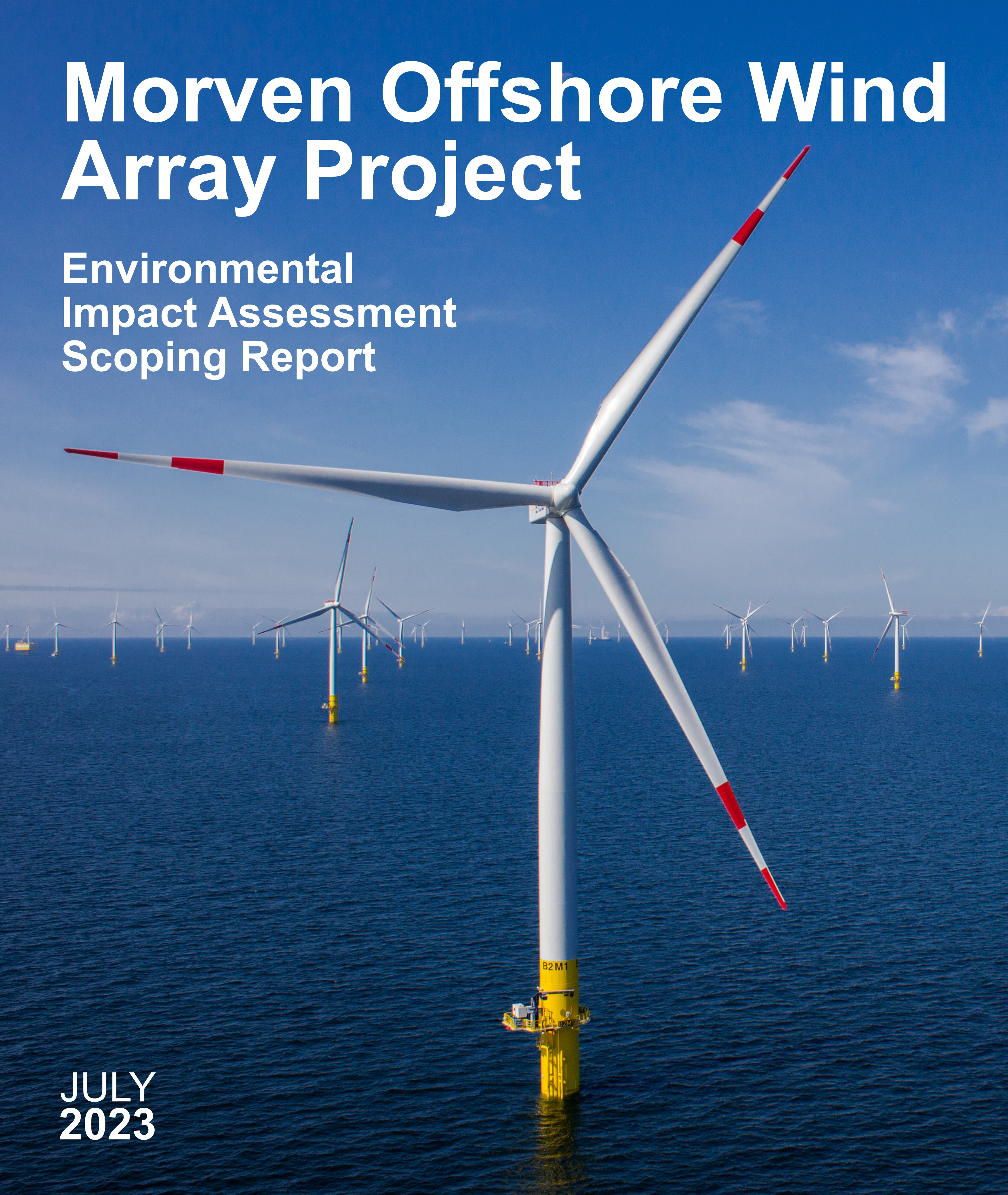
Morven Offshore Wind Array Project

Environmental Impact Assessment Scoping Report



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A TETRA TECH COMPANY

Partners in UK offshore wind

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Executive Summary

1.1.1.1 BP Alternative Energy Investments (bp), together with German partner Energie Baden-Württemberg AG (EnBW) has been awarded a seabed option, under the 2021/22 ScotWind leasing round. The bp/EnBW collaboration is jointly developing the Morven Offshore Wind Project (hereafter 'the Project'); an offshore wind farm within Plan Option (PO) area E1 identified in the Scottish Government's Sectoral Marine Plan for Offshore Wind (the SMP) (Scottish Government, 2020).

1.1.1.2 The Project is a proposed large-scale fixed-foundation offshore wind farm (OWF) located approximately 60km from the Aberdeenshire coast. bp/EnBW are working to secure the necessary consents, licences and permissions to build and operate the Project through Morven Offshore Wind Limited (hereafter, 'the Applicant').

1.1.1.3 The United Kingdom (UK) and Scottish Government's ambitions for offshore wind deployment are supported by the Offshore Transmission Network Review (OTNR). The Holistic Network Design (HND), brought up under the OTNR's 'Pathway to 2030' workstream, recommends a network design for the connection of offshore generation assets (for a total capacity of 23 gigawatt (GW)) to the network. HND-Phase 1 was published in July 2022.

1.1.1.4 As a result of the HND process and in order to progress the Project, the Applicant will seek to consent the Project's generation and transmission aspects separately. The Morven Offshore Wind Array Project (hereafter, the 'Array Project') will seek consent for the Array Project Assets; i.e. the Project's wind turbines, Offshore Substation Platforms (OSPs) and the respective required foundations, inter-array and inter-connector cables and associated infrastructure. The area within which the Array Project will be located is referred to as the 'Array Project Scoping Boundary' (hereafter, the 'Scoping Boundary'). Consents will be sought separately for the Project's offshore and onshore transmission aspects by the 'Morven Offshore Wind Transmission Project' (hereafter, the 'Transmission Project').

1.1.1.5 Environmental Impact Assessments (EIA) are being progressed for both aspects to understand the likely significant environmental effects of the respective proposals, supported by environmental and survey information. This Scoping Report has been produced with respect to the Array Project. This Array Project Scoping Report is, hereafter, referred to as the Scoping Report.

1.1.1.6 The components of the Array Project (hereafter, 'Array Project Assets') will include:

- up to 191 wind turbines and associated support structures and foundations;
- up to 844km of inter-array cables and up to 751km of inter-connector cables;
- up to 11 Offshore Substation Platforms (OSPs) and associated support structures and foundations.

1.1.1.7 The following consents are required for the Array Project:

- marine licences under the Marine and Coastal Access Act 2009 (separate licences will be sought for the generating assets and the OSPs);
- a Section 36 consent under the Electricity Act 1989.

1.1.1.8 The Array Project will be considered under the appropriate EIA Regulations, which differ slightly depending on the consent being sought:

- for the marine licences under the Marine and Coastal Access Act 2009, The Marine Works (Environmental Impact Assessment) Regulations 2007;
- for the Section 36 consent application, The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017.

1.1.1.9 The Array Project is subject to the EIA Regulations. As part of the EIA process, this Scoping Report, whilst not mandatory, has been undertaken to support a request for a formal Scoping Opinion on the Array Project from Scottish Minsters, via the Marine Directorate Licensing Operations Team (MD-LOT). The objective of this Scoping Report is to provide all stakeholders with sufficient information on the proposals specific to the Array Project, to enable meaningful engagement within the pre-application consultation process.

1.1.1.10 This Scoping Report describes; the characteristics of the Array Project, the environmental and social factors likely to be affected by the proposals, the topics to be addressed in the EIA, as well as baseline data sources and assessment methodologies used to inform the assessments. Potential likely significant effects on environmental and social receptors are identified within this Scoping Report and impacts that are proposed to be scoped out of the EIA process are also identified, e.g. on the basis no likely significant effects or receptor pathways were identified. The following topics have been considered:

- Offshore physical environment:
  - physical processes;
  - underwater sound;
  - offshore water quality.
- Offshore biological environment:
  - benthic subtidal ecology;
  - fish and shellfish ecology;
  - marine mammals;
  - offshore ornithology.
- Offshore human environment:
  - commercial fisheries;
  - shipping and navigation;
  - aviation (military and civil);
  - marine archaeology;
  - other sea users, marine infrastructure and communications;
  - socio-economics;
  - seascape, landcape and visual impact and onshore historic environment;
  - climate change;
  - major accidents and disasters;
  - human health.

1.1.1.11 The Applicant requests a formal opinion on the key impacts identified, the data sources used, the methodology proposed through the consultation process and the topic specific questions presented within Appendix 3: Morven Array Project Scoping Workshop of this Scoping Report.

1.1.1.12 The Applicant would also welcome feedback on Appendix 4: Array Project Stakeholder Engagement Plans of this Scoping Report, which provides an overview of the proposed approach for future consultation with statutory and non-statutory stakeholders throughout the EIA and Habitats Regulations Appraisal (HRA) process. Appendix 4: Array Project Stakeholder Engagement Plans of this Scoping Report will aid the Applicant in delivering a proportionate EIA and Report to Inform an Appropriate Assessment (RIAA). The reports will incorporate advice from stakeholders throughout the development process to address concerns and develop appropriate mitigation and compensation measures, where required.

Glossary

Term	Meaning
Allision	The act or process of a moving object striking a stationary object.
Amphipods	An order of malacostracan crustaceans with no carapace and generally with laterally compressed bodies.
Annelida	An invertebrate belonging to the phylum annelid. Also known as the ringed worms or segmented worms, they are a large phylum, that include ragworms, earthworms, and leeches.
Anthropogenic	Something that is human made.
Applicant (the)	Morven Offshore Wind Limited; the entity making the consent applications.
Application (the)	The information to support the Applicant's request for the consents for the Morven Offshore Wind Array Project.
Array Project	Refers to the wind turbines, Offshore Substation Platforms, associated foundations, inter-array cables, inter-connector cables and associated infrastructure.
Array Project Assets	The Project's wind turbines, Offshore Substation Platforms, associated foundations, inter-array cables, inter-connector cables and associated infrastructure.
Array Project Environmental Impact Assessment (EIA) Report (hereafter, "EIA Report")	Document prepared to provide information on: the baseline environment; project description for the Array Project; a systematic assessment of the Array Project's likely significant environmental effects; measures to avoid, prevent, reduce or offset likely significant adverse environmental effects; a description of the reasonable alternatives studied by the Applicant, and a non-technical summary.
Array Project Environmental Impact Assessment (EIA) Scoping Opinion (hereafter, "Scoping Opinion")	Scoping Opinion identifies the scope of impacts to be addressed and the method of assessment to be used in the Environmental Impact Assessment Report ("EIA Report") for the Proposed Development.
Array Project Scoping Boundary (hereafter, "Scoping Boundary")	The Scoping Report red line boundary within which the Array Project Assets will be located.
Arthropod	A member of the phylum Arthropoda, the largest phylum in the animal kingdom, which includes lobsters, crabs, spiders, mites, insects, centipedes, millipedes and the like.
Attenuation	Gradual loss of acoustic energy.
Automatic Identification System (AIS)	A system by which vessels automatically broadcast their identity, key statistics including location, destination, length, speed and current status. Most commercial vessels and European Union (EU) fishing vessels over 15m length overall (LOA) are required to carry AIS.
Aviation archaeology	This comprises all military and civilian aircraft crash sites and related wreckage.
Bathymetry	The measurement of water depth in oceans, seas and lakes.

Term	Meaning
Benthic subtidal ecology	Encompasses the study of the organisms living in and on the sea floor, the interactions between them and impacts on the surrounding environment.
Berwick Bank Offshore Wind Farm (OWF)	The wind farm which is to be located within the Agreement for Lease area for Berwick Bank Wind Farm (formerly Seagreen 2 Offshore Wind Farm) and the Agreement for Lease area for Marr Bank (formerly Seagreen 3 Offshore Wind Farm) - together now referred to as Berwick Bank Wind Farm.
Bivalve	A large class of molluscs, also known as pelecypods. They have a hard calcareous shell made of two parts or 'valves'.
bp/EnBW	BP Alternative Energy Investments (bp), together with German partner Energie Baden-Württemberg AG as the energy companies that have partnered to develop the Morven Offshore Wind Project via the Applicant.
Bryozoan	Filter-feeding, aquatic invertebrate that mostly live in sedentary colonies.
Cable protection	Measures to protect cables from physical damage including but not limited to cable protection systems, bend restrictors/stiffeners, concrete mattresses, with or without frond devices, and/or rock placement, the use of bagged solutions filled with grout or other materials.
Cable protection system	A specific type of cable protection to protect the cable from damage coming from the foundation going into the ground.
Cetacean	Aquatic mammals constituting the infraorder Cetacea (whales, dolphins, porpoises).
CfD auctions	The UK Government’s main mechanism for supporting low-carbon electricity generation.
Circalittoral	The region from the lower limit of the infralittoral zone to the maximum depth at which photosynthesis is still possible.
Climate Emergency	A situation where urgent action is necessary to decrease or stop climate change and any environmental damage stemming from it.
Cnidarian	An invertebrate belonging to the phylum Cnidaria which includes the likes of corals, hydras, jellyfish, Portuguese men-of-war, sea anemones, sea pens, sea whips and sea fans.
CO_2e	Carbon dioxide equivalent. The standard measurement of greenhouse gas (GHG) emissions. The amount of CO_2 needed to produce the same amount of warming that other GHGs create.
Collision	The act or process of one moving object striking another moving object.
Conceptual overlap	Potential for an impact to affect receptors, directly or indirectly.
Continuous sound	As defined in the National Physical Laboratory (NPL) 2014 guidelines (NPL, 2014), continuous sounds are sounds where the acoustic energy is spread over a significant time, typically many seconds, minutes or even hours. The amplitude of the sound may vary throughout the duration, but the amplitude does not fall to zero for any significant time. The sound may contain broadband noise and tonal (narrowband) noise at specific frequencies. Examples of continuous sound include ship noise, operational

Term	Meaning
	noise from machinery including marine renewable energy devices, and noise from drilling.
COVID-19 pandemic	The COVID-19 pandemic is a global outbreak of coronavirus, an infectious disease caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) virus.
Crossing and/or Proximity Agreement	A formal arrangement that establishes the responsibilities and obligations of entities with assets which cross and/or are proximate and allows operations to be managed safely.
Cumulative effects	The effect of the Morven Offshore Wind Array Project assessed together with effects from one or more different projects and plans on the same receptor/resource.
Data confidence	Premise that any project or plans with a low level of detail available will be screened out of the cumulative effects assessment.
Decibel (dB)	Expression of the ratio of one value of a power quantity to another (reference value) on a logarithmic scale. The reference value should be stated.
Decidecade	One tenth of a decade. A decade is a logarithmic frequency interval whose upper bound is ten times larger than its lower bound. Also referred to as one-third octave.
Demersal fish species	Fish that live near or on the seabed. Includes species such as haddock, cod, whiting and flatfish.
Designed in measures	For the purposes of the EIA process and in line with Institute of Environmental Management and Assessment (IEMA) (2016) guidance, designed in measures include Primary and Tertiary measures which refer to measures developed as part of the Project design, or measures implemented to comply with standard industry practices, or those required by law.
Diadromous fish species	Fish species that migrate between fresh water and the marine environment, such as salmonids.
Echinoderm	An invertebrate animal belonging to the phylum Echinodermata that includes sea stars, brittle stars, feather stars, sea urchins and sea cucumbers.
Effect	Term used to express the consequence of an impact. The significance of an effect is determined by correlating the magnitude of the impact with the importance, or sensitivity, of the receptor or resource in accordance with defined significance criteria.
EIA Regulations	Collectively the term used in this Scoping Report to refer to The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017 and the Marine Works (Environmental Impact Assessment) Regulations 2007 (in each case as amended).
Elasmobranchs fish species	Elasmobranchs like sharks, rays and skates have a skeleton composed entirely of cartilage.
Emissions Reductions Targets	Goals set by the UK Government to decrease CO_2 emissions.
Ensonified	Filled with sound.

Term	Meaning
Environmental Impact Assessment	Assessment of the potential likely significant effects of the proposed Array Project on the physical, biological, and human environment during construction, Operations and Maintenance (O&M) and decommissioning.
Epifauna	Animals living on the surface of the seabed or attached to submerged objects, animals or plants.
EU Exit	the withdrawal of the United Kingdom (UK) from the European Union (EU)
European site	A Special Area of Conservation, (SAC), or candidate SAC (cSAC), a Special Protection Area (SPA), a site listed as a Site of Community Importance (SCI), a Ramsar site or, as per Scottish Planning Policy (SPP), a possible SAC (pSAC) or potential SPA (pSPA).
Exclusive Economic Zone	An area up to 200 nautical miles from the coast over which a sovereign state has rights regarding marine resources.
Food Standards Scotland	A non-ministerial government department of the Scottish Government with responsibility for food safety, food standards, nutrition, food labelling and meat inspection in Scotland.
Formal Safety Assessment	A structured and systematic process for assessing the risks and costs (if applicable) associated with shipping activity.
Forth and Tay Region	Most southerly Scottish Marine Region on the east coast of Scotland, extending north from the border with England to Montrose.
Gazetteer	A geographical index or dictionary.
Geoacoustic	Relating to the acoustic properties of the seabed.
Geophonic sound	Naturally generated, non-biological sound.
Gravel	Sediment classification of grain sizes between 2mm and 64mm.
Group of Seven (G7)	Organisation to discuss global matters comprised of Finance Ministers and Central Bank Governors of Canada, France, Germany, Italy, Japan, the UK and US.
Habitat	The environment in which a plant or animal lives.
Habitats Directive	Council Directive 92/43/EEC on the Conservation of natural habitats and of wild fauna and flora (the Habitats Directive) is the European Union Directive from which the requirement for the consideration of potential impacts of the Array Project upon European sites and sites designated within the National Site Network is derived.
Habitats Regulations	A term that refers to the collective legislation that translates the Habitats Directive into specific legal obligations in Scotland. namely: the Conservation (Natural Habitats, &c.) Regulations 1994; the Conservation of Habitats and Species Regulations 2017; and the Conservation of Offshore Marine Habitats and Species Regulations 2017 (in each case as amended).
Heritage assets	Assets that have value due to their historical, artistic, cultural, scientific, and environmental characteristics.
High Voltage Alternating Current (HVAC) collector substation	High voltage alternating current collector substation

Term	Meaning
High Voltage Direct Current (HVDC) converter substation	High voltage direct current converter substation
Holistic Network Design (HND)	A network design process being undertaken by National Grid Electricity System Operator (ESO) that aims to provide a more centralised, strategic approach to network planning to support large-scale delivery of electricity generated from offshore wind in Great Britain. Compared to the connection of offshore wind farms individually, the recommended network design seeks to reduce seabed impacts (from cables), costs (through efficiencies) and emissions to the environment.
Holocene	Current geological epoch, beginning approximately 11,650 years ago.
Homogenous	A substance with a uniform composition throughout.
Hydrodynamic variables	Physical processes of water movement, for example, ocean currents.
Impact	A change caused by an action that occurs during a project's lifetime.
Important Ecological Feature (IEF)	Ecological features including habitats, species and other environmental aspects that require further consideration within the Environmental Impact Assessment process
Impulsive sound	Sound which is typically transient and brief, with rapid rise time and rapid decay.
Infauna	Animals that live within the seabed sediments.
Infralittoral	A region of shallow water within the sublittoral zone, dominated by erect algae, such as kelp, attached to upward facing rock.
Inch Cape Offshore Windfarm (OWF)	The Inch Cape Offshore Wind Farm comprising 72 turbines that will be located 15km off the Angus Coast and connect to the national grid at Cockenzie, East Lothian
Inter-array cables	Cables which link the wind turbines to each other and the Offshore substation platforms (OSPs).
Inter-connector cables	Cables which will connect the Offshore substation platforms (OSPs) to other OSPs to provide redundancy against cable failure elsewhere.
Intertidal area	The area between Mean High Water Springs and Mean Low Water Springs.
Kyoto Protocol	International treaty adopted in 2008 addressing the problem of climate change and reducing anthropogenic CO_2 emissions.
Lee slope	A gentle slope that becomes lower as you move away from the peak.
Lowest Astronomical Tide	The lowest level that can be expected to occur under average meteorological conditions and under any combination of astronomical conditions.
Macrofauna	Animals that are visible to the naked eye between 0.5mm and 50mm.
Magnitude	A combination of the spatial extent, duration, frequency and reversibility of an impact.

Term	Meaning
Marine (Scotland) Act 2010	Legislation that sets a framework to manage the competing demands made on marine resources within Scottish seas.
Marine Directorate	The Marine Directorate of the Scottish Government, formerly known as Marine Scotland. The planning and licensing authority for Scotland’s seas and custodian of Scotland’s National Marine Plan.
Marine Directorate Licensing Operations Team (MD-LOT)	The part of the Scottish Government’s Marine Directorate responsible for assessing and administering applications for marine licences and Section 36 consent (offshore) in Scotland.
Marine Licence	A marine licence permits the undertaking of different activities in the marine environment, including construction, the deposition or removal of substances or objects, and dredging. The Marine and Coastal Access Act 2009 requires a marine licence to be obtained for licensable marine activities within the Scottish offshore region (12nm – 200nm). The Marine (Scotland) Act 2010 requires marine licences for licensable activities taking place within Scottish Territorial Waters (MHWS to 12nm).
Marine Guidance Note (MGN)	A system of guidance notes issued by the 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	Relates generally to underwater cultural heritage and particularly to craft or vessels and any of their associated structures and/or cargo.
Maximum Design Scenario (MDS)	The scenario within the design envelope likely to result in the greatest impact on a particular topic receptor and, therefore, the one that should be assessed for that topic receptor.
Mean High Water Springs (MHWS)	The average tidal height throughout the year of two successive high waters during those periods of 24 hours when the range of the tide is at its greatest.
Mean tidal range	Difference in height between average high tide and average low tide.
Megafauna	The largest body size class of organisms, 50mm and above.
Megaripple	Undulations (0.5 to 25m λ) produced by the movement of waves and currents over sediments.
Mesozoic	Geological era taking place between 252 to 66 million years ago.
Mitigation	Mitigation measures to eliminate, reduce or control adverse effects of the Project that are embedded within the assessment at the relevant point in the Environmental Impact Assessment (e.g. at Scoping).
Modified Folk Classification	A modified version of the commonly used Folk sediment classification system, which is based on the ratio between sand, mud and gravel. The modified version simplifies the classifications and aligns with the EUNIS habitat classification system.
Mollusc	Invertebrate animal belonging to the phylum Mollusca, which includes the likes of snails, clams, chitons, tooth shells, and octopi.

Term	Meaning
Morven Offshore Wind Project (hereafter, 'the Project')	The whole Morven Project, comprising the offshore and onshore infrastructure required to generate and transmit electricity from an offshore array area to the mainland. An overarching term for the Project that includes the generation and transmission aspects and the infrastructure of the offshore wind farm, and both offshore and onshore transmission.
Morven Offshore Wind Transmission Project	The Morven Offshore Wind Transmission Project is comprised of the Project's offshore and onshore transmission assets and associated activities.
Mud	Sediment classification of grain sizes less than 0.63mm.
Neart na Gaoithe (NnG) Offshore Windfarm (OWF)	An offshore wind farm project that will comprise 54 wind turbines being progressed by EDF Renewables UK and ESB that will be located 15.5km off the Fife coast. Offshore construction commenced in 2020.
Nephrops	Norway lobster (*Nephrops norvegicus*) is a small lobster, pale orange in colour.
Net zero (target)	When anthropogenic emissions of greenhouse gases to the atmosphere are balanced by anthropogenic removals over a specified period.
Non-statutory consultee/stakeholder	Organisations that MD-LOT may choose to engage with (if, for example, there are marine planning policy reasons to do so) who are not designated in law but are likely to have an interest in a project.
Notice to Mariners	A release of navigational information and advice to assist mariners navigating in a particular region.
Nursery ground	An area that is suitable for young fish to grow and live.
Offshore infrastructure	All of the infrastructure including wind turbines, Offshore Substation Platforms and all cable types to be installed in the offshore environment.
Offshore Substation Platform(s) (OSPs)	OSPs comprise the support structure, topside and electrical components used for collecting and/or converting the electricity generated by the wind turbine generators for the passage or transmission between OSPs and to offshore export cables.
Offshore Transmission Network Review (OTNR)	A review into the way that the offshore transmission network is designed and delivered, consistent with the ambition of the UK Government to deliver net zero emissions by 2050.
Operations and Maintenance (O&M)	Includes routine inspections, repairs and replacement of infrastructure and equipment (including inter-connector and inter-array cables), scour protection replenishment or replacement, major component replacement, painting and/or other coating works, removal of marine growth, replacement of access ladders, and geophysical surveys.
Palaeochannel	A geological term describing a remnant of an inactive river or stream channel that has been filled or buried by younger sediment.
Palaeocoastline	Previous positions of present-day coastlines.

Term	Meaning
Palaeoenvironmental	Of or pertaining to the environment at a particular time in the geologic past.
Palaeolithic	Anthropological era from 2.6 million to 12,000 years ago.
Paris Agreement (the)	The Paris Agreement (2015) sets out the aims of keeping the increase in global average temperature to below 2°C above pre-industrial levels, and to pursue efforts to limit global warming to 1.5°C. Within the agreement, long-term goals are set out to provide financing to developing countries in order to implement mitigation measures, improve resiliency, and adapt to climate impacts.
Pelagic fish species	Fish species that inhabit open water. Examples include herring, mackerel and sprat.
Permanent Threshold Shift (PTS)	An irreversible loss of hearing sensitivity.
Philopatric	The tendency of an organism to stay in or habitually return to a particular area.
Physical overlap	Ability for impacts arising from the Project to overlap physically (i.e. in terms of location) with those from other projects/plans on a receptor basis.
Pinnipeds	Infraorder of marine mammals including true and eared seals, sealions and walrus.
Plan Option (PO)	A location identified in the Sectoral Marine Plan as a preferred area for commercial-scale offshore wind development.
Polychaete	Any worm of the class Polychaeta notable for well-defined segmentation of the body.
Pre-construction site investigation surveys	Refers to all pre-construction geophysical, geotechnical, and Metocean surveys scheduled prior to construction.
Pre-lay grapnel run (PLGR)	Part of cable route clearance done prior to start of cable installation works. The cable route is dredged with a grapnel to clear any obstacles, such as fishing nets, ropes, and lines that could obstruct the cable installation equipment.
Primary (type of designed in mitigation measure)	Measures included as part of the Project design. Includes modifications to location or design, integrated into the application for consent. These measures are implemented through the consent itself.
Project Design Envelope (PDE)	A description of the range of possible elements that make up the Array Project design options under consideration when the exact engineering parameters are not yet known.
Ramsar Site	Wetlands that have been designated under the Convention of Wetlands of International Importance, signed in Ramsar, Iran, in 1971.
Recorded Losses	Occurrences of vessels that are known to have been lost in the area, but with which no accurately located remains are associated.
Rochdale Envelope	Inter-changeable with PDE; a method of assessing the Array Project where there is uncertainty in the design that requires flexibility in the evaluation.

Term	Meaning
Root-Mean-Square Sound Pressure (RMSS)	Square root of the integral over a specified time interval of squared sound pressure, divided by the duration of the time interval, for a specified frequency range.
Safety Zones	An area around a structure or vessel which should be avoided.
Sand	Sediment classification of grain sizes between 0.63mm and 2mm.
Scoping Report	Report that presents the findings of the scoping process undertaken for the Array Project.
Scoping Workshop	A series of sessions preceding the finalisation of the Array Project Scoping Report to provide an opportunity for the Applicant to consult on the draft scope and for stakeholders to request additional information on key issues.
Scotland's National Marine Plan	A comprehensive overarching framework for all marine activity in Scottish waters, from MHWS to the 200nm limit. The Scottish and UK Governments agreed that a marine plan for Scotland's inshore waters, enabled as a result of the Marine (Scotland) Act 2010, and a marine plan for Scottish offshore waters, resulting from the Marine & Coastal Access Act 2009, would be published in one document and collectively referred to as Scotland's National Marine Plan (SNMP).This was published in 2015 and is to be updated by the Scottish Government.
Scottish Marine Region	Scottish Marine Regions divide the Scottish Coastal regions into 11 regions which cover sea areas extending from MHWS out to 12 nautical miles
Scottish Ministers (the)	The ultimate decision makers with regard to marine licence(s) and Section 36 consent applications in waters around Scotland.
Scottish Offshore Waters	The area between the seaward boundary of Scottish Territorial Waters and the seaward boundary of the Scottish part of the Exclusive Economic Zone.
Scottish Territorial Waters	The territorial waters of Scotland that extend from MHWS out to 12Nm, as defined by the Marine (Scotland) Act 2010.
ScotWind Leasing Process	A seabed leasing round run by Crown Estate Scotland to grant property rights for the seabed in Scottish waters for new commercial scale offshore wind project development. ScotWind Leasing must be sited within Plan Options of the Sectoral Marine Plan.
Scour protection	Protective materials to avoid sediment being eroded away from the base of the foundations due to the flow of water.
Seabed footprint	The area on the seafloor with which the Morven Offshore Wind Array Project infrastructure will be in contact.
Seagreen Offshore Windfarm (OWF)	The Seagreen Offshore Wind Farm is an offshore wind farm development owned by SSE Renewables and TotalEnergies around 27km from the coast of Angus in the North Sea. The Project has permission to install 150 wind turbines which have been allocated to two subprojects: Seagreen 1 (114 wind turbines) and Seagreen Project 1A (36 wind turbines), which are intended to connect to the national grid at different locations.
Seagreen 1 Offshore Windfarm (OWF)	Seagreen Offshore Wind Farm was consented with permission to install 150 wind turbines: 114 of these will connect to the grid via

Term	Meaning
	a cable route to Carnoustie and a substation at Tealing. These 114 wind turbines are referred to as Seagreen 1 and are currently being installed.
Seagreen 1A Offshore Windfarm (OWF)	Seagreen Offshore Wind Farm was consented with permission to install 150 wind turbines: 36 of these wind turbines will connect to the grid at Cockenzie via a new cable route (Seagreen 1A Export Cable Corridor). These 36 offshore wind turbines are consented but not yet constructed.
Secondary (mitigation measure)	Foreseeable mitigation which requires further activity, identified through the EIA process. Industry standard measures committed to by the Applicant might include a commitment to implementing post-consent management plans to reduce the significance or likelihood of adverse environmental effects. These measures are also implemented through the consent itself.
Section 36 Consent	A consent for the construction and operation of a generating station pursuant to the Electricity Act 1989.
Sectoral Marine Plan	Sectoral Marine Plan (SMP) for Offshore Wind Energy, adopted by Scottish Ministers and accompanied by a Post-Adoption Statement, published on 28 October 2020, to identify sustainable plan options for the future development of commercial-scale offshore wind energy in Scotland, including deep water wind technologies, and covers both Scottish inshore and offshore waters. The SMP is subject to an iterative plan review to ensure the plan remains current.
Sensitivity	The vulnerability, recoverability and value/importance of a receptor.
Service Operation Vessel	A vessel that provides accommodation, workshops and equipment for the transfer of personnel to turbine during OMS. Vessels in service today are typically up to 85m long with accommodation for about 60 people.
Shear wave	Vibration wave where the direction of particle motion is perpendicular to the direction of propagation.
Shellfish	Shellfish is considered a generic term to define molluscs and crustaceans (fish with a hard outer case or shell).
Significance	Effect factor that is determined by the magnitude of impact along with the sensitivity of the receptor.
Soft start procedure	In relation to piling: the gradual increase in hammer energy and strike rate from approximately 15% of the maximum hammer energy at the beginning of the piling sequence.
Sound exposure	Time integral of squared sound pressure over a stated time interval in a stated frequency band.
Sound Exposure Level (SEL)	Ten times the logarithm to the base 10 of the ratio of sound exposure to the specified reference value in decibels.
Sound pressure	The contribution to total pressure caused by the action of sound.
Sound Pressure Level (SPL)	20 times the logarithm to the base 10 of the ratio of rms sound pressure to the specified reference value in decibels.
Spawning ground	Area where fish leave their eggs for fertilisation and development.

Term	Meaning
Spring tide	Tide that occurs when the sun and moon are directly in line with the Earth and their gravitational pulls on the ocean reinforce each other. This creates a higher water level relative to normal tidal periods.
Statutory consultee	Organisations that are required by law to be consulted in respect of the marine licence and/or the Section 36 consent applications for the Array Project.
Study area	For each environmental topic, the baseline environment will be characterised, and the potential environmental impacts will be described within a topic-specific study area. Specific study areas are defined for each topic and are based on the maximum spatial extent across which potential impacts of the Array Project may be experienced by the relevant receptors (i.e. Zone of Influence).
Sublittoral	Area extending seaward of low tide to the edge of the continental shelf.
Submerged prehistoric archaeology	This includes palaeochannels and other inundated terrestrial landforms that may preserve sequences of sediment of palaeoenvironmental interest, Palaeolithic and Mesolithic sites and artefacts.
Subtidal	Areas of the coastal marine environment that lie below the level of mean low water and are continuously submerged by seawater.
Temporal overlap	Overlap in time of impacts from the relevant component project of the Morven Offshore Wind Project and impact(s) from other relevant plans and projects in the Cumulative Effects Assessment.
Temporary Threshold Shift (TTS)	A temporary reduction in hearing sensitivity.
Tertiary (type of designed in mitigation measure)	Inexorable mitigation which will be implemented regardless of the design process and the EIA (i.e. actions that would occur with or without input from the EIA feeding into the design process), e.g. contractor standard industry practices which manage potential nuisance activities or compliance with statutory requirements.
Transboundary effects	Factor that arises when the impacts from a project within one state affects the environment of another state(s).
UK Marine Policy Statement	Framework for preparing Marine Plans and taking decisions affecting the marine environment within section 44 of the Marine and Coastal Access Act 2009.
United Kingdom Hydrography Office (UKHO)	The UKHO is a world-leading centre for hydrography, specialising in marine geospatial data that helps to unlock a deeper understanding of the world's oceans.
Vessel route	Defined transit route (mean position) of commercial vessels identified within the specified Shipping and Navigation Study Area.
Viewpoint	Areas on land where visibility is assessed.
Wind turbines	The wind turbines will follow the traditional wind turbine design with a horizontal rotor axis with three blades connected to the nacelle of the wind turbine.
Zone of Theoretical Visibility	Tool to identify the likely extent of visibility of a proposed development.

Abbreviations

Acronym	Meaning
ABPmer	ABP Marine Environmental Research
ACC	Area Control Centre
ADD	Acoustic Deterrent Device
ADR	Air Defence Radar
ADS	Archaeological Data Service
AEZ	Archaeological Exclusion Zone
AIS	Automatic Identification System
ALs	Action Levels
AL1	Cefas Action Level 1
AL2	Cefas Action Level 2
Amsl	Above mean sea level
ANO	The Air Navigation Order (CAP 393)
ASACS	Air Surveillance and Control System
ATC	Air Traffic Control
ATS	Air Traffic Service
AWI	Ancient Woodland Inventory
BEIS	The Department for Business, Energy, and Industrial Strategy
BGS	British Geographical Survey
bp	bp Alternative Energy Investments
BP	Before Present
BTO	British Trust for Ornithology
CAA	Civil Aviation Authority
CAP	Civil Aviation Publication
CAS	Controlled Airspace
CCA	Coastal Character Assessment
CCC	Climate Change Committee
CCT	Coastal Character Types
CEA	Cumulative Effects Assessment
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 of Ecology and Environmental Management
CIfA	Chartered Institute for Archaeologists

Acronym	Meaning
CITES	Convention on International Trade in Endangered Species
CMS	Construction Method Statement
COLREGs	International Regulations for Preventing Collisions at Sea
COWRIE	Collaborative Offshore Wind Research into the Environment
CO_2e	Carbon dioxide-equivalents
CPS	Cable Protection System
CR	Circalittoral Rock
CV	Coefficient of variation
DBA	Desk Based Assessment
DCO	Development Consent Order
DDV	Drop-Down Video
DECC	Department for Energy and Climate Change
Defra	Department for Environment, Food and Rural Affairs
DIO	MoD Defence Infrastructure Organisation
DSLP	Development Specification and Layout Plan
DUKES	Digest of UK Energy Statistics
EC	European Commission
EcIA	Ecological Impact Assessment
ECOMMAS	East Coast Marine Mammal Acoustic Study
EEA	European Economic Area
EEC	European Economic Community
EEZ	Exclusive Economic Zone
EGPS	Electricity Generation Policy Statement
EIA	Environmental Impact Assessment
EMF	Electromagnetic Field
EMP	Environmental Management Plan
EnBW	Energie Baden-Württemberg AG
EPD	Environmental Product Declaration
EPS	European Protected Species
ERCoP	Emergency Response and Cooperation Plan
ES	Environmental Statement
ESCA	European Subsea Cables UK Association
ESO	Electricity System Operator
EU	European Union
E1	East 1 (Plan Option)
FCS	Favourable Conservation Status

Acronym	Meaning
FeAST	Feature Activity Sensitivity Tool
FD	Finite difference
FIR	Flight Information Region
FL	Flight Level
FLO	Fisheries Liaison Officer
FLOWW	Fishing Liaison with Offshore Wind and Wet Renewables Group
FMMS	Fisheries Management and Mitigation Strategy
FOCI	Feature of Conservation Interest
FSA	Formal Safety Assessment
FTCFWG	Forth and Tay Commercial Fisheries Working Group
FTOWDG	Forth and Tay Offshore Wind Developers Group
GES	Good Environmental Status
GHG	Greenhouse gas (emissions)
GIA	Gross Internal Area
GIS	Geographical Information System
GLVIA	Guidelines for Landscape and Visual Impact Assessment
GNS	Greater North Sea
GPS	Global Positioning System
GT	Gross Tonnage
GVA	Gross Value Added
HD	High Definition
HER	Historic Environment Record
HES	Historic Environment Scotland
HF	High Frequency
HMRI	Helicopter Main Route Indicator
HND	Holistic Network Design
HND-FUE	Holistic Network Design Follow Up Exercise
HRA	Habitats Regulations Appraisal
HVAC	High Voltage Alternating Current
HVDC	High Voltage Direct Current
HWDT	Hebridean Whale and Dolphin Trust
IAC	Inter-array cable
IAIP	Integrated Aeronautical Information Package
IALA	International Association of Marine Aids to Navigation and Lighthouse Authorities
IBTS	International Bottom Trawl Survey

Acronym	Meaning
ICAO	International Civil Aviation Organisation
ICES	International Council for the Exploration of the Sea
ICPC	International Cable Protection Committee
IEF	Important Ecological Feature
IEMA	Institute of Environmental Management and Assessment
IFP	Instrument Flight Procedure
IFR	Instrument Flight Rules
IMARES	Institute for Marine Resource and Ecosystem Studies
IMC	Instrument Meteorological Conditions
IMO	International Maritime Organization
INNS	Invasive Non-Native Species
INNSMP	Invasive Non-Native Species Management Plan
INTOG	Innovation and Targeted Oil and Gas
iPCoD	Interim Population Consequences of Disturbance Model
IPIECA	International Petroleum Industry Environmental Conservation Association
JNAPC	Joint Nautical Archaeology Policy Committee
JNCC	Joint Nature Conservation Committee
LAT (m)	Lowest astronomical tide (metres)
LCA	Lifecycle Analysis Study
LCA	Landscape Character Assessment
LCT	Landscape Character Type
LF	Low Frequency
LFA	Low Flying Area
LGM	Last Glacial Maximum
LiDAR	Light detection and ranging
LLP	Limited Liability Partnership
LMP	Lighting and Marking Plan
LOA	Length Overall
LSE	Likely Significant Effects
LUP	Late Upper Palaeolithic
MCCA 2009	Marine and Coastal Access Act 2009
MADS	Major accidents and disasters
MAIB	Marine Accident Investigation Branch
MarESA	Marine Evidence based Sensitivity Assessment
MarLIN	Marine Life Information Network

Acronym	Meaning
MBA	Marine Biological Association
MBES	Multibeam Echo Sounder
MCA	Maritime and Coastguard Agency
MCZ	Marine Conservation Zone
MDS	Maximum Design Scenario
MEDIN	Marine Environmental Data Information Network
MGN	Marine Guidance Notice
MHWS	Mean High Water Spring
Mil AIP	Military Aeronautical Information Publication
MMMP	Marine Mammal Mitigation Protocol
MMO	Marine Management Organisation
MNCR	Marine Nature Conservation Review
MoD	Ministry of Defence
MPA	Marine Protected Area
MPCP	Marine Pollution Contingency Plan
MRSea	Marine Renewables Strategic environmental assessment
MD-LOT	Marine Directorate Licensing Operations Team
MSFD	Marine Strategy Framework Directive
MSS	Marine Scotland Science
MUs	Management Units
MZ	Mitigation Zone
NAS	Noise Abatement Systems
NBN	National Biodiversity Network
NDC	Nationally Determined Contribution
NEPVA	Natural England Population Viability Analysis
NLB	Northern Lighthouse Board
NMBAQC	Northeast Atlantic Marine Biological Analytical Quality Control
NMFS	National Marine Fisheries Service
NMPi	National Marine Plan Interactive
NOAA	National Oceanic and Atmospheric Administration
NOTAM	Notification to Aviation Missions
NRA	Navigational Risk Assessment
NSP	Navigational Safety Plan
NSTA	North Sea Transition Authority
NtM	Notice to Mariners
OAA	Option Agreement Area

Acronym	Meaning
O&M	Operations and Maintenance
OFLO	Offshore Fisheries Liaison Officers
OREI	Offshore Renewable Energy Installation
OSP	Offshore Substation Platform
OSPAR	Oslo and Paris Commissions
OTNR	Offshore Transmission Network Review
OWEPS	Offshore Wind Energy Policy Statement
OWF	Offshore Wind Farm
PAD	Protocol for Archaeological Discoveries
PAHs	Polycyclic Aromatic Hydrocarbons
PAM	Passive Acoustic Monitoring
PCBs	Polychlorinated Biphenyls
PCW	Phocid Carnivores In Water
PDE	Project Design Envelope
PE	Parabolic equation
PEL	Probable Effect Level
PEXA	Practice Exercise Area
PINS	Planning Inspectorate (England and Wales)
PK (also referred to as SPLpk)	Peak Sound Pressure Level
PLGR	Pre-lay grapnel run
PMF	Priority Marine Feature
PO	Plan Option
POI	Points of interconnection
PSA	Particle Size Analysis
pSPA	potential Special Protection Area
PSR	Primary Surveillance Radar
PTS	Permanent Threshold Shift
PVA	Population Viability Analysis
QA	Quality Assurance
RAP	Recognised Air Picture
REWS	Radar Early Warning Systems
RIAA	Report to Inform Appropriate Assessment
RICS	Royal Institution of Chartered Surveyors
RLoS	Radar Line of Sight
RMNC	Review of Marine Nature Conservation
rms	Root-mean-square

Acronym	Meaning
RMSS	Root-Mean-Square Sound Pressure
RNLI	Royal National Lifeboat Institution
RoRo	Roll-on/Roll-off
ROV	Remotely Operated Vehicle
RRH	Remote Radar Head
RSPB	Royal Society for the Protection of Birds
RYA	Royal Yachting Association
R&D	Research and Development
SAC	Special Area of Conservation
SAR	Search and Rescue
SBES	Single Beam Echosounder
SBP	Sub-bottom Profiler
SCDS	Supply Chain Development Statement
SCOS	Special Committee on Seals
SD	Standard Deviation
SEA	Strategic Environmental Assessment
SEL	Sound Exposure Level
SEPA	Scottish Environment Protection Agency
SFF	Scottish Fishermen's Federation
SLA	Special Landscape Area
SLVIA	Seascape, Landscape, and Visual Impact Assessment
SMP	Sectoral Marine Plan
SMR	Scottish Marine Region
SMRU	Sea Mammal Research Unit
SMU	Seal Management Unit
SNCBs	Statutory Nature Conservation Bodies
SOLAS	International Convention for the Safety of Life at Sea
SoW	Scope of Works
SPA	Special Protection Area
SPFA	Scottish Pelagic Fishermen's Association
SPL	Sound Pressure Level
SPM	Suspended Particulate Matter
SSCs	Suspended Sediment Concentrations
SSER	SSE Renewables
SSR	Secondary Surveillance Radar
SSS	Side Scan Sonar

Acronym	Meaning
SSSI	Site of Special Scientific Interest
STECF	Scientific, Technical and Economic Committee on Fishing
SWFPA	Scottish White Fish Producers Association
TCA	Trade and Cooperation Agreement
TCPA	Town and Country Planning Act 1990
TEL	Threshold Effects Level
TNUoS	Transmission network use of system
TOC	Total Organic Carbon
TSS	Total Suspended Solids
TTS	Temporary Threshold Shift
UHRS	Ultra-High Resolution Seismic
UK	United Kingdom
UK CoS	UK Chamber of Shipping
UKCS	UK Continental Shelf
UKFEN	UK Fisheries Economics Network
UKHO	United Kingdom Hydrographic Office
UKLFH	UK Military Low Flying Handbook
UNECE	United Nations Economic Commission for Europe
US	United States (of America)
UXO	Unexploded Ordnance
VHF	Very High Frequency
VMP	Vessel Management Plan
VMS	Vessel Monitoring Systems
VOR	Valued Ornithological Receptor
WSI	Written Scheme of Investigation
WW1	World War One
ZoI	Zone of Influence
ZTV	Zone of Theoretical Visibility

Units

Unit	Description
dB	Decibel
ft	Feet
GW	Gigawatt
kJ	Kilojoule
kHz	Kilohertz (frequency)
km	Kilometre
km^2	Kilometres squared
kW/m	Kilowatts per metre
MW	MegaWatt
m	Metre
m^2	Metres squared
mg/l	Milligrams per litre
mm	Millimetre
m/s	Metres per second
nm	Nautical miles
µPa	Micropascal (pressure)
rpm	Rotation per minutes
s	Second (time)
º	Degree
%	Percent
λ	Wavelength

1 Introduction

1.1 Background

1.1.1.1 BP Alternative Energy Investments (bp), together with German partner Energie Baden-Württemberg AG (EnBW) has been awarded a seabed option, under the 2021/22 ScotWind leasing round. The bp/EnBW collaboration is jointly developing the Morven Offshore Wind Project (hereafter 'the Project'); an offshore wind farm within Plan Option (PO) area E1 identified in the Scottish Government's Sectoral Marine Plan for Offshore Wind (the SMP) (Scottish Government, 2020).

1.1.1.2 The Project is a proposed large-scale fixed-foundation offshore wind farm (OWF) located approximately 60km from the Aberdeenshire coast. bp/EnBW are working to secure the necessary consents, licences and permissions to build and operate the Project through Morven Offshore Wind Limited (hereafter, 'the Applicant').

1.1.1.3 The United Kingdom (UK) and Scottish Government's ambitions for offshore wind deployment are supported by the Offshore Transmission Network Review (OTNR). The Holistic Network Design (HND) brought up under the OTNR's 'Pathway to 2030' workstream, recommends a network design for the connection of offshore generation assets (for a total capacity of 23GW) to the network. HND-Phase 1 was published in July 2022. A Follow-up Exercise (HND-FUE) for the connection of projects not included in the scope of HND-Phase 1 is expected in 2023 (National Grid ESO, 2022). HND-Phase 1 recommends a connection to an offshore coordinated network consisting of radial, non-radial and onshore transmission assets. The coordinated network has several generation users in addition to the Project and associated points of interconnection (POI) at Fetteresso, Hawthorn Pit, Creyke Beck and Lincolnshire Connection Node. The Project will contribute 1.5GW to this coordinated network. The remaining capacity of the Project will be allocated as part of the ongoing HND FUE process.

1.1.1.4 As a result of the HND process and in order to progress the Project, the Applicant will seek to consent the Project's generation and transmission aspects separately. The 'Array Project' will seek consent for the Array Project Assets, the associated infrastructure is outlined in section 1.3.2. The area within which the Array Project Assets will be located is referred to as the 'Array Project Scoping Boundary' (hereafter, 'the Scoping Boundary'). Consent will be sought separately for the Project's offshore and onshore transmission aspects by the 'Morven Offshore Wind Transmission Project' (hereafter, the 'Transmission Project').

1.1.1.5 Environmental Impact Assessments (EIA) are being progressed for both aspects to understand the likely significant environmental effects of the respective proposals, supported by environmental and survey information. This Scoping Report has been produced with respect to the Array Project.

1.1.1.6 The Project's consenting strategy is currently to seek to consent its generation and transmission aspects, each supported by appropriate environmental assessments (and EIA Reports), as follows:

- Array Project:
  - Marine licences under the Marine and Coastal Access Act 2009 (separate marine licences will be sought for the generating assets and the OSPs) and a Section 36 consent under the Electricity Act 1989 for the generating assets.
- Transmission Project:
  - Currently anticipated to be two marine licences sought under the Marine and Coastal Access Act 2009 (one in England and one in Scotland) for the Transmission Project comprising the Project's offshore transmission assets and associated activities.
  - Planning permission under the Town and Country Planning Act 1990 (TCPA) for the onshore transmission assets, substation and associated activities.
- Further transmission facilities to be confirmed.

1.1.1.7 The cumulative effects of the Project's generation and transmission aspects will be considered in each respective EIA.

1.1.1.8 This report (the 'Array Project Scoping Report', hereafter 'the Scoping Report') has been prepared to request a formal Scoping Opinion for the Array Project within the Scoping Boundary (see Figure 1.1). It also defines the scope of such a Scoping Opinion.

1.1.1.9 A Scoping Report for the Project's transmission assets will be submitted in due course ('the Transmission Project Scoping Report').

1.2 The Applicant and the EIA Team

1.2.1.1 The Applicant is a 50:50 joint venture between bp and EnBW. Both bp and EnBW have growing track records in the development of offshore wind, which include the introduction of new technologies to the sector. Both entities are working to progress the Morgan and Mona offshore wind projects in the Irish Sea.

1.2.1.2 Energie Baden-Württemberg AG (EnBW) is one of the largest energy supply companies in Germany and Europe, with a workforce of 27,000 employees supplying energy to around 5.5 million customers. Installed renewable energy capacity will account for 50 percent of EnBW's generating portfolio by the end of 2025. EnBW plans to halve CO2 emissions by 2027 and aims to attain climate neutrality by 2035. EnBW was among the pioneers in offshore wind power with its Baltic 1 Offshore Wind Farm in the Baltic Sea. EnBW has developed, constructed and operates four offshore wind farms in Germany with a total installed capacity of 945MW, commissioned between 2011 and 2020. The final investment decision in March 2023 for the He Dreiht OWF cleared the way for the start of construction and delivery of a further 960MW in the North Sea. EnBW also develops, constructs, owns and operates onshore wind assets in Germany, France, Turkey and Sweden.

1.2.1.3 bp is an integrated energy company aiming to be a global leader in wind energy. bp is relatively new in the offshore wind industry but has already invested in the Morgan and Mona projects, still in development, and formed a partnership with Equinor to develop offshore wind projects in the United States (US). Projects in the US include the Empire Wind and Beacon Wind projects off the East Coast that have a planned potential 4.4GW generating capacity. bp also has a significant onshore wind business in the US with a gross generating capacity of 1.7GW, operating nine onshore wind assets across the country (bp p.l.c., 2023).

1.2.1.4 RPS has been commissioned by the Applicant to lead the environmental assessments (EIA and Habitats Regulations Appraisal (HRA)) for the Project. This includes the initial review of the environmental issues associated with the construction, O&M, and decommissioning phases of the Array Project, which are the subject of this Scoping Report. RPS has a 20-year history of delivering renewables projects in the UK, including leading the offshore consenting and licence activities for the 4.1GW Berwick Bank Wind Farm being progressed by SSE Renewables in the Firth of Forth. The qualifications and experience of the competent experts involved will be detailed in the EIA report provided for the Array Project (the 'Array Project EIA Report', hereafter, the 'EIA Report').

1.3 Array Project Overview

1.3.1.1 The ScotWind leasing process initiated in 2021 by Crown Estate Scotland (CES) has accelerated offshore wind development in Scottish waters to support Scotland's ambitions for net-zero emissions by 2045[1] (CES, 2021). Applications to CES for new projects under the ScotWind Leasing process were required to be sited within a PO. The SMP identified 15 POs across four regions in Scottish Waters. The East region has three POs (E1, E2 and E3); the Array Project is located within PO E1, which covers a total area of 3,744km^2 (Gray, 2021).

1.3.2 Array Project Assets

1.3.2.1 The Array Project comprises the wind turbines, associated foundations and structures, inter-array and inter-connector cables and OSPs, and associated infrstructure. Further project information is provided in chapter 3: Project Description of this Scoping Report. The construction programme for the Array Project is yet to be confirmed, but will take place within a maximum period of seven years. Construction is likely to commence in 2026.

[1] The Climate Change (Emissions Reduction Targets) (Scotland) Act 2019 committed Scotland to a net zero climate change target by 2045.

1.3.3 Array Project Scoping Boundary

1.3.3.1 The Scoping Boundary is located approximately 60km from the Aberdeenshire coast (at its closest point). The Scoping Boundary covers an approximately 860km^2 area within the Scottish Offshore region (12-200 nautical miles (nm)), which is part of the UK Exclusive Economic Zone (EEZ). The Scoping Boundary for the Array Project (the 'Array Project Scoping Boundary') is presented in Figure 1.1 and establishes the Array Project area and geographic scope of the Scoping Report (which has the same km^2 area as the lease area).

1.3.3.2 There are a number of other offshore wind sites within 30km of the Array Project in the Forth and Tay Region that are still in either their construction or application phases. These include Seagreen 1 OWF, Seagreen Project 1A, Berwick Bank OWF, Inch Cape OWF, and Neart Na Gaoithe (NnG) OWF.

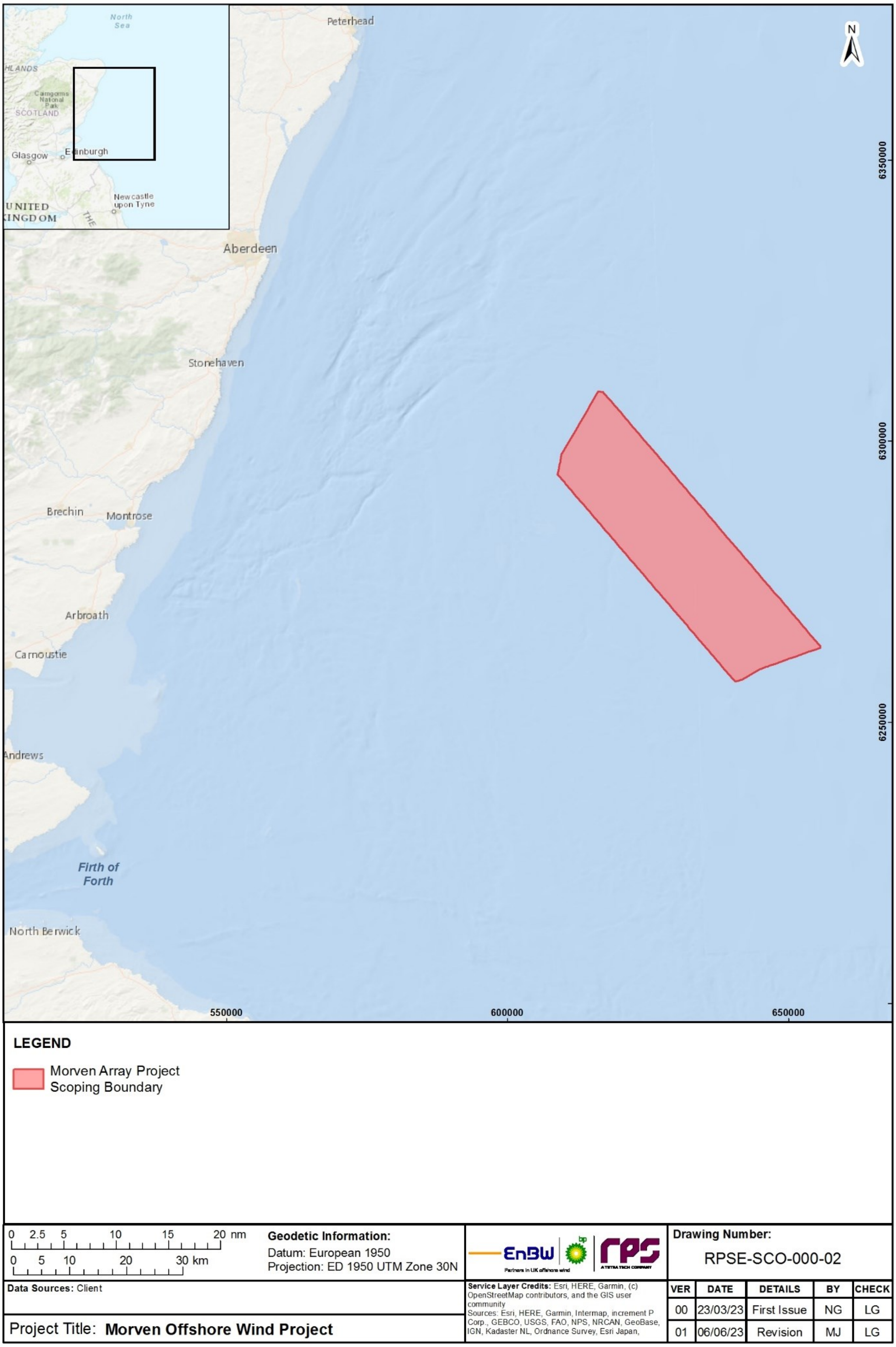


Figure 1.1: Array Project Scoping Boundary

1.4 Purpose of the Scoping Report

1.4.1 Purpose

1.4.1.1 The Array Project is subject to the EIA Regulations (described in section 2.3.5). As part of the EIA process, this Scoping Report has been prepared to support a request for a formal Scoping Opinion on the Array Project from Scottish Minsters, via the Marine Directorate Licensing Operations Team (MD-LOT). The objective of the Scoping Report is to provide all stakeholders with sufficient information on the proposals specific to the Array Project, to enable meaningful engagement within the pre-application consultation process.

1.4.1.2 This Scoping Report describes the characteristics of the Array Project, the environmental and social factors likely to be affected by the proposals and the topics to be addressed in the EIA, as well as baseline data sources and assessment methodologies used to inform the assessments. Potential environmental and social impacts are identified within this Scoping Report and impacts that are proposed to be scoped out of the EIA process are also identified, e.g. on the basis that no likely significant effects or receptor pathways were identified.

1.4.1.3 The EIA requirements for this Scoping Report are listed in Table 1.1. Engagement with stakeholders on these aspects is desired and will continue where opportunities are available. More detail on future engagement is provided in Appendix 4: Draft Stakeholder Engagement Plans of the Scoping Report. Through this process, the Applicant seeks to establish the content and extent of the matters that should be covered in the environmental information to be submitted by the Applicant.

Table 1.1: Scoping requirements of 2017 EIA Regulations and chapters of the Scoping Report where these are addressed

EIA Regulation requirement	Summary Content
A description of the location of the Array Project, including a plan sufficient to identify the land.	Chapter 3 provides a project description and a detailed illustration for the Array Project.
A brief description of the nature and purpose of the Array Project and of its likely significant effects on the environment.	Chapters 3 to 6 (inclusive) cover project purpose and general designs and procedures.
Information on the Array Project and the associated environmental impacts to sufficiently define the potential effects and, therefore, extent of the EIA.	Chapters 7 to 11 (inclusive) describe potential impacts of the Array Project and which ones are proposed to be scoped in or out of the EIA.

1.4.2 Approach

1.4.2.1 The Scoping Report was developed to meet the following objectives:

- present a detailed summary of the baseline environment as well as data collection and survey methodologies utilised to provide a platform for technical assessments;
- propose environmental and social impacts to be scoped into the EIA with evidence to support this decision;
- propose environmental and social impacts to be scoped out of the EIA and provide a justification for this decision.

1.4.2.2 This approach will allow the EIA to focus on those potential impacts that either have the potential to lead to a likely significant environmental effect, or to identify where uncertainty exists on potential effect. This in turn allows for the development of a proportionate EIA. Within individual impact chapters, the Scoping Report will cover:

- an overview of the proposed approach to the EIA;
- a baseline characterisation and an overview of any survey areas;

- impacts to be scoped in and scoped out of the EIA Report with justifications;
- consideration of designed in measures, as well as identification of potential routes to impact in the absence of such measures;
- overview of potential for cumulative impacts;
- potential for transboundary screening and inter-related effects;
- topic specific questions, where relevant, to focus the Scoping Opinion.

1.4.2.3 The approach to scoping is provided in full in chapter 4: EIA Methodology of the Scoping Report. The Scoping Report and subsequent EIA Report will cover the lifespan of the Array Project, across construction, O&M and decommissioning. The Scoping and EIA Reports will assess the likely significant effects identified as resulting from each phase of the Array Project. Stakeholder engagement and consultation will play an important role in informing the above.

1.5 Scoping Report Structure

1.5.1.1 The structure of the Scoping Report is set out in Table 1.2. Each chapter will consider impacts from the Array Project and cumulative effects during the construction, O&M and decommissioning of the Array Project.

Table 1.2: The structure of the Scoping Report

Topic	Summary of content	Chapter	Author
Chapters 1 and 2: Introductory Chapters			
Introduction	Background to the Array Project and the Applicant. Purpose of and approach to scoping and structure of the Scoping Report.	Chapter 1	RPS
Policy and Legislation	High-level overview of policy and legislation of relevance to the Array Project and the consenting process.	Chapter 2	RPS
Chapters 3 – 6: Array Project Methods			
Project Description	Parameters that define the Project Design Envelope (PDE) for the Array Project. Overview of the infrastructure and activities associated with construction, O&M and decommissioning.	Chapter 3	The Applicant
EIA Methodology	Outline methodology proposed to identify and evaluate likely significant environmental effects, cumulative impacts and transboundary and inter-related effects.	Chapter 4	RPS
Consultation	Summary of consultation and the proposed approach to stakeholder engagement, supported by appendices.	Chapter 5	RPS
Site Selection and Consideration of Reasonable Alternatives	Considerations for and approach to site selection and alternatives for the Array Project.	Chapter 6	The Applicant
Chapter 7: Offshore Physical Environment			
Physical Processes	Presentation of relevant study area(s), data sources baseline environment and effects proposed to be scoped in and out of the EIA. Modelling methods are included to support the determination of impact magnitude. Presentation of potential impacts on physical processes (tidal flow, waves, currents, and sediment transport).	Chapter 7.1	RPS

Topic	Summary of content	Chapter	Author
Underwater Sound	Description of modelling procedures, data sources, and noise limitation guidelines required to understand impacts upon sound sensitive receptors, such as marine mammals and fish.	Chapter 7.2	JASCO
Offshore Water Quality	Analysis of potential interactions between the Array Project and the offshore water environment. It is proposed to scope offshore water quality out of the EIA.	Chapter 7.3	RPS
Chapter 8: Offshore Biological Environment			
Benthic Subtidal Ecology	Presentation of relevant study areas for benthic subtidal ecology. Analysis of desk-based data sources and site specific survey results and overview of the baseline environment. Key receptors and effects scoped in and out.	Chapter 8.1	RPS
Fish and Shellfish Ecology	Presentation of relevant study area(s) for fish and shellfish ecology, data sources and baseline environment. Identifies keys receptors and effects proposed to be scoped in and out of the EIA.	Chapter 8.2	RPS
Marine Mammals	Presentation of relevant scope and study area(s) for marine mammals, data sources and overview of the baseline environment. Detailed approach to assessment (underwater sound modelling). Key receptors and effects proposed to be scoped in and out of the EIA.	Chapter 8.3	RPS
Offshore Ornithology	Presentation of relevant scope and study area(s) for offshore ornithology, summary of data sources and overview of the baseline environment. Detailed approach to assessment (modelling). Identifies keys receptors and effects proposed to be scoped in and out of the EIA.	Chapter 8.4	NIRAS
Chapter 9: Offshore Human Environment			
Commercial Fisheries	Overview of the commercial fishing activities within the study area(s) as required to assist in the assessment of potential impacts during construction, O&M and decommissioning.	Chapter 9.1	The Applicant
Shipping and Navigation	An overview of the shipping and navigation routes and characteristics within the Shipping and Navigation Study Area (and Shipping and Navigation Cumulative study area), which is required to assist in understanding impacts upon these from construction, O&M and decommissioning.	Chapter 9.2	Anatec
Aviation (Military and Civil)	An overview of the aviation and communication operations within the vicinity of the Scoping Boundary, which is required to assist in understanding impacts upon these from construction, O&M and decommissioning.	Chapter 9.3	OSPREY
Marine Archaeology	Presentation of desk-based review and strategy to ensure marine archaeological receptors are safeguarded from potential interactions as a basis to propose that this topic can be scoped out of the EIA.	Chapter 9.4	RPS

Topic	Summary of content	Chapter	Author
Other Sea Users, Marine Infrastructure and Communications	Presentation of existing datasets (CES, OceanWise, UK Oil and Gas Data, Marine Directorate, and other published data) and characterisation of potential impacts and key receptors.	Chapter 9.5	RPS
Socio-economics	Approach to the assessment of potential effects on socio-economics on both offshore and onshore receptors. Considerations for the development of assessment study areas, assumptions applied and impact occurrence, and stakeholder engagement strategy.	Chapter 9.6	BiGGAR Economics
Seascape and Visual Impact Assessment (SLVIA) and Onshore Historic Environment	Overview of potential visual impacts on onshore or coastline receptors, including heritage assets. Wirelines and Zones of Theoretical Visibility (ZTV) provide the basis to propose both topics be scoped out of the EIA.	Chapter 9.7	WSP
Climate Change	Identifies the climate change receptors of relevance to the Array Project and considers the potential impacts arising from all phases of the Array Project. Sets out the proposed scope of the EIA Report and the methodology to be used in the assessment of climate change impacts for the Array Project.	Chapter 9.8	RPS
Major Accidents and Disasters (MADS)	Consideration of the potential for likely significant effects due to the vulnerability of the Array Project to major accidents and disasters and the potential for the Array Project to contribute to the risk of major accidents and disasters. It is proposed to scope offshore water quality out of the EIA.	Chapter 9.9	RPS
Human Health	Provides scoping-in and scoping-out rationales across a wide range of determinants of human health.	Chapter 9.10	RPS
Chapter 10: Other Environmental Topics			
Introduction	Background to other topics covered within this chapter.	Chapter 10.1	RPS
Topics with supporting information in the Scoping Report	Topics that will not have stand-alone chapters where the necessary information can be drawn from other chapters of the EIA Report, namely waste.	Chapter 10.1	RPS
Topics covered elsewhere in the Scoping Report	Identification of any topics that do not appear in one chapter or appendix but will instead be spread throughout other topics (material assets and other residues and emissions).	Chapter 10.1	RPS
Chapter 11: Array Project Scoping Summary			
Concluding Chapters	Recap of the Array Project, Scoping Report purpose, and summary of impacts scoped in or out. Cumulative effects summary, transboundary impacts summary and consultation.	Chapter 11.1 to chapter 11.4.	RPS
Next Steps	Overview of future steps in relation to consultation and a timeline for the final application.	Chapter 11.5	RPS
References			
References	List of all references used within the Scoping Report.	Chapter 12	RPS

Topic	Summary of content	Chapter	Author
Appendices			
Transboundary screening	A screening of transboundary impacts has been carried out for each topic chapter. The outcomes of this screening are presented in this appendix.	Appendix 1	RPS
Designed in Measures and Mitigation Log	Sets out a summary of the designed in measures and mitigation to be committed to within the EIA Report.	Appendix 2	RPS
Array Project Scoping Workshop	Provides detail on the content of and outputs from the Array Project Scoping Workshop for the Array Project, held in April 2023.	Appendix 3	RPS
Draft Stakeholder Engagement Plans	Proposed approach to future intentions for stakeholder engagement during the pre-application phase.	Appendix 4	RPS
Underwater Sound Methodology Statement	Details the methodology for modelling the impact of underwater sound generated during construction and O&M of the Array Project.	Appendix 5	JASCO
Marine Protected Area (MPA) Screening	Provides summary of the approach to the MPA Assessment that is proposed for the Array Project and includes the results of a preliminary initial screening of designated MPAs which, it is proposed, are carried forward for consideration in the main MPA Assessment.	Appendix 6	RPS
Marine Mammals Methodology Statement	Presents the proposed methodologies for use in the EIA of the potential impacts of the Array Project on marine mammals. Provides a series of technical briefings on methodologies for use in the Array Project EIA and includes the delineation of study areas and data that will be used to inform the baseline and modelling of population level effects.	Appendix 7	RPS
Offshore Ornithology Yield 1 Data Report	Summary of the data resulting from 2 years and 3 months of monthly aerial digital surveys of the East 1 (E1) development site, plus 4km buffer and abundance and distribution analysis.	Appendix 8	APEM
Offshore Ornithology Methodology Statement	Presents the proposed methodologies for use in the EIA of the potential impacts of the Array Project on offshore ornithology.	Appendix 9	NIRAS
Commercial Fisheries Methodology Statement	Provides additional detail on the proposed methodologies for the assessment of the potential impacts on commercial fisheries.	Appendix 10	The Applicant
SLVIA and Onshore Historic Environment: Methodology Statement	Provides detail on the proposed methodologies for the assessment of the potential impacts for SLVIA and assessment on effects on Onshore Historic Environment, should this topic be scoped into the EIA.	Appendix 11	WSP
SLVIA and onshore Historic Environment: Wirelines and ZTV	Wirelines and ZTV showing areas from which visibility of the Array Project may occur.	Appendix 12	WSP
Marine Archaeology	Gazetteer of marine archaeology identified within the desktop data	Appendix 13	RPS
Marine Archaeology	Gazetteer of recorded losses identified within the desktop data	Appendix 14	RPS

2 Policy and Legislation

2.1.1.1 The key policy drivers specific to the development of offshore wind farms in Scotland, and directly relevant to the Array Project, are summarised in this chapter. They sit alongside international and United Kingdom (UK) policy, legislation, regulation, directives and plans aimed at tackling climate change and delivering energy security. A number of these policies and legislative tools are of relevance to the Array Project. This chapter will consider some of them in the wider context for the development of offshore wind farms (OWFs) in Scotland, which is also of direct relevance to the assessment and consenting process for the Array Project.

2.1.1.2 A Climate Emergency was declared by the First Minister of the Scottish Government in April 2019, which was shortly followed by the declaration of an environmental and climate emergency by the UK Government. These announcements jointly serve to illustrate the prominence and importance of tackling climate change, outline the concern from Scottish and UK Governments surrounding the potential consequences of it and provide context and foundation to the policy and legislative landscape outlined below.

2.2 Climate Change, Energy Policy and Project Need

2.2.1 International Commitments

2.2.1.1 The UK is a signatory to the Kyoto Protocol under the United Nations Framework Convention on Climate Change. The Kyoto Protocol is a legally binding international agreement that commits State parties to reduce greenhouse gas (GHG) emissions by setting emission reduction targets. The Protocol came into effect in 2005, was subsequently incorporated into UK law by the Climate Change Act 2008 and then into Scottish law by the Climate Change (Scotland) Act 2009. An amendment to the Climate Change Act 2008, through the Climate Change Act 2008 (2050 Target Amendment) Order 2019, sets out a target of GHG emissions for the year 2050 to be 100% lower than the 1990 levels. In Scotland, the net zero target must be delivered by 2045; this was secured through the adoption of the Climate Change (Emissions Reduction Targets) (Scotland) Act 2019. The Kyoto Protocol's first commitment period began in 2008 and ended in 2012. The second commitment period began in 2013 and ended in 2020. The Kyoto Protocol has been superseded by the Paris Agreement.

