFDAs EIA Report?
- Do you consider the revised Sinclair boundary (as shown in **Figure 1.2** in **Appendix 1**) to reduce potential interaction with other marine infrastructure users and activities?
- Do you have any other matters or information sources that you wish to present?

13.9 References

NSTA (2023). Offshore Oil and Gas Activity. Available at: https://www.arcgis.com/apps/webappviewer/index.html?id=f4b1ea5802944a55aa4a9df0184205a5.

Marine Conservation Agency and Health and Safety Executive (2017). Regulatory Expectations on Moorings for Floating Wind and Marine Devices. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/640962/Regulatory_expectations_on_mooring_devices_from_HSE_and_MCA.PDF

Marine Scotland (2023). Caledonia Offshore Wind Farm: Scoping Report. Available at: https://marine.gov.scot/sites/default/files/pre-application_-_offshore_scoping_report_redacted.pdf

NSTA (2023). Press Release: Net zero boost as carbon storage licences accepted. Available at: https://www.nstauthority.co.uk/news-publications/news/2023/net-zero-boost-as-carbon-storage-licences-accepted/

Repsol Sinopec (2021). Repsol Sinopec Announce Contract Extension of Bleo Holm FPSO. Available at: https://www.repsolsinopecuk.com/news/repsol-sinopec-announce-contract-extension-of-bleo-holm-fpso

Bluewater (2021). Repsol Sinopec and Bluewater announce contract extension. Available at: https://www.bluewater.com/repsol-sinopec-and-bluewater-announce-contract-extension/

Marine Scotland (2020). Aggregates. Available at: https://marine.gov.scot/sma/assessment/aggregates..

European Subsea Cables Association (ESCAEU) Guidelines: Guideline 06- Proximity of wind Farms. Available at: https://www.escaeu.org/guidelines/.

14 Marine Archaeology and Cultural Heritage

14.1 Introduction

1074. This chapter considers the scope of potential impacts of the construction, operation and maintenance, and decommissioning phases of the Broadshore Hub Wind Farm Development Areas (WFDAs) on marine archaeology and cultural heritage.

1075. This chapter provides an overview of the existing environment and sets out the methodology and proposed approach to assessing effects on marine archaeology and cultural heritage in the Broadshore Hub WFDAs Environmental Impact Assessment (EIA) Report. This chapter has been prepared by Royal HaskoningDHV.

1076. This chapter should be read in conjunction with the following chapters of the Broadshore Hub WFDAs Scoping Report:

- **Chapter 5: Marine Geology, Oceanography and Physical Processes;** and
- **Chapter 15**: **Seascape and Landscape Visual Impact Assessment**.

1077. The marine archaeology and cultural heritage assessment is likely to have key inter-relationships with the above receptors, which will be considered appropriately where relevant in the Broadshore Hub WFDAs EIA Report.

14.2 Legislation, Policy and Guidance

1078. **Table 14.1** provides a summary of relevant legislation, policy and guidance which establishes requirements for the marine archaeology and cultural heritage chapter and the assessment methodology. Policy and legislation relevant to the Broadshore Hub WFDAs generally is provided in **Chapter 2: Policy and Legislative Context**.

Table 14.1: Summary of Relevant Legislation, Policy and Guidance for Marine Archaeology and Cultural Heritage

Relevant Legislation, Policy or Guidance	Relevance to the Assessment
Legislation	
Marine (Scotland) Act (2010)	Provides for the designation of Historic Marine Protected Areas (HMPA) in respect of historically significant areas within the marine zone, including wrecks formerly protected under the Protection of Wrecks Act (1973).

Relevant Legislation, Policy or Guidance	Relevance to the Assessment
Marine (Scotland) Act (2014)	The Act provides a framework to 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.
Merchant Shipping Act (1995)	This Act sets out the procedures for determining the ownership of underwater finds classified as a 'wreck' (flotsam, jetsam, derelict and lagan) found in or on the shores of the sea or any tidal water. It includes ship, aircraft, hovercraft, parts of these, their cargo or equipment. The Receiver of Wreck is responsible for processing incoming reports of wreck and cargo. The Broadshore Hub WFDAs have the potential to impact items associated with wrecks, which fall within the definition of 'wreck'.
The Protection of Military Remains Act (1986)	Provides protection for the wreckage of military aircraft and certain military wrecks. Designations can be either as a Controlled Site or Protected Place where access may be permitted but any operations that may disturb the site are illegal unless licenced by the Ministry of Defence. All military aircraft are automatically protected under this legislation; however, vessels must be designated individually.
Policy	
National Planning Framework 4 (NPF4) 2023	Policies of relevance to this area of technical assessment are: • Policy 1: Tackling the Climate and Nature Crisis; and • Policy 7: Historic Assets and Places.
Scottish Planning Policy (2014) - Paragraph 169	Discusses how proposals for energy infrastructure development should take account of spatial frameworks for wind farms and heat maps where relevant.
Historic Environment Policy for Scotland (HEPS) (2019)	The document is designed to support and enable good decision-making about changes to the historic environment. HEPS sets out a series of principles and policies for the recognition, care and sustainable management of the historic environment which have informed development of the proposed scope and methodology of the assessment.
Tackling the Nature Emergency - strategic framework for biodiversity: consultation (Scottish Government, 2023)	A consultation on Scotland's Strategic Framework for Biodiversity, including the first 5-year Delivery Plan for the Scottish Biodiversity Strategy, and elements of the proposed Natural Environment Bill.
Guidance	
Historic Environment Guidance for the Offshore Renewable Energy Sector (Collaborative Offshore Wind Research into the Environment; COWRIE, 2007)	Guidance note on the survey, appraisal and monitoring of the historic environment during the development of offshore renewable energy projects in the UK. The guidance is applicable to the marine environment and the coastal environment adjacent to any development,

Relevant Legislation, Policy or Guidance	Relevance to the Assessment
	encompassing the inter-tidal area, coastal margin and those areas further inland likely to be affected by offshore renewable energy developments.
Historic Environment Scotland (HES) (2019-updated May 2021) Scotland's Historic Marine Protected Areas	Explains what historic marine protected areas are and HES' role in advising the Scottish Government in designating these areas.
Archaeological Written Schemes of Investigation for Offshore Wind Farm Projects (The Crown Estate, 2021)	High level guidance on a range of archaeological methodologies that may be required in the production of Written Schemes of Investigation (WSIs) and Method Statements.
Guidance for Assessment of Cumulative Impacts on the Historic Environment from Offshore Renewable Energy (Oxford Archaeology, 2008)	Guidance on cumulative impacts on the historic environment arising from offshore renewable energy projects. The guidance identifies issues relating to the assessment of cumulative and synergistic effects at each stage of the Strategic Environmental Assessment/EIA process from screening and scoping to decision-making and implementation.
Institute of Environmental Management and Assessment (IEMA) Principles of Cultural Heritage Impact Assessment (2021)	This publication sets out guiding principles to supplement existing guidance and give a consistent framework for cultural heritage in a variety of settings.
Joint Nautical Archaeology Policy Committee (JNAPC) Code of Practice for Seabed Development (JNAPC and The Crown Estate 2006	This code builds on the principles set out in the original Code (JNAPC 1995) and offers guidance to developers on issues such as risk management and legislative implications. A list of contacts for further advice is also provided. The code also highlights the responsibility of developers in protecting the UK's marine heritage.

14.3 Consultation

1079. Consultation undertaken to date for the Broadshore Hub WFDAs relevant to marine archaeology and cultural heritage is provided in **Table 14.2** below.

Table 14.2: Consultation Relevant to Marine Archaeology and Cultural Heritage

Consultee	Date/Document	Comment	How Comment is Addressed
MD-LOT	13th September 2023, Scoping Workshop (email post-workshop 6th October 2023)	What has been proposed seems sensible for marine archaeology and cultural heritage, however the Scottish Ministers' final comments will come via the scoping opinion once MD-LOT has consulted with relevant stakeholders	Noted.

14.4 Existing Environment

14.4.1 Study Area

1080. The marine archaeology study area encompasses the Broadshore Hub WFDAs Scoping Boundary shown in **Figure 14.1** in **Appendix 1**.

1081. A marine archaeology 60 km study area, will be used (aligned with **Chapter 15**: **Seascape and Landscape Visual Impact Assessment**) for assessment of impact to the setting of onshore heritage assets.

14.4.2 Data and Information Sources

1082. **Table 14.3** sets out the information and data sources which have been considered in the preparation of this chapter, and will be considered within the Broadshore Hub WFDAs EIA Report where relevant matters are scoped in.

Table 14.3: Summary of Key Data and Information Sources for Marine Archaeology and Cultural Heritage

Dataset	Description
United Kingdom Hydrographic Office (UKHO)	Records of wrecks and obstructions data including ‘dead’ and salvaged wrecks that are no longer charted as navigational hazards.
Maritime records maintained by National Record of the Historic Environment (CANMORE)	Maritime records, including documented losses of vessels, and records of terrestrial monuments and findspots, including the archaeological excavation index.
Historic Environment Scotland	Records of designated heritage assets within Scotland, maintained by Historic Environment Scotland. GIS data for all Protected Wrecks, Scheduled Monuments, Listed Buildings, Registered Parks and Gardens and Registered Battlefields.
Aberdeenshire Historic Environment Record (HER)	Contains data on all recorded non-designated heritage assets, held by Aberdeenshire Council. The data includes archaeological, historic landscape and historic building information. Information on previous events (archaeological surveys and investigations) will also be obtained.
British Geological Survey (BGS)	Historic borehole logs and the wider geological background for the region.
Regional Seascape Assessments	Character texts for seascape character of coastal and marine areas around Scotland.
Scottish Archaeological Research Framework (ScARF)	The primary resource for Scottish archaeology, one which provides an overview of the subject and also a set of relevant research questions to guide assessment
Existing archaeological studies and published sources	Background information on the archaeology of the Moray Firth, including the results of previous archaeological assessments carried out of Moray West and Moray East windfarms as well as wider assessments carried out in the North Sea area.
Geophysical (mid-August – mid-September 2023) and geotechnical (scheduled mid-November 2023 to mid-January 2024) survey data from Broadshore Hub WFDAs Scoping Boundary	All geophysical and geotechnical data acquired by the Applicants as part of offshore survey campaign within the Broadshore Hub WFDAs will be reviewed by an archaeological specialist to inform the Broadshore Hub WFDAs EIA Report.

14.4.3 Baseline Environment

1083. An initial high-level desk-based review of existing literature and data sources was undertaken to support this scoping exercise.

1084. The marine archaeology study area is located outside of the Moray Firth, 47 km north off the coast of Fraserburgh. The seabed of the Moray Firth is generally smooth, with water depths in the western part reaching some 50-70 m, and deepening eastwards (Department of Energy and Climate Change, 2004, p.32).

1085. No prehistoric archaeological artefacts or landscapes have been recorded within the marine archaeology study area. Generally, it is accepted that the potential for prehistoric archaeology and landscapes across wide areas of the United Kingdom Continental Shelf (UKCF) is high (Wessex Archaeology, 2009, p.9) however the potential for site preservation in of the UKCF deeper than 80 m is low (Flemming, 2003, p.16).

1086. Recent palaeogeographic assessment of the geophysical data work for the Telford, Stevenson and MacColl Wind Farms (Moray Offshore Renewables (East) Limited, 2014) and Moray East Wind Farm (Moray Offshore Renewables (West) Limited, 2018) has demonstrated the potential for the presence of as of yet undiscovered in situ prehistoric sites and finds within the Inner Moray Firth c. 40 km to the west of the marine archaeology study area. The shallow geology of this area is dominated by Devensian, cold stage deposits which limit prehistoric potential due to the presence of extensive ice coverage across the region which both prohibited human occupation, as well as removing underlying geology.

1087. There is, however, potential for the survival of post-Devensian, Holocene deposits, with both archaeological and paleoenvironmental potential, deposited at a time when the region was exposed as a terrestrial environment after the last glacial period, post-ice retreat but prior to the Holocene marine transgression. It is difficult however to predict the potential for prehistoric human remains further east towards the central North Sea due to strong currents, exposure to North Atlantic storms, thin sediment cover and large areas of exposed bedrock in this area of the North Sea (Flemming, 2004, p.11).

1088. While the presence of prehistoric archaeology and landscapes is currently unknown within the marine archaeology study area, a more thorough evaluation of archaeological information will be incorporated into a marine archaeology desk-based assessment (ADBA), which will be generated to guide a comprehensive mitigation plan.

1089. Within the marine archaeology study area, there are no nationally important wrecks protected under Historic Marine Protected Areas or Protection of Military Remains Act 1986.

1090. There is high potential for other wrecks, wreck remains, aircraft and aircraft remains to be present within the marine archaeology study area. Provisional information from the high-resolution geophysical survey covering the Broadshore Hub WFDAs has identified three shipwrecks within the area. There is a total of 60 UKHO records of wrecks/obstructions within the marine archaeology study area recorded at a depth of 70 m – 105 m. These comprise one named wreck (SS *Lars Magnus Trozelli*) and three unnamed wrecks, one of which is classified as 'dead'. 'Dead' wrecks/obstructions are wrecks/obstructions which have not been identified since their loss and so are presumed not to exist. Out of the remaining 56 UKHO records relating to Fisherman's Fasteners (51) and unnamed records (5), 53 are classified as 'dead'.

1091. There are a further nine Canmore Maritime records within the marine archaeology study area, five of which appear as duplications of the UKHO data. The remaining four are wrecks:

- Unknown wreck (Canmore ID 325157);
- *Mountain Crest* (Canmore ID 308585) a Motor Fishing boat which caught fire and sank 25 miles off Fraserburgh;
- *Snowdrop* (Canmore ID 207086) a wooden lugger recorded as lost on 25 August 1896; and

- *Junior* (Canmore ID 308586) a Motor Vessel, with cargo of coal, recorded as lost on 24 December 1929.

1092. It should be noted that the location of the four recorded wrecks in the Canmore Maritime data are recorded as a centre point of a National Grid Reference given to the nearest 1 km.

1093. Within the marine archaeology 60 km study area which covers part of the Aberdeenshire coast there are a total of 49 Scheduled Monuments and 410 Listed Buildings (comprising 20 Category A, 144 Category B and 246 Category C).

1094. The potential receptors that may be present within the study areas are summarised as:

- Palaeolandscape features and sub-seabed deposits of palaeoenvironmental interest;
- Prehistoric occupation sites;
- Wreck and aviation remains; and
- Onshore designated heritage assets.

14.5 Potential Impacts

1095. Potential impacts to marine archaeology and cultural heritage assets include both direct and indirect impacts. Impacts can also occur from changes in the setting of heritage assets, which could affect heritage significance.

1096. Direct impacts to heritage assets present on the seafloor or buried under the seabed, may result in damage to, or the destruction of any archaeological material, or the relationship between that material and the wider environment (stratigraphic context or setting). Relationships between archaeological material and the wider environment are crucial to developing a full understanding of such material. These impacts may occur if heritage assets or material are present within the footprint of the Broadshore Hub WFDAs (i.e., substructure or inter-array cables (IACs)) or from construction related activities (i.e., seabed clearance and anchoring).

1097. There is also the potential for the Broadshore Hub WFDAs to directly and indirectly change the local and regional hydrodynamic and sedimentary process regimes. Changes in coastal processes can lead to the re-distribution of erosion and accretion patterns. Similarly, changes in tidal currents may affect the stability of nearby morphological and archaeological features. Indirect impacts to heritage assets may occur if buried heritage assets become exposed to increased wave/tidal action, as these will deteriorate farther than assets protected by sediment. Conversely, if increased sedimentation results in an exposed site becoming buried, it may add some protection and be considered a beneficial impact. This will be considered based on the results of the assessment of local and regional hydrodynamic and sedimentary process regimes undertaken for marine physical processes (please refer to **Chapter 5: Marine Geology, Oceanography and Physical Processes**).

1098. Heritage assets may be affected by direct physical changes or by changes to their setting (HES, 2020). Impacts to the significance of a heritage asset may also occur if a development changes the setting of the asset (the surrounding in which the heritage assets is located, experienced and appreciated).

1099. Similarly, historic character may also be affected if the Broadshore Hub WFDAs result in a change to the prevailing character of the area and/or alters perceptions of the seascape.

14.5.1 Embedded Mitigation Measures

1100. The following embedded measures which can reduce potential for significant effects have been considered in the identification of potential impacts associated with the Broadshore Hub WFDAs:

- The implementation of Archaeological Exclusion Zones (AEZs) around sites identified as having a known important archaeological potential to mitigate the potential impacts from offshore infrastructure.
- Archaeological input into specifications for and analysis of future preconstruction geophysical surveys within the Broadshore Hub WFDAs.
- Archaeologists to be consulted in the preparation of any preconstruction Remotely Operated Vehicle (ROV) or diver surveys and in monitoring/checking of data, if appropriate based upon the findings of the archaeological assessment of geophysical survey data.
- All anomalies of possible archaeological potential will be reviewed against the final layout and design. If they are likely to be impacted, these anomalies would undergo further archaeological investigation. Should these anomalies prove to be of archaeological importance then future AEZs may be implemented following consultation with HES.
- Archaeological input into specifications for and analysis of future preconstruction geotechnical surveys, including a provision for sampling, analysis and reporting of recovered cores, if appropriate. The results of all geoarchaeological investigations to be compiled in a final report which includes a sediment deposit model.
- Commitment to preparation and agreement on an Offshore Written Scheme of Investigation (WSI) and Protocol of Archaeological Discoveries (PAD).
- Micro-siting of SKS to avoid known heritage assets (AEZs) where possible.
- Development and adherence to a Cable Plan (CaP).
- Development of Unexploded Ordnance (UXO) Threat and Risk Assessment.

14.6 Scoping of Potential Impacts

1101. All potential impacts for the construction, operation and maintenance and decommissioning phases of the Broadshore Hub WFDAs is provided in **Sections 14.6.1, 14.6.2**, and **14.6.3** below. No impacts are proposed to be scoped out from further assessment in the Broadshore Hub WFDAs EIA Report. A summary of potential impacts scoped in is provided in **Table 14.4.**

14.6.1 Potential Impacts During Construction

1102. Direct impacts may occur if archaeological material is present within the footprint of the Broadshore Hub WFDAs (e.g. IACs, substructures, station keeping systems (SKS), footprint of jack-up vessels).

1103. Indirect impacts to heritage assets may occur if the physical presence of construction vessels and offshore infrastructure impacts the hydrodynamic regime. Similarly, if seabed preparation associated with substructures, SKS, subsea hub and IAC installation leads to localised effects upon sedimentary processes this could lead to indirect impacts to heritage assets.

1104. There would also be potential for temporary impacts to the setting of heritage assets from the presence of vessels associated with the installation of the offshore infrastructure.

1105. Based on the above, all construction-related impacts are scoped in for further assessment in the Broadshore Hub WFDAs EIA Report.

14.6.2 Potential Impacts During Operation and Maintenance

1106. Direct impacts may occur if archaeological material is present within the footprint of works required for routine maintenance activities which disturb the seabed (for example, seabed contact by legs of jack-up vessels and/or anchors). Similarly, this can occur in exceptional circumstances such as the replacement of cabling.

1107. However, given the areas where such activities would be undertaken would already have been disturbed during construction, there would be limited further impact during operation and maintenance.

1108. Indirect impacts to heritage assets may occur if the physical presence of the installed infrastructure impact the hydrodynamic or sedimentary regime. This includes the potential for increased scour around FBSS and SKS.

1109. There would also be potential for impacts to the setting of heritage assets from the presence of the installed infrastructure and ongoing maintenance activities.

1110. Based on the above all impacts that may occur during operation and maintenance are scoped in for further assessment in the Broadshore Hub WFDAs EIA Report.

14.6.3 Potential Impacts During Decommissioning

1111. The scope of the decommissioning works would most likely involve removal of the accessible installed infrastructures. Offshore, this is likely to include removal of all the wind turbine components, part of the SKS (that above seabed level), removal of some or all of the IACs.

1112. If IACs and elements of the SKS are left in place there would be no potential for direct impact. Direct impacts to heritage assets may occur if the accessible infrastructure is removed. This is not anticipated as any remains at the locations of the installed infrastructure will already have been impacted/mitigated during the construction phase assuming the same locations for jack-ups or vessel anchors are used.

1113. If archaeological material is present within areas (not previously used for construction) of jack-ups or vessel anchors deployed during decommissioning activities, direct impacts may also occur.

1114. Based on the above all impacts at decommissioning are scoped in for further assessment in the Broadshore Hub WFDAs EIA Report.

14.6.4 Potential Cumulative Effects

1115. The CEA for marine archaeology and cultural heritage will follow the general methodology set out in **Chapter 4: Approach to Scoping and Environmental Impact Assessment**. The CEA will be considered in two stages; a CEA of the of the whole Broadshore Hub (i.e., the Broadshore Hub WFDAs, the Broadshore Hub OfTDAs and the Broadshore Hub OnTDAs), followed by a CEA of the whole Broadshore Hub alongside other plans or projects.

1116. Individual heritage assets would not be subject to cumulative direct impacts from other known plans or projects as they are discrete and there would be no physical overlap of different infrastructure. However, although individual assets are discrete, taken together they could have collective heritage significance. Therefore, multiple impacts upon similar assets could occur cumulatively.

1117. In addition, there is potential for multiple developments to affect the larger-scale archaeological features such as palaeolandscapes. The setting of heritage assets may also be affected.

1118. There is also the potential for cumulative indirect impacts associated with changes to marine physical processes. There is, therefore, the potential for cumulative impacts and these are scoped in for further assessment in the Broadshore Hub WFDAs EIA Report for each phase (construction, operation and maintenance, and decommissioning).

14.6.5 Potential Transboundary Effects

1119. Direct transboundary impacts may occur during construction if wrecks or aircraft of non-British nationality are subject to impacts from the Broadshore Hub WFDAs. Such wrecks may fall within the jurisdiction of another country, and may include, for example, foreign warships lost in UK waters. Similarly, where palaeolandscapes within the North Sea cross international boundaries, direct transboundary impacts may occur.

1120. There is, therefore, the potential for transboundary impacts and these are scoped in for further assessment in the Broadshore Hub WFDAs EIA Report for all for each phase (construction, operation and maintenance, and decommissioning).

1121. Indirect transboundary impacts, associated with changes to marine physical processes, where those changes cross an international boundary, are not expected to occur and are therefore scoped out.

14.6.6 Summary of Marine Archaeology and Cultural Heritage Impacts Scoped In and Out

1122. A summary of potential impacts scoped in and out from further assessment in the Broadshore Hub WFDAs EIA Report is provided in **Table 14.4** below.

Table 14.4: Summary of Potential Impacts Scoped In (✓) or Scoped Out (x) for Marine Archaeology and Cultural Heritage

Potential Impact	Receptor(s)	Description of Potential Effect	Scoped In or Scoped Out? (✓ or x)			Embedded Mitigation Measures
			Construction	Operation and Maintenance	Decommissioning	
Direct impacts to heritage assets	Maritime archaeology receptors such as wrecks, debris, submerged prehistoric receptors palaeolandscapes and associated archaeological receptors).	Site preparation and construction activities causing direct impacts to heritage assets.	✓	✓	✓	See **Section 14.5.1.**
Indirect impacts to heritage assets associated with changes to marine physical processes	Maritime archaeology receptors such as wrecks, debris, submerged prehistoric receptors palaeolandscapes and associated archaeological receptors).	Physical presence of construction vessels and offshore infrastructure impacts the hydrodynamic regime or has localised effects upon sedimentary processes.	✓	✓	✓	
Change to the setting of heritage assets.	Onshore and offshore heritage receptors.	Change to the setting of heritage assets which could affect heritage significance.	✓	✓	✓	N/A

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14.7 Proposed Approach to Impact Assessment

1123. Within the marine archaeology and cultural heritage chapter of the Broadshore Hub WFDAs EIA Report, the overall impact assessment for the Broadshore Hub WFDAs will be presented first. Following this, a summary of each WFDA will be given (Broadshore WFDA, Sinclair WFDA, Scaraben WFDA).

1124. The marine archaeology assessment in the Broadshore Hub WFDAs EIA Report will be informed by the interpretation of the geophysical survey data collected by the Applicants (namely the bathymetry and side scan sonar (SSS) data to identify seabed features, such as wrecks, magnetometry data to identify magnetic anomalies and sub-bottom profile data to identify palaeolandscape features).

1125. All geophysical and geotechnical data acquired by the Applicants as part of offshore survey campaign within the Broadshore Hub WFDAs will be reviewed by an archaeological specialist to inform the Broadshore Hub WFDAs EIA Report.

1126. An ADBA will be undertaken to establish the baseline for both known and potential heritage assets within the defined areas based upon the desk-based sources listed in **Table 14.3**.

1127. The ADBA and assessment of geophysical data will be used to identify a strategy for mitigation including the avoidance of identified heritage assets through the application of AEZs where appropriate. This mitigation strategy will be set out in the Outline WSI which will be submitted alongside the Broadshore Hub WFDAs EIA Report. The Outline WSI will cover the Broadshore Hub WFDAs to ensure that a commitment to archaeological investigation and mitigation, as relevant to both known and potential heritage assets, is captured across the extents of the Broadshore Hub WFDAs.

1128. Initial consideration of the setting of heritage assets and any potential for impact upon their associated heritage significance will be undertaken as part of the setting assessment. This will be informed by site visits to onshore heritage assets, Seascape Landscape Visual Impact Assessment (SLVIA) wireframes, zones of theoretical visibility (ZTVs), visualisation and photomontages where appropriate. A full consideration of, and conclusions regarding, setting impacts will be made in the Broadshore Hub WFDAs EIA Report, following finalisation of the project design.

1129. The methodology of the assessment will also take account of guidance listed in **Table 14.1**.

1130. Technical consultation with HES will be undertaken. This will help to identify and agree the primary methodologies, present initial findings and ensure potential historic environment issues and risk are identified and considered in the Broadshore Hub WFDAs EIA Report.

14.8 Scoping Questions to Consultees

1131. The following questions are posed to consultees to help them frame and focus their response to the marine archaeology and cultural heritage scoping exercise, which will in turn inform the Scoping Opinion for the Broadshore Hub WFDAs:

- Do you agree with the characterisation of the existing environment?
- Have all the marine archaeology and cultural heritage impacts resulting from the Broadshore Hub WFDAs been identified in the Broadshore Hub WFDAs Scoping Report?
- Do you agree with the marine archaeology and cultural heritage impacts that have been scoped in for/out from further consideration within the Broadshore Hub WFDAs EIA Report?
- Have all the relevant data sources been identified in the Broadshore Hub WFDAs Scoping Report?
- Do you agree with the proposed approach to assessment in the Broadshore Hub WFDAs EIA Report?
- Do you have any other matters or information sources that you wish to present?