2.2.1.2 The Paris Agreement (Paris Agreement Under the United Nations Framework Convention on Climate Change) is the first-ever universal, legally binding global climate deal, originally agreed at the Paris Climate Conference (COP21). The Paris Agreement (2015) sets out the aims of keeping the increase in global average temperature to below 2°C above pre-industrial levels, and to pursue efforts to limit global warming to 1.5°C. Furthermore, within the agreement, long-term goals are set out to provide financing to developing countries in order to implement mitigation measures, improve resiliency, and adapt to climate impacts. The Paris Agreement entered into force on 4 November 2016.

2.2.2 Scottish Climate Change and Energy Legislation and Policy

2.2.2.1 The Climate Change (Scotland) Act 2009 (outlined in section 2.2.1), as amended by the Climate Change (Emission Reduction Targets) (Scotland) Act 2019, sets out a legally binding target for reducing GHG emissions by 100% lower than 1990 levels by 2045. The Act also requires Scottish Ministers and public bodies to act within sustainable development parameters and places duties on them to deliver this. Furthermore, it also allows Scotland to contribute to the Paris Agreement goals of limiting global warming to well below 2°C and pursuing efforts to limit it to 1.5°C. In Scotland, the Emissions Reductions Targets include a reduction of all GHG to net-zero by 2045 with interim targets for reductions of at least 75% by 2030 and 90% by 2040.

2.2.2.2 The Scottish Energy Strategy: The Future of Energy in Scotland (Scottish Government, 2017), sets out how the Scottish Government sees the future energy system. The strategy outlines six priorities around Scotland's vision, which includes renewable and low carbon energy solutions. It sets targets of the equivalent of 50% of the energy for Scotland's heat, transport and electricity consumption to be supplied from renewable sources and an increase of 30% by 2030 in the productivity of energy use across the Scottish economy. The strategy highlights the success of Scottish projects in offshore wind in recent CfD (Contracts for Difference) auctions and highlights the great potential for future development, particularly within deeper waters. The 'Energy Strategy and Just Transition Plan', published for consultation on 10 January 2023, will soon replace the Scottish Energy Strategy. Consultation on the draft Energy Strategy and Just Transition Plan closed on 22 May 2023.

2.2.2.3 The Offshore Wind Energy Policy Statement (OWEPS) (Scottish Government, 2020) sets out ambitions for offshore wind development and the role this technology could play in meeting commitments of net zero by 2045, as required by The Climate Change (Emissions Reduction Targets) (Scotland) Act 2019. The OWEPS builds upon the ambitions outlined in Scotland's Energy Strategy (Scottish Government, 2017). Scotland's Energy Strategy forms a key component of the implementation of The Offshore Wind Energy Policy Statement through the identification of suitable offshore wind farm development areas.

2.2.2.4 In March 2015, the Scottish Government published Scotland's National Marine Plan – a Single Framework for Managing our Seas (NMP) (Scottish Government, 2015). The NMP sets out strategic policies for the sustainable development of Scotland's marine resources out to 200nm. As required, the NMP is compatible with the UK Marine Policy Statement (UK Government, 2011) and other marine plans across the UK.

2.2.2.5 In 2011, the first Sectoral Marine Plan (SMP) for Offshore Wind Energy was adopted (Marine Scotland, 2011). In 2013, draft wind, wave and tidal SMPs were produced (Marine Scotland, 2013). Further to this work, the SMP for Offshore Wind Energy (Scottish Government, 2020) builds on technological, policy, regulatory and market development to form a new strategic planning process. The SMP seeks to contribute to the achievement of Scottish and UK energy and climate change policy objectives and targets, through the provision of a spatial strategy to inform the seabed leasing process for commercial offshore wind energy in Scottish waters, which:

- minimises the potential adverse effects on other marine users, economic sectors and the environment resulting from further commercial scale offshore wind development;
- maximises opportunities for economic development, investment and employment in Scotland, by identifying new opportunities for commercial scale offshore wind development, including deeper water wind technologies.

2.2.2.6 Further to the above, within the Application and consenting timescales, it is anticipated the SMP will be subject to an iterative review process whereby aspects of the content may be updated. Similarly, a second NMP (NMP2) is expected to be published, providing an updated policy basis for offshore renewable energy projects.

2.2.3 UK Climate Change and Energy Legislation and Policy

2.2.3.1 The Climate Change Act 2008 (outlined in section 2.2.1), as amended by the Climate Change Act 2008 (2050 Target Amendment) Order 2019, outlines the emission reduction targets set out previously. This provides a legal framework for ensuring the tackling of climate change in the UK. The adoption of this Act established the UK as the first Group of Seven (G7) nation to set such a climate change goal.

2.2.3.2 The Energy Act 2013 sets out a commitment by the UK to low carbon industry and also to investments in low carbon electricity generation. The Act provides for a legislative framework for the setting of a 2030 decarbonisation target range for electricity (in secondary legislation) and also for electricity market reforms consisting of measures that seek to secure investment towards a low carbon transmission of the electricity market. This includes CfD, which are essentially long-term low carbon electricity generation contracts designed to encourage investment.

2.2.3.3 The UK Marine Policy Statement (UK Government, 2011) was created and adopted by the UK Government and devolved administrations. This outlines an integrated and holistic approach to marine planning across the entirety of the UK, providing a platform for a high-level framework for the preparation of marine plans and decision making with regard to the marine environment. This also sets out the requirement for the development and adoption of marine plans within UK waters.

2.2.3.4 The Department for Energy Security and Net Zero (DESNZ) released the 'Powering Up Britain: Energy Security Plan' initiative in 2023 to ensure that the UK has secure, affordable and clean energy. Building on from the 'British Energy Security Strategy' and 'Net Zero Strategy', the initiative supports the deployment of more offshore wind, as well as other renewable energy sources, to reduce the UK's emissions and energy reliance on foreign sources. The strategy aims to create new jobs in the offshore wind sector, reduce carbon emissions, and support the creation of a low-carbon economy. It also provides support for the development of new technologies, such as floating offshore wind farms, and investment in infrastructure to ensure a more secure energy supply.

2.3 Consenting Process

2.3.1 Consenting Process for Infrastructure in Scottish Waters

2.3.1.1 As an offshore wind farm, or in legislative terms a generating station with a capacity greater than 50 megawatt (MW), the following consents are required for the generating assets forming part of the Array Project:

- a marine licence under the Marine and Coastal Access Act 2009;
- a Section 36 consent under the Electricity Act 1989.

2.3.1.2 The Array Project also comprises offshore substation platforms (OSPs), which will also be consented via a marine licence under the Marine and Coastal Access Act 2009.

2.3.1.3 The Array Project will also be considered under the appropriate EIA Regulations, which differ slightly depending on the consent being sought:

- for the marine licences under the Marine and Coastal Access Act 2009, The Marine Works (Environmental Impact Assessment) Regulations 2007;
- for the Section 36 consent application, The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017.

2.3.1.4 Collectively, the above noted regulations will be referred to the 'EIA Regulations'.

2.3.1.5 Each of these consents, licences and permissions are described below. Should additional pre-construction licences be required, these will be discussed and agreed with the relevant consenting authority during the pre-construction phase.

2.3.1.6 Pre-application consultation is set out as a requirement for many offshore wind developments. This is derived from these projects interacting with the seabed or land within 12nm, as well as onshore areas, for which legislation requires such steps to be taken. In the case of the Array Project, there are no interactions with these elements and neither of the above noted Acts require such steps to be taken. Despite there being no legislative requirement, the Applicant will voluntarily consult with communities, supply chains, shipping and fishing stakeholders, where relevant and appropriate, to ensure appropriate levels of engagement. Consultation is already underway with key stakeholders as part of the Project development and Environmental Impact Assessment (EIA) process.

2.3.1.7 Marine licences and marine licence exemptions for activities including surveys, UXO clearance and other site preparation activities will also be sought separately if required under the Marine (Scotland) Act 2010 or the Marine and Coastal Access Act 2009 (as relevant depending on location).

2.3.2 Marine and Coastal Access Act 2009

2.3.2.1 The Marine and Coastal Access Act (MCCA) 2009 applies to all UK offshore waters out to 200nm, except Scottish waters between 0nm and 12nm, which are covered by the Marine (Scotland) Act 2010. Under the MCAA 2009 there is the requirement for a marine licence to be obtained prior to the construction, alteration or improvement of any works or deposit any object in or over the sea, or on or under the seabed.

2.3.3 Marine (Scotland) Act 2010

2.3.3.1 The Marine (Scotland) Act 2010 provides the legal framework for the protection and sustainable use of Scotland's marine environment within 0 to 12nm of the Scottish coast. It introduced a number of measures, including the establishment of a network of Marine Protected Areas (MPAs), the introduction of a statutory Marine Planning system, and a licensing regime for certain offshore activities. The Act also established Marine Scotland, the Scottish Government's marine management body (now known as Marine Directorate). Marine Directorate Licensing Operations Team (MD-LOT) supports Scottish Ministers, in whose name decisions are made, and provides the necessary advice, guidance and consent for the proper management of marine activities in this area.

2.3.4 The Electricity Act 1989 and Section 36

2.3.4.1 As the Array Project comprises an offshore generating station that is greater than 50MW and is located in Scottish Offshore Waters (between 12nm and up to 200nm offshore), there is a requirement for consent under Section 36 of the Electricity Act 1989. Section 36 consent will allow for the construction and operation of the generation assets for the Array Project.

2.3.4.2 Where applications for both a marine licence under the MCAA 2009 and consent under Section 36 of the Electricity Act 1989 are made, and where the Scottish Ministers are the determining authority, the related applications may be considered at the same time.

2.3.5 The Environmental Impact Assessment (EIA) Process

2.3.5.1 In compliance with the relevant EIA Regulations, when applying for Section 36 consent or a marine licence, an EIA Report is required to be prepared and submitted to support these applications if the development applied for is likely to have a significant effect on the environment due to factors such as its size, nature or location. In this instance, the Array Project would consist of more than two wind turbines with hub heights over 15m and so, under Schedule 2 of the aforementioned regulations, requires the production of an EIA Report to support such a development.

2.4 Other Consents and Legislation

2.4.1 Habitats Regulations

2.4.1.1 The Council Directive 92/43/EEC (the Habitats Directive) was adopted in 1992 and provided a means for the EU to meet its obligations under the Bern Convention. The aim of the Directive is to maintain or restore the natural habitats and wild species listed at a favourable conservation status. This protection was granted through the designation of European sites (Special Areas of Conservation (SAC) and measures to protect European Protected Species (EPS). European Directive (2009/147/EC) on the conservation of wild birds (The Birds Directive) affords rare and vulnerable species listed under Annex I of the Directive, and regularly occurring migratory species, protection through the identification and designation of Special Protection Areas (SPAs). Further to the UK exit from the European Union (EU), the Conservation (Natural Habitats, &c.) (EU Exit) (Scotland) (Amendment) Regulations 2019 (effective from 1 January 2021) provide that Scotland is currently obliged to continue to maintain the standards required by the EU Habitats and Wild Birds Directives, subject to only minor (non-material) changes. As such, the Habitats and Birds Directives continue to provide the framework for the conservation and management of rare and vulnerable habitats and species and wild birds within Europe and the UK.

2.4.1.2 It is worth clarifying that the HRA process the consenting and licensing process for the Array Project, with HRA reports submitted separately from the aforementioned consenting documentation (i.e. the EIA Report). Coverage of this legislation is included here for context.

2.4.1.3 The “Habitat Regulations 2017” of relevance to the Array Project are:

- the Conservation of Habitats and Species Regulations 2017;
- the Conservation of Offshore Marine Habitats and Species Regulations 2017 (which apply within the Scottish Offshore region).

2.4.1.4 The Habitat Regulations 2017 require that where a plan or project is likely to have a significant effect on a European site, either individually or in combination with other plans or projects, it shall be subject to an Appropriate Assessment of its implications for the site in view of the site’s conservation objectives. Scottish Ministers must, therefore, consider whether the Array Project is likely to have significant effects on the conservation objectives of the sites considered in the HRA. Where Likely Significant Effects (LSE) cannot be excluded at the screening stage, and in the absence of mitigation measures, an Appropriate Assessment of the implication of the plan or project must be undertaken by the Competent Authority before consent may be given for Array Project.

2.4.1.5 A HRA Stage 1 Screening Report has been developed alongside the Scoping Report. The screening exercise presented in the report is based on the current understanding of the baseline environment and proposed activities associated with the Array Project and the project and site specific information currently available. Changes that may arise as a result of further site specific surveys, environmental assessment, consultation, and/or refinements to the PDE will be reflected in the Report to Inform Appropriate Assessment (RIAA).

2.4.2 European Protected Species Legislation

2.4.2.1 European Protected Species (EPS) are animals and plants (species listed in Annex IV of the Habitats Directive) that are afforded protection under The Habitats Regulations 2017. All cetacean species (whales, dolphins and porpoise) are EPS. If any activity is likely to cause disturbance or injury to an EPS, a licence is required to undertake the activity legally.

2.4.2.2 Activities that can be licensed under EPS licences include those such as underwater sound disturbance to marine mammals due to piling construction activities. EPS licences are obtained from NatureScot or the Scottish Ministers, depending on the species subject to the licence application. Although the granting of EPS licences is separate to the Section 36 and marine licence application process, it can be considered in parallel by regulators although EPS licences are often sought post-consent and prior to construction when more detailed design is known.

3 Project Description

3.1 Introduction

3.1.1.1 This chapter of the Scoping Report provides an outline design description of the Array Project. The description includes the procedures for the construction, Operations and Maintenance (O&M) and decommissioning for the Array Project. Designs are conceptual at this early development phase and based on the current understanding of the environmental conditions, as indicated by initial engineering survey work.

3.2 Project Design Envelope Approach

3.2.1.1 The Project Design Envelope (PDE) approach is standard and accepted practice for large scale energy projects such as this Array Project. The approach has been employed for the majority of offshore windfarm applications in the UK to date. The PDE approach is set out in Scottish Government (2013) guidance, where it is acknowledged that 'by applying the principles of the approach it is possible to undertake an environmental assessment which takes account of the need for flexibility in the future evolution of the detailed Project proposal, within clearly defined parameters. In such cases, the level of detail of the proposals must be sufficient to enable a proper assessment of the likely significant environmental effects, and any resultant mitigation measures - if necessary, considering a range of possibilities'. The approach is referenced in guidance prepared by Marine Scotland and the Energy Consents Unit in June 2022 for applicants using the PDE approach for applications under Section 36 of the Electricity Act 1989 (Scottish Government, 2022).

3.2.1.2 At Application, the necessary information on site conditions and the procurement process is not available to inform the final project design. The PDE approach (also known as the 'Rochdale Envelope') (Scottish Government, 2022) will, therefore, be adopted for the Environmental Impact Assessment (EIA) Report. The PDE concept allows for some flexibility in project design options, particularly for foundations and wind turbine type, where the full details of a project are not known at application.

3.2.1.3 An example of the PDE approach would be where several types of wind turbine foundations are being considered and the assessment is based on the foundation known to have the greatest impact. In this instance, the PDE for the foundation with the greatest seabed disturbance potential would be the foundation with the largest footprint and the greatest number of wind turbines. If, after undertaking the impact assessment, it is shown that no significant effect is anticipated, it can be assumed that any project parameters equal to or less will, therefore, also have no significant effect upon the receptors for the topic under consideration. Throughout this Scoping Report (and subsequent EIA Report), the PDE approach has been undertaken to allow meaningful assessments of the Array Project to proceed, whilst still allowing reasonable flexibility for future project design decisions.

3.2.1.4 The PDE is distinct from the Maximum Design Scenarios (MDS) developed for the EIA Report. The PDE describes a range of parameters that apply to a project's technology design scenario (e.g. largest wind turbine option). However, each design parameter set out in this chapter is not considered independently in the EIA Report. The MDS developed for each impact pathway has been taken from the PDE to establish the parameters (or combination of parameters) likely to result in the maximum effect. It does not follow necessarily that the largest parameters set out in this chapter comprise the MDS for any given receptor.

3.3 Offshore Infrastructure

3.3.1.1 The key components of the Array Project are likely to include:

- up to 191 wind turbines and associated support structures and foundations;
- up to 844km of inter-array cables and up to 751km of inter-connector cables;
- up to 11 Offshore Substation Platforms (OSPs) and associated support structures and foundations.

3.3.1.2 The requirements for each design aspect are summarised in the following sections.

3.3.2 Wind Turbines

3.3.2.1 The Array Project will comprise up to 191 wind turbines. The final layout of the wind turbines will be confirmed post-consent at the detailed design stage.

3.3.2.2 The maximum blade tip height (metres (m) above Lowest Astronomical Tide (LAT)) is expected to be no greater than 390m, with a maximum rotor diameter (m) of 350m and a minimum blade tip height (m above LAT) of 30m. The PDE for the wind turbines is presented in Table 3.1 and a schematic of a typical offshore wind turbine is illustrated in Figure 3.1.

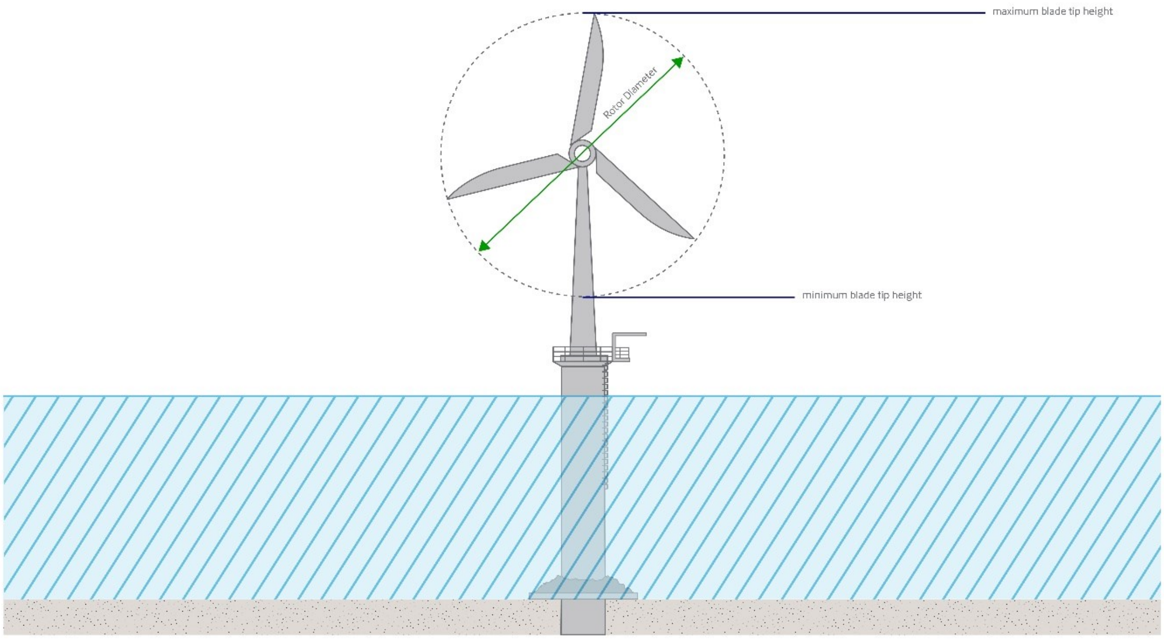


Figure 3.1: Illustrative wind turbine design

3.3.2.3 The specifics of the lighting and navigation markings on the wind turbines will be discussed with consultees post-Application.

Table 3.1: Project Design Envelope for the Array Project's wind turbines

Parameter	Maximum/Minimum Design Parameter
Maximum number of wind turbines	191
Maximum blade tip height (m) above Lowest Astronomical Tide (LAT)	390
Minimum blade tip height (m above LAT)	30
Maximum hub height (m above LAT)	218
Maximum rotor diameter (m)	350
Minimum turbine spacing (m)	1,000

3.3.3 Offshore Substation Platforms (OSPs)

3.3.3.1 The Array Project may require up to 11 OSPs within the Scoping Boundary. These OSPs can be divided into two types: HVAC (High Voltage Alternating Current) collector substations and HVDC (High Voltage Direct Current) converter substations. The need of these and the specifications of each OSP will depend on the final electrical set up for the wind farm. Figure 3.2 illustrates a typical design of an offshore substation platform with the topside placed on a piled jacket foundation. Alternatively, the OSP topsides could be placed on monopile foundations, suction bucket jacket foundations or gravity base foundations.

3.3.3.2 The locations of the OSPs will be determined during the design phase. All OSPs will be marked for aviation and navigation purposes. The PDE for OSPs is presented in Table 3.2.

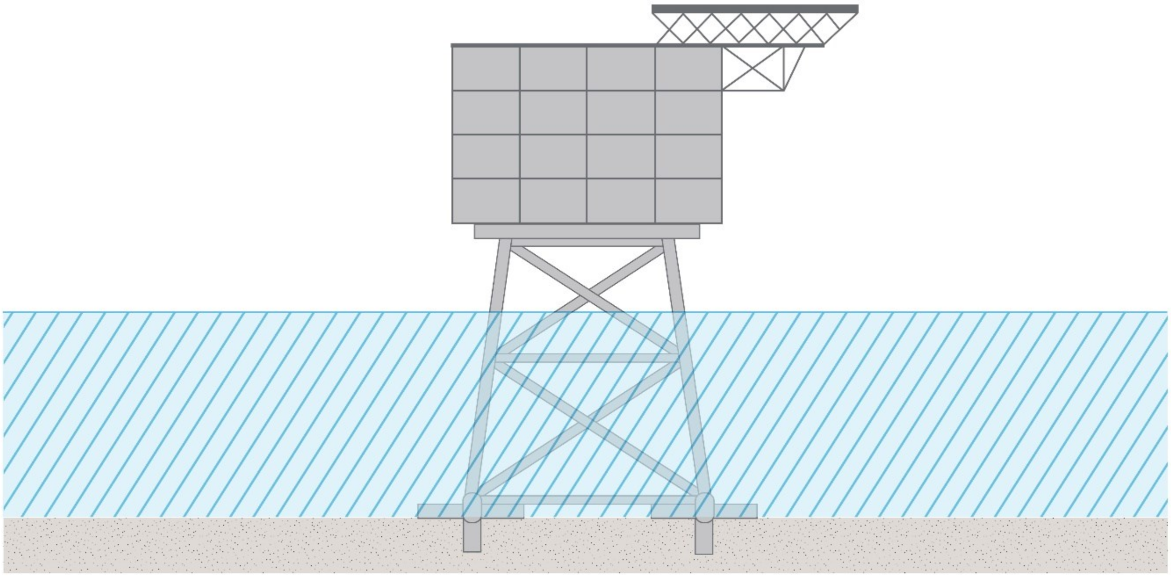


Figure 3.2: Illustrative offshore substation platform on a piled jacket foundation

Table 3.2: Project Design Envelope for offshore substation platforms

Parameter	Maximum Design Parameter for HVAC Collector Substations	Maximum Design Parameter for HVDC Converter Substations
Number of Platforms (OSPs)	8	3
Main structure height above LAT (m)	70	100
Topside length (m)	80	240
Topside width (m)	60	180

3.3.4 Foundations and Support Structures

3.3.4.1 Several foundation types will be considered for the Array Project wind turbines and OSPs:

- monopile foundations;
- gravity base foundations;
- piled jacket foundations (three or four legs for wind turbines; three, four or six legs for OSPs);
- suction bucket jacket foundations (three or four legs for wind turbines; three, four or six legs for OSPs).

3.3.4.2 The foundation type selected will depend on the environmental and pre-construction site investigation surveys and on the wind turbine selected. The foundations will be fabricated offsite, stored at a port facility or alternative dry or wet storage and transported to the Scoping Boundary for installation by specialist vessels. This section provides an overview of the design parameters associated with each proposed foundation type for both wind turbines and OSPs.

3.3.4.3 Wind turbine foundations and OSP foundations may be installed concurrently.

Monopile Foundations

3.3.4.4 Monopile foundations consist of a single steel tubular section and can come with or without a transition piece (TP). There may be ladders, a crane, and other components to facilitate boat landings, or connection to the tower (Table 3.3). The TP or upper part of the monopile is typically painted yellow and marked according to relevant regulatory guidance.

3.3.4.5 Depending on soil conditions and monopile size, monopile foundations are most likely to be piled by hydraulic hammers, vibrated, or drilled and grouted. In areas of rough seabed, drilling may aid the piling process, with drilling spoil disposed of at the drill site. The installation will be done from jack-up or floating vessels/barges with the required equipment. The equipment can operate above or below the sea surface.

3.3.4.6 Up to two monopiles may be installed in a 24-hour period, with the MDS being concurrent installation of the two monopiles. A 'soft start' procedure will be employed whereby the hammer strikes will commence from 15% of the maximum hammer energy up to 100% of the maximum hammer energy (if required). The underwater sound assessments will determine the need for noise mitigation. The PDE for monopile foundations is shown in Table 3.3 and an illustrative monopile foundation is shown in Figure 3.3.

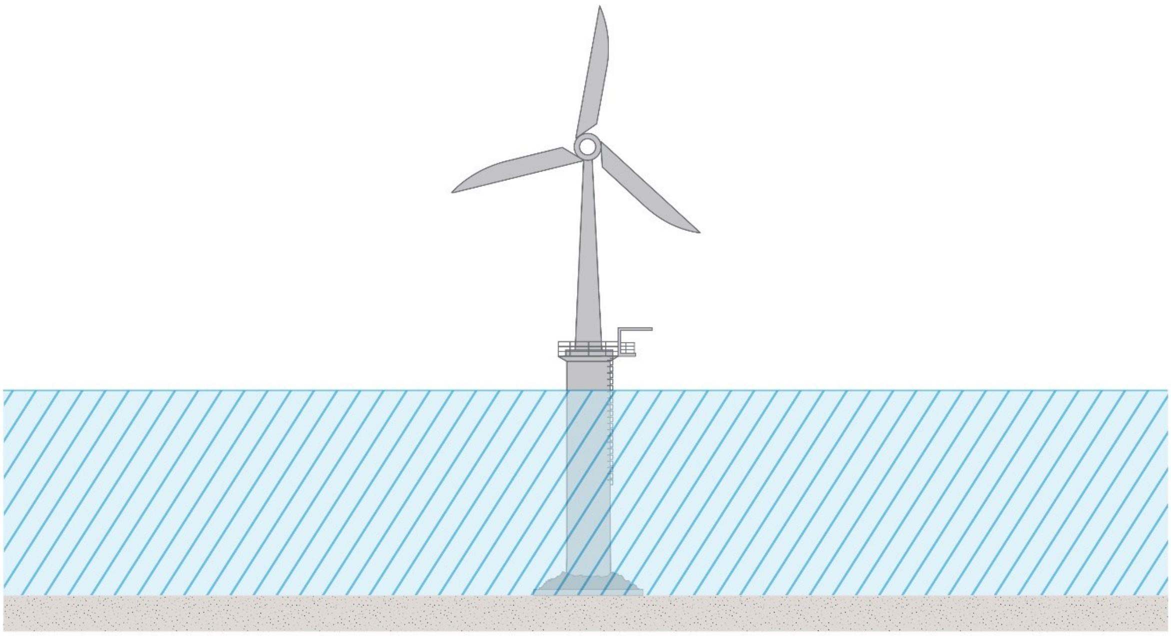


Figure 3.3: Illustrative monopile foundation design

Table 3.3: Project Design Envelope for monopile foundations

Parameter	Maximum design parameter for wind turbines	Maximum design parameter for OSPs
Number of piles requiring piling	191	26
Pile diameter (m)	19	19
Hammer energy (kJ)	7,500	7,500
Pile penetration depth (m)	70	70
Seabed footprint per pile (m^2)	300	300
Scour protection material (type)	Layers of graded stones, rock filled mesh fibre bags, pre-cast concrete block mattresses, polypropylene fronds mattresses secured by weighted perimeter or anchors.	Layers of graded stones, rock filled mesh fibre bags, pre-cast concrete block mattresses, polypropylene fronds mattresses secured by weighted perimeter or anchors

Parameter	Maximum design parameter for wind turbines	Maximum design parameter for OSPs
Total seabed footprint including scour protection (m^2) (per structure/location)	5,800	13,800

Gravity Foundations

3.3.4.7 Gravity foundations are ballast weights with a conical caisson built around a monopile, (Figure 3.4) which hold structures to the seabed and eliminate the requirement for drilling or piling, unless ground reinforcements with piles or suction buckets would be required to stabilise the seabed. In case of the latter, the numbers and dimensions of piles or suction buckets will not exceed the values given for piled jacket foundations or suction bucket jacket foundations. The seabed is dredged and primed with bedding material (e.g. crushed rock) to stabilise the foundation prior to installation, with excavated material disposed of on site. The PDEs for conical gravity foundations for wind turbines and HVAC collector substations are listed in Table 3.4.

3.3.4.8 Note, HVDC converter substations will not be developed via a gravity base with conical caisson and instead may be developed with gravity foundations built around a rectangular support structure, as outlined below.

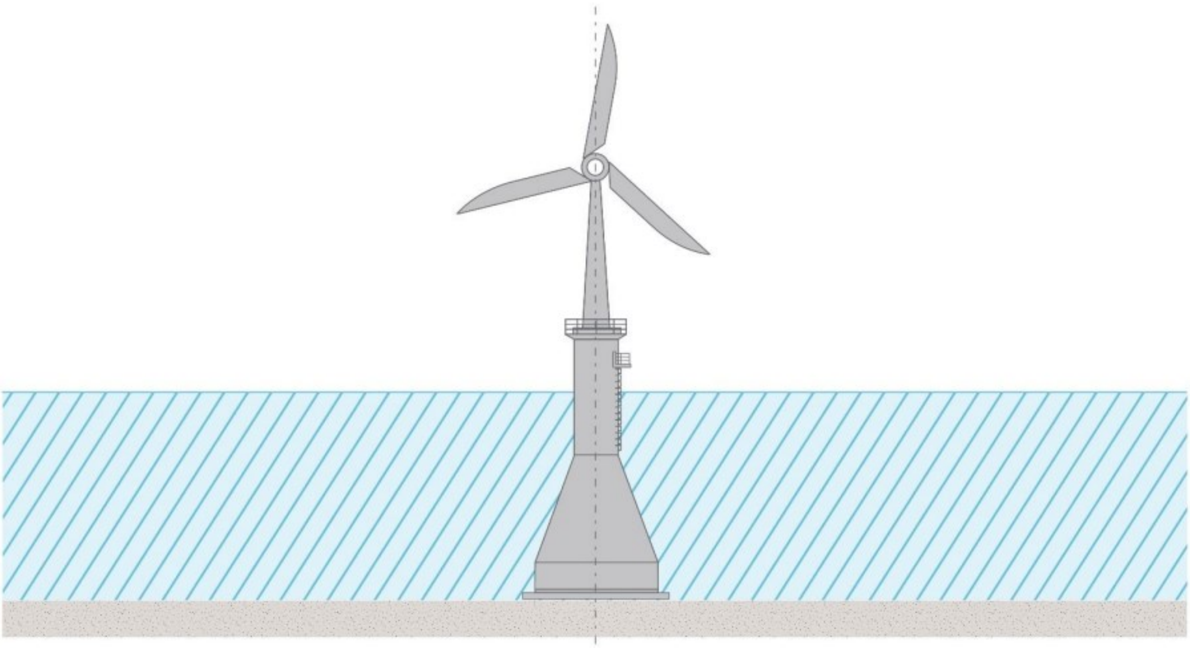


Figure 3.4: Illustrative conical gravity base foundation

Table 3.4: Project Design Envelope for conical gravity base foundations for wind turbines and HVAC collector substations

Parameter	Maximum design parameter for wind turbines	Maximum design parameter for HVAC Collector Substations
Number of gravity base foundations	191	8
Foundation diameter at seabed (m)	63	63
Seabed footprint per gravity base foundation (m^2)	3,200	3,200
Scour protection material (type)	Layers of graded stones, rock filled mesh fibre bags, pre-cast concrete block mattresses, polypropylene fronds	Layers of graded stones, rock filled mesh fibre bags, pre-cast concrete block mattresses, polypropylene fronds

Parameter	Maximum design parameter for wind turbines	Maximum design parameter for HVAC Collector Substations
	mattresses secured by weighted perimeter or anchors.	mattresses secured by weighted perimeter or anchors.
Diameter scour protection footprint (m) per gravity base foundation	230	230
Total seabed footprint including scour protection (m^2) (per gravity base foundation)	40,300	40,300

3.3.4.9 For large OSPs such as the HVDC converter substations, gravity base foundations may be ballast weight built around a rectangular support structure with up to six legs (Figure 3.5). This eliminates the requirement for drilling or piling, unless ground reinforcements with piles or suction buckets would be required to stabilise the seabed. In case of the latter, the numbers and dimensions of piles or suction buckets will not exceed the values given for piled jacket foundations or suction bucket jacket foundations. The seabed is dredged and primed with bedding material (e.g. crushed rock) to stabilise the foundation prior to installation, with excavated material disposed of on site. The PDE for gravity foundations for HVDC converter substations can be found in Table 3.5.

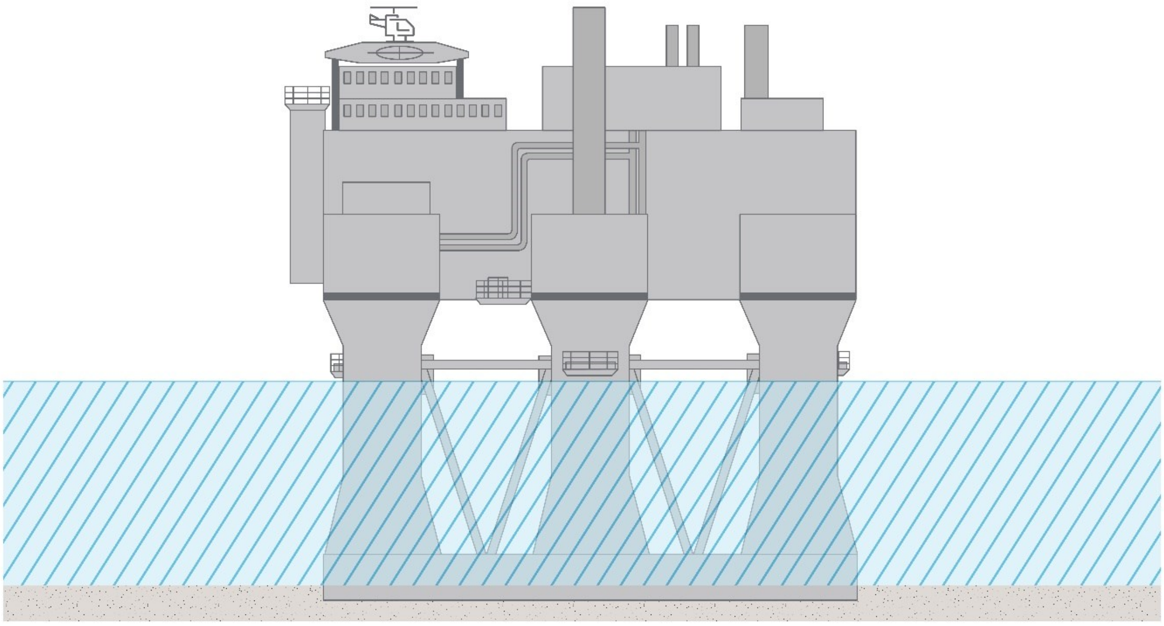


Figure 3.5: Illustrative rectangular gravity base foundation

Table 3.5: Project Design Envelope for rectangular gravity base foundations for HVDC converter substations

Parameter	Maximum design parameter for HVDC converter substations
Number of gravity base foundations	3
Foundation dimensions at seabed (m)	180 x 240 (rectangular)
Seabed footprint per gravity base foundation (m^2)	43,200
Scour protection material (type)	Layers of graded stones, rock filled mesh fibre bags, pre-cast concrete block mattresses, polypropylene fronds mattresses secured by weighted perimeter or anchors.
Dimension of scour protection footprint (m) per gravity base foundation	230 x 290 (rectangular)
Total seabed footprint including scour protection (m^2) (per gravity base foundation)	66,700

Piled Jacket Foundations

3.3.4.10 Piled jacket foundations are steel lattice constructions (comprising steel tubular members and welded joints) which support wind turbines or OSPs and are secured to the seabed by pin piles. The steel tubular pin piles are typically narrower than monopiles and will most likely be piled by hydraulic hammers, vibrated, or drilled into the seabed (Figure 3.6).

3.3.4.11 Pin piles may be installed concurrently for wind turbines and OSPs, with the MDS assuming concurrent installation at two locations. A 'soft start' procedure will be employed, whereby the hammer strikes will commence from 15% of the maximum hammer energy up to 100% of the maximum hammer energy (if required). The PDE for piled jacket foundations for wind turbines (three and four legs) is provided in Table 3.6 and for OSPs (three, four and six legs) in Table 3.7.

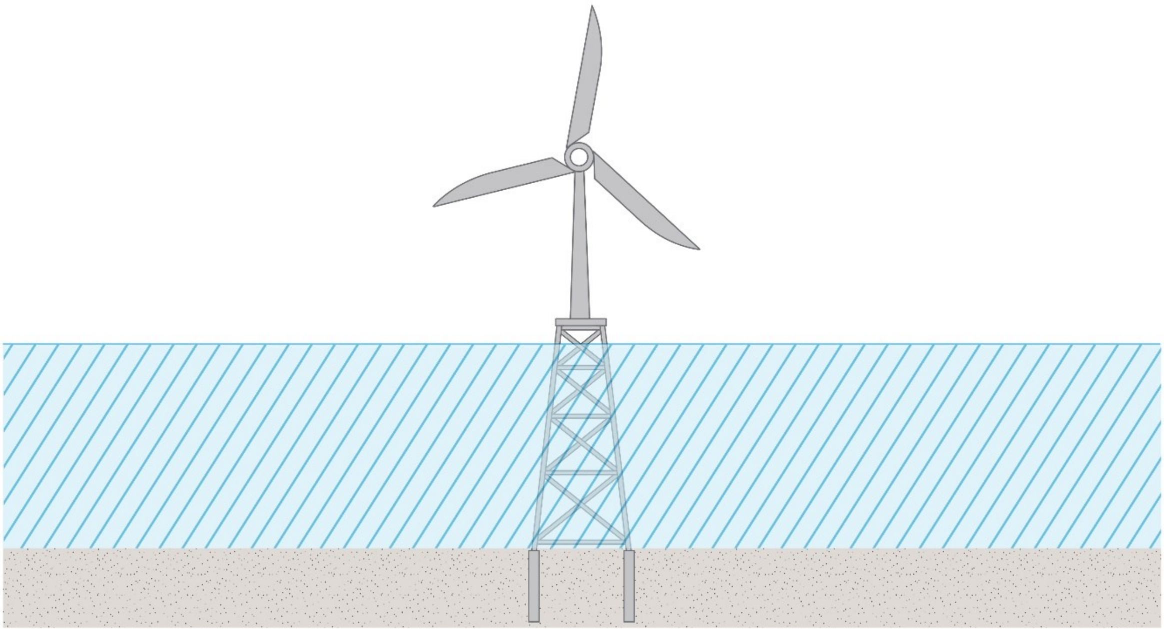


Figure 3.6: Illustrative pin pile jacket foundation design

Table 3.6: Project Design Envelope for wind turbines with pin pile jacket foundations

Parameter	Maximum design parameter (3-legged)	Maximum design parameter (4-legged)
Number of piled jacket foundations	191	191
Diameter of jacket leg (m)	5.3	5.1
Number of piles per leg	3	3
Diameter of pin piles (m)	6.2	6.0
Seabed footprint per jacket foundation (m^2)	300	400
Number of concurrent piling events	2	2
Hammer energy (kJ)	4,300	4,200
Scour protection material (type)	Layers of graded stones, rock filled mesh fibre bags, pre-cast concrete block mattresses, polypropylene fronds mattresses secured by weighted perimeter or anchors	Layers of graded stones, rock filled mesh fibre bags, pre-cast concrete block mattresses, polypropylene fronds mattresses secured by weighted perimeter or anchors
Total seabed footprint including scour protection and mud mats (m^2) (per foundation)	7,000	9,300

Table 3.7: Project Design Envelope for OSPs with pin pile jacket foundations

Parameter	Maximum design parameter (3-legged)	Maximum design parameter (4-legged)	Maximum design parameter (6-legged)
Number of piled jacket foundations	8	11	11
Diameter of piled jacket leg (m)	5.3	5.3	5.0
Number of piles per leg	4	4	4
Diameter of pin piles (m)	4.5	5.0	5.0
Seabed footprint per piled jacket foundation (m^2)	440	580	740
Number of concurrent piling events	2	2	2
Hammer energy (kJ)	3,200	3,600	3,600
Scour protection material (type)	Layers of graded stones, rock filled mesh fibre bags, pre-cast concrete block mattresses, polypropylene fronds mattresses secured by weighted perimeter or anchors	Layers of graded stones, rock filled mesh fibre bags, pre-cast concrete block mattresses, polypropylene fronds mattresses secured by weighted perimeter or anchors	Layers of graded stones, rock filled mesh fibre bags, pre-cast concrete block mattresses, polypropylene fronds mattresses secured by weighted perimeter or anchors
Total seabed footprint including scour protection and mud mats (m^2) (per piled jacket foundation)	5,000	9,900	16,900

Jacket Foundations with Suction Buckets

3.3.4.12 Jacket foundations with suction buckets are steel lattice constructions (comprising tubular steel members and welded joints) fixed to the seabed by suction buckets installed below each leg of the jacket. The suction buckets are typically hollow steel cylinders, capped at the upper end and do not require a hammer or drill for installation (illustrated in Figure 3.7).

3.3.4.13 At the installation site, the jacket foundations would be lowered by crane to the seabed and water would be pumped from the bucket to suction it to the seabed. Once the bucket has penetrated the seabed to the expected depth of 25m, the pump is turned off. A thin layer of grout is then injected under the top side of the bucket to fill the void and ensure contact between the soil within the bucket, and the top of the bucket itself.

3.3.4.14 The Applicant proposes jackets with three and four legs for wind turbine foundations (Table 3.8) along with three, four, and six legs for OSP foundations (Table 3.9).

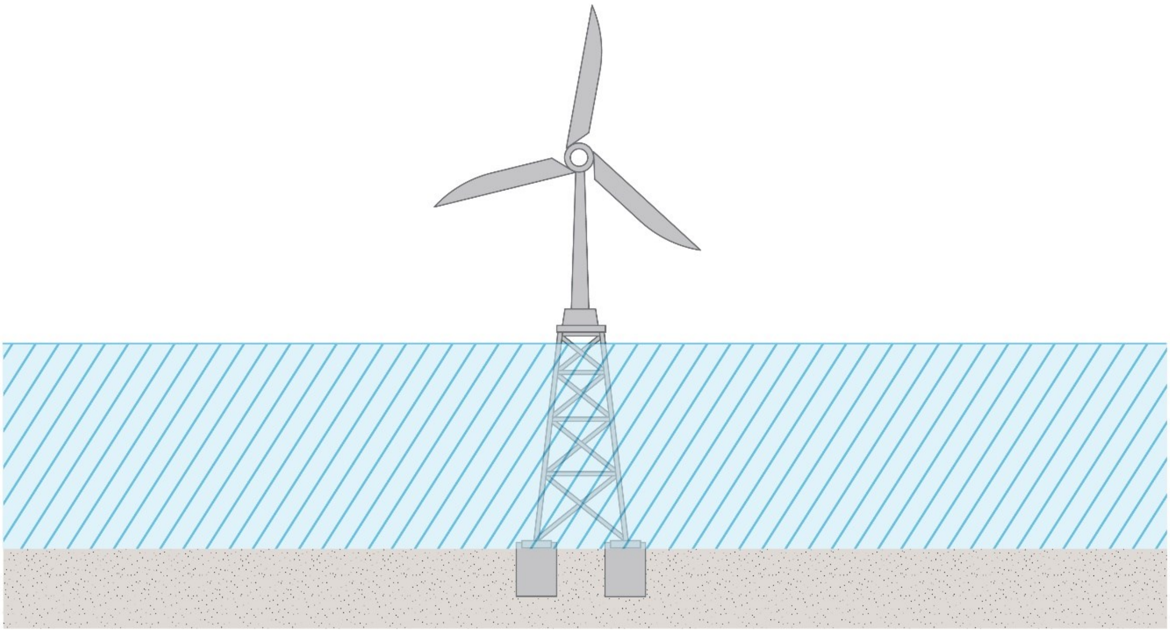


Figure 3.7: Illustrative design of jacket with suction buckets

Table 3.8: Project Design Envelope for wind turbines with suction bucket jacket foundations

Parameter	Maximum design parameter (3-legged)	Maximum design parameter (4-legged)
Number of suction bucket jacket foundations	191	191
Suction bucket diameter (m)	20	20
Diameter of jacket leg (m)	5.3	5.1
Expected bucket penetration depth (m)	25	25
Seabed footprint per jacket foundation (m^2)	950	1,300
Scour protection material (type)	Layers of graded stones, rock filled mesh fibre bags, pre-cast concrete block mattresses, polypropylene fronds mattresses secured by weighted perimeter or anchors	Layers of graded stones, rock filled mesh fibre bags, pre-cast concrete block mattresses, polypropylene fronds mattresses secured by weighted perimeter or anchors
Total seabed footprint including scour protection (m^2) (per foundation)	14,600	16,900

Table 3.9: Project Design Envelope for OSPs with suction bucket jacket foundations

Parameter	Maximum design parameter (3-legged)	Maximum design parameter (4-legged)	Maximum design parameter (6-legged)
Number of suction bucket jacket OSP foundations	8	11	11
Suction bucket jacket diameter (m)	20	20	18
Diameter of suction bucket jacket leg (m)	5.3	5.3	5.0
Expected bucket penetration depth (m)	25	25	25
Seabed footprint per suction bucket jacket foundation (m^2)	950	1,300	1,600

Parameter	Maximum design parameter (3-legged)	Maximum design parameter (4-legged)	Maximum design parameter (6-legged)
Scour protection material (type)	Layers of graded stones, rock filled mesh fibre bags, pre-cast concrete block mattresses, polypropylene fronds mattresses secured by weighted perimeter or anchors	Layers of graded stones, rock filled mesh fibre bags, pre-cast concrete block mattresses, polypropylene fronds mattresses secured by weighted perimeter or anchors	Layers of graded stones, rock filled mesh fibre bags, pre-cast concrete block mattresses, polypropylene fronds mattresses secured by weighted perimeter or anchors
Total seabed footprint including scour protection (m^2) (per suction bucket jacket foundation)	14,300	22,500	26,600

3.3.5 Seabed Preparation

3.3.5.1 Seabed preparation will be required prior to foundation and cable installation. Seabed preparation may include seabed levelling, and removing surface and subsurface debris such as boulders, fishing nets or lost anchors. If debris is present below the seabed surface, then excavation may be required for access and removal.

3.3.5.2 A dedicated Unexploded Ordnance (UXO) survey and a risk strategy will seek to reduce UXO risk. UXO may be avoided via re-routing, micro-siting, or cleared via identification and removal methodologies. Regarding inter-array cables and inter-connector cables, the UXO clearance corridor will include a 20m buffer to each side of the 20m corridor (given as width of seabed corridor (disturbance) from installation tool in Table 3.10 and Table 3.11).

3.3.6 Scour Protection

3.3.6.1 The wind turbine and OSP foundation structures may be susceptible to seabed erosion and 'scour hole' formation due to natural hydrodynamic and sedimentary processes. The development of scour is influenced by the shape of the foundation structure, seabed sedimentology and site specific Metocean conditions e.g. currents and current direction.

3.3.6.2 Scour may be mitigated with the use of scour protection. The scour protection requirements vary according to soil conditions and foundation types considered. Scour protection may include:

- layers of graded stones;
- rock filled mesh fibre bags;
- pre-cast concrete block mattresses;
- polypropylene fronds mattresses secured by weighted perimeter or anchors.

3.3.7 Inter-Array Cables

3.3.7.1 Inter-array cables (IAC) will carry electrical current produced by the wind turbines to the OSPs. Several wind turbines are typically grouped on the same cable 'string' to connect the wind turbines to an OSP, with multiple cable 'strings' connecting back to each OSP. Depending on the final design of the array cable layout, there may be an IAC back link introduced to connect wind turbines at the end of two strings, allowing for partial rerouting of power in case of cable failure. The inter-array cables will be buried wherever possible. Where burial is not achievable (for example, when the cable crosses existing cables, pipelines, or bedrock, or at the entry to the foundation) cables will be protected with rock dumping, rock bags, mattresses secured by weighted perimeter or anchors, Cable Protection Systems, and/or bend restrictors/stiffeners.

3.3.7.2 Inter-array cables may be installed by pre-lay plough, plough, trenching, cutting and/or jetting. Each technique involves the displacement of sediments by mechanical tools or water jets on or above the seabed, which enable the cable to be lowered into a trench below the seabed. The PDE for inter-array cables is shown in Table 3.10.

Table 3.10: Project Design Envelope for inter-array cables

Parameter	Maximum design parameter
Inter-array cable length (km)	844
External cable diameter (mm)	299
Number of cables	205
Target burial depth (m)	1
Width of seabed corridor (disturbance) from installation tool (m)	20
Total area of seabed disturbance for inter-array cables (km^2)	17
Cable protection material (type)	Burial, rock dump, rock bags, mattressing, CPS, bend restrictors/stiffeners
Cable protection height x width (m)	3 x 10

3.3.8 Inter-connector Cables

3.3.8.1 Inter-connector cables will connect the OSPs to other OSPs within the Scoping Boundary. Inter-connector cables will be buried wherever possible. Where burial is not achievable (for example, when the cable crosses existing cables, pipelines, or bedrock, or at the entry to the foundation) cables will be protected with rock dumping, rock bags and or mattresses secured by weighted perimeter or anchors, Cable Protection Systems, and/or bend restrictors/stiffeners.

3.3.8.2 Inter-connector cables will be installed by the same methods proposed for inter-array cables in section 3.3.7.2. The PDE for inter-connector cables is provided in Table 3.11.

Table 3.11: Project Design Envelope for inter-connector cables

Parameter	Maximum design parameter
Number of inter-connector cables within OWF array	30
External cable diameter (mm)	322
Total length of inter-connector cables (km)	751
Target burial depth (m)	1
Width of seabed corridor (disturbance) from installation tool (m)	20
Total area of seabed disturbance for inter-connector cable route (km^2)	15
Cable protection material (type)	Burial, rock dump, rock bags, mattressing, CPS, bend restrictors/stiffeners
Cable protection height x width (m)	3 x 10

3.4 Construction

3.4.1.1 The construction of the Array Project is estimated to occur over a duration of up to seven years. Table 3.12 provides an indication of the expected major construction activities.

Table 3.12: Indicativeconstruction activities for the Array Project

Activity	Description
Pre-construction surveys	Geotechnical and geophysical surveys, boulder and UXO surveys
Seabed preparation activities	Seabed preparation activities (e.g., rock picking, sand wave leveling and clearance (prelay plough/dredging), pre-lay grapnel run (PLGR), UXO clearance, and removal of third party or out of service cables) to aid installation of wind turbine and OSP foundations, inter-array cables and inter-connector cables.

Activity	Description
Foundations installation	Installation of wind turbine and OSP foundations.
Offshore substation platform installation and commissioning	Installation of OSPs and associated equipment required forthis infrastructure, including commissioning.
Inter-connector cables installation	Installation of inter-connector cables, connecting OSPs to OSPs.
Inter-array cables installation	Installation of inter-array cables, connecting wind turbines to wind turbines or to OSPs throughout the Scoping Boundary.
Wind turbine installation and commissioning	Installation of the wind turbines onto the previously installed wind turbine foundations, including commissioning.
Post-construction as-built surveys	Surveys to document what has been constructed.

3.4.1.2 The construction of the Array Project will be supported by various construction vessels, including but not limited to main installation and support vessels, tug/anchor handlers, cable lay installation and support vessels, heavy lift vessels, supply vessels, jack-up vessels, guard vessels, survey vessels, seabed preparation vessels, crew transfer vessels, scour protection installation vessels and cable protection installation vessels.

3.4.1.3 A maximum of 166 construction vessels and 12 helicopters could be used on site at any one time during the construction phase.

3.4.1.4 Wind turbines, foundations, and offshore structures will be produced on land and transported to the Scoping Boundary via installation vessels. At the Scoping Boundary, various foundations will be installed. The wind turbine towers are typically set in place first, followed by the nacelle and blades. Once fully installed and connected through relevant cables, testing will start to begin the commissioning process.

3.5 Operations and Maintenance

3.5.1.1 Throughout the lifetime of the Array Project, routine and non-routine O&M works will be undertaken. Routine maintenance activities may include inspections, removal of marine growth build up, minor repairs, cleaning activities, and the replacement of consumables and corrosion protection systems. Non-routine major maintenance activities may include component exchanges and replacement of infrastructure and equipment (e.g. wind turbine blades, gearboxes and inter-connector and inter-array cables), scour protection and cable protection replenishment or replacement, cable reburial and cable repair activities, painting and other coating works, replacement of access ladders, and geophysical survey.

3.5.1.2 Up to 3,545 return vessel trips per year are estimated for the Array Project's O&M phase, including crew transfer vessels, jack-up vessels, cable repair vessels, service operation vessels, excavators or backhoe dredgers, and other similar vessel. Helicopters may also be used to transport personnel and equipment. Additionally, drones may be used e.g. for inspections or to transport equipment.

3.5.1.3 The details of estimated annual and total O&M activities will be specified within the EIA Report.

3.6 Decommissioning and Repowering

3.6.1.1 Under Section 105 of the Energy Act 2004 (as amended), developers of offshore renewable energy projects are required to prepare a decommissioning programme for approval by Scottish Ministers. Regulators will issue a Section 105 notice to developers post issue of the consent or marine licence for the given development. The offshore renewable energy developer is required to subsequently provide a detailed plan of decommissioning works, which includes an overview of the anticipated cost and financial securities. This plan should adhere to good industry practice, guidance and legislation relating to decommissioning at that time. The plan will be consulted on by an approved set of stakeholders and will be publicly available.

3.6.1.2 The EIA Report will present an overview of the anticipated decommissioning events and an assessment of the potential significant effects of this phase on receptors.

3.6.1.3 It is also possible that the lifetime of the Array Project's generation assets is extended through repowering, subject to the relevant consenting and licensing regime prevailing at that time.

3.7 Designed In Measures and Mitigation

3.7.1.1 There are three different forms of designed in measures and mitigation described by Institute of Environmental Management and Assessment (IEMA) (2016).

- Primary mitigation (inherent): "Modification to the location or design of the development made during the pre-application phase that are an inherent part of the project, and do not require additional action to be taken" (IEMA, 2016).
- Secondary mitigation (foreseeable): "Actions that will require further activity in order to achieve the anticipated outcome. These may be imposed as part of the planning consent, or through inclusion in the ES" (IEMA, 2016).
- Tertiary mitigation (inexorable): "Actions that would occur with or without input from the EIA feeding into the design process. These include actions that will be undertaken to meet other existing legislative requirement, or actions that are considered to be standard practices used to manage commonly occurring environmental effects" (IEMA, 2016).

3.7.1.2 Through the incorporation of appropriate designed in measures, the Applicant's commitment to implementing the identified measures is demonstrated. These are referred to as designed in measures throughout this Scoping Report and the subsequent Array EIA Report.

3.7.1.3 The designed in measures of the Array Project are described, justified and categorised (according to IEMA guidance) in the relevant chapters of this Scoping Report, in the 'designed in measures and mitigation' sections. A full table of designed in measures is also provided in Appendix 2 to this report. These measures may include those developed as part of the project design, industry standard measures committed to by the Applicant, or measures that are required by law.

4 EIA Methodology

4.1 Introduction

4.1.1.1 This chapter presents the methodology for the identification and evaluation of likely significant environmental effects from the Array Project, including potential cumulative, inter-related and transboundary effects. A systematic, auditable and evidence-based approach will evaluate and interpret potential effects on physical, biological and human environment receptors. The Environmental Impact Assessment (EIA) process can be understood as three stages that lead to Application; scoping, consultation and EIA Report preparation.

4.2 Scoping

4.2.1.1 Scoping is the process of identifying the issues to consider within the EIA Report (establishing the scope of the assessment). Figure 4.1 highlights the key inputs to the scoping process. Initially, a project description and the maximum design parameters of project components with an understanding of the receiving environment will indicate likely interactions. The nature of these can be clarified through further assessment, reference to guidance, good practice and consultation.

Figure 4.1: Overview of the scoping process

4.2.1.2 This Scoping Report presents the findings of the scoping process undertaken to date and sets out the proposed methodologies for carrying out the EIA. The process of scoping identifies the potential impacts that are proposed to be considered within the EIA process for the Array Project. Each topic area is considered, setting out the proposed scope of assessment and identifying any sub-topics that are proposed to be scoped out of the assessment (where no significant effects are considered likely).

4.3 Legislation and Guidance

4.3.1.1 In addition to the relevant EIA legislation in chapter 2: Policy and Legislation, of the EIA Report, topic-specific methodologies and guidance will be drawn on, as appropriate, within the topic chapters. The EIA methodology will draw upon the following general EIA principles, regulations, and guidance:

- Scottish Government Planning Advice Note 1/2013: Environmental Impact Assessment (Scottish Government, 2013);
- Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater and Coastal (CIEEM, 2018);
- Institute of Environmental Management and Assessment (IEMA) Environmental Impact Assessment Guide to Shaping Quality Development (IEMA, 2016);
- A Handbook on Environmental Impact Assessment, Version 5 (SNH, 2018);
- Assessing the Cumulative Impact of Onshore Wind Energy Developments (NatureScot, 2021).

4.4 Key Principles of the Assessment

4.4.1 Overview

4.4.1.1 The EIA will assess the potential for impacts to arise during the construction, O&M and decommissioning phases of the Array Project. The assessment of effects for each environmental topic (as listed in chapter 1: Introduction of the Scoping Report) will form a separate chapter of the offshore wind farm (OWF) EIA Report. For each environmental topic, the following will be addressed:

- identification of the study area(s) for the topic-specific assessments;
- description of the relevant planning policy and guidance;
- summary of consultation;
- description of the environmental baseline conditions;
- presentation of the assessment of effects, including the identification of:
  - the MDS for each effect considered;
  - the measures adopted, including design measures which prevent, reduce or offset potential effects;
  - assessment of the significance of identified effects;
  - identification of any further mitigation measures required in respect of likely significant effects, together with consideration of any residual effects;
  - identification of any future monitoring;
  - assessment of any cumulative effects with other major developments, including those that are proposed[2], consented and under construction (including, where applicable, those projects, plans or activities that are currently operational that were not operational when baseline data was collected or that have an ongoing effect);
  - assessment of any transboundary effects (i.e. effects on European Economic Area (EEA) states).

4.4.1.2 Inter-related effects (i.e. inter-relationships between environmental topic areas) will be assessed in a separate standalone chapter of the Scoping Report.

4.4.1.3 Within each topic chapter a number of key principles will be applied and these are detailed in the following sections.

[2] As defined in four tier system in the CEA methodology (see Figure 4.2).

4.4.2 Proportionate EIA

4.4.2.1 The EIA should be robust but proportionate to the scale or complexity of the project under consideration. The level of environmental assessment necessary is a matter of professional judgement, but there are tools and processes to ensure likely significant effects are identified and addressed appropriately. The Applicant is committed to information sharing at the sector scale and consultation to promote evidence-based practice and avoid the use of over-precautionary data where knowledge is not easily accessible.

4.4.3 Maximum Design Scenario Approach

4.4.3.1 As described in chapter 3: Project Description of the Scoping Report, the Array Project will apply the PDE approach, also known as the Rochdale Envelope. This approach allows for a project to be assessed on the basis of maximum project design parameters (i.e. the realistic MDS) in order to provide flexibility, while ensuring all potentially significant effects are assessed within the EIA process and reported in the EIA Report. Those parameters include a range of potential values.

4.4.3.2 This approach will be taken for the EIA because it is not possible to provide precise final design details for the Array Project before procurement of infrastructure. Additionally, the Array Project has yet to undertake its consultation process and receive feedback from statutory and non-statutory stakeholders. This will allow the Applicant to fully understand any potential significant impacts that need to be mitigated/managed, which will aid the refinement of the final application. Offshore wind is a constantly evolving industry; therefore, improvements in technology and construction methodologies occur frequently and an unnecessarily prescriptive approach could preclude the adoption of new technology and methods.

4.4.3.3 For each of the impacts to be assessed in the topic-specific EIA chapters, the MDS will be identified from the range of potential options for each parameter in the PDE. The MDS assessed is, therefore, the scenario that would give rise to the greatest potential impact. For example, where several wind turbine options are included in the design, then the assessment of the Array Project would be based on the wind turbine option predicted to have the greatest impact. This may be the wind turbine option with the largest footprint, the greatest tip height or the largest area of seabed disturbance during construction, depending on the topic under consideration. Through the identification of the MDS for any given impact, it can be concluded that the impact (and, therefore, the effect) will be no greater for any other design scenario than that assessed for the MDS. By employing the MDS approach, the Applicant retains some flexibility in the design of the Array Project and associated infrastructure, within certain maximum parameters which are assessed in the EIA. All assumptions regarding the PDE will be clearly set out within the project description chapters of the EIA Report and within the topic chapters.

4.4.4 Measures Envisaged to Avoid, Prevent, Reduce or Offset Significant Adverse Effects

4.4.4.1 Designed in measures of the Array Project may include those developed as part of the project design, industry standard measures committed to by the Applicant, or measures which are required by law. Other than for shipping and navigation (that refers to embedded mitigation), EIA mitigation is classified into three types, as per IEMA's Guidance (2016) (see Table 4.1):

Table 4.1: Designed in measures and mitigation

Type		Definition
Primary	Designed in	Measures included as part of the project design. Includes modifications to location or design, integrated into the application for consent. These measures are implemented through the consent itself.
Secondary	Post-design	Foreseeable mitigation which requires further activity, identified through the EIA process. Industry standard measures committed to by the Applicant might include a commitment to implementing post-consent management plans to reduce the

Type		Definition
		significance or likelihood of adverse environmental effects. These measures are also implemented through the consent itself.
Tertiary	Designed in	Inexorable mitigation that will be implemented regardless of the design process and the EIA (i.e. actions that would occur with or without input from the EIA feeding into the design process), e.g. contractor standard industry practices which manage potential nuisance activities or compliance with statutory requirements.

4.4.4.2 The development of mitigation is part of an iterative EIA process, whereby measures are developed throughout the EIA in response to the findings of initial assessments. Impacts are initially assessed to evaluate the significance of environmental effects. If the effect is significantly adverse, changes are made where practicable to the project design to reduce or offset the impact magnitude (i.e. primary mitigation). This process is repeated until the EIA practitioner is satisfied that either:

- the effect is reduced to a level that is not significant in EIA terms; or
- no further primary or secondary mitigation can be applied to reduce the impact magnitude (and hence the significance of the effect). In these cases, an overall effect that is still significant in EIA terms may be presented.

4.4.4.3 Where appropriate, opportunities are explored within the EIA process to develop enhancement measures and to create beneficial effects. The assessment of effects presented within each topic-specific chapter of the EIA Report will take into account all measures adopted to which the Applicant is committed.

4.4.4.4 All designed in measures of the Array Project, together with the means of securing them (e.g. through the submission of post-consent management or via conditions within the marine licence), will be presented within the relevant receptor chapters of the Scoping Report.

4.5 Identification of Impacts and Assessment of Significance

4.5.1 Definitions of Impact and Effect

4.5.1.1 The Array Project has the potential to create a range of impacts and effects on the physical, biological and human environment. For the purposes of the EIA, ‘impact’ is used to define a change that is caused by an action. For example, the piling of wind turbine foundations (action) will result in increased levels of underwater sound (impact). Impacts can be defined as direct, indirect, secondary, cumulative and inter-related. They can also be either adverse or beneficial. In addition, for certain impacts, the reversibility of an impact is relevant to its overall effect. An irreversible (permanent) impact may occur when recovery is not possible, or not possible within a reasonable timescale. In contrast, a reversible (temporary) impact is one where natural recovery is possible over a short time, or where mitigation measures can be effective at reversing the impact.

4.5.1.2 The term ‘effect’ will be used in the EIA to express the consequence of an impact. Considering the foundation piling example, the piling of wind turbine foundations (action) results in increased levels of underwater sound (impact), with the potential to disturb marine mammals (effect).

4.5.1.3 Each topic chapter will consider the magnitude of the impact alongside the sensitivity of the receptor in determining the significance of the effect, in accordance with defined significance criteria.

4.5.2 Defining Magnitude of Impact

4.5.2.1 For each of the impacts assessed in the EIA, a magnitude will be assigned. In assigning magnitude, the spatial extent, duration, frequency and reversibility of the impact will be considered (in line with Schedule 3, section 3, of the 2017 EIA Regulations). For each topic, the magnitude of impact will be categorised into the scale below:

- no change;
- negligible;
- low;
- medium;
- high.

4.5.2.2 Topic-specific definitions for each of these categories will be provided in each of the topic chapters of the EIA Report, based on relevant guidance and specialist knowledge.

4.5.3 Defining Sensitivity of Receptor

4.5.3.1 Receptors are defined as the physical or biological resource or human user group that would be affected by the impacts of an Array Project. Identification of receptors will be informed by available data and the baseline studies completed in the preparation of the EIA.

4.5.3.2 In defining the sensitivity of each receptor, the vulnerability, recoverability and value/importance will be taken into account. The determination of these factors will be specific to each environmental topic and defined within the corresponding chapters of the EIA Report.

4.5.3.3 The sensitivity of each receptor to each impact will then be defined for each topic according to the scale below:

- negligible;
- low;
- medium;
- high;
- very high.

4.5.4 Evaluation of Significance of Effect

4.5.4.1 Effect is the term used to express the consequence of an impact (expressed as the 'significance of effect'). The significance of an effect will be determined by the consideration of the magnitude of impact alongside the sensitivity of the receptor. In order to ensure a consistent approach throughout the EIA, a matrix approach will be adopted to guide topic-specific assessments. An example of such an EIA matrix is given in Table 4.2.

4.5.4.2 By cross-referencing the magnitude of impact with the sensitivity of the receptor, a significance of effect may be assigned for all potential impacts. The significance of effect may be one, or a range of the following:

- no change;
- negligible;
- minor;
- moderate;
- major.

4.5.4.3 These significance levels are defined in Table 4.3.

Table 4.2: Matrix used for assessment of significance, showing the combinations of receptor sensitivity and the magnitude of impact

Sensitivity of Receptor	Magnitude of impact				
	No change	**Negligible**	**Low**	**Medium**	**High**
Negligible	No change	Negligible	Negligible or Minor	Negligible or Minor	Minor
Low	No change	Negligible or Minor	Negligible or Minor	Minor	Minor or Moderate
Medium	No change	Negligible or Minor	Minor	Moderate	Moderate or Major
High	No change	Minor	Minor or Moderate	Moderate or Major	Major
Very High	No change	Minor	Moderate or Major	Major	Major

Table 4.3: Definition of significance levels

Impact	Justification
No change	No loss or alteration of characteristics, features or elements; no observable impact in either direction.
Negligible	No effects or those that are beneath levels of perception, within normal bounds of variation or within the margin of forecasting error.
Minor	These beneficial or adverse effects are generally, but not exclusively, raised as local factors. They are unlikely to be critical in the decision-making process but are important in enhancing the subsequent design of the project.
Moderate	These beneficial or adverse effects have the potential to be important and may influence the decision-making process. The cumulative effects of such factors may influence decision-making if they lead to an increase in the overall adverse or beneficial effect on a particular resource or receptor.
Major	These beneficial or adverse effects are very important and are likely to be material in the decision-making process. These effects are generally, but not exclusively, associated with sites or features of international, national or regional importance. However, a major change in a site or feature of local importance may also enter this category. Effects upon human receptors may also be attributed this level of significance.

4.5.4.4 In general, a significance level of 'moderate' or greater is considered to be a 'significant effect' in the context of the EIA Regulations. However, this will be topic-specific and dependent on relevant practitioner guidance. Therefore, what is considered 'significant' will be clearly defined for each topic chapter of the EIA Report. In cases where a range is suggested for the significance of effect, there remains the possibility that this may span the significance threshold (e.g. if the range is given as 'minor' to 'moderate'). In such cases, the final significance is based upon expert opinion as to which outcome delineates the most likely effect, with an explanation as to why this is the case.

4.6 Addressing Uncertainty

4.6.1.1 There is some degree of uncertainty within the EIA process in relation to future improvements to construction and design (see section 4.4.3). In addition, there is uncertainty in relation to future baseline conditions, such as the potential effects of climate change on existing receptors. There is also a degree of uncertainty in terms of the margin of error within forecasting or modelling tools. The following sections set out the proposed approach to addressing uncertainty. In all cases, where uncertainty exists, this will be identified (and quantified where possible) within the relevant chapter of the EIA Report, together with details of the measures that have been taken to reduce uncertainty as far as reasonably practicable.

4.6.2 Future Baseline and Assessment Years

4.6.2.1 The baseline for the assessment of environmental effects will primarily be drawn from evidence collated during review of desktop data and any site specific environmental surveys. Consideration will also be given to any likely changes between the time of data collection/survey and the future baseline for the construction and O&M of the Array Project.

4.6.2.2 In some cases, these changes may include the construction or operation of other planned developments in the area. Where such developments are built and operational at the time of writing and data collection, these will be considered to form part of the baseline environment. Where sufficient and robust information is available, such as expected traffic growth figures, other future developments will be considered as part of the future baseline conditions. In all other cases, planned future developments will be considered within the assessment of cumulative effects.

4.6.2.3 The consideration of future baseline conditions will be taken into account as far as these are known at the time of writing, including the likely effects of climate change. It is recognised that there will be some element of uncertainty regarding future trends in environmental conditions and climate. Where accepted, methodologies for identifying the likely effects of climate change and other future baseline changes, where relevant, will be considered in the assessment. For example, information available from the UK Climate Projections project (UKCP18) provides information on plausible changes in climate for the UK (Environment Agency and Met Office, 2018) and in published documents such as the UK Climate Change Risk Assessment 2022 (HM Government, 2022) and subsequent updates. Recent published research will also be reviewed to inform judgements on whether specific receptors are susceptible to the effects of climate change. Each topic will also consider the likely evolution of the baseline environment, without the implementation of the Project. The likely evolution of the baseline in the absence of the Array Project will also be considered, in accordance with the EIA Regulations.

4.6.3 Forecasting and Modelling

4.6.3.1 Where forecasting and modelling tools are used, care will be taken to ensure that the tool selected is appropriate for the assessment, taking into account topic-specific good practice and guidance, and available relevant stakeholder feedback. Model assumptions will be described, and calibration will be used to ensure a reasonable degree of accuracy in measurements. In addition, uncertainty will be addressed by undertaking modelling for a number of scenarios and at representative points across the Array Project, where applicable. Topic chapters within the EIA Report will set out measures taken to address any uncertainty with regard to modelling inputs and outputs.

4.7 Cumulative Effects Assessment

4.7.1.1 This section describes the proposed approach to the Cumulative Effects Assessment (CEA) for the Array Project. Cumulative effects are defined as those that result from incremental changes caused by other reasonably foreseeable plans and projects (see para 4.7.3.2) alongside the Array Project. Cumulative effects are, therefore, the combined effects on the same single receptor/resource of the assessed project considered along with the effects from a number of other, different plans and projects. A fundamental requirement of undertaking the CEA is to identify those foreseeable developments or activities (i.e. existing and approved developments) with which the Array Project may interact to produce cumulative effects. Interactions have the potential to arise during the construction, O&M , and decommissioning phases.

4.7.2 CEA Screening Stage

4.7.2.1 The CEA process is divided into a screening stage and an assessment stage. The proposed process is broadly illustrated in Figure 4.2.

4.7.2.2 An extensive list of plans, projects and activities will be prepared to inform the CEA, known as the CEA long list. A process will be followed to methodically and transparently screen the large number of projects and plans that may be considered cumulatively alongside the Array Project. This involves a stepwise process that considers the level of detail available for projects/plans, as well as the potential for interactions to occur on the following basis:

- Data confidence: data confidence is taken into account when screening projects, plans and activities into or out of the CEA. The premise here is that projects, plans and activities with a low level of detail publicly available cannot meaningfully contribute to a CEA and, as such, are screened out. The application of this screening step is consistent with Guiding Principle 7 of the RenewableUK Cumulative Impact Assessment Guidelines (RenewableUK, 2013).
- Conceptual overlap: for a conceptual overlap to occur it must be established that such an impact has the potential to affect the receptor(s) in question, directly or indirectly. In EIA terms this is described as an impact-receptor pathway and is defined here as a conceptual overlap.
- Physical overlap: a physical overlap refers to the ability for impacts arising from the Array Project to overlap with those from other projects/plans on a receptor basis. This means that, in most examples, 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. Exceptions to this exist for certain mobile receptors that may move between, and be subject to, two or more separate physical extents of impact from two or more projects.
- Temporal overlap: in order for a cumulative effect to arise from two or more projects, a temporal overlap of impacts arising from each must be established. It should be noted that some impacts are active only during certain phases of development, such as piling noise during construction. In these cases, it is important to establish the extent to which an overlap may occur between the specific phase of the Array Project and other projects/plans. The absence of a strict overlap, however, may not necessarily preclude a cumulative effect as receptors may become further affected by additional, non-temporally overlapping projects.

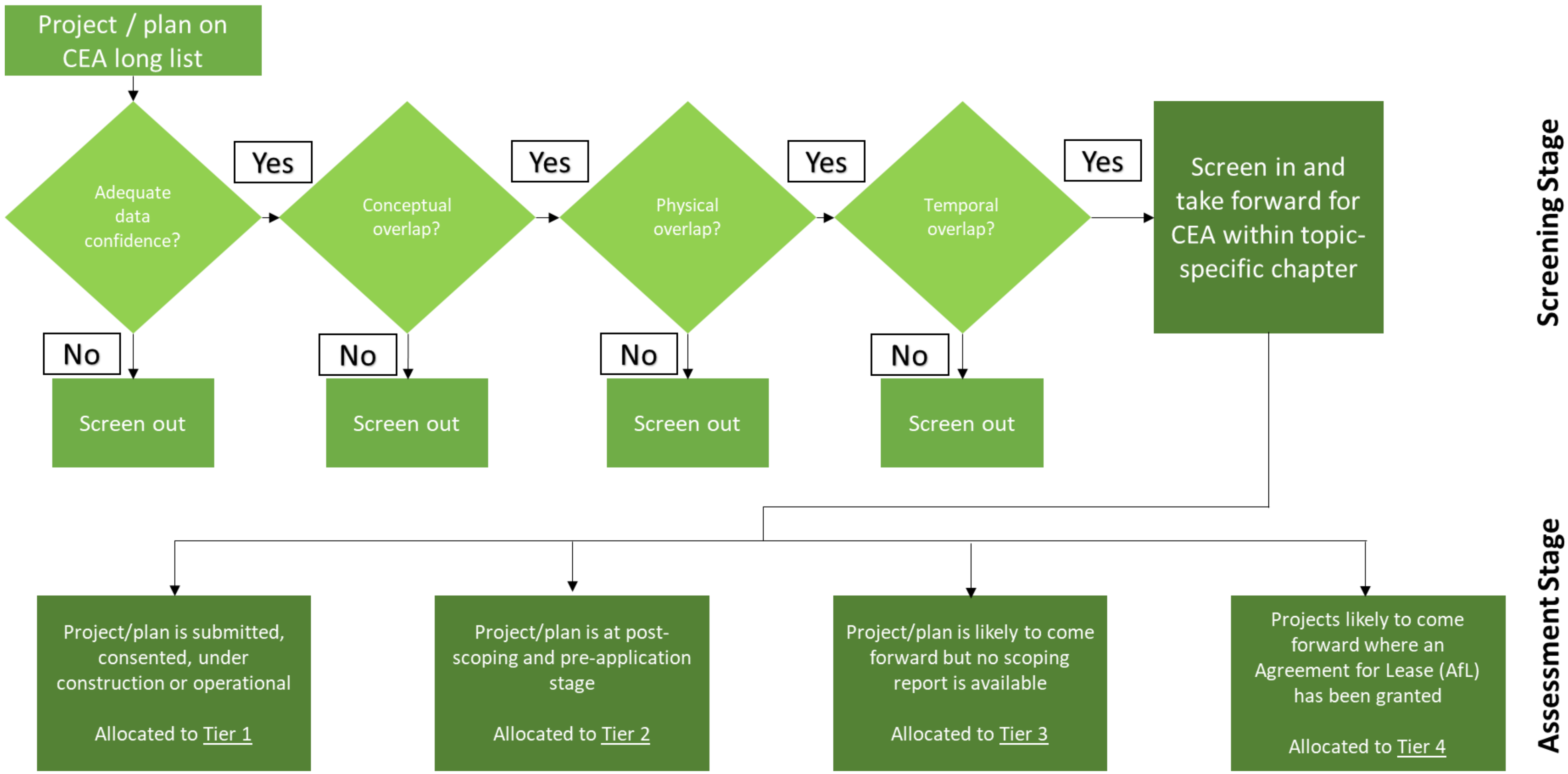


Figure 4.2: Proposed methodology for the Array Project for screening of projects/plans to identify potential cumulative effects

4.7.3 CEA Assessment Stage

4.7.3.1 Once a project has been taken forward to the assessment stage, a tiered approach is proposed for the CEA. The tiered approach provides a framework to assist the decision maker in placing relative weight upon the potential for each project/plan assessed cumulatively to ultimately be realised, based upon the project/plan's current stage of maturity. The allocation of projects/plans into tiers is not affected by the screening process; it is a categorisation applied to all projects/plans that have been screened in for assessment.

4.7.3.2 The definitions of the tiers to be used will be included in the EIA Report but they will be broadly consistent with the RenewableUK Cumulative Impact Assessment Guidelines, specifically Guiding Principle 4 and Guiding Principle 7 (RenewableUK, 2013).

4.7.3.3 All projects/plans that have been screened into the CEA via the screening process will be allocated into one of the Tiers and assessed for cumulative effect. Where practicable, the CEA methodology then follows the outline of the project-alone assessment methodology as described in section 4.5. This approach allows consistency throughout the EIA and enables comparisons to be made.

4.8 Transboundary Impacts

4.8.1.1 Transboundary effects arise when impacts from a project within one State affect the environment of another State(s). The need to consider such transboundary effects has been embodied by the United Nations Economic Commission for Europe Convention on EIA in a Transboundary Context (commonly referred to as the 'Espoo Convention'). The Convention requires that assessments are extended across borders between Parties of the Convention when a planned activity may cause significant adverse transboundary impacts.

4.8.1.2 The Espoo Convention has been implemented in the UK by the EIA Regulations. Regulation 32 of the 2017 EIA Regulations and Regulations 18 to 20 of the 2007 EIA Regulations set out a prescribed process of consultation and notification.

4.8.1.3 The Planning Inspectorate's (PINS) Advice Note Twelve (PINS, 2020) also sets out a procedure for screening, consulting and assessing transboundary issues. Despite the fact that PINS does not operate in Scotland, the Array Project will broadly follow this process with respect to the transboundary EIA, and will have regard to any other guidance that may prevail at the time of undertaking the assessment. The procedure involves the following broad steps, which are divided into two stages:

- Stage 1:
  - developer may carry out pre-application consultation with other State(s) if required;
  - developer notifies Scottish Ministers of transboundary assessment;
  - developer prepares initial matrix to identify potential significant impacts on other State(s) and provides to Marine Directorate;
  - Scottish Ministers undertake transboundary screening;
  - Scottish Ministers notify other relevant state(s);
  - other State(s) notify Scottish Ministers of their wish to participate in the consultation.
- Stage 2:
  - developer submits the Application, including translated non-technical summary and a consultation report summarising any pre-submission transboundary consultation;
  - Scottish Ministers undertake consultation with other relevant State(s);
  - other State(s) consult with their public and provide comments to Scottish Ministers;
  - consultation responses are considered in the decision-making process.

4.9 Inter-related Effects

4.9.1.1 The EIA Regulations require a consideration of the interactions or interrelationships between EIA topics that may lead to additional environmental effects. For example, the separate impacts of underwater sound and habitat loss may together have an effect upon a single receptor, such as marine mammals.

4.9.1.2 The approach to the assessment of inter-related effects will consider two levels of potential effect:

- project lifetime effects: effects that occur throughout more than one phase of the Array Project (e.g. construction, O&M or decommissioning);
- receptor led effects: effects that interact spatially and/or temporally resulting in inter-related effects upon a single receptor.

4.9.1.3 The assessment of inter-related effects will be undertaken with specific reference to the potential for such effects to arise in relation to receptor groups (i.e. the proposed approach assessment will, in the main, not assess every individual receptor assessed at the EIA stage, but rather, potentially sensitive groups of receptors).

4.9.1.4 The broad approach to inter-related effects assessment will follow the key steps below:

- review of effects for individual EIA topic areas;
- review of the assessment carried out for each EIA topic area, to identify receptor groups requiring assessment;
- identify potential inter-related effects on these receptor groups via review of the assessment carried out across a range of topics;
- develop tables that list all potential effects on the selected receptor across the construction, O&M and decommissioning phases (project lifetime effects);
- develop lists for all potential receptor led effects;
- qualitative assessment on how individual effects may combine to create inter-related effects.

5 Consultation Process

5.1 Pre-Application Consultation

5.1.1.1 This chapter of the Scoping Report provides a record of consultation on the Array Project undertaken with statutory consultees and relevant bodies and organisations. The Applicant has actively sought to consult prior to (and during) the Scoping process with the following principle aims:

- to discuss draft survey scopes and share preliminary data to inform survey design;
- to collate baseline information to assist in the identification of effects, environmental constraints and evidence requirements;
- to keep stakeholders appraised of developments of importance or potential interest and the Applicant's intentions for the Environmental Impact Assessment (EIA) reporting;
- to engage with and facilitate consultation options for the Array Project consenting process;
- to reach agreement with stakeholders on impacts proposed to be scoped out of the EIA.

5.1.1.2 A summary of consultation undertaken to date in relation to the environmental aspects of the Array Project is provided in Table 5.1. The key consultation undertaken to date includes:

- quarterly meetings with the Marine Directorate Licensing Operations Team (MD-LOT) (formerly Marine Scotland Licensing Operations Team (MS-LOT)) to support a wide range of strategic as well as project-specific issues;
- survey specification consultation to discuss survey methodologies, overview survey data results (e.g. preliminary site specific survey results) and discuss survey campaign updates;
- the Scoping Workshop to gain feedback from key stakeholders on the draft scoping assessment and on the scoping in/out of specific impacts to key receptors (see section 5.2).

5.1.1.3 The Applicant intends that consultation will be ongoing throughout the EIA process, where stakeholders are open to engagement. A stakeholder engagement plan for further pre-application consultation is presented in Appendix 4: Array Project Stakeholder Engagement Plans of this Scoping Report. This Scoping Report will be issued to consultees in Quarter 3 (Q3) of 2023 to seek feedback on the proposed approach and methodology of the EIA assessment. The EIA Report will provide a full account of consultation and how issues raised have been considered in the design and assessment process.

5.2 Scoping Workshop

5.2.1.1 Early in the process, the Applicant was advised by MD-LOT that a Scoping Workshop could precede the formal submission and publication of the Scoping Report and request for a Scoping Opinion. The purpose of the Scoping Workshop was understood to be an opportunity for the Applicant to consult on the draft scope and for stakeholders to request additional information on key topics and impact-receptor pathways to be addressed in the Scoping Report.

5.2.1.2 The Scoping Workshop for the Array Project was held on 18 and 19 April 2023 and consisted of a series of topic specific sessions over two days, targeted to the relevant stakeholders. MD-LOT and NatureScot assisted in the identification of these stakeholders and coordination of the Scoping Workshop. A list of the stakeholders involved in this workshop is provided below:

- MD-LOT;
- NatureScot;
- Marine Scotland Science (MSS);
- Royal Society for the Protection of Birds (RSPB);
- Historic Environment Scotland (HES);
- Scottish Fishermen's Federation (SFF);

- Scottish White Fish Producers’ Association (SWPFA);
- Scottish Pelagic Fishermen’s Association;
- Royal Yachting Association (Scotland)
- North and East Coast Regional Inshore Fisheries Group;
- Maritime and Coastguard Agency (MCA);
- Northern Lighthouse Board (NLB);
- UK Chamber of Shipping (CoS);
- Forth Ports and Montrose Port
- Aberdeenshire Council, Aberdeen City Council and Angus Council;
- City of Edinburgh Council;
- Scottish Enterprise;
- Energy Transition Zone Limited (ETZ Ltd.).

5.2.1.3 The Applicant was encouraged to provide technical reports and data used to inform the assessments and to prepare topics and questions to stakeholders in advance of the Scoping Workshop to enable feedback and to frame and focus responses. Materials were requested to be sent at least two weeks prior to the Scoping Workshop and were sent on 28 March for all topics except for ornithology, for which materials were circulated on 29 March. The consultees that were identified through this process and a summary of the relevant information provided in advance of Scoping Workshop is provided in Appendix 3: Array Project Scoping Workshop Information.

5.2.1.4 The key topics discussed in the Scoping Workshop were decided through consideration of pre-scoping engagement, survey results to date, expected impact pathways, general project updates, current knowledge and baseline data. The agenda for the Scoping Workshop is provided in Appendix 3: Array Project Scoping Workshop Information. The topics discussed are listed below:

- physical processes;
- benthic ecology;
- fish and shellfish ecology;
- shipping and navigation;
- marine mammals;
- underwater sound;
- offshore ornithology;
- Habitats Regulations Appraisal (HRA) approach;
- commercial fisheries;
- seascape, landscape and visual assessment (SLVIA);
- onshore historic environment;
- socio-economics.

5.2.1.5 European sites will be considered through the HRA process, which will run in parallel to the EIA, but for efficiency and at the request of MD-LOT, the approach to the HRA was included in the Scoping Workshop.

5.2.1.6 The Applicant asked a series of targeted questions to guide each topic-specific session of the Scoping Workshop. These questions are presented in Appendix 3: Array Project Scoping Workshop Information. The consultees were able to give their views and to provide information that has been addressed in the finalisation of this Scoping Report. Details of discussions and how comments have been addressed are provided in the Consultation sub-section of each of the Scoping chapters for the key topics identified above.

5.3 Scoping Opinion

5.3.1.1 In line with the EIA Regulations, upon receipt of the Scoping Report, the Scottish Ministers will undertake statutory consultation. On their behalf MD-LOT will produce a Scoping Opinion that will incorporate stakeholder comments and advice, address any concerns and develop appropriate mitigation and potential compensation for the Array Project. Potential effects to be scoped in or out of the EIA will also be discussed. The Scoping Opinion is expected in Q4 2023.

5.3.1.2 Following the Scoping Opinion, a MD-LOT gap analysis will be developed to record any environmental concerns that have been identified. Future consultation will also be subject to the Scoping Opinion, which will indicate anticipated stakeholder engagement requirements and will be given as early as possible.

5.4 Pre-Application Consultation (PAC) Report

5.4.1.1 Under the Marine Licensing (Pre-application Consultation) (Scotland) Regulations 2013, any development within the Scottish Inshore Region (12nm) requires Pre-Application Consultation to be carried out. There is no provision for PAC in the Marine and Coastal Access Act 2009, so these requirements do not apply in respect of relevant applications in the Scottish Offshore Region within which the Array Project is wholly located. Under Section 5(6) of the PAC Regulations, it is outlined that an Applicant can write to Scottish Ministers to obtain confirmation that the development is not within a prescribed class requiring PAC and thus that it is not required to carry out PAC.

5.4.1.2 The Applicant proposes to undertake pre-application consultation for the Array Project and produce a consultation report. The consultation report will include reviewing any materials presented at consultation events to ensure that appropriate focus and weighting is given to prominent and most significant issues to facilitate positive, proactive engagement with stakeholders.

5.4.1.3 Thereafter, a consultation report will be prepared to outline:

- the consultation event(s) - how, where, when, etc.;
- provide information presented at the event (posters, interactive maps, etc.);
- list of public comments received;
- describe any amendments made or to be made because of comments received;
- an explanation of the approach taken if no changes are to be made because of comments.

Table 5.1: Record of pre-application consultation undertaken to date for the Array Project

Topic	Stakeholder(s)	Date, method of consultation and record	Purpose of engagement
General project introductions	NatureScot MD-LOT MSS Scottish Government	Meeting: Online via Teams 17 March 2021 Minuted	Introduction of Array Project.
Benthic subtidal ecology, marine mammals and offshore ornithology	MD-LOT NatureScot MSS RSPB	Meeting: Online via Teams 11 August 2021 Minuted	Discussion on the approach to baseline data review and development of offshore survey scopes for fish and shellfish ecology, benthic subtidal ecology, marine mammals and offshore ornithology.
Marine mammals and offshore ornithology	NatureScot MD-LOT MSS RSPB	Meeting: Online via Teams 21 October 2021 Minuted	Follow up consultation from the initial meeting on 11 August 2021 to share proposed draft survey scopes and get feedback. Draft reports (baseline data and survey scopes) shared prior to the meeting.
Marine archaeology	HES	Email correspondence 04 April 2022	Consultation on the archaeological Preliminary Desk Based Assessment (DBA) and Written Scheme of Investigation (WSI), including the Protocol for Archaeological Discoveries (PAD) for the Array Project geophysical, geotechnical and benthic subtidal ecology surveys.
Marine mammals	MSS NatureScot	Email correspondence 25 May 2022	Advice on survey proposal for Passive Acoustic Monitoring (PAM) and intention to deploy PAM during the Metocean survey campaign to collect underwater soundscape information and presence/absence data for marine mammals.
Ornithology	RSPB	Meeting: Online via Teams 12 September2022 27 January 2023	Meetings with RSPB to provide an introduction to the Array Project.

Topic	Stakeholder(s)	Date, method of consultation and record	Purpose of engagement
E6 fisheries group Monthly meetings	E1-E3 developers SFF and SWPF present at two meetings	Meeting: Online via Teams July 2022 – ongoing	Provide updates and actions on engagement with commercial fishery groups.
Commercial fisheries	SFF SWPF	Meeting: Online via Teams 29 March 2022 15 February 2023	Meeting with commercial fisheries representatives to update them on the Array Project.
Weekly E1-3 developer Ornithology Group	E1-E3 developers	May 22 – ongoing	To agree on regional ornithology survey methodology and manage regional ornithology surveys across E1-3.
Quarterly Meeting	MD-LOT MSS NatureScot	Meeting: Online via Teams 15 July 2022 3 November 2022 Minuted	Array Project's quarterly meeting with MD-LOT, MSS and NatureScot.
Scoping Report	MD-LOT	Email correspondence 20 October 2022	Guidance shared by MD-LOT relating to the Scoping Workshops offered to all ScotWind developers.
Shipping and navigation	MCA	Email Correspondence 15 November 2022	Consultation on the proposed approach and methodology to be followed for the Array Project's winter 2022 shipping and navigation survey. MCA approval of the proposal was provided 16 November 2022, via email.
Shipping and navigation	MCA NLB CoS	Meeting: Online via Teams 16 December 2023 Minuted	Pre-Scoping Meeting with MCA, NLB, and UK CoS to discuss the Array Project and stakeholder expectations for cumulative assessment.
Scoping Workshop (preparation meeting)	MD-LOT	Meeting: Online via Teams 23 January 2023 Minuted	To discuss bp/EnBW proposed Scoping Workshop Agenda (shared previously with MD-LOT) and lessons learned from Scoping Workshops undertaken to date.

Topic	Stakeholder(s)	Date, method of consultation and record	Purpose of engagement
SLIVA	NatureScot Aberdeenshire, Angus and Aberdeen City Councils	Email Correspondence 1 February 2023	Discussion on Zone of Theoretical Visibility (ZTV)/wireline results and agreement on additional matters with stakeholders relating to the SLVIA to provide a technical note and justification behind the viewpoints and ZTVs.
Scoping Workshop	MD-LOT Scottish Government Marine Analytical Unit NatureScot MSS RSPB HES SFF SWPF Scottish Pelagic Fishermen's Association North and East Coast Regional Inshore Fisheries Group MCA NLB CoS Forth Ports Montrose PortRYA(S) Aberdeenshire Council, Aberdeen City Council and Angus Council City of Edinburgh Council Scottish Enterprise EZT Ltd	Workshop: Online via Teams 18 and 19 April 2023	A Scoping Workshop to gain feedback from key stakeholders on the draft scoping assessment and on the scoping in/out of specific impacts to key receptors. The key topics covered included: • Physical processes; • Benthic subtidal ecology; • Fish and shellfish ecology; • Shipping and navigation; • Marine mammals; • Underwater sound; • Offshore ornithology; • HRA approach; • Commercial fisheries; • SLVIA and onshore historic environment; • Socio-economics.

6 Site Selection and Consideration of Reasonable Alternatives

6.1 Introduction

6.1.1.1 This chapter provides an overview of the site selection process and the consideration of alternative options. This includes an outline of the stages of site selection that established the Scoping Boundary. It details the ScotWind sites analysis, the site Plan Options (PO), the Option Agreement Area and the main design of the wind turbines. The detailed project design will be an ongoing process during the EIA and pre-construction phases and the description of the Array Project provided within chapter 3: Project Description of this Scoping Report should be used as context for the wider Scoping Report.

6.2 ScotWind Leasing Processes

6.2.1.1 In January 2022, under the ScotWind leasing round (see Figure 6.1), the Project was awarded an Option for Lease Agreement within the East Scotland PO area E1. The POs provide the spatial footprint for this ScotWind Leasing round. The site selection process for the Array Project and, subsequently, aspects of the design, is grounded on the specifications of the ScotWind leasing round and its evaluation process.

6.2.1.2 Each individual application within the leasing process was required to be located within an individual Sectoral Marine Plan (SMP) draft plan area. The stated objectives of the SMP in devising the draft PO areas were to:

- minimise the potential adverse effects on other marine users, economic sectors and the environment resulting from further commercial-scale offshore wind development;
- maximise opportunities for economic development, investment and employment in Scotland, by identifying new opportunities for commercial scale offshore wind development, including deeper water wind technologies.

6.2.1.3 In the 'Draft Sectoral Marine Plan for Offshore Wind Energy', published by Marine Scotland in December 2019, there were 17 Draft PO sites identified for potential offshore wind Option for Leases, (SW1, W1, N1-4, NE1-8, E1-E3). Once the SMP was published in October 2020 (Scottish Government, 2020), the SW1 and NE5 sites were dropped, primarily to mitigate the potential negative impacts on commercial fishing, natural heritage and shipping and objections from the public in relation to SW1. This left 15 potential sites, across four Regions, within Scottish Waters (see Figure 6.1).

6.2.1.4 The East Scotland region encompasses three POs (E1, E2 and E3). Large areas of good water depth across the region indicated the East POs would be well-suited to jacket foundations and attractive to developers keen to develop large, fixed-bottom projects.

6.2.1.5 Through an iterative analysis, Areas of Search were refined to draft and then final POs. The draft POs were assessed under a Sustainability Appraisal and consulted on from 18 December 2019 to 25 March 2020 before the final POs were determined (Scottish Government, 2020). The E1 PO that featured within the SMP (and was made accessible to the Project) was identified through the use of a constraints model, which identified and then weighted multiple spatial features and constraints.

6.2.1.6 The ScotWind Leasing round was, thereafter, managed by Crown Estate Scotland (CES). In 2018, CES published a Discussion Document setting out a proposed approach to the new offshore wind leasing work in Scotland. Applicants were able to select site boundary and size and CES indicated the broad level of new capacity but did not cap individual projects. The 2018 Discussion Document states that "the evaluation of applications will cover the headings suggested in the Discussion Document, although we may broaden the requirement for commitment to the project to also encompass an appropriate commitment to realising wider benefits from developments" (CES, 2018).

6.2.1.7 The headings within the Discussion Document and responses to stakeholders documented therein indicated that the factors considered in the development and evaluation of the sites included: timing, site selection, rent, clustering and separation (applications 5km or less from the boundary of an existing offshore wind farm agreement were not accepted), the accessibility of grid connections, efficient use of the seabed; cumulative effects (on ecological and stakeholders and/or infrastructure) and the commercial sensitivities of a project and how this may affect the capacity for refinement (CES, 2018).

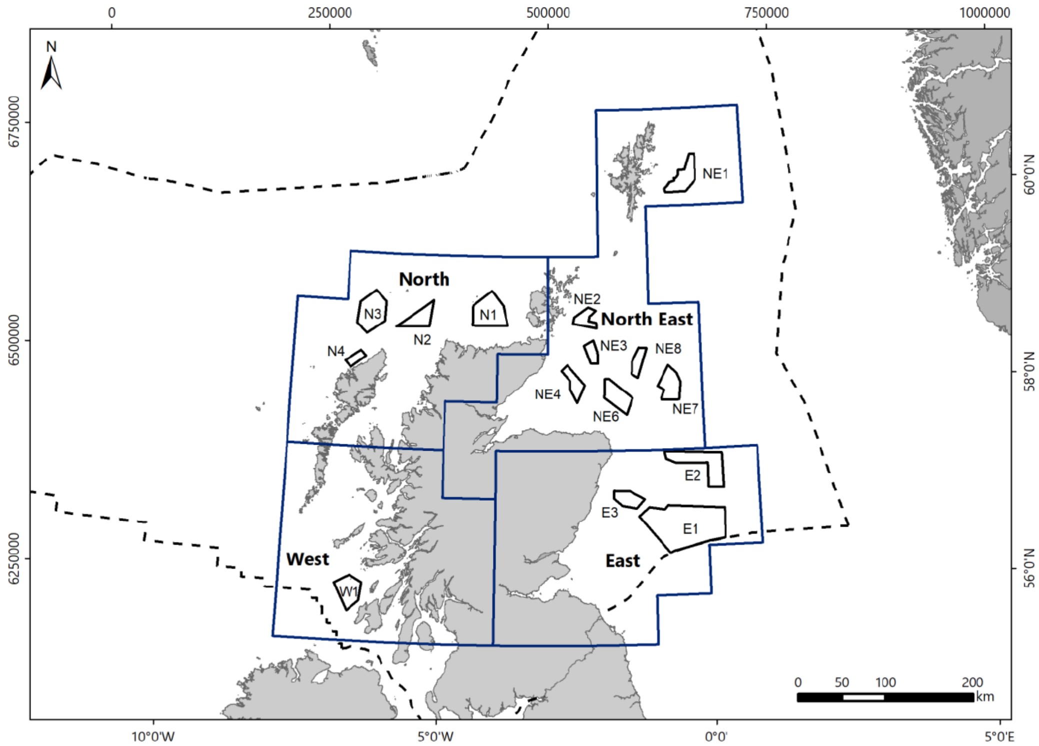


Figure 6.1: ScotWind Plan Regions and final ScotWind Plan Options (Scottish Government, 2020)

6.2.1.8 The POs have been subject to Strategic Environmental Assessment (SEA)[3], Habitats Regulations Appraisal (HRA)[4] and socio-economic assessment (and reports have been produced to summarise these). The SMP further guides relevant consenting bodies with decision making on licence and consent applications. For PO E1, the HRA report identifies concerns over in-combination impacts on seabirds and directs further regional survey effort before development can progress. Further and supplementary to the SMP, a Roadmap of Actions (Ornithology) (2022) has been produced. E1 and E2 have regional survey requirements under the Roadmap of Actions to address uncertainties about the potential cumulative impacts on seabirds, particularly in the non-breeding season.

6.2.1.9 The PO areas are located in varying water depths with the majority being suitable for floating windfarms. PO areas W1, E3, N1, N3 (mixed), NE4 and the eastern part of E1 are located in water depths of 60m to 80m, allowing deeper fixed foundations windfarms to be developed.

6.3 Site Selection Process

6.3.1 Identification of Preferred Plan Option (E1)

6.3.1.1 The Morven Option Agreement Area (OAA) was identified by bp/EnBW within the E1 PO of the Sectoral Marine Plan (Figure 6.1). The Applicant was awarded exclusivity of the E1 site by Crown Estate Scotland in January 2022 during the ScotWind leasing round.

6.3.1.2 The E1 site was considered as the optimal site due to competitiveness, commercial, engineering and environmental considerations. Whilst it was recognised that certain environmental topics were sensitive, the site was considered to have the highest overall value.

[3] 2019 Offshore Wind Energy - Draft Sectoral Marine Plan: Strategic Environmental Assessment.

[4] 2019 HRA 'Sectoral Marine Plan: Appropriate Assessment'.

6.3.1.3 The OAA was developed taking into consideration key constraints and consultation with stakeholders. The Morven OAA, located along the western edge of the E1 site area, was selected for the following reasons:

- The wind direction (south - southwest) would avoid upwind drafts caused by other OWF.
- Water depths were shallow enough to allow the construction of a fixed foundation wind farm with the ability to install it using jack-up barges. Any areas further east would have required a floating solution.

6.3.1.4 PO E1 covers 3,744km^2. The water depth across the entire E1 PO is between 60m to 100m. Areas within E1 were identified in the SMP as likely to be important fish spawning grounds, including for herring, cod, whiting, plaice and sandeel. Consultation was also expected to be required regarding potential radar interference from any turbines in E1. The PO is further noted to be subject to potentially 'high levels of ornithological constraint' (Scottish Government, 2020).

6.3.1.5 The Social and Economic Impact Assessment undertaken on the 17 draft POs identifies only minor socio-economic cost impacts arising from potential development in E1 to commercial shipping, fishing and power inter-connector sectors (Scottish Government, 2020). The SEA of the SMP indicates there is potential to mitigate the effects on bird species at a project level (Scottish Government, 2019).

6.4 Scoping Boundary

6.4.1.1 The suitability of the Scoping Boundary (which is the same area as the OAA) has been considered with respect to information gathered to inform potential engineering, societal, economic and environmental risks. Regional ornithological surveys covering the E1 and E2 sites (and a 12km buffer zone) commenced in Q1 2022 and will potentially conclude in Q1 2023 (one year data collection). Project specific ornithology data (collected within a 4km buffer of the Scoping Boundary) will also inform the suitability of the site. Preliminary geophysical survey (including benthic sampling) was mobilised in March 2022 (and completed July 2022). Potential constraints to the placement of offshore generation assets (wind turbines and foundations) include ground conditions, the presence of Marine Protected Areas (MPAs), sensitive ecological features, other wind projects and commercial fisheries or vessel routes.

6.4.1.2 Ongoing stakeholder engagement and environmental assessments will ensure that the Applicant has the latest understanding of the potential impacts on the receiving environment, local communities, environmental and other interested groups to continue to inform design decisions. The advancement of the EIA process is expected to facilitate the refinement process for the Array Project, through assessments and consultation. The boundary and design will remain subject to review, following consultation.

6.4.1.3 The EIA will have a fully detailed description of the site selection process and consideration of alternatives including details on the consenting, technical and commercial constraints.

6.5 Consideration of Reasonable Alternatives

6.5.1.1 Design alternatives considered for the Array Project included floating turbines, however, the water depth was deemed too shallow for this technology. Further design alternatives under consideration and for which details will be provided in the EIA Report include turbine size, turbine blade tip to sea clearance and turbine foundation types.

7 Offshore Wind Farm: Physical Environment

7.1 Physical Processes

7.1.1 Introduction

7.1.1.1 This chapter of the Scoping Report identifies the elements of the physical processes of relevance to the Array Project and considers the potential impacts from the construction, Operations and Maintenance (O&M) , and decommissioning phases on physical processes.

7.1.1.2 The following elements are collectively referred to as 'physical processes' throughout this Scoping Report and in the Environmental (EIA) Report:

- bathymetry;
- wind and waves;
- tidal currents and elevation;
- geology and seabed substrate;
- suspended sediments;
- sediment transport (which is influenced by the aforementioned elements).

7.1.2 Physical Processes Study Area

7.1.2.1 For the purposes of this Scoping Report, a Physical Processes Study Area has been defined as the extent of one spring tidal excursion (Figure 7.1). The Physical Processes Study Area encompasses the Scoping Boundary and the entire water column, including the seabed that may be influenced by changes to physical processes.

7.1.2.2 One spring tidal excursion of between circa 5.5km and 13.5km from the Scoping Boundary has been identified through interim numerical modelling techniques and is defined as the distance that suspended sediment is transported before being carried back on the returning tide. The interim model was informed from bathymetric datasets available as part of the Marine Environmental Data Information Network (MEDIN).

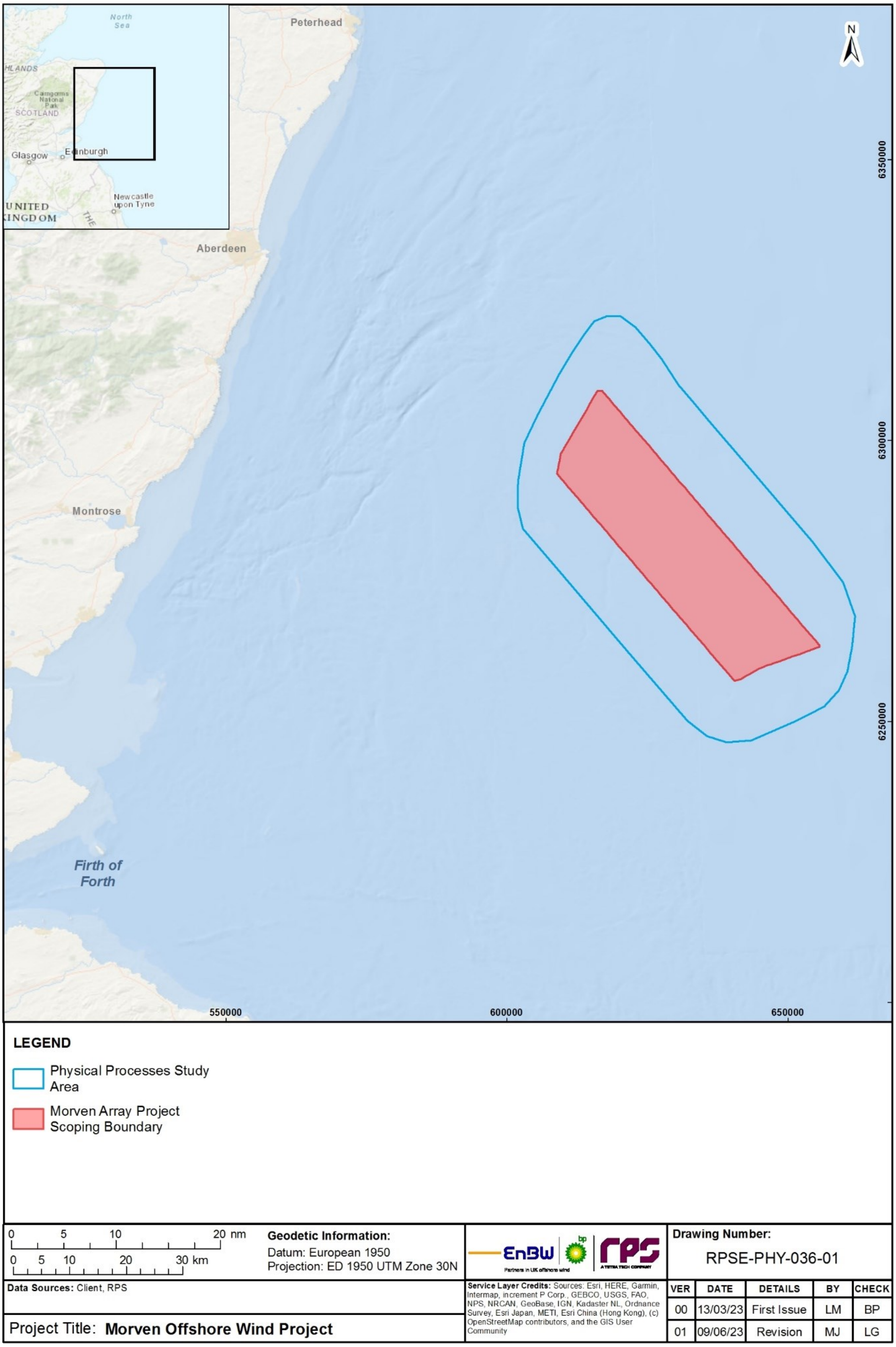


Figure 7.1: Physical Processes Study Area

7.1.3 Data Sources

7.1.3.1 The physical processes baseline environment has been characterised through site specific data and a literature review of key desktop datasets and reports (Table 7.1). It should be noted that this list is not exhaustive, and further datasets and reports will be covered in more detail within the Physical Processes Technical Report and Physical Processes chapter within the EIA Report. A range of geophysical data was collected during the offshore wind farm (OWF) integrated survey, involving magnetometer, side scan sonar (SSS), single beam echosounder (SBES), multibeam echosounder (MBES), 2D ultra-high resolution seismic (UHRS) and sub-bottom profiler (SBP) data to determine bathymetry, seabed features, shallow soils and highlight any debris and unexploded ordnance (UXO). These data were collected across the Scoping Boundary between April and August 2022 by Gardline and XOcean.

7.1.3.2 In addition, six Metocean devices were deployed within the Scoping Boundary in September 2022 and will remain in place for 12 months (therefore, data was not available to inform the baseline in this Scoping Report but will be used in the EIA Report). These devices consisted of two light detection and ranging (LiDAR) buoys, two wavebuoys and two subsea moorings.

Table 7.1: Summary of key desktop resources used to characterise the physical processes baseline

Resource	Coverage	Data Provided	Source
Joint Nature Conservation Committee (JNCC) Marine Protected Area (MPA) Mapper	UK (marine, coastal and terrestrial)	Spatial data for marine protected areas including Scottish Marine Protected Areas (MPAs), English Marine Conservation Zones (MCZs), Special Areas of Conservation (SACs), Sites of Special Scientific Interest (SSSI) and conservation zones	JNCC, 2023
Berwick Bank Wind Farm EIA Report, Volume 2, Chapter 7: Physical Processes	Berwick Bank Wind Farm (approximately 31.64km from the Scoping Boundary)	Tidal ranges, current speeds, and sediment transport	SSE Renewables (SSER), 2022
Atlas of UK Marine Renewable Energy Resources	UK waters	Annual mean significant wave height (m) Annual mean wave power (kW/m) Mean spring tidal range (m)	ABP Marine Environmental Research (ABPmer), 2017
British Geographical Survey (BGS) Seabed Geology Layers	Whole continental shelf	Seabed geology	Marine Scotland, 2017
Suspended Sediment Climatologies around the UK	UK Waters	Suspended sediments	Centre for Environment, Fisheries and Aquaculture (Cefas), 2016
Appendix E2 – Metocean and Geophysical Surveys	Seagreen 1 and Seagreen 1A (approximately 25.16km from the Scoping Boundary)	Metocean data	Royal Haskoning DHV, 2012a

Resource	Coverage	Data Provided	Source
Appendix E3 – Geomorphological Assessment	Seagreen 1 and Seagreen 1A	Suspended sediments and tidal current speeds	Royal Haskoning DHV, 2012b
Neart na Gaoithe Offshore Environmental Statement, Chapter 9 – Physical Processes	Neart na Gaoithe OWF (approximately 80.04km from the Scoping Boundary)	Metocean data	Mainstream Renewable Power Ltd, 2012
MEDIN	UK Waters	Bathymetry data	MEDIN, 2023
United Kingdom Hydrographic Office (UKHO) - Published Charts and Tide tables	UK Waters	Charts 1409 0:200000 and 273 0:200000 incorporating tidal diamonds with current stream data	Admiralty Raster Chart Service (ARCS), 2023

7.1.4 Consultation

7.1.4.1 The approach to consultation for the Array Project is set out in chapter 5: Consultation Process of the Scoping Report. A summary of the consultation undertaken to date relevant to Physical Processes is set out in Table 7.2. Further detail on the Scoping Workshop and stakeholder plans for future engagement is set out in chapter 5: Consultation of the Scoping Report, supported by Appendix 3: Array Project Scoping Workshop Information and Appendix 4: Array Project Stakeholder Engagement Plans of the Scoping Report.

Table 7.2: Pre-application consultation relevant to Physical Processes undertaken to date

Date	Overarching theme	Method of engagement	Stakeholder	Summary of stakeholder feedback	Applicant's response and relevant cross reference
18.04.23	EIA approach	Scoping Workshop session	NatureScot	Encouraged a clear distinction between receptors/pathways. Stated that pathways only include magnitude of change.	Consistent approach will be applied across the EIA.
18.04.23	Impact pathways	Scoping Workshop session	NatureScot	Suggested that potential for loss and damage to seabed be considered.	Confirmation that this impact pathway will be considered. See section 7.1.6.
18.04.23	EIA approach	Scoping Workshop session	NatureScot	Encouraged further technical consultation on modelling methodology and suggested including a modelling methodology summary.	Modelling methodology included in section 7.1.8.
18.04.23	Data or datasets	Scoping Workshop session	NatureScot	Noted consideration of the bathymetric data resolution to distinguish between different bedform types.	The Applicant confirms that this approach will be included in the EIA Report.
25.05.2023	Data	Written advice	NatureScot	NatureScot confirmation that the existing data are sufficient to describe the baseline environment, and advise that the bathymetry data	The Applicant confirms the resolution of the bathymetric data is to a suitable resolution (1m).

Date	Overarching theme	Method of engagement	Stakeholder	Summary of stakeholder feedback	Applicant's response and relevant cross reference
				resolution should enable distinction between types of bedform.	
25.05.2023	Impact pathways	Written advice	NatureScot	NatureScot agrees on the impact pathways identified. NatureScot encourages distinction between physical processes as receptors or pathways.	To be considered within the EIA Report, whereby magnitude of change to physical processes (eg. wave climate and tidal currents) is quantified and difference plots provided.
25.05.2023	Designed In Measures	Written advice	NatureScot	NatureScot agrees that the designed in measures are suitable.	Noted.
25.05.2023	Impact pathways	Written advice	NatureScot	It is common to scope in direct physical impact of the seabed. However, this depends on the receptor/pathway distinction (as outlined above). It is unlikely that seabed needs to be a receptor. Consideration would need to be given to how this affects the benthic assessment. Direct physical impact on the seabed may only need to be scoped into the Benthic Subtidal Ecology chapter of the EIA Report.	The magnitude of change, including to the seabed will be quantified as part of the EIA Report. Therefore, whilst not a receptor for Physical Processes, potential changes will be addressed, which can feed into the benthic assessment as necessary.
25.05.2023	Methodology	Written advice	NatureScot	NatureScot agree with the proposed methodology. With regards to modelling, NatureScot encourage further technical discussion around methods and how results will be presented.	The modelling methodology will be via the MIKESuite of Software. The Applicant will discuss this approach with NatureScot and adapt as necessary.

7.1.5 Baseline Environment

7.1.5.1 This section presents a high-level overview of the baseline environment of the Physical Processes Study Area.

Bathymetry

7.1.5.2 Geophysical data collected in 2022 suggests that the water depth across the Scoping Boundary ranges between c.64m to c.76m, relative to the LAT, with a maximum depth of c.76m recorded at the southeastern edge. There were gentle undulations in the seabed, with a gradient of <1° throughout. A sandbank crossed the southeastern part of the Scoping Boundary, measuring 4m high and approximately 4km at its widest point.

7.1.5.3 Further shoals, influenced by seabed currents, were present across the Scoping Boundary, predominantly in the northern section. These typically had gradients of <1° and are thought to be both accumulations of surficial sediments and associated with the underlying geology. One discrete feature in the south rises 2m above the seabed, with gradients up to 8° on its flanks. The seabed across much of the Scoping Boundary was dominated by megaripples, which were better defined and more extensive in the north (Figure 7.2). The megaripples were typically 0.5m above the seabed and had wavelengths of 15m to 50m. The megaripples were generally orientated from west to east, with their lee slope facing south, which indicated a dominant southward current direction.

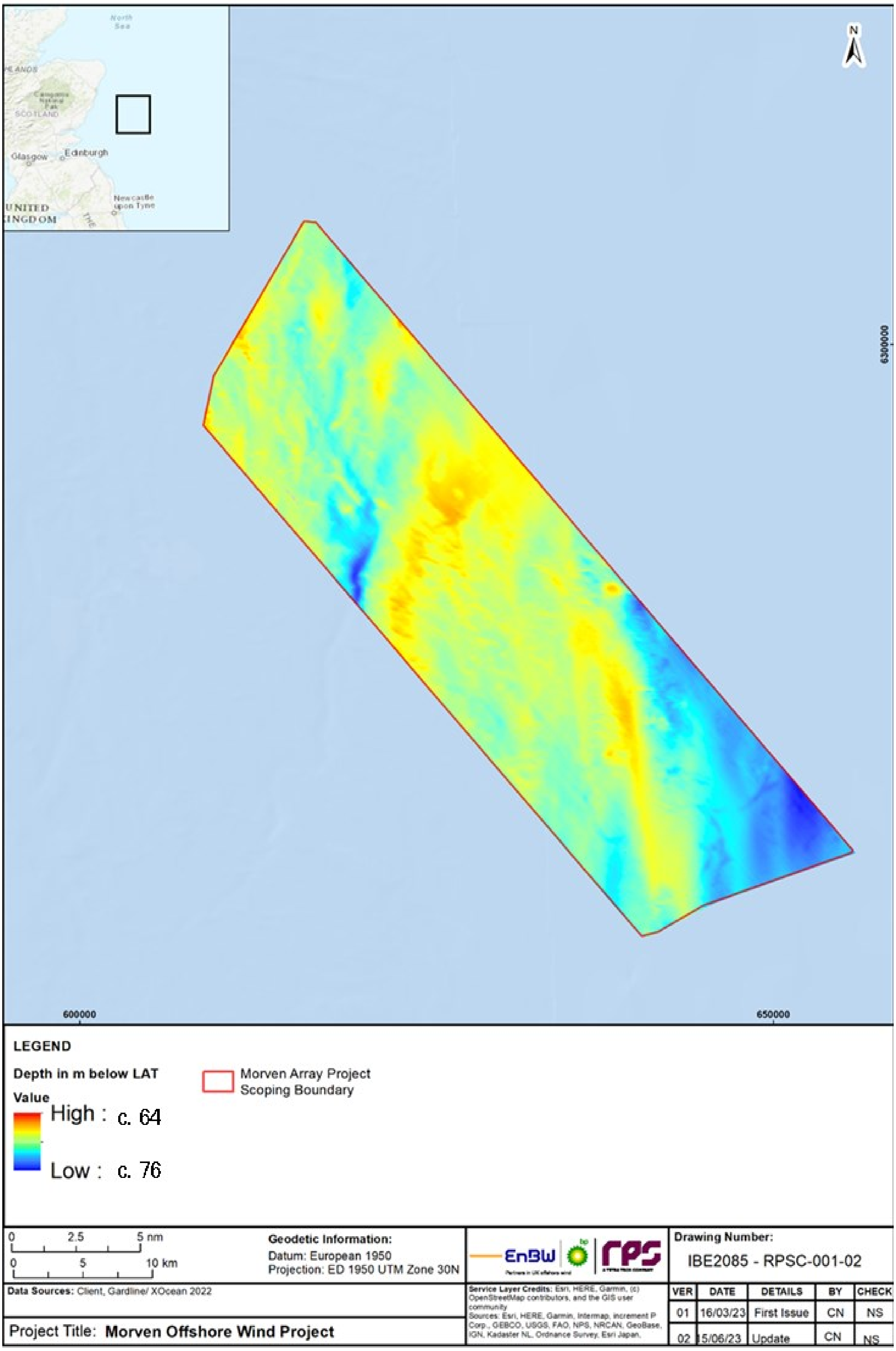


Figure 7.2: Scoping Boundary bathymetry

Wind and waves

7.1.5.4 In the North Sea, the propagation of tidal waves (as well as the dominant residual circulation) generally follows cyclonic patterns (Vindenes *et al.*, 2018). Strong winds can occur in the North Sea, however, wave heights vary greatly due to water depth and fetch limitations (Royal Haskoning DHV, 2012b). Annual mean significant wave height ranged from approximately 1.77m to 2.00m across the Scoping Boundary, and annual mean wave power ranged from approximately 14.3kW/m to 17.6kW/m (ABPmer, 2017).

7.1.5.5 In the absence of available site specific Metocean data, data collected from other OWF projects in the North Sea has been used to characterise the baseline. In the Round 3 Firth of Forth Zone, during the stormiest event over the 18-month wave buoy deployment in January 2012, a significant wave height of 6.7m was recorded which correlates with a one in one year sea wave climate return period event. Peak spectral wave periods of up to 20 seconds (s) were recorded, both associated with strong winds and storms that are characteristic of the North Sea, (Royal Haskoning DHV, 2012a). At Neart na Gaoithe OWF, the highest significant wave height recorded was 6m and wave periods ranged between two seconds and nine seconds (Mainstream Renewable Power Ltd, 2012). However, it should be noted that both Seagreen OWF and NnG OWF are further inshore than the Array Project, thus there is potential for larger significant wave heights and wave periods within the Scoping Boundary, which is exposed to greater fetch lengths and less influenced by land. A more detailed assessment of the baseline will be undertaken in the EIA Report.

7.1.5.6 Within the EIA Report, a detailed baseline will be presented to provide an overview of the site specific wind and wave regime within the Scoping Boundary. Numerical models will be constructed using data collected from the deployed Metocean and LiDAR buoys.

Tidal currents and elevation

7.1.5.7 Currents are primarily tide driven, with a residual component driven by storms. The Atlas of UK Marine Renewable Energy Resources reports mean spring tidal ranges between approximately 2.3m to 2.7m across the Scoping Boundary (ABPmer, 2017). The Atlas also indicates spring peak current speeds of circa 0.4m/s to 0.6m/s across the Scoping Boundary. Elsewhere in the North Sea, a mean tidal range of 3.25m and current speeds between 0.5m/s to 0.6m/s were calculated within Berwick Bank OWF (SSER, 2022). In addition, Metocean deployments within Seagreen 1 OWF and Seagreen 1A OWF recorded maximum current speeds of 0.91m/s, with mean speeds of 0.21m/s to 0.35m/s across the survey area (Royal Haskoning DHV, 2012b).

7.1.5.8 A detailed baseline will be presented within the EIA Report to provide an overview of the site specific tidal regime within the Scoping Boundary.

Geology and seabed substrate

7.1.5.9 There was no sub-seabed interpretation required as part of the site specific geophysical survey scope of works (SoW). However, detailed imaging of the surficial Holocene sediments, as well as information on the Quaternary sediments down to >50m and imaging of sub-cropping PalaeoZoIc and MesoZoIc soils were collected. The predominant Holocene seabed sediment was fine to coarse sand with gravel and shell material, and seabed sediments were relatively homogenous (Figure 7.3). This correlates with the megaripples that dominate much of the seabed (paragraph 7.1.5.2). There were numerous higher SSS reflectivity areas throughout the Scoping Boundary, which were comprised of medium sand with shells, shell fragments and occasional gravels, pebbles and cobbles.

7.1.5.10 It is expected that the surficial sands and gravelly sands were relatively thin, as numerous boulders and cobbles were present, particularly in the troughs between megaripples. A total of 32,568 boulders were interpreted from the SSS and MBES data. Boulders were most common in the northwest and eastern areas where the underlying geology formed broad seabed shoals. There were 245 items of debris identified from the SSS data as well as 94 items of linear debris (such as fishing lines). The largest debris item measured 9.0 by 2.5 by 1.1m. It is likely that additional boulders and debris are present across the Scoping Boundary as 100% sonar coverage was not acquired.

7.1.5.11 Offshore marine bedrock data (scale 1:250,000) provided by the BGS illustrates that the Scoping Boundary is dominated by chalk (upper Cretaceous, Cenomanian to Maastrichtian) (Marine Scotland, 2017).

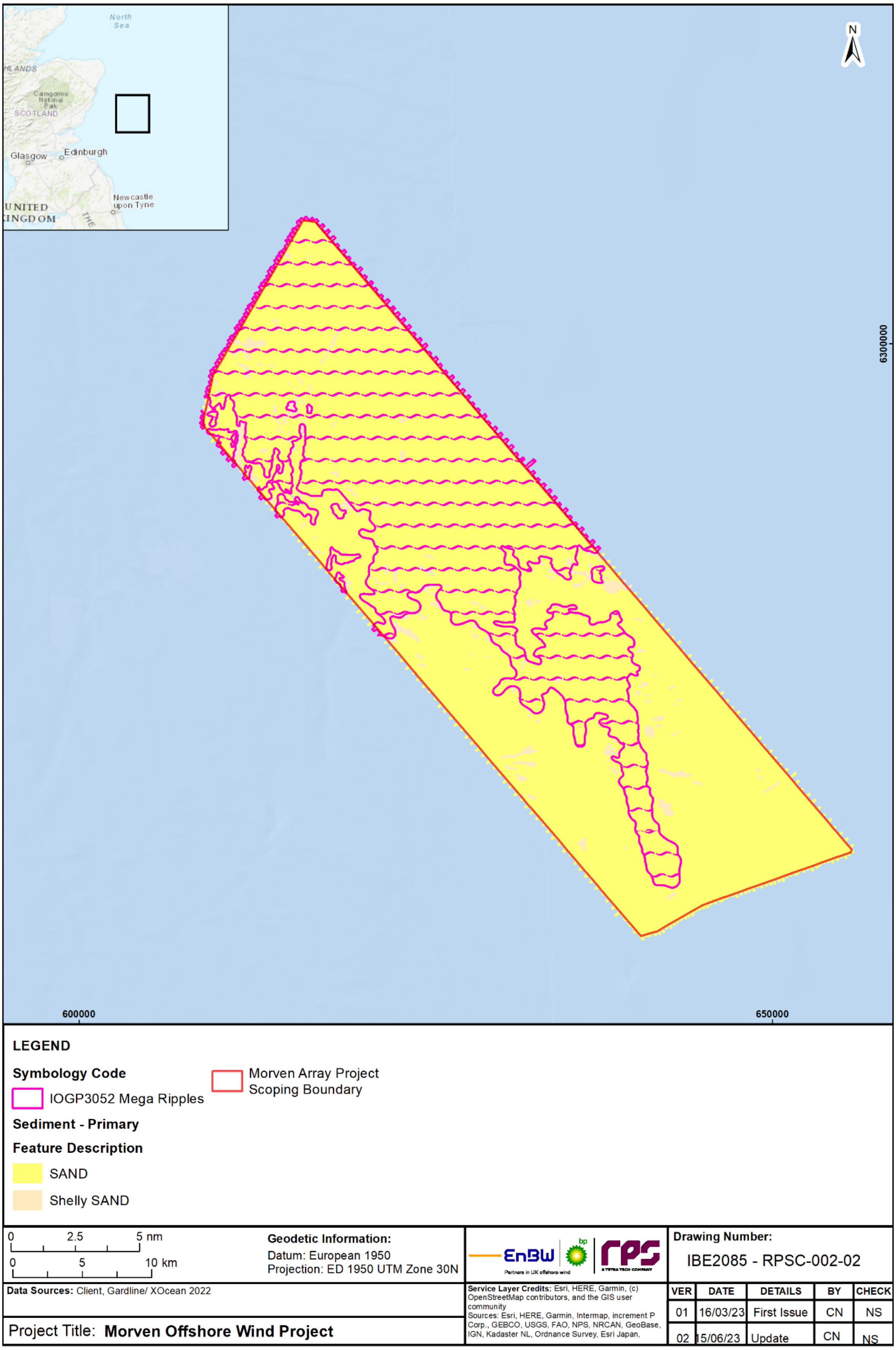


Figure 7.3: Scoping Boundary seabed sediment and megaripples

Suspended sediments

7.1.5.12 Finer sediment fractions (e.g. fine sand, mud and silt) are more likely to be suspended as they mobilise more easily within the water column. HR Wallingford (2009) has reported that sand transport rates are relatively low over much of the central North Sea, due to increased water depth and lower tidal current speeds than other regions. Similarly, low sediment transport rates due to low residual current speeds were reported within the Berwick Bank OWF, with increases observed during flood tides (SSER, 2022). Sediment transport rates also increase during storm events; based on the modelling undertaken for Berwick Bank OWF, the largest and most frequent waves approach from the north of Scoping Boundary. Therefore, net sediment transport under storm conditions would be in a southerly direction.

7.1.5.13 Recently, Cefas (2016) presented an analysis of the spatial distribution on non-algal suspended particulate matter (SPM) in UK waters. Within the Scoping Boundary and surrounding waters, mean SPM levels were estimated to be between 0mg/l to 1mg/l from 1998 to 2015, with higher levels typically observed in winter months (e.g. up to 3mg/l) (Cefas, 2016). Elsewhere in the vicinity of the Scoping Boundary, total suspended solids (TSS) were low at four sampling stations in the Firth of Forth in March and June 2011, with TSS levels of <5mg/l in most samples (Royal Haskoning DHV, 2012b). TSS were generally higher in March, with values of 10mg/l to 11mg/l recorded several times, and a maximum value of 18mg/l (Royal Haskoning DHV, 2012b). Tidal currents are the primary drivers of suspended sediment concentrations (SSCs), and fluctuations occurring across the spring-neap cycle and across tidal stages were observed in both March and June 2011 (Royal Haskoning DHV, 2012b).

7.1.5.14 During storms, wave-driven currents can elevate SSCs temporarily. SSC levels can rise significantly, compared to baseline levels, and then gradually decrease to baseline conditions after the storm. Therefore, SSC levels follow a broadly seasonal pattern due to the seasonal nature and frequency of storms. Elevated SSCs during storm events are less significant in deeper water, as the degree of wave penetration is lower than that of shallower water. Thus, it has been inferred that SSCs and TSSs are likely to be lower within the Physical Processes Study Area than in the Seagreen OWF study and, therefore, likely below a maximum value of 10mg/l during a winter storm.

Designated sites

7.1.5.15 The closest designated site with physical processes receptors is the Firth of Forth Banks Complex Marine Protected Area (MPA), which is located 0.04km from the Scoping Boundary at its closest point (Figure 7.4). This MPA includes the Berwick, Scalp and Montrose Banks and the Wee Bankie shelf banks and mounds. This MPA includes a mosaic of different sands and gravels that overlie subsea banks and mounds and are strongly influenced by currents . The MPA is designated for the following physical processes receptors, alongside aggregations of ocean quahog (*Arctica islandica*):

- Annex I habitat: Offshore subtidal sands and gravels;
- shelf banks and mounds;
- moraines representative of the Wee Bankie Key Geodiversity Area (JNCC, 2017).

7.1.5.16 The next nearest sites designated for physical processes receptors are the Farnes East Marine Conservation Zones (MCZ), northeast of Farnes Deep MCZ and Swallow Sand MCZ (JNCC, 2023). These MCZs are designated for a range of seabed habitats and geology features. However, they are located 68.06km, 63.42km and 61.14km, respectively, from the Scoping Boundary and are, therefore, unlikely to be sensitive to any potential impacts occurring within the Physical Processes Study Area.

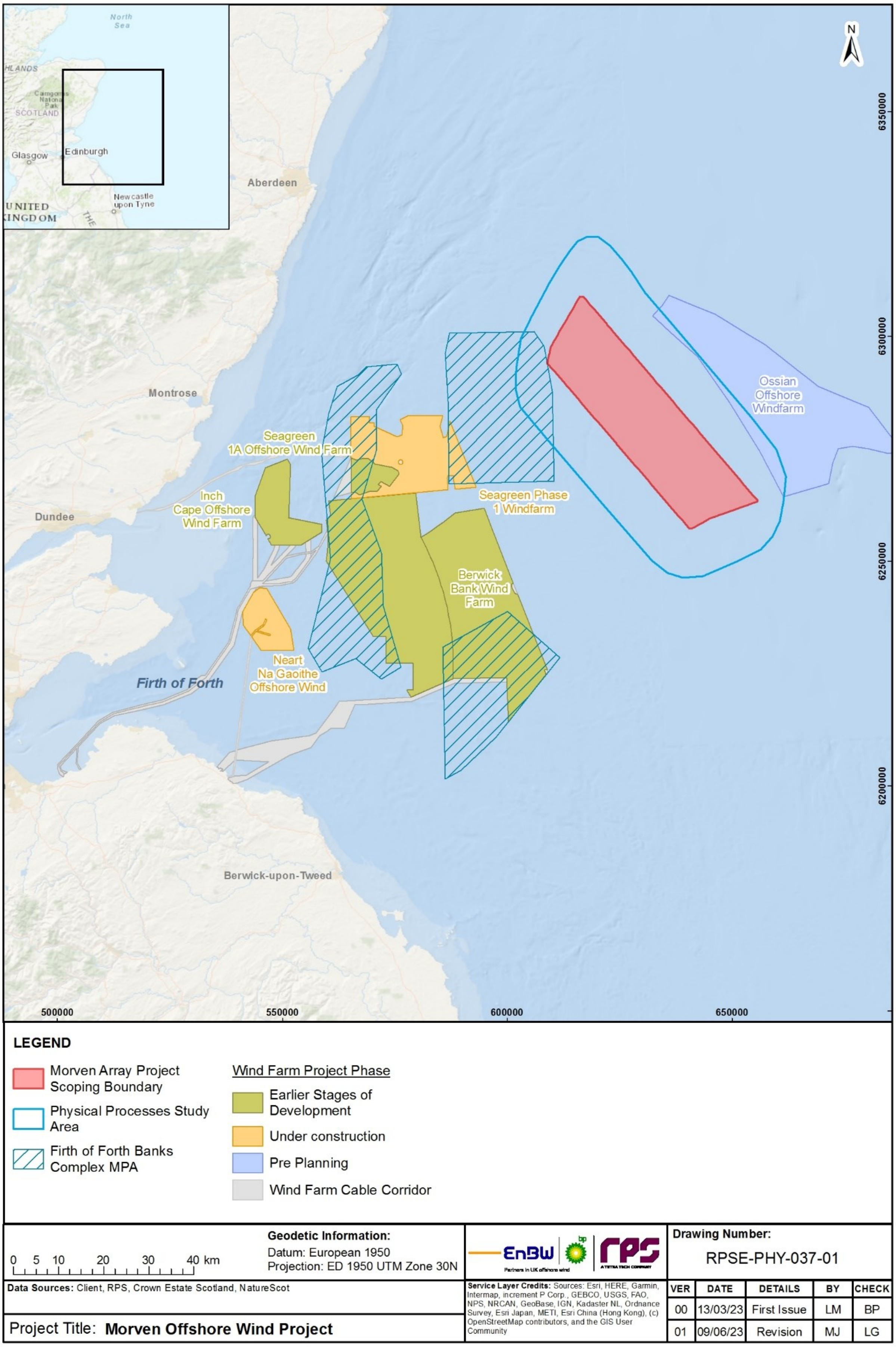


Figure 7.4: OWF projects in the vicinity of the Physical Processes Study Area

7.1.6 Potential Impacts of the Array Project

7.1.6.1 A range of potential impacts on physical processes have been identified, which may occur during the construction, O&M and decommissioning phases of the Array Project in the absence of designed in measures.

7.1.6.2 The impacts that have been scoped into the assessment are outlined in Table 7.3 together with a description of any additional data collection (e.g. site specific surveys) and supporting analyses (e.g. modelling) that will be required to enable a full assessment of the impacts.

7.1.6.3 At this stage, there are no potential impacts proposed to be scoped out of the assessment.

Table 7.3: Impacts proposed to be scoped in to the Array Project assessment for physical processes.

C = Construction phase, O = O&M phase, D = Decommissioning phase.

Impact	Project phase*			Justification	Data collection and analysis required to characterise the baseline environment	Summary of proposed approach to assessment
	C	O	D			
Increased SSCs and associated deposition	✓	✓	✓	There is potential for increased SSCs and associated deposition in all three Array Project phases. This impact could occur due to seabed preparation activities, foundation installation activities and cable installation activities in the construction phase, cable repair and reburial in the O&M phase and decommissioning activities, such as cable and foundation removal.	Data collected during the 2022 site specific geophysical survey campaign will provide data to support the development of the physical processes numerical modelling. Site specific Metocean data collected in 2022/23 may also be utilised to validate desktop sources and modelling. In addition, a detailed desktop data review will be conducted during the EIA process, which will be used to support the characterisation of the baseline environment regarding this impact.	Numerical modelling will be conducted to provide an overview of the potential changes to physical processes due to increased SSCs and associated deposition in all three phases. Further details of this modelling are presented in section 7.1.7. The outputs of the modelling will be used to inform a decommissioning assessment and a qualitative assessment.
Impacts to the wave regime due to the presence of infrastructure	×	✓	×	The presence of infrastructure in the water column (such as turbine foundations and offshore substation platforms (OSPs)) could alter the wave regime and could, potentially, impact physical features and physical processes receptors (such as the Firth of Forth Banks Complex MPA).		The impacts upon physical processes due to the presence of infrastructure in the O&M phase will be informed by numerical modelling. Further details of this modelling are presented in section 7.1.7.
Impacts to the tidal regime due to the presence of infrastructure	×	✓	×	The presence of infrastructure in the water column (listed above) may interact with the tidal regime. This, in turn, could potentially alter sediment transport and sediment transport pathways and impact physical features and physical processes receptors (such as the Firth of Forth Banks Complex MPA).		
Impacts to sediment transport and sediment transport pathways due to the presence of infrastructure	×	✓	×	As stated in the row above, the presence of infrastructure within the water column could alter the tidal regime and impact sediment transport and pathways as a result. Furthermore, the presence of infrastructure on the seabed could potentially disrupt sediment transport and sediment transport pathways directly, which may affect physical features and physical processes receptors (such as the Firth of Forth Banks Complex MPA).		

7.1.7 Designed In Measures and Mitigation

7.1.7.1 As part of the project design process, a number of designed in measures (primary and tertiary) will reduce the potential for impacts on physical processes (Table 7.4). As there is a commitment to implement these measures, they are considered inherent to the design of the Array Project. The determination of magnitude and significance will assume the implementation of such measures. Some of these measures are considered standard industry practice for this type of development.

7.1.7.2 The requirement for any additional (secondary) mitigation measures will be dependent on the significance of the effects on physical processes receptors. The requirement for and feasibility of any mitigation measures will be consulted upon with statutory consultees throughout the EIA process.

Table 7.4: Designed in measures of the Array Project, relevant to Physical Processes

Reference number	Measures adopted	Justification	Primary or tertiary
MM-1	Scour protection will be used around offshore structures as set out in chapter 3: Project Description.	There is the potential for scouring of seabed sediments to occur due to interactions between Metocean regime (wave, sand and currents) and foundations or other seabed structures. This scouring can develop into depressions around the structure; the use of scour protection around offshore structures and foundations will be employed, as described in detail in chapter 3: Project Description. The scour protection has been included in the modelled scenarios used within the assessment of effects to protect foundations from the effects of scour.	P
MM-41	Sufficient spacing between wind turbines (at least 1,000m).	Sufficient spacing between wind turbines to mitigate wake effects and changes to the wave field.	P
MM-2	Development and adherence to a Cable Plan.	There is a potential for cable exposure to occur due to interactions between Metocean regime (wave, sand and currents). Sediment transportation can lead to exposure of cables and infrastructure, although the use of a target cable burial depth alongside the cable installation strategy should provide sufficient depth to avoid exposure. The Cable Plan will outline the technical specifications of the cables used in the Array Project and describe the installation methodology; also includes cable protection to be installed.	P
MM-45	Implementation, management and monitoring of cable protection (via burial or external protection where adequate burial depth, as identified via risk assessment, is not feasible) with any damage, destruction or decay of cables notified to MCA, NLB, Kingfisher and United Kingdom Hydrography Office (UKHO) no later than 24 hours after discovered. Secured through the Navigation Safety and Vessel Management Plan.	Cable protection may be necessary in some locations where sufficient target cable burial depth cannot be achieved or where cables become exposed during the lifetime of the Array Project. To ensure that the Cable Plan has been successfully implemented, monitoring will be undertaken as part of wider Array Project pre- and post-construction geophysical surveys and are likely to involve a combination of MBES or high-resolution SSS. This minimises the risks of underwater allision with cable protection, anchor or fishing gear interaction with subsea cables and interference with magnetic position fixing equipment.	P

7.1.8 Proposed Assessment Methodology

7.1.8.1 The physical processes chapter of the EIA Report will follow the methodology set out in chapter 4: EIA Methodology of the Scoping Report. The following guidance will also be considered:

- 'Coastal Process Modelling for Offshore Wind Farm Environmental Impact Assessment: Best Practice Guide' (Lambkin *et al*., 2009);
- 'Guidelines in the use of Metocean data through the lifecycle of a marine renewable development' (Cooper *et al*., 2008);
- Guidance on Environmental Impact Statement (EIS) and Natura Impact Statement (NIS) Preparation for Offshore Renewable Energy Projects, Department of Communications, Climate Action and Environment, (2017);
- Advice to Inform Development of Guidance on Marine, Coastal and Estuarine Physical Processes Numerical Modelling Assessments. Natural Resources Wales (NRW) Report No 208, 139pp, NRW, Pye, K., Blott, S.J. and Brown, J. (2017).

7.1.8.2 As stated in Table 7.2, numerical modelling is planned to fully assess the potential impacts of all phases of development upon physical processes. This modelling will be undertaken to assess the magnitude and significance of impacts upon physical processes and will include tidal currents, wave regime, littoral currents, SSCs and sediment transport and pathways.

7.1.8.3 The modelling will be undertaken using MIKE software, which contains a suite of global standard coastal and environmental modelling modules. These modules can be applied to a single model mesh and allow the modelling of combined (coupled) parameters to be undertaken. The MIKE flexible mesh coupled modules will then be used to model the baseline wave climate, tidal flows and sediment transport. This model provides sufficient detail to simulate the parameters and is also computationally efficient as it uses a flexible mesh comprising the most recent bathymetric data. The modelling will be validated using all available sources, including data from the site specific surveys within the Scoping Boundary.

7.1.8.4 The computational model applied in the baseline study will be amended to assess the impact of the following:

- the interactions between the wind turbines and OSPs with scour and cable protection to quantify their alterations to wave climate and sediment transport;
- sediment released into the water column during cable installation and laying to gauge the sediment dispersion, transport and fate.

7.1.8.5 Modelling will be validated using all available data sources, including site specific sampling undertaken across the Scoping Boundary extending to include wave climate and tidal currents for which monitoring has been undertaken.

7.1.8.6 The outputs of the numerical modelling will be used to support the impact assessment for other topics in the EIA Report, such as benthic subtidal ecology, fish and shellfish ecology, marine mammals, marine archaeology, and other sea users and marine infrastructure.

7.1.9 Potential Cumulative Impacts

7.1.9.1 In the absence of modelling, it is uncertain at this stage whether the predicted impacts to physical processes will be localised within the Scoping Boundary during all phases of development. These impacts could interact with those from other projects in proximity to the Scoping Boundary and result in a cumulative impact upon physical processes and physical processes receptors (e.g. the Firth of Forth Banks Complex MPA). Other OWF projects in the vicinity include Ossian OWF, Berwick Bank OWF, Seagreen 1 OWF, Seagreen 1A OWF, Inch Cape OWF and Neart na Gaoithe OWF (Figure 7.4). The cumulative effects assessment will follow the approach outlined in chapter 4: EIA Methodology of the Scoping Report.