14.9 References

Flemming, N. C. (2003). The scope of Strategic Environmental Assessment of Continental Shelf Area SEA 4 in regard to prehistoric archaeological remains. Prepared for the Dept. of Trade & Industry. Available at https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/197361/SEA4_TR_Archaeology_NFC.pdf.

Flemming, N. C. (2004). Submarine prehistoric archaeology of the North Sea: research priorities and collaboration with industry.

Historic Environment Scotland (2020). Managing Change in the Historic Environment: Setting

Moray Offshore Renewables (East) Limited (2014) Environmental Statement Vol 4 Chapter 11 Human Environment

Moray Offshore Renewables Limited (2014) Environmental Statement Technical Appendix 5.5 A - Archaeology Technical Report

Department of Energy and Climate Change (2004) Strategic Environmental Assessment 5: Environmental Report

Moray Offshore Renewables (West) Limited (2018) Environmental Statement Vol 4 Appendix 16.1 Marine Archaeology Baseline

15 Seascape and Landscape Visual Impact

15.1 Introduction

1132. This chapter considers the scope of potential impacts of the construction, operation and maintenance, and decommissioning phases of the Broadshore Hub Wind Farm Development Areas (WFDAs) on the seascape, landscape and visual environment.

1133. This chapter provides an overview of the existing environment and further sets out the methodology and approach to assessing effects on seascape, landscape and visual receptors in the Broadshore Hub WFDAs Environment Impact Assessment (EIA) Report. This chapter has been prepared by LUC Ltd.

1134. Seascape, Landscape and Visual Impact Assessment (SLVIA) considers effects on:

- Seascape/landscape as a resource in its own right (caused by changes to its constituent elements, its specific aesthetic or perceptual qualities and/or its character); and
- Views and visual amenity as experienced by people (caused by changes in the appearance of the seascape/landscape).

1135. This chapter should be read in conjunction with the following chapters of the Broadshore Hub WFDAs Scoping Report:

- **Chapter 14:** European Subsea Cables Association (ESCAEU) Guidelines: Guideline 06- Proximity of wind Farms. Available at: https://www.escaeu.org/guidelines/.**Marine Archaeology and Cultural Heritage;** and
- **Chapter 16: Socioeconomics, Tourism and Recreation**.

1136. The SLVIA is likely to have key inter-relationships with the above receptors, which will be considered appropriately where relevant in the Broadshore Hub WFDAs EIA Report.

15.2 Legislation, Policy and Guidance

1137. There is no legislation of direct relevance to SLVIA. **Table 15.1** sets out the local policy and national guidance which have been considered in the preparation of this chapter, and will inform the SLVIA chapter in the Broadshore Hub WFDAs EIA Report where appropriate. The overarching policy and legislation relevant to the Broadshore Hub WFDAs is described in **Chapter 2: Policy and Legislative Context**.

Table 15.1: Summary of Relevant Legislation, Policy and Guidance for Seascape, Landscape and Visual Impact Assessment

Relevant Legislation, Policy or Guidance	Relevance to the Assessment
Policy	
Scottish Government (2023) National Planning Framework 4	Sets out policies in relation to proposed “renewable energy development onshore and offshore”, including effects on landscape and visual receptors.
Scottish Government (2015) Scotland’s National Marine Plan	Sets out policies that apply to the marine environment, including policies relating to effects on seascape, landscape and visual receptors.
Aberdeenshire Council (2023) Aberdeenshire Local Development Plan 2023	The current development plan for the onshore part of the SLVIA study area (see **Section 15.4.1**), including policies relating to landscape character and landscape designations, relevant to consideration of onshore receptors.
Guidance	
Landscape Institute and Institute of Environmental Management and Assessment. (2013) *Guidelines for Landscape and Visual Impact Assessment*. Third Edition. (‘GLVIA3’)	Industry standard guidance on approach to undertaking assessment of effects of development on landscape and visual receptors.
Landscape Institute (2019) *Visual Representation of Development Proposals*. Technical Guidance Note 06/19	Provides guidance on preparing and presenting visualisations, such as photomontages, which will be used to support SLVIA.
Landscape Institute (2021) *Assessing landscape value outside national designations*. Technical Guidance Note 02/21	Provides guidance on how to assess the value of landscape receptors, which GLVIA3 approach states is a component of their sensitivity.
NatureScot (2021) *Assessing the Cumulative Impact of Onshore Wind Energy Developments*	Provides guidance on assessing cumulative landscape and visual effects, which is applicable to offshore as well as onshore projects.
NatureScot (2017) *Visual Representation of Windfarms*. Version 2.2	Provides wind-farm-specific guidance on preparing and presenting visualisations, such as photomontages, which will be used to support SLVIA.
NatureScot (2017) *Guidance on Coastal Character Assessment*	Provides guidance on undertaking coastal character assessment as a means of classifying and describing coastal landscapes.

15.3 Consultation

1138. A scoping workshop for the Broadshore Hub WFDAs was held on 13th September 2023 with Marine Directorate - Licensing Operations Team (MD-LOT) and NatureScot, at which the approach to SLVIA was outlined. Relevant observations from this workshop are noted in **Table 15.2**. No other consultation for SLVIA has taken place at this stage.

Table 15.2: Consultation Relevant to Seascape, Landscape and Visual Impact Assessment

Consultee	Date/Document	Comment	How comment is addressed
NatureScot	13th September 2023 Scoping Workshop	The sensitivity of ferry passengers should not be considered as low – the sensitivity will depend on distance of the ferry from the Broadshore Hub WFDAs. NatureScot agrees that workers on platforms/ fishing vessels would be considered lower sensitivity receptors.	The sensitivity of ferry passengers and other offshore receptors is discussed in **Section 15.5.3**.
NatureScot	13th September 2023 Scoping Workshop	NatureScot agreed that the focus of the SLVIA for the Broadshore Hub WFDAs is on visual receptors, as opposed to landscape receptors, given the distance offshore. The combined effects of the Offshore Transmission Development Area (OfTDA), and the Onshore Transmission Development Area (OnTDA) will need to be included in the Cumulative Effects Assessment (CEA). The CEA would require coastal character assessment. Requested that information on how the CEA would be undertaken is presented in the Broadshore Hub WFDAs Scoping Report.	Visual Assessment is scoped in (**Section 15.6.1**) Coastal Character Assessment is scoped out of the Broadshore Hub WFDAs EIA, including for the CEA. Approach to CEA is set out in **Section 15.6.3**. Coastal Character Assessment will be considered as part of Broadshore Hub OfTDA and OnTDA assessments.
NatureScot	13th September 2023 Scoping Workshop	There are no firm rules on the number of viewpoints required and it will depend on the sensitivity of receptors and other issues. NatureScot consider that the proposed viewpoint locations seem reasonable. NatureScot recommends to consult with Aberdeenshire Council for local context.	The proposed viewpoint locations are set out in **Section 15.5.3**. Aberdeenshire Council will be consulted on the number and location of viewpoints used for the SLVIA through this Broadshore Hub WFDAs Scoping Report and meetings with the Applicants.
NatureScot	13th September 2023 Scoping Workshop	NatureScot suggested a collaboration within the North Eastern and Eastern Developer Groups for baseline coastal character assessment/photos for landfall(s). This was undertaken for Forth and Tay applications.	The need for a common coastal character baseline at the landfall(s) location would be explored in relation to the Broadshore Hub OfTDAs and OnTDAs assessments.

Consultee	Date/Document	Comment	How comment is addressed
NatureScot	13th September 2023 Scoping Workshop	Wet storage should be considered in the EIA	The Applicants' position is that the Broadshore Hub WFDAs EIA Report will not include consideration of earlier manufacturing activities, port activities (e.g. WTG assembly), or 'wet storage' of the WTGs. Those do not form part of the Broadshore Hub WFDAs or activities for which consent is sought. Where those activities constitute development requiring a new planning permission, or requiring a Marine Licence, that would need to be applied for separately by the relevant party seeking such consent and would need to be accompanied by any appropriate environmental assessment required. Therefore wet storage of floating offshore units will be included within the CEA section along with other projects and plans (**Section 15.6.3**).

1139. Following receipt of the Scoping Opinion, further consultation may be required to agree the details of the SLVIA scope (e.g. representative viewpoints for assessment). Relevant stakeholders will include NatureScot and Aberdeenshire Council.

15.4 Existing Environment

15.4.1 Seascape, Landscape and Visual Impact Assessment Study Area

1140. The SLVIA study area is defined as a radius around the Broadshore Hub WFDAs. Published guidance suggests a study area of 45 km radius for wind turbines over 150 m in overall height (Scottish Natural Heritage (SNH), 2017a). A 'Ready Reckoner' of potential visual effects related to offshore turbine size (White et al., 2019) suggests a very approximate ratio of 1:133 between turbine height and distance at which low magnitude of impact might be detected. For a proposed maximum blade tip height of 400 m, this would indicate a SLVIA study area radius of 53.2 km.

1141. For recent offshore wind proposals, a SLVIA study area of 60 km has been advised by stakeholders in recognition of the increasing heights of wind turbines. For example, 60 km was recommended for Berwick Bank, where 355 m turbines were proposed (Marine Scotland, 2021), and for Caledonia Offshore, which is proposing a maximum 350 m blade tip height (Marine Scotland, 2023a).

1142. This chapter therefore considers a SLVIA study area of 60 km radius around the Scoping boundary, as likely significant effects would not occur beyond this distance. **Figure 15.1** in **Appendix 1** shows the Broadshore Hub WFDAs in the context of a 60 km SLVIA study area. It should be noted that the SLVIA would be based on a 60 km radius around the submitted WFDAs, and may therefore differ from the boundary shown in Figure 15.1.

1143. The majority of the SLVIA study area comprises open sea within the Outer Moray Firth. A small area of north-east Aberdeenshire, between Macduff and St Fergus (approx. 290 km^2), falls within the SLVIA study area. A 60 km area defined around the Sinclair WFDA only would not include any land. A 60 km area defined around the Scaraben WFDA only would encompass a very small area of land around Fraserburgh (approx. 25 km^2).

1144. The Broadshore Hub WFDAs are located approximately 47 km north of Fraserburgh, off the Aberdeenshire coast in Scotland. They are 72 km from the Caithness coast to the west, and 81 km from the closest point on Orkney. The Broadshore WFDA is closest to land. The Sinclair WFDA is located 61 km from the coast while the Scaraben WFDA is located 58 km from the coast.

1145. The baseline of the SLVIA study area is discussed below in terms of offshore seascape, coastal and onshore landscape, and visual amenity. This section also considers the value attached to the identified receptors.

15.4.2 Data and Information Sources

1146. Data will be gathered from desk-based sources as listed in **Table 15.3**. In addition, site visits will be undertaken to the landward part of the SLVIA study area to verify the baseline and to carry out assessments.

Table 15.3: Summary of Key Data and Information Sources for Seascape, Landscape and Visual Impact Assessment

Dataset	Year(s)	Description
National Marine Plan Interactive	Up to 2023	Compilation of various datasets including vessel traffic and offshore infrastructure, relevant to the understanding of baseline seascape character and potential visual receptors.
Aberdeenshire Council (2017) Local Development Plan Supplementary Guidance: Aberdeenshire Special Landscape Areas.	2023	Extent of locally designated landscapes in the onshore part of the SLVIA study area.
Scottish Natural Heritage Map of Coastal Character Types	2010	High-level classification of coastal character at a national scale.
Scottish Landscape Character Types Map and Descriptions (Nature Scot, 2019)	2019	Digital map-based classification of Scotland's landscape character.

15.4.3 Offshore Seascape Baseline

1147. The majority of the SLVIA study area comprises open sea. This area of sea includes the operational Moray East and Beatrice offshore wind farms in the west, and oil and gas infrastructure in the east. Parts of the SLVIA study area are relatively busy with shipping and fishing activity, with vessel traffic across the SLVIA study area but most frequent closer to the port of Fraserburgh.

1148. A number of future offshore wind farm proposals are also located within the SLVIA study area, as shown in **Figure 15.1** in **Appendix 1**. To the west, the consented Moray West (under construction) is alongside Moray East. Proposed ScotWind offshore wind sites include Caledonia to the west, Stromar and Ayre to the north-west, Buchan to the north-east, and Marram to the east. The Green Volt Innovation and Targeted Oil and Gas (INTOG) site is also to the east.

1149. There is no published characterisation of offshore seascape character in Scotland. As such there are no key characteristics for the majority of the SLVIA study area. There are no designations within the offshore environment that are relevant to SLVIA. The value of the offshore seascape is therefore considered to be low.

15.4.4 Coastal and Onshore Landscape Character Baseline

1150. The SLVIA study area includes part of north-east Aberdeenshire, from Macduff in the west, to St Fergus in the east, and extending inland up to 13 km to include Mormond Hill.

15.4.4.1 Coastal Character

1151. The coast varies from high cliffs in the west to low sandy bays in the east. Coastal character assessment is the preferred approach to identifying the key characteristics of coastal and marine landscapes in Scotland (SNH, 2017b). Coastal character types have been mapped at a national level (SNH, 2010). The coastline west of Fraserburgh is classed as ‘Rocky Coastline/Open Sea Views’, while the lower coast to the east is classed as ‘Deposition Coastline, Open Views’.

1152. There is no national dataset of more detailed coastal character areas. Parts of the Aberdeenshire coast to the west have been characterised to inform other SLVIA studies (Moray Offshore Renewables Ltd, 2012), although this does not extend into the SLVIA study area. A baseline coastal character assessment would need to be undertaken, following NatureScot guidance as set out in SNH (2017b). This would likely differentiate between:

- The cliffs and coastal hills flanking Troup Head in the west of the SLVIA study area;
- The sloping farmed coast west of Fraserburgh;
- The sandy bays and low rocky headlands between Fraserburgh and St Combs; and
- The wide beaches and dunes either side of Rattray Head.

1153. The key characteristics of these areas are likely to include views along the coast and out to sea.

15.4.4.2 Landscape Character

1154. Onshore landscape character is described in a national dataset of landscape character types (LCT), published by NatureScot (2019). The following landscape character types are within the onshore part of the SLVIA study area:

- Cliffs and Rocky Coast, Aberdeenshire;
- Beaches, Dunes and Links, Aberdeenshire;
- Gently Undulating Coastal Farmland;
- Broad Ridges and Valleys;
- Coastal Farmland with Ridges and Valleys;
- Coastal Agricultural Plain, Aberdeenshire; and
- Undulating Agricultural Heartland.

1155. The key characteristics of coastal LCTs include references to sea views, but these are not generally a characteristic of more inland landscapes.

15.4.4.3 Landscape Designations

1156. There are no nationally designated landscapes within the SLVIA study area. The Aberdeenshire coast, either side of Fraserburgh, is locally designated as Special Landscape Areas (SLA), recognising its scenic qualities (Aberdeenshire Council, 2017). The SLAs are shown in **Figure 15.3** in **Appendix 1**. The aspects and features for which the North Aberdeenshire Coast SLA is designated mentions, among others: "*accessibility to the wild sense of place felt in the area*"; "*Panoramic views from higher headlands*"; "*Elemental qualities include experience of exposure, wildness and remoteness and drama associated with rugged cliffs*"; and "*A recreational coast, with beaches coastal paths enabling good access to the outdoors*".

1157. The aspects and features for which the North East Aberdeenshire Coast SLA is designated include "*panoramic views out to sea from cliff tops and open beaches*", and also "*panoramic views out to sea from headlands and beaches and important views along the coast*".

1158. The value of the coastal landscape character within the SLVIA study area is therefore considered to be medium, based on the local or regional importance indicated by SLA designation.

15.4.5 Visual Amenity Baseline

1159. The zone of theoretical visibility (ZTV) shown in **Figure 15.2** and **Figure 15.3** in **Appendix 1** illustrates the locations where views of the Broadshore Hub WFDAs may be available to receptors at sea and on land. The ZTV has been generated based on the maximum turbine height of 400 m across the whole of the Broadshore Hub WFDAs. It therefore shows a maximum level of visibility. The ZTV indicates continuous visibility across the at-sea parts of the SLVIA study area. For the onshore part of the SLVIA study area, most of the coastal edge is within the ZTV. Visibility extends inland towards the edge of the SLVIA study area, but is intermittent due to the undulating nature of the land. The ZTV is based on bare ground, so does not reflect the screening by vegetation and buildings that would further reduce the visibility of the offshore turbines. This ZTV has been used to inform Scoping, but the SLVIA will be based on a ZTV generated for the submitted WFDAs, which may differ from the ZTV shown in **Figure 15.2** and **Figure 15.3** in **Appendix 1**.

1160. A number of factors affect the visibility of distant features in views, including meteorological conditions. The Met Office records data on atmospheric visibility and classifies visibility of over 40 km as 'excellent'. An analysis carried out for the Seagreen Offshore Wind Farm (Seagreen, 2012), using Met Office data from Leuchars, Fife, indicates that visibility of greater than 40 km only occurs 8% of the time (including hours of darkness). This is the equivalent of 29 days per year. Visibility is also affected by meteorological conditions, such as rain. SLVIA nevertheless considers the worst-case.

1161. As noted in **Section 15.4.1**, a study area of 60 km radius around the Broadshore Hub WFDAs is considered sufficient to capture all likely significant effects. The ZTV extends beyond this distance, indicating theoretical visibility, but this does not equate to potential visual effect, as confirmed by GLVIA3 (paragraph 6.6).

1162. On land, actual visibility will vary greatly due to vegetation and buildings that are not included in the ZTV. Clear views can be assumed for closer marine views within the SLVIA study area, with inland views more likely to be obscured.

1163. Automatic Identification System (AIS) Ship Traffic data has been used to identify potential receptors crossing the SLVIA study area (Marine Scotland, 2023b). Shipping activity is focused on the coast and the port at Fraserburgh, as well as traffic crossing the area to and from Aberdeen. Activity includes ferry routes between Orkney, Shetland and Aberdeen (see **Figure 15.2** in **Appendix 1**), as well as vessel traffic between Aberdeen and the oil and gas installations in the SLVIA study area. Fishing takes place across the SLVIA study area, but activity is focused towards the coast (please refer to **Chapter 10: Commercial Fisheries** for further information on fisheries).

1164. AIS Ship Traffic data shows that more vessels of all types are more likely to be found in inshore locations around the southern edge of the SLVIA study area. This includes frequent recreational marine users travelling along the east coast of Scotland. Visual receptors closer to the Broadshore Hub WFDAs are limited to those passing through the area on vessels, most of whom will be working in the fishing, transport and oil and gas industries.

1165. Visual receptors also include people on land where they have views of the sea. The coastline within the SLVIA study area includes coastal walks, beaches and viewpoints offering views out to sea. Sea views are also available to residents in their homes and within their communities, and people travelling along the coast on roads and railways.

1166. Given the distance between the Broadshore Hub WFDAs and the visual receptors on land, a small number of viewpoints are considered to be representative. Viewpoints have been chosen to reflect the places where higher sensitivity receptors may experience views out to sea in the direction of the Broadshore Hub WFDAs. These viewpoints are shown in **Figure 15.3** in **Appendix 1** and listed in **Table 15.4**. Proposed viewpoint locations are subject to revision based on refined ZTVs, micrositing in the field, views expressed through the scoping process and through consultation with Aberdeenshire Council. Once refined, final viewpoints will be agreed with NatureScot and Aberdeenshire Council.

Table 15.4: Proposed Viewpoint Locations

Proposed Viewpoint Location	Grid Reference	Distance to Site (approx.)	Reason for Selection
1. Troup Head	382457, 867166	52.8 km	Elevated headland, accessible via a circular walk within an RSPB nature reserve. Represents wide open views experienced by visitors.
2. Pennan	384421, 865509	53.5 km	Open northward view from this coastal edge settlement, recognised for its traditional character. Represents views experienced by the community as well as visitors.
3. New Aberdour	388437, 863369	54.6 km	Coastal views from open space next to Aberdour Church, at the edge of this small settlement on high coastal farmland. Also represents views from the coastal B9031 road.
4. Rosehearty War Memorial	393189, 866886	49.3 km	Landmark monument overlooking this settlement, with sea views beyond. On a core path close to the community of Rosehearty.
5. Kinnaird Head, Fraserburgh	399837, 867579	47.2 km	Headland that is the closest onshore location to the Broadshore Hub WFDAs, and within this largest settlement in the SLVIA study area. Adjacent to the Museum of Scottish Lighthouses, and on a coastal core path.
6. St Combs	405666, 863219	50.7 km	On the low-lying north-east coast, view from the dunes over the long beach towards Inverallochy. Represents views experienced by the community and by visitors

15.5 Potential Impacts

1167. The Broadshore Hub WFDAs will comprise three WFDAs for offshore wind turbines located approximately 47 km from the shore. The maximum number of turbines being considered for the Broadshore Hub WFDAs combined is 74, and the tip height of turbines will not exceed 400 m above LAT. The turbines will require lights at hub height for aviation safety. Offshore substation(s) (OFSSs) may be required, which will be up to 75 m above LAT in height, but these will be consented within the Broadshore Hub Offshore Transmission Development Areas (OfTDAs) EIA Report (they will also be considered in the Broadshore Hub WFDAs Cumulative Effects Assessment (CEA)). Other permanent elements of the Broadshore Hub WFDAs will be below the sea surface, and will not give rise to effects on seascape, landscape and visual receptors.

1168. Construction and decommissioning of the Broadshore Hub WFDAs will require vessel movements, offshore cranes and other vessels, and lighting within the SLVIA study area. Given the type and scale of the development, and the distance offshore, it is considered that the receptors that may experience likely significant effects would be similar between construction, operation and maintenance, and decommissioning.

1169. The following sections consider the potential for the Broadshore Hub WFDAs to give rise to significant effects on the receptors noted in **Section 15.4**.

15.5.1 Offshore Seascape Receptors

1170. The offshore seascape is unlikely to be sensitive to changes arising from the infrastructure and activities associated with the Broadshore Hub WFDAs. Sensitivity, for the purposes of SLVIA, is judged with consideration of the susceptibility of the receptor to change, and the value placed on the seascape, landscape or visual resource. The baseline offshore seascape, including existing infrastructure and activity, is considered unlikely to be highly susceptible to changes of the type that would arise from introduction of the Broadshore Hub WFDAs. There are no designations or other indications that the area is a valued seascape. Both susceptibility and value, and therefore sensitivity, are likely to be low. While the scale of change in seascape character may be high in the vicinity of the Broadshore Hub WFDAs, significant effects are unlikely to arise due to the low sensitivity.

15.5.2 Coastal and Onshore Character Receptors

1171. Some of the key characteristics associated with coastal and onshore landscapes are susceptible to changes arising from the introduction of offshore structures. The coast is also locally designated for its scenic value. Susceptibility and value, and therefore sensitivity, are likely to be higher along the coast, though potentially lower inland.

1172. The ZTV presented in **Figure 15.2** in **Appendix 1** indicates that the Broadshore Hub WFDAs will be visible from the coast and from slightly further inland. However, coastal character is determined by many factors, not only sea views. The potential for the presence of the Broadshore Hub WFDAs in views to affect coastal character to such a degree that key characteristics would be changed, is considered limited. While there is no published research on this topic, experience suggests that significant effects on coastal and onshore landscape character would be unlikely to occur at over 40 km from an offshore wind farm. This has been accepted by stakeholders, for example in NatureScot's response to the Caledonia Offshore Wind Farm Scoping Report (Marine Scotland, 2023a).

1173. With the closest coastal and landscape receptors being 47 km from the Broadshore Hub WFDAs, significant effects on coastal and onshore landscape character are unlikely to arise.

15.5.3 Visual Receptors

1174. People within the offshore part of the SLVIA study area will be either passing through or working within the Outer Moray Firth or northern North Sea. Receptors working in the area, such as shipping crew, fishermen, or people travelling to offshore platforms, are unlikely to be susceptible to changes in their outlook as they move around the sea. Passengers on ferries may be more susceptible to changes in the view as their journey may be part of a recreational trip. There is no indication that any particular value is placed on views within the marine environment. For the most part the sensitivity of receptors is likely to be low, although the sensitivity of ferry passengers may be higher (**Table 15.2**). The scale of change in views may be high for receptors close to the Broadshore Hub WFDAs. The duration of any impact will be small as receptors will be passing through the area, and will only be close to the WFDAs for a short time. As such, significant effects are not considered likely, even for higher sensitivity receptors such as ferry passengers.

1175. Visual receptors close to the coast or onshore include residents, visitors to coastal locations and beaches, and recreational users of inshore waters. The marine view forms part of their enjoyment of the area, and they are likely to be of higher sensitivity to changes in seaward views. The value of coastal views is recognised in local landscape designations, and in the many viewpoints provided along the coast. Susceptibility and value, and therefore sensitivity, of these receptors is likely to be higher. While the distance between the Broadshore Hub WFDAs and the more sensitive visual receptors remains considerable, there is a potential for a relatively low magnitude of change to result in a significant effect on higher sensitivity receptors.

1176. Representative viewpoints have been provisionally identified (see **Table 15.4** and **Figure 15.3** in **Appendix 1**) and will be utilised in examining the potential for likely significant effects to occur.

15.5.4 Embedded Mitigation Measures

1177. The effects of the Broadshore Hub WFDAs on sensitive seascape, landscape and visual receptors will be limited due to the distance between the turbines and the shore (47 km at the closest point). No embedded mitigation measures are therefore proposed.

15.6 Scoping of Potential Impacts

1178. The following sections describe the impacts scoped in and scoped out of the SLVIA, including consideration of cumulative and transboundary impacts. These are summarised in **Table 15.5.**

15.6.1 Potential Impacts Scoped In

1179. Due to the potential for significant effects to occur, impacts on visual receptors within the SLVIA study area will be 'scoped in' to the SLVIA. This will focus on more sensitive visual receptors, including people onshore and close to the coast. These impacts will be examined during construction, operation and maintenance, and decommissioning.

15.6.2 Potential Impacts Scoped Out

1180. Significant effects on offshore seascape character receptors are unlikely to arise due to their low sensitivity, and therefore these impacts will be scoped out of the SLVIA. Due to distance, significant effects on coastal and onshore landscape character are unlikely to arise, and impacts on these receptors will also be scoped out of the SLVIA. Effects on views experienced by people in offshore locations, including ferry passengers, will be scoped out of the SLVIA as significant effects are unlikely, due either to low receptor sensitivity, or the transient nature of views as people pass through the study area.

15.6.3 Potential Cumulative Effects

1181. Cumulative seascape, landscape and visual effects may arise from the presence of multiple developments, usually other wind farms, affecting the same receptors. As shown in **Figure 15.1** in

Appendix 1, a number of operational and planned offshore wind farms are located within the SLVIA study area. It is likely that the Broadshore Hub WFDAs would be seen by receptors in the SLVIA study area in combination with the Moray East Offshore Wind Farm (operational) and Moray West Offshore Wind Farm (under construction), and with proposed offshore wind farms should they be constructed. There are a number of wind turbines within the onshore part of the SLVIA study area, but no large wind farms.

1182. The Broadshore Hub CEA will consider the cumulative effects of the WFDAs, OfTDAs (which includes the interconnector cables, offshore export route and OFSSs) and the OnTDAs (which includes the landfall(s), onshore export cable route and the onshore substation(s)). The CEA will follow the general methodology set out in **Chapter 4: Approach to Scoping and Environmental Impact Assessment**.

1183. The low sensitivity of the offshore seascape receptors means that any cumulative effects are unlikely to be judged as significant. Due to the distance offshore, significant effects on landscape and coastal character are unlikely to arise from the Broadshore Hub WFDAs, and therefore these receptors will also be scoped out of the cumulative assessment, including the Broadshore Hub CEA. Visual receptors across the SLVIA study area could have views of the Broadshore Hub WFDAs in combination with other offshore and onshore turbines, and other elements of the OfTDAs and OnTDAs. An assessment of cumulative effects on visual receptors is therefore proposed to be included in the assessment.

1184. The Applicants' position is that the Broadshore Hub WFDAs EIA Report will not include consideration of earlier manufacturing activities, port activities (e.g. WTG assembly), or 'wet storage' of the WTGs. Those do not form part of the Broadshore Hub WFDAs or activities for which consent is sought. Where those activities constitute development requiring a new planning permission, or requiring a Marine Licence, that would need to be applied for separately by the relevant party seeking such consent and would need to be accompanied by any appropriate environmental assessment required. Therefore, wet storage of floating offshore units will be included within the CEA section along with other projects and plans.

15.6.4 Potential Transboundary Effects

1185. Due to the distance of the Broadshore Hub WFDAs from other European Economic Area Member States (approx. 180 km from the limit of UK waters and 400 km from mainland Norway), there is no potential for transboundary effects in relation to seascape, landscape and visual receptors from impacts caused by the construction, operational and maintenance, and decommissioning of the Broadshore Hub WFDAs.

15.6.5 Summary of Seascape, Landscape and Visual Impacts Scoped In and Out

1186. A summary of potential impacts scoped in and out from further assessment in the Broadshore Hub WFDAs EIA Report is provided in **Table 15.5** below.

Table 15.5: Summary of Potential Impacts Scoped In (✓) or Scoped Out (x) for Seascape, Landscape and Visual Impact Assessment

Potential Impact	Receptor(s)	Description of Potential Effect	Scoped In or Scoped Out? (✓ or x)			Embedded Mitigation Measures
			Construction	Operation and Maintenance	Decommissioning	
Presence of offshore construction activity, including vessel movements, cranes and lighting in the seascape	Offshore seascape character within the SLVIA study area	Potential change in offshore character.	x	x	x	None identified
	Coastal and onshore landscape character within the SLVIA study area	Potential change in character of coastal or onshore landscape.	x	x	x	None identified
	Offshore visual receptors within the SLVIA study area	Change in view experienced by people in the offshore environment.	x	x	x	None identified
	Onshore and inshore visual receptors within the SLVIA study area	Change in view experienced by people on or near the coast, or further inland.	✓	✓	✓	None identified
Presence of the floating offshore wind turbines in the seascape	Offshore seascape character within the SLVIA study area	Potential change in offshore character.	x	x	x	None identified
	Coastal and onshore landscape character within the SLVIA study area	Potential change in character of coastal or onshore landscape.	x	x	x	None identified

Potential Impact	Receptor(s)	Description of Potential Effect	Scoped In or Scoped Out? (✓ or x)			Embedded Mitigation Measures
			Construction	Operation and Maintenance	Decommissioning	
	Offshore visual receptors within the SLVIA study area	Change in view experienced by people in the offshore environment.	✓	✓	✓	None identified
	Onshore and inshore visual receptors within the SLVIA study area	Change in view experienced by people on or near the coast, or further inland.	✓	✓	✓	None identified

15.7 Proposed Approach to Impact Assessment

1187. Within the SLVIA chapter of the Broadshore Hub WFDAs EIA Report, the overall impact assessment for the Broadshore Hub WFDAs will be presented first. Following this, a summary of each WFDA will be given (Broadshore WFDA, Sinclair WFDA, Scaraben WFDA).

1188. The approach to SLVIA in the Broadshore Hub WFDAs EIA Report will follow the principles set out in the Guidelines for Landscape and Visual Impact Assessment (Landscape Institute and IEMA, 2013). The principal steps involved in the assessment of impacts are set out below:

- The SLVIA study area will be defined based on the extent of the Broadshore Hub WFDAs, using a radius (60 km) to define the area within which receptors will be considered.
- The area in which the Broadshore Hub WFDAs may be visible will be established through generation of a ZTV based on maximum height parameters (400 m above LAT) for the WTGs.
- The landscape baseline of the SLVIA study area will be analysed, including seascape, coastal character and terrestrial landscape, and receptors will be identified.
- The visual baseline will be recorded in terms of the different groups of people (visual receptors) who may experience views of the Broadshore Hub WFDAs, the places where they will be affected, and the nature of views and visual amenity that is experienced at present.
- Assessment viewpoints will be selected to represent the range of views likely to be experienced by people, and these viewpoints will be agreed with relevant stakeholders.
- Based on the type and scale of the proposal, the potentially significant effects on landscape and visual receptors will be identified.
- The significance of seascape, landscape and visual effects will be judged for each receptor. In line with GLVIA3, this will be judged with reference to the sensitivity of the receptor (combining receptor susceptibility and the value attached to the resource) and the magnitude of impact (a combination of the scale, geographical extent, duration and reversibility of the impact).

1189. Cumulative effects will be considered in the same way, focusing firstly on the potential interactions between Broadshore Hub WFDAs with the Broadshore Hub OfTDAs and Broadshore Hub OnTDAs, where these may give rise to significant effects beyond those arising from the Broadshore Hub WFDAs on its own, and secondly on the potential interactions of the Broadshore Hub with other projects and plans.

15.8 Scoping Questions to Consultees

1190. The following questions are posed to consultees to help them frame and focus their response to the SLVIA scoping exercise, which will in turn inform the Scoping Opinion:

- With reference to the guidance noted in **Section 15.4.1**, and the recent Scoping Opinions issued for Caledonia Offshore Wind Farm and others, do you agree that a 60 km radius from the Broadshore Hub WFDAs Scoping Boundary is a sufficient study area for the SLVIA, and that receptors beyond this distance (including those in Orkney and Caithness) are scoped out?

- Do you agree that offshore seascape character is of low sensitivity to the type of change proposed, and that offshore seascape receptors can be scoped out as no likely significant effects would arise?
- With reference to stakeholder views noted above, do you agree that the effects on coastal and onshore landscape character are unlikely to be significant beyond 40 km, and that due to the distance offshore (47 km) these effects can be scoped out of the SLVIA?
- Do you agree that the viewpoints listed in **Table 15.4** are proportionate to the level of impacts likely to be experienced by visual receptors, and/or do you have any alternative viewpoint suggestions?
- Do you agree that effects on onshore and inshore visual receptors should be considered for construction, operation and maintenance, and decommissioning stages?
- Do you agree that cumulative effects on seascape and coastal and landscape character can be scoped out of the SLVIA?
- Do you have any other matters or information sources that you wish to present?

15.9 References

Aberdeenshire Council (2017) *Local Development Plan Supplementary Guidance: Aberdeenshire Special Landscape Areas*. Available at: https://www.aberdeenshire.gov.uk/media/20071/9-special-landscape-areas-part-1.pdf

Landscape Institute and Institute of Environmental Management and Assessment. (2013) *Guidelines for Landscape and Visual Impact Assessment*. Third Edition.

Landscape Institute (2019) Visual Representation of Development Proposals. Technical Guidance Note 06/19. Available at: https://www.landscapeinstitute.org/visualisation/

Landscape Institute (2021) Assessing landscape value outside national designations. Technical Guidance Note 02/21. Available at: https://www.landscapeinstitute.org/publication/tgn-02-21-assessing-landscape-value-outside-national-designations/

Marine Scotland (2021) *Scoping Opinion: Berwick Bank Offshore Wind Farm*. Available at: https://marine.gov.scot/sites/default/files/scoping_opinion_7.pdf

Marine Scotland (2023a) *Scoping Opinion: Caledonia Offshore Wind Farm*. Available at: https://marine.gov.scot/sites/default/files/scoping_opinion_12.pdf

Marine Scotland (2023b) National Marine Plan Interactive. Available at: https://marinescotland.atkinsgeospatial.com/nmpi/

Moray Offshore Renewables Limited (2012) *Environmental Statement: Telford, Stevenson, MacColl Wind Farms and Associated Transmission Infrastructure*. Volume 2. Available at https://www.morayeast.com/application/files/6315/8013/6685/Chapter-5-Human-Environment-Baseline.pdf.

Nature Scot (2019) 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.

Nature Scot (2021) Assessing the Cumulative Impact of Onshore Wind Energy Developments.. Available at: https://www.nature.scot/doc/guidance-assessing-cumulative-landscape-and-visual-impact-onshore-wind-energy-developments

Scottish Government (2023) National Planning Framework 4. Available at: https://www.gov.scot/publications/national-planning-framework-4/

Scottish Government (2015) Scotland's National Marine Plan. Available at: https://www.gov.scot/publications/scotlands-national-marine-plan/

Scottish Natural Heritage (2010) Coastal Character Types. Available at: https://www.webarchive.org.uk/wayback/archive/20220126143616mp_/https://www.nature.scot/sites/default/files/2018-05/National%20coastal%20character%20map.pdf

Scottish Natural Heritage (2012). Offshore Renewables – guidance on assessing the impact on coastal landscape and seascape. Guidance for Scoping an Environmental Statement. Available at: SNH SCOPING ADVICE – for MARINE RENEWABLES EIA (webarchive.org.uk).

Scottish Natural Heritage (2017a). Visual Representation of Wind Farms. Version 2.2. Available at: https://www.nature.scot/doc/visual-representation-wind-farms-guidance.

Scottish Natural Heritage (2017b). Guidance on Coastal Character Assessment. Available at: https://www.nature.scot/sites/default/files/2018-02/Guidance%20Note%20-%20Coastal%20Character%20Assessment.pdf.

Seagreen (2012). *Seagreen Alpha and Bravo Offshore Wind Farms: Environmental Statement Volume 1, Chapter 16 Seascape, Landscape and Visual Amenity*. Available at: https://marine.gov.scot/sites/default/files/chapter_16_-_seascape_landscape_and_visual_amenity.pdf.

White, S. Michaels, S and. King, H. (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. NRW Evidence Series. Report No: 315, 94pp, NRW, Bangor. Available at: https://cdn.naturalresources.wales/media/689503/eng-evidence-report-315-seascape-and-visual-sensitivity-to-offshore-wind-farms-in-wales.pdf

16 Socioeconomics, Tourism and Recreation

16.1 Introduction

1191. This chapter considers the scope of potential impacts of the construction, operation and maintenance, and decommissioning phases of the Broadshore Hub Wind Farm Development Areas (WFDAs) on socioeconomic, tourism and recreation receptors.

1192. This chapter provides an overview of the existing environment and further sets out the methodology and approach to assessing effects on socioeconomic, tourism and recreation in the Broadshore Hub WFDAs Environmental Impact Assessment (EIA) Report.

1193. As discussed in **Chapter 4: Approach to Scoping and Environmental Impact Assessment**, the assessment of the Offshore Transmission Development Areas (OfTDAs) and Onshore Transmission Development Areas (OnTDAs) associated with the Broadshore Hub will be included in separate planning applications, and therefore separate EIA Reports. The proposed approach to the SEIA is:

- Overall SEIA for the Broadshore Hub WFDAs which will be presented in the socioeconomics, tourism and recreation chapter of the Broadshore Hub WFDAs EIA Report. Following this, a summary of each WFDA will be given (Broadshore WFDA, Sinclair WFDA, Scaraben WFDA).
- SEIA for each of the projects: Broadshore Project, Sinclair Project and Scaraben Project. These three SEIAs will be presented in a standalone report and appended to the Broadshore Hub WFDAs EIA Report and then subsequently, the Broadshore Hub OfTDAs EIA Report and Broadshore Hub OnTDAs EIA Report. Therefore, while the assessment presented in each EIA Report will remain valid, an iterative approach will be adopted for the whole project assessments.

1194. This approach to the SEIAs allows for assessments to be undertaken as per the applications (overall Broadshore Hub WFDAs and each individual WFDA - refer to **Plate 4.4** in **Chapter 4: Approach to Scoping and Environmental Impact Assessment**) and also allows for full project assessments (Broadshore Project, Sinclair Project and Scaraben Project) which accounts for both the onshore and offshore socio-economic effects together.

1195. The key impacts that will be covered in this chapter include:

- Increase in employment and Gross Value Added (GVA);
- Demographic changes;
- Changes to housing demand;
- Changes to other local public and private services;

- Socio-cultural impacts;
- Changes to commercial fisheries; and
- Changes to shipping and marine recreation.

1196. This chapter should be read in conjunction with the following chapters of the Broadshore Hub WFDAs Scoping Report:

- **Chapter 10: Commercial Fisheries;**
- **Chapter 11: Shipping and Navigation;**
- **Chapter 13: Marine Infrastructure and Other Users**; and
- **Chapter 15**: **Seascape and Landscape Visual Impact Assessment**.

1197. This socioeconomics, tourism and recreation chapter is likely to have key inter-relationships with the above receptors, which will be considered appropriately where relevant in the Broadshore Hub WFDAs EIA Report.

1198. This chapter has been prepared by BiGGAR Economics Ltd.

16.2 Legislation, Policy and Guidance

1199. **Table 16.1** sets out the legislation, policy and guidance which have been considered in the preparation of this chapter, and will be considered within the Broadshore Hub WFDAs EIA Report assessment where appropriate. The overarching policy and legislation relevant to the Broadshore Hub WFDAs is described in **Chapter 2: Policy and Legislative Context**.

1200. In addition to the guidance documents listed, the Scottish Government is in the process of developing guidance on the assessment of the socioeconomic impacts of offshore wind energy projects. It is expected that this shall be published prior to the submission of the Broadshore Hub WFDAs EIA Report. If available, this will be considered within the EIA. The Applicants will engage with the Marine Analytical Unit (MAU) throughout the pre-application phase to ensure that any methodologies applied are in line with developing guidance.

Table 16.1: Summary of Relevant Legislation, Policy and Guidance for Socioeconomics, Tourism and Recreation

Relevant Legislation, Policy or Guidance	Relevance to the Assessment
Policy	
Scottish Government (2023), National Planning Framework 4 (NPF4)	Establishes a framework for spatial priorities in Scotland.
Scottish Government (2020), Offshore Wind Policy Statement	Sets out the Scottish Government’s ambitions for the future of offshore wind in Scotland.
Scottish Government (2022a), National Strategy for Economic Transformation	Sets out the priorities for the Scottish economy, as well as how to achieve a wellbeing economy.
Scottish Government (2018), National Performance Framework	Sets out a framework for what a successful country would look like, providing a range of measures to assess a proposed project against.
Department for Business, Energy & Industrial Strategy (BEIS) (2020), The Offshore Wind Sector Deal	Sets out the economic opportunities associated with offshore wind, including UK Government targets on the share of UK content.
Scottish Government (2015) National Marine Plan	Covers the management of both Scottish inshore and offshore waters
Guidance	
Marine Scotland (2022a) Defining ‘Local Areas’ for assessing impacts of offshore renewables and other marine developments: Guidance Principles	Outlines the approach that should be taken when considering what the geographic scope of socioeconomic receptors should be.
Marine Scotland (2022b) General Advice for Socio-Economic Impact Assessment, Marine Analytical Unit	Outlines the methodology that should be applied for economic impact assessments and the scope of social impacts that should be considered.
HM Treasury (2022), Green Book: Appraisal and Evaluation in Central Government	Provides guidance on economic impact assessments, including the consideration of additionality and discounting

16.3 Consultation

1201. A scoping workshop for the Broadshore Hub WFDAs was held on 13th September 2023 with Marine Directorate - Licensing Operations Team (MD-LOT), including representatives from the MAU and NatureScot, at which the approach to socioeconomics, tourism and recreation impact assessment was outlined. Relevant observations from this workshop are noted in **Table 16.2**.

Table 16.2: Consultation Relevant to Socioeconomics, Tourism and Recreation

Consultee	Date/Document	Comment	How Comment is Addressed
MD-LOT/ MAU	13th September 2023, Scoping Workshop	MD-LOT highlighted the General Advice for Assessing the Socio-economics of Offshore Wind Farms. This included requests to conduct primary social research around the most likely port locations.	The scope of the assessment is outlined in **Section 16.6** in relation to the General Advice from the Marine Directorate. Port locations will not be determined until post consent. The implications of this are outlined in **Section 16.6**.

1202. The Applicants will continue to engage with stakeholders during the pre-application phase, following the publication of the Scoping Opinion and supporting consultation responses. It is anticipated that further engagement will be required with MD-LOT and Aberdeenshire Council. The scope of the topics to be discussed will be dependent on the content of the Scoping Opinion but is likely to broadly include:

- Further discussion and agreements about the socioeconomic study areas;
- Assessment methodologies for socioeconomic impacts; and
- Proposed approach to community and stakeholder engagement.

16.4 Existing Environment

16.4.1 Study Areas

1203. The relevant study areas for the socioeconomic assessment are onshore. This is because the organisations, individuals and communities that might be impacted by the Broadshore Hub WFDAs activities are based in onshore communities, including coastal communities.

1204. The socioeconomic study areas for the assessment of effects on employment and economy will be defined in line with the guidance on identification of 'local areas' for offshore developments published by Marine Scotland (Marine Scotland, 2022a). This guidance identified six principles for identifying local study areas for offshore developments:

- **Principle 1 (Dual Geographies):** The local area for the supply chain and investment impacts should be separate from the local area(s) for wider socioeconomic impacts, including tourism and recreation.
- **Principle 2 (Appropriate Impacts):** The appropriate impacts to be considered for assessments should be identified before defining the local areas.
- **Principle 3 (Epicentres):** The local areas should include all the epicentres of the appropriate impacts.

- **Principle 4 (Accountability):** The local areas used in the assessment should comprise of pre-existing economic or political geographies (community councils, local authorities, development agencies) to enhance accountability.
- **Principle 5 (Understandable):** The local areas should be defined in such a way that they are understandable to the communities they describe.
- **Principle 6 (Connected Geography):** The local area for the supply chain and investment impacts should consist of connected (including coastal) pre-existing economic or political geographies.

1205. The epicentres of impact associated with the infrastructure and activities for the Broadshore Hub WFDAs will include the locations of the key construction and operations and maintenance ports, the location of any large manufacturing facilities and any locations on land with visibility of the offshore infrastructure. The Broadshore Hub WFDAs will be located approximately 47 km east of Aberdeenshire. While the distance between the Broadshore Hub WFDAs and onshore visual receptors remains considerable, the Zone of Theoretical Visibility (ZTV) presented in **Figure 15.2** in **Appendix 1** indicates that the Broadshore Hub WFDAs will be visible from the coast and from slightly further inland (see **Chapter 15**: **Seascape and Landscape Visual Impact Assessment** for details). At this stage the port location(s) and supply chain companies have not been defined and therefore a 'local area' for the combined elements of the Broadshore Project, the Sinclair Project and the Scaraben Project, have not been defined in this Broadshore Hub WFDAs Scoping Report. A 'local area' for the Socioeconomic Impact Assessment (SEIA) will be defined within the Broadshore Hub WFDAs EIA Report if more details on the potential port locations are known, however it is not expected that port locations will be identified prior to the EIA assessment.

1206. The socioeconomic effects will also be assessed at the level of Scottish and UK economies.

1207. For tourism and recreation, the primary focus of the assessment will be effects on onshore activity that may arise from the development, construction, operation and maintenance, and decommissioning of the Broadshore Hub infrastructure. Given the Broadshore Hub WFDAs will be visible from a section of the coast and slightly inland, there is potential for visual impacts for visitors to coastal locations and beaches, and recreational users of the coast and inshore waters. In addition, any potential changes to visitor behaviour would be expected to arise due to increased activity at ports and harbours. These impacts have been scoped out of the assessment as it is not expected that ports will be identified prior to the EIA assessment.

1208. In addition, there will also be the potential for marine recreation to be affected by the construction and decommissioning of the offshore export cable route, near the potential landfall location(s) in Aberdeenshire. These could occur if the vessels used during the construction impede on the ability of marine recreation users to pursue these activities, including recreational sailing or sea angling.

16.4.2 Data and Information Sources

1209. **Table 16.3** sets out the key information and data sources which have been considered in the preparation of this chapter, and will be considered within the Broadshore Hub WFDAs EIA Report assessment where relevant matters are scoped in.

Table 16.3: Summary of Key Data and Information Sources for Socioeconomics, Tourism and Recreation

Dataset	Year(s)	Description
National Records of Scotland (2022), Mid-2021 Population Estimates Scotland	2022	Population estimates, broken down by age.
National Records of Scotland (2022), 2012-based Principal Population Projections	2022	Population projections for Scotland
National Records of Scotland (2020), 2018-based Principal Population Projections	2020	Population projections for Scotland and each of its 32 local authorities, broken down by age.
Office for National Statistics (ONS) (2020), Principal Populations 2018-Based	2020	Population projections for the UK as a whole, broken down by age.
ONS (2023) Annual Survey of Hours and Earnings 2022	2023	Provides average and median residential and workplace earning.
ONS (2022), Business Register and Employment Survey 2021	2022	Provides a breakdown of employment by sector.
ONS (2023), Annual Population Survey 2022	2023	Provides statistics on characteristics of populations, including economic activity rate and unemployment rate
Offshore Wind Industry Council (OWIC) (2023), Offshore Wind Skills Intelligence Report	2023	Provides information on the existing offshore wind labour force across the UK as well as the skills that are expected to be needed up to 2030.
Offshore Renewable Energy Catapult (2020), The Offshore Wind Operation and Maintenance Opportunity	2020	Discusses the potential opportunities in offshore wind by 2030, with a detailed breakdown of annual spending and associated opportunities in the UK.
BEIS (2020), The Offshore Wind Sector Deal	2020	Sets out the economic opportunities associated with offshore wind, including UK Government targets on the share of UK content.
Scottish Government (2018), National Performance Framework	2018	Sets out a framework for what a successful country would look like, providing a range of measures to assess a proposed project against.
Scottish Government (2022a), National Strategy for Economic Transformation	2022	Sets out the priorities for the Scottish economy, as well as how to achieve a wellbeing economy.
Scottish Government (2023), NPF4	2023	Establishes a framework for spatial priorities in Scotland.
Scottish Government (2020), Offshore Wind Policy Statement	2020	Sets out the Scottish Government's ambitions for the future of offshore wind in Scotland.
Kantar TNS (2020), GB Tourism Survey 2019	2020	Annual publication of domestic overnight tourism visits and nights by number, value and purpose, with 2019 as

Dataset	Year(s)	Description
		the latest year not affected by Covid-19. May be updated prior to drafting the EIA.
ONS (2020), International Passenger Survey	2020	Annual publication of international overnight tourism visits and nights by number, value and purpose, with 2019 as the latest year not affected by Covid-19. May be updated prior to drafting the EIA.
Scottish Government (2022), Annual Growth Sector Statistics	2022	Provides economic statistics, such as employment and GVA, on growth sectors identified by the Scottish Government, including sustainable tourism.

16.4.3 Socioeconomic Baseline

1210. The focus of the socioeconomic baseline will be analysis of the key indicators that will determine the sensitivity of the receptors and the potential magnitude of any change. It will therefore cover:

- Population and demographics;
- Labour market indicators, including employment levels, skills and salaries;
- Industrial structure;
- Housing market indicators; and
- Productivity and economic output indicators.

1211. The geographic scope of the baseline will consider the study areas that have been identified in **Section 16.4.1**. This will include Scotland and the UK.

1212. The working age population in Scotland is projected (National Records of Scotland, 2022) to decrease over time and so the Scottish economy requires new drivers of growth. The offshore renewables sector represents an opportunity of substantial scale for the Scottish, and wider UK, economies and this is highlighted in the strategic objectives of both the Scottish and UK Governments.

16.4.4 Tourism and Recreation Baseline

1213. Sustainable tourism is identified as one of Scotland's growth sectors, accounting for 209,000 jobs in 2022. In 2022, total visitor spending was £10.4 billion, this included international visitors (VisitScotland 2023a), overnight domestic visitors (VisitScotland 2023b) and day visitors (VisitScotland 2023c). The tourism baseline will be augmented with local visitor attractions and other data if more information is known about the construction and operation port(s).

16.4.5 Strategic Overview

1214. The strategic baseline is provided in the sections below. This will be updated during the EIA to reflect any revisions to existing strategies or any local strategies if a local study area has been identified. Please see **Chapter 2: Policy and Legislative Context** for the winder policy context.

16.4.5.1 National Performance Framework

1215. Scotland's National Performance Framework (NPF) (Scottish Government, 2018), first published in 2018, sets out the ambitions of the Scottish Government across a range of economic, social and environmental factors. The framework includes 'increased wellbeing' as part of its purpose and combined measurement of how well Scotland is doing in economic terms with a broader range of wellbeing measures. The NPF is designed to give a more rounded view of economic performance and progress towards achieving sustainable and inclusive economic growth and wellbeing across Scotland.

1216. The aims for Scotland set out in the NPF are:

- "Create a more successful country;
- Give opportunities to all people living in Scotland;
- Increase the wellbeing of people living in Scotland;
- Create sustainable and inclusive growth; and
- Reduce inequalities and give equal importance to economic, environmental and social progress."