7.1.10 Potential Inter-Related Effects

7.1.10.1 The EIA will consider inter-related effects. Inter-related effects relate to effects arising from the Array Project, either across their own phases (project lifetime) or different effects on one receptor in one phase (receptor-led). The EIA will consider inter-related effects, in relation to the potential effects of multiple impacts from the construction, O&M and decommissioning phases of the Array Project, affecting one receptor. Inter-related effects are assessed through consideration of all effects on a receptor, considering both spatial and temporal overlaps, with the Array Project. This will ensure that the Array Project as a whole is appropriately considered within the EIA.

7.1.11 Potential Transboundary Impacts

7.1.11.1 A screening of transboundary impacts has been carried out and is presented in Appendix 1: Transboundary Screening. This screening exercise identified that there is no potential for transboundary impacts on physical processes receptors due to construction, O&M and decommissioning impacts of the Array Project.

7.2 Underwater Sound

7.2.1 Introduction

7.2.1.1 This chapter of the Scoping Report identifies the elements of underwater sound of relevance to the Array Project and considers the potential impacts arising from the construction, O&M and decommissioning of the Array Project.

7.2.1.2 The underwater sound study will provide an assessment of the levels of underwater sound generated during each of the Array Project's phases. The effects of this underwater sound on the following receptor groups are discussed in their respective chapters:

- chapter 8.2: Fish and Shellfish Ecology;
- chapter 8.3: Marine Mammals;
- chapter 9.1: Commercial Fisheries.

7.2.2 Study Area

7.2.2.1 The Underwater Sound Study Area is defined by the sensitive receptors outlined above and, as such, no separate study area is identified.

7.2.3 Data Sources

7.2.3.1 Where data inputs for underwater sound modelling are not provided by data collection during characterisation of the baseline environment, public data sources will be used. A summary of the datasets that have so far been identified is presented in Table 7.5.

Table 7.5: Summary of likely data sources to be used for underwater sound modelling

Data requirement	Data source	Description
Environment - bathymetry	European Marine Observation and Data Network (EMODnet) bathymetry (EMODnet Bathymetry Consortium, 2020)	A 1/16 arc minute resolution (approximately 115m × 115m) grid rendered for European sea basins. Used to extend bathymetry beyond the Scoping Boundary.
Environment – sound speed profile	Generalised Digital Environmental Model (GDEM; Teague *et al.*, 1990; Carnes, 2009)	An ocean climatology of temperature and salinity for the world's oceans on a latitude-longitude grid with 0.25° resolution, with a temporal resolution of one month, based on global historical observations from the US Navy's Master Oceanographic Observational Data Set.
	Copernicus European North West Shelf-Ocean Physics Reanalysis (E.U. Copernicus Marine Service Information, 2020)	Ocean physics reanalysis for the North-West European Shelf containing vertical profiles of temperature and salinity available as monthly and daily 25-hour, de-tided, averages.
	Scottish Shelf Waters Reanalysis Service (Barton *et al.*, 2022)	A hindcast model covering the Scottish continental shelf waters as well as most of UK waters, the North Sea and the English Channel.
Acoustic source levels – vessels and construction sound	For example: Austin (2014), MacGillivray and de Jong (2021), Nedwell and Edwards (2004), Robinson *et al.* (2011)	There is a great deal of published literature detailing sound levels from vessels and construction activities, from recorded data. Source levels for these activities are highly dependent on the characteristics of the vessel and/or machinery and, as such, the specific data sources will depend on these source characteristics, once defined.
Acoustic source levels - mid- and high-frequency geophysical sources	Manufacturer datasheets	Parameters relevant to these sources such as source level, operating frequency, pulse length, pulse repetition rate, transducer shape and beamwidth, beam count and swath coverage are specific to the source but typically well defined by the manufacturers of such sources provided in data sheets

7.2.4 Consultation

7.2.4.1 The approach to consultation for the Array Project is set out in chapter 5: Consultation Process of the Scoping Report. A summary of the pre-application consultation undertaken to date relevant to underwater sound is set out in Table 7.6. Further detail on the Scoping Workshop and stakeholder plans for future engagement is set out in chapter 5: Consultation of the Scoping Report, supported by Appendix 3: Array Project Scoping Workshop Information and Appendix 4: Array Project Stakeholder Engagement Plans of the Scoping Report.

Table 7.6: Pre-application consultation relevant to Underwater Sound undertaken to date

Date	Overarching theme	Method of engagement	Stakeholder	Summary of stakeholder feedback	Applicant's response and relevant cross reference
18.04.23	EIA Approach	Scoping Workshop session	NatureScot	NatureScot agreed with approach and methodology proposed by JASCO.	See Appendix 5: Underwater Sound Methodology Statement for methodology.
18.04.23	Guidance	Scoping Workshop session	Marine Scotland Science	Mitigation and monitoring may need updating following completion and review of propagation modelling.	Agreed with consultee. Approach to mitigation presented in section 7.2.7.

7.2.5 Baseline Environment

7.2.5.1 Ambient underwater sound represents the baseline environment for this component and is defined as the sound present in the absence of a specified activity (ISO 18405:2017). The specified activities for the purposes of the EIA are the underwater sound-generating processes within each of the Array Project phases. Ambient sound is a composite of many sources, near or far, which may be geophonic, biophonic, or anthrophonic in origin (Krause, 2008).

7.2.5.2 Sources of geophonic sound may be related to oceanographic conditions. Higher sea states and wind speeds commonly generate higher sound levels due to breaking whitecaps, surface flow sound, wave generation, cavitation, and pressure change (Urick, 1983). Rainfall may also elevate sound levels via sound from surface impacts and bubble entrapment (Heindsmann *et al.*, 1955; Bom, 1969; Scrimger *et al.*, 1987). Waves, sea ice, currents, and seismic activity (such as earth movement and subsea landslides) can also be geophonic contributors generating high sound levels, although typically only for short durations (Chapp *et al.*, 2005; Ardhuin *et al.*, 2011).

7.2.5.3 Marine mammals are the primary biological contributors to underwater ambient sound, though some aquatic invertebrates and fish species are also capable of producing sound. Marine mammals, particularly cetaceans, rely almost exclusively on sound for navigating, foraging, breeding, and communicating (Clark, 1990; Edds-Walton, 1997; Tyack and Clark, 2000).

7.2.5.4 Anthropogenic underwater sound can either be used for a specific purpose (e.g. geophysical surveys) or is a by-product of marine operations. Within the vicinity of the Scoping Boundary, the primary sources of anthropogenic sound are likely to be related to shipping activity and, to a lesser extent, oil and gas activity. The predominant sources of sound from shipping are engine sound radiating through vessel hulls and cavitating propulsion systems. More detailed information related to shipping is presented in chapter 9.2: Shipping and Navigation of the Scoping Report.

7.2.5.5 No site specific surveys have been carried out to characterise the baseline underwater sound conditions for this Scoping Report. Surveys that will be carried out to characterise the environment that will help inform underwater sound modelling for underwater sound modelling are presented in Table 7.7.

7.2.6 Potential Impacts of the Array Project

7.2.6.1 A range of potential impacts could arise from underwater sound generated during the construction, O&M and decommissioning phases of the Array Project.

7.2.6.2 The impacts that have been scoped into the assessment are outlined in Table 7.7 together with a description of any additional data collection (e.g. site specific surveys) and supporting analyses (e.g. modelling) that will be required to enable a full assessment of the impacts. No potential impacts relating to underwater sound have been scoped out of the assessment.

Table 7.7: Impacts proposed to be scoped into the Array Project assessment for underwater sound

C = Construction phase, O = O&M phase, D = Decommissioning phase

Impact	Project phase*			Basis for Impact	Data collection and analysis required to characterise the baseline environment	Summary of proposed approach to assessment
	C	O	D			
Increased underwater sound from pile driving activity.	✓	×	×	Pile driving activity related to wind turbine foundation installation generates impulsive sound which can affect marine fauna.	Data collected during the site specific geophysical and geotechnical survey campaign will provide data to characterise the geoacoustic environment, as needed for underwater sound modelling.	Numerical modelling will be conducted to assess the impact of underwater sound on receptor groups highlighted in section 7.2.1. The approach is outlined in section 7.2.8 and presented in more detail in Appendix 5: Underwater Sound Methodology Statement. The results of the underwater sound assessment will be presented in an Underwater Sound Technical Report, which will inform the Fish and Shellfish Ecology, Marine Mammal and Commercial Fisheries EIA Report chapters. A separate EIA Report chapter for underwater sound will, therefore, not be presented.
Increased underwater sound from unexploded ordnance (UXO) clearance.	✓	×	×	UXO clearance, required as preparatory work before construction generates impulsive sound which can affect marine fauna.		
Increased underwater sound from non-impulsive sound sources.	✓	✓	✓	Effects of non-impulsive sound on marine fauna are assessed against different criteria used for impulsive sound. The exact sources of non-impulsive sound have not yet been explicitly defined but are likely to include: • vessel activity during all Array Project phases • construction activities such as cable laying, drilling and cable protection installation during the construction phase • wind turbine operational sound during the O&M phase • geophysical surveys during all Array Project phases • decommissioning activities such as cutting and removal of piles and cables. Additional sound sources will be considered as needed when raised throughout the EIA process.		

7.2.7 Designed In Measures and Mitigation

7.2.7.1 As part of the project design process, a number of designed in measures (primary and tertiary) will reduce the potential for impacts on underwater sound (Table 7.8). As there is a commitment to implement these measures, they are considered inherent to the design of the Array Project. The determination of magnitude and significance will assume the implementation of such measures. Some of these measures are considered standard industry practice for this type of development.

7.2.7.2 The requirement for any additional (secondary) mitigation measures will be dependent on the significance of the effects on underwater sound receptors, and may include consideration of noise abatement systems (NAS). The requirement for and feasibility of any mitigation measures will be consulted upon with statutory consultees throughout the EIA process.

Table 7.8: Designed in measures of the Array Project, relevant to underwater sound

Reference Number	Measures adopted	Justification	Primary or tertiary
MM-40	A soft start procedure (including low hammer initiation and ramp up) be implemented for pile driving to allow additional time for animals to leave the area before full power piling begins. Soft start procedure to be outlined in the Construction Method Statement (CMS).	Soft start will allow time for animals to leave the area prior to full power piling beginning.	P
MM-5	Development of, and adherence to, an Environmental Management Plan (EMP), including actions to minimise Invasive Non-Native Species (INNS), draft Marine Mammal Mitigation Protocol (MMMP) and a Marine Pollution Contingency Plan (MPCP), which will include planning for accidental spills, address all potential contaminant releases and include key emergency details.	Provides a means to ensure the efficient management and communication of commitments made for the management of the potential environmental impacts. The EMP will include a MMMP. The MMMP may include using Marine Mammal Observer(s) and PAM to monitor the mitigation zone (MZ, as determined by the underwater sound modelling) to ensure that animals are not observed within the MZ during piling. Acoustic Deterrent Devices (ADD) may be used if required to deter animals from the MZ. For offshore water quality, measures will be adopted to ensure that the potential for release of pollutants from construction, and O&M, is minimised. In this manner, the accidental release of contaminants from rigs and supply/service vessels will be strictly controlled, thus providing protection for birds and their prey species across all phases of the development. For benthic subtidal ecology, an MPCP and Invasive Non-Indigenous Species Management Plan (INISMP) will be included. The MPCP will include planning for accidental spills, addressing all potential contaminant releases and include key emergency details. The INNSMP will include measures for controlling INNS and their impact on fish and shellfish ecology receptors.	T

7.2.8 Proposed Assessment Methodology

7.2.8.1 A detailed outline of the proposed methodology for assessing underwater sound is presented in Appendix 5: Underwater Sound Methodology Statement. The broad outline of the procedure is as follows:

- Estimate source levels for each activity either through source modelling or use of a suitable proxy source.
- Conduct sound propagation modelling in three dimensions around the source and estimate distances to impact criteria thresholds.
- Consider cumulative impacts of multiple events and multiple operations.
- Incorporate animal swim speeds to assess accumulated sound exposure.

7.2.8.2 Where data inputs for underwater sound modelling are not provided by data collection during characterisation of the baseline environment (see Table 7.7), public data sources will be used. A summary of the datasets that have so far been identified is presented Table 7.5.

7.2.9 Potential Cumulative Impacts

7.2.9.1 Consideration will be given to cumulative effects on relevant receptors due to underwater sound in the respective topic sections of the EIA Report.

7.2.10 Potential Transboundary Impacts

7.2.10.1 A screening of transboundary impacts has been carried out and is presented in Appendix 1: Transboundary Screening. This screening exercise identified that there is no potential for transboundary impacts due to underwater sound arising from construction, O&M and decommissioning impacts of the Array Project. Transboundary impacts affecting specific receptor groups are considered separately (within Appendix 1: Transboundary Screening).

7.3 Offshore Water Quality

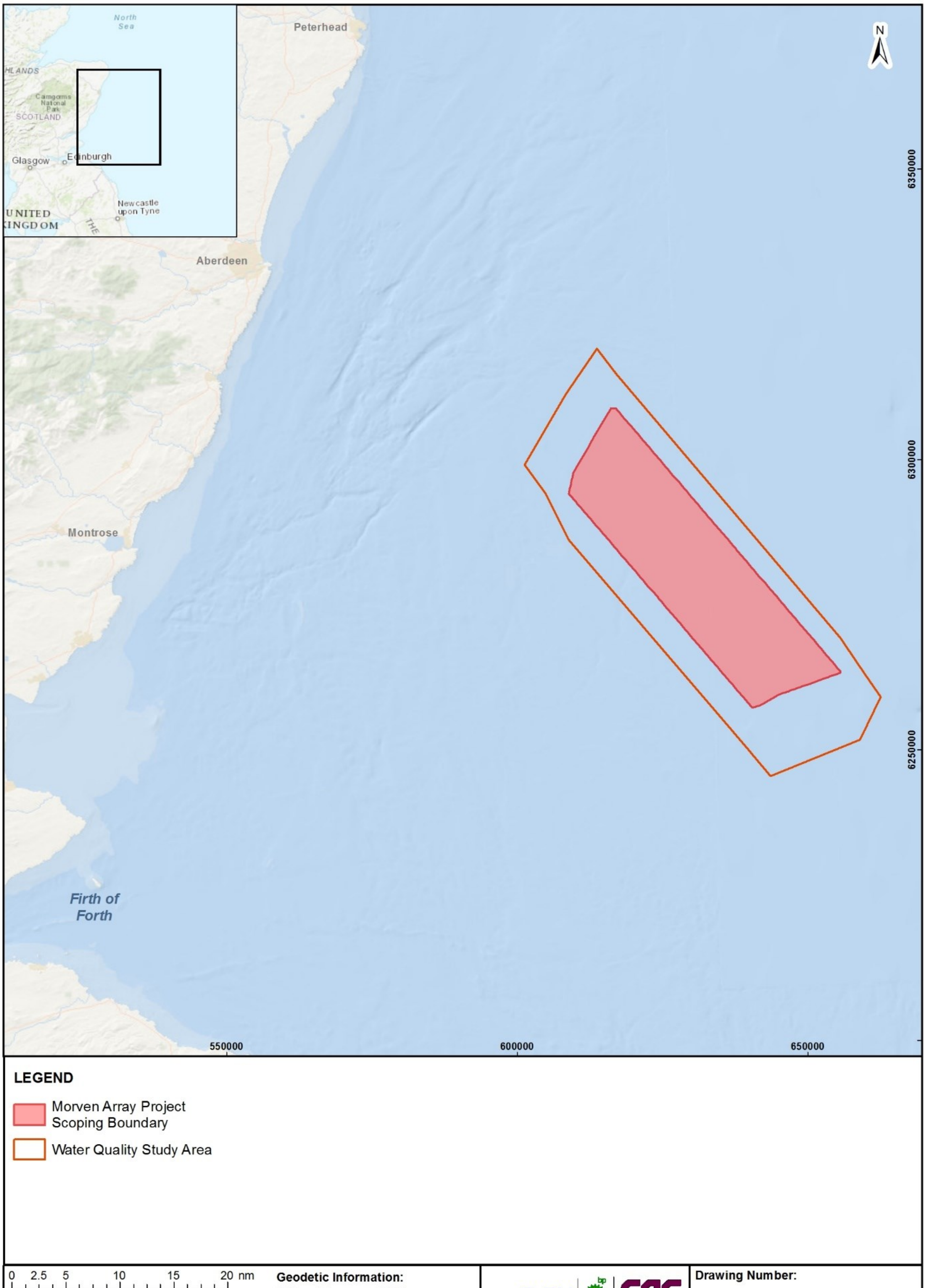
7.3.1 Introduction

7.3.1.1 This chapter of the Scoping Report identifies receptors of relevance to the Array Project in relation to offshore water quality. It considers the potential for impacts to arise from the construction, O&M , and decommissioning of the Array Project on offshore water quality.

7.3.1.2 It is proposed to scope out offshore water quality from the Environmental Impact Assessment (EIA) and this chapter of the Scoping Report sets out the rationale for this approach.

7.3.2 Study Area

7.3.2.1 The Offshore Water Quality Study Area includes the Scoping Boundary, plus a tidal Zone of Influence (ZoI) buffer defined from desktop sources (3km to 13km; Gardline, 2023), as shown in Figure 7.5. This Offshore Water Quality Study Area incorporates the ZoI for the maximum extent of indirect impacts to benthic subtidal receptors, fish and shellfish ecology and marine protected area (MPA) receptors from increases in suspended sediment concentrations (SSC) and deposition.



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00	21/02/23	First Issue	NA	AW
02	08/06/23	Revision	MJ	LG

Figure 7.5: Offshore Water Quality Study Area

7.3.3 Data Sources

Desktop data

7.3.3.1 An initial desk-based review of literature and data sources to support the offshore water quality chapter has identified a number of data sources that provide coverage of the Offshore Water Quality Study Area, summarised in Table 7.9.

Table 7.9: Summary of key desktop datasets and reports

Title	Source	Year	Author
Marine Directorate Licensing Operations Team: Scoping Opinion for Berwick Bank Offshore Wind Farm	Marine Directorate Licensing Operations Team	2022	Marine Scotland
The River Basin Management Plan for Scotland 2021– 2017	Scottish Environmental Protection Agency (SEPA)	2021	SEPA for the Scottish Government
Scottish Bathing Waters 2016	SEPA for the Scottish Government	2016	SEPA for the Scottish Government
Bathing Waters profiles: Eyemouth, Coldingham, Pease Bay, Thorntonloch, Whitesands, Dunbar (East), Dunbar (Bellhaven), Seacliff	SEPA for the Scottish Government	2023	SEPA for the Scottish Government
Downie Point to Big Rob's Cove Water Body 200092 information sheet	SEPA for the Scottish Government	2023	SEPA for the Scottish Government
Garron Point to Downie Point (Stonehaven) Water Body 200518 information sheet	SEPA for the Scottish Government	2023	SEPA for the Scottish Government
Big Rob's Cove to Couts Rock (Inverbervie) Water Body 200087 information sheet	SEPA for the Scottish Government	2023	SEPA for the Scottish Government
Sediment analysis and sample plans	Marine Management Organisation (MMO)	2022	MMO
Action level tool for sediment contaminants	Centre for Environment Fisheries and Aquaculture Science (Cefas)	2022	Cefas
Shellfish water protected areas	SEPA for the Scottish Government	2023	SEPA for the Scottish Government

7.3.4 Consultation

7.3.4.1 No pre-application pre-Scoping consultation has been undertaken to date for offshore water quality receptors.

7.3.5 Baseline Environment

7.3.5.1 This section provides a summary of the offshore water quality baseline environment for the Array Project, based on desktop data. In the United Kingdom (UK), water quality is regulated through a number of regulations which cover different types of water bodies, depending on their location. The main regulations in Scotland that cover these water bodies are described below in terms of the type of water quality covered and relative proximity to the Array Project.

Marine Strategy Regulations 2010

7.3.5.2 The Marine Strategy Regulations 2010 transpose the requirements of Council Directive 2008/56/EC (the Marine Strategy Framework Directive) into UK law. The Regulations outline the requirement of achieving Good Environmental Status (GES) by 2020, which has been implemented through the UK Marine Strategy.

7.3.5.3 GES reflects the UK's vision for 'clean, healthy, safe, productive and biologically diverse ocean and seas'. Under the Marine Strategy Framework Directive, GES involves protecting the marine environment, preventing its deterioration, restoring it where practical, and phasing out marine pollution.

7.3.5.4 There are 11 descriptors of GES, three of which were considered potentially relevant:

- Non-indigenous species (NIS) introduced by human activities are at levels that do not adversely alter the ecosystems (Descriptor 2).
- Hydrographical conditions are not permanently altered such that ecosystems are adversely affected (Descriptor 7).
- Concentrations of contaminants are at levels not giving rise to pollution effects (Descriptor 8).

7.3.5.5 The Offshore Water Quality Study Area sits within the geographic scope of monitoring of these descriptors, as it lies within the marine waters in which the UK exercises jurisdiction. Compliance with the Marine Strategy Regulations through the UK Marine Strategy is measured by GES, however, data from monitoring programmes are pending publication as of early 2023.

7.3.5.6 Scotland has worked with the UK Government on amendments that have been made to the Marine Strategy Regulations 2010, so that they continue to be effective now that the UK is no longer part of the European Union (EU) (Scottish Government 2020).

7.3.5.7 In view of the offshore location of the Array Project and the designed in measures presented in Table 7.11, the Array Project is not considered to present any increased risk to the achievement of the above listed indicators of GES, or the aspirations of the UK Marine Strategy. It is proposed to scope out these pathways to reduced water quality out of the EIA. Further justification is provided in Table 7.10.

Water Environment (Controlled Activities) (Scotland) Regulations 2011 (as amended)

7.3.5.8 The requirements of the European Union's (EU) Water Framework Directive (WFD) were transposed into Scottish law under the Water Environment and Water Services (Scotland) Act 2003 (known as the WEWS Act). The legislation covers rivers, lochs, transitional waters (estuaries), coastal waters, ground water and groundwater-dependent wetlands.

7.3.5.9 The WFD establishes a legislative framework for the protection of surface waters (including rivers, lakes, transitional waters and coastal waters) and groundwater out to 3nm in Scotland as opposed to 1nm from baseline throughout other regions of the EU and UK. A requirement of the WFD is to report on the 'ecological status' of surface and groundwater in coastal waters (out to 1nm from baseline) and the 'chemical status' of surface and groundwater in territorial waters (out to 12nm from baseline). Within each water body, the WFD sets ecological and chemical objectives. By 2021, 87% of water bodies had achieved Good status (Scottish Environment Protection Agency (SEPA), 2021). SEPA aims to maintain this and achieve, or return to, Good status in 94% of waters by 2027 (SEPA, 2015). Under all conditions, the WFD requires that there should be no deterioration in the status of any water bodies.

7.3.5.10 The Water Environment (Controlled Activities) (Scotland) Regulations 2011 are more commonly known as the Controlled Activity Regulations (CAR). Amendments made in 2013 and 2021 apply regulatory controls over activities which may affect Scotland's water environment, as outlined in the WEWS Act. The Water Environment (Controlled Activities) (Scotland) Amendment Regulations 2021 include changes to the description of controlled activities.

7.3.5.11 Maintaining and improving water quality in WFD water bodies is achieved via measures described in the river basin management plan for Scotland (SEPA, 2021), which include regulating new and existing discharges, abstractions, impoundments and engineering works in accordance with the Water Environment (Controlled Activities) (Scotland) Regulations 2011 (as amended).

7.3.5.12 At approximately 60km offshore, the Offshore Water Quality Study Area does not overlap with any WFD water bodies. The nearest water bodies to the Offshore Water Quality Study Area are Downie Point to Big Rob's Cove (ID: 200092) approximately 51km away, Garron Point to Downie Point (Stonehaven) (ID: 200518) approximately 52km away and Big Rob's Cove to Couts Rock (Inverbervie) (ID: 200087) approximately 54km away. The most recent sampling results and status classifications available for this water body are from 2020 (SEPA, 2023a).

7.3.5.13 In view of the offshore location of the Array Project relative to the closest WFD water bodies and the designed in measures presented in Table 7.11, the Array Project is considered to present no increased risk of deterioration of any WFD element of any water body. It is, therefore, proposed to scope out WFD receptors from the EIA in relation to the Array Project.

Bathing Water Regulations 2008

7.3.5.14 The Bathing Water (Scotland) Regulations 2008 transpose Council Directive 2006/7/EC (the Bathing Water Directive) concerning the management of bathing water quality into Scottish law and reporting commenced in 2015.

7.3.5.15 Compliance with the Bathing Water Regulations is measured using two microbiological parameters: Escherichia coli (E. coli) and intestinal Enterococci, and bathing waters are classed as either poor, sufficient, good or excellent. The revised Bathing Water Directive introduced a new classification system with more stringent water quality standards, requiring all bathing waters to be classed as at least 'sufficient'. It also puts an emphasis on providing information to the public.

7.3.5.16 The nearest water designated under the bathing water directive standards is at Stonehaven, which is located approximately 62km from the Offshore Water Quality Study Area. For the 2022 bathing period (from 15 May to 30 September) the Stonehaven location was classified as Good (SEPA 2023c). There is no explicit statutory requirement for bathing waters to achieve or maintain a given status, but summary information on water quality status must be available to the public at bathing locations.

7.3.5.17 In view of the offshore location of the Array Project relative to the closest designated bathing waters and the designed in measures presented in Table 7.11, the Array Project is considered to present noincreased risk of deterioration of designated bathing waters. It is, therefore, proposed to scope out bathing waters receptors from the EIA in relation to the Array Project.

Shellfish Water Protected Areas: Environmental Objectives etc.) (Scotland Regulations 2013)

7.3.5.18 The Water Environment (Shellfish Water Protected Areas: Environmental Objectives etc.) (Scotland) Regulations 2013 transpose the Shellfish Waters Directive (2006/113/EC) concerning the management of water quality for commercial shellfish cultivation into Scottish law.

7.3.5.19 Shellfish, such as mussels and oysters, filter large volumes of water to obtain food. During this process they can concentrate organisms such as bacteria and viruses in their bodies, some of which may be harmful to humans (pathogens). Such organisms can be present due to contamination of water with sewage or animal faeces (faecal contamination) (Marine Scotland 2023).

7.3.5.20 Levels of faecal contamination in shellfish collected from production areas (PAs) are monitored by Food Standards Scotland (FSS) as prescribed in the European Regulation (EU) 2017/625. *E. coli* is used as an indicator of this contamination and, as such, of water quality (Marine Scotland 2023). SEPA works closely with FSS to assess and classify each protected area. FSS samples, analyses and reports water quality in production areas throughout the year to ensure shellfish are safe for consumption or to determine if they require further treatment. At the end of each year FSS provides SEPA with this data; SEPA then uses it to classify the wider shellfish water protected areas (SWPA). SEPA's classification gives an overview of the water quality over the year for the whole SWPA (SEPA 2023b).

7.3.5.21 SWPAs are located predominately in the west of Scotland. The nearest shellfish water protected area to the Offshore Water Quality Study Area is Cromarty Bay, over 200km away to the north-west of the Array Project (SEPA 2023d).

7.3.5.22 In view of the offshore location of the Array Project relative to the closest shellfish water protected area and the designed in measures presented in Table 7.11, the Array Project is considered to present no increased risk of deterioration of any shellfish water protected areas. It is, therefore, proposed to scope out shellfish water protected area receptors from the EIA in relation to the Array Project.

Important Ecological Features

7.3.5.23 Within the Offshore Water Quality Study Area, there are no Important Ecological Features (IEFs) specifically appropriate to offshore water quality. This has been determined in line with the Chartered Institute of Ecology and Environmental Management (CIEEM) guidelines. These guidelines indicate that as the marine environment is sufficiently widespread and a highly dynamic habitat that is expected to remain viable and sustainable throughout the Array Project, detailed assessment is not necessary (CIEEM, 2018). Deterioration of water quality has the potential, however, to adversely affect benthic ecology and fish and shellfish ecology receptors. The IEFs appropriate to these topics will be fully addressed in the relevant chapters of the EIA Report.

7.3.6 Potential Impacts of the Array Project

7.3.6.1 Water quality is not generally regarded as a receptor in itself. However, increased suspended sediments in the water may indirectly impact other receptors including benthic ecology, fish and shellfish and offshore ornithology through indirect effects on prey availability. Potential impacts on offshore water quality have been identified, which may occur during the construction, O&M and decommissioning phases of the Array Project. These impacts will be fully addressed in the relevant chapters of the EIA Report.

7.3.6.2 As outlined in paragraph 7.3.1.2, it is proposed to scope out all potential impacts on offshore water quality from the EIA Report. The justifications for this approach are presented in Table 7.10.

Table 7.10: Impacts proposed to be scoped out of the Array Project assessment for Offshore Water Quality

Impact	Basis for impact
Impacts to sediment transport and sediment transport pathways due to the presence of infrastructure	The presence of infrastructure within the water column for the lifetime of the Array Project could alter the tidal regime, impact sediment transport and pathways. Such changes could affect water, depending on where sediment is redirected and in what volumes. Furthermore, the presence of infrastructure on the seabed could potentially disrupt sediment transport and sediment transport pathways directly, which may, in turn, increase sediment disturbance and affect water quality. It is anticipated that the physical processes modelling undertaken for the Array Project will demonstrate that impacts to sediment transport or sediment transport pathways would be spatially restricted to within the boundaries of the Array Project and the surrounding area. Considering the distance at which the Array Project is located from shore (c. 60km), any effects on water quality would dissipate quickly and would be isolated to a remote, offshore location. This impact is proposed to be scoped out of further consideration within the EIA with respect to offshore water quality receptors.
Increased suspended sediment concentrations and associated deposition	Sediment disturbance arising from construction activities (e.g. foundation and cable installation – including drilling and any deposits arising, UXO clearance and seabed preparation); maintenance operations (e.g. cable repair/reburial, use of jack-up vessels to facilitate wind turbine component repairs, etc.); and decommissioning activities (e.g. foundation removal) may result in increases in suspended solids and siltation rate changes. However, any increases in suspended sediment concentrations are predicted to be short term, returning to baseline levels on subsequent tides. Considering the distance at which the Array Project is located from shore (60km), any effects would dissipate quickly and would be isolated to a remote, offshore location sosignificant impacts on offshore water quality are not predicted. This impact is proposed to be scoped out of further consideration within the EIA with respect to offshore water quality receptors.
Increased risk of introduction and spread of invasive non-native species (INNS)	There is potential for an increased risk of introduction and spread of INNS through the vessel movements required during all phases of the Array Project. This risk will be assessed in the benthic subtidal ecology chapter of the EIA Report and mitigated through the designed in measures set out in Table 7.11. An Environmental Management Plan will be implemented, which will aim to manage and reduce the risk of potential introduction and spread of INNS so far as reasonably practicable and vessels will be required to comply with the International Maritime Organization (IMO) ballast water management guidelines. Therefore, significant impacts on offshore water quality as a result of the introduction and spread of INNS are not predicted. This impact is proposed to be scoped out of further consideration within the EIA with respect to offshore water quality receptors.
Accidental pollution during construction, O&M and decommissioning.	There is a risk of pollution being accidentally released during the construction, O&M and decommissioning phases of the Array Project from sources including vessels/vehicles, equipment/machinery and operational painting and cleaning of marine growth. However, the risk of such events is managed by the implementation of measures set out in standard post-consent plans (e.g. a EMP, including MPCPs) (see Table 7.11). These plans include planning for accidental spills, address all potential contaminant releases and include key emergency contact details. They will also set out industry good practice and OSPAR (Oslo-Paris), IMO and MARPOL (International Convention for the Prevention of Pollution from Ships) guidelines for preventing pollution at sea.

Impact	Basis for impact
	Therefore, the likelihood of accidental pollution occurring is very low and in the unlikely event that such events did occur, the magnitude of these will be minimised through measures such as a MPCP. This impact is proposed to be scoped out of further consideration within the EIA with respect to offshore water quality receptors.
Impacts from the release of sediment-bound contaminants.	Seabed disturbance associated with construction, maintenance and decommissioning activities (e.g. foundation and cable installation) could lead to the remobilisation of sediment-bound contaminants that may result in harmful and adverse effects on benthic communities. Site specific sampling within the Benthic Subtidal Ecology Study Area has shown levels of sediment contaminants are very low (See chapter 8.1: Benthic Subtidal Ecology of the Scoping Report). Sediment contamination analysis identified that all sample stations except for one were below Cefas AL1 and AL2 as well as below Canadian threshold effects level (TEL) and probable effects level (PEL) for metals, polychlorinated biphenyls (PCB) and Polycyclic aromatic hydrocarbons (PAH). The exception to this was one station, which was above Cefas AL1 and Canadian TEL for arsenic. However, it should be noted that this station is located outside of the Scoping Boundary and, therefore, is unlikely to be directly disturbed. Background levels were reviewed as part of the evidence base in the application of the Cefas action levels to put the values in context. The risk of sediment-bound contaminants being present in concentrations likely to be harmful to benthic receptors is considered negligible. This potential impact is proposed to be scoped out of further consideration within the EIA, subject to consultation with the Statutory Nature Conservation Bodies (SNCBs).

7.3.7 Designed In Measures and Mitigation

7.3.7.1 As part of the project design process, a number of designed in measures (primary and tertiary) will reduce the potential for impacts on offshore water quality (Table 7.11). As there is a commitment to implement these measures, they are considered inherent to the design of the Array Project. The determination of magnitude and significance will assume the implementation of such measures. Some of these measures are considered standard industry practice for this type of development.

7.3.7.2 The requirement for any additional (secondary) mitigation measures will be dependent on the significance of the effects on offshore water quality receptors. The requirement for and feasibility of any mitigation measures will be consulted upon with statutory consultees throughout the EIA process.

Table 7.11: Designed in measures of the Array Project, relevant to Offshore Water Quality.

Reference number	Measures adopted	Justification	Primary or tertiary
MM-2	Development and adherence to a Cable Plan.	There is a potential for cable exposure to occur due to interactions between Metocean regime (wave, sand and currents). Sediment transportation can lead to exposure of cables and infrastructure, although the use of a target cable burial depth alongside the cable installation strategy should provide sufficient depth to avoid exposure. The Cable Plan will outline the technical specifications of the cables used in the Array Project and describe the installation methodology; also includes cable protection to be installed	P
MM-4	Development of, and adherence, to a Construction Method Statement (CMS).	Provided as a means of controlling specific health and safety risks that have been identified and to ensure the health and safety aspects of the development are secured.	T
MM-5	Development of, and adherence to, an EMP, including actions to minimise INNS, MMMP and a MPCP, which will include planning for accidental spills, address all potential contaminant releases and include key emergency details.	Provides a means to ensure the efficient management and communication of commitments made for the management of the potential environmental impacts. The EMP will include a MMMP. The MMMP may include using Marine Mammal Observer(s) and passive acoustic monitoring (PAM) to monitor the mitigation zone (MZ), as determined by the underwater sound modelling) to ensure that animals are not observed within the MZ during piling. ADD may be used if required to deter animals from the MZ. For offshore water quality, measures will be adopted to ensure that the potential for release of pollutants from construction, and O&M, is minimised. In this manner, the accidental release of contaminants from rigs and supply/service vessels will be strictly controlled, thus providing protection for birds and their prey species across all phases of the development. The MPCP will include planning for accidental spills, addressing all potential contaminant releases and include key emergency details. The INISMP will include measures for controlling INNS and their impact on fish and shellfish ecology receptors.	T
MM-32	Use of drilling fluids regulated by the UK REACH Regulations, secured through the Environmental Management Plan (EMP).	To limit potential environmental damage from small quantities of drill fluids may be released.	P

7.3.8 Potential Cumulative Impacts

7.3.8.1 No effects on offshore water quality have been identified due to the remote offshore location of the Array Project. Therefore, no cumulative effects on offshore water quality are anticipated.

7.3.9 Potential Inter-Related Effects

7.3.9.1 The EIA will consider inter-related effects. Inter-related effects relate to effects arising from the Array Project, either across their own phases (project lifetime) or different effects on one receptor in one phase (receptor led). The EIA will consider inter-related effects, in relation to the potential effects of multiple impacts from the construction, O&M and decommissioning phases of the Array Project, affecting one receptor. Inter-related effects are assessed through consideration of all effects on a receptor, considering both spatial and temporal overlaps, with the Array Project. This will ensure that the Array Project as a whole is appropriately considered within the EIA.

7.3.10 Potential Transboundary Impacts

7.3.10.1 The potential effects from construction, O&M and decommissioning on offshore water quality receptors are considered in Appendix 1: Transboundary Screening. No transboundary effects have been identified due to the remote offshore location of the Array Project and that any impacts on offshore water quality are anticipated to be temporary and spatially restricted to the Scoping Boundary and the surrounding area. There is, therefore, no potential for the Array Project to have a significant effect on the offshore water quality of an European Economic Area (EEA) State.

8 Offshore Wind Farm – Biological Environment

8.1 Benthic Subtidal Ecology

8.1.1 Introduction

8.1.1.1 This chapter of the Scoping Report identifies the benthic subtidal ecology receptors of relevance to the Array Project and considers the potential impacts arising from the construction, O&M and decommissioning of the Array Project.

8.1.2 Study Areas

8.1.2.1 Two study areas are defined for benthic subtidal ecology:

- the Benthic Subtidal Ecology Study Area;
- the Regional Benthic Subtidal Ecology Study Area.

8.1.2.2 The study areas are defined as follows:

- The Benthic Subtidal Ecology Study Area includes the Scoping Boundary, plus a buffer extending approximately 5.5km to 13.5km from the Scoping Boundary. This buffer is designed to incorporate the Zone of Influence (ZoI) from indirect effects (e.g. increases in suspended sediment concentrations and potential changes in physical processes) and equates to one maximum tidal ellipse over a large spring tide around the Scoping Boundary[5], as shown in Figure 8.1. Beyond this distance, any effects from the Array Project on benthic subtidal ecology receptors would be minimal. The Benthic Subtidal Ecology Study Area is the area within which the site specific benthic surveys have been undertaken to inform the baseline characterisation and identification of benthic receptors against which potential impacts associated with the Array Project will be assessed.
- Regional Benthic Subtidal Ecology Study Area, as shown in Figure 8.1, encompasses wider northern North Sea habitats and neighbouring, consented, developing and planned offshore wind farms (OWF) and designated sites. The Regional Benthic Subtidal Ecology Study Area will be characterised by desktop data to provide wider context for the site specific data collected within the Benthic Subtidal Ecology Study Area. The Regional Benthic Subtidal Ecology Study Area has also taken into account feedback received from MD-LOT and the SNCBs on other OWF projects in the Firth of Forth region, namely Berwick Bank. The feedback advised that Regional Benthic Subtidal Ecology Study Areas should be focused on an area that included neighbouring OWF projects and designated sites.

8.1.2.3 The Regional Benthic Subtidal Ecology Study Area was presented to and agreed with NatureScot during the Scoping Workshop (18 April 2023). The Benthic Subtidal Ecology Study Area was previously agreed with NatureScot during consultation on the subtidal survey scope and this has been updated to fully capture the ZoI as determined by the interim numerical modelling techniques.

[5] One spring tidal excursion has been identified through interim numerical modelling techniques and is defined as the distance that suspended sediment is transported before being carried back on the returning tide. The interim model was informed from bathymetric datasets available as part of the Marine Environmental Data Information Network (MEDIN). The area is asymmetrical due to the orientation of the Scoping Boundary compared to the tidal currents.

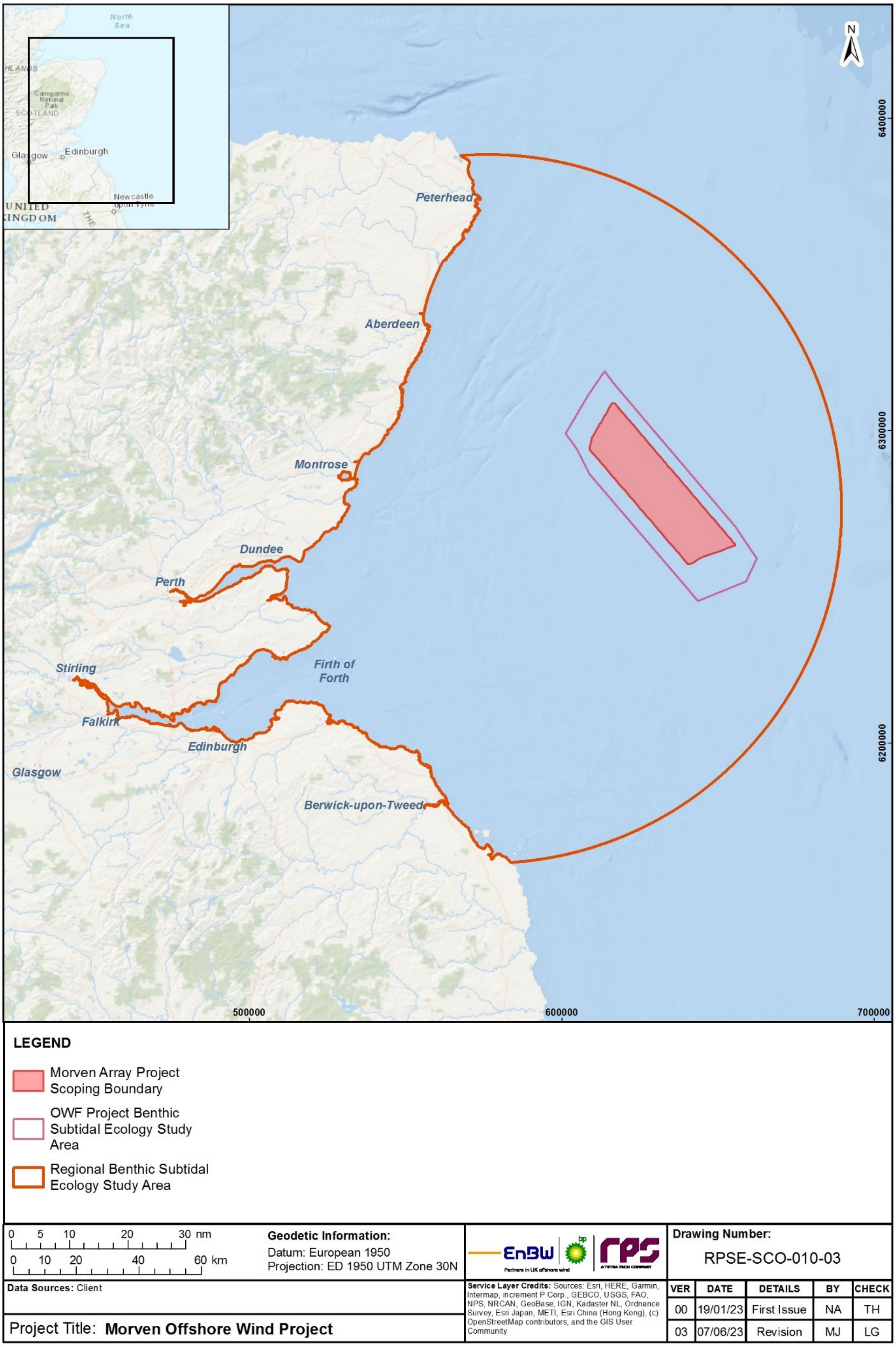


Figure 8.1: Benthic Subtidal Ecology Study Area and Regional Benthic Subtidal Ecology Study Area

8.1.3 Data Sources

Desktop data

8.1.3.1 An initial desk-based review of literature to support the Scoping Report identified a number of data sources. These provide coverage of the Regional Benthic Subtidal Ecology Study Area, and will provide context to the site specific benthic ecology survey data collected within the Benthic Subtidal Ecology Study Area. Key desktop datasets and reports are summarised in Table 8.1.

Table 8.1: Summary of key desk top datasets and reports

Title	Source	Year	Author
Berwick Bank Wind Farm Offshore Environmental Impact Assessment Appendix 8.1: Benthic Subtidal and Intertidal Ecology Technical Report	SSE Renewables	2022	SSE Renewables
Eastern Green Link 2 - Marine Scheme Environmental Appraisal Report Volume 2 Chapter 8 - Benthic Ecology	National Grid Electricity Transmission and Scottish Hydro Electric Transmission	2022	National Grid Electricity Transmission and Scottish Hydro Electric Transmission plc
Benthic subtidal ecology validation survey undertaken for the Seagreen (Alpha) export cable corridor marine licence application	Seagreen Wind Energy Limited	2021	Seagreen Wind Energy Limited
National Biodiversity Network (NBN) Atlas	NBN Atlas	2019	NBN Atlas
EMODnet broad scale seabed habitat map for Europe (EUSeaMap)	EMODnet – Seabed Habitats	2019	EMODnet – Seabed Habitats
The Marine Scotland National Marine Interactive (NMPi) maps	Marine Scotland	2019	Marine Scotland for the Scottish Government
A big data approach to macrofaunal baseline assessment, monitoring and sustainable exploitation of the seabed	Centre for Environment, Fisheries and Aquaculture Science (Cefas)	2017	Cooper, K.M. and Barry, J.
Descriptions of Scottish Priority Marine Features (PMFs)	Scottish Natural Heritage (SNH)	2016	Tyler-Walters *et al.*
Kincardine Offshore Wind Farm: Environmental Statement	Kincardine Offshore Wind Farm	2016	Atkins
Hywind Scotland Pilot Park Environmental Statement	Hywind Offshore Wind Farm	2015	Statoil
Firth of Forth Banks Complex Marine Protected Area (MPA) – Relevant Documentation – Site Summary Document	Joint Nature Conservation Committee (JNCC)	2014	JNCC
Biotope Assignment of Grab Samples from Four Surveys Undertaken in 2011 Across Scotland’s Seas (2012)	JNCC	2014	Pearce, B., Grubb, L., Earnshaw, S., Pitts, J. and Goodchild, R.
Analysis of seabed imagery from the 2011 survey of the Firth of Forth Banks Complex, the 2011 IBTS Quarter 4 (Q4) survey and additional deep-water sites from Marine Scotland Science surveys	JNCC	2014	Axelsson, M., Dewey, S. and Allen, C.

Title	Source	Year	Author
Mapping habitats and biotopes from acoustic datasets to strengthen the information base of MPAs in Scottish waters – Phase 2	JNCC	2014	Sotheran, I. and Crawford-Avis, O.
Mapping habitats and biotopes from acoustic datasets to strengthen the information base of MPAs in Scottish waters	JNCC	2013	Sotheran, I. and Crawford-Avis, O.
Environmental Impact Statement. Volume 1, Chapter 11 Benthic Ecology and Intertidal Ecology	Seagreen Ltd	2012	Seagreen Ltd
Offshore Environmental Statement, Volume 1B: Biological Environment, Chapter 12 Benthic Ecology	Inch Cape Offshore Limited	2011	Inch Cape Offshore Limited
European Offshore Wind Deployment Centre: Request for an Environmental Impact Assessment (EIA), Scoping Opinion	Aberdeen Offshore Wind Farm Limited	2010	Aberdeen Offshore Wind Farm Limited
Appendix 7.1 Benthic Characterisation Survey Report	Neart na Gaoithe Offshore Wind Ltd	2010	Neart na Gaoithe Offshore Wind Ltd
The Marine Nature Conservation Review (MNCR) Area Summary for southeast Scotland and northeast England	JNCC	1998	Brazier *et al*.
The ecology of Scottish inshore fishing grounds	Aberdeen Offshore Wind Farm Limited	1958	McIntyre A. D.

Site specific survey data

8.1.3.2 A benthic subtidal survey was undertaken in spring/summer 2022 by Gardline, on the vessel Ocean Geograph, to characterise the Benthic Subtidal Ecology Study Area.

8.1.3.3 The benthic subtidal surveys comprised combined drop-down video (DDV) and grab sampling at 100 stations with a further two stations sampled using DDV only. All grab samples were analysed for macrofauna and particle size analysis (PSA). Two stations, in the north of the Scoping Boundary and northwest of the Benthic Subtidal Ecology Study Area (see Figure 8.2) were sampled using DDV only as grab sampling was unsuccessful. Samples at 50 stations within the Benthic Subtidal Ecology Study Area were analysed for sediment chemistry and environmental DNA (eDNA). The eDNA analysis identified species of fish including elasmobranch, marine mammals and benthic invertebrates, as well as bacteria.

8.1.3.4 In total, of the 102 stations that were sampled, 83 were located within the Scoping Boundary and 19 were within the ZoI. Four of the sample stations in the ZoI were positioned within the Firth of Forth Banks Complex MPA.

8.1.3.5 A total of 300 grab samples were retained from 367 deployments of a $0.1m^2$ day grabs. This was to ensure adequate data coverage for both infaunal and epifaunal communities at each location. There were 21 stations with failed sampling attempts due to stones and shells being stuck in the grab jaws, causing sample washout.

8.1.3.6 All 102 sample stations in the Benthic Subtidal Ecology Study Area were surveyed with DDV. Environmental seabed photos were taken by means of a digital stills shallow water camera system with a dedicated strobe and lamps, mounted within a stainless-steel frame. Continuous video footage was also acquired at all stations using a high definition (HD) video camera. All photographs were taken less than 10m from the target location. A total of 5,221 photos were taken using the stills camera system across the 102 sample stations. Furthermore an additional 353 photos were collected and analysed from video footage.

8.1.3.7 The PSA samples were analysed by Thomson Environmental Consultants in accordance with the Northeast Atlantic Marine Biological Analytical Quality Control (NMBAQC) methods for diamictons (Mason, 2016). The PSA data were categorised using the modified Folk (1954) classification, which groups particles into mud, sand and gravel (mud 2mm) and the relative proportion of each used to ascribe the sediment to one of 15 classes (e.g. slightly gravelly sand, muddy sand etc.) (Long, 2006).

8.1.3.8 Sediment samples taken during the subtidal survey for sediment chemistry analysis were analysed for hydrocarbons, metals, total organic carbon (TOC), organotins and polychlorinated biphenyls (PCBs). The results of the sediment chemistry analysis were compared to the Cefas Guideline Action Levels (ALs) for the Disposal of Dredged Material at Sea (Cefas, 1994) to give an indication of how suitable the sediments are for disposal at sea. Contaminant levels below AL1 are of no concern, whilst those that are above AL2 are considered unsuitable for disposal at sea. Those between AL1 and AL2 would require further consideration before a licensing decision can be made.

8.1.3.9 Sediment chemistry data were also compared to the Canadian Sediment Quality Guidelines (CSQG; CCME, 2001), which give an indication of the degree of contamination and the likely impact on marine ecology. For each contaminant, the guidelines provide a threshold effects level (TEL), which is the minimal effect range at which adverse effects rarely occur and a probable effect level (PEL), which is the probable effect range within which adverse effects frequently occur.

8.1.3.10 Outputs from this analysis have been used to inform the characterisation of the physical environment within the Benthic Subtidal Ecology Study Area presented as part of the baseline in section 8.1.5.

8.1.3.11 Preliminary analysis of the DDV footage has been undertaken to identify and report on the presence of habitats of conservation importance, such as sea pens and burrowing megafauna habitat or Annex I rocky or biogenic reefs (e.g. *Sabellaria spinulosa* reefs), within the Benthic Subtidal Ecology Study Area. This information has been included within the baseline characterisation in section 8.1.5.

8.1.3.12 Macrofaunal analysis of the grab sample data will be undertaken to fully characterise the biological communities within the Benthic Subtidal Ecology Study Area. Some preliminary results regarding some of the most prevalent and key species are presented as part of the baseline in section 8.1.5.

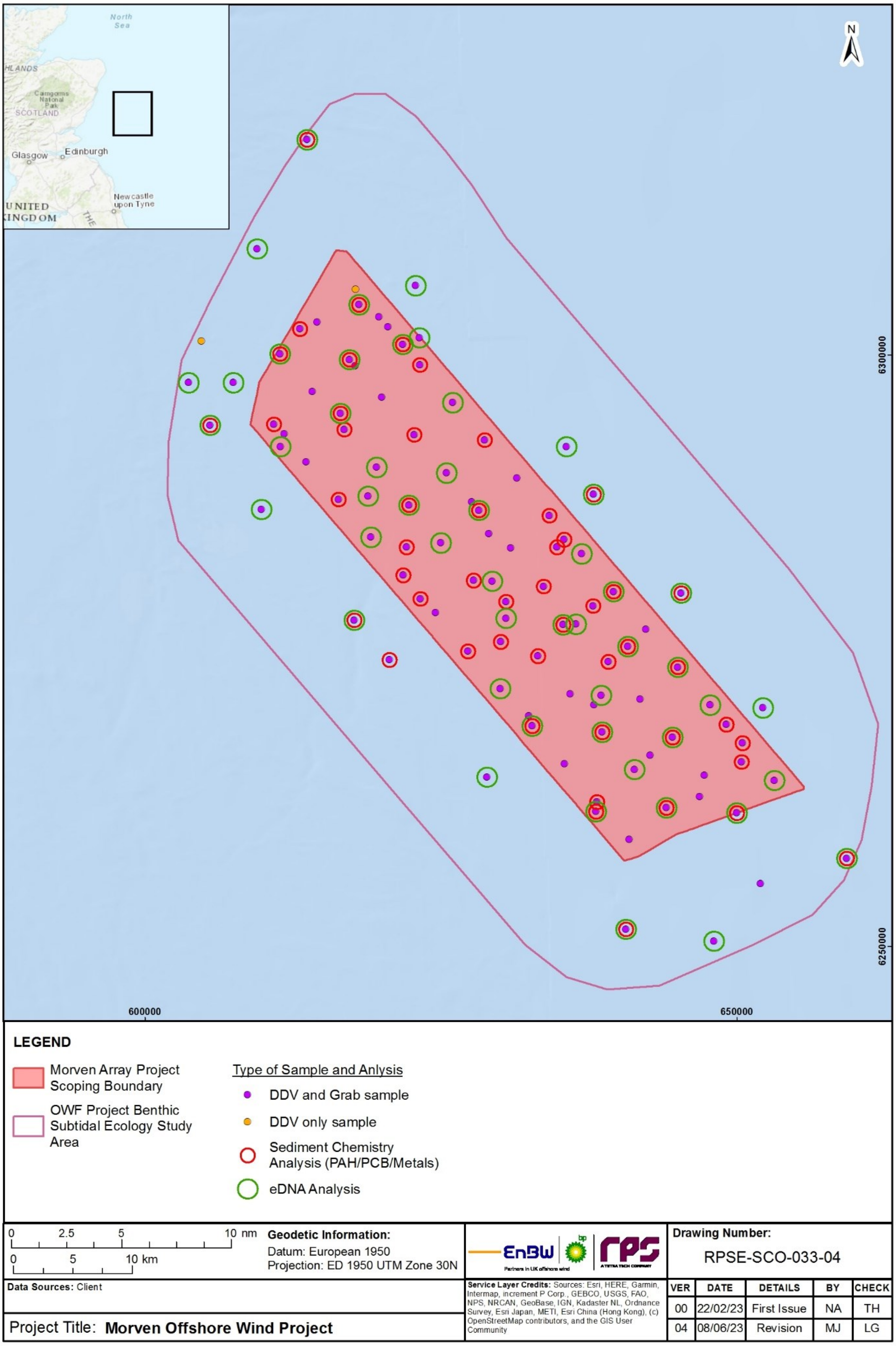


Figure 8.2: Sample locations with the Scoping Boundary

8.1.4 Consultation

8.1.4.1 The approach to consultation for the Array Project is set out in chapter 5: Consultation Process of the Scoping Report. A summary of the consultation undertaken to date relevant to Benthic Subtidal Ecology is set out in Table 8.2. Further detail on the Scoping Workshop and stakeholder plans for future engagement is set out in chapter 5: Consultation Process of the Scoping Report, supported by Appendix 3: Array Project Scoping Workshop Information and Appendix 4: Array Project Stakeholder Engagement Plans of the Scoping Report.

Table 8.2: Pre-application consultation relevant to benthic subtidal ecology undertaken to date

Date	Overarching theme	Method of engagement	Stakeholder	Summary of stakeholder feedback	Applicant's response and relevant cross reference
18.04.23	Impact pathways	Scoping Workshop session	NatureScot	NatureScot suggest that electro-magnetic field (EMF) is not scoped out, and confirm that a qualitative assessment would be acceptable. NatureScot advised reference to strategic projects (e.g. via ScotMER).	The Benthic Subtidal Ecology chapter has been updated to ensure the EMF impact pathway is scoped into the EIA (see Table 8.4). The assessment will be qualitative in nature.
18.04.23	Impact pathways	Scoping Workshop session	NatureScot	Recommended that 'removal of hard substrates' is scoped into the EIA.	The Benthic Subtidal Ecology chapter has been updated to ensure the effects of the removal of hard substrates on benthic invertebrates is scoped into the EIA (see Table 8.4).
18.04.23	Impact pathways	Scoping Workshop session	NatureScot	Highlighted the possibility of EMF cumulative impacts and requested these are considered. Agreed mobile/migratory shellfish species be addressed in the fish and shellfish cumulative effects assessment (CEA).	The fish and shellfish chapter of the EIA Report will conduct an EMF CEA.
18.04.23	Impact pathways	Scoping Workshop session	NatureScot	Recommended potential impacts from scour should be considered in relation to sediment transport pathways. Confirmation that this would require desktop calculations rather than modelling.	The potential effects of scour on benthic receptors will be captured in the assessment of "changes in physical processes" and will draw on the assessment in the physical processes technical report and chapter.
18.04.23	Study Area	OWF Scoping Workshop session	NatureScot	Agreed that the Regional Study Area presented is appropriate and sufficient.	Agreement noted.
18.04.23	Baseline data	Scoping Workshop session	NatureScot	Confirmed no additional desktop datasets that the Applicant should consider.	Agreement noted.

Date	Overarching theme	Method of engagement	Stakeholder	Summary of stakeholder feedback	Applicant's response and relevant cross reference
18.04.23	Approach	Scoping Workshop session	NatureScot	Agreed the assessment of sensitivity be primarily informed by Marine Evidence Based Sensitivity Assessment (MarESA) and Feature Activity Sensitivity Tool (FeAST) tools (and supplemented with any more recent, relevant evidence).	Agreement noted.
18.04.23	Approach	Scoping Workshop session	NatureScot	Agreed (as no Annex I habitats or other sensitive habitats were recorded during baseline surveys), that pre-construction Annex I surveys will not be required.	Agreement noted.
18.04.23	Approach to CEA	Scoping Workshop session	NatureScot	Agreed that impacts assessed as negligible for the Array Project alone can be scoped out of the Benthic Subtidal Ecology CEA.	Agreement noted.
25.05.2023	Study Area	Written advice	NatureScot	NatureScot agree that the regional study area is appropriate and sufficient.	No further response required.
25.05.2023	Data	Written advice	NatureScot	NatureScot confirm there are no further additional desktop datasets to be considered.	No further response required.
25.05.2023	Methodology	Written advice	NatureScot	NatureScot agreed with the proposed methodology for undertaking the benthic ecology assessment.	No further response required.
25.05.2023	Methodology	Written advice	NatureScot	NatureScot agreed the assessment of sensitivity should be primarily informed by MarESA and FeAST tools and supplemented with any more recent relevant evidence.	No further response required.
25.05.2023	Impact pathways	Written advice	NatureScot	NatureScot advise that due to the uncertainty around EMF and benthic species, EMF should be scoped in and considered further in a qualitative assessment. There are some strategic EMF projects being undertaken and these should be included in the assessment if published (e.g. Marine Directorate	The Benthic Subtidal Ecology chapter has been updated to ensure the EMF impact pathway is scoped into the EIA (see Table 8.4). The assessment will be qualitative in nature.

Date	Overarching theme	Method of engagement	Stakeholder	Summary of stakeholder feedback	Applicant's response and relevant cross reference
				ScotMER EMF strategic considerations).	
25.05.2023	Impact pathways	Written advice	NatureScot	NatureScot advise that the removal of hard substrates should be scoped in.	The Benthic Subtidal Ecology chapter has been updated to ensure the effects of the removal of hard substrates on benthic invertebrates is scoped into the EIA (see Table 8.4).
25.05.2023	Impact pathways	Written advice	NatureScot	Considerations of potential scour should also be included in the impact assessment for sediment transport and pathway changes in physical processes.	The potential effects of scour on benthic receptors will be captured in the assessment of "changes in physical processes" and will draw on the assessment in the physical processes technical report and chapter.
25.05.2023	Impact pathways	Written advice	NatureScot	NatureScot agree with the other impacts proposed to be scoped out and NatureScot do not advise that any additional impacts should be scoped out.	The benthic scoping chapter has been updated to incorporate this feedback received during the Scoping Workshop.
25.05.2023	Impact pathways	Written advice	NatureScot	Other than our advice above, NatureScot agree with the impacts proposed to be scoped in.	No further response required.
25.05.2023	Methodology	Written advice	NatureScot	NatureScot agree on the basis that no Annex I habitats or other sensitive habitats were recorded during the baseline surveys, pre-construction Annex I surveys will not be required.	No further response required.
25.05.2023	Cumulative	Written advice	NatureScot	NatureScot do not agree that impacts assessed as negligible for the project alone assessment can be scoped out of the cumulative assessment. It is possible that impacts that are assessed as negligible for the project alone assessment could be significant in the cumulative assessment.	Noted, and all of the impacts scoped in to the project alone assessment will also be considered in the cumulative assessment.

8.1.5 Baseline Environment

8.1.5.1 This section provides a summary of the benthic ecology baseline environment for the Array Project, based on desktop data and preliminary analysis of the site specific survey data.

Subtidal sediments

Regional Benthic Subtidal Ecology Study Area

8.1.5.2 Based on EUSeaMap data (EMODnet, 2019), within the Regional Benthic Subtidal Ecology Study Area, seabed sediments are centrally dominated by 'deep circalittoral coarse sediment' (A5.15) forming a mosaic with areas of 'deep circalittoral sand' (A5.27) (Figure 8.3). The sediment transitions to become more dominated by SS.SSa.OSa in the east of the Regional Benthic Subtidal Ecology Study Area.

8.1.5.3 Within the mosaic of SS.SCS.OCS and SS.SSa.OSa there are also smaller patches of 'deep circalittoral mud' (A5.37), with the largest areas existing in the west of the Regional Benthic Subtidal Ecology Study Area.

8.1.5.4 There are areas of 'Atlantic and Mediterranean moderate energy circalittoral rock' (CR) further inshore to the southwest and further along the coast to the east and south of the Scoping Boundary. The largest area of CR occurs around the entrance to the Firth of Forth and along the coast of Budle and Bamburgh at the southern-most extent of the Regional Benthic Subtidal Ecology Study Area. The CR around the entrance to the Firth of Forth is accompanied by 'deep circalittoral mixed sediment' (A5.45) in most locations.

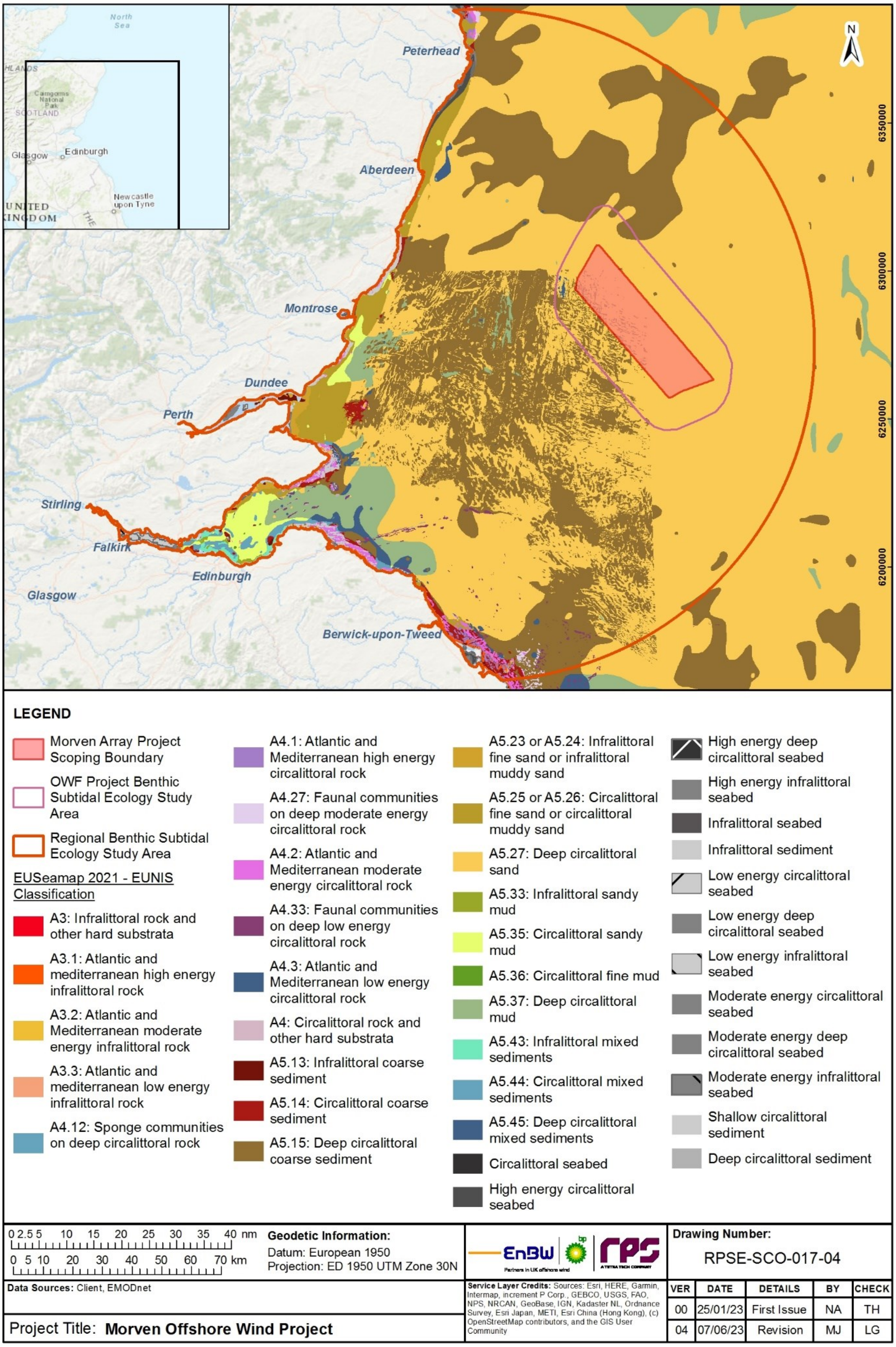


Figure 8.3: EUSeaMap data showing seabed classifications for the Regional Benthic Subtidal Ecology Study Area

Firth of Forth Banks Complex MPA

8.1.5.5 The key geological features of the Regional Benthic Subtidal Ecology Study Area are the Berwick, Scalp and Montrose Banks and the Wee Bankie shelf banks and mounds. The 'Shelf Banks and Mounds' and 'Moraines representative of the Wee Bankie Key Geodiversity Area' are both protected features of the Firth of Forth Banks Complex MPA. These features are composed of sands and gravels (JNCC, 2021). The Wee Bankie includes moraines, which are formed from glacial till deposited during the last Ice Age and they are scientifically important for their role in improving our understanding of the history of glaciation around Scotland (JNCC, 2021).

8.1.5.6 The Firth of Forth Banks Complex MPA is also designated for offshore subtidal sands and gravels. The offshore subtidal sands and gravels feature comprises a heterogeneous mosaic of coarse, sandy and mixed sediments. The feature is interspersed with small patches of rock and mud (not considered part of the feature) in the Wee Bankie and Montrose Bank sections of this MPA. JNCC considers the heterogeneity of the habitat types present to be a consequence of localised hydrodynamic processes acting on the MPA (JNCC, 2014). For information on the location of these features in relation to the Benthic Subtidal Ecology Study Area see paragraph 8.1.5.65.

8.1.5.7 The Axelsson *et al*. (2014) analysis of the video and still photography from the 2011 surveys undertaken within the Firth of Forth Banks Complex MPA as part of the Scottish MPA Project, reported three broad habitat types: soft sediments with ripples; mixed sediment; and coarse sediments with some rocky outcrops. In the north of the area surveyed for this study (south of the Benthic Ecology Study Area) gravelly sand sediments were more frequently recorded and gravelly muddy sands and mixed sediments were more dominant in the south of the area surveyed for this study (Axelsson *et al*., 2014).

Other offshore wind farms

8.1.5.8 The benthic surveys conducted for planned and operational offshore wind projects within the Regional Benthic Subtidal Ecology Study Area also provide an overview of the sedimentary habitats present; these are listed below and shown in Figure 8.4.

- Berwick Bank Offshore Wind Farm;
- Neart na Gaoithe Offshore Wind Farm;
- Inch Cape Offshore Wind Farm;
- Seagreen 1 Offshore Wind Farm;
- Kincardine Floating Demonstration Offshore Wind Farm;
- Aberdeen Offshore Wind Farm;
- Hywind Offshore Wind Farm.

8.1.5.9 Berwick Bank OWF, located 26.47km southeast of the Array Project, conducted geophysical surveys in 2020 (SSE Renewables, 2022). The data from these surveys identified heterogenous sediment across Berwick Bank's proposed array area. Features such as megaripples, sand waves, ribbons and bars were noted across the south and northwest extents.

8.1.5.10 Grab samples conducted across Berwick Bank OWF's proposed array area and export cable corridor indicated that the sediments were predominantly slightly gravelly sands according to the Folk (1954) sediment classification. Sediments closer to the coast in the Berwick Bank OWF export cable corridor were, typically, finer than the offshore sediment in the array area.

8.1.5.11 Baseline characterisation surveys for Neart na Gaoithe OWF, including seabed sampling, were conducted in 2009 (Neart na Gaoithe Offshore Wind Ltd., 2010). Within the Neart na Gaoithe OWF, which included the array area (and surrounding area) and the export cable corridors and lies 75.28km south of the Array Project, most sampling stations were classified as slightly gravelly sand. The array area in the offshore environment was associated with coarser sediment with a larger gravel component. Along the export cable corridors, the sediments had a greater fines component with most sediment samples as slightly gravelly muddy sand and muddy sand.