16.4.5.2 National Planning Framework

1217. In February 2023, the Scottish Government published NPF4 (Scottish Government, 2023), which set out Scotland's spatial strategy to 2045. It affirms the importance of Scotland's transition to a net zero economy through green investment and green jobs, with wind energy highlighted as playing a significant role in the coming years. It states that renewable energy developments will only be supported where they maximise net economic impact, including local and community socioeconomic benefits, such as employment, associated business and supply chain opportunities.

16.4.5.3 National Strategy for Economic Transformation

1218. In March 2022, the Scottish Government released the National Strategy for Economic Transformation (Scottish Government, 2022a), which set out its ambition for Scotland's economy over the next 10 years. The Scottish Government's vision is to create a wellbeing economy where society thrives across economic, social and environment dimensions, which delivers prosperity for all Scotland's people and places. Of particular importance is the ambition to be greener, with a just transition to net zero, a nature-positive economy and a rebuilding of natural capital.

1219. A key longer-term challenge identified in the strategy is to address deep-seated regional inequality, which includes rural and island areas that face problems such as a declining labour supply, poorer access to infrastructure and housing. The transition to net zero presents a further challenge of delivering positive employment, revenue and community benefits.

1220. To deliver its vision and address the economy's challenges, five programmes of action have been identified (with a sixth priority of creating a culture of delivery), including:

- Establishing Scotland as a world-class entrepreneurial nation;
- Strengthening Scotland's position in new markets and industries, generating new, well-paid jobs from a just transition to net zero;
- Making Scotland's businesses, industries, regions, communities and public services more productive and innovative;
- Ensuring that people have the skills they need to meet the demands of the economy, and that employers invest in their skilled employees; and
- Reorienting the economy towards wellbeing and fair work.

1221. The strategy notes that Scotland has substantial energy potential, with a quarter of Europe's wind potential, and that it has developed a growing green industrial base. This provides a strong foundation for securing new market opportunities arising from the transition to net zero, for example in the hydrogen economy and in the decarbonisation of heating systems, where Scotland may be able to secure first-mover advantage and will need continuing investment and support. Renewable energy also has a role to play in supporting productive businesses and regions across Scotland.

16.4.5.4 Offshore Wind Policy Statement

1222. The Scottish Government's 2020 Offshore Wind Policy Statement (Scottish Government, 2020) highlights the substantial potential of Scotland's waters for offshore wind and the importance of the sector in the transition to net zero.

1223. When the policy statement was published in October 2020 the ScotWind leasing round was expected to lead to an additional 11 GW of offshore wind capacity by 2030, generating substantial economic impacts in Scotland's offshore wind supply chain. In contrast, the ScotWind leasing round is now expected to lead to an additional 25 GW of offshore wind capacity (Crown Estate Scotland, 2022), with economic opportunities related to floating offshore.

16.4.5.5 UK Government Offshore Wind Sector Deal

1224. The UK Government's Offshore Wind Sector Deal (BEIS, 2020) aims to ensure that UK companies can benefit from the opportunities presented by the expansion of the offshore wind sector, enhancing the competitiveness of UK firms internationally and sustaining the UK's role as a global leader in offshore wind generation, as outlined in the offshore wind sector deal. Offshore wind is also expected to play a significant role in the transition to net zero, creating green jobs as part of the net zero, build back greener agenda.

16.5 Potential Impacts

1225. The socioeconomics, tourism and recreation impacts that are considered are those defined in the general advice published by the MAU in 2022 (Marine Scotland, 2022), which highlights some commonly identified socioeconomic impacts which could occur as a result of the development of an offshore wind farm. These include:

- Economic impacts:
  - GVA;
  - Employment, including characteristics of employment; and
  - Direct, indirect and induced impacts.
- Impacts on other sectors:
  - Tourism; and
  - Commercial fisheries.
- Demographic impacts;
- Housing impacts;
- Other local public and private services; and
- Socio-cultural effects.

16.5.1 Embedded Mitigation and Enhancement Measures

1226. As part of the development and design process, the Applicants have identified measures to mitigate against adverse socioeconomics, tourism and recreation effects and to enhance any beneficial effects, in particular those associated with the supply chain.

1227. To enhance the beneficial effects associated with the supply chain the Applicants place a strong focus on supply chain engagement and skills development to build the capacity. The Applicants are mapping the current Scottish supply chain capabilities and holding introductory meetings with potential suppliers and stakeholders.

1228. As part of the ScotWind bidding process, the Broadshore Applicant provided a Supply Chain Development Statement (SCDS), which outlines a 'commitment' scenario and an 'ambition' scenario for the level of supply chain content to be secured within Scotland and the UK.

1229. The Broadshore Applicant is collaborating with local and national agencies to train and upskill the workforce by formulating specific enterprise and skill development programmes. Works are ongoing with the Energy Skills Partnership to upskill and re-skill the existing work force and also with Edinburgh Science to promote the industry via education programmes, STEM (science, technology, engineering and mathematics) projects and funding.

1230. In relation to local supply chain, the Broadshore Project's ambition is to spend £1.24 billion within the Scottish supply chain during its development, construction and operation, with a commitment of £832 million (Broadshore Offshore Wind Farm, 2023). The Broadshore Applicant's approach to supply chain development is one of 'shared value' - a combination of project competitiveness and sustainable development of the Scottish offshore wind supply chain.

16.6 Scoping of Potential Impacts

1231. **Table 16.5** sets out the initial assessment of potential impacts on socioeconomics, recreation and tourism due to the construction, operation and maintenance, and decommissioning of the Broadshore Hub WFDAs infrastructure. The assessment is based on a combination of:

- The definition of the Broadshore Hub WFDAs at the scoping stage;
- Embedded mitigation, as set out in **Section 16.5.1**;
- The level of understanding of the baseline at the scoping stage;
- The existing evidence base for socioeconomics, tourism and recreation effects due to the Broadshore Hub WFDAs;
- Relevant policy; and
- The professional judgement of qualified economists and social researchers.

1232. The social impacts that are considered in this section are those defined in the general advice published by the Marine Analytical Unit in 2022 (Marine Scotland, 2022), as described in **Section 16.5**. At the time of writing, the construction and operation port(s), which are expected to be the main epicentres of impact, are not yet known and will not be known until post consent. At the time of the assessment it will however be possible to identify hypothetical areas of impact and undertake scenario planning for impact at potential locations for the construction base and operation and maintenance base. It will not therefore be possible to be definitive about the nature and scale of the impacts affecting communities but information on impacts for a number of potential scenarios will be presented, including an overview of:

- What impacts may occur and at what scale;
- The sensitivity of the communities that these impacts may occur in; and
- How these impacts may be felt across these communities.

1233. Consideration has been given to taking a proportionate approach to undertaking social research required for the socioeconomic assessment, and how it will complement the wider community engagement activities that the Applicants wish to undertake.

16.6.1 Potential Impacts Scoped In

1234. The impacts 'scoped in' to the assessment are:

- Increase in employment and GVA;

- Demographic changes;
- Changes to housing demand;
- Changes to other local public and private services;
- Changes to commercial fisheries;
- Changes to shipping sector;
- Changes to marine recreation; and
- Changes to coastal tourism and recreation.

1235. Descriptions of the impacts scoped in are provided in **Table 16.5**.

16.6.2 Potential Impacts Scoped Out

1236. The following socio-cultural effects are identified in the General Advice (Marine Scotland, 2022) as a potential type of impact;

- Lifestyles/quality of life;
- Gender issues; family structure;
- Social problems (e.g. crime, ill-health, deprivation);
- Human rights;
- Community stress and conflict; integration, cohesion and alienation; and
- Community character or image.

1237. Impacts are scoped out of the EIA Report are those which do not have the potential for significant effects. It is therefore proposed that socio-cultural effects are scoped out of the assessment for the EIA Report because:

- The socio-cultural effects are generally neither adverse nor significant; and
- The communities that will experience these socio-cultural effects cannot be definitively identified at the time of assessment. Therefore, it is not considered proportionate to conduct primary social research in all areas that may have the potential to host activities associated with the Broadshore Hub WFDAs regarding:
  - Perceptions of impact;
  - Sensitivities of communities to any of the changes; and
  - The relative magnitude in any change that would be required to identify significant adverse effects.

1238. There will be a collaborate approach, led by Scottish Offshore Wind Energy Council (SOWEC) that will consider socio-cultural impacts on communities across the offshore wind sector. The Applicants will support this approach.

1239. In 2022, the Scottish Government published social research by the Diffley Partnership (Scottish Government, 2022b) that considered the social impacts that coastal communities with experience of offshore wind farms have had. While this research found that the perception of these communities was that the offshore wind farms have had a minor net positive impact on their quality of life, community relations and community character, the majority of respondents felt that the offshore wind farm projects have had no impact on these socio-cultural attributes. This is shown in **Table 16.4**, which shows that 63% of respondents felt the development of offshore wind projects had no impact on their quality of life, 59% felt it had no impact on community relations and 55% felt it had no impact on community character.

Table 16.4: Responses from Coastal Communities to Questions Regarding Socio-cultural Impacts of Offshore Wind Farms

What impact, if any, do you think that offshore wind farms in your area have had on …	Total Positive Impact	No Impact	Total Negative Impact	Net Positive/ Negative
…Quality of Life?	25%	63%	4%	+ 21%
…Community Relations?	16%	59%	7%	+ 9%
…Community Character?	21%	55%	9%	+ 12%

1240. The general effect of offshore wind developments on these socio-cultural attributes of coastal communities is therefore neither adverse nor significant.

1241. The assessment of these effects for the Broadshore Hub WFDAs would require primary social research within the communities that will be impacted, in particular those that will experience the greatest demographic or employment effects. However, at the time of the assessment the locations of these communities will not be known as the primary construction and operational ports will not have been identified.

1242. While there may be issues that are specific to the communities around the epicentres of impact that could result in significant or adverse effects, at the time of the assessment these locations are not likely to be known. Unlike the potential impacts on demographics, housing and other services the socio-cultural effects are not so directly linked to the scale of the employment opportunities in each of the communities. As the location of the construction/integration port(s) and operation and maintenance port will not be made until post consent, it will not be possible to discuss the potential socio-cultural beyond the general impact of offshore wind on coastal communities.

16.6.3 Potential Cumulative Effects

1243. The process by which potential cumulative effects will be assessed through the Cumulative Effects Assessment (CEA) is described in **Chapter 4: Approach to Scoping and Environmental Impact Assessment**.

1244. There is the potential for the potential impacts identified in **Table 16.5** to interact with other projects particularly other offshore wind farms being developed as part of the ScotWind and INTOG leasing rounds, and other significant capital projects in the area. Cumulatively, the development of the ScotWind projects are expected to represent a substantial increase in demand at the Scottish level for the industries that will be involved in the construction of these projects.

1245. As one of potentially many offshore wind projects, the Broadshore Hub WFDAs will contribute to the cumulative case for potential local or inward investment by making it more financially attractive to set up new manufacturing and fabrication facilities in Scotland, as opposed to relying on overseas facilities that may have higher transportation costs. Consideration will also be given to the cumulative effects on port facilities during both construction and operation and maintenance phases. As port locations for the Broadshore Hub WFDA will not be known until post consent and it is unlikely other offshore wind projects will declare port locations the time of the assessment, this impact will be discussed qualitatively.

1246. The decommissioning timetable of other capital projects, particularly offshore wind projects, is not known at this stage, and the main constraint on this activity will be the port infrastructure. The baseline assessment of port capabilities and constraints is likely to change over time as ports invest in new facilities to feed the decommissioning demand. Therefore, the CEA will not consider decommissioning impacts.

1247. The CEA will consider the Broadshore Hub OfTDAs and the Broadshore Hub OnTDAs based on details available at the time of assessment. A full SEIA for the Broadshore Hub OfTDAs and OnTDAs will be included in their respective EIA Reports.

16.6.5 Potential Transboundary Effects

1248. The following transboundary effects have been identified as potential occurrences resulting from activities associated with the Broadshore Hub WFDAs construction, operation and maintenance, and decommissioning:

- Socioeconomic effects taking place outside of the UK, relating to non-UK supply chain during the construction, operation and decommissioning phases. These will be imports from outside of the UK, and are expected to be positive in nature; and
- Effects on commercial fisheries and other marine users based outside of the UK during construction, operation and decommissioning.

16.6.6 Summary of Potential Socioeconomics, Tourism and Recreation Impacts Scoped In and Out

1249. Potential impact pathways relevant to socioeconomics, tourism and recreation which may occur during the construction, operation and maintenance, or decommissioning phases of the Broadshore Hub WFDA so have been summarised in **Table 16.5.**

Table 16.5: Summary of Potential Impacts Scoped In (✓) or Scoped Out (x) for Socioeconomics, Tourism and Recreation

Potential Impact	Receptor(s)	Description of Potential Effect	Scoped In or Scoped Out? (✓ Or X)			Embedded Mitigation and Enhancement Measures
			Construction	Operation and Maintenance	Decommissioning	
Increase in employment and GVA	Economies of Scotland and the UK	Economic impacts associated with the expenditure of the Broadshore Hub WFDAs and supply chain requirements.	✓	✓	✓	SCDS and wider stakeholder engagement
Demographic changes	Potential range of communities around epicentres of impact	Change in population and characteristics of population as a result of the Broadshore Hub WFDAs.	✓	✓	✓	N/A
Changes to housing demand	Potential range of communities around epicentres of impact	Change in level of demand for accommodation as a result of the Broadshore Hub WFDAs and its demographic impacts.	✓	✓	✓	Stakeholder engagement, including with local authorities and sector bodies.
Changes to other local public and private services	Potential range of communities around epicentres of impact	Change in level of demand for services as a result of the Broadshore Hub WFDAs and its demographic impacts.	✓	✓	✓	Stakeholder engagement, including with local authorities and sector bodies.
Socio-cultural effects	Communities local to epicentres of impact	Changes in perceptions of communities wellbeing, including quality of life and community cohesion.	x	x	x	N/A

Potential Impact	Receptor(s)	Description of Potential Effect	Scoped In or Scoped Out? (✓ Or X)			Embedded Mitigation and Enhancement Measures
			Construction	Operation and Maintenance	Decommissioning	
Changes to commercial fisheries	Commercial fishing sector and associated supply chains	Potential disruption to the commercial fishing sector leading to changes in economic activity in the sector.	✓	✓	✓	Proposed embedded mitigation are outlined in **Chapter 10: Commercial Fisheries**
Changes to shipping	Shipping and navigation sector	Changes to economic activity as a result of the Broadshore Hub WFDAs may affect activity in the shipping sector.	✓	✓	✓	Proposed embedded mitigation are outlined in **Chapter 11: Shipping and Navigation**
Changes to marine recreation	Marine recreation users in affected communities	Changes to recreational amenity as a result of the Broadshore Hub WFDAs may affect activity on the marine recreation.	✓	✓	✓	Proposed embedded mitigation are outlined in **Chapter 11: Shipping and Navigation**
Changes to coastal tourism and recreation	Coastal recreation users and tourism assets	Changes to coastal recreation and tourism assets as a result of the potential visibility of the Broadshore Hub	✓	✓	✓	N/A

16.7 Proposed Approach to Impact Assessment

1250. The assessment of socioeconomic, tourism and recreation receptors will comply with the general approach set out in **Chapter 4: Approach to Scoping and Environmental Impact Assessment** and the guidance listed in **Section 16.2.** Within the socioeconomics, tourism and recreation chapter of the Broadshore Hub WFDAs EIA Report, the overall impact assessment for the Broadshore Hub WFDAs will be presented first. Following this, a summary of each WFDA will be given (Broadshore WFDA, Sinclair WFDA, Scaraben WFDA).

1251. Further detail on the specific approach to assessment for this chapter is provided below.

16.7.1 Economic Impact Methodology

1252. To assess the socioeconomic effects of the Broadshore Hub WFDAs the focus will be on the direct and indirect (supply chain) effects, in line with the UK Offshore Wind Sector Deal (BEIS, 2020). In addition to this, the assessment will also consider the effects of staff spending and the economic impact that this subsequent increase in demand stimulates (the induced effect).

1253. The economic impacts will be considered for each Study Area and will be reported in terms of:

- **GVA:** this is a measure of economic value added by an organisation, industry or region and is typically estimated by subtracting the non-staff operational costs from the turnover of an organisation.
- **Years of Employment:** this is a measure of employment which is equivalent to one person being employed for a year and is typically used when considering short to medium term employment impacts, such as those associated with the construction phase of the Broadshore Hub WFDAs.
- **Jobs:** this is a measure of employment which considers the headcount employment in an organisation or industry. This measure is used when considering long term impacts such as the jobs supported during the operation and maintenance phase of the Broadshore Hub WFDAs.

1254. The socioeconomic assessment will consider the lowest, realistic levels of expenditure associated with the Broadshore Hub WFDAs, since that would represent the 'worst-case' scenario in terms of the expected positive socioeconomic effects. This will take account of the 'Commitment' scenario in the SCDS submitted as part of the ScotWind leasing process, though may be revised to reflect subsequent revisions of the SCDS which will take account of any changes or development in the local supply chain.

1255. The impact assessment will take account of deadweight, leakage, displacement and substitution. Sensitivity analysis will also be undertaken to account for risk, uncertainty and optimism bias, where they could have implications for the economic impacts. The sensitivity analysis will be presented in the stand alone reports because the assessment will focus on the worst case scenario within the chapter.

1256. The assessment will include the elements of the Broadshore Hub WFDAs. Full details specific to the WFDAs are discussed in **Chapter 3: Project Description.** The onshore elements will include construction and installation of the landfall(s), onshore export cable route and onshore substation(s).

1257. The analysis for the Broadshore Hub WFDAs will cover three phases:

- Construction;
- Operation and maintenance; and
- Decommissioning.

1258. The impacts during the construction phase will be based on the actual expenditure that has occurred to date as well as the planned expenditure associated with the construction phase. In addition to the total impact over the period, the assessment will also consider the timings of impacts during the construction phase to understand the peaks and troughs of this activity.

1259. The impacts during the operation and maintenance phase for the Broadshore Hub WFDAs will be based on projected operational (including maintenance) expenditure.

1260. In instances where impacts are expected to occur over several years, such as the operation and maintenance phase or the decommissioning phase, a discount rate will be applied. This allows impacts that occur sooner to be valued more highly than impacts that occur in the future, a concept known as time preference. In this instance a discount rate of 3.5% will be chosen, which is in line with the UK Government's Green Book (HM Treasury, 2022). On this basis it is expected that the decommissioning phase impacts will be substantially lower than for the construction phase.

16.7.2 Social Impact Assessment Methodology

1261. In order to avoid negative impacts of the SEIA process itself, consultation will be limited to statutory stakeholders (such as local authorities). The methodology aims to minimise disruption to communities through over-consultation, and ultimately seeks to avoid reputational damage to the Broadshore Hub WFDAs, its Applicants, the offshore sector in general, and the Scottish Government's consenting processes.

1262. More details on why location is particularly important in understanding how impacts are felt across communities are provided in this section, particularly around the factors that influence the sensitivity of the communities that will be affected.

1263. This section outlines the methodology that will be applied to potential impacts that have been 'scoped in' to the assessment.

16.7.2.1 Demographics

1264. The employment that will be created as a result of the Broadshore Hub WFDAs will have demographic impacts if this employment helps to retain or attract people to the communities where this activity occurs. The potential impacts of demographic change will be assessed as far as possible, including the scale of any impact and its potential to be significant.

1265. As location(s) for activities associated with the Broadshore Hub WFDAs will not have been determined at the time of drafting the Broadshore Hub WFDAs EIA Report, the assessment will consider the potential scale of employment opportunities at hypothetical locations of the construction base and the operation and maintenance base.

1266. The sensitivity of each of the demographic receptors will be determined by the trends in demographics in the potential host communities and projections estimated for how these demographics will change over time, and how the demographics of the workforce would relate to different communities. The magnitude of any demographic change will be determined by the change relative to the current population.

16.7.2.2 Housing

1267. The potential impacts on housing are one of the key topics that coastal communities are concerned about (Scottish Government, 2022b). The demographic changes that result from the employment opportunities have the potential to change the level of demand for housing.

1268. As with the demographic impacts, potential effects on housing will vary considerably between communities. The sensitivity of any housing market to changes in demand as a result of the Broadshore Hub WFDAs will be determined by factors including:

- The population of the community, including the wider travel to work area;
- The availability of housing or other accommodation within the community;
- The scale of the overnight tourism sector in the community;
- The ability of the housing market to adjust supply to respond to changes in demand; and
- The relative level of housing affordability in the area.

1269. Similarly, the magnitude of any change will be determined by the peak level of additional accommodation demand in each area, relative to the baseline accommodation provision. The magnitude of any change in housing demand would also be determined by the demographic changes as a result of the Broadshore Hub WFDAs. This would be determined by the baseline labour supply in each of the potential areas and the relative size of any transient labour population.

1270. As location(s) for activities associated with the Broadshore Hub WFDAs will not have been determined at the time of drafting the EIA Report, the assessment will consider the potential scale of additional demand on housing that will occur during the peak periods of employment in areas identified as potential locations for activities associated with the Broadshore Hub WFDAs.

16.7.2.4 Other Local Service

1271. As with the housing market, the demographic changes that could result from the employment opportunities, could result in changes to the level of demand for other services. This will include:

- Public and private sector services;
- Educational services;
- Health services and social support;
- Police, fire, recreation, transport; and
- Local authority finances.

1272. The assessment of the effect on these services will also be determined by factors of sensitivity that will be specific to the potentially impacted communities. This will include the capacity of each service in each of the potential areas and the ability of the service to adapt to changes in demand.

1273. The magnitude will also be determined by the relative demographic change in each potential area, which will vary based on the size of the population and the availability of labour in each of the study areas.

1274. As the location of the construction base and operation and maintenance base will not have been determined at the time of drafting the EIA Report, the assessment will consider the potential scale of additional demand on other services that will occur during the peak periods of employment based on the potential demographic effects in each potential host area and the propensity of each demographic group to use each of the services listed.

16.9 Scoping Questions to Consultees

1275. The following questions are posed to consultees to help them frame and focus their response to the socioeconomics, tourism and recreation scoping exercise, which will in turn inform the Scoping Opinion:

- Do you agree with the study areas defined for socioeconomics, tourism and recreation?
- Do you agree with the use of data listed in this chapter being used to inform the Broadshore Hub WFDAs EIA Report?
- Are there any further data sources or guidance documents that should be considered?
- Do you agree with the scoping in and scoping out of impact pathways in relation to socioeconomics, tourism and recreation (as presented in **Table 16.5**)?
- Do you agree with the assessment of transboundary effects in relation to socioeconomics, tourism and recreation?
- Do you agree with the assessment of cumulative effects in relation to socioeconomics, tourism and recreation?
- Do you agree with the proposed iterative approach for SEIA, which includes a stand-alone report appended to the EIA Reports in which SEIAs will be presented for the Broadshore Project, Sinclair Project and Scaraben Project individually (see **Section 16.1**). Please note that this does not include an SEIA for the Broadshore Hub (i.e. Broadshore Project, Sinclair Project and Scaraben Project combined).
- Do you agree with the proposed methodology for tourism and recreation?
- Do you agree on the suitability of the proposed embedded mitigation of relevance to socioeconomics, tourism and recreation that have been identified for the Broadshore Hub WFDAs?
- Do you have any other matters or information sources that you wish to present?

16.10 References

BEIS (2020). ‘Offshore wind: Sector Deal’. Available at: https://www.gov.uk/government/publications/offshore-wind-sector-deal

HM Treasury (2022). The Green Book. Available at: https://www.gov.uk/government/publications/the-green-book-appraisal-and-evaluation-in-central-govenent/the-green-book-2020

Marine Scotland (2022a), Defining 'local area' for assessing impact of offshore renewables and other marine developments: guidance principles. Available at: https://www.gov.scot/publications/defining-local-area-assessingimpact-offshore-renewables-marine-developments-guidance-principles/

Marine Scotland (2022b), General Advice for Socio-Economic Impact Assessment: Marine Analytical Unit.

National Records of Scotland (2022), 2012-based Principal Population Projections. Available at: https://www.nrscotland.gov.uk/statistics-and-data/statistics/statistics-by-theme/population/population-projections

Scottish Government (2023). National Planning Framework 4. Available at: https://www.gov.scot/publications/national-planning-framework-4/

Scottish Government (2022a). Scotland's National Strategy for Economic Transformation. Available at: https://www.gov.scot/publications/scotlands-national-strategy-economic-transformation/.

Scottish Government (2022b). Public Perceptions of Offshore Wind farm Developments in Scotland. Available at: https://www.gov.scot/publications/public-perceptions-offshore-wind-farm-developments-scotland/

Scottish Government (2022c). Environmental Impact Assessment - EIA. Available at: https://www.mygov.scot/eia#:~:text=Environmental%20Impact%20Assessment%20(EIA)%20is,reduce%20or%20offset%20those%20effects.

Scottish Government, (2020). 'Offshore wind policy statement'. Available at: https://www.gov.scot/publications/offshore-wind-policy-statement/

Scottish Government (2018). National Performance Framework. Available at: https://nationalperformance.gov.scot/sites/default/files/documents/NPF_A2_Poster.pdf.

Scottish Government (2015) National Marine Plan. Available at: Scotland's National Marine Plan – gov.scot (www.gov.scot)

VisitScotland (2023a) International Tourism Performance in 2022; Available at: https://www.visitscotland.org/binaries/content/assets/dot-org/pdf/research-insights/q4-and-2022-full-year-ips-update.pdf

VisitScotland (2023b) Great Britain Tourism Survey 2022; Available at: https://www.visitscotland.org/binaries/content/assets/dot-org/pdf/research-insights/great-britain-tourism-survey-2022-revised-lifestage.pdf

VisitScotland (2023c) Great Britain Day Visits Survey 2022 Available at: https://www.visitscotland.org/binaries/content/assets/dot-org/pdf/research-insights/great-britain-day-visits-survey-2022-revised-lifestage.pdf

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

17 Climate Change

17.1 Introduction

1276. This chapter considers the scope of potential impacts of the construction, operation and maintenance, and decommissioning phases of the Broadshore Hub Wind Farm Development Areas (WFDAs) on climate change.

1277. This chapter provides an overview of the existing environment and sets out the proposed methodology and approach to assessing effects on climate change in the Broadshore Hub WFDAs Environmental Impact Assessment (EIA) Report. This chapter has been prepared by Royal HaskoningDHV.