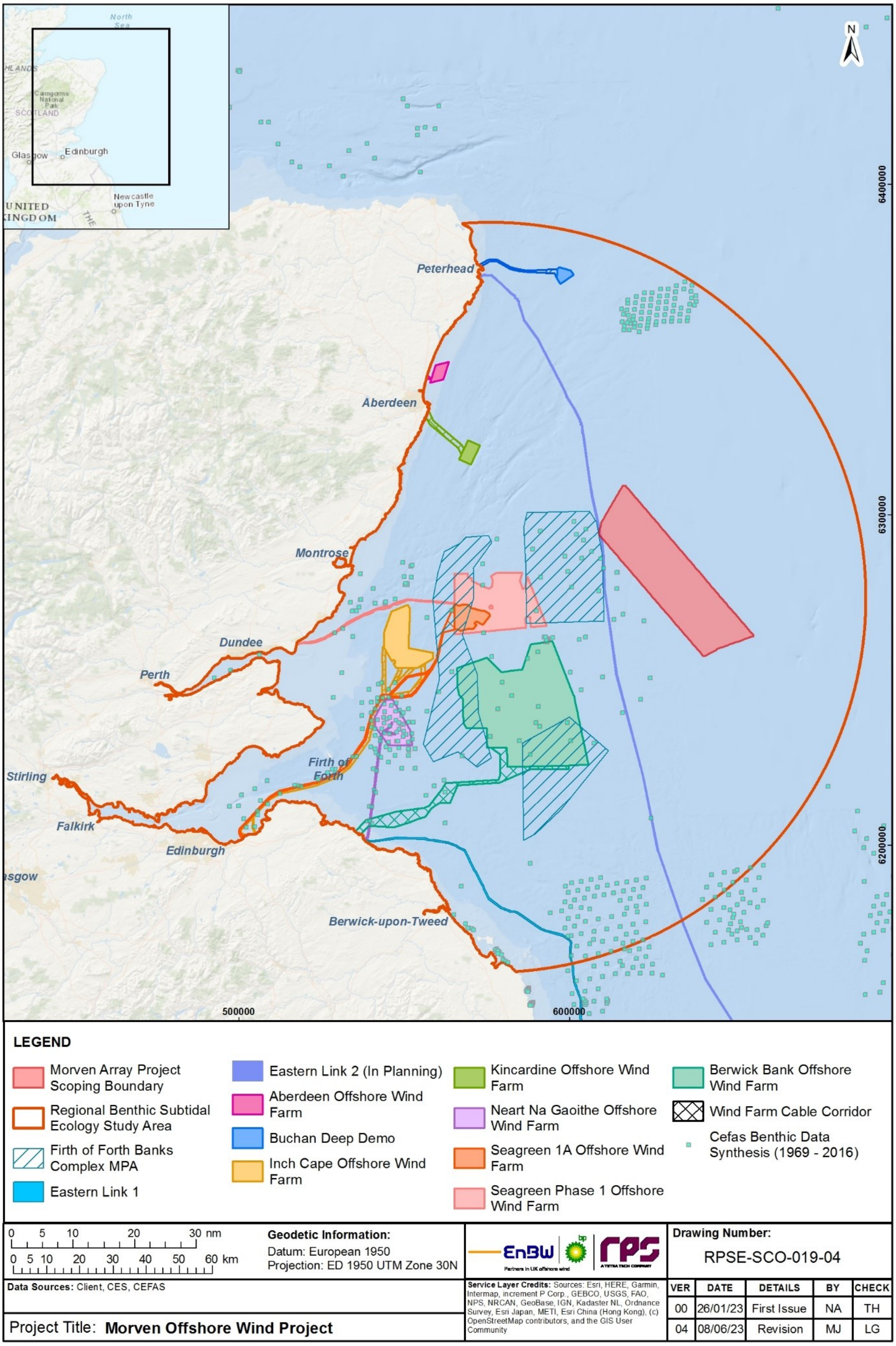


Figure 8.4: OWF and research sample locations in the Regional Benthic Subtidal Ecology Study Area

8.1.5.12 The baseline characterisation surveys for Inch Cape OWF array area (Inch Cape Offshore Limited, 2011), which lies to the southeast of the Array Project, reported the sediments to be primarily circalittoral sands and gravelly sands, with smaller areas of muddy mixed sediment.

8.1.5.13 Surveys conducted in 2011 to support the EIA benthic baseline characterisation for Seagreen 1 OWF, which lies southeast of the Array Project, identified a similarly gravelly environment to Neart na Gaoithe (Seagreen, 2012). Most samples in Seagreen 1 OWF were identified as gravelly sand and sandy gravels with samples in the export cable corridor and the west of the array area generally having a higher mud content. Video sampling of these areas found shelly and gravelly sand as well as ripples and megaripples. Cobbles were also recorded and were the predominant sediment component at six sites within Seagreen 1 OWF.

8.1.5.14 The Kincardine Floating Demonstration OWF site lies in the north of the Regional Benthic Subtidal Ecology Study Area, east of Aberdeen. Site specific sampling of the array area and cable corridor for this project indicated that the sediment was difficult to sample as the seabed was quite compact (Kincardine Offshore Wind Farm, 2016). Samples, which were obtained largely in the export cable corridor, characterised the sediment as sandy with medium grain sand identified closer to shore and fine sand identified further offshore and within the array area. The seabed also exhibited rippled bedforms.

8.1.5.15 Aberdeen OWF lies close to the coast north of Aberdeen. Surveys in this area identified the seabed within the project boundary to predominantly be composed of silty sand with patches of finer sediment (Aberdeen Offshore Wind Farm Limited, 2010). In the southeast of the Aberdeen OWF there is also a ribbon of finer sand within the silty sand.

8.1.5.16 Hywind OWF occurs in the far north of the Regional Benthic Subtidal Ecology Study Area, east of Peterhead. The site specific surveys in this area found the sediments to be dominated by sand and gravel. Boulder fields were present at locations close to shore in the export cable corridor but as depth decreases to less than 20m approximately 1km from shore the seabed consists almost entirely of outcropping bedrock (Statoil, 2015). In the array area, sediments were similar to the export cable corridor, dominated by sand and gravel with megaripples. This description is representative of most of the array area except the northwest, which contained scattered patches of boulders.

Benthic Subtidal Ecology Study Area

8.1.5.17 Particle size analysis performed on the 2022 site specific benthic grab surveys from the Benthic Subtidal Ecology Study Area characterised most grab sample locations as sand according to the Modified Folk classification (Long, 2006), accounting for 71% of samples (Figure 8.5).

8.1.5.18 The next most dominant sediment types occupied a much smaller proportion of the Benthic Subtidal Ecology Study Area, those being muddy sand and slightly gravelly sand at 14% and 10% respectively. In general, the coarser sediments were found in the northwest of the Benthic Subtidal Ecology Study Area whereas the finer sediment, such as muddy sand, was found in the southeast (Figure 8.5). This was supported by the distribution of boulders, which generally followed the same trend.

8.1.5.19 The percentage sediment composition (i.e. mud ≤0.63 mm; sand <2 mm; gravel ≥2 mm) at each grab sample station is presented in Figure 8.6. As expected, the sediment composition of all samples was predominantly sand, which on average made up 91% of sediment sample composition. Fine sediment on average made up 8% of sample composition and gravel 1%.

8.1.5.20 Most samples across the Benthic Subtidal Ecology Study Area were identified as being moderately sorted (57%) followed by poorly sorted (36%). One station in the far north of the Benthic Subtidal Ecology Study Area was classified as being very poorly sorted. This was due to the proportion of gravel at this site being much higher than average and sand being lower than average (fines 5.2%; sand 62.8%; gravel 32%).

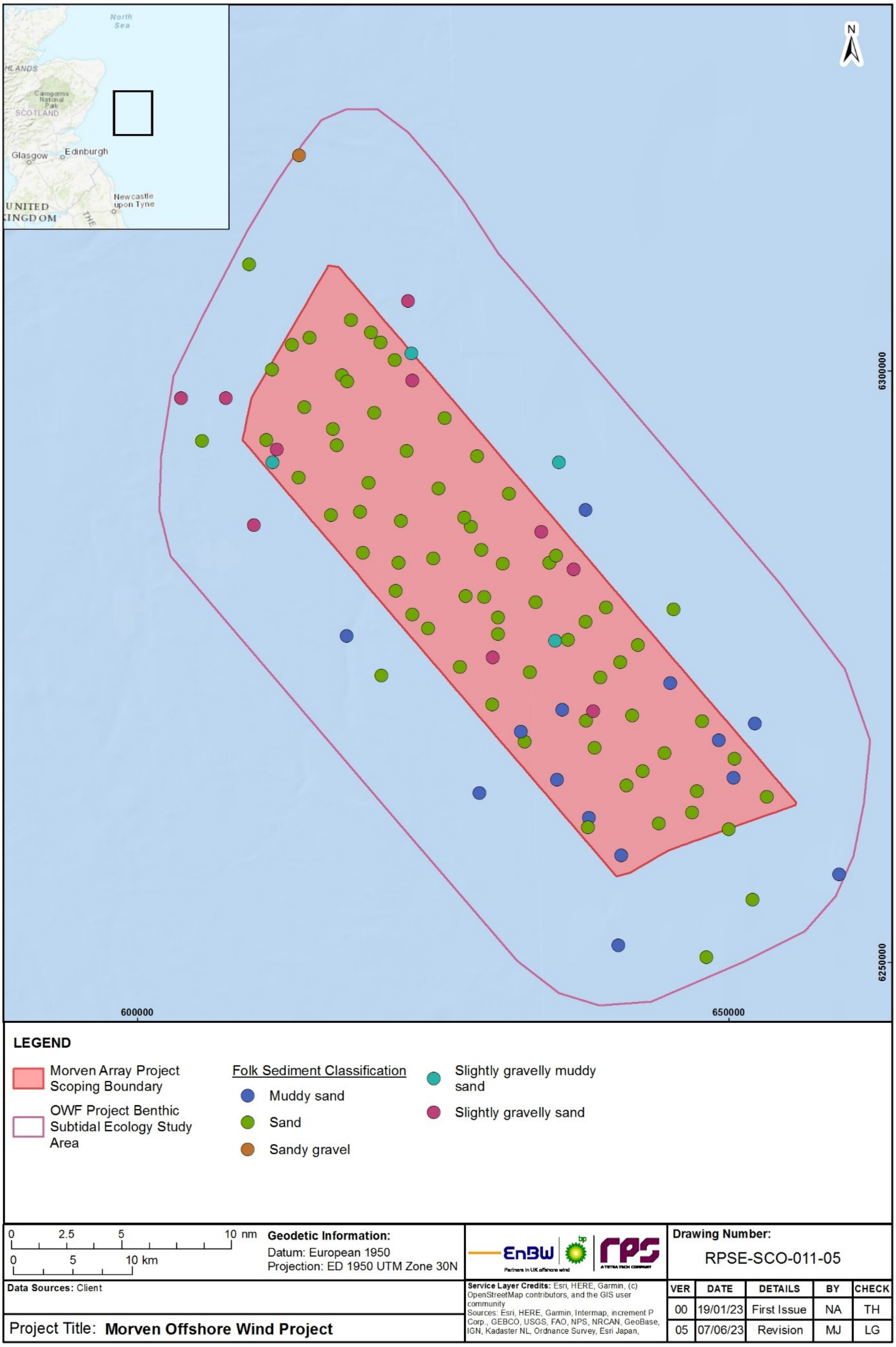


Figure 8.5: Folk sediment classifications (from PSA) for each site specific benthic survey grab sample

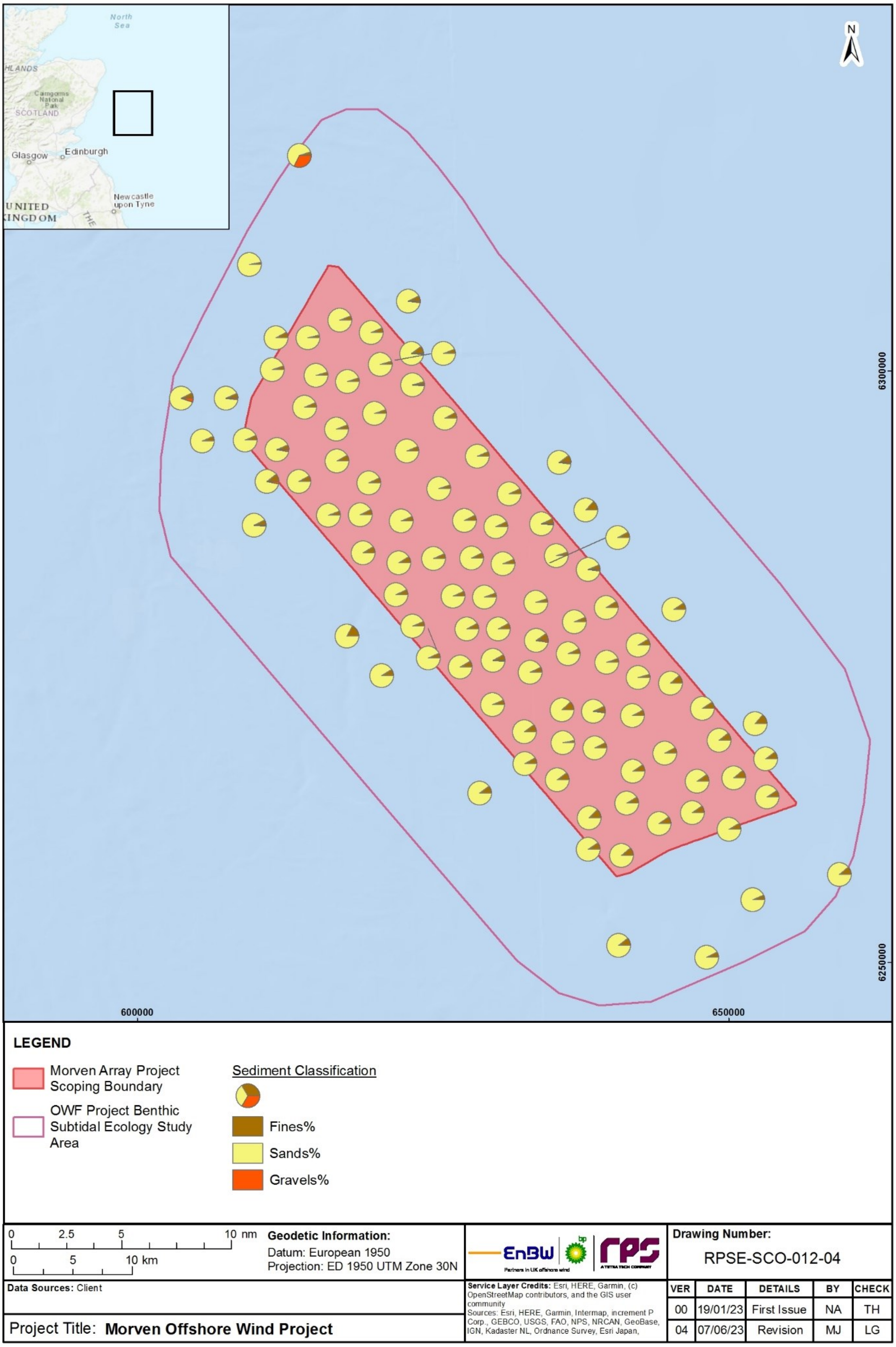


Figure 8.6: Sediment composition (from PSA) for each site specific benthic survey grab sample

Sediment Contamination

8.1.5.21 Sediment chemistry analysis has identified that levels of contamination were, overall, very low across the Benthic Subtidal Ecology Study Area. The only exception was the concentration of arsenic in the sediment at a single station in the far north of the Benthic Subtidal Ecology Study Area which exceeded the Cefas AL1 and Canadian TEL. However, levels were below both the Cefas AL2 and Canadian PEL. Concentrations of all other metals were below the Cefas AL1/AL2, the Canadian PEL and the Canadian TEL. All PCBs were also below their respective Cefas ALs and Canadian TEL/PEL. As part of this sediment chemistry analysis, background levels were reviewed as part of the evidence base in the application of the Cefas action levels to put the values in context; for example, the mean arsenic content in marine shale sediment is as much as 13 mg/kg (Chester, 1990).

Subtidal Benthic Communities

Regional Benthic Subtidal Ecology Study Area

8.1.5.22 The north part of the North Sea is mainly characterised by polychaete dominated communities (*Spionidae, Glyceridae, Terebellidae, Capitellidae, Phyllodocidae* and *Nemertea*), sparse faunal communities (*Nephtyidae, Spionidae, Opheliidae*) and diverse faunal communities (including the polychaetes: *Spionidae, Nephtyidae, Lumbrineridae, Oweniidae, Cirratulidae, Capitellidae, Ampharetidae,* the echinoderm *Amphiuridae*, the bivalve *Semelidae* and *Nemertea*) (Cooper and Barry, 2017).

8.1.5.23 The Marine Nature Conservation Review study of the nearshore subtidal zone from North Berwick in Lothian to Flamborough Head in Yorkshire recorded nearshore seabed habitats in the south of the Regional Benthic Subtidal Ecology Study Area. Five seabed habitats were recorded (Brazier *et al*., 1998), including sublittoral muddy sand biotopes, kelp forests, sublittoral fine sand biotopes and circalittoral rock biotopes.

- *Kurtiella bidentata* and *Thyasira* spp. in circalittoral muddy mixed sediment/*Amphiura filiformis*, *Kurtiella bidentata* and *Abra nitida* in circalittoral sandy mud (SS.SMx.CMx.MysThyMx/SS.SMu.CSaMu.AfilMysAnit).
- *Laminaria hyperborea* forest and foliose red seaweeds on moderately exposed upper infralittoral rock (IR.MIR.KR.Lhyp.Ft).
- Amphipods and *Scolelepis* spp. in littoral medium-fine sand (LS.LSa.MoSa.AmSco).
- *Nephtys cirrosa* and *Bathyporeia* spp. in infralittoral sand (SS.SSa.IFiSa.NcirBat).
- Brittlestars on faunal and algal encrusted exposed to moderately wave-exposed circalittoral rock (CR.MCR.EcCr.FaAlCr.Bri).

8.1.5.24 Analysis by Southeran and Crawford-Avis was undertaken on the data from seabed acoustic surveys in 2013 to contribute to the evidence base for the presence and extent of MPA features in Scottish waters (Southeran and Crawford-Avis, 2013). Phase 1 of the surveys included the approaches to the Firth of Forth in the southeast of the Regional Benthic Subtidal Ecology Study Area.

8.1.5.25 Habitats varied from sand sediments to coarse and mixed sediments in the inshore regions and sand sediments in the offshore region. The biotope circalittoral muddy sand (SS.SSa.CMuSa) was recorded in the nearshore subtidal area close to St. Andrews with circalittoral rock habitats with mixed faunal turf communities (CR.HCR.XFa) and echinoderms and crustose communities (CR.MCR.EcCr) recorded in the nearshore subtidal area off Craighead.

8.1.5.26 Offshore subtidal sand (SS.SSa.OSa) and offshore circalittoral coarse sediment (SS.SCS.OSC) were recorded across the approaches to the Firth of Forth and the Wee Bankie to Gourdon. However, SS.SSa.OSa was more frequently recorded in the regions further offshore. Circalittoral mixed sediments (SS.SMx.CMx) and offshore mixed sediments (SS.SMx.OMx) were recorded in areas further inshore. Occasional patches of circalittoral rock were also recorded across the approaches to the Firth of Forth and Wee Bankie to Gourdon areas (Southeran and Crawford-Avis, 2013).

8.1.5.27 The following biotopes were reported within the Regional Benthic Subtidal Ecology Study Area (Southeran and Crawford-Avis, 2013):

- Kelp with cushion fauna and/or foliose red seaweeds (Foliose red seaweeds with dense *Dictyota dichotoma* and/or *Dictyopteris membranacea* on exposed lower infralittoral rock (IR.HIR.KFaR.FoR.Dic) and *Laminaria hyperborea* and red seaweeds on exposed vertical rock (IR.HIR.KFaR.LhypRVt)).
- Mixed faunal turf communities on circalittoral rock (*Flustra foliacea* and colonial ascidians on tide-swept exposed circalittoral mixed substrata (CR.HCR.XFa.FluCoAs.X), *Flustra foliacea*, small solitary and colonial ascidians on tide-swept circalittoral bedrock or boulders (CR.HCR.XFa.FluCoAs.SmAs) and *Flustra foliacea* and colonial ascidians on tide-swept moderately wave exposed circalittoral rock (CR.HCR.XFa.FluCoAs)).
- Circalittoral coarse sediment (*Pomatoceros triqueter* with barnacles and bryozoan crusts on unstable circalittoral cobbles and pebbles (SS.SCS.CCS.PomB)).
- Deep circalittoral coarse sediment (offshore circalittoral coarse sediment (SS.SCS.OCS), SS.SCS.OCS.(PoGintBy) and SS.SCS.OCS.(Sbom)).
- Circalittoral muddy sand (*Abra alba* and *Nucula nitidosa* in circalittoral muddy sand or slightly mixed sediment (SS.SSa.CMuSa.AalbNuc) and SS.SSa.CMuSa).
- Deep circalittoral sand (SS.SSa.OSa/SS.SSa.OSa.(Sbom)).
- Circalittoral mixed sediments (*Ophiothrix fragilis* and/or *Ophiocomina nigra* brittlestar beds on sublittoral mixed sediment (SS.SMx.CMx.OphMx), *Flustra foliacea* and *Hydrallmania falcata* on tide-swept circalittoral mixed sediment (SS.SMx.CMx.(FluHyd)), *Mysella bidentata* and *Thyasira* spp. in circalittoral muddy mixed sediment (SS.SMx.CMx.MysThyMx) and *Sabellaria spinulosa* on stable circalittoral mixed sediment (SS.SBR.PoR.SspiMx)).
- Deep circalittoral mixed sediments (Polychaete-rich *Galathea* community with encrusting bryozoans and other epifauna on offshore circalittoral mixed sediment (SS.SMx.OMx.(PoGintBy)).
- *Modiolus* beds on open coast circalittoral mixed sediment (SS.SBR.SMus.ModMx).
- *Alcyonium digitatum, Pomatoceros triqueter*, algal and bryozoan crusts on wave-exposed circalittoral rock (CR.MCR.EcCr.FaAlCr.Adig) and *Flustra foliacea* on slightly scoured silty circalittoral rock (CR.MCR.EcCr.FaAlCr.Flu).
- Seapens and burrowing megafauna in circalittoral fine mud (SS.Smu.CfiMu.SpnMeg).

8.1.5.28 Phase 2 survey analysis by Southeran and Crawford-Avis focused on the data from seabed acoustic surveys on the east approaches to the Firth of Forth, the west tip of which overlaps with the Regional Benthic Subtidal Ecology Study Area (Southeran and Crawford-Avis, 2014). The following biotopes were reported within the east approaches to the Firth of Forth area:

- SS.SCS.CCS;
- SS.SSa.CMuSa;
- SS.SSa.OSa.

8.1.5.29 With regards to protected species and habitats, such as those protected as Scottish PMFs (a variety of habitats and species that are a priority for conservation in Scotland's seas (Tyler-Walters *et al.*, 2016)), Annex I species under the Habitats Directive and UK Biodiversity Action Plan species, the National Biodiversity Network (NBN) Atlas and the SeaSearch database include records of *Sabellaria* spp. and ocean quahog *Arctica islandica* in the Regional Benthic Subtidal Ecology Study Area (NBN, 2021). NatureScot publications have been searched to understand the presence of Scottish PMFs in the Regional Benthic Subtidal Ecology Study Area. Tyler-Walters *et al*., (2016) reported blue mussel (*Mytilus edulis*) and horse mussel (*Modiolus modiolus*) beds, burrowed mud, kelp beds, ocean quahog aggregations, maerl or coarse shell gravel with burrowing sea cucumbers, seagrass beds and offshore subtidal sands and gravels within the Regional Benthic Subtidal Ecology Study Area.

8.1.5.30 *Sabellaria spinulosa* individuals have been recorded within the Regional Benthic Subtidal Ecology Study Area, but records are limited to the Solway Firth and the North Sea off Rattray Head (Pearce and Kimber, 2020). There are very few records of *S. spinulosa* from Scotland and even fewer extant records of reefs; one of the only other locations known to have recorded *S. spinulosa* outside of the Regional Benthic Subtidal Ecology Study Area is Luce Bay in the south west of Scotland. This is thought to be due to low sampling effort to date and, therefore, it is expected that more records of species and reefs will be made as the offshore industry progresses in the region (Pearce and Kimber, 2020). Site specific studies for the Seagreen 1 and Berwick Bank Offshore Wind Farms have also recorded *S. spinulosa* but as individuals and not in a reef formation (paragraphs 8.1.5.37, 8.1.5.39 and 8.1.5.44).

8.1.5.31 A baseline seagrass survey by the Scottish Environmental Protection Agency (SEPA, 2018) found that in Montrose Basin (in the west of the Regional Benthic Subtidal Ecology Study Area) the total area of seagrass coverage in 2013 was 1,747,000m^2 with an average density of 41.8%. Most of the seagrass was found in the northeast and the west of the Montrose Basin butthere were smaller beds in the south. These surveys identified two species of seagrass, *Zostera noltii* and *Zostera angustifolia*. Seagrass beds are a PMF in Scotland as well as being a UK Biodiversity Action Plan habitat.

Firth of Forth Bank Complex MPA

8.1.5.32 The Firth of Forth Bank Complex MPA is designated for Ocean quahog, offshore subtidal sands and gravels, shelf banks and mounds and moraines. More detail on this designated site is included in paragraphs 8.1.5.65 and 8.1.5.66. Analysis by Axelsson *et al.* (2014) of grab samples and still photography from sample locations within the Firth of Forth Banks Complex MPA identified multiple other habitats of conservation interest. *Modiolus* beds were identified on muddy gravels and coarse sands in the south of the Benthic Ecology Study Area, within the Firth of Forth Banks Complex MPA. The beds were not obvious from video footage but still photography captured an image of a clearly identifiable *M. modiolus* bed. Sea pen and burrowing megafauna habitats were also observed on finer sediments classified as sandy mud. This habitat is characterised by the seapen (*Pennatula phosphorea*), which can be identified in video and still imagery. Other associated species included *A. digitatum*, *F. foliacea* and *Crossaster papposus*. Stony reefs were also identified at four sample locations across the Firth of Forth Banks Complex MPA. The seabed at these locations was characterised by moderately large pebbles and cobbles on muddy sand and gravel colonised by large aggregations of ascidians or *A. digitatum*. A further three sites could potentially be classified as 'stony reef' but this could not be confirmed by the author as the topography was indistinct, the soft sediment component was too large or the extent was unknown (minimum requirement from Irving (2009) is 25 m^2) at these locations (Axelsson *et al.,* 2014). All of these stony reef sites are located to the south west of the Scoping Boundary, outwith the Benthic Subtidal Ecology Study Area.

Eastern Link 2

8.1.5.33 The proposed Eastern Link 2 subsea cable route (Figure 8.4) passes through the Regional Benthic Subtidal Ecology Study Area, extending from Peterhead north of the Regional Benthic Subtidal Ecology Study Area to Bridlington in England. Site specific surveys of the Eastern Link 2 subsea cable route were undertaken in 2021 including a combination of DDV and grab sampling methods (National Grid Electricity Transmission and Scottish Hydro Electric Transmission plc, 2022). The survey identified a variety of taxonomic groups, mostly polychaetes, followed by molluscs and arthropods (mainly crustaceans).

8.1.5.34 Habitats with coarse or mixed sediments were identified as having higher taxonomic abundance and richness compared to sand habitats, in part due to high levels of epifauna including *S. spinulosa*, especially towards the nearshore stations. Characteristic species of coarse or mixed sediment habitats included the polychaetes *Mediomastus fragilis, Lumbrineris spp, Glycera lapidum*, the sea urchin *Echinocyamus pusillus* and a range of encrusting fauna. Habitats dominated by sand were characterised by species such as the brittlestar (*Amphiura filiformis*), the polychaetes *Goniada maculata, Diplocirrus glaucus* and *Spiophanes kroyeri* and the bivalve *Timoclea ovata*.

8.1.5.35 The site specific surveys also identified protected habitats and species of conservation importance; those identified with the Regional Benthic Subtidal Ecology Study Area included subtidal sands and gravels (a UK Biodiversity Action Plan Priority Habitat) and ocean quahog *A. islandica.*

Seagreen 1 Offshore Wind Farm

8.1.5.36 Seagreen 1 OWF (Figure 8.4) baseline characterisation surveys were conducted in 2011, approximately 25km southeast of the Scoping Boundary, and comprised grab sampling, beam trawl sampling and DDV sampling.

8.1.5.37 '*Sabellaria*' (SS.SBR.PoR.SspiMx), *Moerella* spp. with venerid bivalves in infralittoral gravelly sand (SS.SCS.ICS.MoeVen) and *Flustra foliacea* and *Hydrallmania falcata* on tide-swept circalittoral mixed sediment (SS.SMX.CMx.FluHyd) were identified as key habitats in the west of the Seagreen 1 OWF. More centrally, the seabed was dominated by the sabellid polychaete classes, 'dense Chone' (SS.SMx.OMx.(Chone)) and 'sparse Chone'.

8.1.5.38 In the east, Polychaete-rich deep Venus community in offshore mixed sediments (SS.SMx.OMx.PoVen) was identified as a key habitat across the whole area, with the centre also associated with *S. spinulosa* and the east with the Chone polychaete.

8.1.5.39 The number of species and individuals within the east of the Seagreen 1 OWF was generally lower than within the west of the Seagreen 1 OWF, which was likely to be a result of a predominance of finer sediments in the east. Epifauna and encrusting fauna were more common where the sediments were coarser, containing gravel, shell or cobble (Seagreen, 2012).

8.1.5.40 Pre-construction benthic monitoring and Annex I reef surveys in 2020 within the Seagreen 1 OWF were undertaken in the array area and export cable corridor. Benthic habitats were recorded as circalittoral mixed sediments, SS.SMx.CMx.FluHyd and *Ophiothrix fragilis* and/or *Ophiocomina nigra* brittlestar beds on sublittoral mixed sediment (SS.SMx.CMx.OphMx), with patches of moderate energy circalittoral rock and circalittoral coarse sediment (APEM, 2020). The *S. spinulosa* aggregations identified in these surveys were not found to meet criteria to define them as reefs, however, they were in association with high biodiversity areas (Seagreen, 2012). Patches of medium and low resemblance stony reef were recorded among larger areas of cobble and sand in the offshore section of the export cable corridor and within the centre and northeast of the Seagreen 1 OWF array area (APEM, 2020).

Seagreen 1A Project

8.1.5.41 The Seagreen 1A Project provides the infrastructure required to connect the remaining 36 consented offshore turbines at Seagreen 1 OWF to the grid at the same landfall point as the Inch Cape OWF (Figure 8.4). A benthic validation survey was undertaken in 2020 and 2021 to support the marine licence application for Seagreen Project 1A. The benthic subtidal survey (comprised of grab and DDV sampling) was located to the southeast of the Array Project.

8.1.5.42 Sediments recorded ranged from sand to mixed sediments, with sample stations closer to the coast containing a higher percentage of mud and those further offshore containing a higher percentage of sand. The Seagreen Project 1A benthic validation survey recorded sandy mud biotopes (circalittoral sandy mud (SS.SMu.CSaMu) and *Amphiura filiformis, Mysella bidentata* and *Abra nitida* in circalittoral sandy mud (SS.SMu.CSaMu.AfilMysAnit)) across the mid-section of the export cable corridor survey area. Mixed sediment biotopes (polychaete-rich deep *Venus* community in offshore mixed sediments (SS.SMx.OMx.PoVen) and SS.SMx.CMx.OphMx) were recorded in the furthest offshore samples within the export cable corridor survey area. The inshore sections of the export cable corridor survey area were dominated by muddy sediment biotopes (seapens and burrowing megafauna in circalittoral fine mud (SS.SMu.CFiMu.SpnMeg) and *Melinna palmata* with *Magelona* spp. and *Thyasira* spp. in infralittoral sandy mud (SS.SMu.ISaMu.MelMagThy)). No Annex I reefs were recorded during the Seagreen Project 1A benthic validation surveys, which included some areas of the Seagreen 1 OWF array area.

Berwick Bank Offshore Wind Farm

8.1.5.43 The Berwick Bank OWF (Table 8.4) is located 32km to the southeast of the Array Project and within the Regional Benthic Subtidal Ecology Study Area. The baseline characterisation surveys for Berwick Bank OWF occurred in 2020 and comprised grab and DDV sampling (SSE Renewables, 2022).

8.1.5.44 The results of these surveys identified that the array area was predominantly populated by sand based communities including *Amphiura filiformis, Kurtiella bidentata* and *Abra nitida* in circalittoral sandy mud (SS.SMu.CSaMu.AfilKurAnit) and *Echinocyamus pusillus*, *Ophelia borealis* and *Abra prismatica* in circalittoral fine sand (SS.SSa.CFiSa.Epus.OborApri), which were found to be particularly dominant in the east of the Berwick Bank OWF array area, accompanied by smaller areas of offshore circalittoral sand (SS.SSa.OSa), SS.SSa.OSa [*Echinocyamus pusillus*] and *Kurtiella bidentata* and *Thyasira* spp. in circalittoral muddy mixed sediment (SS.SMx.CMx.MysThyMx). In the west of the Berwick Bank OWF array area mixed sediment and mud-based communities are more prevalent, including

SS.SMx.OMx.PoVen, SS.SMu.CSaMu.AfilMysAnit, and *Echinocyamus pusillus, Ophelia borealis* and *Abra prismatica* in circalittoral fine sand (SS.SSa.CFiSa.Epus.OborApri) biotopes with two patches of non-reef forming *Sabellaria spinulosa* on stable circalittoral mixed sediment (SS.SBR.PoR.SspiMx) biotope in the south.

8.1.5.45 The Berwick Bank OWF export cable corridor is also characterised by mixed and soft sediment communities such as SS.SSa.OSa and *Amphiura filiformis* and *Ennucula tenuis* in circalittoral and offshore sandy mud (SS.SMu.CSaMu.AfilNten) in the offshore end of the export cable corridor, transitioning to Seapens and burrowing megafauna in circalittoral fine mud (SS.SMu.CFiMu.SpnMeg) biotope in the central section. The echinoderms and crustose communities (CR.MCR.EcCr) biotope was recorded in the inshore areas adjacent to the landfall.

8.1.5.46 During the Berwick Bank OWF survey some grab samples also recorded species of conservation importance. *A. islandica* were recorded in the array area and export cable corridor and *M. modiolus* was recorded in the Berwick Bank OWF array area only in small numbers (<four individuals) except for one trawl, which recorded 31 individuals. No *M. modiolus* beds were recorded during the DDV survey and no *M. modiolus* was recorded in the infaunal grab survey.

<u>Inch Cape Offshore Wind Farm</u>

8.1.5.47 The Inch Cape OWF is located 61km to the south of the Array Project and within the Regional Benthic Subtidal Ecology Study Area (Figure 8.4). The baseline characterisation surveys for the Inch Cape OWF showed that the array area was dominated by circalittoral sands and gravelly sands with areas of mixed sediment. The epifaunal surveys recorded epibenthic species that were typical for these sediments and included dead man’s fingers (*Alcyonium digitatum*), horned wrack (*F. foliacea*), brittlestar (*O. fragilis*), hydroids (e.g. *H. falcata*) and a number of small fish and mobile benthic invertebrates. The DDV survey recorded a number of similar species; the key species recorded were *A. digitatum, P. triqueter, Munida rugosa, F. foliacea*, and common starfish (*Asterias rubens*). The brittlestar (*O. fragilis*) occurred in high densities, but only at two stations (Inch Cape Offshore Limited, 2011).

8.1.5.48 The dominating biotopes within the array were *Kurtiella bidentata* and *Thyasira spp.* in circalittoral muddy mixed sediment (SS.SMx.CMx.MysThyMx) covering 65% of the array area, SS.SCS.OCS covering 31% of the area and *Mediomastus fragilis, Lumbrineris spp*. and venerid bivalves in circalittoral coarse sand or gravel (SS.SCS.CCS.MedLumVen) covering 4% of the area (Inch Cape Offshore Limited, 2011). A number of reef forming polychaetes (i.e. *Sabellaria*) were recorded; however, no evidence of Annex I reef features was found.

<u>Neart na Gaoithe Offshore Wind Farm</u>

8.1.5.49 The Neart na Gaoithe OWF (Figure 8.4) array area is approximately 80km south of the Array Project and within the Regional Benthic Subtidal Ecology Study Area. The baseline characterisation surveys for the Neart na Gaoithe OWF array area reported slightly gravelly sands with areas of coarser sediments (e.g. sandy gravels and gravelly sand). Analysis of the grab samples mainly characterised the Neart na Gaoithe OWF array area as *Amphiura filiformis* and *Ennucula tenuis* in circalittoral and offshore sandy mud (SS.SMu.CSaMu.AfilNten) and a mosaic of SS.SCS.CCS/SS.SSa.OSa. Small patches of *Thyasira* spp. and *Ennucula tenuis* in circalittoral sandy mud (SS.SMu.CSaMu.ThyNten) were reported in the east, *Abra prismatica, Bathyporeia elegans* and polychaetes in circalittoral fine sand (SS.SSa.CFiSa.ApriBatPo) in the south and *Owenia fusiformis* and *Amphiura filiformis* in offshore circalittoral sand or muddy sand (SS.SSa.OSa.OfusAfil) in the north and west of the Neart na Gaoithe OWF array area (EMU, 2010). No protected or rare species were recorded (Neart na Gaoithe Offshore Wind Ltd., 2010).

8.1.5.50 Analysis of the DDV data mainly characterised the array area as SS.SMu.CFiMu.SpnMeg with regular patches of SS.SMx.CMx throughout the Neart na Gaoithe OWF array area. SS.SMx Sublittoral mixed sediments, SS.SMx.CMx.OphMx and CR.MCR.EcCr (on boulders) were also recorded in small patches in the array area (EMU, 2010).

<u>Kincardine Offshore Wind Farm</u>

8.1.5.51 The site specific surveys at the Kincardine OWF (Figure 8.4) involved a combination of DDV and grab sampling which identified the key characteristics of the Kincardine OWF export cable corridor and array area (Kincardine Offshore Wind Farm, 2016). The Kincardine OWF array area was predominantly characterised by SS.SSa.OSa, which was found at all 18 stations across the development area. DDV most frequently identified *A. digitatum* and *A. rubens* at all 18 sample stations, these species were also the most common within the Kincardine OWF export cable corridor. In the Kincardine OWF export cable corridor, east of the Kincardine OWF array area, there was a greater variety of habitats identified, the majority of which being circalittoral fine sand (SS.SSa.CFiSa) followed by SS.SSa.OSa, with only a couple of stations defined as SS.SCS.CCS.

Aberdeen Offshore Wind Farm

8.1.5.52 Within the Aberdeen OWF (Figure 8.4) in the north of the Regional Benthic Subtidal Ecology Study Area two main biotopes were identified: SS.SCS.CCS and SS.SSa.CMuSa (Aberdeen Offshore Wind Farm Limited, 2010). Data from surveys completed around this area by McIntyre (1958) described the benthic environment to be dominated by lamellibranchs and polychaetes as well as echinoderms such as *Ophiura affinis* and *E. pusillus*.

Hywind Offshore Wind Farm

8.1.5.53 Hywind OWF (*Ophiura affinis*), located in the north of the Regional Benthic Subtidal Ecology Study Area, identified a variety of habitats within its export cable corridor and array area. Video surveys of the Buchan Deep recorded the biotope "circalittoral fine sand", characterised by a poorly developed epifauna with sparse hermit crabs and brittle stars (*Ophiura* sp.), as well as hydroids and anemones on the scattered cobbles (Statoil, 2015). The main infaunal species here were the polychaetes *Scoloplos armiger*, *Spiophanes bombyx* and *Owenia fusiformis*, the brittle stars (*Amphiura filiformis* and *Ophiura affinis*) and the burrowing sea urchins (*Spatangus* sp. and *Echinocyamus pusillus*) (Statoil, 2015). The occasional patches of boulders and mixed sediment supported a raised diversity of epifaunal species including shrimps, sponges, sessile cnidarians and occasional aggregations of sandy tubes of the polychaete *S. spinulosa*. Coverage of *S. spinulosa* on the seabed in these locations was low, patchy and small in extent (Statoil, 2015).

Benthic Subtidal Ecology Study Area

8.1.5.54 The preliminary outputs of the analysis of DDV from the site specific surveys across the Benthic Subtidal Ecology Study Area reported on the presence of habitats of conservation importance as well as general species distribution. The analysis identified two main groups of species based on their sediment preferences.

8.1.5.55 Softer substrates were characterised by:

- Annelida – Polychaeta (*Aphrodita aculeata, Maxmuelleria faex inc., Myxicola stet., Oxydromus flexuosus, Terebellidae stet.).*
- Arthropoda – Malacostraca (*Cancer pagurus, Corystes cassivelaunus, Homarus stet., Liocarcinus depurator, Macropodia stet.).*
- Cnidaria – Anthozoa (*Arachnanthus sarsi, Ceriantharia stet., Edwardsiidae indet., Pennatuloidea stet*).
- Echinodermata – Asteroidea (*Astropecten irregularis, Luidia sarsii*), Holothuroidea (*Psolus phantapus* inc.), Echinoidea (*Spatangus purpureus*), Ophiuroidea (*Ophiura ophiura* inc.).
- Mollusca – Bivalvia (*Acanthocardia aculeata*), Gastropoda (*Naticidae* stet.), and eggs, Cephalopoda (*Octopoda* stet., *Sepiida* stet.).

8.1.5.56 Fewer species were identified on coarser sediments such as gravel, cobble and boulders including:

- Annelida – Polychaeta.
- Arthropoda - Malacostraca (*Majidae* stet., *Munida rugosa* inc.), Thecostraca (*Cirripedia* indet.).
- Cnidarians – Hydrozoa (*Tubularia indivisa, Thuiaria indet*.), Anthozoa (*Actiniaria, Alcyonium digitatum, Metridium senile inc., Nemertesia antennina, Sertularia indet., Sertulariidae stet., Urticina eques, Urticina stet.*).
- Bryozoa – Gymnolaemata (*Alcyonidium diaphanum*).

- Mollusca – Bivalvia (*Anomiidae*).

8.1.5.57 The coarser sediments were populated by sessile epifaunal organisms such as hydrozoans, octocorals (e.g. *A. digitatum*), as well as molluscs and bryozoans.

Habitats of conservation importance

8.1.5.58 The site specific surveys within the Benthic Subtidal Ecology Study Area included an assessment of habitats and species of conservation importance.

8.1.5.59 *A. islandica* is listed as an OSPAR (2008) declining species as well as a designated feature of the Firth of Forth Banks Complex MPA and Scottish PMF. *A. islandica* shells were observed during the DDV survey but all shells were evidently deceased given the disarticulation of the shells and the absent or degraded black periostracum that is normally present when alive. Where found, the relative whole nature of the shells did suggest live specimens may be present in the wider region. Dead shells were noted at 43 stations. In addition to shells, there was further evidence of molluscs in the form of possible bivalve siphons and siphons identified as *A. islandic*a (identified at 59 stations). The presence of *A. islandica* within the survey area was confirmed by the identification of live specimens in the macrofaunal sample analysis (Gardline, in progress).

8.1.5.60 The scarce tube-dwelling anemone *Arachnanthus sarsii* is classified as "a rare mobile species in Scottish waters" on the Scottish Biodiversity List (2020) as well as a Scottish PMF in territorial waters (NatureScot, 2020). This species is a large tube dwelling anemone and eleven individuals were observed across eight stations.

8.1.5.61 Seabed imagery was also used to determine the presence of habitats of conservation importance. An assessment was undertaken to determine the presence of sea pen and burrowing megafauna communities, *S. spinulosa* and *M. modiolus* biogenic reefs, rocky reefs and Fragile Sponge and Anthozoan Communities on Subtidal Rocky Habitats. These assessments, however, concluded that no habitats of conservation importance were present within the Benthic Subtidal Ecology Study Area. Habitats of conservation importance within designated sites have been identified in the section below (e.g. offshore subtidal sands and gravels).

Designated sites

8.1.5.62 Within the Regional Benthic Subtidal Ecology Study Area there a number of European (i.e. Special Areas of Conservation (SACs)) and nationally (i.e. MPAs) designated sites with relevant subtidal benthic ecology features (Table 8.2).

Table 8.3: Summary of designated sites with relevant benthic ecology features within the regional benthic subtidal ecology Study Area

Designated site	Distance to Array Project (km)	Distance to Array Project ZoI (km)	Relevant subtidal features
Firth of Forth Banks Complex MPA	0.04	0	Ocean quahog Offshore subtidal sands and gravels Shelf banks and mounds Quaternary of Scotland: Moraines
Southern Trench MPA	56.79	46.45	Burrowed mud Shelf deeps Quaternary of Scotland: Moraines Quaternary of Scotland: Sub-glacial tunnel valleys Submarine Mass Movement: Slide scars
Firth of Tay and Eden Estuary SAC	95.9	90.79	Estuaries Sandbanks which are slightly covered by sea water all the time

Designated site	Distance to Array Project (km)	Distance to Array Project ZoI (km)	Relevant subtidal features
Berwickshire and North Northumberland Coast SAC	97.2	88.44	Large shallow inlets and bays Reefs Submerged or partially submerged sea caves
Isle of May SAC	104.6	99.68	Reefs

8.1.5.63 The identification of designated sites for inclusion in the Array Project benthic subtidal ecology chapter of the EIA Report was carried out as follows:

- Sites with relevant qualifying features that overlap with the Scoping Boundary were screened in for further assessment.
- Sites with relevant qualifying features that are located within the likely ZoI of effects associated with the Scoping Boundary were screened in for further assessment. The likely ZoI is encapsulated by the Benthic Subtidal Ecology Study Area and has been determined through a review of the potential impacts associated with the Array Project. On this basis, designated sites within the Benthic Subtidal Ecology Study Area have been included. This ensures that all sites potentially affected by changes in water quality (e.g. increased suspended sediment concentrations) and potential changes to the hydrodynamic regime are included in the assessment.

8.1.5.64 Within the Benthic Subtidal Ecology Study Area there is a single MPA with benthic ecology features: the Firth of Forth Banks Complex MPA (Figure 8.7). All other designated sites are located beyond the ZoI for benthic receptors.

8.1.5.65 The Firth of Forth Banks Complex MPA covers 2,130km^2 and is spilt into the three sections of Berwick Bank, Scalp and Montrose Bank, and Wee Bankie. The MPA is located to the south of the Scoping Boundary and Montrose Bank overlaps with the Benthic Subtidal Ecology Study Area. The offshore subtidal sands and gravels and ocean quahogs occur inside the Benthic Subtidal Ecology Study Area, however, the shelf banks and mounds feature, as well as the moraines feature, occur outside the Benthic Subtidal Ecology Study Area (13.45km and 14.03km respectively from the Benthic Subtidal Ecology Study Area).

8.1.5.66 The Firth of Forth Banks Complex MPA is designated for ocean quahog *A. islandica* aggregations, offshore subtidal sands and gravels, shelf banks and mounds, and moraines (JNCC, 2014) . The conservation objectives are to ensure that, subject to natural change, the integrity of the site is maintained or restored as appropriate, and that the site contributes to achieving the Favourable Conservation Status (FCS) of its qualifying features.

8.1.5.67 Further detail on potential effects on MPAs is presented in the MPA Screening Report (Appendix 6: Marine Protected Area Screening).

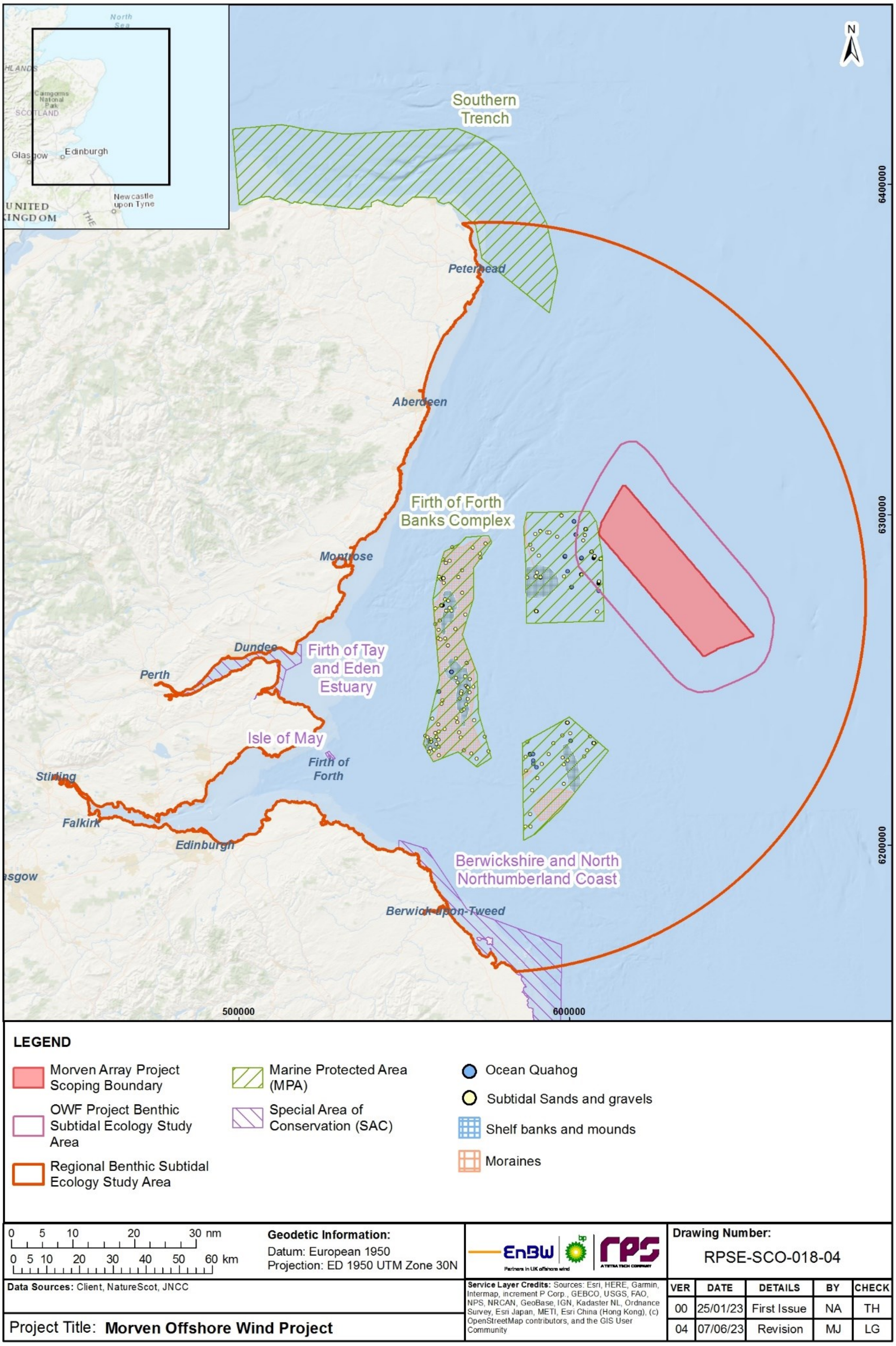


Figure 8.7: Designated sites within the Regional Benthic Subtidal Ecology Study Area

8.1.6 Potential Impacts of the Array Project

8.1.6.1 A range of potential impacts on benthic subtidal ecology have been identified which may occur during the construction, O&M and decommissioning phases of the Array Project.

8.1.6.2 The impacts that have been scoped into the assessment are outlined in Table 8.3 together with a description of any additional data collection (e.g. site specific surveys) and supporting analyses (e.g. modelling) that will be required to enable a full assessment of the impacts.

8.1.6.3 Potential impacts scoped out of the assessment are presented in Table 8.4, with justification.

Table 8.4: Impacts proposed to be scoped into the Array Project assessment for benthic subtidal ecology

C = Construction phase, O = O&M phase, D = Decommissioning phase.

Impact	Project phase*			Basis for impact	Data collection and analysis required to characterise the baseline environment	Summary of proposed approach to assessment
	C	O	D			
Temporary habitat loss/disturbance	✓	✓	✓	There is potential for temporary, direct habitat loss and disturbance during the construction phase as a result of site p reparation activities in advance of installation activities, cable installation activities (including unexploded ordnance (UXO) clearance, pre-cabling seabed clearance and anchor placements), and placement of spud-can legs from jack-up operations. Temporary habitat loss/disturbance may occur during the O&M phase as a result of operations (e.g. cable repair/reburial, use of jack-up vessels to facilitate wind turbine component repairs, etc.). The impacts associated with these operations are likely to be similar in nature to those associated with the construction phase, although of reduced magnitude. There is potential for temporary, direct habitat loss and disturbance due to decommissioning activities, resulting in potential effects on benthic ecology.	Benthic subtidal surveys were undertaken across the Benthic Subtidal Ecology Study Area in 2022. This survey will provide data to support the benthic characterisation within the Benthic Subtidal Ecology Study Area.	No specific modelling is required to inform this impact assessment, although the assessment will be quantitative in nature (i.e. clearly presenting the maximum spatial scale of impacts). This assessment will be based on information derived from the PDE. The significance of effects upon benthic receptors will be determined by correlating the magnitude of the impact and the sensitivity of the receptor. Where possible, the magnitude of the impact will be quantified for the MDS. For example, the MDS for temporary habitat loss/disturbance will be quantified and the assessment will present the areas of habitat potentially affected in the context of the size of the Regional Benthic Subtidal Ecology Study Area. The sensitivity of benthic receptors will be determined using the MarESA tool and the FeAST tools.
Increased suspended sediment concentrations (SSC) and associated deposition	✓	✓	✓	Sediment disturbance arising from construction activities (e.g. foundation and cable installation – including drilling and any deposits arising, UXO clearance and seabed preparation); maintenance operations (e.g. cable repair/reburial, use of jack-up vessels to	As per temporary habitat loss/disturbance.	The outputs of numerical modelling undertaken for the physical processes assessment will inform this impact assessment. Further details of this modelling are presented within chapter 7.1: Physical Processes of the

Impact	Project phase*			Basis for impact	Data collection and analysis required to characterise the baseline environment	Summary of proposed approach to assessment
	C	O	D			
				facilitate wind turbine component repairs etc.); and decommissioning activities (e.g. foundation removal) may result in indirect impacts on benthic communities due to temporary increases in SSCs and associated sediment deposition (i.e. smothering effects). Changes in SSCs can impact benthic receptors through changes in water clarity and reduced feeding due to increases in suspended solids and smothering and siltation rate changes. This assessment will consider the potential impacts on benthic subtidal ecology.		Scoping Report. For the O&M phase, the magnitude is assumed to be no greater than for the construction phase, therefore, modelling carried out for the construction phase will be used to quantify the magnitude of effect.
Long term habitat loss	✓	✓	✓	There is the potential for long term habitat loss to occur directly under all foundation structures and associated scour protection, and under any cable protection required. As foundations are installed throughout the construction phase this impact is also relevant to the construction phase, although this impact will largely occur throughout the O&M phase. Permanent habitat loss may occur under any infrastructure that is not decommissioned at the end of the Array Project's lifetime, such as cable or scour protection.	As per temporary habitat loss/disturbance.	No specific modelling is required to inform this impact assessment, although the assessment will be quantitative in nature (i.e. clearly presenting the maximum spatial scale of impacts). This assessment will be based on information derived from the PDE. The approach to assigning the significance of effect is outlined above for 'temporary habitat loss/disturbance'.
Increased risk of introduction and spread of invasive non-native species (INNS)	✓	✓	✓	There is potential for an increased risk of introduction and spread of INNS through the vessel movements required during all phases of the Array Project.	As per temporary habitat loss/disturbance.	No specific modelling is required to inform this impact assessment. A qualitative assessment will be undertaken and presented in the EIA Report. This assessment will be based on information derived from the PDE. The approach to assigning the

Impact	Project phase*			Basis for impact	Data collection and analysis required to characterise the baseline environment	Summary of proposed approach to assessment
	C	O	D			
						significance of effect is outlined above for 'temporary habitat loss/disturbance'.
Colonisation of hard structures	×	✓	×	Artificial structures placed on the seabed (i.e. foundations and scour/cable protection) in the offshore environment are expected to be colonised by a range of marine organisms leading to localised increases in biodiversity. These structures may also facilitate the spread of marine INNS.	As per temporary habitat loss/disturbance.	No specific modelling is required to inform this impact assessment. A qualitative assessment will be undertaken and presented in the EIA Report. This assessment will be based on information derived from the PDE. INNS will be considered, particularly in relation to colonisation of hard structures. The approach to assigning the significance of effect is outlined above for 'temporary habitat loss/disturbance'.
Changes in physical processes	×	✓	×	The presence of foundation structures, associated scour protection and cable protection may introduce localised changes to the tidal flow and wave climate, resulting in potential changes to the sediment transport pathways and associated effects on benthic ecology.	As per temporary habitat loss/disturbance.	Outputs of numerical modelling (as discussed in chapter 7.1: Physical Processes of the Scoping Report) undertaken for the physical processes assessment will inform this impact assessment. The approach to assigning the significance of effect is outlined above for 'temporary habitat loss/disturbance'.
Removal of hard substrates	×	×	✓	The removal of foundations during decommissioning has the potential to lead to loss of species/habitats colonising these structures.	As per temporary habitat loss/disturbance.	No specific modelling is required to inform this impact assessment, although the assessment will be quantitative in nature (i.e. clearly presenting the maximum spatial scale of impacts). This assessment will be based on information derived from the

Impact	Project phase*			Basis for impact	Data collection and analysis required to characterise the baseline environment	Summary of proposed approach to assessment
	C	O	D			
						PDE. The approach to assigning the significance of effect is outlined above for 'temporary habitat loss/disturbance'.
Impacts to benthic invertebrates due to electromagnetic fields (EMF).	×	✓	×	The presence of an additional EMF from operational subsea cables may affect benthic subtidal ecology by changing the behaviours and physiology of relevant benthic ecology receptors	As per temporary habitat loss/disturbance.	No specific modelling is required to inform this impact assessment, although the assessment will be quantitative in nature (i.e. clearly presenting the maximum spatial scale of impacts). This assessment will be based on information derived from the PDE. The approach to assigning the significance of effect is outlined above for 'temporary habitat loss/disturbance'.

Table 8.5: Impacts proposed to be scoped out of the Array Project assessment for Benthic Subtidal Ecology

Impact	Basis for impact
Accidental pollution	There is a risk of pollution being accidentally released during the construction, O&M and decommissioning phases from sources including vessels/vehicles and equipment/machinery. However, the risk of such events is managed by the implementation of measures set out in standard post-consent plans (e.g. Environmental Management Plan, including MPCPs. These plans include planning for accidental spills, address all potential contaminant releases and include key emergency contact details. It will also set out industry good practice and OSPAR (Oslo-Paris), International Maritime Organization (IMO) and MARPOL (International Convention for the Prevention of Pollution from Ships) guidelines for preventing pollution at sea. Therefore, the likelihood of an accidental spill occurring is very low and in the unlikely event that such events did occur, the magnitude of these will be minimised through measures such as a MPCP. As such, it is intended that this impact is scoped out of further consideration within the benthic subtidal ecology chapter of the EIA Report.
Release of sediment-bound contaminants	Seabed disturbance associated with construction, maintenance and decommissioning activities (e.g. foundation and cable installation) could lead to the remobilisation of sediment-bound contaminants that may result in harmful and adverse effects on benthic communities. Site specific sampling within the Benthic Subtidal Ecology Study Area has shown levels of sediment contaminants are very low. Sediment contamination analysis identified that all sample stations except for one were below Cefas AL1 and AL2, as well as below Canadian TEL and PEL for metals, PCBs and PAHs. The exception to this was one station, which was above Cefas AL1 and Canadian TEL for arsenic. However, it should be noted that this station is located outside of the Scoping Boundary and, therefore, is unlikely to be directly disturbed. The risk of sediment-bound contaminants being present in concentrations likely to be harmful to benthic receptors is considered negligible. This potential impact is proposed to be scoped out of further consideration within the benthic subtidal ecology chapter of the EIA Report subject to consultation with the SNCBs.
Impacts to benthic invertebrates due to thermal emissions from subsea electrical cables	Thermal emissions generated by the subsea electrical cabling may affect benthic subtidal receptors. However, there is limited evidence for subsea cables significantly changing the temperature of the sea floor and surrounding water and, therefore, the impact of heat on benthic invertebrates. A review by Taormina *et al.* (2018) of the current knowledge on the impacts of subsea cables, including thermal emissions, identified that buried cables can warm the sediment in direct contact with the cable, which can then have an impact on the chemical and physical properties of the substrate. The thermal profile of a cable, however, can depend heavily on physical characteristics of the burial and the sediment (Taormina *et al.,* 2018). In addition, for buried cables, the temperature change at the seabed is reduced due to the distance between the cable and the seabed surface as a result of the increased dissipation of heat with distance from the cable (Meißner *et al*.,2007). A study conducted at Nysted Offshore Wind Farm in Denmark (Meißner *et al*., 2007) found the temperature change in the top 30cm of sediment (where most infauna live) above a high voltage cable (132kV) to be a maximum of 2°C, which is well within the thermal tolerance for most benthic organisms. For cables that are unburied and instead protected by thick concrete mattresses or rock berms, the heat conduction is likely to be negligible due to the density of the structures. Based on their review Taormina *et al.* (2018) concluded the small area associated with these cable corridors, and the expected weakness of thermal radiation, would not produce a significant impact. A Cable Plan for the Array Project will include cable burial where possible or cables will be protected as necessary, therefore, there is limited scope for impacts to benthic invertebrates due to heat from subsea cables.

8.1.7 Designed In Measures and Mitigation

8.1.7.1 As part of the project design process, a number of designed in measures (primary and tertiary) will reduce the potential for impacts on benthic subtidal ecology (Table 8.6). As there is a commitment to implement these measures, they are considered inherent to the design of the Array Project. The determination of magnitude and significance will assume the implementation of such measures. Some of these measures are considered standard industry practice for this type of development.

8.1.7.2 The requirement for any additional (secondary) mitigation measures will be dependent on the significance of the effects on benthic subtidal ecology receptors. The requirement for and feasibility of any mitigation measures will be consulted upon with statutory consultees throughout the EIA process.

Table 8.6: Designed in measures of the Array Project, relevant to Benthic Subtidal Ecology

Reference number	Measures adopted	Justification	Primary or tertiary
MM-1	Scour protection will be used around offshore structures as set out in chapter 3: Project Description.	There is the potential for scouring of seabed sediments to occur due to interactions between Metocean regime (wave, sand and currents) and foundations or other seabed structures. This scouring can develop into depressions around the structure; the use of scour protection around offshore structures and foundations will be employed, as described in detail in chapter 3: Project Description. The scour protection has been included in the modelled scenarios used within the assessment of effects to protect foundations from the effects of scour.	P
MM-2	Development and adherence to a Cable Plan.	There is a potential for cable exposure to occur due to interactions between Metocean regime (wave, sand and currents). Sediment transportation can lead to exposure of cables and infrastructure, although the use of a target cable burial depth alongside the cable installation strategy should provide sufficient depth to avoid exposure. The Cable Plan will outline the technical specifications of the cables used in the Array Project and describe the installation methodology; also includes cable protection to be installed.	P
MM-5	Development of, and adherence to, an EMP, including actions to minimise INNS, MMMP and a MPCP, which will include planning for accidental spills, address all potential contaminant releases and include key emergency details.	Provides a means to ensure the efficient management and communication of commitments made for the management of the potential environmental impacts. The EMP will include MMMP. The MMMP may include using Marine Mammal Observer(s) and PAM to monitor the mitigation zone (MZ, as determined by the underwater sound modelling) to ensure that animals are not observed within the MZ during piling. ADD may be used if required to deter animals from the MZ. For offshore water quality, measures will be adopted to ensure that the potential for release of pollutants from construction, and O&M, is minimised. In this manner, the	T

Reference number	Measures adopted	Justification	Primary or tertiary
		accidental release of contaminants from rigs and supply/service vessels will be strictly controlled, thus providing protection for birds and their prey species across all phases of the development. For benthic subtidal ecology, an MPCP and INISMP will be provided. The MPCP will include planning for accidental spills, addressing all potential contaminant releases and include key emergency details. The INISMP will include measures for controlling INNS and their impact on fish and shellfish ecology receptors.	
MM-4	Development of, and adherence, to a Construction Method Statement (CMS).	Provided as a means of controlling specific health and safety risks that have been identified and to ensure the health and safety aspects of the development are secured.	T
MM-45	Implementation, management and monitoring of cable protection (via burial or external protection where adequate burial depth, as identified via risk assessment, is not feasible) with any damage, destruction or decay of cables notified to MCA, NLB, Kingfisher and UKHO no later than 24 hours after discovered. Secured through the Navigation Safety and Vessel Management Plan.	Cable protection may be necessary in some locations where a sufficient target cable burial depth cannot be achieved or where cables become exposed during the lifetime of the Array Project. To ensure that the Cable Plan has been successfully implemented, monitoring will be undertaken as part of wider Array Project pre- and post-construction geophysical surveys and are likely to involve a combination of multibeam echosounder or high-resolution side-scan sonar. This minimises the risks of underwater allision with cable protection, anchor or fishing gear interaction with subsea cables and interference with magnetic position fixing equipment.	P

8.1.8 Proposed Assessment Methodology

8.1.8.1 The benthic subtidal ecology EIA will follow the methodology set out in chapter 4: EIA Methodology of the Scoping Report. Specific to the benthic subtidal ecology EIA Report, the following guidance documents will also be considered:

- Guidelines for Ecological Impact Assessment (EcIA) in the UK and Ireland. Terrestrial, Freshwater and Coastal (CIEEM, 2022).
- Guidance on Environmental Considerations for Offshore Wind Farm Development (OSPAR, 2008).
- Best Methods for Identifying and Evaluating *Sabellaria spinulosa* and Cobble Reef (Limpenny *et al*., 2010).
- Defining and Managing *Sabellaria spinulosa* Reefs (Gubbay, 2007).
- Identification of the Main Characteristics of Stony Reef Habitats under the Habitats Directive (Irving, 2009).
- Advances in assessing *Sabellaria spinulosa* reefs for ongoing monitoring (Jenkins *et al*., 2018).

- Marine Evidence-based Sensitivity Assessment – A Guide (Tyler-Walters *et al*., 2018).
- SNH (now NatureScot) guidance: Guidance on Survey and Monitoring in Relation to Marine Renewables Deployments in Scotland – Volume 5: Benthic Habitats (Saunders *et al.*, 2011).
- Guidelines for Data Acquisition to Support Marine Environmental Assessments of Offshore Renewable Energy Projects (Judd, 2012).

8.1.8.2 A benthic subtidal ecology technical report will be produced for the EIA Report, which will present a detailed baseline characterisation for the Array Project. The subtidal ecology technical report will present the full results of the site specific survey data and the most recent desktop data. This report will inform the benthic subtidal ecology EIA for the EIA Report. The approach and focus of these impact assessments will be discussed with stakeholders through consultation on this Scoping Report.

8.1.8.3 For the purposes of undertaking the EIA, marine habitats and species identified as occurring in the Benthic Subtidal Ecology Study Area will be grouped into broad habitat/community types. These broad habitat/community types will serve as the Important Ecological Features (IEFs) against which impacts associated with the construction, O&M and decommissioning phases of the Array Project will be assessed.

8.1.8.4 Habitats with similar physical and biological characteristics (including species complement and richness/diversity) as well as conservation status/interest will be grouped together for the purposes of the EIA. Consideration will also be given to the sensitivities of different habitats in assigning the groupings, such that habitats and species with similar vulnerability and recoverability, often because of similar broad sediment types and species complements, will be grouped together. Impacts on IEFs will be described in terms of the magnitude of that impact and correlated against the sensitivity of each IEF to each impact, to produce a statement of significance.

8.1.8.5 Information on the sensitivities of benthic ecology receptors will largely be drawn from the MarESA (Tyler-Walters *et al*., 2018) and the FeAST. The MarESA is a database which has been developed through the Marine Life Information Network (MarLIN) of Britain and Ireland and is maintained by several organisations, including the Marine Biological Association (MBA) and other statutory organisations in the UK. This database comprises a detailed review of available evidence on the effects of pressures on marine species or habitats, a subsequent scoring of sensitivity against a standard list of pressures and their benchmark levels of effect. FeAST allows users to investigate the sensitivity of marine features in Scotland's seas to pressures arising from human activities. Much of the evidence presented within FeAST has been derived from sensitivity assessments originally undertaken by MarLIN and further developed by several Scottish organisations such as NatureScot, MSS, SEPA and JNCC. The tool focuses on features of conservation interest such as protected features of Marine Protected Areas and Priority Marine Features.

8.1.8.6 The evidence base presented in the MarESA is peer reviewed and represents the largest review undertaken to date on the effects of human activities and natural events on marine species and habitats. It is one of the best available sources of evidence relating to recovery of benthic species and habitats.

8.1.8.7 Further detail on how sensitivity is defined is outlined in Tyler-Walters *et al*. (2018). Sensitivities to the key activities across the lifetime of the Array Project (i.e. construction, O&M and decommissioning phases) will be summarised according to the MarESA for each of the IEFs within the Benthic Subtidal Ecology Study Area. Where sensitivity information on specific biotopes is not available through the MarESA, suitable proxies will be used.

8.1.9 Potential Cumulative Impacts

8.1.9.1 The majority of predicted effects of construction, O&M and decommissioning of the Array Project infrastructure within the Scoping Boundary on benthic communities are expected to be localised to within the footprint of the Array Project. However, there is potential for cumulative effects to occur on benthic subtidal ecology from other projects or activities within the Regional Benthic Subtidal Ecology Study Area, where projects or plans could act collectively with the Array Project to affect benthic receptors. The Cumulative Effects Assessment (CEA) will follow the approach outlined in chapter 4: EIA methodology of the Scoping Report.

8.1.9.2 Cumulative impacts arising from plans/projects/activities within the CEA Benthic Subtidal Ecology Study Area will be assessed in the Benthic Subtidal Ecology EIA chapter. For the purposes of the CEA, the CEA Benthic Subtidal Ecology Study Area is proposed to be equivalent to the Regional Benthic Subtidal Ecology Study Area. For interactive/synergistic impacts (i.e. increases in suspended sediment concentration and changes in physical processes) only projects within two tidal excursions of the Array Project will be assessed. Projects considered in the CEA may include, but not may not be limited to, other OWF projects, cables and inter-connector projects and dredge/disposal activities.

8.1.10 Potential Inter-Related Effects

8.1.10.1 The EIA will consider inter-related effects. Inter-related effects relate to effects arising from the Array Project, either across their own phases (project lifetime) or different effects on one receptor in one phase (receptor-led). The EIA will consider inter-related effects, in relation to the potential effects of multiple impacts from the construction, O&M and decommissioning phases of the Array Project, affecting one receptor. Inter-related effects are assessed through consideration of all effects on a receptor, considering both spatial and temporal overlaps, with the Array Project. This will ensure that the Array Project as a whole is appropriately considered within the EIA.

8.1.11 Potential Transboundary Impacts

8.1.11.1 A screening of transboundary impacts has been carried out and is presented in Appendix 1: Transboundary Screening. This screening exercise identified that there is no potential for transboundary impacts upon benthic subtidal ecology due to construction, O&M and decommissioning impacts of the Array Project.

8.2 Fish and Shellfish Ecology

8.2.1 Introduction

8.2.1.1 This chapter of the Scoping Report identifies the fish and shellfish ecology receptors of relevance to the Array Project and considers the potential impacts arising from the construction, O&M and decommissioning of the Array Project.

8.2.1.2 For the purpose of characterisation and assessment, the shellfish component of fish and shellfish ecology will focus on those shellfish species of commercial interest and value. Species such as ocean quahog (*Arctica islandica*) and horse mussel (*Modiolus modiolus*) will be considered benthic ecology receptors due to their lack of commercial value and association with their benthic habitats (including protected status) and are, therefore, addressed within chapter 8.1: Benthic Subtidal Ecology.

8.2.2 Study Areas

8.2.2.1 Two study areas are defined for fish and shellfish ecology:

- the Array Project Fish and Shellfish Ecology Study Area
- the Regional Fish and Shellfish Ecology Study Area.

8.2.2.2 The Study Areas are shown in Figure 8.8 and are defined as follows:

- The Array Project Fish and Shellfish Ecology Study Area covers the Scoping Boundary; the area within which site specific benthic surveys have been undertaken.
- The results of the site specific benthic surveys will inform the baseline characterisation and identification of fish and shellfish receptors, where relevant, against which potential impacts associated with the Array Project will be assessed.
- A buffer zone extends up to 13.5km from the Scoping Boundary, intended to incorporate the Zone of Influence (ZoI) from indirect effects. The buffer equates to one maximum tidal ellipse over a large spring tide around the Scoping Boundary. Beyond that, any effects from the Array Project, with the exception of those relating to underwater sound, would be minimal upon fish and shellfish ecology receptors.

- The Regional Fish and Shellfish Ecology Study Area will comprise the Array Project and extends out to the boundary of the northern North Sea. This boundary also encompasses the Forth and Tay Scottish Marine Region (SMR) waters.
- The Regional Fish and Shellfish Ecology Study Area enables the context required for the population and species information collected and identified within the Array Project Fish and Shellfish Ecology Study Area. This will inform assessments of any impacts affecting fish and shellfish receptors, including both direct and indirect impacts, such as underwater sound.

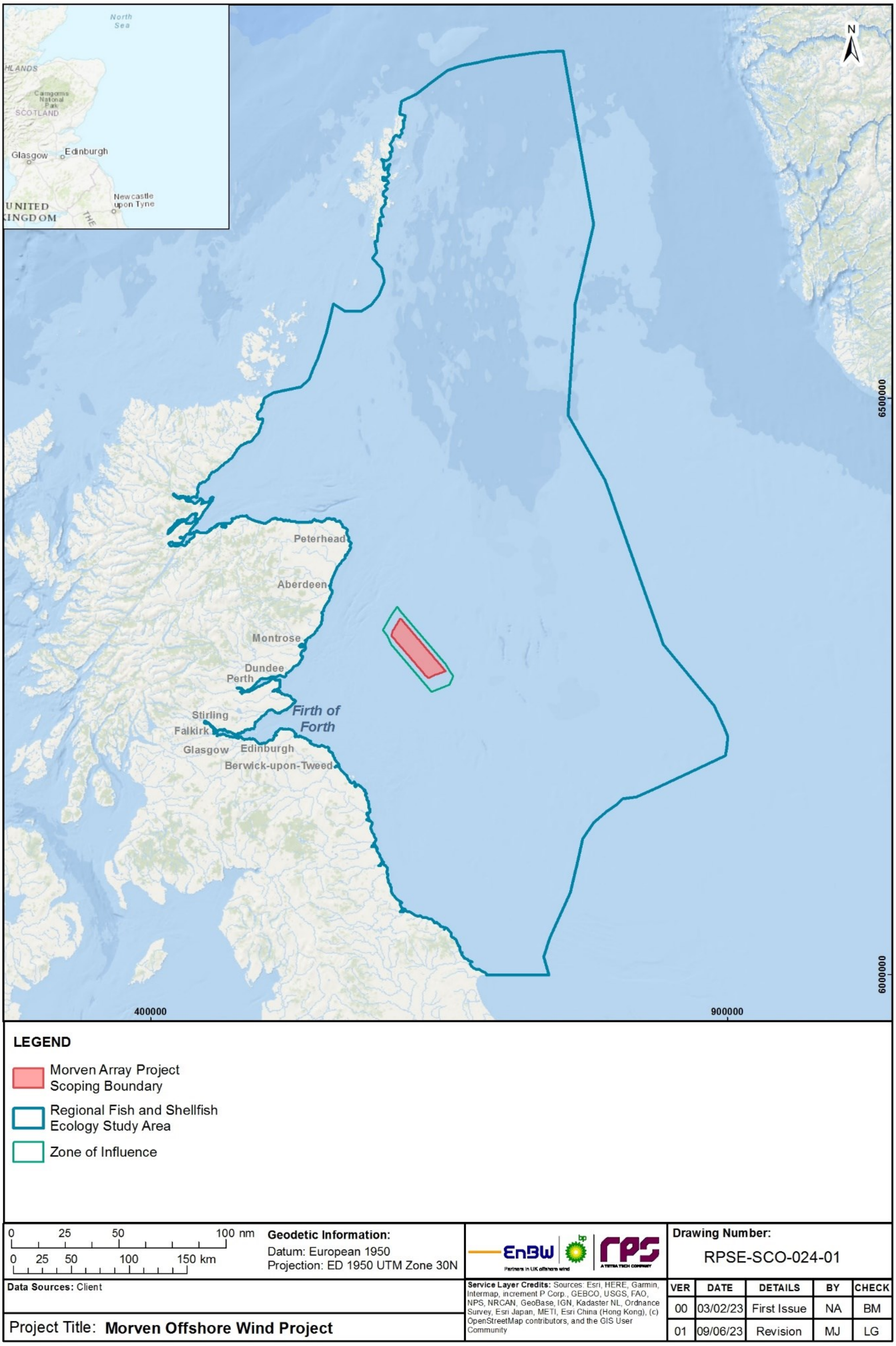


Figure 8.8: Array Project and Regional Fish and Shellfish Ecology Study Areas

8.2.3 Data Sources

Desktop data

8.2.3.1 A number of data sources, which provide coverage of the Regional Fish and Shellfish Ecology Study Area and support the Scoping Report, were identified through an initial desk-based review of the literature This information is summarised below in Table 8.7.

Table 8.7: Summary of key desktop datasets and reports for Fish and Shellfish Ecology

Title	Source	Year	Author
Marine recorder public UK snapshot	Joint Nature Conservation Committee (JNCC)	2022	JNCC
Survey data/reports available through International Council for the Exploration of the Sea (ICES), including International Herring Larvae Survey (IHLS)	ICES	2022	ICES
Survey data/reports available through ICES, including, International Bottom Trawl Survey (IBTS) (North Sea)	ICES	2022	ICES
Berwick Bank Offshore Wind Farm Environmental Impact Assessment (EIA) report	SSE Renewables (SSER)	2022	SSER
Berwick Bank Offshore Wind Farm (OWF) Scoping Report	SSER	2021	SSER
Distribution model for lesser sandeel	Marine Scotland Science (MSS)	2021	Langton *et al.*
JNCC MPA Mapper	JNCC	2020	JNCC
National Biodiversity Network (NBN) Atlas	NBN Atlas	2019	NBN Atlas
EMODnet broadscale seabed habitat map for Europe (EUSeaMap)	EMODnet – Seabed Habitats	2019	EMODnet – Seabed Habitats
Natural Fish and Shellfish Resource Environmental Statement section for the optimised project	Seagreen Environmental Impact Assessment Report: volume 1, chapter 9	2018	Seagreen
Updating fisheries sensitivity maps in British waters	Marine Scotland	2014	Aires *et al.*
Inch Cape fish and benthic survey data	AMEC Environment and Infrastructure UK Limited	2013	AMEC
Spawning and nursery grounds of selected fish species in UK waters	Cefas	2012	Ellis *et al.*
Fisheries Sensitivity Maps	Cefas	1998	Coull *et al.*
Developing Essential Fish Habitat Maps for Fish and Shellfish Species in Scotland	Marine Directorate	In Press	Franco *et al.*

Site specific survey data

8.2.3.2 A site specific benthic ecology characterisation survey was undertaken in 2022 encompassing the Array Project Fish and Shellfish Ecology Study Area. Particle size analysis (PSA), macrofaunal and environmental deoxyribonucleic acid (eDNA) sampling, and underwater imagery records were collected from this survey. Where relevant, this information will be used to support characterisation of the fish and shellfish receptors in the Array Project Fish and Shellfish Ecology Study Area. The site specific survey included sampling for eDNA with samples recovered from both seabed sediments and the water column. Sediment samples targeted the invertebrate or metazoan assay, whereas seawater samples targeted assays for fish and elasmobranchs.

8.2.3.3 DNA metabarcoding was used to support characterisation of the baseline fish and shellfish community. Sediment DNA shows greater longevity than DNA within the water column, therefore, may contain DNA material from organisms that were present some time ago, depending upon the depositional regime at the seabed. This DNA can, therefore, be used to provide a broader characterisation in terms of timescales. Seawater DNA, however, is typically considered to be representative of occurrence within the preceding tidal cycle, as material can be quickly degraded and dispersed when free-floating. Comparison between the two datasets, and with desktop data sources, can increase confidence in the sedimentary results and the characteristic species.

8.2.3.4 Sediment DNA metabarcoding identified the presence of DNA from a number of fish species from the fish assay, including clupeids (herring (*Clupea harengus*), and sprat (*Sprattus sprattus*)), gadoids (cod; (*Gadus mohua*), haddock (*Melanogrammus aeglefinus*), Norway pout (*Trisopterus esmarkii*), and whiting (*Merlangius merlangus*), flatfish (dab (*Limanda limanda)*, lemon sole (*Microstomus kitt),* long rough dab (*Hippoglossoides platessoides),* plaice (*Pleuronectes platessa),* and witch (*Glyptocephalus cynoglossus*)), gurnards (*Triglidae spp*.), mackerel (*Scomber scombrus)* and sandeel (*Ammodytidae spp*.), along with the presence of mussels (*Mytilidae spp*.) from the invertebrate assay at just one station. Although, given the visual observations of horse mussel (*Modiolus modiolus*) during the drop-down video (DDV) survey, it is possible that this result relates to horse mussel as opposed to blue mussel (*Mytilus edulis*), or other species within the family.

8.2.3.5 Seawater metabarcoding revealed almost all the same fish as the sediment DNA (except witch) within the fish assay, with the additions of Norwegian topknot (*Phrynorhombus norvegicus*), gobies (crystal goby; (*Crystallogobius linearis)*, and sand goby; (*Pomatoschistus minutus*)), northern rockling (*Ciliata septentrionalis)*, spotted dragonet (*Callionymus maculatus*) and thornback ray (*Raja clavata*).

8.2.4 Consultation

8.2.4.1 The approach to consultation for the Array Project is set out in chapter 5: Consultation Process of the Scoping Report. A summary of the pre-application consultation undertaken to date relevant to fish and shellfish ecology is set out in Table 8.8. Further detail on the Scoping Workshop and stakeholder plans for future engagement is set out in chapter 5: Consultation Process of the Scoping Report, supported by Appendix 3: Array Project Scoping Workshop Information and Appendix 4: Array Project Stakeholder Engagement Plans of the Scoping Report.

Table 8.8: Pre-application consultation relevant to fish and shellfish ecology undertaken to date

Date	Overarching theme	Method of engagement	Stakeholder	Summary of stakeholder feedback	Applicant's response and relevant cross reference
18.04.23	Data or datasets	Scoping Workshop session	NatureScot	NatureScot recommended additional dataset on sandeels (Langton *et al*., (2021)) and suggest utilising ScotMER outputs (Franco *et al.,* 2022) for fish habitat data.	Additional data sources added to section 8.2.3 and will aid the development of the Fish and Shellfish Ecology EIA Report chapter.
18.04.23	EIA Approach	Scoping Workshop session	NatureScot	NatureScot agreed that ocean quahog and horse mussel can be assessed within the Benthic Subtidal Ecology chapter and, therefore, not in the Fish And Shellfish Ecology	See section 8.2.1.2 which clarifies this approach.

Date	Overarching theme	Method of engagement	Stakeholder	Summary of stakeholder feedback	Applicant's response and relevant cross reference
				chapter of the EIA Report.	
18.04.23	Impact pathways	Scoping Workshop session	NatureScot	Agreed that EMF should be considered as part of the cumulative effects assessment even if no impact is assessed for the Array Project alone.	This has been included in the approach to the cumulative effects assessment for fish and shellfish ecology in section 8.2.9
18.04.23	Guidance	Scoping Workshop session	NatureScot	NatureScot agreed with the approach to the underwater sound assessment for the Fish And Shellfish Ecology chapter of the EIA Report.	Approach to underwater sound assessment for fish and shellfish is detailed in section 7.2.
18.04.23	EIA Approach	Scoping Workshop session	NatureScot	Suggested that migratory fish should be assessed in the EIA not the HRA.	The Applicant does not think the uncertainty in their migration routes and connectivity, or a lack of population data, are reasons to screen all diadromous fish out of the HRA, or that this rationale would be compliant with the Habitat Regulations. Atlantic salmon are, therefore, screened into the HRA.
18.04.23	Impact pathways	Scoping Workshop session	NatureScot	NatureScot recommend that sandeels present throughout the year with limited movement are considered in the Fish And Shellfish Ecology chapter of the EIA Report.	Noted, to be assessed as being present throughout the year.
25.05.2023	Study Area	Written advice	NatureScot	NatureScot agree agree that the regional study area is appropriate and sufficient.	Noted.
25.05.2023	Data	Written advice	NatureScot	NatureScot advise that Langton *et al*. (2021) and the ScotMER led development of essential fish habitat mapping for fish and shellfish species in Scotland (Franco *et al*., 2022) should also be considered.	Additional data sources added to section 8.2.3 and will aid the development of the Fish and Shellfish Ecology EIA Report chapter.
25.05.2023	Scope	Written advice	NatureScot	NatureScot agree that ocean quahog and horse mussel should be considered in the Benthic Subtidal Ecology chapter only.	Noted.

Date	Overarching theme	Method of engagement	Stakeholder	Summary of stakeholder feedback	Applicant's response and relevant cross reference
25.05.2023	Methodology	Written advice	NatureScot	NatureScot agree with the proposed methodology for undertaking the fish and shellfish ecology assessment.	Noted.
25.05.2023	Underwater Sound Approach	Written advice	NatureScot	NatureScot are content with the use of Popper *et al*. (2014) for group 1-4 and eggs. NatureScot advise that consideration is given for cod, herring eggs and sandeels. Note that sandeels are present all year round, not just during the spawning and nursery periods.	Noted, to be considered in the Fish and Shellfish Ecology EIA Report chapter.
25.05.2023	Impact pathways	Written advice	NatureScot	NatureScot agree with the impacts proposed to be scoped in	Noted.
25.05.2023	Impact pathways	Written advice	NatureScot	NatureScot agree with the impacts proposed to be scoped out. NatureScot do not advise that any additional impacts should be scoped out.	Noted.
25.05.2023	Cumulative	Written advice	NatureScot	NatureScot do not agree because it is possible that impacts that are assessed as negligible for the project alone assessment could be significant in the cumulative assessment. For example, given the scale of ScotWind and the number of proposed developments, it may be too premature to discount cumulative impacts. In addition to the impacts associated within the wind farm array consideration should also be given to displaced fishing activity for habitat loss/change to key forage species.	Noted, and understood that whilst some impacts would be considered negligible in the alone assessment, there is potential for an adverse cumulative impact. All scoped in impacts will be carried into the cumulative assessment within the EIA Report.

8.2.5 Baseline Environment

8.2.5.1 This section provides a concise summary of the baseline for the fish and shellfish environment of the Regional Fish and Shellfish Ecology Study Area. The seas off the east coast of Scotland and the Regional Fish and Shellfish Ecology Study Area have several protected areas designated for fish; these are summarised below and will be assessed in the EIA Report.

Fish assemblage

8.2.5.2 Demersal, pelagic, diadromous and elasmobranch fish species are included within the fish assemblage of the Regional Fish and Shellfish Ecology Study Area, including both commercial and non-commercial species. Demersal species likely include sandeel, cod, whiting, lemon sole, ling (*Molva molva*), saithe (*Pollachius virens*) and plaice. Pelagic species include herring, sprat, and mackerel. Elasmobranch species, such as spotted ray (*Raja montagui*), thornback ray, tope (*Galeorhinus galeus*), small-spotted catshark (*Scyliorhinus ommissio*), spurdog (*Squalus acanthias*), thorny skate (*Amblyraja radiata*) and cuckoo ray (*Leucoraja naevus*), among others, have been observed in the Regional Fish and Shellfish Ecology Study Area (Coull, *et al.,* 1998, Daan *et al.,* 2005, Baxter *et al.,* 2011, Ellis *et al.,* 2012). Several of these species (sandeel, cod, whiting, ling, saithe, mackerel, spurdog) are Primary Marine Features (PMF) (JNCC, 2012). These species are listed as a PMF if they are either a large proportion of their population occurs in Scotland's seas, if the species is under threat or in decline or due to the function role of the species.

8.2.5.3 Herring and sandeel are considered substrate-specific, as both rely on a particular sediment composition to support spawning and burrowing (sandeel). Substrata suitable for herring spawning is reported to comprise less than 5% mud content and greater than 10% gravel content (Reach *et al.*, 2013). Suitable substrate for sandeel inhabitation is reported as less than 10% mud content, over 50% sand and less than 80% gravel content, with a preference for areas comprising less than 4% mud content (prime and sub-prime) and over 70% sand (Holland *et al.,* 2005).

8.2.5.4 Between 2011 and 2020, site specific epifaunal beam trawl surveys were undertaken across the Berwick Bank and Seagreen 1 and Seagreen 1A OWFs (approximately 31.64km and 25.16km from the Array Project, respectively). They recorded a range of demersal species, such as dab, long rough dab, lesser sandeel (*Ammodytes tobianus*), Raitt's sandeel (*A. marinus*), four-bearded rockling (*Enchelyopus cimbrius*), pogge (*Agonus cataphractus*), butterfish (*Pholis gunnellus*), Norwegian topknot, reticulated dragonet (*C. reticulatus*), common dragonet (*C. lyra*), lemon sole, bullrout (*Myoxocephalus ommissi*) and goby species (Gobiidae spp.). Commercial species such as plaice, whiting, cod, and red gurnard (*Chelidonichthys cuculus*), were also recorded, as were smooth sandeel (*Gymnammodytes semisquamatus*) and greater sandeel (*Hyperoplus lanceolatus*), and one elasmobranch species, the cuckoo ray (Seagreen, 2012, 2018, SSER, 2022a).

Diadromous and anadromous fish species

8.2.5.5 Diadromous fish (i.e. species that migrate between freshwater and the marine environment) migrate to and from rivers in the vicinity of the Array Project and, therefore, may migrate through the site boundary during certain periods of the year (NBN Atlas, 2019).

8.2.5.6 Based on information on diadromous fish populations on the east coast of Scotland, the Berwick Bank, Seagreen 1 and Seagreen 1A EIAs identified eight diadromous fish species that have the potential to occur in offshore areas within the vicinity of the Array Project or coastal areas along the east of Scotland. These species were Atlantic salmon (*Salmo salar*), sea trout (*S. trutta)*, sea lamprey (*Petromyzon marinus*), river lamprey (*Lampetra fluviatilis)*, European eel (*Anguilla Anguilla*), allis shad (*Alosa alosa*), twaite shad (*A. fallax*), and European smelt (*Osmerus eperlanus*) (Seagreen, 2018; SSER, 2022a). It should be noted that river lamprey and European smelt are primarily coastal species and, therefore, unlikely to interact with the Array Project. The species that are considered as having the greatest potential to be present within the vicinity of the Array Project are Atlantic salmon, sea trout, European eel, sea lamprey and allis and twaite shad.

8.2.5.7 No site specific surveys are proposed to inform the diadromous fish impact assessment. For the intended purpose of this Scoping Report, it will be assumed that the species referred to above are likely to be present within the Regional Fish and Shellfish Ecology Study Area during migration at key stages of their life cycles. This includes smolt migration from natal rivers and adult migration to spawning habitats. The aim of the impact assessment is to determine whether construction, O&M or decommissioning activities have the potential to disrupt the migration of these species. Therefore, migratory seasons will be an important element of the baseline characterisation and will be collated through desktop data sources (Malcolm *et al.*, 2010, 2015, Godfrey *et al.*, 2015, Hume, 2017, Lothian *et al.*, 2017, Newton *et al.*, 2017, Gardiner *et al.*, 2018, Seagreen, 2018). Migration timings for diadromous fish species relevant to the Array Project are provided in Table 8.9.

8.2.5.8 The River Dee Special Area of Conservation (SAC), River South Esk SAC, and River Spey SAC are designated for Annex II Atlantic salmon and the symbiotic freshwater pearl mussel (*Margaritifera margaritifera*) as primary features. Although freshwater pearl mussel is not found in the offshore environment, the species depends on the Atlantic salmon smelting population during their parasitic larval stage (Taeubert and Geist, 2017). Therefore, freshwater pearl mussel populations may be indirectly affected if Atlantic salmon are adversely affected by the Array Project.

Table 8.9: Migration timings for key diadromous fish species

Common name	Scientific Name	Timing of downstream migration	Timing spent at sea before first return	Timing of upstream migration	Source
Allis and twaite shad	*Alosa alosa* and *Alosa fallax*	Autumn (juveniles)	2 years spent in estuaries and marine areas do not return to fresh water until they are sexually mature.	April to June (to spawn in freshwater)	Maitland and Hatton-Ellis, 2003, ABPMer, 2019
Atlantic salmon	*Salmo salar*	April to June	1 to 4 years	All year, with a peak in late summer/early autumn	Malcolm *et al.,* 2010, 2015, ABPMer, 2019
European eel	*Anguilla anguilla*	June to November	May not return to freshwater; many do not	Varies spatially, typically arrives in coastal waters of eastern Scotland in December and may migrate upstream until June	Malcolm *et al.,* 2010
River lamprey	*Lampetra fluviatilis*	From late autumn onwards (to feed in estuaries)	Spends 1 to 2 years in estuaries	Winter and spring, when temperatures are <10°C	NatureScot, 2022a, ABPMer, 2019
Sea lamprey	*Petromyzon marinus*	From late autumn onwards (to open sea) (timing varies between rivers)	18 to 24 months	April to May (to spawn in May to June)	NatureScot, 2022a, ABPMer, 2019
Sea trout	*Salmo trutta*	Spring	2 or more	April to June	Malcolm *et al.,* 2010
European smelt	*Osmerus eperlanus*	Not applicable (migration to estuaries only)	Spends time in estuaries	February to April (to spawn in estuaries and large rivers)	NatureScot, 2022b

Shellfish assemblage

8.2.5.9 The population structure of shellfish stocks around the UK is not well understood, with assessments largely based on previous fishing and landings data (Mesquita *et al.,* 2016). The shellfish industry in the UK is economically important; UK shellfish landings contributed to 45% (£313m) of fisheries landings (£691.8m) in 2021 (MMO, 2022). Fisheries landings data provides information which can be used as a principal overview of the species present within a certain area. Using fisheries catch and landings data alongside baseline data from other projects, we can build an overview of the species present within the Regional Fish and Shellfish Ecology Study Area. Landings data have been reviewed from the ICES Rectangles presented in Figure 8.9 to provide an overview of the key shellfish species within the region and support characterisation of the shellfish assemblage. Shellfish contribute significant value to the Scottish fishing industry. There are consistently high landings of *Nephrops* (Norway lobster (*Nephrops norvegicus)*), and medium to low landings of European lobster (*Homarus ommissi*), brown crab (*Cancer pagurus*), velvet swimming crab (*Necora puber*), king scallop (*Pecten maximus*), whelk (*Buccinum undatum*), razor clam (*Solen* spp.), surf clam (*Spisula* spp.), clams (*Mya arenaria*), squid (*Loligo* spp.) and octopus (Mesquita *et al.,* 2016, 2017; Marine Scotland, 2021). Occasionally caught species include green crab (*Carcinus maenas*), common prawn (*Palaemon serratus*) and queen scallop (*Aequipecten opercularis*) (Marine Scotland, 2021).

8.2.5.10 Epifaunal trawls conducted for the Seagreen OWF in 2011 observed several shellfish species including king and queen scallop in the samples, with queen scallop found to be one of the most frequently recorded species, present in 64% of the samples recovered (201 individuals, overall; Seagreen, 2018). The Seagreen OWF fish and shellfish ecology chapter also refers to data supplied by Marine Scotland in 2012 demonstrating high abundances of *Nephrops* recorded through underwater imagery acquisition by Marine Scotland in the inshore waters and southern parts of Regional Fish and Shellfish Ecology Study Area.

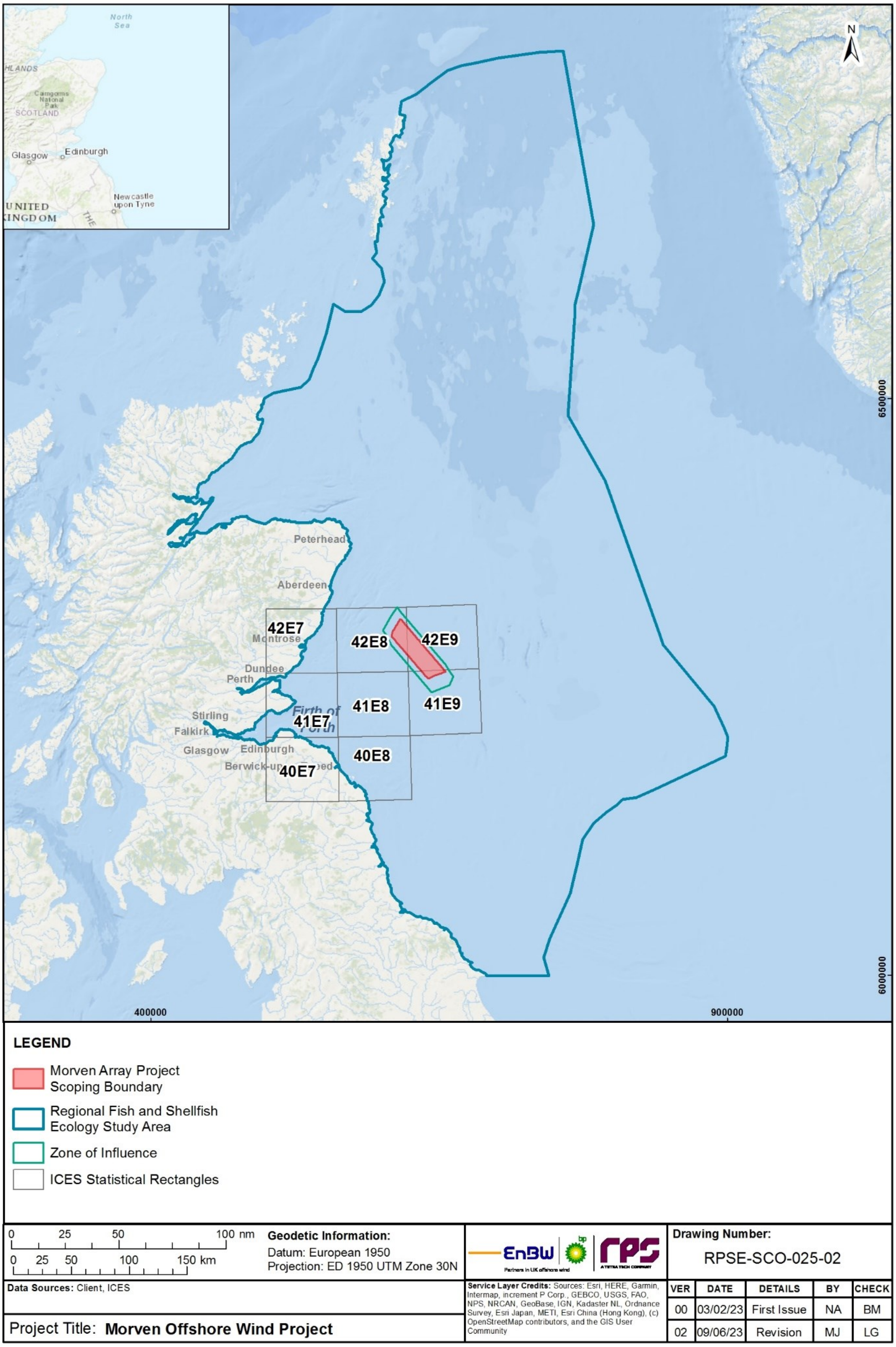


Figure 8.9: Array Project and Regional Fish and Shellfish Ecology Study Areas with ICES statistical rectangles

Spawning and nursery grounds

8.2.5.11 Coull *et al*. (1998) identified the potential spawning and nursery areas in the North Sea for a range of species through a range of larvae, egg and benthic habitat survey data. For some species, these data were reviewed by Ellis *et al.* (2012) to update the data with details of spatial distribution of high and low intensity spawning and nursery grounds. Spawning and nursery grounds for herring and sandeel were identified in the Berwick Bank OWF, which could suggest that similar sites may be present close to or within the Array Project.

8.2.5.12 More recently, Aires *et al.* (2014) provided an update to fisheries sensitivity maps in British waters following results of work by Marine Scotland Science, by collating evidence regarding the distribution of 0-group fish (fish within their first year of life) and larvae from key commercially targeted species. The Array Project Fish and Shellfish Ecology Study Area is located within an area with a mean modelled probability of 0-group haddock aggregation of 0.183, anglerfish (0.021), mackerel (0.006), blue whiting (0.001), plaice (0.003), and sole (0.0002) (Aires *et al*., 2014). Essential Fish Habitat maps are currently in publication by Marine Directorate and will, if available, be referenced within the fish and shellfish ecology technical report to the Array Project EIA chapter.

8.2.5.13 Species with known spawning and nursery grounds identified overlapping with the Array Project are summarised below in Table 8.10.

Table 8.10: Species with spawning and nursery grounds overlapping the Array Project (adapted from Coull *et al.,* 1998, Ellis *et al*., 2012 and Aires *et al.,* 2014)

Common name	Species	Spawning	Nursery	Spawning intensity	Nursery intensity
Teleost fish					
Anglerfish	*Lophius piscatorius*	Insufficient data	✓	Not applicable	Low
Blue whiting	*Micromesistius poutassou*	Insufficient data	✓	Not applicable	Low
Cod	*Gadus morhua*	✓	✓	Low	High and Low
European hake	*Merluccius merluccius*	No grounds present	✓	Not applicable	Low
Haddock	*Melanogrammus aeglefinus*	No grounds present	✓	Not applicable	Not applicable
Herring	*Clupea harengus*	✓	✓	Not defined	High and Low
Horse Mackerel[6]	*Trachurus trachurus*	No grounds present	✓	Not applicable	Not applicable
Lemon sole	*Microstomus kitt*	✓	✓	Not defined	Not applicable
Ling	*Molva molva*	Insufficient data	✓	Not applicable	Low
Mackerel	*Scomber scombrus*	No grounds present	✓	Not applicable	Low
Norway pout	*Trisopterus esmarkii*	✓	✓	Low	Not defined
Plaice	*Pleuronectes platessa*	✓	✓	Low	Low

[6] Horse mackerel nursery grounds are considered widespread based upon catches of juvenile fish during groundfish surveys, with no specific grounds defined, but catches have been recorded within the Array Project Fish and Shellfish Ecology Study Area and the wider Regional Fish and Shellfish Ecology Study Area.

Common name	Species	Spawning	Nursery	Spawning intensity	Nursery intensity
Sandeel	Ammodytidae spp.	✓	✓	High and Low	Low
Sprat	*Sprattus sprattus*	✓	✓	Not defined	Not applicable
Whiting	*Merlangius merlangus*	✓	✓	Low	High
Saithe	*Pollachius virens*	No grounds present	✓	Not applicable	Not applicable
Elasmobranchs					
Common skate	*Dipturus batis*	No grounds present	✓	Not applicable	Low
Spotted ray	*Raja montagui*	No grounds present	✓	Not applicable	Low
Spurdog	*Squalus acanthias*	No grounds present	✓	Not applicable	Low
Tope	*Galeorhinus galeus*	No grounds present	✓	Not applicable	Low
Shellfish					
Nephrops (also known as the Norway lobster, Dublin Bay prawn, langoustine or scampi)	*Nephrops norvegicus*	✓	✓	Not defined	Not applicable

8.2.5.14 Several species have spawning areas in and around the Fish and Shellfish Ecology Study Area including herring and sandeel.

8.2.5.15 High and low intensity nursery grounds of herring, a widespread and ubiquitous pelagic fish species, are documented to overlap the scoping boundary, whilst spawning grounds of unknown intensity sit adjacent to the northern tip of the site boundary, within the Regional Fish and Shellfish Ecology Study Area. Records collated by Ellis *et al.* (2012) reveal that herring larvae catches, albeit at relatively low levels, extend south into the Array Project Fish and Shellfish Ecology Study Area. This suggests that suitable spawning substrate for herring likely occurs within the scoping boundary. The assessment will consider substrate suitability for herring spawning, based upon the site specific benthic survey sediment composition data, following the method outlined by Reach *et al.* (2013).

8.2.5.16 Both high and low intensity sandeel spawning grounds fall within the Array Project and extend across the Regional Fish and Shellfish Ecology Study Area. The Array Project is also characterised by low intensity sandeel nursery grounds, although it is worth noting that these grounds extend across much of the North Sea (Ellis *et al.*, 2012). Further, distribution models by Langton *et al.* (2021) have predicted probabilities of occurrence and densities of sandeel within the ZoI, though again, these probabilities are far greater in areas of the central North Sea that lie to the south of the Array Project. There are five species of sandeel in UK waters that are widely distributed and abundant within suitable habitats. Sandbanks and other sandy substrates may be important habitats for these species. The assessment will consider substrate suitability for sandeel inhabitation, based upon the site specific benthic survey sediment composition data, following the method outlined by Latto *et al.* (2013).

8.2.5.17 Figure 8.10 to Figure 8.15 show the spawning and nursery grounds of fish and shellfish species with respective grounds overlapping the Array Project, illustrating the reported intensity of activity within the grounds where information is available (Coull *et al*., 1998; Ellis *et al.,* 2012).

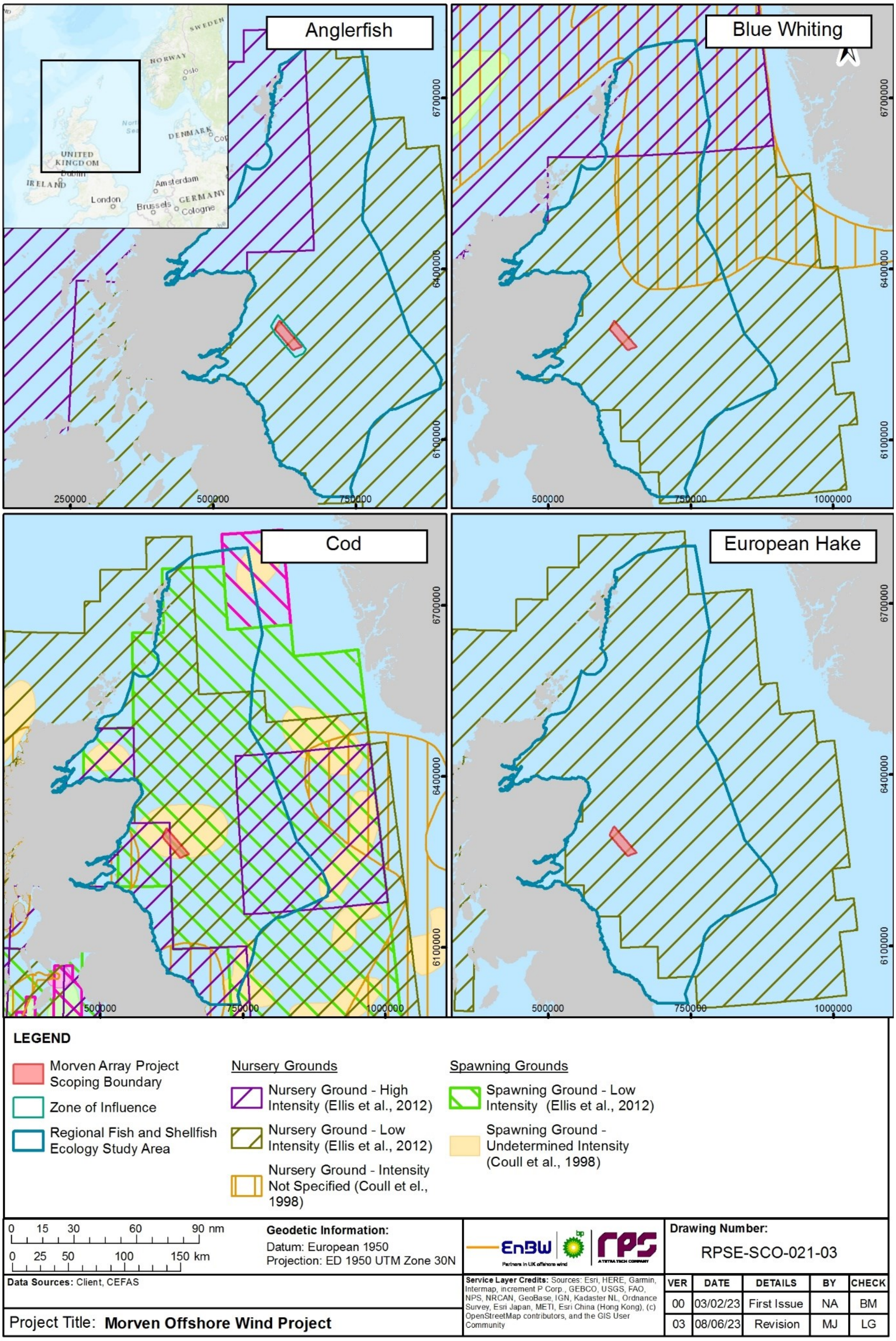


Figure 8.10: Spawning and nursery intensity maps of anglerfish, blue whiting, cod and European hake

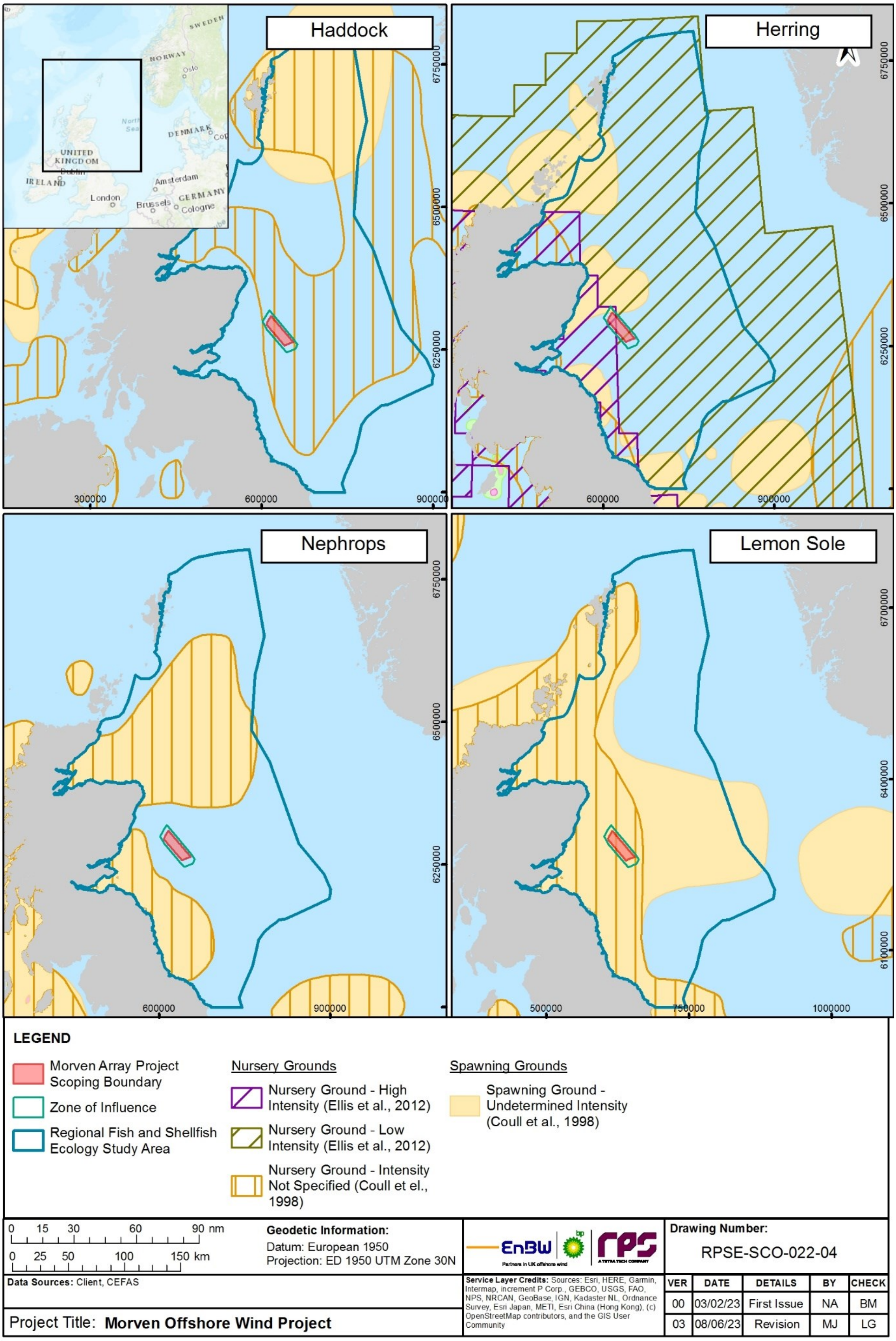


Figure 8.11: Spawning and nursery intensity maps of haddock, *Nephrops*, herring and lemon sole

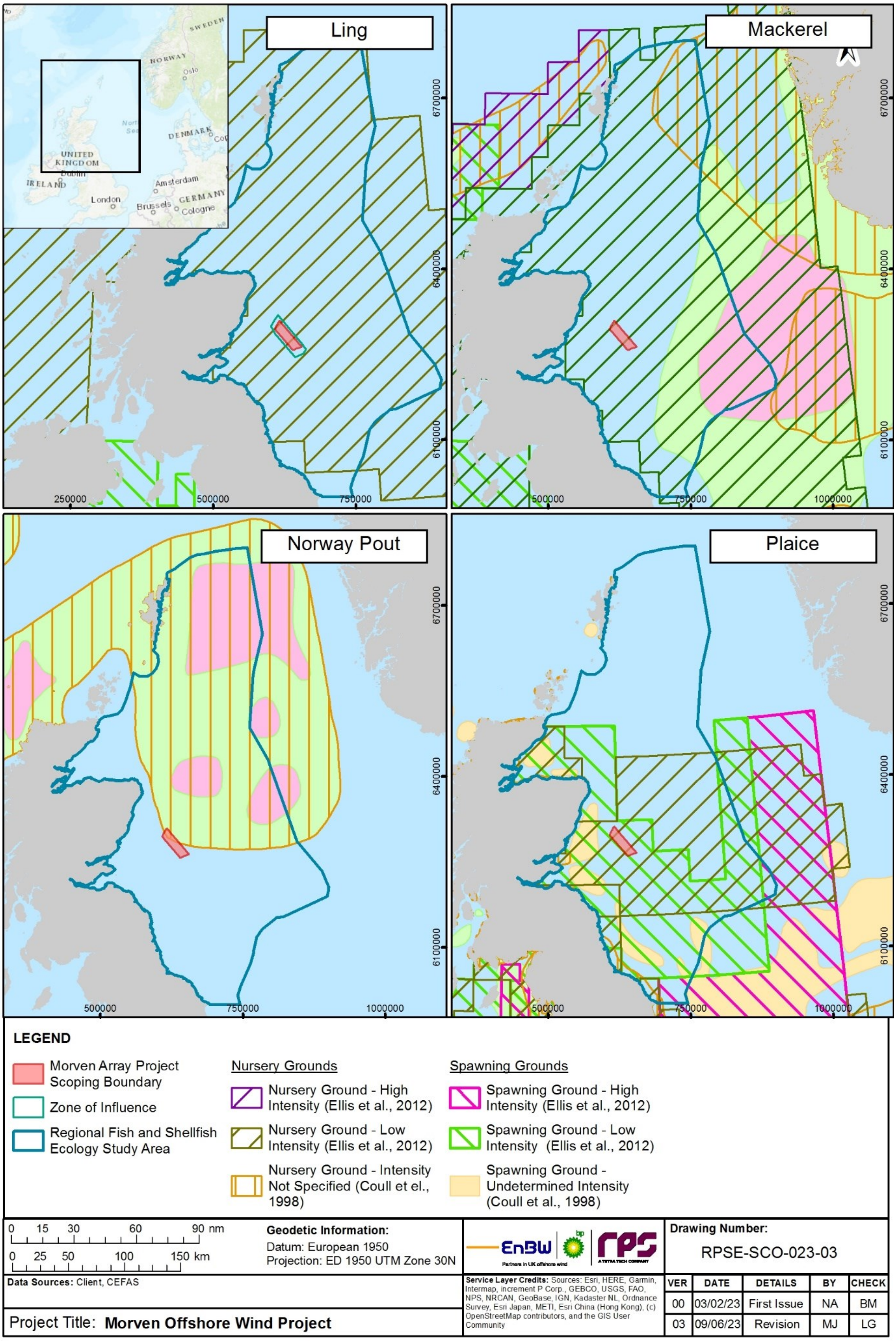


Figure 8.12: Spawning and nursery intensity maps of ling, mackerel, Norway pout and plaice

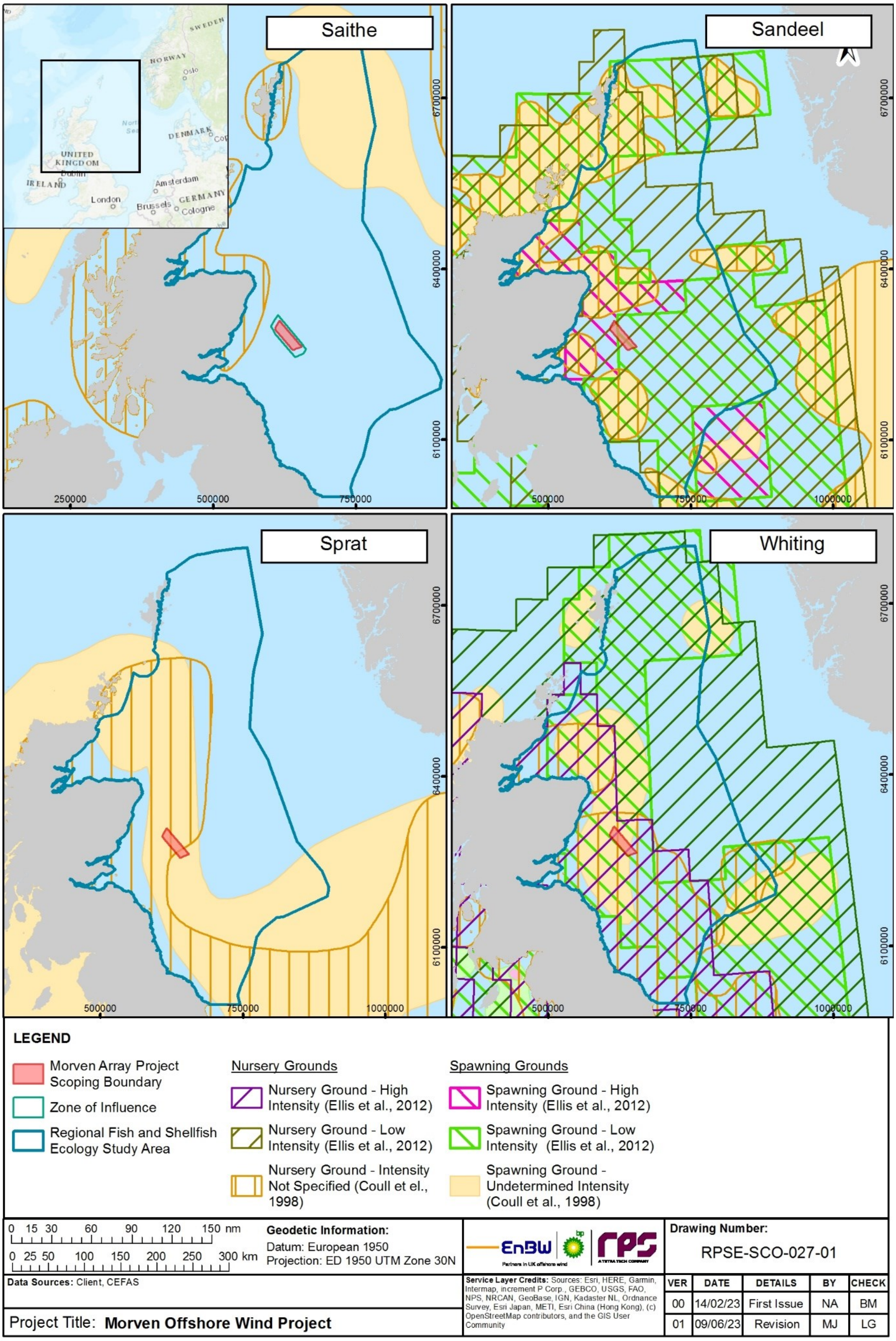


Figure 8.13: Spawning and nursery intensity maps of saithe, sandeel, sprat and whiting

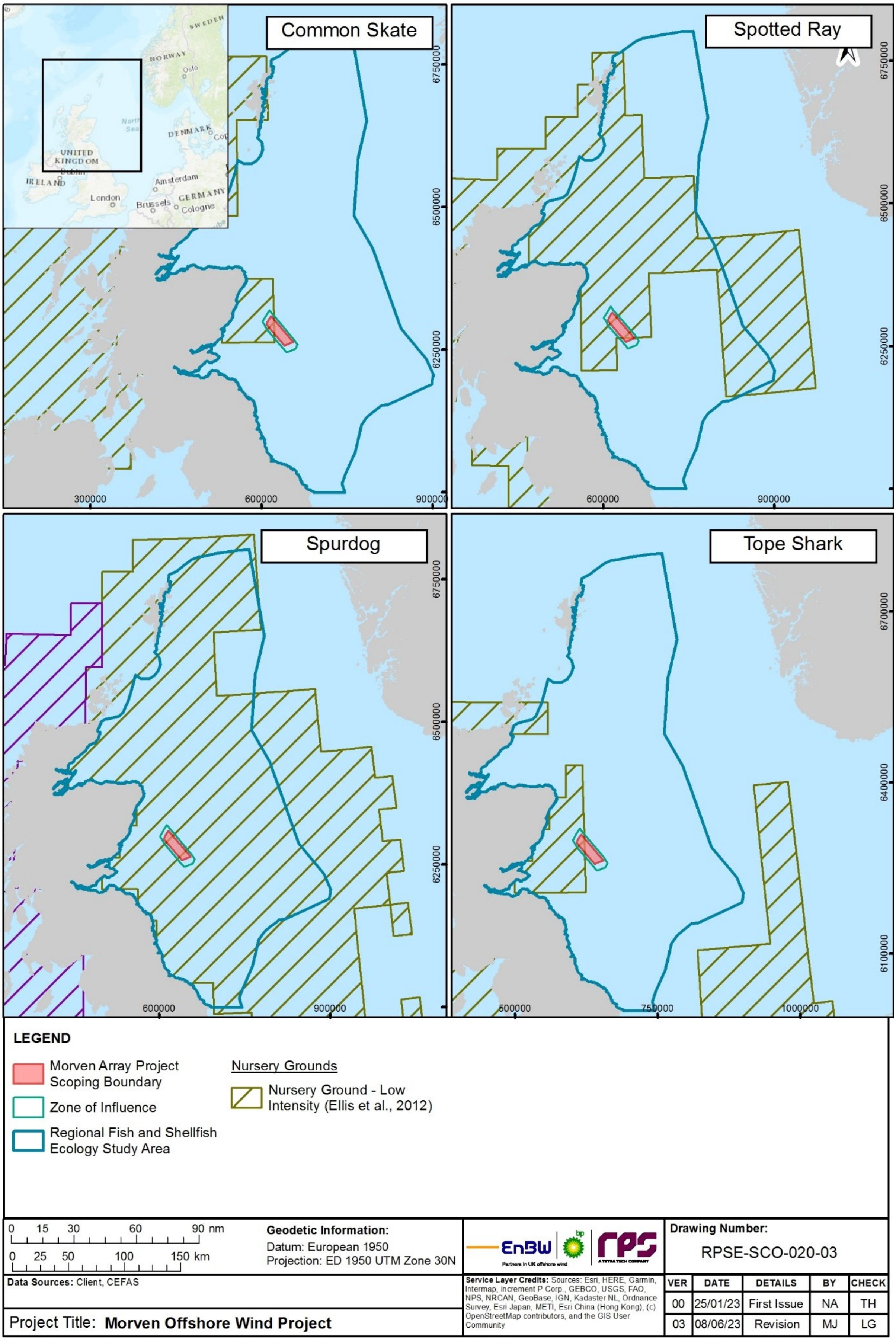


Figure 8.14: Spawning and nursery intensity maps of common skate, spotted ray, spurdog and tope

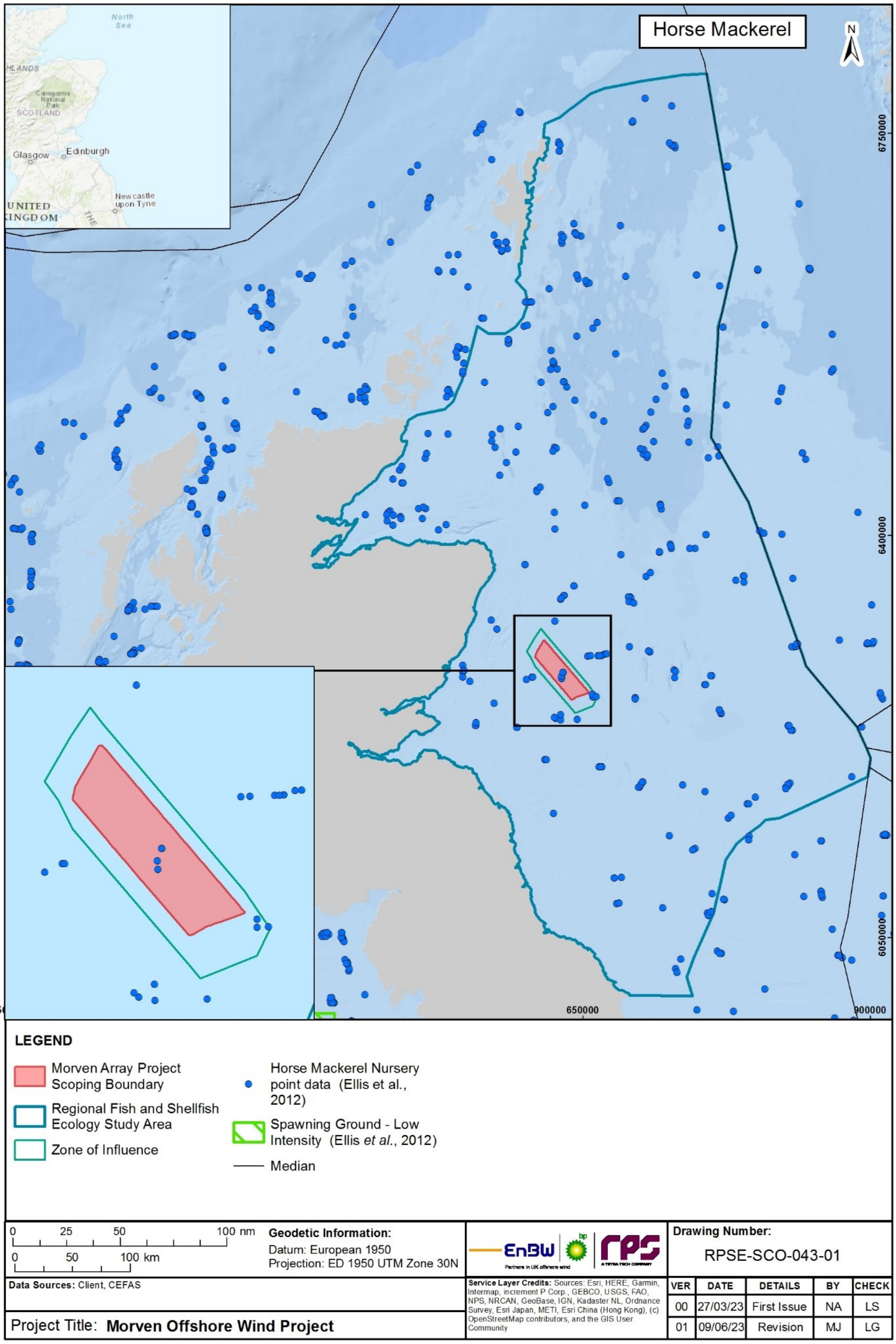


Figure 8.15: Spawning intensity and nursey point data of horse mackerel

Designated sites and species of conservation importance

8.2.5.18 Designated sites with relevant qualifying features (i.e. fish and shellfish species) that overlap with the Array Project Fish and Shellfish Ecology Study Area are described in this section and are illustrated in Figure 8.16. While there are no designated sites that overlap the Scoping Boundary, there are several areas in northeast England and east Scotland that are protected for fish and shellfish, including some protected sites where connectivity may occur via mobile, migratory species for which those sites are designated. These sites comprise of a Marine Protected Area (MPA), SACs and a Site of Special Scientific Interest (SSSI). Please refer to section 8.2.5.5 for an overview of the eight migratory species (Atlantic salmon, sea trout, sea lamprey, river lamprey, European eel, allis shad, twaite shad, and European smelt) that migrate to and from rivers and potentially through the Array Project.

8.2.5.19 There are several fish and shellfish species that are likely, or have the potential, to be present and with spawning/nursery grounds overlapping with the Array Project Fish and Shellfish Ecology Study Area. A number of these species are of conservation significance (Table 8.11) and will be considered and assessed in the fish and shellfish ecology EIA chapter. These species include but are not limited to anglerfish, blue whiting, herring, horse mackerel, saithe, sandeel, spurdog, whiting, the marine life stage of the Atlantic salmon, European eel, river lamprey, sea lamprey and sea trout (Tyler-Walters *et al.,* 2016).

8.2.5.20 Further detail on potential effects on fish features of MPAs is presented in the MPA Screening Report (Appendix 6: Marine Protected Area Screening).

Table 8.11: Fish species that are located at various designated sites and their distances to the Array Project

Designated site	Distance to the Array Project (km)	Features
Turbot Bank MPA	46.51	• Sandeels
River Dee SAC	63.46	• Atlantic salmon • Freshwater pearl mussel
River South Esk SAC	81.54	• Atlantic salmon • Freshwater pearl mussel
River Tay SAC	104.26	• Atlantic salmon • Sea lamprey • River lamprey
River Tweed SAC and SSSI	112.26	• Atlantic salmon • Sea lamprey • River lamprey
River Spey SAC	131.62	• Atlantic salmon • Freshwater pearl mussel • Sea lamprey
River Teith SAC	182.22	• Atlantic salmon • Sea lamprey • River lamprey

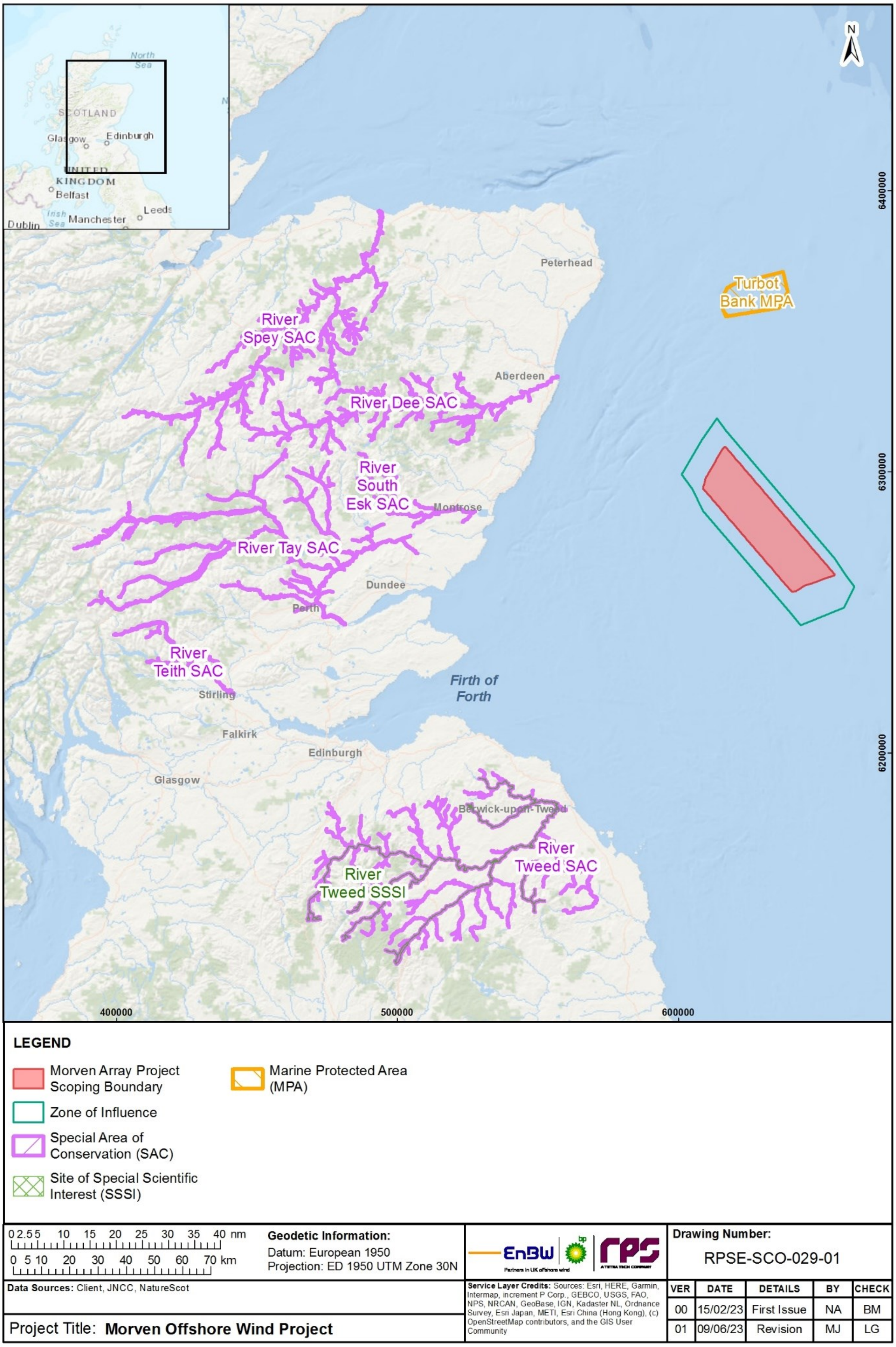


Figure 8.16: Designated sites with fish and shellfish features

8.2.6 Potential Impacts of the Array Project

8.2.6.1 A range of potential impacts on fish and shellfish ecology have been identified, which may occur during the construction, O&M and decommissioning phases of the Array Project.

8.2.6.2 The impacts that have been scoped into the assessment are outlined in Table 8.12 together with a description of any additional data collection (e.g. site specific surveys) and supporting analyses (e.g. modelling) that will be required to enable a full assessment of the impacts.

8.2.6.3 Potential impacts scoped out of the assessment are presented in Table 8.13, with justification.

Table 8.12: Impacts proposed to be scoped into the Array Project assessment for fish and shellfish ecology

C = Construction phase, O = O&M phase, D = Decommissioning phase.

Impact	Project phase			Justification (including consideration of designed in measures)	Data collection and analysis required to characterise the baseline environment	Summary of proposed approach to assessment
	C	O	D			
Temporary habitat loss and disturbance of habitats	✓	✓	✓	There is potential for temporary, direct habitat loss and disturbance due to pre-foundation installation activities, cable installation works (including UXO clearance, anchor placements and pre-cabling seabed clearance), and spud-can leg placement from jack-up operations. Temporary habitat loss/disturbance may occur during the O&M phase because of operations (e.g. cable repair/reburial, use of jack-up vessels to facilitate wind turbine component repairs etc.). Impacts associated with these operations are likely to be similar to those associated with the construction phase albeit of reduced magnitude. There is potential for temporary, direct habitat loss and disturbance due to decommissioning activities to remove array cables resulting in potential effects on fish and shellfish ecology.	There is wide-ranging and comprehensive desktop information and data sources available to characterise the Fish and Shellfish Ecology Study Area (as set out in section 8.2.3); therefore, no site specific surveys are proposed.	No specific modelling is required to inform this impact assessment, although the assessment will be quantitative in nature (i.e. clearly presenting the maximum spatial scale of impacts). This assessment will be based on information derived from the PDE. The significance of effects upon fish and shellfish receptors will be determined by correlating the magnitude of the impact and the sensitivity of the receptor. Where possible, the impact magnitude will be quantified for the MDS. For example, the MDS for habitat loss/disturbance will be quantified and the assessment will present the areas of habitat potentially affected in the context of the Fish and Shellfish Ecology Study Area for the generation assets.
Underwater sound impacting fish and shellfish receptors	✓	×	✓	There is potential for disturbance, injury and mortality to sensitive fish and shellfish species due to construction activities such as pre-construction site investigation surveys, pile-driving, UXO clearance, and similar potential for decommissioning activities.	As above.	Underwater sound modelling will be undertaken as set out in section 8.2.8 to inform the assessment of underwater sound impacts on fish and shellfish. This will use the most up to date best practice guidelines (i.e. Popper *et al.*, 2014) and other scientific literature to consider the potential for injury and disturbance to fish and shellfish species, including disruption to spawning activity for marine fish species, disruption to

Impact	Project phase			Justification (including consideration of designed in measures)	Data collection and analysis required to characterise the baseline environment	Summary of proposed approach to assessment
	C	O	D			
						migration of diadromous fish species, with a particular focus on potential barriers to migration. In particular, the hearing ability of fish species will be considered and both sound pressure and particle motion will be considered, where appropriate.
Increased suspended sediment concentrations (SSCs) and associated sediment deposition	✓	✓	✓	Sediment disturbance arising from construction activities (e.g. foundation and cable installation including drilling and any deposits arising, UXO clearance, and seabed preparation), maintenance operations (e.g. cable repair/reburial etc.), and decommissioning activities (e.g. cable and foundation removal) may result in indirect impacts on fish and shellfish communities due to temporary increases in SSCs and associated sediment deposition (i.e. smothering effects).	As above.	The outputs of numerical modelling undertaken for the Physical Processes assessment (see chapter 7.1) will inform this impact assessment. This will include consideration of the potential for effects on spawning habitats (i.e. changes to sediment composition, smothering of eggs, etc.) and disturbance to diadromous fish species migration. This will consider differing sensitivities of the identified receptors and life history stages to this impact. Impacts during the decommissioning phase are anticipated to be less than or equal to the construction phase.
Long-term habitat loss	✓	✓	✓	There is the potential for long term habitat loss to occur directly under all foundation structures and associated scour protection, and under any cable protection required. As foundations are installed throughout the construction phase, this impact is also relevant to the construction phase although it will largely occur throughout the O&M phase. Permanent habitat loss may occur under any infrastructure that is not decommissioned at the end of the Array Project lifetime, such as cable or scour protection.	As per temporary habitat loss/disturbance.	No specific modelling is required to inform this impact assessment, although the assessment will be quantitative in nature (i.e. clearly presenting the maximum spatial scale of impacts). This assessment will be based on information derived from the PDE. The approach to assigning the significance of effect is outlined above for ‘temporary habitat loss/disturbance’.

Impact	Project phase			Justification (including consideration of designed in measures)	Data collection and analysis required to characterise the baseline environment	Summary of proposed approach to assessment
	C	O	D			
Colonisation of hard structures	×	✓	×	It is expected that artificial seabed structures (i.e. scour/cable protection and foundations) will become colonised by a variety of marine organisms in the offshore environment, leading to localised biodiversity increases. The spread of INNS may also be facilitated at these structures.	As above	No specific modelling would be required to inform the assessment of the impact of colonisation of hard structures.
EMF from subsea electrical cabling	×	✓	×	The predator/prey relationship may be impacted, by EMF generated through the subsea cables installed, by impacting the behaviours of fish and shellfish species behaviours with the changes to background EMFs.	As above	No specific modelling is required to inform this impact assessment. A qualitative assessment will be undertaken and presented in the EIA Report, based on a thorough review of the available scientific information on EMFs in the marine environment and effects on fish and shellfish ecology receptors. This assessment will be based on information derived from the PDE. The significance of effects upon fish and shellfish receptors will be determined by correlating the magnitude of the impact and the sensitivity of the receptor.

Table 8.13: Impacts proposed to be scoped out of the Array Project assessment for fish and shellfish ecology

Impact	Basis for impact
Accidental release of pollutants	Sources such as vessels, vehicles, machinery, and other equipment have the potential to accidentally release pollution during phases of development. Measures setting out standards of procedure within post consent plans including an EMP will help manage the risk. The plans will address accidental spills, discuss all potential contaminant releases, and include details in case of an emergency. The Management Plan will also set out good practice techniques and use information and guidelines from the IMO, and MARPOL. The likelihood of spills occurring through the development stages is very low and if a spill was to occur the magnitude will be minimised due to the measures undertaken throughout the Project. With the assessment of the impact of accidental pollutant release, pending consultation with stakeholders, relevant groups and feedback from the Scoping Report, it is proposed that this impact is scoped out of consideration within the EIA for Fish and Shellfish Ecology.
Release of sediment-bound contaminants	Seabed disturbance associated with construction, maintenance and decommissioning activities (e.g. foundation and cable installation) could lead to the remobilisation of sediment-bound contaminants that may result in harmful and adverse effects on fish and shellfish communities. Site specific sampling within the Fish and Shellfish Ecology Study Area has shown levels of sediment contaminants are very low, in line with background levels. Samples from all stations except ENV054, located outside of the Scoping Boundary were below Cefas AL1 and AL2 as well as below Canadian TEL and PEL for metals, PCB and PAH. Station ENV054 was above Cefas AL1 and Canadian TEL for arsenic and showed elevated levels of other elements. The risk of sediment-bound contaminants being present in concentrations likely to be harmful to benthic receptors is considered negligible, as station ENV054 is located outside of the Array Project and is, therefore, unlikely to face direct disturbance. This potential impact is proposed to be scoped out of further consideration within the fish and shellfish ecology EIA chapter, subject to consultation with the SNCBs following submission of the Scoping Report.
Underwater sound from wind turbine operation	Sound Pressure Levels (SPL) and frequencies from operational wind turbines are low (Andersson *et al.*, 2011); as such, behavioural changes amongst fish occur only within a few metres of a wind turbine (Sigray and Andersson, 2011). Underwater sound from wind turbine generation should, therefore, be scoped out of the EIA Report for fish and shellfish ecology as the potential effects on fish and shellfish receptors from wind turbine sound are likely to be insignificant.
Underwater sound from vessels	The occurrence of O&M vessels is not likely to represent a significant change from baseline noise levels of shipping, and fish are not believed to be sensitive to vessel sound. For these reasons, underwater sound from O&M vessels can be scoped out of the fish and shellfish ecology EIA.

8.2.7 Designed In Measures and Mitigation

8.2.7.1 As part of the project design process, a number of designed in measures (primary and tertiary) will reduce the potential for impacts on fish and shellfish ecology (Table 8.14). As there is a commitment to implement these measures, they are considered inherent to the design of the Array Project. The determination of magnitude and significance will assume the implementation of such measures. Some of these measures are considered standard industry practice for this type of development.

8.2.7.2 The requirement for any additional (secondary) mitigation measures will be dependent on the significance of the effects on fish and shellfish ecology receptors. The requirement for and feasibility of any mitigation measures will be consulted upon with statutory consultees throughout the EIA process.

Table 8.14: Designed in measures of the Array Project, relevant to Fish and Shellfish Ecology

Reference number	Measures adopted	Justification	Primary or tertiary
MM-4	Development of, and adherence, to a CMS.	Provided as a means of controlling specific health and safety risks that have been identified and to ensure the health and safety aspects of the development are secured.	T
MM-40	A soft start procedure (including low hammer initiation and ramp up) will be implemented for pile driving.	Soft start will allow time for animals to leave the area prior to full power piling beginning.	P
MM-5	Development of, and adherence to, an EMP, including actions to minimise INNS, MMMP and a MPCP, which will include planning for accidental spills, address all potential contaminant releases and include key emergency details.	Provides a means to ensure the efficient management and communication of commitments made for the management of the potential environmental impacts. The EMP will include a MMMP. The MMMP may include using Marine Mammal Observer(s) and PAM to monitor the mitigation zone (MZ, as determined by the underwater sound modelling) to ensure that animals are not observed within the MZ during piling. ADD may be used if required to deter animals from the MZ. For offshore water quality, measures will be adopted to ensure that the potential for release of pollutants from construction and O&M is minimised. In this manner, the accidental release of contaminants from rigs and supply/service vessels will be strictly controlled, thus providing protection for birds and their prey species across all phases of the development. For benthic subtidal ecology, a MPCP and outline INISMP will be provided. The MPCP will include planning for accidental spills, addressing all potential contaminant releases and include key emergency details. The INISMP will include measures for controlling INNS and their impact on fish and shellfish ecology receptors.	T

8.2.8 Proposed Assessment Methodology

8.2.8.1 The methodology presented in chapter 4: EIA Methodology of the Scoping Report will be followed for the fish and shellfish EIA chapter. The following guidance and documents will also be considered, which are specific to the fish and shellfish topic:

- Guidelines for Ecological Impact Assessment (EcIA) in the UK and Ireland. Terrestrial, Freshwater, Coastal and Marine (CIEEM, 2022).
- Guidance on Environmental Considerations for Offshore Wind Farm Development (OSPAR, 2008).
- Sound exposure guidelines for Fishes and Sea Turtles (Popper et al., 2014).