1278. One of the principle aims of the Broadshore Hub is to make a contribution to tackling climate change by generating secure, low carbon and renewable electricity, helping decarbonise the power sector and other sectors in the United Kingdom (UK). Refer to **Chapter 2: Policy and Legislative Context** for background on the need for the Broadshore Hub.

1279. Climate change must be considered within the Broadshore Hub WFDAs EIA Report as required by the EIA Directive 2014/52/EU, which was transposed into the Electricity Works (Environmental Impact Assessment) (Scotland) Regulations and the Marine Works (EIA) Regulations in 2007.

1280. The climate change chapter of the Broadshore Hub WFDAs EIA Report will include consideration of both the Broadshore Hub WFDAs infrastructure's impacts on climate change, and the impacts of climate change on the Broadshore Hub WFDAs infrastructure. As discussed in **Chapter 4: Approach to Scoping and Environmental Impact Assessment**, the assessment of the Broadshore Hub Offshore Transmission Development Areas (OfTDAs) and the Broadshore Hub Onshore Transmission Development Areas (OnTDAs) and their component parts will be included in separate planning applications and therefore separate EIA Reports.

1281. Therefore, the climate change chapter will comprise two separate assessments, as follows:

- A whole-life greenhouse gas (GHG) assessment, which will comprise the following elements:
  - Overall GHG assessment for the Broadshore Hub WFDAs, which will be presented in the climate change chapter of the Broadshore Hub WFDAs EIA Report. This assessment will cover GHG emissions released over the Broadshore Hub WFDAs infrastructure's lifecycle, and the avoided emissions from the provision of renewable electricity to the National Electricity Transmission System. Following this, a summary of each WFDA's GHG impacts will be given (Broadshore WFDA, Sinclair WFDA, Scaraben WFDA).
  - Three project assessments, one for each of the Broadshore Project, the Sinclair Project and the Scaraben Project, will be presented in a standalone report appended to the Broadshore Hub WFDAs EIA Report, and then subsequently, the Broadshore Hub OfTDAs EIA Report and Broadshore Hub OnTDAs EIA Report. This assessment will evaluate the net contribution of each project as a whole to climate change, through consideration of

GHG emissions arising from infrastructure associated with all component parts (WFDAs, OfTDAs, OnTDAs). Further details are discussed in **Section 17.7.1.2.**

- A climate change resilience (CCR) assessment, which will evaluate future trends in climate change impacts and the Broadshore Hub WFDAs' vulnerability and resilience to such changes. The CCR assessment will consider the Broadshore Hub WFDAs only, with the vulnerability and resilience to climate change impacts considered separately for the Broadshore Hub OnTDAs and OfTDAs in their respective EIA Reports.

1282. This approach to GHG assessments allows for assessments to be undertaken as per the applications (overall Broadshore Hub WFDAs and each individual WFDA – refer to **Plate 4.4** in **Chapter 4: Approach to Scoping and Environmental Impact Assessment**) and also allows for whole project assessments (for each individual project).

1283. The climate change assessment is likely to have key inter-relationships with the other receptors considered in this Broadshore Hub WFDAs Scoping Report, which will be considered appropriately where relevant in the Broadshore Hub WFDAs EIA Report.

17.2 Legislation, Policy and Guidance

1284. **Table 17.1** provides an overview of relevant legislation, policy and guidance which establishes requirements for the climate change chapter and the assessment methodology. Policy and legislation relevant to the Broadshore Hub WFDAs generally is provided in **Chapter 2: Policy and Legislative Context**.

Table 17.1: Summary of Relevant Legislation, Policy and Guidance for Climate Change

Relevant Legislation, Policy and Guidance	Relevance to the Assessment
GHG Assessment	
Legislation	
The United Nations Framework Convention on Climate Change (UNFCCC), 1992	The UNFCC is an international treaty which established a global climate governance framework and solidified climate change as an agenda item for future agreements and policies. The UNFCCC facilitated intergovernmental climate change negotiations such as the Conference of the Parties (COP).
The Kyoto Protocol, 1987	Following from the UNFCCC, the Kyoto Protocol committed industrialised countries to limit and reduce their GHG emissions in accordance with individual targets to reduce the rate and extent of global warming. Annex A of the Kyoto Protocol defined key GHGs as follows: • Carbon dioxide (CO_2). • Methane (CH_4). • Nitrous oxide (N_2O).

Relevant Legislation, Policy and Guidance	Relevance to the Assessment
	• Hydrofluorocarbons (HFC). • Perfluorocarbons (PFC). • Sulphur Hexafluoride (SF_6). • Nitrogen Trifluoride (NF_3).
The Climate Change Act 2008 and Climate Change (Scotland) Act 2009	The Climate Change Act 2008 provides the legal basis for the UK's long-term response to tackling climate change. The Climate Change Act (2050 Target Amendment) Order 2019 revised the UK's target to net zero by 2050, with an interim target of 78% emission reduction by 2035 compared to 1990 levels. The Act requires the UK Government to set legally binding carbon budgets to limit GHG emissions in a given time period. These budgets are set by the Climate Change Committee (CCC) in five-year periods. Scotland has its own distinct climate change legislation, the Climate Change (Scotland) Act 2009, which was amended by the Climate Change (Emissions Reduction Targets) (Scotland) Act 2019. Scotland has committed to achieving net zero by 2045, with a series of interim and annual targets that are more ambitious than the UK's targets. Unlike the UK's five yearly carbon budgets, the Scottish Government sets budgets on a yearly basis.
The Paris Agreement, 2015	The Paris Agreement entered into force in 2016 and was ratified by the UK Government at COP22. It is a legally binding international treaty with an overarching goal of "*holding the increase in the global average temperature to well below 2°C above pre-industrial levels and pursue efforts to limit the temperature increase to 1.5°C above pre-industrial levels*". The Paris Agreement requires countries to submit national climate action plans known as Nationally Determined Contributions (NDC), with each successive NDC reflecting increasing decarbonisation ambitions.
Policy	
National Planning Framework 4	Scotland's fourth National Planning Framework (NPF4) sets out the national spatial strategy up to 2045, which guides infrastructure projects on principles and priorities. NPF4 supports developments that enable decarbonisation through the provision of renewable, low-carbon and zero emission technologies (Policies 1 and 11). In addition, NPF4 requires developments to minimise their lifecycle GHG emissions as far as possible (Policy 2).
Scotland's Climate Change Plan	The Scottish Government publishes Climate Change Plans to set out the pathway to achieving its GHG emission reduction targets per the Climate Change (Scotland) Act 2009. The most recent version, the 2018-2032 Update, includes the Offshore Wind Policy

Relevant Legislation, Policy and Guidance	Relevance to the Assessment
	Statement that supports the development of between eight to 11 GW of offshore wind capacity by 2030.
The Innovation and Targeted Oil and Gas (INTOG) Decarbonisation Sectoral Marine Plan	The INTOG Decarbonisation Sectoral Marine Plan provides a strategic framework for offshore wind projects in sustainable locations to help deliver net zero commitments, with a focus on the delivery of smaller innovation projects (IN) and the provision of low-carbon electricity to the offshore oil and gas sector (TOG).
The UK Net Zero Strategy 2021 and British Energy Security Strategy, 2022	The UK Net Zero Strategy and British Energy Security Strategy apply to Scotland and provide a national commitment to the provision of low-carbon, secure and affordable energy sources, including an ambition to deliver up to 50 GW of offshore wind capacity by 2030.
UK Climate Change Strategy 2021 - 2024	The latest UK Climate Change Strategy aids UK exporters and suppliers through the transition to net zero by increasing support to clean growth and climate adaptation, reducing GHG emissions and understanding and mitigating climate-related financial risks. The Strategy highlights the importance of transforming the financial system to boost innovation and transition away from high carbon sectors.
Aberdeenshire Local Development Plan (LDP), 2023	The Aberdeenshire LDP 2023 aims to help develop a strong and resilient economy whilst maintaining a high quality of life and environment with new sustainable development. Policy C2 'Renewable Energy' supports renewable energy and energy storage developments which are in appropriate sites and of the appropriate design.
Guidance	
Institute of Environmental Management and Assessment (IEMA): Assessing Greenhouse Gas Emissions and Evaluating their Significance (2022)	The guidance document presents guidelines for undertaking GHG assessments, evaluating the significance of a development's GHG emissions in an EIA context, and approach to mitigation.
PAS2080: Carbon Management in Buildings and Infrastructure (2023)	The guidance document provides specifications for the management of whole-life carbon in built environment projects and best practice measures to enable further emission reductions.
The Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard (2015)	The guidance document provides requirements for the preparation of GHG emission inventories and the consideration of direct and indirect GHG emissions (Scope 1, 2 and 3 emissions).
GloMEEP: Port Emissions Toolkit (2018)	The guidance document provides a methodology for calculating vessel emissions during various operating modes such as in transit and manoeuvring.
CCR Assessment	
Legislation	

Relevant Legislation, Policy and Guidance	Relevance to the Assessment
The Climate Change Act 2008 and Climate Change (Scotland) Act 2009	The Climate Change Act 2008 requires the UK Government to undertake a Climate Change Risk Assessment (CCRA) every five years and identify key climate risks and opportunities to national communities and economic sectors. The Climate Change (Scotland) Act 2009 poses a similar requirement for the preparation of strategic programmes for climate change adaptation following the publication of each UK CCRA. The third UK CCRA was published in 2022, followed by the third National Adaptation Programme (NAP), which outlines priority adaptation actions to be taken. The Scottish Climate Change Adaptation Programme (SCCAP) 2019-2024 identifies specific actions for Scotland, including a need for resilient infrastructure systems.
Policy	
National Planning Framework 4	As a long-term vision for spatial development, NPF4 supports the enhancement of the climate resilience of existing and future developments. NPF4 requires developments to be sited and designed to adapt to current and future risks from climate change (Policy 2).
Guidance	
IEMA: Environment Impact Assessment Guide to Climate Change Resilience and Adaptation (2020)	The guidance document provides a methodology for characterising the climate baseline and assessing a development's vulnerability and resilience to climate change in the EIA process.
European Commission: Technical Guidance on the Climate Proofing of Infrastructure in the Period 2021 – 2027 (2021)	The guidance document outlines climate adaptation considerations for infrastructure projects and a risk assessment methodology for integration into impact assessments.
C40 Cities: Climate Change Risk Assessment Guidance (2018)	The guidance document includes a Climate Hazard Taxonomy based on the United Nations Disaster Risk Reduction classification, which provides the basis for identifying and screening climate hazards. Although geared towards cities, the approach is largely applicable to all built environment projects.

17.3 Consultation

1285. Consultation undertaken to date for the Broadshore Hub WFDAs relevant to climate change is provided in **Table 17.2** below.

Table 17.2: Consultation Relevant to Climate Change

Consultee	Date/Document	Comment	How Comment Is Addressed
MD-LOT	13th September 2023, Scoping Workshop (email post-workshop 6th October 2023)	The approach to EIA proposed at the Scoping Workshop seems sensible for climate change, however the Scottish Ministers' final comments will come via the scoping opinion once MD-LOT has consulted with relevant stakeholders	Noted.

17.4 Existing Environment

17.4.1 Study Area

17.4.1.1 Greenhouse Gas Assessment

1286. All GHG emissions will affect the same receptor, the global atmosphere, as opposed to directly affecting any specific local receptor. Emissions which are released or avoided due to project activities will have the same global effect on atmospheric GHG concentration, and its net effect on climate change regardless of where they occur, therefore the study area of the GHG assessment is not geographically defined (IEMA, 2022).

1287. The scope of the Broadshore Hub WFDAs GHG assessment will be limited to quantifying direct and indirect GHG emissions arising from the Broadshore Hub WFDAs' infrastructure over its full lifecycle: construction (including upstream emissions from the sourcing, manufacturing and transport of construction materials), operation and maintenance, and decommissioning. As the Broadshore Hub will supply renewable energy to the National Electricity Transmission System, the GHG assessment will also account for emission savings from the displacement of grid electricity which would have otherwise been generated using a more GHG intensive source. The study area for the Broadshore Hub WFDAs GHG assessment will encompass all associated GHG emitting activities, including carbon benefits beyond the infrastructure system such as avoided emissions from exported electricity. The proposed assessment boundary for the Broadshore Hub WFDAs GHG assessment is detailed under **Section 17.6**.

17.4.1.2 Climate Change Resilience Assessment

1288. The scope of the CCR assessment will be limited to evaluating the vulnerability and resilience of the Broadshore Hub WFDAs and its receptors to the effects of climate change. Therefore, the study area for the CCR assessment is geographically bounded and defined by the Broadshore Hub WFDAs (**Figure 1.1** in **Appendix 1**). The CCR assessment will be informed by historical observations and future projections of climate variables. The spatial resolution of the baseline data collected for the CCR assessment will provide representative coverage of the Broadshore Hub WFDAs and the wider region of Eastern Scotland (The Met Office, 2016a).

1289. The temporal boundary of the CCR assessment will be defined by the Broadshore Hub WFDAs construction, operation and maintenance, and decommissioning phases, noting that there may be differences in the duration of the project phases between the Broadshore WFDA and the Sinclair WFDA and Scaraben WFDA:

- The maximum construction periods for the Broadshore WFDA, the Sinclair WFDA and Scaraben WFDA are assumed to be up to three and up to two years respectively.
- The operational lifetime is assumed to be between 25 and 50 years for Sinclair WFDA and Scaraben WFDA, where the seabed lease will be for up to 25 years.
- The operational lifetime is assumed to be between 25 and 50 years for the Broadshore WFDA but the seabed lease will be for up to 60 years. The design life will be dictated by the WTG suppliers and will reflect market maturity and operational experience globally at the time of construction. At the end of the operational life, any repowering will be subject to separate consents.
- The duration of the decommissioning period will depend on the Broadshore Hub WFDAs end-of-life strategy but, for EIA purposes, are assumed to be similar in timescales as the construction periods.

1290. In order to characterise the future baseline climate, representative time slices will be identified in alignment with the Broadshore Hub WFDAs' project phases (construction, operation and maintenance and decommissioning), and climate change projection data will be presented for each time slice to reflect changes in climate change severity over time and capture the likely climate conditions at each project phase.

17.4.2 Data and Information Sources

1291. The desk-based sources which will be used to characterise the existing environment and inform the GHG assessment and CCR assessment will consist primarily of publicly available datasets and reports from government and industry sources. **Table 17.3** identifies potential desk-based sources, which will be updated throughout the EIA process.

Table 17.3: Summary of Key Data and Information Sources for Climate Change

Dataset	Year(s)	Description
GHG Assessment		
Department for Energy Security and Net Zero's (DESNZ) Greenhouse Gas Reporting Conversion Factors	2023 (or latest at time of assessment)	Emission factors suitable for UK-based operations for various activities such as fuel consumption.
DESNZ's Digest of UK Energy Statistics	2023 (or latest at time of assessment)	Up-to-date statistics for the UK power sector, including the operational GHG intensity of each fuel or generation source.
DESNZ's Treasury Green Book Supplementary Guidance: Valuation of Energy Use and Greenhouse Gas Emissions for Appraisal	2023 (or latest at time of assessment)	Current and projected operational GHG intensity of grid electricity.
CCC's UK Carbon Budgets	Various, most recent publication in 2020	National carbon budgets used to contextualise the Broadshore Hub WFDAs' GHG emissions[45].
CCC's Reducing the UK's Carbon Footprint Report	2013	Estimated lifecycle carbon intensity of various forms of electricity generation.
The Scottish Parliament and Scottish Natural Heritage's Blue Carbon Reports	Various	Research on the blue carbon potential of Scotland's coastal and marine environment, including the carbon sequestration rate by habitats.
Inventory of Carbon and Energy (ICE) Database v3.0	2019	Emission factors for embodied carbon in materials used during construction and replacement or repair activities.
Dolan and Heath, Life Cycle Greenhouse Gas Emissions of Utility Scale Wind Power	2012	GHG emission benchmarks for offshore wind projects to inform assumptions used in the GHG assessment regarding the likely contribution of emission sources to the Broadshore Hub WFDAs' GHG footprint.
Thompson and Harrison, Life Cycle Costs and Carbon Emissions of Offshore Wind Power	2015	
DESNZ's UK Territorial Greenhouse Gas Emissions National Statistics	2023 (or latest at time of assessment)	Estimates of annual GHG emissions from activities occurring within the UK's borders.
Scottish Greenhouse Gas and Energy Statistics (Scottish government, 2023a)	2023 (or latest at time of assessment)	Statistical publications relating to energy and GHG emissions in Scotland.
CCR Assessment		

[45] The Scottish carbon budgets are published yearly, and to date, are only available from 2023 to 2024. To provide full coverage of the Broadshore Hub WFDAs project phases, the UK five-yearly carbon budgets are considered appropriate for contextualising the GHG assessment.

Dataset	Year(s)	Description
The Met Office's UK Climate Projection (UKCP) Database and supporting reports	Various	Climate change projection data and summaries for the UK for various climate variables such as air temperature and precipitation. Note: UKCP data is most applicable to onshore and coastal areas.
The Met Office's UK Climate Averages and Regional Climate Summaries	Various	Historical climate observations and current climate conditions for the UK.
Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report	Various	Current state of knowledge on climate science and possible climate futures.
Marine Climate Change Impacts Partnership (MCCIP) Reports	Various	A collection of evidence reviews and summary reports on climate change effects in the marine environment.
Department for Business, Energy and Industrial Strategy's (BEIS) Offshore Energy Strategic Environment Assessment 4 (SEA4)	2022	Observed meteorological conditions at seas around the UK.
Weisenfeld et al., Offshore Wind Climate Adaptation and Resiliency Study	2021	Review of key climate factors to the offshore wind sector and opportunities for climate resilience.

1292. No baseline surveys are proposed for the GHG assessment and CCR assessment. However, cross-disciplinary engagement with the Applicants' engineering team and other relevant EIA chapters will help refine the assessment and identify suitable mitigation measures.

17.4.3 Greenhouse Gas Assessment

1293. A GHG assessment evaluates the effect significance of emissions released or avoided by a development based on its alignment with a science-based transition towards net zero and requirements set by international climate commitments, national policies and best industry practice. To contextualise the assessment, national carbon budgets and relevant existing and emerging net zero policies, targets and performance standards will be reviewed and compared against the predicted GHG impacts.

1294. Climate change is a devolved matter within the UK, and as such, the Scottish Government is committed to developing and implementing carbon reduction policies that are compatible with the UK's ambitions. Under the Climate Change (Scotland) Act 2009, the Scottish Government publishes its carbon budget annually, with the 2023 – 2024 budget set at 8.8 Mt CO_2e (Scottish Government, 2022). It should be noted that Scotland's net zero target is more ambitious than the UK's target (discussed in **Paragraph 1297**), with a commitment to achieving net zero by 2045. The following interim targets illustrate Scotland's planned decarbonisation trajectory:

- At least 56% emission reduction relative to 1990 levels by 2020;
- At least 75% emission reduction relative to 1990 levels by 2030; and.
- At least 90% emission reduction relative to 1990 levels by 2040.

1295. In addition, the Scottish Government has its own offshore wind capacity ambitions in support of the UK's national target (discussed in **Paragraph 1294**), with the award of the ScotWind offshore wind leasing round in Scottish waters by the Crown Estate Scotland (CES) in 2022 and the award of the INTOG offshore wind leasing round in 2023. The Broadshore Project falls within the ScotWind leasing round. ScotWind's objective was to help Scotland achieve its net-zero emissions target by 2045, by granting property rights for the seabed in Scottish waters for new commercial scale offshore wind projects in a way that was fair and transparent. In doing so, ScotWind facilitates and encourages development of the low-carbon energy generation needed to meet the world-leading targets committed to in The Climate Change (Emissions Reduction Targets) (Scotland) Act 2019. The Sinclair and Scaraben Projects fall within the INTOG leasing round and aim to stimulate innovation in Scotland's offshore wind sector and support net-zero ambitions. The leasing context for the Broadshore Hub is discussed further in **Chapter 2: Policy and Legislative Context**.

1296. The Offshore Wind Policy Statement (Scottish Government, 2020a) and the Sectoral Marine Plan for Offshore Wind Energy (Scottish Government, 2020b) include a target to deliver up to 11 GW of offshore wind capacity by 2030 to support Scotland's commitment to net zero by 2045. According to the Scottish Energy Statistics Hub, Scotland's operational offshore wind capacity measured around 2.6 GW in June 2023, with an additional 8.2 GW in planning, awaiting construction or under construction (Scottish Government, 2023b).

1297. On a broader scale, the Climate Change Act 2008 provides a framework for the UK, and Scotland via its devolved climate change policies, to decarbonise and meet its long-term goals of achieving net zero emissions. The UK Government sets a series of legally-binding carbon budgets, which establish a limit on the total amount of GHG emissions than can be emitted within the UK over five-year periods until 2050. Six carbon budgets have been approved so far, as shown in **Table 17.4** (CCC, 2020), which cover the time period between 2008 and 2036. The UK is currently in the fourth carbon budget period.

Table 17.4: UK Carbon Budgets (2008 to 2037)

Budget Period	Carbon Budget (Mt of carbon dioxide equivalents (CO_2e)	Reduction Relative to 1990 Levels
1st carbon budget (2008 to 2012)	3,018	26%
2nd carbon budget (2013 to 2017)	2,782	32%
3rd carbon budget (2018 to 2022)	2,544	38%
4th carbon budget (2023 to 2037)	1,950	52%
5th carbon budget (2028 to 2032)	1,725	58%
6th carbon budget (2033 to 2037)	965	77%

Budget Period	Carbon Budget (Mt of carbon dioxide equivalents (CO_2e)	Reduction Relative to 1990 Levels
7th carbon budget (2038 to 2042)	To be set in 2025	
Net zero target	At least 100% emission reduction by 2050	

1298. The UK Government has also set out its intention to decarbonise all sectors of the UK economy, including the power sector, within the Clean Growth Strategy (BEIS, 2017). Reaffirmation of this ambition was provided as a commitment within the Offshore Wind Sector Deal (BEIS, 2019), which reinforces the UK Government's aims to advance offshore wind generation as an integral part of a future low-cost, low-carbon and flexible grid system. In light of recent progress, the commitment to 30 GW offshore wind capacity within the Offshore Wind Sector Deal has been superseded by a 40 GW by 2030 target as set out in the Ten Point Plan for a Green Industrial Revolution (HM Government, 2020) and the Net Zero Strategy: Build Back Greener (HM Government, 2021). The UK Government has since increased its offshore wind capacity target to 50 GW by 2030 in the British Energy Security Strategy (2022).

1299. The renewable electricity generated by the Broadshore Hub WFDAs would displace an equivalent amount of electricity which would have been generated using alternative energy sources. The focus of the GHG assessment will be to determine the Broadshore Hub WFDAs' contribution towards Scotland's and the UK's national emission reduction and long-term net zero targets. This will be achieved by comparing the 'Do Nothing' scenarios to the emissions avoided as a result of the Broadshore Hub WFDAs operations.

1300. Two 'Do Nothing' scenarios will be established for the GHG assessment, which assume that the Broadshore Hub WFDAs is not constructed, and present different future baseline environments based on the energy and climate policies adopted:

- The first scenario assumes that the electricity generated by the Broadshore Hub WFDAs would have otherwise been generated using natural gas, which is an approach advocated for use by offshore wind farms by RenewableUK (2022) and will be adopted to account for the UK's transition from fossil fuel-based generation to renewables.
- The second scenario assumes that the electricity generated by the Broadshore Hub WFDAs would have otherwise been generated using all forms of generation sources considered as part of the future National Electricity Transmission System mix, represented by the long-run marginal emission factors (DESNZ, 2023). This approach is considered to be conservative, as the decline in GHG intensity of grid electricity evident under this scenario accounts for growth in renewables such as the Broadshore Hub becoming operational.

1301. To contextualise the magnitude of GHG emissions reported in the assessment and the evaluation of their effects on climate change, the baseline review will cover the carbon budgets and targets relevant to each phase (construction, operation and maintenance, and decommissioning) of the Broadshore Hub WFDAs, as well as recent national emission statistics for Scotland and the UK, the emission contribution of the power sector and the lifecycle GHG intensities of various forms of electricity generation.

17.4.4 Climate Change Resilience Assessment

1302. The current baseline for the CCR assessment will be defined using historical climate data and meteorological records maintained by the Met Office. Climate averages for the 1991 to 2020 time period will be obtained from the nearest onshore climate station to the Broadshore Hub WFDAs, which is Fraserburgh (57.6935, -2.006), for temperature, precipitation and wind variables (The Met Office, 2023). This will be supplemented with regional climate characteristics (The Met Office, 2016b), based on observations recorded between 1981 and 2010, and baseline information from the Offshore Energy SEA4 (BEIS, 2022) which provides meteorological conditions at sea for various offshore regions surrounding the UK. The Broadshore Hub WFDAs lie closest to the Eastern Scotland climate region and sit within Regional Sea 1 respectively.

1303. Climate change projections will be used to characterise the future baseline climate within the study area for the CCR Assessment, with changes to climate variables serving as indications of likely climate hazards. The Met Office's UKCP database provides probabilistic climate change projections for the UK at a spatial resolution of 25 km grid squares, covering the time period of 1961 to 2100. Probabilistic projections provide a broad range of possible climate outcomes and account for uncertainties present in climate models.

1304. UKCP data uses Representative Concentration Pathways (RCP) which depicts future atmospheric GHG concentration based on various emission reduction scenarios. For the CCR assessment, projection data will be obtained for RCP4.5 (intermediate scenario) and RCP8.5 (worst-case scenario) and presented at three probability levels where applicable: 10th percentile, 50th percentile (median) and 90th percentile. In line with best practice (IEMA, 2020), this approach would provide a robust overview of the future baseline climate.

1305. It should be noted that the majority of UKCP data is land-based and thus does not provide direct coverage of the offshore area in which the Broadshore Hub WFDAs are located. However, to describe projected changes in air temperature, precipitation and wind at the local scale, it is assumed that projections for the grid cell closest to the Broadshore Hub WFDAs would be broadly representative of the study area for the CCR Assessment. Marine climate change projections such as changes in sea temperature, sea level, tides and storm surges will be obtained from the Met Office's UKCP Marine Projections and MCCIP reports. Where information gaps exist, these will be supplemented using other available literature sources.