- Marine Evidence-based Sensitivity Assessment (MarESA) – A Guide (Tyler-Walters et al., 2018).
- Screening Spatial Interactions between Marine Aggregate Application Areas and Atlantic Herring Potential Spawning Habitat: A Method Statement (Reach et al., 2013).
- Screening Spatial Interactions between Marine Aggregate Application Areas and Sandeel Habitat: A Method Statement (Latto et al., 2013).

8.2.8.2 A Fish and Shellfish Ecology technical report will be produced for the EIA, which will present a detailed baseline characterisation for the Array Project using the results of the site specific survey data, where applicable, alongside appropriate desktop data. This report will inform the Fish and Shellfish Ecology EIA chapter. The approach and focus of the impact assessments will be discussed with stakeholders through consultation on this Scoping Report.

8.2.8.3 Fish and shellfish receptors identified as having the potential to occur in the Fish and Shellfish Ecology Study Area will be grouped into broad ecological receptor groups, called IEFs, in line with guidelines set out in CIEEM (2019). These IEFs will be those features against which impacts associated with the construction, O&M and decommissioning phases of the Array Project will be assessed. Criteria defining the value of each IEF will be defined to reflect topic-specific interests.

8.2.8.4 The Fish and Shellfish Ecology EIA chapter will include diadromous fish in the Fish and Shellfish ecology impact assessment, and a separate section presented discussing sensitivity of and implications of the impact on diadromous fish in each impact assessment.

8.2.8.5 Information on the sensitivities of fish and shellfish ecology receptors will be drawn from the MarESA (Tyler-Walters *et al*., 2018) and the Feature Activity Sensitivity Tool (FeAST), where available. The MarESA is a database which has been developed through the Marine Life Information Network (MarLIN) of Britain and Ireland and is maintained by several organisations, including the Marine Biological Association (MBA) and other statutory organisations in the UK. This database comprises a detailed review of available evidence on the effects of pressures on marine species or habitats, a subsequent scoring of sensitivity against a standard list of pressures and their benchmark levels of effect.

8.2.8.6 FeAST allows users to investigate the sensitivity of marine features in Scotland's seas to pressures arising from human activities. Much of the evidence presented within FeAST has been derived from sensitivity assessments originally undertaken by MarLIN and further developed by several Scottish organisations such as NatureScot, MSS, the Scottish Environmental Protection Agency (SEPA) and the Joint Nature Conservation Committee (JNCC). The tool focuses on features of conservation interest (FOCI) such as protected features of Marine Protected Areas (MPAs) and Priority Marine Features (PMFs).

8.2.8.7 The evidence base presented in the MarESA is peer-reviewed and represents the largest review undertaken to date on the effects of human activities and natural events on marine species and habitats.

8.2.8.8 Further detail on how sensitivity is defined is outlined in Tyler-Walters *et al*. (2018). Sensitivities to the key activities across the lifetime of the Array Project (i.e. construction, O&M and decommissioning phases) will be summarised according to the MarESA for each of the IEFs within the Array Project and Regional Fish and Shellfish Ecology Study Areas. Where sensitivity information on specific species or habitats is not available through MarESA, suitable proxies will be used.

8.2.8.9 The importance of key prey species such as herring, sprat and sandeel will be assessed within relevant sections and informed by the Fish and Shellfish Ecology EIA chapter, which will provide the outputs required to best inform these assessments.

8.2.8.10 Habitat suitability for sandeel and herring spawning will be assessed using data collected as part of the site specific benthic ecology survey in line with industry best practice guidelines and considering discussion with stakeholders following Scoping.

8.2.9 Potential Cumulative Impacts

8.2.9.1 Across the construction, O&M and decommissioning phases, the majority of potential impacts on fish and shellfish ecology receptors are expected to be localised within the Scoping Boundary. However, there is potential for cumulative effects to occur on fish and shellfish ecology from other projects or activities within the Regional Fish and Shellfish Ecology Study Area, where projects or plans could act collectively with the Array Project to affect fish and shellfish ecology receptors. The CEA will follow the approach discussed in chapter 4: EIA methodology of the Scoping Report.

8.2.9.2 Cumulative impacts will be assessed within a representative 50km buffer of the Array Project for all impacts and specifically including EMF. Underwater sound will be assessed within a 100km buffer (Figure 8.8). These buffers are considered appropriate as most impacts considered in Table 8.12 will be localised in extent.

8.2.10 Potential Inter-Related Effects

8.2.10.1 The EIA will consider inter-related effects. Inter-related effects relate to effects arising from the Array Project, either across their own phases (project lifetime) or different effects on one receptor in one phase (receptor-led). The EIA will consider inter-related effects, in relation to the potential effects of multiple impacts from the construction, O&M and decommissioning phases of the Array Project, affecting one receptor. Inter-related effects are assessed through consideration of all effects on a receptor, considering both spatial and temporal overlaps, with the Array Project. This will ensure that the Array Project as a whole is appropriately considered within the EIA.

8.2.11 Potential Transboundary Impacts

8.2.11.1 Screening of transboundary impacts has been carried out and is presented in Appendix 1: Transboundary Screening. This screening exercise identified that there is potential for transboundary impacts upon fish and shellfish ecology due to construction, O&M and decommissioning impacts of the Array Project. These include:

- temporary habitat loss and disturbance;
- underwater sound;
- increased SSC and associated sediment deposition;
- long-term habitat loss;
- colonisation of hard structures;
- EMF.

8.3 Marine Mammals

8.3.1 Introduction

8.3.1.1 This chapter of the Scoping Report identifies the marine mammals of relevance to the Array Project and considers the potential impacts arising from the construction, O&M and decommissioning of the Array Project.

8.3.2 Study Area

8.3.2.1 Two Study Areas are defined for marine mammals:

- the Project Marine Mammal Study Area;
- the Regional Marine Mammal Study Area.

8.3.2.2 The Study Areas are defined as follows:

- The Project Marine Mammal Study Area is defined as the area encompassing the Scoping Boundary plus a buffer of 4km (Figure 8.17). This is the area within which the site specific aerial surveys have been undertaken and will provide fine-scale data showing the spatial distribution and densities of marine mammals on a project-specific basis. Site specific aerial surveys are a widely accepted data collection method and help inform understanding of spatial distribution and densities. The data derived from these surveys will be used to underpin the quantitative assessment of impacts on marine mammal ecological receptors.

- The Regional Marine Mammal Study Area for the Array Project extends over the North Sea geographic region (Figure 8.17). Marine mammals are highly mobile and may range over large distances and, therefore, the Regional Marine Mammal Study Area for the Array Project provides wider context. The desktop review will consider the ecology, distribution, and abundance of marine mammals within the Regional Marine Mammal Study Area and will inform the assessment where the ZoI for a given impact (e.g. underwater sound) may extend beyond the Array Project Marine Mammal Study Area. The Regional Marine Mammal Study Area will also be applied as the initial screening area for the CEA.

8.3.2.3 Other areas of importance in the context of the marine mammal Scoping Report are the regional marine mammal management units (MUs), which differ between species (Figure 8.18). The marine mammal MU will be used as reference populations for the quantitative assessment (i.e. comparing the number of animals affected by a given impact against the species-specific MU). The area for SCANS-III survey block R (Hammond *et al.,* 2021) is also shown on the map for additional context as published data on densities and abundance of key species is available for this survey area which overlaps the Array Project.

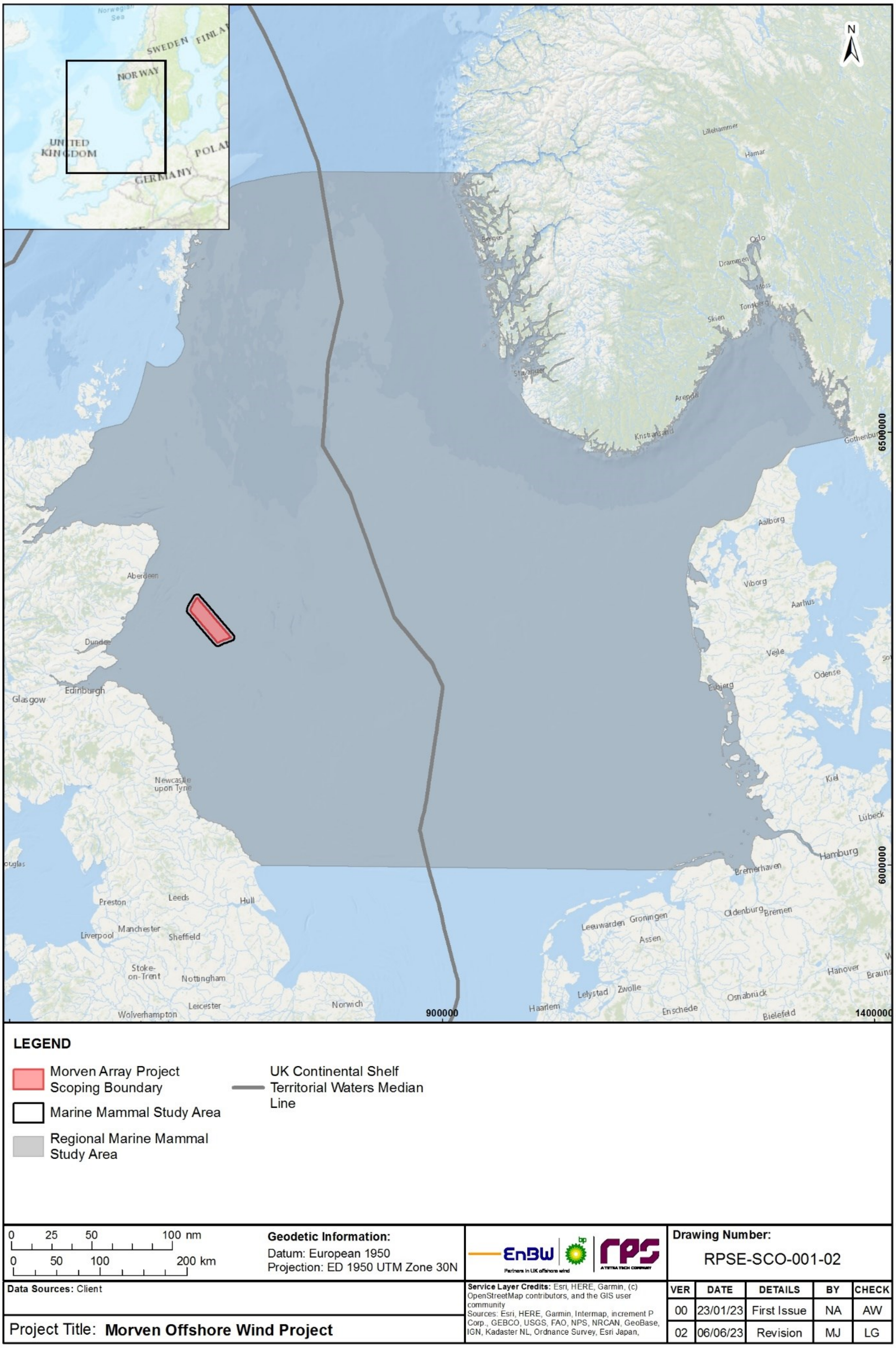
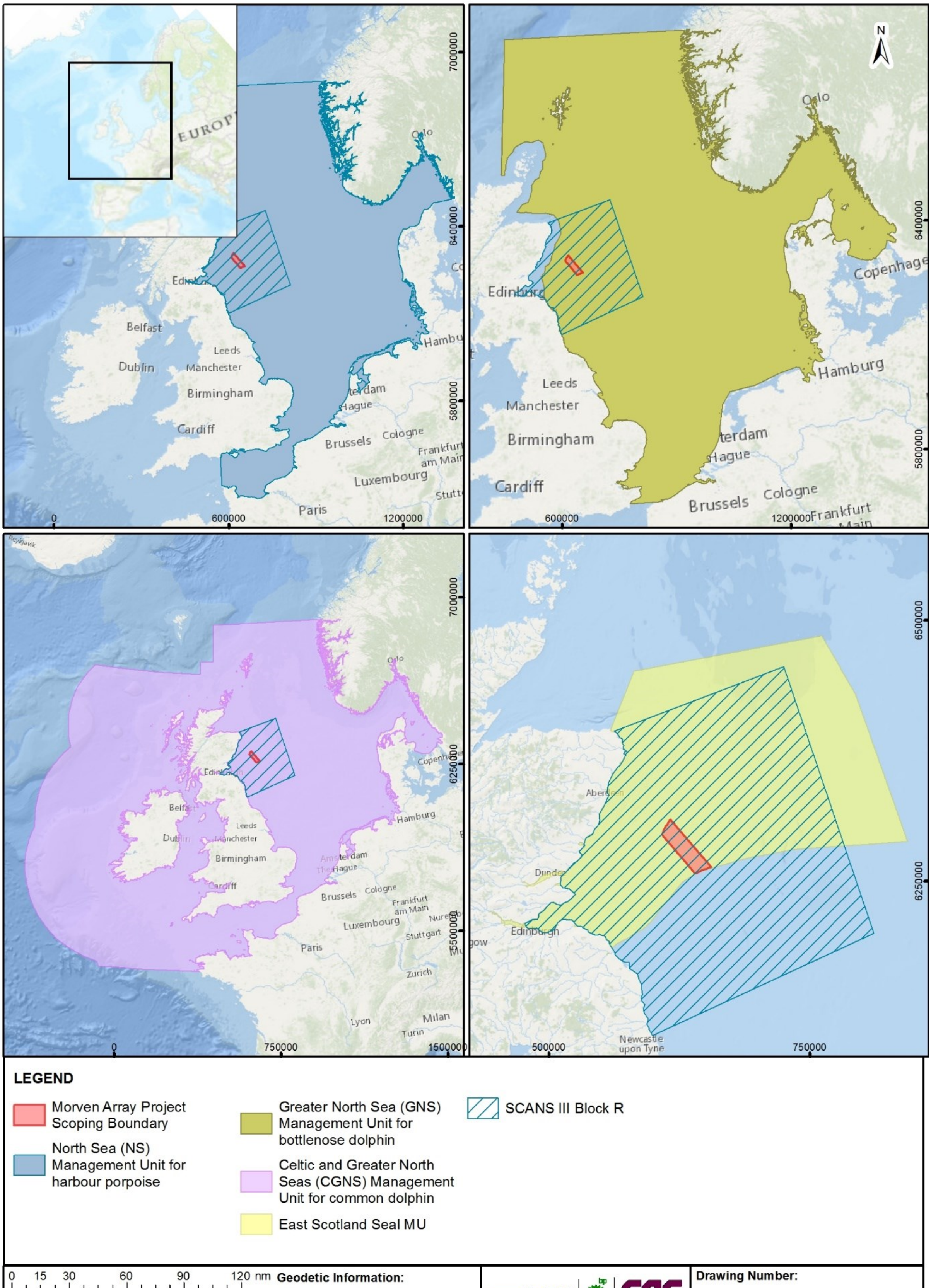


Figure 8.17: The Array Project Marine Mammal and Regional Marine Mammal Study Areas



VER	DATE	DETAILS	BY	CHECK
00	17/03/23	First Issue	NA	BP
03	09/06/23	Revision	MJ	LG

Figure 8.18: The marine mammal MUs of relevance to the Array Project

8.3.3 Data Sources

Desktop data

8.3.3.1 An initial desk-based review of literature to support this Scoping Report has identified a number of data sources that provide coverage of the Regional Marine Mammal Study Area. These are summarised in Table 8.15.

Table 8.15: Summary of key desktop datasets and reports

Title	Source	Year	Author
Sympatric Seals, Satellite Tracking and Protected Areas: Habitat-Based Distribution Estimates for Conservation and Management.	Frontiers in Marine Science	2022	Carter *et al.*
Regional baselines for marine mammal knowledge across the North Sea and Atlantic areas of Scottish waters. Scottish Marine and Freshwater Science.	Marine Scotland Science	2020	Hague *et al.*
Joint Nature Conservation Committee (JNCC) Report 544: Harbour Porpoise Density.	JNCC	2010–2011	Heinänen and Skov
JNCC Report 680: Updated abundance estimates for Cetacean MUs in UK waters (Revised 2022).	JNCC	2022	Inter-Agency Marine Mammal Working Group (IAMMWG)
Revised Phase III Data Analysis of Joint Cetacean Protocol Data Resource.	JNCC	2016	Paxton *et al.*
Map view – inventory of the Cetaceans database sightings and effort.	Joint Cetacean Data Programme (JCDP)	2023	JCDP
JNCC MPA mapper.	JNCC	2019	JNCC
Seasonal and diel acoustic presence of North Atlantic minke whales in the North Sea.	Nature Scientific Reports	2019	Risch *et al.*
Distribution maps of Cetacean and seabird populations in the North-East Atlantic.	Journal of Applied Ecology	2020	Waggitt *et al.*
Background information on marine mammals for SEA 6.	Sea Mammal Research Unit (SMRU), University of St Andrews	2005	Hammond *et al.*
Estimates of cetacean abundance in European Atlantic waters in summer 2016 from the SCANS-III aerial and shipboard surveys.	SMRU, University of St Andrews	2021	Hammond *et al.*
Modelled density surfaces of Cetaceans in European Atlantic waters in summer 2016 from the SCANS-III surveys[7].	SMRU, University of St Andrews	2022	Lacey *et al.*

[7] SCANS IV will be incorporated into the baseline if data is available at the time of drafting the marine mammal technical report.

Title	Source	Year	Author
Scientific advice on matters related to the management of seal populations: 2021.	SMRU, University of St Andrews	2022	Special Committee on Seals (SCOS)
Seal telemetry and haul out study obtained for Morven OWF.	SMRU Consulting	2023	SMRU Consulting
Seagreen Alpha and Bravo OWFs EIA Report.	Seagreen Wind Energy	2018	Seagreen Wind Energy
Berwick Bank OWF EIA Report.	SSER	2022	SSER

Site specific surveys

8.3.3.2 Aerial marine mammal surveys have been undertaken across the Project Marine Mammal Study Area. Surveys commenced in January 2021 and continued until March 2023. One flight was undertaken per month over this period.

8.3.3.3 The survey method was designed to optimise the data collection for marine mammals by using a grid-based collection method with 30% of the sea surface collected and 10% analysed. APEM's bespoke camera system was fitted into a twin-engine aircraft. The camera system captured still imagery along 30 survey lines spaced approximately 2km between tracks. The images are currently being analysed and quality assured (QA) to enumerate marine mammals to species level, where possible.

8.3.3.4 Detailed survey reports have been issued periodically to the relevant consultees throughout the survey period as described in chapter 5: Consultation process of the Scoping Report. Whilst the final analysed and quality assured aerial survey dataset was not available at the time of writing this Scoping Report, initial observations from site specific surveys undertaken from January 2021 to December 2021 (as presented in the survey reports) have been included. Full analyses of the two years of site specific aerial data will be presented as a technical annex in the EIA.

8.3.4 Consultation

8.3.4.1 The approach to consultation for the Array Project is set out in chapter 5: Consultation Process of the Scoping Report. A summary of the pre-application consultation undertaken to date relevant to marine mammals is set out in Table 8.16. Further detail on the Scoping Workshop and stakeholder plans for future engagement is set out in chapter 5: Consultation Process of the Scoping Report, supported by Appendix 3: Array Project Scoping Workshop Information and Appendix 4: Array Project Stakeholder Engagement Plans of the Scoping Report.

Table 8.16: Pre-application consultation relevant to marine mammals undertaken to date

Date	Overarching theme	Method of engagement	Stakeholder	Summary of stakeholder feedback	Applicant's response and relevant cross reference
18.04.23	Data or datasets	Scoping Workshop session	NatureScot	Confirmation of proposed data sources for the Marine Mammal chapter of the EIA Report.	Data sources outlined in Section 8.3.3.
18.04.23	Data or datasets	Scoping Workshop session	MSS	Recommend use of Hague *et al.* (2020) and Lacey *et al.* (2022) to inform the EIA Report marine mammal chapter.	Data sources outlined in Section 8.3.3.
18.04.23	Data or datasets	Scoping Workshop session	NatureScot	SCANS IV survey campaign taking place during summer 2023. Outputs to be used in EIA Report if feasible. Final SCANS IV report expected in Q4 2023.	If available, SCANS IV will be used to inform the Marine Mammal chapter of the EIA Report.
18.04.23	Impact pathways	Scoping Workshop session	NatureScot	NatureScot agree with proposed approach to scope out injury to marine mammals due to collision with vessels during the O&M phase of the Array Project.	Table 8.20 outlines impact pathways to be scoped out for the Array Project.
18.04.23	EIA approach	Scoping Workshop session	NatureScot	Outlined expected approach to marine mammal underwater sound assessment: both Sound Pressure Level (SPLpk) and cumulative Sound Exposure Level (SELcum) should be used for assessment. SPLpk should be used to determine distances from the source for which nominal measures will be implemented, such as marine mammal observers and PAM to mitigate potential injury effects from instantaneous sound (i.e. SPLpk) of piling first strike. Maximum hammer energy should be used to model injury ranges. If modelled SELcum ranges are greater than those predicted for SPLpk, then additional mitigation measures should be considered, such as ADD or sound emission reduction/abatement systems.	Approach to marine mammal underwater sound assessment outlined in Appendix 7: Marine Mammals Methodology Statement.
18.04.23	EIA approach	Scoping Workshop session	NatureScot	NatureScot agree with the suggested approach to modelling of SELcum ranges both with and without ADD.	Approach to marine mammal underwater sound assessment outlined in Appendix 7: Marine Mammals Methodology Statement.
18.04.23	EIA approach	Scoping Workshop session	NatureScot	With regard to incorporation of ADD into modelling, recommended 30 minutes as an appropriate duration of active ADD. Beyond this duration, recommend consideration of additional mitigation measures such as sound emission reduction technologies.	Approach to assessment of population level effects outlined in Appendix 7: Marine Mammals Methodology Statement.

Date	Overarching theme	Method of engagement	Stakeholder	Summary of stakeholder feedback	Applicant's response and relevant cross reference
18.04.23	EIA Approach	Scoping Workshop session	NatureScot	Agreed modelling of UXO approach: Temporary Threshold Shift (TTS) as a proxy to model disturbance (TTS represents a temporary change in hearing sensitivity and is also the onset of a moving away response; therefore, is used as a proxy for behavioural disturbance for UXO).	Approach to assessment of population level effects outlined in Appendix 7: Marine Mammals Methodology Statement.
18.04.23	EIA approach	Scoping Workshop session	MSS	Confirmed support of approach to assessment of population level effects via Interim Population Consequences of Disturbance Model (iPCoD) and the new Cumulative Effects Framework (CEF) tool.	Approach to assessment of population level effects outlined in Appendix 7: Marine Mammals Methodology Statement.
18.04.23	EIA approach	Scoping Workshop session	NatureScot	NatureScot agree with approach to selecting the species to be modelled via iPCoD, with a caveat that decisions are to be informed by the results of underwater sound modelling. Propose further engagement is undertaken to discuss at the relevant point.	To be further discussed and agreed with NatureScot at relevant point.
18.04.23	EIA Approach	Scoping Workshop session	NatureScot	NatureScot agree with the approach suggested for the Regional Marine Mammal Study Area.	The Regional Marine Mammal Study Area illustrated in Figure 8.17.
18.04.23	EIA approach	Scoping Workshop session	NatureScot and MSS	Approach to assessment of unidentified species and allocation to species groups (e.g. unidentified seal to grey seal group) to be discussed further following analysis of site specific survey data.	Approach to allocation of unidentified species outlined in Appendix 7: Marine Mammals Methodology Statement.
18.04.23	EIA approach	Scoping Workshop session	NatureScot	NatureScot request consideration of humpback whale (qualitatively) in the Marine Mammal chapter of the EIA Report.	Other marine mammal species are discussed within section 8.3.5, and will be discussed within the Marine Mammal chapter of the EIA Report.
25.05.23	Study Area	Written advice	NatureScot	NatureScot agree with the Regional Marine Mammal Study Area.	Response noted. The Regional Marine Mammal Study Area comprises the North Sea Marine Natural Area (MNA) extended towards the European coastline, as shown in Figure 8.17.
25.05.23	Data	Written advice	NatureScot	NatureScot are content with the baseline data sources presented. SCANS IV is taking place over the summer and should be available soon. This should be included in the baseline data sources if available.	SCANS IV will be incorporated into the baseline if data is available at the time of drafting the Marine Mammal Technical Report.

Date	Overarching theme	Method of engagement	Stakeholder	Summary of stakeholder feedback	Applicant’s response and relevant cross reference
25.05.23	Impact pathways	Written advice	NatureScot	NatureScot advise that humpback whale should be scoped in using a qualitative approach due to a recent increase in sightings along the East coast. Otherwise, NatureScot agree with the impacts to be scoped in and out.	The Applicant note NatureScot's advice on this species and will include it in the marine mammal baseline and adopt a qualitative approach to the assessment, and request any known data is shared. Currently have information from the Forth Marine Mammal Project.
25.05.23	Impact pathways	Written advice	NatureScot	Given this is a fixed foundation project in a ‘busy’ area, NatureScot reiterate the importance of the use of the CEF. NatureScot encourage collaboration (particularly with neighboring developers) when planning piling schedules to reduce potential cumulative impacts of noise. Consideration of noise abatement systems may also be necessary.	Intention is to use the Cumulative Effects Framework (CEF) if the platform is available at the time of drafting, otherwise, will use the iPCoD model (which in any case underpins the CEF). The assessment will include an evaluation of potential population consequences during piling at cumulative projects within the Regional Marine Mammal Study Area.
25.05.23	Impact pathways	Written advice	NatureScot	With regards to the digital aerial survey (DAS) marine mammal data, NatureScot note that unidentified species will be allocated to identified species proportionally. NatureScot have concerns about this approach due to the introduction of bias and the underestimation of rarer species. NatureScot would welcome the presentation of data both with and without unidentified species to be included, and request further consultation on the marine mammal DAS data and the proposed allocations so that NatureScot can provide more specific advice.	Note NatureScot's concerns regarding allocating unidentified species proportionally. The analyses can be done both with and without the allocation and both densities will be presented in the technical report. This is a more precautionary approach to estimating site specific densities. Density estimates from the DAS data can only be generated for the more abundant species and, therefore, allocating unidentified animals to these more abundant species will increase the density estimates, where otherwise data may have been disregarded.
25.05.23	Underwater Sound Approach	Written advice	NatureScot	Modelling should be undertaken at maximum hammer as a worst case. Although there will be a soft start, there is still uncertainty about how the noise levels will change during ramping up, so NatureScot would recommend taking a precautionary approach by using the maximum hammer energy. Further discussion on this during the pre-application stage maybe helpful.	Modelling will consider the peak SPL at discrete points along the piling sequence from soft start, through ramp up, and up to the maximum hammer energy and maximum penetration depth. The maximum peak level for a given piling operation, excluding varying geological considerations, is a function of the hammer energy and pile stick-up length. Consequently, depending on the scenario, it may be the case that the maximum peak levels occur prior to the point at which the hammer energy is at maximum. Will aim to capture the point at which the peak level is greatest in the modelling of the sequence as informed by the proposed pile driving schedule.

Date	Overarching theme	Method of engagement	Stakeholder	Summary of stakeholder feedback	Applicant's response and relevant cross reference
25.05.23	Underwater Sound Approach	Written advice	NatureScot	NatureScot support the use of the dual metric approach for impulsive noise, as described in Southall *et al.* (2019).	Noted, will be modelling both metrics (SELcum and SPLpk) in assessment. Whilst TTS will also be modelled and ranges presented in the Underwater Sound Technical Report, this is not taken forward to the marine mammal assessment for predicting injury ranges. The focus will instead be on PTS as a permanent (non-recoverable) injury).
25.05.23	Underwater Sound Approach	Written advice	NatureScot	For non-impulsive noise, accumulated noise metrics (SEL) should be used.	Appendix 5: Underwater Sound Methodology Statement provides the PTS and TTS criteria for non-impulsive noise from Southall *et al.* (2019) and is based on hearing-weighted SELcum thresholds.
25.05.23	Underwater Sound Approach	Written advice	NatureScot	NatureScot do not recall agreeing to the provision of a NatureScot technical note. If more information is needed further to the advice contained here, NatureScot are happy to discuss this further.	A request for a NatureScot technical note was in response to position on the use of SPLpk at maximum hammer energy to determine the mitigation zone rather than consideration of the largest range predicted using either of the dual metrics as per Southall *et al.* (2019) which was discussed above. The advice provided by NatureScot has provided further information to support position.
25.05.23	Underwater Sound Approach	Written advice	NatureScot	In terms of mitigating the injurious noise sources, NatureScot recommend using the pre-piling instantaneous impact to inform mitigation measures. However, there is also the risk of injury accruing over time, and, therefore, the accumulated noise dose should also be considered in assessment. There are many uncertainties with the accrual of a noise dose, from the uncertainty in any behavioural response, to recovery between noise exposures, and the effect of a pulse noise signal losing the impulsiveness over distance. Currently there is no framework to assess this transition to a non-impulsive signal, and so the accumulated risk is assessed using the worst case impulsive noise thresholds. It is because of this high level of uncertainty that NatureScot recommend the use of predictions of instantaneous injury (SPL(pk)) rather than accumulated injury (SEL(cum)) to determine pre-piling mitigation.	Clarification on NatureScot's position on the use of SPLpk to define the pre-piling mitigation zone noted.

Date	Overarching theme	Method of engagement	Stakeholder	Summary of stakeholder feedback	Applicant's response and relevant cross reference
25.05.23	Underwater Sound Approach	Written advice	NatureScot	NatureScot agree with the dose response approach for all species.	Confirmation noted.
25.05.23	Underwater Sound Approach	Written advice	NatureScot	NatureScot agree with the NMFS criteria of non-trivial (strong) disturbance (160 dBrms) for impulsive sound sources.	Confirmation noted.
25.05.23	Underwater Sound Approach	Written advice	NatureScot	NatureScot agree with the approach to UXO (modelling a range from low order to high order clearance). Noting that NatureScot wish to see low order disposal techniques as recommended in the Joint Position Statement on UXO clearance.	NatureScot's position with respect to UXO clearance using low order disposal is understood. However, given the uncertainty regarding the condition, size, and location of any UXOs that might be present in the area, the assessment will need to assess a range of options as, at this stage, it is not possible to commit to using low order methods for detonation.
25.05.23	Underwater Sound Approach	Written advice	NatureScot	NatureScot agree with TTS being used as a proxy for behavioral effects for UXO only.	Confirmation noted.
25.05.23	Underwater Sound Approach	Written advice	NatureScot	NatureScot do not agree on the long periods of ADD use for mitigation. Their duration of use should be limited to ensure their efficacy and to reduce the overall noise entering the marine environment. If modelling predicts that ADDs are required for greater than about 30 minutes in order to clear an ensonified area, then other mitigation, such as noise abatement systems, should be considered.	Feedback noted, agree that minimising the use of ADD will be important to reduce the overall noise introduced into the marine environment. The duration of ADD will be determined by the radius of the mitigation zone to allow animals to flee safely beyond this area, however, will investigate the efficacy of using an ADD if >30mins is required and highlight that the intention will be to minimise any additional noise introduced whilst ensuring that mitigation is effective in reducing the risk of injury.

8.3.5 Baseline Environment

Initial site specific survey results

8.3.5.1 Initial results from twelve months of surveys (January 2021 to December 2021) provided sightings of harbour porpoise, white-beaked dolphin, grey seal and minke whale within the Project Marine Mammal Study Area. Details on the number and seasonality of individuals recorded are presented for each species in the summaries below.

8.3.5.2 Some individuals could not be identified to species level. For example, the surveys recorded unidentified seal species in January, February, March, April, May and November, with a peak of seven individuals recorded in April. Similarly, unidentified dolphins were recorded in May and June, where nine and one individuals were recorded, respectively. Mammals that could not be distinguished between dolphin and porpoise were recorded every month between February and July, and then October, with peak numbers recorded in May with 32 counts. Lastly, marine mammals that could not be assigned to any group were recorded in June, July, August and December, with a peak of three individuals recorded in July.

Harbour Porpoise (Phocoena phocoena)

8.3.5.3 The harbour porpoise has a large population and is extensively distributed throughout the North Sea, where it is the most abundant cetacean species (JCDP 2023; Hammond *et al.,* 2021; Evans and Waggitt, 2020; Chevallard *et al.,* 2019). Harbour porpoise diets are diverse, vary regionally, and predominantly consist of cephalopods and an assortment of fish species (Ransijn *et al.,* 2019). Historical studies of harbour porpoise in Scottish waters have illustrated that sandeels and whiting dominate the species' diet (Santos and Pierce, 2003; Baines *et al.,* 2012; Ransijn *et al.,* 2019). Long-term passive acoustic data collected near the Moray Firth, Scotland has shown that harbour porpoises were increasingly detected during sunrise, sunset and throughout the night in deeper areas with muddy substrate, but in shallow, sandy areas during the day, suggesting the importance of multiple habitat types necessary to ensure species success (Williamson *et al.,* 2017). According to the Marine Mammal Research Unit (MMRU), harbour porpoises have a typical life expectancy of around 8–12 years (MMRU, 2022). The most recent assessment of harbour porpoise in UK waters concluded that the overall trend in Conservation Status was Unknown, highlighting that there was insufficient data to establish a trend for the population size or to assess potential prospects for the population (JNCC, 2019a).

8.3.5.4 Hague *et al.* (2020) present information on regional baselines for marine mammals across the North Sea and Atlantic areas of Scottish waters. The most recent broadscale data on harbour porpoise is reported to be that available from the SCANS III survey (Hammond *et al.,* 2021) and the series of SCANS surveys between 1994 and 2016, although these only reflect summer distribution. These data suggest the density of harbour porpoise varies throughout the North Sea MU. For example, in the UK portion of the MU, the densities range from 0.152 porpoise per km^2 in Block S (covering the Moray Firth and Orkney) to 0.888 porpoise per km^2 in Block O (southern North Sea) (Hammond *et al.,* 2021. Within the vicinity of the Array Project plus buffer, SCANS III densities (remodelled by Lacey *et al.,* 2022) suggest the density of harbour porpoise is, on average, 0.686 animals per km^2.

8.3.5.5 The Joint Cetacean Protocol (JCP) has undertaken an analysis of 18 years of data to inform the identification of discrete and persistent areas of relatively high harbour porpoise density in the United Kingdom (UK) marine area (Heinänen and Skov, 2015). Areas of persistent high density of harbour porpoise include Smith Bank in the Moray Firth, 160km from the Array Project, and a large area of the southern North Sea, subsequently designated as the Southern North Sea Special Area of Conservation (SAC) for the protection of harbour porpoise, which lies approximately 140km from the Array Project (Figure 8.21; Heinänen and Skov, 2015; Robinson *et al.,* 2021; Waggitt *et al.*, 2020). In the harbour porpoise North Sea MU, water depth and hydrodynamic variables are the most important predictors for presence and density of harbour porpoise Regional Marine Mammal Study Area .

8.3.5.6 The Array Project is within the North Sea Management Unit (MU) for harbour porpoise (Figure 8.17; IAMMWG, 2022), which is estimated to have an abundance of 346,601 individuals (CV (coefficient of variation): 0.09; 95% CI (confidence interval): 289,498 – 419,967) based on estimates from SCANS III (Hammond *et al.,* 2021). Within the UK portion of the NS MU, the population is estimated to have an abundance of 159,632 (CV: 0.12, 95% CI: 127,442 – 199,954) (IAMMWG, 2022; Hammond *et al.,* 2021; Rogan *et al.,* 2018).

8.3.5.7 Initial data collected during the site specific (aerial) surveys, undertaken across the Project Marine Mammal Study Area, indicate harbour porpoise numbers are higher in the spring and summer months, with lower values in autumn and winter. Detailed design-based and model-based analyses will be undertaken on the full two-year aerial survey dataset for the Array Project, including the application of an appropriate correction factor to derive absolute abundance and density estimates.

8.3.5.8 Site specific surveys have also been undertaken at other OWFs in the Firth of Forth, which are closer to the coast. Data from surveys at the Seagreen Project (Seagreen Alpha/Bravo) and Berwick Bank OWF correspond with the initial data collected in the Project Marine Mammal Study Area, indicating harbour porpoise numbers are higher in spring and summer months (Seagreen Wind Energy 2018; SSER 2022).

8.3.5.9 Given the sightings recorded during the site specific aerial surveys, and from previous surveys at nearby OWFs, harbour porpoise is considered likely to occur year-round within the Project Marine Mammal Study Area and wider potential ZoIs.

Minke Whale (Balaenoptera acutorostrata)

8.3.5.10 The minke whale is the smallest, most abundant baleen whale (mysticete) species observed in UK waters (Robinson *et al.*, 2021; Evans and Waggitt, 2020). Recent studies have determined there are approximately 9,000 individuals in the North Sea, with most sightings coming from inshore, shelf waters up to 200 m in depth along the northern North Sea (Robinson *et al.*, 2021; JCDP 2023). Studies have shown that minke whale is more commonly sighted in summer months when the species undergoes seasonal movements, illustrating their wide spatial distribution (Gilles *et al.*, 2019). While the species has been frequently observed from April to October in coastal waters of the North Sea, sightings have been documented year-round (Dolman *et al.*, 2013; Reid *et al.*, 2003; Waggitt *et al.,* 2020).

8.3.5.11 Off the coast of Scotland, sightings peak from July to August, relating to meso-scale oceanographic features that most likely increase minke whale foraging opportunities in the area (Tetley and Robinson, 2008; Robinson et al., 2009). The minke whale diet in Scottish waters primarily consists of sandeel, herring, whiting, and plankton (HWDT, 2021; Pierce *et al*., 2004). There is evidence that minke whales undergo large, seasonal migrations between breeding grounds and foraging grounds, although these have not been conclusively identified for UK waters (Risch *et al*., 2014; Risch *et al*., 2019a). The species' relatively small size and elusive behaviour have resulted in uncertainty regarding their migratory routes and seasonal distributions, making effective conservation and management difficult (Risch et al., 2019b).

8.3.5.12 Minke whale is a commonly occurring species off the coast of Scotland. More specifically, they are found to have significant distributions along the southern coastline in the Moray Firth. Minke whales are observed less frequently in the southern North Sea compared to the northern and central North Sea (Risch *et al.*, 2019a). These highly productive waters are home to rich feeding grounds, which attract high densities of minke whales during summer and autumn months, resulting in the designation of the Southern Trench Marine Protected Area (MPA) (Figure 8.21; Robinson *et al*., 2021). The Southern Trench Marine Protected Area (MPA) covers an area of 2,536km^2 off the Aberdeenshire coast (from Buckie to Peterhead). The dynamic mixing of warm and cold waters provides a thermal front that attracts abundant shoaling fish, including herring, mackerel and cod, and the soft sands provide an ideal habitat for sandeel, a key prey species for minke whale (NatureScot, 2019).

8.3.5.13 Acoustic recordings were collected from May to November 2016 across 10 recording sites within the Moray Firth and the Eastern coast of Scotland (Risch *et al*., 2019a). These recording sites, from north to south include locations close to the settlements of Latheron, Helmsdale, Cromarty, Spey Bay, Fraserburgh, Cruden Bay, Stonehaven, Arbroath, St Andrews, and St Abbs. Minke whale acoustic recordings were present at 70% of the recording locations, with most detections in the Moray Firth, particularly at Latheron, Helmsdale, and Spey Bay (Risch *et al*., 2019a). The nearest recording site to the Array Project is approximately 50km west of the array area at Stonehaven, which had just one detection hour of minke whale (Risch *et al*., 2019a).

8.3.5.14 For minke whale, the density estimates reported by Hague *et al*. (2020) are sourced from SCANS III (Hammond *et al*., 2021) and Cetacean Offshore Distribution and Abundance in the European Atlantic (CODA) (Macleod *et al*., 2009). These data suggest that density estimates in Scottish waters range from 0.008 to 0.039 minke whales per km^2 and that Block R (which overlaps the Array Project) and Block T E (Shetland) in east coast waters represents the higher end of the range, with up to 0.039 minke whale per km^2 (CV: 0.61) for the survey block relevant to the Array Project (Block R) (Hammond *et al*., 2021). Within the vicinity of the Array Project plus buffer, SCANS III densities (remodelled by Lacey *et al*., 2022) suggest the density of minke whale is, on average, 0.026 animals per km^2. Higher densities of minke whale are found to the north of the Array Project in the outer Moray Firth (approximately 0.04 animals per km^2), reflected in the designation of the Southern Trench MPA.

8.3.5.15 Minke whales in UK waters are part of the Celtic and Greater North Seas (CGNS) MU (Figure 4; IAMMWG, 2022), which is estimated to have an abundance of 20,118 minke whale (CV: 0.18, 95% CI: 14,061–28,786) based on estimates from the SCANS III survey (Hammond *et al.*, 2017; Hammond *et al.,* 2021) and the ObSERVE survey (Rogan *et al.,* 2018). Within the UK portion of the CGNS MU, the population is estimated to have an abundance of 10,288 (CV: 0.26, 95% CI: 6,210–17,042) (IAMMWG, 2022; Hammond *et al.,* 2021; Rogan *et al.,* 2018).

8.3.5.16 The most recent assessment of minke whale in UK waters concluded that the overall trend in Conservation Status was Unknown, highlighting that there was insufficient data to establish a trend for the population size or to assess the potential prospects for the population (JNCC, 2019b).

8.3.5.17 During the site specific surveys of the Project Marine Mammal Study Area, low numbers of minke whale were sighted and during the summer months only. Detailed design-based and model-based analyses will be undertaken on the full two-year aerial survey dataset, including the application of an appropriate correction factor to derive absolute abundance and density estimates.

8.3.5.18 Site specific surveys have also been undertaken at other OWFs in the Firth of Forth closer to the coast. Data from surveys at the Seagreen Project (Seagreen Alpha/Bravo) and Berwick Bank OWF correspond with the initial data collected at the Project OWF, indicating minke whale numbers are highest in spring and summer months (Seagreen Wind Energy 2018; SSER 2022). This seasonality reflects the seasonal frontal systems (as described for the Southern Trench MPA) attracting minke whale to move inshore to feed on sandeel and other prey items.

8.3.5.19 Given the sightings recorded during the site specific aerial surveys, and from previous surveys at nearby OWFs, minke whales are considered likely to occur regularly in the summer months within the Project Marine Mammal Study Area and wider potential ZoIs.

White-Beaked Dolphin (Lagenorhynchus albirostris)

8.3.5.20 The white-beaked dolphin is endemic to the North Sea, with an estimated population of nearly 36,000 individuals (Ijsseldijk *et al.,* 2018). The white-beaked dolphin is the second most common cetacean species present in the North Sea following the harbour porpoise (Schick *et al.,* 2020). This species is typically found along continental shelf waters between 50–100 m in depth, predominantly in the western portion of the central and northern North Sea (Hammond *et al.,* 2013). Analysis of stomach contents from North Sea white-beaked dolphins have illustrated that cod, gobies, haddock, and whiting play an important role in the species' diet (Schick *et al.,* 2020). Sexual maturity has been found to range between six to 10 years in females and seven to 12 years in males (Schick *et al.,* 2020). Although little is known regarding the species' reproductive behaviours, calving is believed to take place in summer months from May to September (Ijsseldijk *et al.,* 2018), coinciding with peak densities found along the Scottish coast (Gilles *et al*., 2019; Waggitt *et al.,* 2020). Temperature is a critical factor in determining the distribution of white-beaked dolphins. Several authors have emphasised the potential impacts of increased water temperatures due to ramifications of climate change and their effects on prey abundance and distribution, altering white-beaked dolphin habitat and foraging preferences (Evans and Bjørge, 2013; Ijsseldijk *et al.,* 2018).

8.3.5.21 Species-specific densities have been based on SCANS III Survey Block R densities (Hammond *et al.,* 2021). The abundance estimate for white-beaked dolphin within Survey Block R was 15,694 individuals, with a density of 0.243 animals per km^2 (Hammond *et al.,* 2021). Within the vicinity of the Array Project plus buffer, SCANS III densities (remodelled by Lacey *et al.,* 2022) suggest the density of white-beaked dolphin is, on average, 0.00012 animals per km^2. The Conservation Status of the white-beaked dolphin in UK waters was assessed as Favourable but this has subsequently been revised to

Unknown for the latest assessment (JNCC, 2019c). Large-scale abundance surveys conducted from 1994–2005 have consistently reported similar numbers, suggesting that the population size has remained relatively stable without significant increase or decrease in total population size within the North Sea (Hammond *et al.,* 2021; Paxton *et al.,* 2016).

8.3.5.22 The relevant MU for white-beaked dolphins is the Central and Greater North Seas (CGNS) MU (IAMMWG, 2022), which has an estimated population size of 43,951 dolphins (CV: 0.22, 95% CI: 28,439–67,924) based on estimates from the SCANS III survey (Hammond *et al.,* 2021) and the ObSERVE survey (Rogan *et al.,* 2018). Within the UK portion of the CGNS MU, it is estimated there are 34,025 white-beaked dolphin (IAMMWG, 2022).

8.3.5.23 During the aerial site specific surveys at the Project Marine Mammal Study Area, white-beaked dolphin was sighted in low numbers and during the summer months only. Detailed design-based and model-based analyses will be undertaken on the full two-year aerial survey dataset, including the application of an appropriate correction factor to derive absolute abundance and density estimates.

8.3.5.24 Site specific surveys have also been undertaken at other OWFs in the Firth of Forth closer to the coast. Data from surveys at the Seagreen Project (Seagreen Alpha/Bravo) and Berwick Bank OWF correspond with the initial data collected at the Project OWF indicating white-beaked dolphin numbers are highest in summer months (Seagreen Wind Energy 2018; SSER 2022).

8.3.5.25 Given the sightings recorded during the site specific aerial surveys, and from previous surveys at nearby OWFs, white-beaked dolphins are considered likely to occur regularly in the summer months within the Project Marine Mammal Study Area and wider potential ZoIs.

Bottlenose Dolphin (Tursiops truncates)

8.3.5.26 Scotland is home to a small, resident population of bottlenose dolphin that is protected through a SAC in the Moray Firth, approximately 190km from the Array Project (Figure 8.21) (Cheney *et al.,* 2018 JNCC, 2022a). The Moray Firth hosts the only year-round resident population of bottlenose dolphin in the North Sea (Robinson *et al.,* 2017). Bottlenose dolphins have also been recorded off the western Isles of Scotland and are commonly found in inshore and deep coastal waters (Avant, 2008). However, the Coastal East Scotland population has been known to show high site fidelity and the Moray Firth area is understood as their core location (Fernandez-Betelu *et al.,* 2019), and, therefore, the Moray Firth SAC was established to protect this population.

8.3.5.27 Bottlenose dolphin have been known to exhibit high flexibility in both their foraging behaviour and habitat use (Fernandez-Betelu *et al.,* 2019). Prey availability and prey concentration drive species' habitat preference, with their foraging behaviours known to adapt accordingly (Genov *et al.,* 2019; Garagouni *et al.,* 2019). Most female bottlenose dolphins found in the Moray Firth were found to give birth from six to 13 years of age, with calves born predominantly from May to October, peaking during the summer months with increased water temperatures (Robinson *et al.,* 2017).

8.3.5.28 There are two different ecotypes for bottlenose dolphin in Scottish waters: the wide-ranging offshore ecotype and the philopatric coastal ecotype (Louis *et al.* 2014). Coastal ecotypes are concentrated mostly within distinct populations in the east and west coast of Scotland, namely the Moray Firth and Firth of Tay (east coast) and the Inner Hebrides and Sound of Barra (west coast) (Hague *et al.,* 2020; van Geel 2016; Cheney *et al.,* 2013). These coastal ecotypes are primarily limited to coastal waters and as a result unlikely to overlap with the Project Marine Mammal Study Area. There is less certainty in the distribution and abundance of the offshore ecotypes (Cheney *et al.,* 2013).

8.3.5.29 The East Coast Marine Mammal Acoustic Study (ECOMMAS) utilised acoustic recorders (C-PODs) to collect data on the relative abundance of bottlenose dolphins in 30 locations off the east coast of Scotland (NMPi, 2022; Hague *et al*., 2020; Williamson, 2018). Deployments are undertaken twice per year since 2013 (currently ongoing), with data covering the months of April to November (Hague *et al*., 2020). Data collected from 2013–2016 (available via Marine Directorate) illustrated that the greatest presence of bottlenose dolphin was detected at Cromarty, situated approximately 200km northwest of the Array Project, almost certainly representing the coastal ecotype only (NMPi, 2022).

8.3.5.30 The Array Project is located within the Greater North Sea (GNS) MU for bottlenose dolphin (Figure 8.18; IAMMWG, 2022). The abundance of bottlenose dolphin in the GNS MU is estimated at 2,022 individuals (CV of 0.75), equating to a density of 0.003 animals per km^2 (IAMMWG, 2022). The UK portion of the GNS MU encompasses a large area of the North Sea and the density estimate derived from the smaller SCANS III Survey Block R which include animals from both coastal and offshore ecotypes (total abundance of 1,924 individuals in Block R), is more conservative (Hammond *et al.,* 2021). The density estimate for bottlenose dolphin within SCANS-III Block R was estimated as 0.03 animals per km^2 (Hammond *et al.,* 2021). Within the vicinity of the Array Project plus buffer, SCANS III densities (remodelled by Lacey *et al.,* 2022) suggest the density of bottlenose dolphin is, on average, 0.0043 animals per km^2. This supports findings from Waggitt *et al.* (2020) which presented estimated density maps (at 50km^2 resolution) based on compiled data for the Northeast Atlantic between 1980 and 2018 and suggests that, in the waters off the east coast of Scotland, there are very low densities of bottlenose dolphin in offshore numbers between July to October.

8.3.5.31 Thirty-nine km to the west of Array Project lies the Coastal East Scotland (CES) MU (inshore of 12nm), which links the Moray Firth SAC with key foraging habitat along the east coast of Scotland and into the coastal waters of northern England. Animals move along this coastal area but are primarily found nearshore in waters less than 20m deep (Quick *et al.,* 2014). The most recent population estimate of bottlenose dolphin abundance for the CES MU is 224 dolphins (95% CI: 214–234) (IAMMWG, 2022), based on capture-mark-recapture photo-ID (Arso Civil *et al.,* 2021).

8.3.5.32 The conservation status of the bottlenose dolphin in UK waters was assessed as Favourable but this has subsequently been revised to Unknown for the latest assessment (JNCC, 2019d). The Moray Firth coastal population of bottlenose dolphin has recently shown signs of increased range extension, occurring off the eastern coast of Scotland and England (Cheney *et al.,* 2014; Evans and Waggitt, 2020).

8.3.5.33 No sightings of bottlenose dolphin were recorded during the site specific aerial surveys. Site specific survey data from other OWFs in the Firth of Forth closer to the coast were investigated. At Berwick Bank OWF, which is located closer to the Scottish east coast population compared to the Array Project, bottlenose dolphin were sighted in very low numbers during site specific aerial surveys, and it was not possible to generate site specific density estimates (SSER, 2022). There were no bottlenose dolphin sightings during the Firth of Forth Round 3 surveys (Sparling, 2012) but three individuals were recorded during aerial surveys for the FTOWDG region (Grellier and Lacey, 2012).

8.3.5.34 Both the broadscale data and site specific data suggest that bottlenose dolphin may not be a key receptor due to the low likelihood of encountering this species within the Project Marine Mammal Study Area. Further, with respect to the CES population, which supports higher densities of bottlenose dolphin, there is less likely to be a receptor-impact pathway due to the distance of the Array Project from the CES (i.e. if there is no overlap of the ZoIs with the CES range). However, inclusion of bottlenose dolphin in the quantitative impact assessment will be determined based on the results of underwater sound modelling to determine the potential extent of the ZoI for piling impacts. If there is no overlap of the ZoI for underwater sound from piling with the CES population range, the assessment will consider this species (and potential effects on the offshore cohort) as part of a less detailed (more qualitative) assessment together with other species that may occur in very low numbers or are occasional visitors within the Firth of Forth region. Feedback is sought from consultees on this approach as part of the Scoping Opinion to agree this.

Grey Seal (Halichoerus grypus)

8.3.5.35 Grey seals have a wide distribution in the seas around UK, with the largest pupping sites located in the Inner and Outer Hebrides, Orkney, Isle of May, Farne Islands and Donna Nook (JNCC, 2022b). The most recent assessment of grey seal in UK waters concluded that the overall trend in Conservation Status was Favourable, with an overall trend in Conservation Status assessed as Improving (JNCC, 2019e).

8.3.5.36 The most recent UK wide grey seal pup production count was in 2016 and 2018, which resulted in a modelled UK adult population size in 2020 of 157,300 grey seals (95% CI 144,600–169,400) (SCOS, 2022). Pup production in the UK increased by 1.4% per annum between 2016 and 2019, with growth mainly limited to North Sea colonies. In the Firth of Forth, grey seal pup production count increased by 4.2% per annum over the same period, with Fast Castle now representing the biggest grey seal colony in the North Sea (SCOS, 2022).

8.3.5.37 The Project Marine Mammal Study Area is located within the East Scotland MU for seals where the most recent August count was 3,683 (between 2016–2019) (SCOS, 2022). This count can be scaled by the estimated proportion hauled-out (0.239, 95% CI: 0.192–0.286) to produce an estimate of 15,410 grey seals in the MU (95% CI: 12,878–19,182) (Russell *et al.,* 2016) (SCOS, 2022).

8.3.5.38 At-sea distribution (absolute density) of grey seal derived from high-resolution GPS tracking data across the UK and Ireland reveals that, across the Project Marine Mammal Study Area, up to ten grey seals are estimated to be present in the majority of 5km x 5km grid cells at any one time, equating to a density of up to 0.4 animals per km^2 (Figure 8.19) (Carter *et al.,* 2022). Grey seal counts during site specific aerial surveys were on average, very low with single observations recorded in June and December 2021 only. However, a number of sightings were of unidentified seals and these are considered likely to be grey seals due to the distance offshore. Detailed design-based and model-based analyses will be undertaken on the full two-year aerial survey dataset, including the application of an appropriate correction factor to derive absolute abundance and density estimates.

8.3.5.39 Site specific surveys have also been undertaken at other OWF developments in the Firth of Forth closer to the coast and allow comparison of densities with the Array Project. Data from surveys at the Seagreen Project (Seagreen Alpha/Bravo) and Berwick Bank OWF suggest grey seal numbers are generally low throughout the year but with peak numbers in May/June (Seagreen Wind Energy 2018; SSER 2022).

8.3.5.40 Given the sightings recorded during the site specific aerial surveys, from previous surveys at nearby OWF projects, and from the seal telemetry and habitat preference maps (Carter *et al.,* 2022), grey seals are considered likely to occur year-round within the Project OWF marine mammal Study Area and wider potential ZoIs, albeit in low numbers.

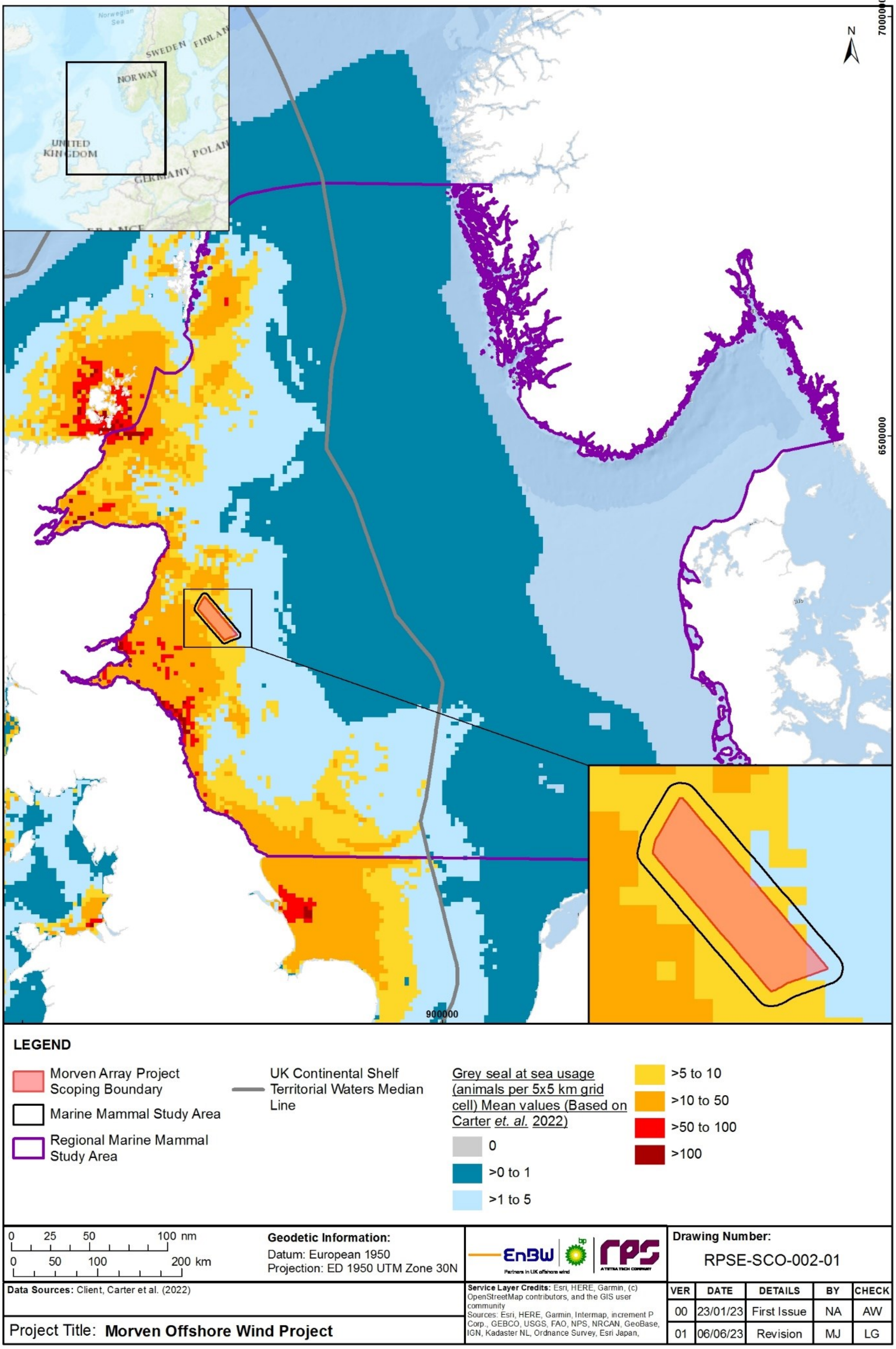


Figure 8.19: Grey seal at-sea distribution

Harbour Seal (Phoca vitulina)

8.3.5.41 Harbour seals are present around the UK with a higher abundance around Scotland; approximately 80% of the UK population resides around the Scottish coast. Low numbers are also encountered along the south and west coast of England and along the coasts of Wales. Harbour seals have been assessed as having an Unfavourable – Inadequate Conservation Status overall (JNCC, 2019f) and, although this is an improvement from the previous 2013 assessment (Unfavourable - Bad) due an increase in the overall UK population trend and stable range, there were too few data points to confidently draw conclusions on the current and future population trends (JNCC, 2019f).

8.3.5.42 The Project Marine Mammal Study Area is located within the East Scotland MU for seals. The most recent harbour seal August moult count presented for this East Scotland MU is 343 (2016–2019 count period) (SCOS, 2022), which can be scaled by the estimated proportion hauled-out (0.72, 95% CI: 0.54–0.88) to provide an estimate of 476 harbour seals in the East Scotland MU in 2019 (95% CI: 389–635) (Lonergan *et al.,* 2013; SCOS, 2022). The Array Project is adjacent to the North-East England MU where the most recent population estimate is 109 (95% CI: 89–146) (SCOS, 2022).

8.3.5.43 SCOS (2022) illustrates the regional fluctuations in population trends; for the east coast of Scotland region the counts between 1996 and 2015 recorded large declines in the population, but in the most recent counting period (2016-2021) the counts of harbour seal have increased from 224 to 343. In the northeast of England, the count has increased from 54 in the 1996-1997 count period to 79 in the most recent count period (2016-2021). Notably the most recent count data at the Firth of Tay and Eden Estuary SAC shows no evidence that the population is recovering after the decline in the 2000s and the 2019 SAC count is ~95% lower than the 1992 count (SCOS, 2021). This designated site is located ~100km from the Array Project and, given that harbour seals tend to forage within 40km to 50km from haul out sites, the Array Project does not represent a key habitat in the regional context.

8.3.5.44 At-sea distribution (relative density) of harbour seal derived from high-resolution GPS tracking data across the UK and Ireland reveals that densities across the Project Marine Mammal Study Area are likely to be very low. Between zero and one harbour seal is estimated to be present in all 5km x 5km grid cells at any one time, equating to a density of up to 0.04 animals per km^2 (Figure 8.20) (Carter *et al.,* 2022). No harbour seals were identified in the initial results from the site specific aerial surveys; however, general ‘seal species’ were recorded so presence of harbour seal cannot be discounted based on aerial survey data.

8.3.5.45 Due to no sightings of harbour seal during the Array Project site specific aerial surveys to date, to inform the marine mammal baseline characterisation it is necessary to explore published density estimates that include previous site specific data from other OWFs in the Firth of Forth. Findings from desk-based data from surveys at other OWFs in the Firth of Forth suggest harbour seal numbers are generally low throughout the year but with peak numbers in May/June (Seagreen Wind Energy 2018; SSER 2022).

8.3.5.46 Although, undoubtedly, harbour seal is a vulnerable species off eastern Scotland given the historic population declines and unknown future trajectory, the baseline data suggests that the Array Project does not fall within an important area for harbour seal. There were no sightings of this species recorded during the Array Project site specific aerial surveys, very low numbers from other site specific surveys at nearby OWFs identified in the desk-based review. Very low densities (or zero in some cases) of harbour seal were predicted in cells overlapping the Array Project, as seen in the seal telemetry and habitat preference maps (Carter *et al.,* 2022). Harbour seal is, therefore, considered likely to occur in very low numbers within the Project Marine Mammal Study Area and wider potential ZoIs and, at this stage, is not considered to be a key species for assessment. This will be evaluated in light of the results of a SMRU-commissioned seal telemetry study for the Array Project to determine the potential usage of the site (e.g. animals moving between haul-outs and the Array Project). As part of the Scoping Opinion, feedback on this approach is sought from consultees.

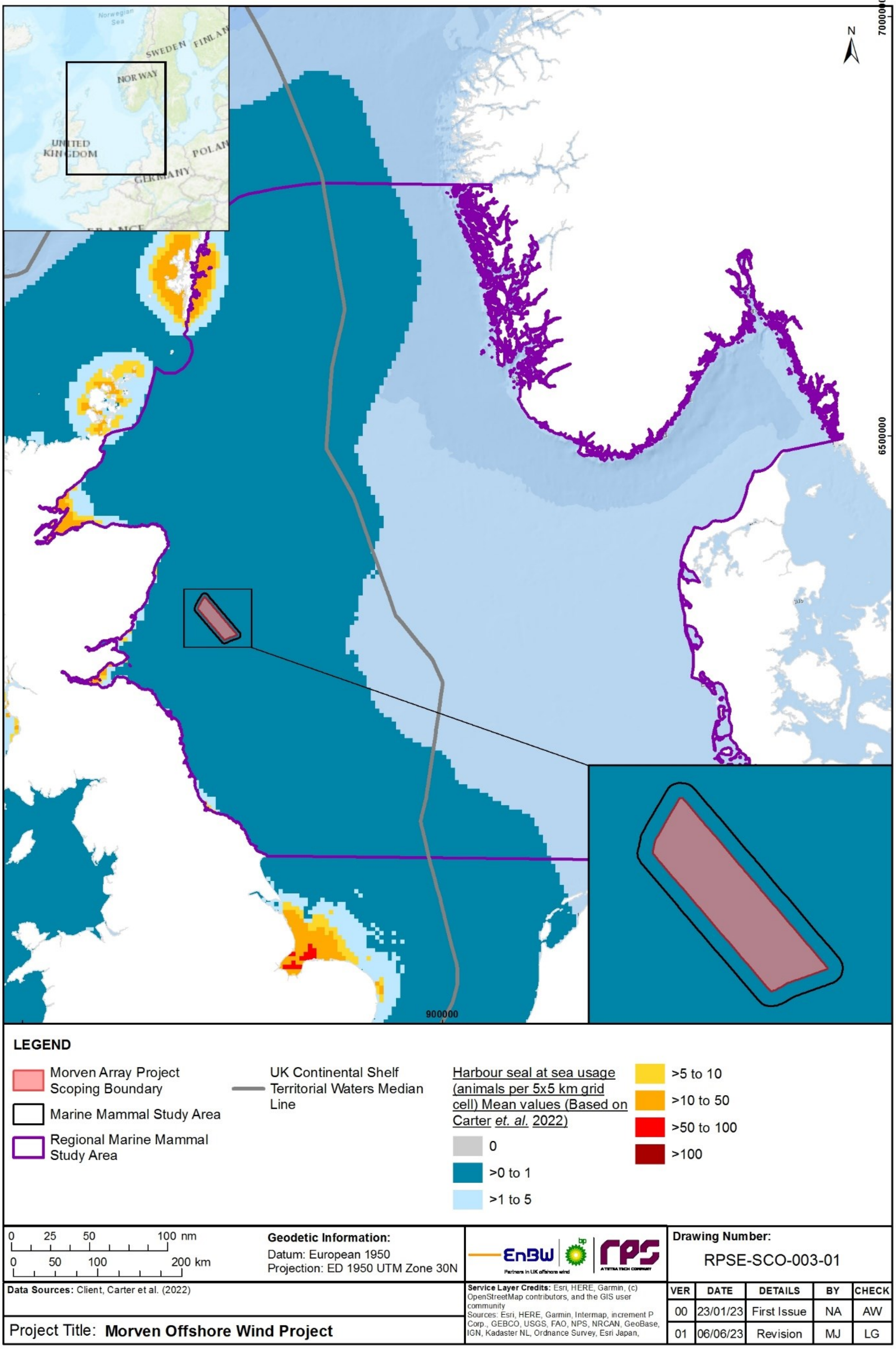


Figure 8.20: Harbour seal at-sea distribution

Other marine mammal species

8.3.5.47 A number of other marine mammal species have been recorded occasionally (or in very low numbers) within, or in proximity to, the Marine Mammal Study Area during historic surveys.

8.3.5.48 There were a low number of Atlantic white-sided dolphins (*Lagenorhynchus acutus*) and one Risso's dolphin (*Grampus griseus*) recorded within the Regional Marine Mammal Study Area in the most recent SCANS-III survey (Hammond *et al*., 2017; Hammond *et al.,* 2021). Estimated density maps (at 50km^2 resolution) based on compiled data for the Northeast Atlantic between 1980 and 2018 suggest that, in the waters off the east coast of Scotland, Atlantic white-sided dolphin may occur in very low numbers between late spring and early autumn while Risso's dolphin may occur seasonally in low numbers from July to November (Waggitt *et al.*, 2020). One sighting of a group of ten white-sided dolphins was observed during site specific boat-based surveys conducted during Firth of Forth Round 3 surveys for the nearby Seagreen 1 Offshore Wind Farm (Sparling, 2012).

8.3.5.49 Killer whale (*Orcinus orca*), short-beaked common dolphin (*Delphinus delphis*), long-finned pilot whales (*Globicephala melas*) and pygmy sperm whale (*Kogia breviceps*) have been recorded as rare or occasional visitors within the Regional Marine Mammal Study Area (*Reid et al.,* 2003). One common dolphin, one killer whale and a group of eight long-finned pilot whales, were observed in aerial surveys for Seagreen's regional study area (Grellier and Lacey, 2012). Waggitt *et al.* (2020) maps suggest that, in the Firth of Forth offshore region, there were very low estimated densities of short-beaked common dolphin in summer months. Whilst there are accounts that short-beaked common dolphin may have expanded its range northward in UK waters (MacLeod *et al.,* 2005; van Weelden *et al.,* 2021), given its preference for warmer temperate and tropical seas, it is still regarded as an occasional visitor within the northern North Sea. Waggitt *et al.* (2020) also found low estimated densities of killer whale in all months and long-finned pilot whales are more likely to occur further north in the offshore waters of the Moray Firth.

8.3.5.50 The Forth Marine Mammal Project has mapped inshore sightings of marine mammals (from coastal vantage points) within the Firth of Forth between April 2021 to April 2023, although noting that there is a high probability that the same individuals were recorded by multiple observers. The interactive map[8] shows that short-beaked common dolphin has been only sighted occasionally, mostly in summer months; a single killer whale was sighted in June 2021; several sightings of humpback whale were recorded in December 2022 and January/February 2023; and several sightings of sei whale were recorded in spring/summer 2021.

8.3.5.51 During the Scoping Workshop the consultees highlighted several recent sightings of humpback whale (*Megaptera novaeangliae*) in Scottish east coast waters, including the Firth of Forth, and suggested that further information should be sought on the occurrence and presence of this species within the Marine Mammal Study Area and Regional Marine Mammal Study Area.

8.3.5.52 Due to low likelihood of occurrence and/or their rarity in the Regional Marine Mammal Study Area most species reported above are not considered to require further assessment for the Array Project. The exception is humpback whale which, based on the recent increase in sightings around the Firth of Forth and upon feedback from NatureScot, will be taken forward for consideration in the assessment (qualitatively). Further baseline information will be gathered as part of a more comprehensive literature review to ensure that all key species are considered in the assessment. Initial feedback is sought from consultees for the key species identified within this scoping report.

Designated sites

8.3.5.53 The Project Marine Mammal Study Area does not overlap with any protected sites that have been designated for marine mammal features (Figure 8.21). Designated sites with relevant qualifying marine mammal features, which overlap with the Regional Marine Mammal Study Area, are described in this chapter. For the purposes of this scoping report, UK waters only have been included here; the LSE Screening will consider waters extending into Europe.

8.3.5.54 A full screening of European sites (i.e. SACs) with qualifying marine mammal features will be undertaken in the LSE Screening Report for the Array Project, as part of the HRA process. The

[8] https://storymaps.arcgis.com/stories/0b06dab9522e4efcb1ca5c8392c15626

assessment of European sites and effects on the site(s) conservation objectives will be undertaken in the RIAA.

8.3.5.55 Table 8.17 provides an early indication of the designated sites that may be considered within the LSE Screening Report and, potentially, the RIAA if an LSE is identified. The list of designated sites, which includes all marine mammal SACs within the Regional Marine Mammal Study Area, will be presented in the marine mammal EIA chapter. As a more detailed understanding of the Array Project activities and impact pathways develops, the EIA will consider potential impacts on relevant Annex II marine mammal species of European designated sites.

8.3.5.56 The Southern Trench MPA (Figure 8.21) is designated under the Section 80 of the Marine (Scotland) Act 2010 and Section 127 of the Marine & Coastal Access Act (2009) and, therefore, is not included in the LSE Screening Report. Where there is potential for a direct impact on the MPA, the site will be included in an MPA Assessment (Appendix 6: Marine Protected Area Screening).