1306. Climate change projections are commonly provided as time series data. For the CCR assessment, the data will be processed and presented as climate averages over the selected time slices. It is assumed that these time slices would provide sufficient temporal coverage of the study area for the CCR Assessment. The Broadshore Hub WFDAs' construction, operation and maintenance and decommissioning phases will be segmented into multiyear time slices (typically 20 to 30 year periods), depending on data availability, to illustrate differences in short-term, medium-term and long-term climate change.

17.5 Potential Impacts

17.5.1 Greenhouse Gas Assessment

1307. Potential impacts considered in the GHG assessment include direct and indirect emissions released as a result of Broadshore Hub WFDAs' activities during construction, operation and maintenance and decommissioning. The Broadshore Hub WFDAs' provision of renewable energy, will also result in avoided emissions by displacing grid electricity which would have otherwise been generated using more GHG-intensive sources.

1308. It should be noted that GHG emissions released or avoided by the Broadshore Hub WFDAs may occur outside its spatial boundary and the UK's territorial boundary, such as upstream emissions from the manufacturing of wind farm infrastructure. However, given that GHG emissions affect the climate system wherever they occur, and the need to avoid 'carbon leakage' overseas when reducing UK emissions, such emissions will be included in the Broadshore Hub WFDAs GHG assessment. GHG emission sources in the assessment boundary are detailed under **Section 17.6**.

17.5.2 Climate Change Resilience Assessment

1309. Potential impacts considered in the CCR assessment include extreme weather events and chronic climatic changes with the potential to harm receptors and affect their ability to maintain their function or purpose. A high-level review of direct interdependencies with other critical infrastructure or activities, such as the electricity transmission network, will also be undertaken to identify the potential for cascading risks and their effects on the Broadshore Hub WFDAs' climate resilience. Receptor groups considered in the CCR assessment include:

- Infrastructure receptors such as wind turbine generators (WTGs) and other built assets, equipment and temporary structures;
- Human receptors such as site personnel; and
- Environmental receptors such as habitats and species associated with landscaping or ecological mitigation and enhancement measures.

17.5.3 Embedded Mitigation Measures

1310. As part of the design process, mitigation measures will be considered throughout to reduce the Broadshore Hub WFDAs impact on climate change and vice versa, which will evolve as the EIA progresses and in response to consultation. These measures will include actions that have been identified through the design process (primary mitigation) and those that can be expected to occur in compliance with other regulatory requirements and good industry practice (tertiary mitigation), as detailed further in the following paragraphs.

1311. The IEMA guidance (2022) highlights the importance of embedded mitigation in minimising GHG emissions from a proposed development. The IEMA GHG Management Hierarchy sets out a structure to eliminate, reduce, substitute and compensate such emissions. The GHG assessment will consider mitigation measures which are designed into the Broadshore Hub WFDAs and will identify opportunities for further emission reduction where practicable, in line with the GHG Management Hierarchy, such as measures to minimise vessel traffic or embodied carbon through the efficient use of materials. In addition, the PAS2080 guidance document (2023) will be reviewed to outline best practice carbon management measures for further consideration.

1312. The design of offshore wind farms and occupational health and safety requirements provide an inherent degree of climate change readiness and resilience. The CCR assessment will account for the Broadshore Hub WFDAs' technical requirements, design specifications and operational strategy which are built upon best practice engineering codes and standards in the offshore wind sector, and standard health and safety procedures outlined in relevant management plans. Where likely significant effects are predicted, additional mitigation will be identified from available literature sources and in collaboration with the engineering team to ensure the Broadshore Hub WFDAs are resilient to impacts arising from current extreme weather events and climatic conditions. Accounting for uncertainties in longer-term climate change projections and their implications for the Broadshore Hub WFDAs, adaptive management measures will also be reviewed in line with IEMA's guidance (2020) to ensure mitigation is implemented where and when appropriate.

17.6 Scoping of Potential Impacts

1313. A summary of the proposed scoping proposals for the climate change chapter is provided in **Table 17.9**. The scopes of the GHG and CCR assessments will be revisited in the Broadshore Hub WFDAs EIA Report to align with the most up-to-date design of the Broadshore Hub WFDAs and are subject to information availability.

17.6.1 Potential Impacts Scoped In

17.6.1.1 Greenhouse Gas Assessment

1314. The scoping exercise for the GHG assessment identifies emission sources which are included/excluded from the assessment boundary and are presented in accordance with the PAS2080 lifecycle modules.

1315. **Table 17.5** shows the GHG emission sources which are proposed to be 'scoped in' to the Broadshore Hub WFDAs EIA Report.

Table 17.5: Potential Greenhouse Gas Impacts 'Scoped In' to the Broadshore Hub WFDAs EIA Report

Phase	PAS2080 Lifecycle Module	Potential Emission Sources
Pre-Construction (including Product Stage) and Construction	A0: Preliminary Studies, Design and Engineering	Emissions from design and engineering activities are not likely to be significant. It is anticipated that most works will be office-based. However, pre-construction surveys and activities such as geotechnical surveys and seabed preparation will be considered where possible. Further details on pre-construction works are

Phase	PAS2080 Lifecycle Module	Potential Emission Sources
		provided in **Chapter 3: Project Description**.
	A1: Raw Materials Supply A2: Transport to Manufacturing Site A3: Manufacturing	Embodied carbon in materials used during the construction of offshore infrastructure such as WTG and substructures. Embodied carbon in materials in this assessment are emissions arising from the raw material extraction and manufacturing of materials used for the Broadshore Hub WFDAs' infrastructure.
	A4: Transport to/from Construction Site	Fuel consumption from the movement of materials, equipment and personnel to/offshore waste from the offshore construction site using road vehicles, marine vessels and helicopters. This will include vessels travelling from their origin location to the Broadshore Hub WFDAs.
	A5: Construction	Fuel and electricity consumption associated with plant and equipment use during offshore construction activities. Seabed/habitat disturbance or loss due to activities within the Broadshore Hub WFDAs footprint such as piling, resulting in impacts to blue carbon, which is a term used to define carbon captured by marine and coastal ecosystems.
Operation and Maintenance	B2: Maintenance B3: Repair B4: Replacement B5: Refurbishment	Fuel and electricity consumption associated with transport (marine vessels and road vehicles if applicable) and plant and equipment use during offshore operation and maintenance activities. Embodied carbon in materials used in spare parts during repair and replacement events.
	B8: Other Operational Processes	Seabed/habitat disturbance or loss due to the presence of the Broadshore Hub WFDAs' infrastructure over the operational lifetime, resulting in impacts to blue carbon.
Decommissioning (End-of-Life)	C1: Deconstruction C2: Transport to/from Site	Emissions associated with the deinstallation of the Broadshore Hub WFDAs' infrastructure, transport to

Phase	PAS2080 Lifecycle Module	Potential Emission Sources
	C3: Waste Processing for Recovery C4: Disposal	landfill or other end destination and the treatment and processing for reuse, recycling, recovery or disposal.
Whole Lifecycle	D: Benefits and Loads beyond the Infrastructure System	Avoided emissions from the provision of renewable energy to the grid.

17.6.1.2 Climate Change Resilience Assessment

1316. The scoping exercise for the CCR assessment identifies climate hazards, selected from the C40 Taxonomy, and potential climate change impacts which may result in likely significant effects to the Broadshore Hub WFDAs.

1317. **Table 17.6** outlines the climate hazards which are proposed to be ‘scoped in’ to the Broadshore Hub WFDAs EIA Report and their potential for climate change impacts to the Broadshore Hub WFDAs.

Table 17.6: Potential Climate Change Resilience Impacts ‘Scoped In’ to the Broadshore Hub WFDAs EIA Report

<table>
<tr><th>Climate Hazard</th><th>Type of Climate Hazard</th><th>Potential Climate Change Impacts to the Broadshore Hub WFDAs</th></tr>
<tr><td>Extreme precipitation (e.g., rain, snow, hail, fog)</td><td>Extreme weather event</td><td rowspan="6">• Delays to programme such as inability to undertake offshore construction or maintenance activities.
• Physical damage to built assets, equipment and vessels.
• Increased maintenance, repair and replacement requirements due to faster asset deterioration.
• Reduced wind farm efficiency and functioning from operational downtime.
• Occupational health and safety impacts to project personnel.</td></tr>
<tr><td>Storm and wind (e.g., gales, storm surge, thunderstorms)</td><td>Extreme weather event</td></tr>
<tr><td>Extreme temperatures (e.g., cold and heat waves)</td><td>Extreme weather event</td></tr>
<tr><td>Changes in marine climate and extreme weather events</td><td>Chronic climatic change</td></tr>
<tr><td>Sea level rise</td><td>Chronic climatic change</td></tr>
<tr><td>Changes in sea conditions (e.g., wave and currents, salinity)</td><td>Chronic climatic change</td></tr>
</table>

17.6.2 Potential Impacts Scoped Out

17.6.2.1 Greenhouse Gas Assessment

1318. Table 17.7**Table 17.7** shows the GHG emission sources which are proposed to be scoped out of the Broadshore Hub WFDAs EIA Report and the rationale.

Table 17.7: Potential Greenhouse Gas Impacts Scoped Out of the Broadshore Hub WFDAs EIA Report

Phase	PAS2080 Lifecycle Module	Rationale
Operation and Maintenance	B1: Use	Direct emissions or removals from components and materials installed as part of the infrastructure, such as venting or flaring, are not relevant to the Broadshore Hub WFDAs. No process/fugitive emissions or carbon sequestration are anticipated. No onshore land use change due to the Broadshore Hub WFDAs.
	B6: Operational Energy Use	The Broadshore Hub WFDAs' operational energy requirements are assumed to be delivered entirely by its own electricity generation.
	B7: Operational Water Use	The Broadshore Hub WFDAs' operational water use is anticipated to be negligible and therefore emissions are not likely to be significant.
	B9: User's Utilisation of Infrastructure	Emissions from user's utilisation are not relevant to the Broadshore Hub WFDAs. End users will consume the electricity generated by the Broadshore Hub WFDAs but will not directly interact with the infrastructure.

17.6.2.2 Climate Change Resilience Assessment

1319. **Table 17.8** outlines the climate hazards which are proposed to be scoped out of the Broadshore Hub WFDAs EIA Report and the rationale.

Table 17.8: Potential Climate Change Resilience Impacts Scoped Out of the Broadshore Hub WFDAs EIA Report

Climate Hazard	Type of Climate Hazard	Rationale
Flooding (e.g., surface water, groundwater, coastal, river flooding)	Extreme weather event	These climate hazards only apply to onshore areas. As the Broadshore Hub WFDAs are located entirely offshore, no climate change impacts associated with these climate hazards are expected to arise to the Broadshore Hub WFDAs.
Wildfires	Extreme weather event	

Climate Hazard	Type of Climate Hazard	Rationale
Mass movements (e.g., earthquakes, landslides)	Extreme weather event	Although earthquakes can occur offshore, the UK Continental Shelf does not sit on a major fault line between tectonic plates and primarily experiences low magnitude earthquakes annually, with moderate earthquakes as rare occurrences. Furthermore, it is considered unlikely that climate change will exacerbate the frequency or severity of submarine earthquakes in the UK.
Land changes (e.g., saltwater intrusion, subsidence)	Chronic climatic change	
Water stress (e.g., drought, desertification)	Chronic climatic change	
Ocean acidification	Chronic climatic change	Although acidification is a climate hazard specific to the marine environment in which the Broadshore Hub WFDAs are located, it is not likely to result in a climate change impact to the Broadshore Hub WFDAs.

17.6.3 Potential Cumulative Effects

17.6.3.1 Greenhouse Gas Assessment

1320. The only receptor for the GHG assessment is the global atmosphere. GHG emissions, wherever they occur, have the potential to contribute to climate change, and therefore their effects are global and cumulative by nature. The IEMA guidance (2022) states that the effects of GHG emissions from specific cumulative projects should not be individually assessed, as there is no basis for selecting which projects to assess cumulative over any other. As such, no additional consideration of cumulative effects is required for the GHG assessment.

17.6.3.2 Climate Change Resilience Assessment

1321. The CCR assessment considers the vulnerability and resilience of the Broadshore Hub WFDAs to climate change impacts. There is potential for other plans or projects to act collectively to exacerbate or reduce a project's climate vulnerability and risk. However, given its offshore location, there is only one active development immediately adjacent to the Broadshore Hub WFDAs (Captain oil and gas field), with considerable separation distances from other infrastructure. Refer to **Chapter 13 Infrastructure and Other Users** for full details on existing assets and proposed projects surrounding the Broadshore Hub WFDAs. It is highly unlikely for the Broadshore Hub WFDAs' climate change resilience to be significantly affected by neighbouring developments. Therefore, cumulative effects are scoped out of the CCR assessment.

17.6.4 Potential Transboundary Effects

17.6.4.1 Greenhouse Gas Assessment

1322. As the receptor for the GHG assessment is the global atmosphere, GHG impacts are transboundary by nature. Emissions considered in the GHG assessment will be contextualised using the relevant UK carbon budgets and national net zero targets, which have been established in accordance with international climate commitments such as the UK's NDC under the Paris

Agreement (2015). As such, no additional consideration of transboundary effects is required for the GHG assessment.

17.6.4.2 Climate Change Resilience Assessment

1323. It is not relevant to assess transboundary effects relating to climate change resilience, as the assessment focusses on the effects of climate change on the Broadshore Hub WFDAs. Therefore, transboundary effects are scoped out of the CCR assessment.

17.6.5 Summary of Potential Climate Change Impacts Scoped In and Out

1324. A summary of potential impacts scoped in and out from further assessment in the Broadshore Hub WFDAs EIA Report is provided in **Table 17.9** below.

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Table 17.9: Summary of Potential Impacts Scoped In (✓) or Scoped Out (x) for Climate Change

Potential Impact	Receptor(s)	Description of Potential Effects	Scoped In or Scoped Out? (✓ or x)			Embedded Mitigation Measures
			Construction	Operation and Maintenance	Decommissioning	
GHG Assessment						
Whole lifecycle GHG impacts	Global atmosphere	GHG emissions by project phase and the GHG footprint over the full lifecycle of the Broadshore Hub WFDAs. Combined GHG emissions of each of the three projects in their entirety (Broadshore Project, Sinclair Project and Scaraben Project). Avoided emissions from the provision of renewable electricity to the National Electricity Transmission System. Net contribution to Scotland's and the UK's decarbonisation and net zero policies and targets.	✓	✓	✓	Implementation of IEMA Carbon Management Hierarchy and PAS2080 carbon management measures
CCR Assessment						
Vulnerability and resilience to climate change impacts	Infrastructure, human and ecological receptors associated with the Broadshore Hub WFDAs	• Physical damage or disruption to infrastructure receptors. • Risk of injuries or fatalities to human receptors. • Harm or decline in functioning of environmental receptors.	✓	✓	✓	Climate resilience measures embedded into the design and relevant management plans

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17.7 Proposed Approach to Impact Assessment

17.7.1 Greenhouse Gas Assessment

1325. The GHG assessment will be undertaken in accordance with the following guidance documents:

- Assessing Greenhouse Gas Emissions and Evaluating their Significance (IEMA, 2022);
- The Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard (World Resources Institute and World Business Council for Sustainable Development, 2015); and
- PAS 2080: Carbon Management in Buildings and Infrastructure (British Standards Institution, 2023). Port Emissions Toolkit (GloMEEP, 2018).

1326. The GHG assessment for the Broadshore Hub WFDAs EIA Report will be structured as follows:

- Emissions from the construction of the Broadshore Hub WFDAs;
- Emissions from the operation and maintenance of the Broadshore Hub WFDAs;
- Avoided emissions from the provision of renewable energy into the National Electricity Transmission System during the Broadshore Hub WFDAs' operations;
- Emissions from the decommissioning of the Broadshore Hub WFDAs infrastructure;
- A summary of lifecycle emissions of the Broadshore Hub WFDAs across the construction, operation and maintenance and decommissioning phases; and
- Combined emissions of the Broadshore WFDA, OfTDA and OnTDA, the Sinclair WFDA, OfTDA and OnTDA and the Scaraben WFDA, OfTDA and OnTDA to establish the net contribution to climate change for each of the three projects in their entirety.

1327. GHG emissions will be calculated using a standard calculation-based methodology, which involves multiplying activity data supplied by the design team with the representative emission factors, and where applicable, calorific, load and global warming potential (GWP) factors. Industry benchmarks and assumptions based on professional judgment will be used where data gaps exist. Subject to data availability, end-of-life emissions during decommissioning and emissions from spare parts used during repair and replacement events will be estimated using industry benchmarks from the GHG footprinting of offshore wind projects (Thomson and Harrison, 2015).

1328. Although the Broadshore Hub WFDAs EIA Report will consider the overall GHG impacts of the Broadshore Hub WFDAs, the GHG emissions released or avoided by the individual Broadshore WFDA, Sinclair WFDA and Scaraben WFDA and their respective effect significance will also be summarised in the climate change chapter.

17.7.1.1 Assessment Criteria

1329. The receptor for the GHG assessment is defined as the global atmosphere. The receptor's sensitivity will be characterised as high, given that any net reduction of GHG emissions will support decarbonisation efforts in line with national and international climate commitments.

1330. The magnitude of impact is not defined, as the effect significance for the GHG assessment is not determined by the magnitude of emissions alone (IEMA, 2022). However, GHG emission values (both in terms of emissions released and avoided) will be calculated and expressed as tonnes of CO_2e to account for differences in GWP between GHGs. GWP factors will be obtained from the most recent IPCC's Assessment Report 100-year estimates. GHG emissions will be calculated using a lifecycle approach in alignment with the PAS 2080 modules and presented both by project phase and over the whole lifecycle.

1331. Significance criteria for the assessment will be adapted from IEMA's guidance (2022), which recognises that: '*when evaluating significance, all new GHG emissions contribute to a negative environmental effect. However, some projects will replace existing development or baseline activity that have higher GHG profiles. The significance of a project's emissions should therefore be based on its net impacts, which may be positive, negative or negligible'.*

1332. The IEMA guidance provides relative significance descriptions to assist assessments of GHG emissions in an EIA context. Section VI of the updated guidance (IEMA, 2022) describes five distinct levels of significance (major adverse, moderate adverse, minor adverse, negligible and beneficial), which are not based solely on whether a project emits GHG emissions, but on how the project makes a relative contribution towards achieving a science-based transition towards net zero. For the purposes of the EIA, major adverse, moderate adverse and beneficial effects will be considered as significant.

1333. To assist in evaluating significance of the Broadshore Hub WFDAs' GHG impacts, comparisons to the UK carbon budgets and relevant existing and emerging net zero policies, targets and performance standards will be undertaken. The assessment will conclude whether and how the Broadshore Hub WFDAs contribute to or undermine the UK's emission reduction efforts and trajectory towards net zero. Additional parameters will be calculated to contextualise the predicted carbon benefits, including the GHG intensity of electricity generated and the GHG payback period (RenewableUK, 2022).

17.7.1.2 Assessment of Each Project as a Whole

1334. As the project WFDAs form an element of the three wider projects in the Broadshore Hub, GHG emissions from the construction, operation and maintenance and decommissioning of infrastructure associated with each project's WFDA, OfTDA and OnTDA (which are subject to a separate consent applications and EIAs) will also be considered in a standalone report (referred to as the "whole project assessments") appended to the Broadshore Hub WFDAs EIA Report. A whole project assessment will be undertaken to evaluate the net contribution of each individual project as a whole to climate change.

1335. The study area for each whole project assessment will encompass all GHG emitting activities, including avoided emissions, associated with the construction, operation and maintenance and decommissioning of the WFDA, OfTDA and OnTDA infrastructure, for the Broadshore Project, the Sinclair Project and the Scaraben Project respectively.

1336. Likely emission sources and lifecycle GHG emissions associated with the projects' OfTDAs and OnTDAs infrastructure will be estimated using project assumptions and industry benchmarks from literature such as the Royal Institution of Chartered Surveyors (RICS) Whole Life Carbon Assessment Standard for the Built Environment, 2nd edition (2023) and The Institution of Structural

Engineers (IStructE) How to Calculate Embodied Carbon guidance, 2nd edition (2022). Their indicative emissions will be combined with the calculated lifecycle emissions for each project's WFDA to determine the likely total emissions for each project in turn. To evaluate the overall effect significance of each individual project (Broadshore Project, Sinclair Project and Scaraben Project), the assessment criteria presented in **Section 17.7.1.1** will also be used for the whole project assessments.

1337. The individual project assessments, as noted in **Section 17.1,** will be presented in a standalone report appended to the Broadshore Hub WFDAs EIA Report. These individual project assessments will be updated with the subsequent submissions of the Broadshore Hub OfTDAs EIA Report and the Broadshore Hub OnTDAs EIA Report. Although the assessments presented in each EIA Report will remain valid, this iterative approach allows for up to date information to be incorporated within each submission. The overall GHG impacts of each individual project will therefore be confirmed in the EIA Report for the final Development Area consent application submitted and will include the emission footprints of all infrastructure of each project's Development Areas.

17.7.2 Climate Change Resilience Assessment

1338. A four-step methodology will be adopted for the CCR assessment based on IEMA's 'Environmental Impact Assessment Guide to: Climate Change Resilience & Adaptation' (2020) and the European Commission's 'Technical Guidance on the Climate Proofing of Infrastructure in the Period 2021 – 2027' (2021). The initial stages of the assessment will involve a screening exercise of climate hazards which the Broadshore Hub WFDAs may be vulnerable to and are likely to result in climate change impacts. If deemed necessary, a detailed risk assessment will be undertaken on impacts which are material to the Broadshore Hub WFDAs to evaluate likely significant effects with respect to climate change resilience.

1339. For the purpose of the CCR assessment, the following key terms will be adopted, which are defined as follows:

- Climate variable: a measurable, monitorable aspect of the weather or climate such as temperature or wind speed.
- Climate hazard: a weather or climate-related event or trend in climate variable, such as storms or heat waves, which has potential to do harm to receptors.
- Climate change impact: an impact from a climate hazard, such as asset damage or failure, which affects the ability of the receptor to maintain its functions or purpose.

1340. As noted in **Section 17.4.1.2**, the operational lifetime is assumed to be 25 to 50 years for the Sinclair WFDA and Scaraben WFDA and between 25 and 50 years for the Broadshore WFDA. The duration of the construction and decommissioning phases for the Sinclair WFDA and Scaraben WFDA are likely to be slightly shorter than the duration for the Broadshore WFDA. To account for differences in future baseline conditions and the severity of climate change impacts, which depend on the timing and duration of each project's temporal scope, separate CCR assessments will be undertaken for the Broadshore WFDA and the Sinclair WFDA and Scaraben WFDA where relevant. Any future repowering of the Broadshore Project will be subject to additional consents and licences.

1341. It is anticipated that the potential for likely significant effects from climate change impacts would be highest over the Broadshore Hub WFDAs' operational lifetime, given its duration and alignment with longer-term climate change. Therefore, the focus of the CCR assessment will be on the operation and maintenance phase. Given the short duration of the construction and decommissioning phases and low potential for likely significant effects, a high-level CCR assessment will be undertaken only. An overview of the step-by-step approach is provided below:

17.7.2.1 Step 1: Identifying Receptors, Climate Variables and Hazards

1342. Key climate hazards relevant to the study area for the CCR Assessment and the receptors which they affect will be identified based on the design information and a review of the current and future climate baseline and other available literature sources. In addition, climate variables used to quantify or contextualise the hazards will also be selected.

17.7.2.2 Step 2: Climate Vulnerability Assessment

1343. Vulnerability is defined as the degree of response to a change in the environment and the capacity to accommodate or recover from change, and is considered to be a function of sensitivity and exposure. Climate change impacts only arise when receptors are vulnerable to climate hazards. A vulnerability assessment will be undertaken whereby only hazards categorised as medium or high vulnerability will be taken forward in the CCR assessment. Hazards with low vulnerability will be screened out, and a non-significant effect will be concluded.

17.7.2.3 Step 3: Climate Risk Assessment

1344. The magnitude of the climate change impact, or the climate risk, will then be evaluated based on its likelihood and consequence. For climate risks identified as medium, high or extreme, additional mitigation measures will be proposed proportionate to the degree of risk, and the residual risk will be reassessed.

17.7.2.4 Step 4: Resilience Rating

1345. The effect significance of the CCR assessment will be determined using a matrix-based approach by considering the residual risk identified in Step 3 and a resilience rating based on the Broadshore Hub WFDAs' preparedness and adaptive capacity to the climate change impact. The higher the resilience rating, the higher the Broadshore Hub WFDAs' capability to tolerate and manage the residual climate risk.

17.9 Scoping Questions to Consultees

1346. The following questions are posed to consultees to help frame and focus their response to the climate change scoping exercise, which will in turn inform the Scoping Opinion:

- Do you agree with the study area definitions and the approach to characterising the existing environment?
- Do you agree that all relevant data sources have been identified in this Broadshore Hub WFDAs Scoping Report?
- Do you agree that all receptors and potential impacts have been identified in this Broadshore Hub WFDAs Scoping Report?
- Do you agree with the GHG emission sources that have been scoped into/out from the Broadshore Hub WFDAs EIA Report?
- Do you agree with the climate hazards and resulting climate change impacts that have been scoped into/out from the Broadshore Hub WFDAs EIA Report?
- Do you agree with the proposed methodology for the WFDAs GHG assessment, including the iterative approach to the whole project assessments?
- Do you agree with the proposed iterative approach for GHG, which includes a stand-alone report appended to the EIA Reports in which the GHG assessments will be presented for the Broadshore Project, Sinclair Project and Scaraben Project individually (see **Section 17.1**)? Please note that this does not include the Broadshore Hub (i.e. Broadshore Project, Sinclair Project and Scaraben Project combined).
- Do you agree with the proposed methodology for the Broadshore Hub WFDAs CCR assessment?
- Do you have any other matters or information sources that you wish to present?

17.10 References

BEIS (2016). Offshore Energy SEA 4: Appendix 1f Climate & Meteorology. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1061602/Appendix_1f_-_Climate___Meteorology.pdf

BEIS (2017). The Clean Growth Strategy: Leading the way to a low carbon future. Available at: https://assets.publishing.service.gov.uk/media/5ad5f11ded915d32a3a70c03/clean-growth-strategy-correction-april-2018.pdf

BEIS (2019). Industrial Strategy: Offshore Wind Sector Deal. Available at: Offshore wind Sector Deal - GOV.UK (www.gov.uk)BEIS, (2021). Net Zero Strategy: Build Back Greener. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1033990/net-zero-strategy-beis.pdf

BEIS (2022). British Energy Security Strategy. Available at: https://www.gov.uk/government/publications/british-energy-security-strategy/british-energy-security-strategy

British Standards Institution (2023). PAS 2080: 2023 Carbon management in buildings and infrastructure.

C40 Cities (2018). Climate Change Risk Assessment Guidance. Available at: https://www.c40knowledgehub.org/s/article/Climate-Change-Risk-Assessment-Guidance?language=en_US

CCC (2013). Reducing the UK's carbon footprint. Available at: http://www.theccc.org.uk/wp-content/uploads/2013/04/Reducing-carbon-footprint-report.pdf

CCC (2020). The Sixth Carbon Budget: The UKs path to Net Zero. 1st ed [pdf] London: Climate Change Committee, p. 228. Available at: https://www.theccc.org.uk/publication/sixth-carbon-budget/?msclkid=553aaa35ae7511ec8e7fcfabb0201b38

Defra (2022). UK Climate Change Risk Assessment 2022.

Defra (2023). The Third National Adaptation Programme and the Fourth Strategy for Climate Adaptation Reporting.

DESNZ (2023). Greenhouse gas reporting: conversion factors 2023. Available at: https://www.gov.uk/government/collections/government-conversion-factors-for-company-reporting

DESNZ (2023). Green Book supplementary guidance: valuation of energy use and greenhouse gas emissions for appraisal. Available at: https://www.gov.uk/government/publications/valuation-of-energy-use-and-greenhouse-gas-emissions-for-appraisal

DESNZ (2023). Digest of United Kingdom Energy Statistics, 2023. Available at: https://www.gov.uk/government/statistics/digest-of-uk-energy-statistics-dukes-2023

DESNZ (2023). UK territorial greenhouse gas emissions national statistics. Available at: https://www.gov.uk/government/collections/uk-territorial-greenhouse-gas-emissions-national-statistics

Dolan, S. L., Heath, G. A. (2012). Life Cycle Greenhouse Gas Emissions of Utility-Scale Wind Power.

European Commission, (2021). Commission Notice – Technical guidance on the climate proofing of infrastructure in the period 2021 – 2027. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52021XC0916(03)&from=ENGloMEEP (2018). Port Emissions Toolkit: Guide No.1 Assessment of Port Emissions.

IEMA (2020). Environmental Impact Assessment Guide to Climate Change Resilience and Adaptation.

IEMA (2022). Institute of Environmental Management & Assessment (IEMA) Guide: Assessing Greenhouse Gas Emissions and Evaluating their Significance.

IPCC (2021). Working Group I Contribution to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change: The Physical Science Basis.

IStructE (2022). How to Calculate Embodied Carbon, 2nd Edition. [Online]. Available at: https://www.istructe.org/resources/guidance/how-to-calculate-embodied-carbon/.

Jones, C., Hammond, G. (2019). Circular Economy and University of Bath ICE (Inventory of Carbon and Energy) Database, Version 3. Available at: https://drive.google.com/drive/folders/1vHpIGkpgkplmItn_0IaPXQ-5Fxnr08Wz?usp=sharing .

The Met Office (2016a). Eastern Scotland: climate. Available at: https://www.metoffice.gov.uk/binaries/content/assets/metofficegovuk/pdf/weather/learn-about/uk-past-events/regional-climates/eastern-scotland_-climate---met-office.pdf

The Met Office (2016b). UK regional climates. Available at: https://www.metoffice.gov.uk/research/climate/maps-and-data/regional-climates/index.

The Met Office (2018). UKCP18 Interface. Available at: https://ukclimateprojections-ui.metoffice.gov.uk/ui/home.

The Met Office (2023). UK climate averages. Available at: https://www.metoffice.gov.uk/research/climate/maps-and-data/uk-climate-averages.

RenewableUK (2022). Wind Energy Statistics Explained. [Online] Available at: https://www.renewableuk.com/page/UKWEDExplained

RICS (2023). Whole Life Carbon Assessment Standard for the Built Environment, 2nd edition. [Online]. Available at: https://www.rics.org/profession-standards/rics-standards-and-guidance/sector-standards/construction-standards/whole-life-carbon-assessment.

Scottish Government (2013). Climate Ready Scotland: Scottish Climate Change Adaptation Programme. Available at: www.gov.scot/binaries/content/documents/govscot/publications/strategy-plan/2019/09/climate-ready-scotland-second-scottish-climate-change-adaptation-programme-2019-2024/documents/climate-ready-scotland-second-scottish-climate-change-adaptation-programme-2019-2024/climate-ready-scotland-second-scottish-climate-change-adaptation-programme-2019-2024/govscot%3Adocument/climate-ready-scotland-second-scottish-climate-change-adaptation-programme-2019-2024.pdf

Scottish Government (2020). Sectoral marine plan for offshore wind energy. Available at: https://www.gov.scot/publications/sectoral-marine-plan-offshore-wind-energy/documents

Scottish Government (2021). Blue Carbon, SPICe Briefing SB21-19. Available at: https://sp-bpr-en-prod-cdnep.azureedge.net/published/2021/3/23/e8e93b3e-08b5-4209-8160-0b146bafec9d/SB%2021-19.pdf

Scottish Government (2022). Reducing greenhouse gas emissions: Annual targets. Available at https://www.gov.scot/policies/climate-change/reducing-emissions/

Scottish Government (2023a). Scottish Greenhouse Gas Statistics. Available at: https://www.gov.scot/publications/scottish-greenhouse-gas-statistics-2021/#:~:text=Between%201990%20and%202021%2C%20there,e%20%3B%2077.6%20per%20cent%20reduction.

Scottish Government (2023b). Scottish Energy Statistics Hub. Available at: https://scotland.shinyapps.io/sg-scottish-energy-statistics/

Thomson, R. C., Harrison, G. P. (2015). Life Cycle Costs and Carbon Emissions of Offshore Wind Power.

Weisenfeld, N., Dix, B., Fried, M., Moran, G., Phillips, C., Whiting, M. (2021). NYSERDA: Offshore Wind Climate Adaptation and Resilience Study.

World Resource Institute and World Business Council for Sustainable Development (2015). A Corporate Accounting and Reporting Standard, Revised Edition.

18 Offshore Air Quality

18.1 Introduction

1347. This chapter considers the scope of potential impacts of the construction, operation and maintenance, and decommissioning phases of the Broadshore Hub Wind Farm Development Areas (WFDAs) on offshore air quality.

1348. This chapter provides an overview of the existing environment and further sets out the methodology and approach to assessing effects on offshore air quality in the Broadshore Hub WFDAs Environmental Impact Assessment (EIA) Report. This chapter has been prepared by Royal HaskoningDHV.

1349. This chapter should be read in conjunction with the following chapters of the Broadshore Hub WFDAs Scoping Report:

- **Chapter 17: Climate Change;** and
- **Chapter 19: Major Accidents and Disasters.**

1350. The air quality assessment is likely to have key inter-relationships with the above receptors, which will be considered appropriately where relevant in the Broadshore Hub WFDAs EIA Report.

18.2 Legislation, Policy and Guidance

1351. **Table 18.1** sets out the legislation, policy and guidance which have been considered in the preparation of this chapter. The overarching policy and legislation relevant to the Broadshore Hub WFDAs is described in **Chapter 2: Policy and Legislative Context**.

Table 18.1: Summary of Relevant Legislation, Policy and Guidance for Offshore Air Quality

Relevant Legislation, Policy or Guidance	Relevance to the Assessment
Legislation	
National Emission Ceilings Directive (NECD), revised 2016 (NECD 2016/2284/EU) (Official Journal of the European Union, 2016).	European Union legislation which delegates emission reduction commitments for nitrogen oxides NO_x, sulphur dioxide SO_2, non-methane volatile organic compounds (NMVOC), ammonia (NH_3), PM_{10} and $PM_{2.5}$ for 2020 and 2030.
Climate Change (Emissions Reductions Targets) (Scotland) Act 2019.	Scottish legislation which sets a target for net zero emissions by 2045.
Annex VI of the International Convention for the Prevention of Pollution from Ships (MARPOL).	Regulations from the International Maritime Organisation (IMO) to reduce vessel emissions.
Merchant Shipping (Prevention of Air Pollution from Ships) Regulations 2008.	The regulations transpose the IMO international air pollution standards into United Kingdom law.
Policy	
Cleaner Air for Scotland 2. Towards to a Better Place for Everyone (Scottish Government, 2021).	Scottish legislation sets out how the Scottish Government proposes to reduce air pollution to protect human health between 2021 and 2026.
Guidance	
Air Quality Monitoring in the Vicinity of Demolition and Construction Sites (Institute of Air Quality Management) (2018).	Guidance on implementing effective air quality monitoring systems in construction zones.

18.3 Consultation

1352. At this stage, no consultation relating to offshore air quality has been undertaken for the Broadshore Hub WFDAs. Consultation on this chapter will be undertaken by Marine Directorate - Licensing Operations Team (MD-LOT) to inform the Scoping Opinion.

18.4 Existing Environment

1353. The primary source of offshore atmospheric emissions is likely to be from vessels emitting nitrogen oxides (NOx), particulate matter (PM) and sulphur dioxide (SO_2).

1354. The International Maritime Organisation (IMO) has enacted regulations to reduce vessel emissions under Annex VI of the International Convention for the Prevention of Pollution from Ships (MARPOL). The North Sea is a designated Emission Control Area under MARPOL, with sulphur content of fuel oil being limited to 0.5 %. Furthermore, as of 1st January 2021, vessels operating within the North Sea must comply with the most stringent NOx emission limits to comply with the Emission Control Area requirements.

1355. Pollutant concentrations should only be compared to the relevant air quality objectives where there is representative exposure. There are no offshore human receptors which are sensitive to air quality, and marine-based ecological designations are unlikely to be sensitive to air pollution impacts (Centre for Ecology and Hydrology, 2023). Receptors may only be affected where there are isolated locations of relevant human exposure (e.g., residences) close to the shoreline, and land-based designated ecological sites.

18.5 Potential Impacts

1356. Impacts on offshore air quality could potentially occur during construction, operation and maintenance and decommissioning, due to vessel movements associated with the Broadshore Hub WFDAs. The combustion of fuel used to power vessels may result in atmospheric emissions of pollutants such as SO_2, carbon dioxide CO_2, NOx which are comprised of NO_2 and NO, PM_{10}, and $PM_{2.5}$.

18.5.1 Embedded Mitigation Measures

1357. The Applicants will ensure compliance with relevant national and international maritime air quality standards and legislation, including the MARPOL Annex VI Regulations.

1358. The Applicants will also ensure development of, and adherence to, an Environmental Management Plan (EMP).

18.6 Scoping of Potential Impacts

1359. Vessels utilised during construction, operation and maintenance, and decommissioning of the Broadshore Hub WFDAs may contribute to emissions offshore; however, in the context of the existing vessel traffic within the North Sea, the Broadshore Hub WFDAs' contributions would be small. Because the Broadshore Hub WFDAs are located approximately 47 km north of Fraserburgh, off the Aberdeenshire coast in Scotland, most construction and operation and maintenance works would be carried out at a distance from the shore and therefore would be unlikely to impact upon landside human or ecological receptors.

1360. As there would be a relatively low number of vessels utilised for works associated with the Broadshore Hub WFDAs, the considerable distances to sensitive receptors and the MARPOL emissions regulations that will be applied, it is considered that effects would not be significant. As such, it is proposed to scope offshore air quality impacts out of the Broadshore Hub WFDAs EIA Report. This is in line with other recent scoping opinions such as for Caledonia Offshore Wind Farm (Marine Scotland Licensing Operations Team; MS-LOT, 2023) and for the Green Volt Offshore Windfarm (MS-LOT, 2022).

18.6.1 Potential Cumulative Effects

1361. As described above, most offshore works will be undertaken at a significant distance from any sensitive receptors. As such, it is considered unlikely that any significant cumulative effects would occur with other offshore emission sources (i.e., vessels) used for any other plans or projects within the area.

18.6.2 Potential Transboundary Effects

1362. It is unlikely that exhaust emissions from vessels/helicopters associated with the Broadshore Hub WFDAs operating within the North Sea would give rise to any significant transboundary effects to surrounding European Economic Area member states. It is therefore proposed that all transboundary offshore air quality effects should be scoped out of the Broadshore Hub WFDAs EIA Report.

18.6.3 Summary of Potential Air Quality Impacts Scoped In or Out

1363. **Table 18.2** outlines the offshore air quality impacts which are proposed to be scoped out of the Broadshore Hub WFDAs EIA Report.

Table 18.2 Summary of Potential Impacts Scoped In (✓) or Scoped Out (x) for Offshore Air Quality

Potential impact	Receptor(s)	Description of Potential Effect	Scoped In or Scoped Out? (✓ or x)			Embedded Mitigation Measures
			Construction	Operation and Maintenance	Decommissioning	
Impacts of emissions from vessels	Human receptors	No pathway of effect	X	X	X	None required as all impacts scoped out, however, the Applicants commit to implementing a Vessel Management Plan and ensuring compliance with relevant national and international maritime air quality standards, as detailed in **Section 18.5.1**.
Impacts of emissions from vessels	Ecological receptors	No pathway of effect	X	X	X	

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18.7 Proposed Approach to Impact Assessment

1364. As offshore air quality is proposed to be scoped out from further assessment in the Broadshore Hub WFDAs EIA Report, no proposed approach to EIA is presented.

18.8 Scoping Questions to Consultees

1365. The following questions are posed to consultees to help them frame and focus their response to the offshore air quality scoping exercise, which will in turn inform the Scoping Opinion:

- Do you agree with the characterisation of the existing environment?
- Have all the offshore air quality impacts resulting from the Broadshore Hub WFDAs been identified in the Scoping Report?
- Do you agree that all offshore air quality impacts should be scoped out of the Broadshore Hub WFDAs EIA Report?
- Do you have any other matters that you wish to present?

18.9 References

IMO (2023). Special Areas under MARPOL. Available at: https://www.imo.org/en/OurWork/Environment/Pages/Special-Areas-Marpol.aspx

MS-LOT (2023). Caledonia Offshore Wind Farm – Scoping Opinion. Available at: https://www.marine.gov.scot/node/23386

MS-LOT (2023). Green Volt Offshore Wind Farm – Scoping Opinion. Available at: https://marine.gov.scot/sites/default/files/scoping_opinion_9.pdf

Scottish Government (2021). Cleaner Air for Scotland 2 - Towards a Better Place for Everyone. Available at: https://www.gov.scot/binaries/content/documents/govscot/publications/strategy-plan/2021/07/cleaner-air-scotland-2-towards-better-place-everyone/documents/cleaner-air-scotland-2-towards-better-place-everyone/cleaner-air-scotland-2-towards-better-place-everyone/govscot%3Adocument/cleaner-air-scotland-2-towards-better-place-everyone.pdf

UK Centre for Ecology and Hydrology (UKCEH) (2023). Air Pollution Information System. Available at: https://www.apis.ac.uk/

19 Major Accidents and Disasters

19.1 Introduction

1366. This chapter considers the scope of potential impacts on the environment deriving from the vulnerability of the Broadshore Hub Wind Farm Development Areas (WFDAs) to risks of relevant major accidents and disasters throughout the construction, operation and maintenance, and decommissioning phases of the Broadshore Hub WFDAs.

1367. This chapter sets out the proposed methodology and approach to be taken to assessing these potential impacts within the Broadshore Hub WFDAs Environmental Impact Assessment (EIA) Report. This chapter has been prepared by Royal HaskoningDHV.

1368. This major accidents and disasters chapter should be read in conjunction with the following chapters in the Broadshore Hub WFDAs Scoping Report:

- **Chapter 5: Marine Geology, Oceanography and Physical Processes;**
- **Chapter 6: Benthic Ecology;**
- **Chapter 7: Fish and Shellfish Ecology;**
- **Chapter 8: Marine Mammals;**
- **Chapter 9: Offshore Ornithology;**
- **Chapter 10: Commercial Fisheries;**
- **Chapter 11: Shipping and Navigation;**
- **Chapter 12: Aviation and Radar;**
- **Chapter 13: Marine Infrastructure and Other Users;**
- **Chapter 16: Socioeconomics, Tourism and Recreation;**
- **Chapter 17: Climate Change;** and
- **Chapter 18: Offshore Air Quality.**

1369. This major accidents and disasters chapter is likely to have key inter-relationships with the above receptors, which will be considered appropriately where relevant in the Broadshore Hub WFDAs EIA Report.

1370. The Broadshore Hub WFDAs EIA Report will include an assessment of the likelihood of the occurrence (risk) of major accidents and disasters and the vulnerability of the environment as a consequence of any such occurrence and will reference the appropriate chapters of the Broadshore Hub WFDAs EIA Report where appropriate. Consequently, this chapter does not follow the same approach as the other chapters in this Broadshore Hub WFDAs Scoping Report.

19.2 Legislation, Policy and Guidance

1371. The Marine Works (Environmental Impact Assessment) Regulations 2007 require significant risks to the receiving communities and environment, for example through major accidents and disasters, to be considered. Similarly, significant effects arising from the vulnerability of the Broadshore Hub WFDAs to major accidents and disasters should be considered.

1372. The following definitions are relevant to this chapter of the Broadshore Hub WFDAs Scoping Report (Institute of Environmental Management and Assessment (IEMA), 2020):

- 'Major accidents' are defined as 'events that threaten immediate or delayed serious environmental effects to human health, welfare and the environment and require the use of resources beyond those of the client or its appointed representatives to manage. Whilst malicious intent is not accidental, the outcome (e.g. train derailment) may be the same and therefore many mitigation measures will apply to both deliberate and accidental events.' (IEMA, 2020).
- A 'disaster' is a sudden accident or natural catastrophe that causes great damage or loss of life. These can be natural or can be man-made hazards (e.g. caused by accidental loss of containment) or external hazards (e.g. act of terrorism) which result in consequences for people or the environment.
- For a 'risk' to arise there must be a hazard that consists of a 'source' (e.g. high rainfall); a 'receptor' (e.g. people, property, environment); and a pathway between the source and the receptor (e.g. flood routes).
- 'Vulnerability' describes the potential for harm as a result of an event, for example due to sensitivity or value of receptors. In the context of the EIA Directive, the term refers to the 'exposure and resilience' of the development to the risk of a major accident and disaster. Vulnerability is influenced by sensitivity, adaptive capacity and magnitude of impact.
- A 'receptor' refers to the specific component of the environment that could be adversely affected if the source reaches it. Environmental receptor is specifically defined as: features of the environment that are subject to assessment under Part 1 of the Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017, namely 'population, human health, biodiversity (for example, fauna and flora), land (for example, land take), soil (for example, organic matter, erosion, compaction, sealing), water (for example, hydromorphological changes, quantity and quality), air, climate (for example, greenhouse gas emissions, impacts relevant to adaptation), material assets, cultural heritage, including architectural and archaeological aspects, and landscape.' For the purposes of this assessment the receptors relevant to the Broadshore Hub WFDAs have been grouped into the following: population and human health, designated sites (International, National and Other), scarce habitats, widespread habitat, particular species, and the marine environment.
- 'Serious danger to human health' relates to the people present in the potentially affected areas, either permanently or for prolonged periods of time. This excludes workers operating at the facility.
- 'Serious damage to human populations' is harm which would be considered substantial e.g., deaths, multiple serious injuries or a substantial number requiring medical attention.

- 'Serious damage to the environment' is loss or significant detrimental impact on populations of species or organisms, harm or loss of valued sites (including designated sites), valued cultural heritage sites, contamination of drinking water supplies, ground or groundwater, or permanent or long-lasting harm to environmental receptors that cannot be restored through minor clean-up or restoration efforts.
- 'As Low As Reasonably Practicable' (ALARP) is used in assessment of major accidents and disasters and involves 'weighing a risk against the trouble, time and money needed to control it' noting that 'ALARP describes the level to which risks can be expected to be controlled'.

1373. **Table 19.1** sets out the legislation, policy and guidance which have been considered in the preparation of this chapter, and will be considered within the Broadshore Hub WFDAs EIA Report where appropriate. The overarching policy and legislation relevant to the Broadshore Hub WFDAs is described in **Chapter 2: Policy and Legislative Context**.

Table 19.1: Summary of Relevant Legislation, Policy and Guidance for Major Accidents and Disasters

Relevant Legislation, Policy or Guidance	Relevance to the Assessment
Legislation	
Health and Safety at Work Act 1974	The Act defines the general duties of employers and employees for maintaining health and safety within most workplaces. It requires workplaces to provide adequate training of staff, adequate welfare provisions, a safe working environment and provision of relevant information and supervision.
The Management of Health and Safety at Work Regulations 1999	The Regulations outline what employers must do to manage health and safety and apply this to work activities. The main duty of the employer is to produce risk assessments.
Construction (Design and Management) Regulations 2015	The Regulations outline the actions required for the health, safety and welfare of construction projects to prevent injury and ill health, applying to all building and construction work.
Offshore Installations (Offshore Safety Directive) (Safety Case etc.) Regulations 2015	The Regulations apply to oil and gas operations in external waters and aims to reduce risks from major accident hazards and the health and safety of the workforce.
The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017	The Regulation requires consideration of major accidents and disasters within EIA.
Policy	
The Civil Contingencies Act 2004 and the Civil Contingencies Act 2004 (Contingency Planning) (Scotland) Regulations 2005	The Civil Contingencies Act 2004 establishes a framework for civil protection, setting out roles and responsibilities on organisations who play a role in preparing for and responding to emergencies.

Relevant Legislation, Policy or Guidance	Relevance to the Assessment
Guidance	
The International Organisation of Standardisation (ISO) 31000: 2009. Risk Management – principles and guidelines	This provides principles and guidelines on risk management and can be applied to a range of activities and any type of risk.
IEMA, 2020. Major Accidents and Disasters in EIA: A Primer	This Primer aims to increase awareness of major accidents and disasters within EIA and its application, offering an assessment methodology.
Guidelines for Environmental Risk Assessment and Management Green Leaves III, 2011, Prepared by Defra and the Collaborative Centre of Excellence in 'Understanding and Managing Natural and Environmental Risks, Cranfield University'	This provides guidelines for the assessment and management of environmental risks.
Health and Safety Executive, 2015. Control of Major Accident Hazards (COMAH) Regulations[46]	These regulations aim to prevent and mitigate the effects of major accidents involving dangerous substances which can cause serious harm to people and/or the environment.
Offshore Major Accident Regulator (OMAR) Memorandum of Understanding between The Offshore Petroleum Regulator for Environment and Decommissioning (OPRED) and The Health and Safety Executive	This aims to promote high levels of protection from major accidents for people and the environment.

19.3 Consultation

1374. Consultation undertaken to date for the Broadshore Hub WFDAs relevant to major accidents and disasters is provided in **Table 13.2** below.

Table 19.2: Consultation Relevant to Major Accidents and Disasters

Consultee	Date/Document	Comment	How comment is Addressed
MD-LOT	13th September 2023, Scoping Workshop (email post-workshop 6th October 2023)	The approach to EIA proposed at the Scoping Workshop seems sensible for major accidents and disasters, however the Scottish Ministers' final comments will come via the scoping opinion once MD-LOT has consulted with relevant stakeholders.	Noted.

[46] The COMAH regulations apply to onshore facilities but provide applicable definitions to this major accidents and disasters chapter.

1375. It is proposed that engagement with key technical stakeholders will be progressed in the form of a series of meetings during the EIA process, up to the point of submission of the s.36 and Marine Licence applications for the Broadshore Hub WFDAs. Risks will be identified using the National Risk Register, professional judgement, and a review of available literature. In relation to shipping and navigation (please refer to **Chapter 11: Shipping and Navigation** for further details), a Hazard Workshop will be held to enable discussion with stakeholders, including:

- Maritime and Coastguard Agency (MCA);
- Northern Lighthouse Board (NLB);
- UK Chamber of Shipping;
- Royal Yachting Association Scotland;
- Cruising Association;
- Scottish Fishermen's Federation;
- Local ports and harbours;
- Regular commercial operators (identified from the vessel traffic survey data); and
- Local marinas and yacht clubs.

19.4 Methodology

19.4.1 Study Area

1376. The major accidents and disasters study area for individual hazards will be determined in relation to the impact pathways, the distances to the receptors or from examination of the scale of impacts from examples of historic incidents where available. The geographic scope may reach beyond the Broadshore Hub WFDAs Scoping Boundary where there is potential for interaction. Professional judgement has informed the scope relating to the hazards with the potential for interaction with the Broadshore Hub WFDAs. The Broadshore Hub WFDAs Scoping Boundary is provided in **Figure 1.1** of **Appendix 1** of the Broadshore Hub WFDAs Scoping Report.

1377. The temporal scope relates to the lifespan of the Broadshore Hub WFDAs, through construction, operation and maintenance, and decommissioning, up to between 25 and 50 years[47].

19.4.2 Potential Receptors

1378. The proposed potential receptors relevant to this scoping exercise and the assessment to be undertaken in the Broadshore Hub WFDAs EIA Report are provided with definitions in **Table 19.3**.

[47] The Broadshore WFDA seabed lease is up to 60 years, and the Sinclair WFDA and Scaraben WFDA seabed leases are both up to 25 years. The Broadshore, Sinclair and Scaraben WFDAs' operational life is between 25 and 50 years. At the end of the operational life, any repowering will be subject to separate consents.

The level of harm considered to represent a major accident or disaster is also presented. The thresholds have been determined using industry best practice based upon:

- Criteria for notification of a major accident to the European Commission under Article 18(1) of Seveso III Directive and Regulation 26 of the COMAH Regulations 2015 (cited in IEMA, 2020); and
- Department of the Environment, Transport and the Regions (DETR) (1999).

19.4.3 Data and Information Sources

1379. Information and parameters regarding the design, infrastructure, approach and methods for construction, operation and maintenance and decommissioning of the Broadshore Hub WFDAs will be required to undertake an assessment of major accidents and disasters. This will be developed as the project design is refined and the EIA process progresses. Additionally, there will be a reliance of data collated for the chapters identified in **Section 19.1** to inform the assessment for this chapter in the Broadshore Hub WFDAs EIA Report.

1380. The major accidents and disasters assessment in the Broadshore Hub WFDAs EIA Report will be informed by further acquisition of spatial data as well as through further consultations with industry groups, governing bodies, interest groups and local communities.

1381. It is not considered that there is any additional baseline information required to inform the assessment of major accidents and disasters.

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Table 19.3: Receptors Requiring Consideration for Major Accidents and Disasters for the Broadshore Hub WFDAs EIA Report

Receptor Group	Receptors Included	Major Accident or Disaster Threshold
Population and human health	Construction workers, operations and maintenance workers, and other sea users.	For the public and other sea users: • Substantial number (five or more) of people requiring medical attention or any serious/life-changing injuries. Events of this magnitude may also involve some damage to housing, with low numbers of people being displaced. Potential for localised interruption to utilities and damage to infrastructure. For workers: • Multiple life changing injuries or fatalities.
Designated Sites (International, National and Other)	Special Areas of Conservation (SACs), Special Protection Areas (SPAs), Ramsar Sites, Sites of Special Scientific Interest (SSSIs), Marine Conservation Zones (MCZs), Marine Protected Areas (MPAs).	For SSSIs the thresholds are: • Greater than 0.5 ha adversely affected, or greater than 10% of the area of the site affected (whichever is the lesser), or • Greater than 10% of an associated linear feature adversely affected, or • Greater than 10% of a particular habitat or population of individual species adversely affected. For SACs, SPAs, MPAs and Ramsar sites, the thresholds are: • Greater than 0.5 ha or 5% of the area of the site adversely affected (whichever is the lesser), or greater than 5% of an associated linear feature adversely affected, or • Greater than 5% of a particular habitat or population of individual species adversely affected.
Particular species	Particular species covers all species, both flora and fauna, found in the UK and includes common species, red data book species and other protected or priority species, including rare species.	For common species, where reliable estimates of population numbers exist, the death of, or serious sub-lethal effects within, 1% of any species would be significant. For common plant species, the death of, or serious sub-lethal effects within, 5% of the ground cover would be considered a major accident. For species listed in the Habitats Directive annexes, the Annexes of the Birds Directive, the Schedules of the Wildlife and Countryside Act 1981 (and amendments), all Red Data Book species and priority species under the UK Biodiversity Action Plan, the threshold may be

Receptor Group	Receptors Included	Major Accident or Disaster Threshold
		lower than 1% or 5%, and liaison with the appropriate statutory conservation organisation should be used to determine the appropriate threshold. Moreover, for all species, where reliable estimates of population numbers do not exist, liaison with the statutory authority will be necessary to determine appropriate thresholds. Any loss of a Red Data Book species (or a Red Data Book species site).
Marine environment	Non-estuarine marine waters, sub-littoral zones, benthic community adjacent to the coast and fish spawning grounds.	Permanent or long-term damage to: • An area of two ha or more of the littoral or sub-littoral zone, or the coastal benthic community, or the benthic community of any fish spawning ground, or • An area of 100 ha or more of the open sea benthic community. Or a count of: • 100 or more dead sea birds (excluding gulls), or • 500 dead sea birds of any species, or • Five dead or significantly injured/impaired sea mammals of any species.
Designated Sites (International, National and Other)	Special Areas of Conservation (SACs), Special Protection Areas (SPAs), Ramsar Sites, Sites of Special Scientific Interest (SSSIs), Marine Conservation Zones (MCZs), Marine Protected Areas (MPAs).	For SSSIs the thresholds are: • Greater than 0.5 ha adversely affected, or greater than 10% of the area of the site affected (whichever is the lesser), or • Greater than 10% of an associated linear feature adversely affected, or • Greater than 10% of a particular habitat or population of individual species adversely affected. For SACs, SPAs, MPAs and Ramsar sites, the thresholds are: • Greater than 0.5 ha or 5% of the area of the site adversely affected (whichever is the lesser), or greater than 5% of an associated linear feature adversely affected, or • Greater than 5% of a particular habitat or population of individual species adversely affected.

19.5 Existing Environment

1382. The existing environment has been characterised in the chapters of this Broadshore Hub WFDAs Scoping Report listed in **Section 19.1**.

1383. The receiving environment for major accidents and disasters will vary depending on the type and scale of the event in question. The scope of the major accidents and disasters chapter is determined by the nature of the potential major accidents and disasters which could be associated with the Broadshore Hub WFDAs.

1384. The future baseline for the Broadshore Hub WFDAs relevant to major accidents and disasters will evolve relating to several likely factors over the lifecycle of the Broadshore Hub WFDAs. Climate change is likely to lead to changes in sea state (e.g. storms and waves), increased occurrences of extreme weather, and rising sea levels. Predictions for changes in climate until the end of the 21st century are available from The UK Climate Projections (UKCP, 2021). The impacts of climate change are set out in more detail in **Chapter 17: Climate Change**.

1385. There are likely to be advances in technology over the lifecycle of the Broadshore Hub WFDAs, with potential for further reductions in risks to safety and the environment, or to introduce new hazards with the introduction of novel technology. Novel technologies would be implemented following appropriate risk assessment processes.

1386. In terms of shipping and navigation risks, a Navigational Risk Assessment will be undertaken as part of the EIA process and is discussed further in **Chapter 11: Shipping and Navigation**.

19.5.1 Embedded Mitigation Measures

1387. The Applicants will prepare and adhere to a series of management plans throughout the life span of the Broadshore Hub WFDAs, which form part of the embedded mitigation to manage risk. These will be developed in consultation with stakeholders and will include:

- Environmental Management Plan (EMP);
- Emergency Response and Cooperation Plan (ERCoP);
- Cable Plan (CaP);
- Construction Method Statement (CMS);
- Marine Pollution Contingency Plan (MPCP);
- Vessel Management Plan (VMP);
- Navigational Safety Plan (NSP);
- Lighting and Marking Plan (LMP);
- Development Specification and Layout Plan (DSLP); and
- Decommissioning Programme.

1388. Embedded mitigation with relevance for major accidents and disasters, as detailed within **Chapters 5 – 19**, are proposed below:

- A detailed Cable Burial Risk Assessment (CBRA) will be prepared where IACs are proposed to be buried to determine the target burial depth. The burial depths may vary and will be dependant on risk and ground conditions. The CBRA will also highlight instances where adequate burial cannot be achieved and alternative protection is needed;
- Compliance with the International Convention for the Prevention of Pollution from Ships (MARPOL) 73/78;
- Adherence to the International Convention for the Control and Management of Ships' Ballast Water and Sediments (BWM Convention, 2004);
- Advance warning and accurate location details of construction, maintenance and decommissioning operations, associated Safety Zones and advisory passing distances will be given via Notices to Mariners and Kingfisher Bulletins;
- Application for and use of Safety Zones during construction, major repairs and decommissioning phases;
- Any objects dropped on the seabed during works associated with the Broadshore Hub WFDAs which may pose a hazard will be reported in line with MD-LOT procedures;
- Development of Unexploded Ordnance (UXO) Threat and Risk Assessment and preferred use of low noise UXO clearance techniques where possible and use of UXO mitigation hierarchy;
- Development of a Navigational Risk Assessment;
- All offshore infrastructure associated with the Broadshore Hub WFDAs will be appropriately marked on UKHO Admiralty charts;
- Where appropriate, guard vessels will be used to ensure adherence with Safety Zones or advisory passing distances;
- The Applicants will ensure compliance with Marine Guidance Note 654 and its annexes, where applicable, including completion post consent of Search and Rescue (SAR) Checklist in consultation with the Maritime and Coastguard Agency (MCA).
- The Applicants will ensure compliance with the Regulatory Expectations on Moorings for Floating Wind and Marine Devices (MCA and HSE, 2017);
- Lights, marks, sounds, signals, and other aids to navigation will be exhibited as required by NLB, MCA, and Civil Aviation Authority (CAA) including the buoyed construction/ decommissioning areas;
- Marine coordination will be implemented to manage project vessels throughout construction, maintenance, and decommissioning periods;
- A minimum blade tip clearance of at least 22 m Above Mean Sea Level (AMSL);
- Broadshore Hub WFDAs vessels will ensure compliance with international marine regulations as adopted by the Flag State, including the COLREGs (IMO, 1972/77) and SOLAS (IMO, 1974);

- Appropriate marking of the Broadshore Hub WFDAs on aeronautical charts. This will include provision of the positions and heights of structures to CAA, Ministry of Defence (MoD), and Defence Geographics Centre;
- Aviation lighting and marking, as described in the Lighting and Marking Plan (LMP), will be installed in accordance with Article 223 of the UK ANO 2016 which sets out the mandatory requirements to be followed for lighting of offshore wind turbine generators (WTGs);
- The layout of the WTGs in the Broadshore Hub WFDAs, will be finalised in discussion with the MCA and NLB in order to ensure the specific WTG layout is compatible with potential search and rescue (SAR) activity; and
- Failures of the lighting and marking in the Broadshore Hub WFDAs will be appropriately reported and rectified as soon as practicable. Interim hazard warnings will be put in place as required.

19.6 Potential Impacts

1389. Some of the potential risk types which will be considered within the Broadshore Hub WFDAs EIA Report include:

- Fire;
- Extreme temperature (heat wave, cold snaps)/high winds/storm;
- Electromagnetic Fields (EMF);
- Extreme weather events;
- Electricity failure;
- Exposure to High Voltage;
- Industrial Accidents;
- Natural disasters (such as earthquakes);
- Structure collapse/design error;
- Vessel collision or allision;
- Helicopter collision;
- Exposed cables leading to vessel snagging;
- Vessel snagging with floating substructures and station keeping systems;
- Disturbance of Unexploded Ordnance (UXO) within Broadshore Hub WFDAs;
- WTG breaking free during tow or from moorings; and
- Workplace accident.

1390. It should be noted that effects from accidental releases of pollution are proposed to be scoped out of the Broadshore Hub WFDAs EIA Report for all phases (see **Chapter 5: Marine Geology, Oceanography and Physical Processes**) due to implementation of mitigation measures to reduce risk of this as far as practicable.

19.7 Proposed Approach to Impact Assessment

1391. Within the major accidents and disasters chapter of the Broadshore Hub WFDAs EIA Report, the overall impact assessment for the Broadshore Hub WFDAs will be presented first. Following this, a summary of each WFDA will be given (Broadshore WFDA, Sinclair WFDA, Scaraben WFDA).

1392. Whilst there is no standard methodology for the assessment of major accidents and disasters within Broadshore Hub WFDAs EIA Report, IEMA have prepared 'Major Accidents and Disasters in EIA: A Primer' (IEMA, 2020) which provides guidance on a risk-based approach. The Broadshore Hub WFDAs EIA Report will assess the likelihood of the significant threat or hazard occurring, and the mitigation embedded to ensure a risk is ALARP (or avoided completely). The risks will be identified in respect of the potential vulnerability of the projects to disaster risks, and the potential of the Broadshore Hub WFDAs to cause major accidents and disasters.

1393. Where required, additional mitigation measures will be proposed to manage the identified risks to the environment.

1394. The following steps will be undertaken during the risk assessment:

- **Step 1:** Identify hazards in a long list of possible major accidents and events. Major accidents with little relevance to the Broadshore Hub WFDAs will not be included (e.g., volcanic eruptions). Sources will include the UK Government National Risk Register – 2020 edition and further relevant sources. This step will also involve identification of the receptors in the existing environment.
- **Step 2:** Screening exercise to determine which risks are relevant to the Broadshore Hub WFDAs and require further assessment.
- **Step 3:** Risk evaluation - definition of the potential impacts that may occur from the risks and classification of the likelihood that the events may occur. Identification and evaluation of prevention, minimisation and mitigation measures.
- **Step 4:** Determination of whether the risk has been mitigated ALARP and the identification of any residual risk, and the consequences upon the receptors in the event of a major accident or disaster.

1395. Where a pathway or linkage is established, an assessment will be carried out to determine whether embedded design measures or legal requirements, codes and standards adequately control the potential major accidents and disasters. Reference will be made to other technical chapters of the Broadshore Hub WFDAs EIA Report as appropriate where further studies have been carried out.

1396. The scope of the major accidents and disasters chapter of the Broadshore Hub WFDAs EIA Report will be determined by the nature of the potential major accidents which could be associated with the Broadshore Hub WFDAs, having regard to the potential impacts associated with relevant environmental disciplines in this Broadshore Hub WFDAs Scoping Report as set out in **Section 19.1**.

1397. The potential for significant adverse effects of the Broadshore Hub WFDAs on the environment deriving from its vulnerability to risks of relevant major accidents and disasters will be assessed in line with requirements set out under the EIA Directive.

19.8 Scoping Questions to Consultees

1398. The following questions are posed to consultees to help them frame and focus their response to the major accidents and disasters scoping exercise, which will in turn inform the Scoping Opinion:

- Are you satisfied with the scope proposed for the major accidents and disasters chapter of the Broadshore Hub WFDAs EIA Report?
- Is there any additional guidance and policy that the Applicants should have regard to in the preparation of the major accidents and disasters chapter of the Broadshore Hub WFDAs EIA Report?
- Are there any other potential risk or impacts you believe could result in significant effects which you wish to see assessed in the major accidents and disasters chapter of the Broadshore Hub WFDAs EIA Report?
- Do you have any other matters or information sources that you wish to present?

19.9 References

Defra (2011). Guidelines for Environmental Risk Assessment and Management. Green Leaves III. Available at: https://assets.publishing.service.gov.uk/media/5a79d20540f0b66d161ae5f9/pb13670-green-leaves-iii-1111071.pdf

Health and Safety Executive (2015). Construction (Design and Management) Regulations 2015. Available at: https://www.hse.gov.uk/construction/cdm/2015/index.htm

Health and Safety Executive (2015). Control Of Major Accident Hazards Regulations 2015 (COMAH). Available at: https://www.hse.gov.uk/comah/background/comah15.htm#:~:text=Resources%20Wales%20websites.-,The%20main%20aim%20of%20COMAH,seriously%20as%20those%20to%20people.

Health and Safety Executive (2015). Offshore Installations (Offshore Safety Directive) (Safety Case etc.) Regulations 2015. Available at: https://www.hse.gov.uk/pubns/books/l154.htm

Health and Safety Executive (1974). Health and Safety at Work etc. Act 1974. Available at: https://www.hse.gov.uk/legislation/hswa.htm

IEMA (2020). IEMA Major Accidents and Disasters in EIA Guide. Available at: https://www.iema.net/resources/blog/2020/09/23/iema-major-accidents-and-disasters-in-eia-primer

ISO (2009). ISO 31000:2009. Risk management — Principles and guidelines. Available at: https://www.iso.org/standard/43170.html.

20 Summary and Next Steps

1399. This Broadshore Hub WFDAs Scoping Report accompanies a request for a formal Scoping Opinion from the Marine Directorate - Licensing Operations Team (MD-LOT), acting on behalf of the Scottish Ministers, in relation to the WFDAs for the Broadshore, Sinclair and Scaraben Projects (collectively the Broadshore Hub WFDAs). The purpose of this Broadshore Hub WFDAs Scoping Report is to provide stakeholders with sufficient information on the activities and infrastructure that will be associated with the Broadshore Hub WFDAs and allow for engagement with stakeholders on the key issues to be addressed in the Broadshore Hub WFDAs Environmental Impact Assessment (EIA) Report, as well as the baseline data sources and assessment methodologies to be used**.**

1400. Within this Broadshore Hub WFDAs Scoping Report, potential environmental impacts have been considered. A summary of the technical chapters and potential impacts that are proposed to be scoped in and out of the Broadshore Hub WFDAs EIA Report are outlined in **Table 20.1** below. Impacts are proposed to be scoped out of the Broadshore Hub WFDAs EIA Report where there are no likely significant effects in EIA terms or no effect-receptor pathways have been identified.

1401. Environmental mitigation measures included in this Broadshore Hub WFDAs Scoping Report are set out in **Appendix 3: Mitigation Register.** Environmental mitigation measures will also be recorded in the Broadshore Hub WFDAs EIA Report and in an updated Mitigation Register to enable them to be secured (where required) and implemented.

1402. The Applicants invite Consultees to consider the information provided in this Broadshore Hub WFDAs Scoping Report and the supporting **Broadshore Hub WFDAs Habitats Regulations Appraisal Screening Report**, and provide comments on the proposed approach and, in particular, whether they agree with the conclusions drawn. Responses to this Broadshore Hub WFDAs Scoping Report submitted to MD-LOT from statutory and non-statutory consultees are expected to inform the Scoping Opinion. The Broadshore Hub WFDAs EIA Report produced by the Applicants will be based on the Scoping Opinion received.

1403. The Broadshore Hub WFDAs Scoping Report is available on the Broadshore Hub projects' website.

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Table 20.1: Summary of Potential Impacts Scoped In (✓) or Scoped Out (x) of EIA Report During Construction (C), Operation and Maintenance (O & M) and Decommissioning (D)

Technical Chapter	Potential Impacts	C	O & M	D
Chapter 5 **Marine Geology, Oceanography and Physical Processes**	Impacts on suspended sediment concentrations and transport	✓	✓	✓
	Impacts on chemical contaminant concentrations associated with increases in suspended sediment	✓	✓	✓
	Impacts on tidal currents and waves	x	✓	x
	Impacts on bedload sediment transport and seabed morphological change	✓	✓	✓
	Indentations on seabed morphology due to installation and decommissioning vessels	x	x	x
	Impacts on water column stratification influencing nutrient fluxes and primary production	x	x	x
Chapter 6 **Benthic Ecology**	Physical disturbance and temporary habitat loss of seabed habitat	✓	✓	✓
	Permanent habitat loss	x	✓	✓
	Increased suspended sediment concentrations and sediment re-deposition	✓	✓	✓
	Remobilisation of existing contaminated sediment (to be scoped out if site-specific sediment samples reveal low contaminant levels)	✓	✓	✓
	Introduction of Invasive Non-Native Species (INNS) from marine traffic	x	x	x
	Underwater noise and vibration	x	x	x
	Electromagnetic Field (EMF)	x	✓	x
	Colonisation of introduced substrate	x	✓	✓
	Potential impacts on designated sites	x	x	x

Technical Chapter	Potential Impacts	C	O & M	D
	Accidental release of pollutants	x	x	x
Chapter 7 **Fish and Shellfish Ecology**	Physical disturbance and temporary loss of habitat	✓	✓	✓
	Permanent habitat loss[48]	x	✓	x
	Increased Suspended Sediments Concentrations (SSC) and sediment re-deposition	✓	✓	✓
	Remobilisation of existing contaminated sediments (to be scoped out if site-specific sediment samples reveal low contaminant levels)	✓	✓	✓
	Underwater noise and vibration	✓	✓	✓
	EMF	x	✓	x
	Secondary entanglement with floating substructures	x	✓	x
	Introduction of hard substrate[49]	x	✓	x
	Changes in fishing activity	✓	✓	✓
	Vessel collision for basking shark	✓	✓	✓
	Accidental release of pollutants	x	x	x
	Introduction of INNS from marine traffic	x	x	x

[48] It is acknowledged that the impacts of permanent habitat loss and introduction of hard substrate begin in construction and continue through decommissioning – to avoid duplicating assessments the full extent of these impacts will assessed in the operation and maintenance section, with a clear acknowledgement that they span the duration of the Broadshore Hub WFDAs lifetime.

[49] It is acknowledged that the impacts of permanent habitat loss and introduction of hard substrate begin in construction and continue through decommissioning – to avoid duplicating assessments the full extent of these impacts will assessed in the operation and maintenance section to, with a clear acknowledgement that they span the duration of the Broadshore Hub WFDAs lifetime.

Technical Chapter	Potential Impacts	C	O & M	D
Chapter 8 **Marine Mammals**	Underwater noise during UXO clearance	✓	x	x
	Underwater noise during geophysical surveys	✓	✓	x
	Underwater noise during piling	✓	x	x
	Underwater noise during other substructure installation activities (other than impact piling)	✓	x	x
	Underwater noise from other activities (for example rock placement and IAC laying)	✓	✓	✓
	Underwater noise and presence of vessels	✓	✓	✓
	Underwater noise from operational WTGs and floating turbine substructure moorings on the seabed	x	✓	x
	Direct entanglement	x	x	x
	Secondary entanglement	x	✓	x
	Collision risk with vessels	✓	✓	✓
	Disturbance at seal haul-out sites	✓	✓	✓
	EMF – direct effects on marine mammals	x	✓	x
	Changes in water quality	x	x	x
	Changes to prey availability	✓	✓	✓

Technical Chapter	Potential Impacts	C	O & M	D
Chapter 9 **Offshore Ornithology**	Temporary disturbance and disturbance	✓	✓	✓
	Indirect impacts	✓	✓	✓
	Indirect impacts from unexploded ordnance (UXO) clearance	✓	x	x
	Disturbance and displacement from the physical presence of wind turbine generators and associated maintenance activities	x	✓	x
	Barrier to movement	x	✓	x
	Collision with wind turbine generators	x	✓	x
	Entanglement with subsea infrastructure, specifically debris that may become attached to the mooring lines of floating substructures	x	✓	x
Chapter 10 **Commercial Fisheries**	Reduction in access to, or exclusion from established fishing grounds	✓	✓	✓
	Displacement leading to gear conflict and increased fishing pressure on adjacent grounds	✓	✓	✓
	Disturbance of commercially important fish and shellfish resources leading to displacement or disruption of fishing activity	✓	✓	✓
	Increased vessel traffic associated with the Broadshore Hub WFDAs within fishing grounds leading to interference with fishing activity	✓	✓	✓
	Additional steaming to alternative fishing grounds for vessels that would otherwise fish within the Broadshore Hub WFDAs;	x	x	x
	Physical presence of infrastructure and potential exposure of that infrastructure leading to gear snagging	✓	✓	✓
Chapter 11	Increased vessel to vessel collision risk (third party to third party)	✓	✓	✓
	Increased vessel to vessel collision risk (third party to project vessel)	✓	✓	✓

Technical Chapter	Potential Impacts	C	O & M	D
Shipping and Navigation	Creation of vessel to structure allision risk	x	✓	x
	Reduced access to local ports and harbours	✓	✓	✓
	Loss of station	x	✓	x
	Reduction in under-keel clearance	x	✓	x
	Anchor interaction with station keeping systems (SKS) or inter-array cables (IACs)	x	✓	x
	Interference with navigation, communications, and position-fixing equipment	x	✓	x
	Reduction of Search and Rescue (SAR) capability	x	✓	x
Chapter 12 Aviation and Radar	Creation of an aviation obstacle environment	✓	✓	✓
	Increased air traffic in the area related to the Broadshore Hub WFDAs' activities	✓	✓	✓
	Effects on civil and military Primary Surveillance Radar (PSR) systems	✓	✓	x
	Effects on civil and military Secondary Surveillance Radar (SSR) systems	x	x	x
	Effects on weather radars	x	x	x
Chapter 13 Marine Infrastructure and Other Users	Impacts on other offshore wind farms	✓	✓	✓
	Impacts on offshore oil and gas operations	✓	✓	✓
	Impacts on Carbon Capture and Storage (CCS) sites	✓	✓	✓
	Impacts on subsea cables (utilities)	x	x	x

<table>
<tr><th>Technical Chapter</th><th colspan="2">Potential Impacts</th><th>C</th><th>O & M</th><th>D</th></tr>
<tr><td rowspan="3"></td><td colspan="2">Impacts on dredging and disposal sites</td><td>x</td><td>x</td><td>x</td></tr>
<tr><td colspan="2">Impacts on marine aggregate sites</td><td>x</td><td>x</td><td>x</td></tr>
<tr><td colspan="2">Impacts on Ministry of Defence (MoD) maritime navigational interests</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td rowspan="3">Chapter 14
Marine Archaeology and Cultural Heritage</td><td colspan="2">Direct impacts to heritage assets</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td colspan="2">Indirect impacts to heritage assets associated with changes to marine physical processes</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td colspan="2">Change to the setting of heritage assets.</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td rowspan="8">Chapter 15
Seascape and Landscape Visual Impact Assessment (SLVIA)</td><td rowspan="4">Presence of offshore construction activity, including vessel movements, cranes and lighting in the seascape</td><td>Potential change in offshore character</td><td>x</td><td>x</td><td>x</td></tr>
<tr><td>Potential change in character of coastal or onshore landscape</td><td>x</td><td>x</td><td>x</td></tr>
<tr><td>Change in view experienced by people in the offshore environment</td><td>x</td><td>x</td><td>x</td></tr>
<tr><td>Change in view experienced by people on or near the coast, or further inland</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td rowspan="4">Presence of the floating offshore wind turbines (and offshore substation(s)) in the seascape</td><td>Potential change in offshore character</td><td>x</td><td>x</td><td>x</td></tr>
<tr><td>Potential change in character of coastal or onshore landscape</td><td>x</td><td>x</td><td>x</td></tr>
<tr><td>Change in view experienced by people in the offshore environment</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>Change in view experienced by people on or near the coast, or further inland</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>Chapter 16</td><td colspan="2">Increase in employment and Gross Added Value (GVA)</td><td>✓</td><td>✓</td><td>✓</td></tr>
</table>

Technical Chapter	Potential Impacts		C	O & M	D
Socioeconomics, Tourism and Recreation	Demographic changes		✓	✓	✓
	Changes to housing demand		✓	✓	✓
	Changes to other local public and private services		✓	✓	✓
	Socio-cultural effects		x	x	x
	Changes to commercial fisheries		✓	✓	✓
	Changes to shipping		✓	✓	✓
	Changes to marine recreation		✓	✓	✓
	Changes to coastal tourism and recreation		✓	✓	✓
Chapter 17 **Climate Change**	Greenhouse Gas (GHG) Assessment	Whole lifecycle GHG impacts	✓	✓	✓
	Climate Change Risk Assessment	Vulnerability and resilience to climate change impacts	✓	✓	✓
Chapter 18 **Offshore Air Quality**	Impacts of emissions from vessels		x	x	x
	Impacts of emissions from vessels		x	x	x
Marine Protected Areas Screening (Appendix 2)	Underwater noise during UXO clearance		✓	x	x
	Underwater noise during substructure installation		✓	x	x
	Underwater noise from other activities (for example rock placement and cable laying)		✓	✓	✓
	Underwater noise and presence of vessels		✓	✓	✓

Technical Chapter	Potential Impacts	C	O & M	D
	Underwater noise from operational wind turbines	x	✓	x
	Collision risk with vessels	✓	✓	✓
	Direct entanglement	x	x	x
	Secondary entanglement	x	✓	x
	Changes in water quality	x	x	x
	Changes to prey availability (including from habitat loss and EMF)	✓	✓	✓
	EMF - direct effects	x	x	x
	EMF to impact on marine mammal prey species	x	✓	x