Table 8.17: Summary of designated sites with relevant qualifying features for which potential LSEs have been identified and screened in for further assessment

Designated Site	Distance to the Scoping Boundary (km)	Features
Berwickshire and North Northumberland Coast SAC	~93	Grey seal (*Halichoerus grypus*)
Isle of May SAC	~100	Grey seal (*Halichoerus grypus*)
Firth of Tay and Eden Estuary SAC	~92	Harbour seal (*Phoca vitulina*)
Southern North Sea SAC	~131	Harbour porpoise (*Phocena phocoena*)
Dornoch Firth and Morrich More SAC	~195	Harbour seal (*Phoca vitulina*)
Moray Firth SAC	~157	Bottlenose dolphin (*Tursiops truncates*)

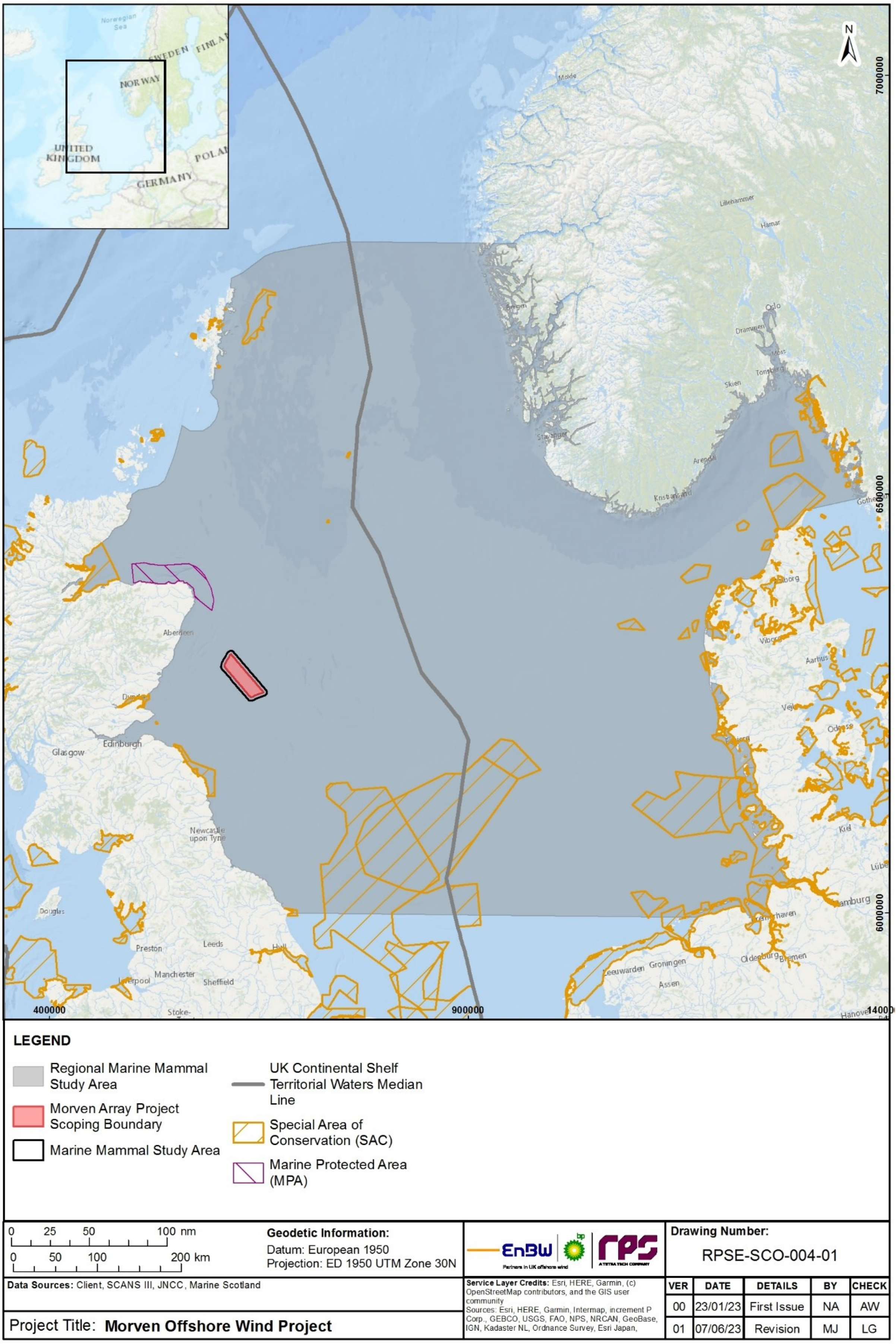


Figure 8.21: Marine nature conservation designations of relevance to marine mammals that overlap with the Regional Marine Mammal Study Area

Summary of key species

8.3.5.57 The key species that are likely to occur in the Project Marine Mammal Study Area and that are proposed to be taken forward to the impact assessment for a detailed assessment are:

- harbour porpoise;
- minke whale;
- white-beaked dolphin;
- grey seal;
- bottlenose dolphin;
- humpback whale (qualitative assessment).

8.3.5.58 Species that may be rare or occasional visitors and/or occur in very low numbers in the Project Marine Mammal Study Area and, therefore, will be scoped out:

- harbour seal (depending on the results of the telemetry study);
- short-beaked common dolphin;
- Atlantic white-sided dolphin;
- Risso's dolphin;
- killer whale;
- long finned pilot whale ;
- pygmy sperm whale;
- sei whale.

8.3.5.59 The species listed above are afforded protection under various legislation, including species protected under Annex II of the Habitats Regulations (Table 8.17).

8.3.5.60 As part of the Scoping Opinion, feedback is sought from consultees on this approach.

Table 8.18: Protection legislation relevant to the key marine mammal species which have the potential to occur within the Project Marine Mammal Study Area

Species	The Conservation of Offshore Habitats and Species Regulations 2017 (as amended)	The Conservation (Natural Habitats, &c.) (EU Exit) (Scotland) (Amendment) Regulations 2019	Nature Conservation (Scotland) Act 2004	Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) 1973	The Bonn Convention 1979	The Bern Convention 1979	Agreement on the Conservation of Small Cetaceans of the Baltic, North East Atlantic, Irish and North Seas, 1992 (ASCOBANS)	The Wildlife and Countryside Act 1981 (as amended)	Convention on Biological Diversity 1993	Annex V of the OSPAR Convention 1992	The Water Environment (Controlled Activities) (Scotland) Regulations 2011. Scottish Statutory Instrument 2011 No. 209	The Protection of Seals (Designation of Haul-Out Sites) (Scotland) Order 2014	Marine (Scotland) Act 2010	Conservation of Seals Act 1970
Harbour porpoise	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			
White-beaked dolphin	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			
Bottlenose dolphin	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			
Minke whale	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			
Humpback whale	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			
Habour seal	✓	✓	✓			✓	✓		✓	✓	✓	✓	✓	✓
Grey seal	✓	✓	✓			✓	✓		✓	✓	✓	✓	✓	✓

8.3.6 Potential Impacts of the Array Project

8.3.6.1 A range of potential impacts on marine mammals have been identified, which may occur during the construction, O&M and decommissioning phases of the Array Project.

8.3.6.2 The impacts that have been scoped into the assessment are outlined in Table 8.19, together with a description of any additional data collection (e.g. site specific surveys) and supporting analyses (e.g. modelling) that will be required to enable a full assessment of the Impacts.

8.3.6.3 Potential impacts scoped out of the assessment are presented in Table 8.20, with justification.

Table 8.19: Impacts proposed to be scoped into the Array Project assessment for Marine Mammals

C = Construction phase, O = O&M phase, D = Decommissioning phase.

Impact	Project phase			Basis for Impact	Data collection and analysis required to characterise the baseline environment	Summary of proposed approach to assessment
	C	O	D			
Injury and disturbance from underwater sound generated from piling.	✓	×	×	Impact piling during construction may result in hearing damage/auditory injury or behavioural disturbance/displacement (including barrier effects) of marine mammals.	Aerial surveys to obtain density estimates, where data allows, for each species within the relevant impact footprint. Desktop data sources will also be used where appropriate. Published correction factors will be applied to determine absolute densities and allow quantification of the potential numbers of animals injured/disturbed. Agreement will be sought with consultees via the Scoping Process on the most appropriate densities and correction factors to apply to the assessment.	Underwater sound modelling will be undertaken (as set out in section 7.2.8) to quantitatively assess the risk of auditory injury. Unless any new guidance is published prior to the Impact assessment, the Southall *et al.* (2019) thresholds will be used to assess the risk of a permanent auditory injury PTS. The risk of auditory injury will be assessed on dual criteria: frequency-weighted cumulative sound exposure level (SEL_{cum}) and unweighted peak Sound Pressure Level (SPL_{peak}). Further to advice from consultees, SPL_{peak} will be used to determine distances from the source for which nominal measures will be implemented, such as marine mammal observers and PAM to mitigate potential injury effects from instantaneous sound (i.e. SPLpk of piling first strike). Maximum hammer energy will be used to model injury ranges. If modelled SEL_{cum} ranges are greater than those predicted for SPL_{peak}, then additional mitigation measures will be considered, such as ADD or sound emission reduction/abatement systems. The assessment will consider any residual risk of injury after implementation of

Impact	Project phase			Basis for Impact	Data collection and analysis required to characterise the baseline environment	Summary of proposed approach to assessment
	C	O	D			
						project designed in measures including: 1) piling soft start and gradual ramp up and 2) standard industry practice mitigation including marine mammal observers, passive acoustic monitoring PAM and ADD deployment. Where a residual risk is determined to lead to a significant effect, the use of further mitigation measures will be considered. (See section 8.3.7 for Mitigation). The assessment of disturbance will be based on the good practice methodology available at the time of assessment and making use of the best available scientific evidence. Sound contours at appropriate intervals will be generated by sound modelling and overlaid on species density surfaces to predict the number of animals potentially affected. Barrier effects (whereby marine mammals are excluded from the Array Project and associated ZoI) will also be investigated. This will be done by considering where sound contours could lead to displacement from, or areas which may be disturbed, whilst taking account of important habitats for key marine mammal species.
Injury and disturbance from underwater	✓	×	×	UXO clearance may result in hearing damage/auditory injury or behavioural	Aerial surveys to obtain density estimates, where data allows, for each species within the relevant Impact	Underwater sound modelling will be undertaken for UXO clearance activities (as set out in section 7.2.8) and will be used to

Impact	Project phase			Basis for Impact	Data collection and analysis required to characterise the baseline environment	Summary of proposed approach to assessment
	C	O	D			
sound generation from unexploded ordnance (UXO) clearance.				disturbance/displacement (including barrier effects) of marine mammals.	footprint. Desktop data sources will also be used where appropriate. Published correction factors will be applied to determine absolute densities and allow quantification of the potential numbers of animals injured/disturbed during UXO clearance. Agreement will be sought with consultees on the most appropriate densities and correction factors to apply to the assessment.	inform the marine mammal impact assessment. A range of UXO sizes and clearance methodologies will be explored to develop the project description (e.g. largest and most likely size/type of UXO, number of possible UXOs requiring clearance, high order vs low order/low yield clearance methodologies). The modelled sound contours will be applied to the marine mammal density values in the Project Marine Mammal Study Area and used to quantify the number of animals that may experience injury/disturbance effects. Barrier effects (as described above) will also be investigated with respect to modelled contours.
Disturbance to marine mammals from vessel use and other (non-piling) sound-producing activities.	✓	✓	✓	The Impact of vessel use during all phases of the Array Project may result in behavioural disturbance/displacement (including barrier effects) of marine mammals. Other (non-piling) related sound-producing activities could also result in disturbance including construction activities (e.g. drilling, trenching, and rock placement), O&M activities and decommissioning activities.	Aerial surveys to obtain density estimates, where data allow, for each species within the relevant Impact footprint. Desktop data sources will also be used where appropriate. Published correction factors will be applied to determine absolute densities and allow quantification of the potential numbers of animals injured/disturbed during vessel use and other (non-piling) sound-producing activities. Agreement will be sought with consultees on the most appropriate densities and correction factors to apply to the assessment.	Sound emissions from a suite of different vessel types will be modelled to represent the likely range of vessel types to be used at different phases of the Array Project. Similarly, a range of different construction activities e.g. drilling, trenching and rock placement, etc. will be investigated as part of the assessment. A quantitative assessment using agreed species densities will be used to determine the number of animals potentially affected within ranges, as predicted by the underwater sound model. Barrier effects (as described above) will also be investigated with respect to modelled contours.

Impact	Project phase			Basis for Impact	Data collection and analysis required to characterise the baseline environment	Summary of proposed approach to assessment
	C	O	D			
Injury to marine mammals due to collision with vessels.	✓	×	✓	Increased vessel traffic during construction and decommissioning activities may result in collisions with marine mammals.	Baseline characterisation to understand the key marine mammal species within the Project Marine Mammal Study Area using aerial data and desktop study.	Collision risk will be assessed semi-quantitatively. The numbers and types of vessels and round trips will provide a quantitative baseline against existing traffic in the area (using information from the shipping and navigation risk assessment). A qualitative assessment will then be undertaken looking at sensitivities of different species and based on best available literature at the time of writing.
Effects on marine mammals due to changes in prey availability.	✓	✓	✓	Changes in prey abundance and distribution resulting from construction activities, O&M activities and decommissioning activities may impact on the ability of marine mammals to forage in the area.	Baseline characterisation to understand the main prey items of marine mammal species within the Project Marine Mammal Study Area using desktop study.	The assessment will be developed using the information in the Fish and Shellfish EIA which considers a range of different Impacts (e.g. habitat loss, disturbance from underwater sound, increased sedimentation, etc.) on sensitive fish and shellfish receptors (chapter 8.2: Fish and Shellfish Ecology). The assessment will adopt a semi-quantitative approach, describing the magnitude of effects where possible (e.g. extent of habitat loss, range of effects from underwater sound, amount of sediment released, etc.) and consider the possible indirect effects on marine mammals in the context of their wider distribution across the Regional Marine Mammal Study Area. This assessment reflects the 'ecosystem approach' as it considers the implications of changes to habitats and fish and shellfish receptors and what that means for marine mammals.

Impact	Project phase			Basis for Impact	Data collection and analysis required to characterise the baseline environment	Summary of proposed approach to assessment
	C	O	D			
Disturbance to marine mammals from pre-construction site investigation surveys.	✓	×	×	Geophysical surveys in the pre-construction phase may result in behavioural disturbance/displacement of marine mammals.	Aerial surveys to obtain density estimates, where data allows, for each species within the relevant Impact footprint. Desktop data sources will also be used where appropriate. Published correction factors will be applied to determine absolute densities and allow quantification of the potential numbers of animals injured/disturbed during piling. Agreement will be sought with consultees on the most appropriate densities and correction factors to apply to the assessment.	Comparative sound modelling for geophysical activities will be undertaken to inform an assessment of possible effects from elevated levels of underwater sound. Geophysical equipment sound emissions characteristics and survey area details/design will be modelled to determine effect ranges and this information will be combined with the species densities to provide a quantitative assessment of the number of animals potentially affected. If, however, there is no information on the types of geophysical surveys the assessment will adopt a qualitative approach instead discussing ‘typical’ effects based on geophysical survey that have been carried out elsewhere.

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Table 8.20: Impacts proposed to be scoped out of the Array Project assessment for marine mammals

Impact	Basis for impact
Accidental pollution during all phases.	There is a risk of pollution (e.g. fuel or oil) being accidentally released during the construction, O&M and decommissioning phases from sources including vessels/vehicles and equipment/machinery. This may lead to direct mortality of marine mammals or a reduction in prey availability, either of which may affect species' survival rates. However, the risk of such events is managed by the implementation of measures set out in standard post-consent plans (e.g. EMP, including MPCP). These plans include planning for accidental spills, address all potential contaminant releases and include key emergency contact details. They also set out industry good practice and OSPAR, IMO and MARPOL guidelines for preventing pollution at sea. Therefore, the likelihood of an accidental spill occurring is very low and, in the unlikely event that such events did occur, the magnitude of these will be minimised through measures such as MPCP. As such, this Impact will be scoped out of further consideration within the marine mammal EIA chapter.
Increased suspended sediment concentrations (SSC) and associated sediment deposition during all phases.	Disturbance to water quality as a result of construction operations can have both direct and indirect Impacts on marine mammals. Indirect Impacts would include effects on prey species (which is scoped in). Direct Impacts include the impairment of visibility and, therefore, foraging ability, which might be expected to reduce foraging success. Marine mammals are well known to forage in tidal areas where water conditions are turbid and visibility conditions poor. For example, harbour porpoise and harbour seal in the UK have been documented foraging in areas with high tidal flows (e.g. Pierpoint, 2008; Marubini *et al.*, 2009; Hastie *et al.*, 2016); therefore, low light levels, turbid waters and suspended sediments are unlikely to negatively Impact marine mammal foraging success. When the visual sensory systems of marine mammals are compromised, they are able to sense the environment in other ways, for example, seals can detect water movements and hydrodynamic trails with their mystacial vibrissae; while odontocetes primarily use echolocation to navigate and find food in darkness. Whilst elevated levels of SSC arising during construction of the Project may decrease light availability in the water column and produce turbid conditions, the maximum Impact range is expected to be localised with sediments rapidly dissipating over one tidal excursion. In addition, there is a large natural variability in the SSC within the Project Marine Mammal Study Area, so marine mammals living here will be tolerant of any small scale increases, such as those associated with the construction activities. As such, this Impact will be scoped out of further consideration within the marine mammal EIA chapter.
Impact of EMF (from surface laid or buried cables) during the O&M phase.	Based on the data available to date, there are uncertainties of EMF related to marine renewable devices having Impact (either positive or negative) on marine mammals (Copping, 2018). Threshold values for EMF effects are only available for a few species (mainly elasmobranchs), leaving major uncertainties in several important taxonomic groups (cetaceans, pinnipeds, fish, crustaceans, etc.). There is currently no evidence that seals can detect or respond to EMF but some species of cetaceans may be able to detect variations in magnetic fields (Normandeau *et al.*, 2011). To date, the only marine mammal known to show any response to EMF is the Guiana dolphin (*Sotalia guianensis*) which has been shown to possess an electroreceptive system that uses the vibrissal crypts on their rostrum to detect electrical stimuli similar to those generated by small to medium sized fish (Czech-Damal *et al.*, 2013). However, this has not been shown in any other species

Impact	Basis for impact
	of marine mammal and this species does not occur within the Project Marine Mammal Study Area. Furthermore, magnetic fields from alternating current (AC) cables are only detectible within a few metres of the cable and decrease with distance from the cable (Hutchison *et al.,* 2020), so the lack of sensitivity combined with extremely small scale of emissions means there will be no likely effect on marine mammals. As such, this Impact will be scoped out of further consideration within the marine mammal EIA chapter.
Disturbance to marine mammals from operational sound from wind turbine operation during the O&M phase.	The Marine Management Organisation (MMO) (MMO, 2014) review of post-consent monitoring at OWFs found that available data on the operational wind turbine sound from the UK and abroad, in general, showed that sound levels from operational wind turbines are low and the spatial extent of the potential Impact of the operational wind turbine sound on marine receptors is generally estimated to be small, with behavioural response only likely at ranges close to the wind turbines. This is supported by several published studies, which provide evidence that marine mammals are not displaced from operational wind farms. At the Horns Rev and Nysted OWFs in Denmark, long term monitoring showed that both harbour porpoise and harbour seal were sighted regularly within the operational OWFs and, within two years of operation, the populations had returned to levels that were comparable with the wider area (Diederichs *et al.*, 2008). Similarly, a monitoring programme at the Egmond aan Zee OWF in the Netherlands reported that significantly more porpoise activity was recorded within the OWF compared to the reference area during the operational phase (Scheidat *et al.*, 2011). Other studies at Dutch and Danish OWFs (Lindeboom *et al.*, 2011) also suggest that harbour porpoise may be attracted to increased foraging opportunities within operating OWFs. In addition, tagging work by Russell *et al.* (2014) found that some tagged harbour and grey seals demonstrated grid-like movement patterns as these animals moved between individual wind turbines, which is strongly suggestive of these structures being used for foraging. Other reviews have also concluded that operational wind farm sound will have negligible effects (Madsen *et al.*,2006; Teilmann *et al.*, 2006a; Teilmann *et al.*, 2006b; Cefas, 2010; Brasseur *et al.*, 2012). As such, this Impact will be scoped out of further consideration within the marine mammal EIA chapter.
Injury to marine mammals due to collision with vessels during the O&M phase.	The impact pathway of injury to marine mammals due to collision with vessels during the O&M phase will be scoped out of further consideration within the marine mammals EIA chapter. O&M vessels will transit slowly through the Array Project, and the Array Project will adhere to the Scottish Marine Wildlife Watching Code. This approach has been discussed and confirmed by NatureScot via the Morven Offshore Wind Farm Scoping Workshop (18 April 2023, please see Table 8.16).

8.3.7 Designed In Measures and Mitigation

8.3.7.1 As part of the project design process, a number of designed in measures (primary and tertiary) will reduce the potential for impacts on marine mammals (Table 8.21). As there is a commitment to implement these measures, they are considered inherent to the design of the Array Project. The determination of magnitude and significance will assume the implementation of such measures. Some of these measures are considered standard industry practice for this type of development.

8.3.7.2 The requirement for any additional (secondary) mitigation measures will be dependent on the significance of the effects on marine mammals receptors. The requirement for and feasibility of any mitigation measures will be consulted upon with statutory consultees throughout the EIA process.

Table 8.21: Designed in measures and mitigation as part of the Array Project, relevant to Marine Mammals

Reference number	Designed in measures	Justification	Primary or tertiary
MM-40	A soft start procedure (including low hammer initiation and ramp up) be implemented for pile driving to allow additional time for animals to leave the area before full power piling begins. Soft start procedure to be outlined in the CMS.	Soft start will allow time for animals to leave the area prior to full power piling beginning.	P
MM-5	Development of, and adherence to, an EMP, including actions to minimise INNS, MMMP and a MPCP, which will include planning for accidental spills, address all potential contaminant releases and include key emergency details.	Provides a means to ensure the efficient management and communication of commitments made for the management of the potential environmental impacts. The EMP will include a MMMP. The MMMP may include using Marine Mammal Observer(s) and PAM to monitor the mitigation zone (MZ, as determined by the underwater sound modelling) to ensure that animals are not observed within the MZ during piling. ADD may be used if required to deter animals from the MZ. For offshore water quality, measures will be adopted to ensure that the potential for release of pollutants from construction and O&M is minimised. In this manner, the accidental release of contaminants from rigs and supply/service vessels will be strictly controlled, thus providing protection for birds and their prey species across all phases of the development. For benthic subtidal ecology, a MPCP and an INISMP will be provided. The MPCP will include planning for accidental spills, addressing all potential contaminant releases and include key emergency details. The INISMP will include measures for controlling INNS and their impact on fish and shellfish ecology receptors.	T

Further measures

8.3.7.3 Any further mitigation requirements for marine mammals will be dependent on the significance of the effects, as identified during the EIA process and may include consideration of a Noise Abatement System (NAS).

8.3.8 Proposed Assessment Methodology

8.3.8.1 The marine mammal offshore EIA will follow the methodology set out in chapter 4: EIA Methodology of the Scoping Report. Specific to the marine mammal EIA, the following guidance documents will also be considered:

- Guidelines for EcIA in the UK and Ireland. Terrestrial, Freshwater, Coastal and Marine (CIEEM, 2019).
- EU Guidance on Wind Energy Developments and Natura 2000 legislation (European Commission, 2010).
- Oslo Paris Convention (OSPAR) Guidance on Environmental Considerations for OWF Development (OSPAR, 2008).
- Marine mammal sound exposure criteria: Updated scientific recommendations for residual hearing effects (Southall et al., 2019).
- Marine mammal sound exposure criteria: assessing the severity of marine mammal behavioural response to human sound (Southall et al., 2021).
- Statutory nature conservation agency protocol for minimising the risk of injury to marine mammals from piling sound (JNCC, 2010).
- JNCC guidelines for minimising the risk of disturbance and injury to marine mammals whilst using explosives (JNCC, 2021).
- JNCC guidelines for minimising the risk of injury to marine mammals from geophysical surveys (JNCC, 2017).
- Guidance on sound management in harbour porpoise SACs (JNCC, 2020).
- The UK Marine Strategy Regulations 2010 seek to achieve Good Environmental Status (GES) in seas by 2020. The qualitative descriptors for determining GES include "Introduction of energy, including underwater sound, is at levels that do not adversely affect the marine environment."
- Department for Business, Energy and Industrial Strategy (BEIS) Policy Statement Marine environment: unexploded ordnance clearance joint interim position statement (BEIS, 2022).

8.3.8.2 The impact criteria will be based on the most recent and up-to-date scientific research and guidance, while utilising a precautionary approach. Potential impacts arising from underwater sound on marine mammals will be assessed with respect to the potential for injury and behavioural disturbance. The approach to the underwater sound modelling assessment is presented in chapter 7.2: Underwater Sound of the Scoping Report, and Appendix 5: Underwater Sound Methodology Statement and will consist of a detailed quantitative assessment for underwater sound (impulsive and continuous sound sources). The underwater sound model will predict the ranges of effect for both permanent auditory injury and behavioural disturbance for each marine mammal hearing group and for the sound-producing activities. Determination of whether there is a potential for injury or disturbance is based on whether the received sound levels are likely to exceed published impulsive or continuous sound thresholds for different marine mammal hearing groups (see Appendix 7: Marine Mammals Methodology Statement).

8.3.8.3 To quantify the magnitude of effects (injury and disturbance) the area within modelled sound contours will be mapped and combined with baseline density information for key marine mammal species. Densities will either be applied as an average (i.e. multiplying the area of the sound contour by the average density) or the underwater sound contours will be overlaid on a spatial density map and numbers calculated from the underlying grid cells. Densities to be used in the assessment process for assessing potential impacts on marine mammals (including correction factors for availability bias) will be discussed and agreed with stakeholders as part of the Scoping Workshop and Scoping process.

8.3.8.4 To understand the potential long-term effects of underwater sound (primarily piling) the interim Population Consequences of Disturbance Model (iPCoD) model will be used to predict the changes in the population over time for an impacted versus an unimpacted population[9].

8.3.8.5 For the purposes of undertaking the EIA, marine mammal receptors identified as having the potential to occur in the Project Marine Mammal Study Area will be grouped into broad ecological receptor groups, called Important Ecological Features (IEFs), in line with guidelines set out in CIEEM (2019).

[9] The Cumulative Effects Framework will be used if the platform is available at the time of drafting, otherwise the iPCoD model will be used (which in any case underpins the CEF).

These IEFs will be those features against which impacts associated with the construction, O&M and decommissioning phases of the Array Project will be assessed. Criteria defining the value of each IEF will be defined to reflect topic specific interests.

8.3.9 Potential Cumulative Effects

8.3.9.1 For marine mammal receptors, the approach to CEA will be proportionate and include only those sources of underwater sound where there is either a) a potential significant effect or b) a degree of uncertainty with respect to potential population-level effects. Based on experience of OWF assessments in the UK, the marine mammal CEA is likely to include the following sources of underwater sound from other plans and projects:

- pile driving;
- UXO clearance;
- disturbance from vessels activity.

8.3.9.2 A range of realistic scenarios for cumulative underwater sound effects will be developed for the CEA, based on publicly available information, liaison with other developers where possible, as well as consultation with the regulators and stakeholders.

8.3.9.3 The impacts of fishing and existing shipping activity will not be considered in the CEA since these activities occur throughout the baseline and are, therefore, already accounted for in the existing marine mammal baseline characterisation abundance and density estimates.

8.3.9.4 The CEA will follow the approach outlined in chapter 4: EIA Methodology of the Scoping Report. The cumulative effects Study Area (within which the initial screening for other plans/projects is undertaken) will be defined as the Regional Marine Mammal Study Area (see section 8.3.2). Refinements to the plans/projects to be included would be undertaken to short-list projects where a receptor-impact pathway is likely to occur. For example, this may include refinement of the extent over which cumulative projects are screened in (e.g. focus on MUs where these are smaller than the Regional Marine Mammal Study Area such as for grey seal). Refinement would also be made with respect to the type of activity. For example, whilst piling associated with other projects could result in cumulative effects from sound emissions over far distances (tens of kilometres), receptor-impact pathways for disturbance from vessels could be refined for those projects that occur within closer proximity to the Array Project as the effects are typically more localised (hundreds of metres) for each project alone. This allows a more proportionate approach to the CEA. Projects screened into the CEA will be agreed with consultees.

8.3.9.5 To understand the potential effects from piling associated with cumulative projects, the assessment will employ the use of the Cumulative Effects Framework platform if available at the time of drafting the assessment. Otherwise, the iPCoD model will be used in the cumulative assessment. Piling schedules are unlikely to be available for each cumulative project and, therefore, the proposed approach will be to spread the piling days evenly across the known construction period for each project.

8.3.10 Potential Inter-Related Effects

8.3.10.1 The EIA will consider inter-related effects. Inter-related effects relate to effects arising from the Array Project, either across their own phases (project lifetime) or different effects on one receptor in one phase (receptor led). The EIA will consider inter-related effects, in relation to the potential effects of multiple impacts from the construction, O&M and decommissioning phases of the Array Project, affecting one receptor. Inter-related effects are assessed through consideration of all effects on a receptor, considering both spatial and temporal overlaps, with the Array Project. This will ensure that the Array Project as a whole is appropriately considered within the EIA.

8.3.11 Potential Transboundary Effects

8.3.11.1 A screening of transboundary effects has been carried out and is presented in Appendix 1: Transboundary Screening. This screening exercise identified that there is the potential for transboundary effects upon marine mammals due to construction, O&M and decommissioning impacts of the Array Project. These include:

- injury and disturbance from underwater sound generated from piling;
- injury and disturbance from underwater sound generated from UXO clearance;
- injury and disturbance from vessel use and other (non-piling) sound producing construction activities;
- injury due to collision with vessels;
- changes in prey availability;
- disturbance from pre-construction site investigation surveys.

8.3.11.2 It is acknowledged that some marine mammals can travel large distances to forage and consequently the Regional Marine Mammal Study Area extends beyond the Scottish and UK offshore water limits and into the waters of neighbouring EEA States. Therefore, there is the potential for transboundary impacts associated with the Array Project to directly affect Annex II marine mammal species. The potential for transboundary effects will be considered within the EIA.

8.4 Offshore Ornithology

8.4.1 Introduction

8.4.1.1 This chapter of the Scoping Report defines the scope of assessment for offshore ornithology receptors Itconsiders the potential impacts arising from the construction, Operations and Maintenance (O&M), and decommissioning of the Array Project.

8.4.2 Study Areas

8.4.2.1 To inform the Scoping Report (and the EIA), two study areas have been defined for offshore ornithology. These are listed below, with further detail provided in the following sections:

- Offshore Ornithology Study Area (Figure 8.22);
- Offshore Ornithology Regional Study Area.

8.4.2.2 The Offshore Ornithology Study Area, which consists of the Scoping Boundary and a 4 kilometre (km) buffer area, is that covered by baseline digital aerial surveys. A 4km buffer is the standard buffer used for baseline characterisation surveys, when sensitive species that may require a larger buffer (e.g. [Redacted] are considered unlikely to be a key consideration in the assessments required. These surveys provide a site specific baseline, which is used to characterise conditions in relation to ornithology. The baseline surveys enable the identification of key species for consideration in assessments and inform specific analyses required for assessments within the Array Project EIA (e.g. collision risk modelling and displacement analysis). Further detail on these surveys and how these inform specific analysis is provided in section 8.4.4.

8.4.2.3 For each species, a regional study area is defined based on the life history characteristics of the species considering the phenology and associated distribution of birds. These aspects are considered between and within species groups to inform the assessment of effects. The information used to define the regional study area for each species might include consideration of phenology of different life stages, the origin of birds, the individual ZoI for impacts, how these interact with different populations and the extent of cumulative effects.

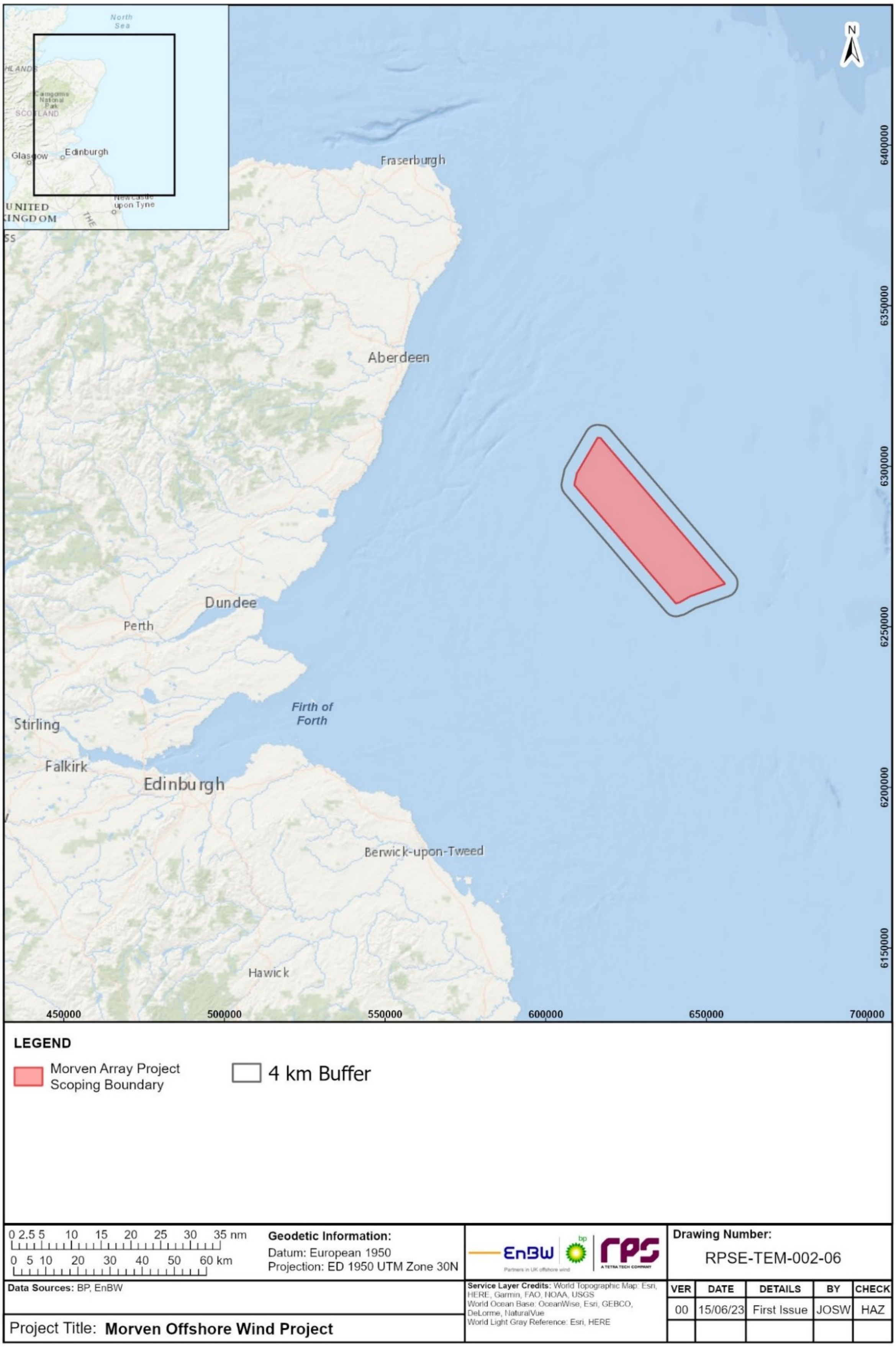


Figure 8.22: Offshore Ornithology Study Area for the Array Project comprising the Scoping Boundary and 4km buffer

8.4.3 Data Sources

Site specific surveys

8.4.3.1 The primary data source to be used to inform the assessments required for offshore ornithology is the digital aerial survey data collected across the Offshore Ornithology Study Area (Scoping Boundary plus a 4km buffer (consistent with the Offshore Ornithology Study Area)) with surveys ongoing since January 2021. For each survey, a series of 30 2km-spaced strip transects have been flown using traditional digital aerial survey techniques. Surveys have been conducted at approximately 400m altitude and at a speed of approximately 120 knots. Data have been collected at 1.5cm ground survey distance with at least 30% coverage of the sea surface, of which 10% was analysed using a grid-based survey design.

8.4.3.2 Data from digital aerial surveys will be analysed using design-based methods and MRSea if this package can be shown to function effectively with the dataset. Abundance metrics will be calculated for all required areas (e.g. Scoping Boundary, Scoping Boundary plus a 2km buffer) and will incorporate the attribution of birds recorded to species groups to species level and availability bias to account for diving birds.

Desk-based literature review

8.4.3.3 An initial desk based review of literature and data sources has been undertaken to support this Scoping Report. This review highlighted the information presented in Table 8.22 to be of relevance to the ornithological interest within the study areas defined in section 8.4.2. This review included information on general seabird ecology, migration behaviour, population sizes and conservation status, particularly on the east coast of Britain, the North Sea, and Britain as a whole.

Table 8.22: Examples of data sources and literature used to inform assessments for the Array Project

Topic	Data sources
Seabird tracking	BirdLife International Seabird Tracking Database; Other relevant data sources will also be explored, such as data owned by private entities (i.e., Universities), organisations (such as the RSPB) and published (i.e., via a Boolean search) and data collected within the Forth and Tay region and at colonies in north-east Scotland.
Bird distribution, migration and foraging movements	Including Stone *et al*. (1995); Wernham *et al.,* (2002); Brown and Grice (2005); Kober *et al*. (2010); Bradbury *et al*. 2014); HiDef Ltd. (2015); Furness (2015); Cleasby *et al*. (2020); Davies *et al*. (2021); Wernham *et al*. (2002); Thaxter *et al*. (2012); Wright *et al*. (2012); Wakefield *et al*. (2013; 2017); Furness *et al*. (2018); Woodward *et al*. (2019); Waggitt *et al.* (2019); Buckingham *et al*. (2022).
Bird breeding ecology, population estimates and demographic rates	Including Cramp and Simmons (1977-94); Del Hoyo *et al*. (1992-2011); Robinson (2005); Mitchell *et al*. (2004); BirdLife International (2004); Holling *et al*. (2011); Musgrove *et al*. (2013); Furness (2015); Horswill *et al*. (2017); Frost *et al*. (2019); JNCC (2020); Birdlife International Seabird Tracking Database.
Information from existing offshore wind projects	A significant amount of information from previous and current development in Scotland and the region relevant to the Array Project can be found on the Scottish Government's Marine Directorate website. Similar information in England will be obtained from the Planning Inspectorate (PINS) website.
Literature pertaining to potential impacts of offshore windfarms on birds	Including Pennycuick (1987); Longcore and Rich (2004); Garthe and Hüppop (2004); Drewitt and Langston (2006); Stienen *et al*. (2007); Alerstam *et al.* (2007); Maclean *et al*. (2009); Speakman *et al*. (2009); Langston (2010); Band (2012); Furness and Wade (2012); Wright *et al*. (2012); Furness *et al*. (2013); Bradbury *et al.* (2014); JNCC *et al.* (2014); Johnston *et al*. (2014a; 2014b); Cook *et al*. (2014; 2018); Wade *et al.* 2016; Webb *et al.* (2016); Dierschke *et al*. (2017); Jarrett *et al*. (2018); Leopold and Verdaat (2018); Skov *et al.* (2018); Mendel *et al*. (2019); Bowgen and Cook (2018); Goodale and Milman (2020).
Designated sites	NatureScot sitelink; Seabird Monitoring Programme database

8.4.4 Consultation

8.4.4.1 The approach to consultation for the Array Project is set out in chapter 5: Consultation Process of the Scoping Report. A summary of the consultation undertaken to date relevant to offshore ornithology is set out in Table 8.23. Further detail on the Scoping Workshop and stakeholder plans for future engagement is set out in chapter 5: Consultation of the Scoping Report, supported by Appendix 3: Array Project Scoping Workshop Information and Appendix 4: Array Project Stakeholder Engagement Plans of the Scoping Report.

Table 8.23: Pre-application consultation relevant to offshore ornithology ecology undertaken to date

Date	Overarching theme	Method of engagement	Stakeholder	Summary of stakeholder feedback	Applicant's response and relevant cross reference
11.08.21	Survey scope	Meeting: Online via Teams	NatureScot Marine Directorate Licensing and Operations Team (MD-LOT) Marine Scotland Science (MSS) Royal Society for the Protection of Birds (RSPB)	Discussed approach to baseline data review and development of offshore survey scopes for offshore ornithology.	Not applicable.
21.10.21	Survey scope	Meeting: Online via Teams	NatureScot MD-LOT MSS RSPB	Follow up consultation from initial meeting on 11 August to share proposed draft survey scopes and get feedback.	Draft reports (baseline data and surveys scopes) shared prior to meeting.
12.09.22 27.01.23	Project information	Meeting: Online via Teams	RSPB	Meetings with RSPB to provide ScotWind projects overview.	Not applicable.
19.04.23	Impact Pathways	Discussion at Scoping Workshop	NatureScot	NatureScot generally in agreement with the impacts the Applicant proposed to scope in or out, but suggested there is consideration of vessel movement.	Agreement noted, and vessel movements to be considered (see Table 8.24).
19.04.23	Impact Pathways (displacement)	Discussion at Scoping Workshop	NatureScot	Confirmed displacement mortality rates contained within NatureScot Guidance Note 8[10].	The displacement and mortality rates provided in NatureScot Guidance Note 8 will be presented in assessments.
19.04.23	Impact Pathways (displacement)	Discussion at Scoping Workshop	NatureScot	If different displacement rates are applied, these should be presented alongside NatureScot guidance rates, with a justification around why other rates are also considered.	Noted, to be considered in the Offshore Ornithology chapter of the EIA Report.
19.04.23	Assessment (Population modelling)	Discussion at Scoping Workshop	NatureScot	NatureScot would not expect different thresholds to be applied for different sites/different colonies to account for feature condition as this would increase complexity.	Noted.

[10] Guidance Note 8: Guidance to support Offshore Wind Applications: Marine Ornithology Advice for assessing the distributional responses, displacement and barrier effects of marine birds

Date	Overarching theme	Method of engagement	Stakeholder	Summary of stakeholder feedback	Applicant's response and relevant cross reference
19.04.23	Impact pathways (habitat loss)	Discussion at Scoping Workshop	RSPB	RSPB recommend that the potential for loss of sandeel habitat is considered, and caution applied with reference to impacts due to loss of habitat as temporary impacts.	This will be considered via indirect temporary habitat loss/disturbance (including indirect effects on prey species) pathway.
19.04.23	Approach (PVA)	Discussion at Scoping Workshop	NatureScot	Advise that Population Viability Analysis (PVA) is undertaken over 25 and 50 years, and then consent period (duration to be outlined in the EIA Report) expected all three in assessment.	Noted, approach to be followed in the Offshore Ornithology EIA Report chapter.
19.04.23	Approach (HPAI)	Discussion at Scoping Workshop	NatureScot	In the absence of guidance on assessment of Highly Pathogenic Avian Influenza (HPAI), suggest sufficient time is scheduled post-scoping opinion but pre-Application to consider potential implications of HPAI.	Noted, further discussion to be held with NatureScot to consider implications of HPAI.
25.05.2023	Impact pathways	Written advice	NatureScot	NatureScot advise that disturbance from vessel traffic may need to be scoped in, depending on the proposed vessel routes. Otherwise, NatureScot agree with the impacts scoped in and out of the assessments.	Potential impacts from vessel traffic is incorporated into "Direct temporary habitat loss/disturbance" and "Indirect temporary habitat loss/disturbance.
25.05.2023	Displacement	Written advice	NatureScot	The displacement mortality rates provided in Guidance Note 8 were reviewed following a displacement workshop undertaken in May 2015 (run by the JNCC). These rates are based on available data and experience across Scottish offshore wind farm casework. As such, they may differ from rates advised by Natural England.	Noted, assessments incorporating these displacement rates will be undertaken to support the the Offshore Ornithology EIA Report chapter.
25.05.2023	Displacement	Written advice	NatureScot	A review of the displacement and mortality rates is being undertaken through the ORJIP QuMR project; however, NatureScot unclear when these will be published. In the meantime, NatureScot expect those rates specified in Guidance Note 8[11] to be used.	Noted, assessments incorporating these displacement rates will be undertaken.

[11] Guidance Note 8: Guidance to support Offshore Wind Applications: Marine Ornithology Advice for assessing the distributional responses, displacement and barrier effects of marine birds

Date	Overarching theme	Method of engagement	Stakeholder	Summary of stakeholder feedback	Applicant's response and relevant cross reference
25.05.2023	Population modelling	Written advice	NatureScot	In general NatureScot prefer not to use a fixed threshold as it risks missing a relatively small effect, which could be significant because of local circumstances. That said, a threshold can be a helpful gauge and, where this is used, it should be set at a precautionary level to minimise this risk. On this basis, NatureScot advise, as per Guidance Note 11[12], that PVAs should be run for populations where the mortality predicted from wind farm effects decreases the adult annual survival rate (thereby increasing mortality) by at least 0.02 percentage point.	Noted, this threshold will be used to identify when PVA is required.
25.05.2023	Population modelling	Written advice	NatureScot	Response to the following queries: • What is the basis for the use a 0.02 percentage point increase in survival rate to identify when PVA is required? • What is NatureScot's position on thresholds to identify when PVA is required when considering the advice from Marine Scotland Science relating to the use of a 0.05 percentage point increase? • Should different thresholds be applied to different colonies to account for feature condition (e.g. favourable, unfavourable)? The MSS threshold referred to within the queries above relates to discussions held during the Berwick Bank pre-application period, which were clarified at the time and subsequently discounted.	Noted, this threshold will be used to identify when PVA is required.

[12] Guidance Note 11: Guidance to support Offshore Wind Applications: Marine Ornithology - Recommendations for Seabird Population Viability Analysis (PVA).

Date	Overarching theme	Method of engagement	Stakeholder	Summary of stakeholder feedback	Applicant's response and relevant cross reference
25.05.2023	Population modelling	Written advice	NatureScot	Feature condition undoubtedly provides useful context particularly in relation to the level of precaution that might be needed. However, NatureScot would caution against screening out the need for a PVA in light of favourable condition or increasing population trends, particularly given the uncertainty around baseline populations and potential for ongoing mortality associated with highly pathogenic avian influenza. Additionally, the threshold applied is considered appropriate for sites and species that are in favourable condition. NatureScot may further consider unfavourable sites and species for which the predicted mortality increase is less than 0.02 percentage points.	Noted, this threshold will be used to identify when PVA is required.
25.05.2023	Population modelling	Written advice	NatureScot	PVA should be carried out for: • 25 years (and the intended lease period if different); • 50 years.	Noted, PVA will incorporate these timeframes.
25.05.2023	Cumulative	Written advice	NatureScot	NatureScot requested that the Applicant email question (what are the other agreed approaches when considering cumulative impacts in the non-breeding season?) with more narrative on the specifics so that NatureScot can answer.	Actioned in email addressed to NatureScot dated 19 June 2032.
25.05.2023	Publications	Written advice	NatureScot	Guidance Note 10[13] on apportioning should be available in several months.	Noted.
25.05.2023	Publications	Written advice	NatureScot	Publication of the update to Feature Activity Sensitivity Tool (FeAST) has been delayed and NatureScot do not have any further information on this at this time.	Noted.
25.05.2023	Publications	Written advice	NatureScot	NatureScot are currently reviewing the recently published Ozsanlav-Harris *et al.* (2022) report and will provide an update on our recommended avoidance rates once these are discussed and agreed across all of the Statutory Nature Conservation Bodies (SNCB). The update to our guidance note is likely to be in the next few months, but NatureScot will advise each development on any change as they scope before our guidance note is updated.	Noted, paper is now published.

[13] Guidance Note 10: Guidance to support Offshore Wind Applications: Marine Ornithology Advice for apportioning impacts to breeding colonies

Date	Overarching theme	Method of engagement	Stakeholder	Summary of stakeholder feedback	Applicant's response and relevant cross reference
25.05.2023	Publications	Written advice	NatureScot	The potential collision risk to migratory species should be assessed qualitatively with reference to the survey results and the existing strategic level report by WWT and MacArthur Green (2014). Please note this is an update to the SOSS-05 project (Wright *et al.* 2012/SOSSMAT) referenced in workshop.	Noted, approach will follow WWT Consulting and MacArthur Green (2014) or mCRM if available.
25.05.2023	Publications	Written advice	NatureScot	An updated review of migratory routes and vulnerabilities across the UK is currently being prepared on behalf of Marine Directorate. This work also includes development of a stochastic migration CRM tool (known as mCRM) to enable quantitative assessment of risks to migratory Special Protection Area (SPA) species including swans, geese, divers, seaduck and raptors. The updated review and its associated mCRM tool should be available imminently and as such NatureScot wish to see it used in the forthcoming assessment.	Noted, approach will follow WWT Consulting and MacArthur Green (2014) or mCRM if available.
25.05.2023	Year 1 baseline report	Written advice	NatureScot	Following our high level review of the Year 1 digital aerial survey (Ref: P00005975, dated March 2023), NatureScot notice a high proportion of birds have not been identified to species level. NatureScot request that further information is provided to clarify this including how typical this is this compared to other surveys elsewhere, so that NatureScot can better understand the drivers for these proportions.	Data has been reviewed to aid improvement of unidentified birds, as shown in Appendix 8 - Offshore Ornithology Yield 1 data (15 months).
25.05.2023	Year 1 baseline report	Written advice	NatureScot	In general NatureScot are satisfied with the survey design and NatureScot will provided further advice once the full 2 year digital aerial survey campaign has been analysed and written up.	Noted.
25.05.2023	Highly Pathogenic Avian Influenza (HPAI)	Written advice	NatureScot	There is no specific guidance on HPAI yet. HPAI should be considered in the application in a qualitative sense. To achieve the best possible assessment in the EIA and RIAA, NatureScot advise that Morven have an open dialogue with NatureScot on HPAI throughout the pre-application period.	Noted.

8.4.5 Baseline Environment

8.4.5.1 Extensive ornithological surveys (e.g. Carter *et al.,* 1993; Stone *et al*., 1995), associated reviews (e.g. Stienen *et al.,* 2007; Kober *et al.,* 2010; Bradbury *et al.,* 2014 and Waggitt *et al.,* 2019) as well as data collected to support previous environmental assessments for OWF have shown that the North Sea is an important area for seabirds. The mix of birds present indicates that the Offshore Ornithology Study Area is probably used at different times by birds (i) overwintering in the area; (ii) foraging from nearby breeding coastal colonies; and (iii) on post-breeding dispersal, migration and pre-breeding return.

8.4.5.2 The Array Project is located in the northern North Sea, within the southeast of Scotland sea area, as defined in JNCC (1997). This area contains areas that are of significant importance for seabirds, although these are located further inshore than the Array Project. There is a considerable amount of information available that provides wider context of the baseline environment, including survey programmes conducted for previous OWF projects (e.g. the existing Forth and Tay OWF developments).

8.4.5.3 The Scoping Boundary is located outside of the area for which considerable existing data is available. To inform the baseline characterisation for offshore ornithological receptors, site specific baseline ornithological data collection has been undertaken, commencing in January 2021.

8.4.5.4 In the breeding season, the southeast of Scotland sea area is internationally important for at least 13 breeding seabird species (northern gannet (*Morus bassanus)*, Manx shearwater (*Puffinus puffinus*), cormorant (*Phalacrocorax carbo*), shag (*Phalacrocorax aristotelis*), herring gull (*Larus argentatus*), lesser black-backed gull (*Larus fuscus*), black-legged kittiwake (*Rissa tridactyla*), common tern (*Sterna hirundo*), Arctic tern (*Sterna paradisaea*), Sandwich tern (*Sterna sandvicensis)*, common guillemot (*Uria aalge*), razorbill (*Alca torda*) and Atlantic puffin (*Fratercula arctica*) (JNCC, 1997; NatureScot, 2020).

8.4.5.5 The eastern coast of Scotland contains a number of important seabird breeding colonies including the St Abb's Head to Fast Castle SPA and the Forth Islands SPA. In addition, a large sea area extending outwards from the Firth of Forth is designated as the Outer Firth of Forth and St Andrews Bay Complex SPA to protect breeding and non-breeding seabird populations that utilise the marine area. In the non-breeding season, the area continues to support many of the aforementioned seabird species in addition to wintering populations of a further eleven species [Redacted] [Redacte long-tailed duck (*Clangula hyemalis),* [Redacted] common gull (*Larus canus*), little gull (*Hydrocoloeus minutus*), black-headed gull (*Chroicocephalus ridibundus*), [Redacted] [Redacted] and common eider (*Somateria mollissima*)), although the distribution of these species tends to be more coastal (NatureScot, 2020).

8.4.5.6 Due to the seabird interest in the region, it has been the focus of extensive research both on the seabirds themselves and the factors that attract them. Such research has identified that the shallow sand banks of Wee Bankie and Marr Bank, which are both located approximately 40km to the west of the Offshore Ornithology Study Area, are important as feeding areas for seabirds in the region (Daunt *et al*., 2011; Wanless *et al*., 1998). A review of evidence undertaken to identify areas supporting important seabird aggregations identified a number of areas within the Firth of Forth and Outer Firth of Forth and moving offshore in a northeast direction (Cook *et al.,* 2015). No important bird areas overlap with the Offshore Ornithology Study Area. Areas 32 (approximately 30km to the south-east) and 40 (small overlap in the north-east of the Offshore Ornithology Study Area) are those closest to the offshore ornithology Study Area. They were identified due to aggregations of guillemot (Area 32) and puffin (Area 40) in the non-breeding season.

8.4.5.7 Reviews of available tracking data suggest that the Offshore Ornithology Study Area may be utilised by gannet from the Forth Islands SPA (Wakefield *et al.,* 2013), kittiwake from Fowlsheugh SPA (Bogdanova *et al.,* 2022) and other local colonies to a moderate extent (overlap with 50-75% utilisation distribution contours in Cleasby *et al.,* 2020) and guillemot and razorbill from local colonies to a lesser extent (overlap with the 95% utilisation distribution contour) (Cleasby *et al.,* 2020).

8.4.5.8 To date, information from 15 months of monthly digital aerial surveys (January 2021 to March 2021) has been analysed. A summary of key information is presented in Table 8.24.

Table 8.24: Abundance, distribution and behaviour of seabird species in the Offshore Ornithology Study Area as recorded during digital aerial surveys between January 2021 and March 2022 (APEM, 2023)

Species	Abundance (raw counts)	Distribution	Behaviour
Black-legged kittiwake (*Rissa tridactyla*)	Peak abundance occurred in June (891 birds) with over 100 birds also recorded in March and September.	No obvious pattern in abundance across all months, although in those months with the highest abundance, birds generally distributed in the centre of the survey area.	More birds generally recorded in flight. Birds regularly recorded flying in a southwesterly direction.
Common gull (*Larus canus*)	Only 2 birds recorded during surveys, one in November and one in December.	Both birds recorded in the southern half of the survey area.	Both birds recorded flying in a southwesterly/west-southwesterly direction.
Great black-backed gull (*Larus marinus)*	Recorded in 8 surveys with fewer than 10 birds in all surveys.	Records scattered through the survey area.	Mainly flying but records of birds sitting on the water occurring as well. No obvious trend in flight direction.
Herring gull *(Larus argentatus*)	Recorded in 5 surveys with only the July survey recording more than 3 birds.	Majority of birds were distributed in the northern section of the survey area including during the July survey.	Birds recorded mainly sitting. Birds recorded flying predominantly in a southwesterly direction.
Lesser black-backed gull (*Larus fuscus*)	Only 1 bird was recorded across all surveys.	Single bird located in the northern section of the survey area.	Bird recorded sitting on the water only.
Arctic tern (*Sterna paradisaea*)	Birds recorded in May and July surveys only and in small numbers (less than 5 birds).	No obvious trends in distribution.	Birds recorded flying in a southeasterly direction.
Great skua (*Stercoraius skua)*	Single birds recorded in the August, September and October surveys.	No obvious trends in distribution.	Birds recorded flying in September and October, bird sitting on water in August. Birds recorded flying in westerly and northwesterly directions.
Arctic skua (*Stercorarius parasiticus)*	Only 2 birds recorded during surveys both in September.	All recordings of birds were distributed in the eastern section of the survey area.	Birds recorded flying in both a west-northwesterly and an east-northeasterly direction.
Common guillemot (*Uria aalge*)	Peak abundance (over 3,500 birds) occurred in July with over 1,000 birds in June and September.	Records scattered throughout the survey area, with higher densities distributed mainly in the northern section of the survey area.	Birds recorded mainly sitting and when recorded flying, flying in several directions.
Razorbill (*Alca torda*)	Peak abundance occurred in July with over 1,000 birds recorded. All other months (except June) recorded less than 100 birds.	Records were scattered throughout the survey area, with higher densities distributed mainly in the northern section of the survey area.	Birds recorded mainly sitting and when recorded flying, flying predominantly in north northeasterly and southwesterly directions.
Black guillemot (*Cepphus grille)*	1 bird recorded in May.	Single bird present in the western region of the survey area.	Birds were only recorded sitting on the water.
Atlantic puffin (*Fratercula arctica*)	Peak abundance occurred in September with fewer than 50 birds recorded in all other months except May and August.	Records were scattered throughout the survey area, with higher densities distributed in the central section of the survey area.	All but 5 birds recorded sitting on the water. Flying birds recorded flying in northerly and southerly directions.

[Redacted]

Northern fulmar (*Fulmarus glacialis*)	Peak abundance (185 birds) occurred in November with over 100 birds also in August and October.	Records were scattered throughout the survey area, with higher densities distributed in the	Equally distributed between birds flying and birds sitting on the water throughout the survey period with birds flying in all directions.

Species	Abundance (raw counts)	Distribution	Behaviour
		central/southern section of the survey area.	
Sooty shearwater (*Ardenna grisea*)	2 birds recorded in September	Birds recorded in the central west section of the survey area.	2 individuals flying a southwesterly direction.
Manx shearwater (*Puffinus puffinus*)	Birds recorded in the May (1 bird), June (2 birds) and July (49 birds) surveys.	Birds were primarily distributed in the northern section of the survey area.	Almost equally distributed between birds flying and birds sitting on the water throughout the survey period with birds flying a west-southwesterly direction.
Northern gannet (*Morus bassanus*)	Peak abundance (262 birds) occurred in July with over 100 birds also recorded in the June, September and October surveys.	Records were distributed across the survey area.	Majority of birds recorded in flight with predominant flight directions to the southwest and northeast.

8.4.5.9 Baseline characterisation surveys are not designed to capture the ephemeral movements of migratory seabird and waterbird species. The surveys are restricted to daylight hours, progress relatively quickly through the survey area and occur once a month. However, a number of migratory species were recorded during surveys including Arctic tern, great skua, Arctic skua, storm petrel species, sooty shearwater, [Redacted]) and unidentified wader and thrush species with less than 10 individuals of each species across all surveys.

8.4.5.10 The HRA Screening exercise undertaken for the Array Project will consider the potential for LSE on ornithological features of European sites comprising the UK National Site Network for the purposes of informing a RIAA. Potential impact(s) on Valued Ornithological Receptors (VORs) that are also qualifying features at those European sites identified in the HRA Screening Report will be considered in the EIA for the Array Project, with the potential impacts on sites that are part of the UK's National Site Network considered in the RIAA.

8.4.5.11 Without prejudice to the HRA screening exercise, it is anticipated that SPAs for which there may be LSE will include sites that are in relatively close proximity to the Array Project. In addition, there are European sites that, despite being located further from the Array Project, have qualifying features with extensive foraging ranges or may interact with the Array Project outside of the breeding season via dispersal or migratory movements. Although the Array Project may not be within the foraging range of features during the breeding season, the Array Project may contribute to impacts with other plans or projects during the non-breeding season. Full consideration of all potential impact pathways and LSE will be provided in the HRA screening report.

8.4.6 Potential Impacts of the Array Project

8.4.6.1 A range of potential impacts on ornithological features have been identified, which may occur during the construction, O&M and decommissioning phases of the Array Project. The impacts that have been scoped into the EIA are outlined in Table 8.24, together with a description of any additional data collection (e.g. site specific surveys) and supporting analyses (e.g. modelling) that will be required to enable a full assessment. The identification of impact pathways has taken into account recent guidance from NatureScot (2023a).

8.4.6.2 On the basis of the offshore ornithology information currently available and the description of Array Project outlined in chapter 3: Project Description of the Scoping Report, a number of impacts are proposed to be scoped out of the assessment for offshore ornithology. These impacts are outlined, together with a justification for scoping them out, in Table 8.25.

Table 8.25: Potential impacts associated with the Array Project on ornithological receptors

Project phase refers to construction (C), O&M (O) and decommissioning (D)

Impact	Project phase in which impact pathway exists			Description	Proposed approach to baseline characterisation and analysis required for assessment
	C	O	D		
Direct temporary habitat loss/disturbance	✓	✓	✓	The impact of construction/decommissioning activities and activities associated with the maintenance of operational wind turbines, such as increased vessel activity and underwater sound, may result in direct disturbance of birds from important feeding and roosting areas. Impact could occur within the Scoping Boundary and an associated buffer and between the Scoping Boundary and relevant points along the coastline (based on worst assumptions for vessels associated with the Array Project) and could occur throughout the lifetime of Array Project.	The vulnerability of each species to this impact will be informed by standard literary sources (e.g. Wade *et al.* 2016). The magnitude of impacts will be informed by baseline survey data and the spatial extent of disturbance.
Indirect temporary habitat loss/disturbance	✓	✓	✓	The impact of construction activities such as increased vessel activity and underwater/above water noise may result in disturbance or displacement of prey from important bird feeding areas. In addition, changes in hydrological energy, wave exposure, suspension of sediments, etc., arising from the physical presence of structures in the marine environment or the activities associated with installing such structures in the marine environment may also displace prey. Impact could occur within the Scoping Boundary and an associated 15km buffer (based on tidal extent) and between the Scoping Boundary and relevant points along the coastline based on worst case assumptions for vessels associated with the Array Project. Impact could occur throughout the lifetime of the Array Project.	The assessment conclusions from the Benthic Subtidal Ecology and Fish and Shellfish Ecology chapters of the EIA Report will be used to inform the assessments for offshore ornithological receptors. The vulnerability of each species to this impact will be informed by standard literary sources (e.g. Wade *et al.,* 2016).
Collision with rotating blades	×	✓	×	Mortality arising from birds colliding with wind turbine structures. Impact is restricted to the Scoping Boundary and will occur in the O&M phase of the Array Project.	See section 8.4.8: Collison risk modelling.
Displacement	×	✓	×	The impact of physical displacement from an area due to the physical presence of wind turbines and other ancillary structures during the operational phase of the development may result in effective habitat loss and reduction in species survival rates and fitness. Impact could occur within the Scoping Boundary and an associated buffer during the operational phase of the Array Project.	See section 8.4.8: Displacement analysis.
Barrier effects	×	✓	×	The impact of barrier effects caused by the physical presence of wind turbines and ancillary structures may prevent clear transit of birds between foraging and breeding sites and whilst on migration.	The vulnerability of each species to this impact will be informed by standard literary sources (e.g. Wade *et al.,* 2016). The magnitude of impacts will be informed by

Impact	Project phase in which impact pathway exists			Description	Proposed approach to baseline characterisation and analysis required for assessment
	C	O	D		
				Additional energetic costs incurred may reduce fitness and survival rate of a species.	baseline survey data and desktop review focusing on knowledge of species' foraging and migratory behaviour alongside studies on barrier effects.
Attraction to light	✓	✓	✓	The impact of attraction to lit structures by migrating birds in particular may cause disorientation, reduction in fitness and possible mortality.	The vulnerability of each species to this impact will be informed by standard literary sources (e.g. Wade *et al.,* 2016). The magnitude of potential impacts will be considered qualitatively.

Table 8.26: Impacts proposed to be scoped out of the Array Project assessment for Offshore Ornithology

Impact	Basis for impact
Permanent habitat loss	Permanent habitat loss associated with the presence of wind turbines and other ancillary structures on the seabed. This is a permanent impact that occurs during the construction phase and is restricted to the footprint of physical structures. Area affected by permanent habitat loss due to the presence of the Array Project components on the seabed is considered to be negligible when compared to the foraging areas that may be utilised by bird species that may interact with the Array Project.
Accidental pollution	The impact of pollution including accidental spills and contaminant releases associated with maintenance or supply/service vessels which may lead to direct mortality of birds or a reduction in prey availability. With the implementation of the designed in measures described in section 8.4.7, it is considered that the likelihood of any impact occurring is very low. As part of recent Scoping Opinions for projects in Scottish waters, the Scottish Ministers have agreed that this impact should be scoped out (see for example Marine Scotland, 2022). For projects where assessments have been undertaken it has been agreed that through the implementation of such measures that complete mortality within the equivalent extent of a windfarm's array plus buffer area is considered very unlikely to occur, and a major incident that may impact any species at a population level is considered very unlikely.

8.4.7 Designed In Measures and Mitigation

8.4.7.1 As part of the project design process, a number of designed in measures (primary and tertiary) will reduce the potential for impacts on offshore birds (see Table 8.27). As there is a commitment to implement these measures, they are considered inherent to the design of the Array Project. The determination of magnitude and significance will assume the implementation of such measures. Some of these measures are considered standard industry practice for this type of development.

8.4.7.2 The requirement for any additional (secondary) mitigation measures will be dependent on the significance of the effects on offshore ornithology receptors. The requirement for and feasibility of any mitigation measures will be consulted upon with statutory consultees throughout the EIA process.

Table 8.27: Designed in measures of the Array Project, relevant to offshore ornithology

Reference Number	Measures adopted	Justification	Primary or tertiary
MM-6	Relevant HSE procedures will be followed for all activities during construction, O&M, and decommissioning periods.	When using consumables that are potentially hazardous, or refuelling offshore, relevant HSE procedures will be followed, with the objective of mitigating any risk of pollution incidents.	T
MM-5	Development of, and adherence to, an EMP, including actions to minimise INNS, MMMP and a MPCP, which will include planning for accidental spills, address all potential contaminant releases and include key emergency details.	Provides a means to ensure the efficient management and communication of commitments made for the management of the potential environmental impacts. The MMMP may include using marine mammal observers and PAM to monitor the mitigation zone (MZ, as determined by the underwater sound	P

Reference Number	Measures adopted	Justification	Primary or tertiary
		modelling) to ensure that animals are not observed within the MZ during piling. ADD may be used if required to deter animals from the MZ. For offshore water quality, measures will be adopted to ensure that the potential for release of pollutants from construction, and operations and maintenance, is minimised. In this manner, the accidental release of contaminants from rigs and supply/service vessels will be strictly controlled, thus providing protection for birds and their prey species across all phases of the development. For benthic subtidal ecology, an MPCP will include planning for accidental spills, addressing all potential contaminant releases and include key emergency details. The INISMP will include measures for controlling INNS and their impact on fish and shellfish ecology receptors.	
MM-7	A Navigation Safety and Vessel Management Plan will be developed, which will determine vessel routing to and from construction areas and ports to avoid areas of high risk.	The Navigation Safety and Vessel Management Plan will confirm the types and numbers of vessels engaged in the Array Project and consider vessel coordination, including indicative transit route planning. The plan will minimise disturbance of seabird species by avoiding bird populations and/or migratory routes, and allow the identification of standard routes.	P
MM-34	Appropriate lighting and marking of wind turbines and offshore substation platforms will be established in accordance with Civil Aviation Authority (CAA) regulations and guidance (CAP 393, The ANO) and in accordance with the CAA and the Defence Infrastructure Organisation (DIO), which is are responsible for the safeguarding of Ministry of Defence (MoD) assets. Secured through the development of, and adherence to, a Lighting and Marking Plan (LMP).	Up to date guidance on turbine lighting will be followed when producing the LMP to address aviation, shipping and ornithological requirements.	T
MM-43	A minimum lower blade tip height clearance of 30 m LAT will be used for the Array Project.	This minimum blade tip height clearance is considered appropriately conservative so as to minimise the risk of bird collisions in the specific circumstances of the Scoping Boundary.	P

8.4.8 Proposed Assessment Methodology

8.4.8.1 The offshore ornithology EIA Report chapter will follow the methodology set out in chapter 4: Environmental Impact Assessment Methodology of the Scoping Report. The approach to the offshore ornithology modelling assessment is presented in Appendix 9: Offshore Ornithology Methodology Statement of the Scoping Report.

8.4.9 Potential Cumulative Impacts

8.4.9.1 The cumulative assessment will consider the same impacts, as outlined in Table 8.25 for the assessment of the Array Project alone. The range of other projects considered will be dependent on the particular impact as well as each species' population distribution and behaviour (e.g. foraging range and non-breeding season distribution). The cumulative assessment will also consider other types of development or activities taking place in the wider area such as:

- aggregate extraction, dredging and spoil disposal;
- navigation and shipping;
- potential port and harbour developments;
- existing and potential future oil and gas installations.

8.4.9.2 Guidance provided in the Collaborative Offshore Wind Research into the Environment (COWRIE) report "Developing Guidance on Ornithological CEA for Offshore Wind Farm Developers" (King *et al*., 2009) will inform the assessment of cumulative impacts within the EIA process.

8.4.9.3 A Cumulative Effects Framework tool is currently under development by the Marine Directorate. This will include information required for cumulative assessment for offshore ornithological receptors and the applicability of this tool to the cumulative assessment required for the Array Project will be considered if the tool becomes available in a timeframe that allows for incorporation into the assessments required for the Array Project.

8.4.10 Potential Inter-Related Effects

8.4.10.1 The EIA will consider inter-related effects. Inter-related effects relate to effects arising from the Array Project, either across their own phases (project lifetime) or different effects on one receptor in one phase (receptor led). The EIA will consider inter-related effects, in relation to the potential effects of multiple impacts from the construction, O&M and decommissioning phases of the Array Project, affecting one receptor. Inter-related effects are assessed through consideration of all effects on a receptor, considering both spatial and temporal overlaps, with the Array Project. This will ensure that the Array Project as a whole is appropriately considered within the EIA.

8.4.11 Potential Transboundary Effects

8.4.11.1 There is potential for seabird populations located outside of UK territorial waters, including those that are qualifying features of designated sites, to interact with the Array Project, primarily in the non-breeding season. Such impacts could occur during the construction, O&M or decommissioning phases of the Array Project. A screening of transboundary effects has been carried out and is presented in Appendix 1: Transboundary Screening.

8.4.11.2 Existing published information on seabird foraging behaviour, based on foraging range (e.g. Woodward *et al*., 2019), will be used to determine transboundary connectivity in the breeding season. In the non-breeding season, it is possible that birds from non-UK seabird colonies may occur within the Scoping Boundary and, therefore, there may be impacts on birds originating from non-UK colonies. These potential impacts will be addressed in the EIA.

8.4.11.3 A wide variety of published material will be used to determine transboundary connectivity for migratory species, including: Wright *et al.* (2012), WWT Consulting and MacArthur Green (2014), Furness (2015) and species-specific tracking information.

9 Offshore Wind Farm: Human Environment

9.1 Commercial Fisheries

9.1.1 Introduction

9.1.1.1 This chapter of the Scoping Report identifies the commercial fisheries of relevance to the Array Project and considers the potential impacts arising from the construction, Operations and Maintenance (O&M) and decommissioning phases of the Array Project.

9.1.2 Study Area

9.1.2.1 The Array Project is located in International Council for the Exploration of the Sea (ICES) Division VIb (Central North Sea). ICES Divisions are separated into statistical rectangles, used in this baseline for the analysis and visualisation of fisheries data. The Commercial Fisheries Study Area is defined by the ICES rectangles within which the Array Project is situated. As shown in Figure 9.1, these are as follows:

- ICES rectangle 42E8, in which the western section of the Scoping Boundary is located.
- ICES rectangle 42E9, in which the majority of the Scoping Boundary is located.
- ICES rectangle 41E9, in which a small section of the southern-most part of the Scoping Boundary is located.

9.1.2.2 The Commercial Fisheries Study Area shown in Figure 9.1 will be used to identify fisheries active in areas relevant to the Array Project. This study area was selected as the potential impacts arising from the Array Project are considered to be associated to the three ICES rectangles listed above.

9.1.2.3 Where appropriate, reference is also made to the waters surrounding these three rectangles in order to provide wider area context, particularly in respect of cumulative effects assessments.

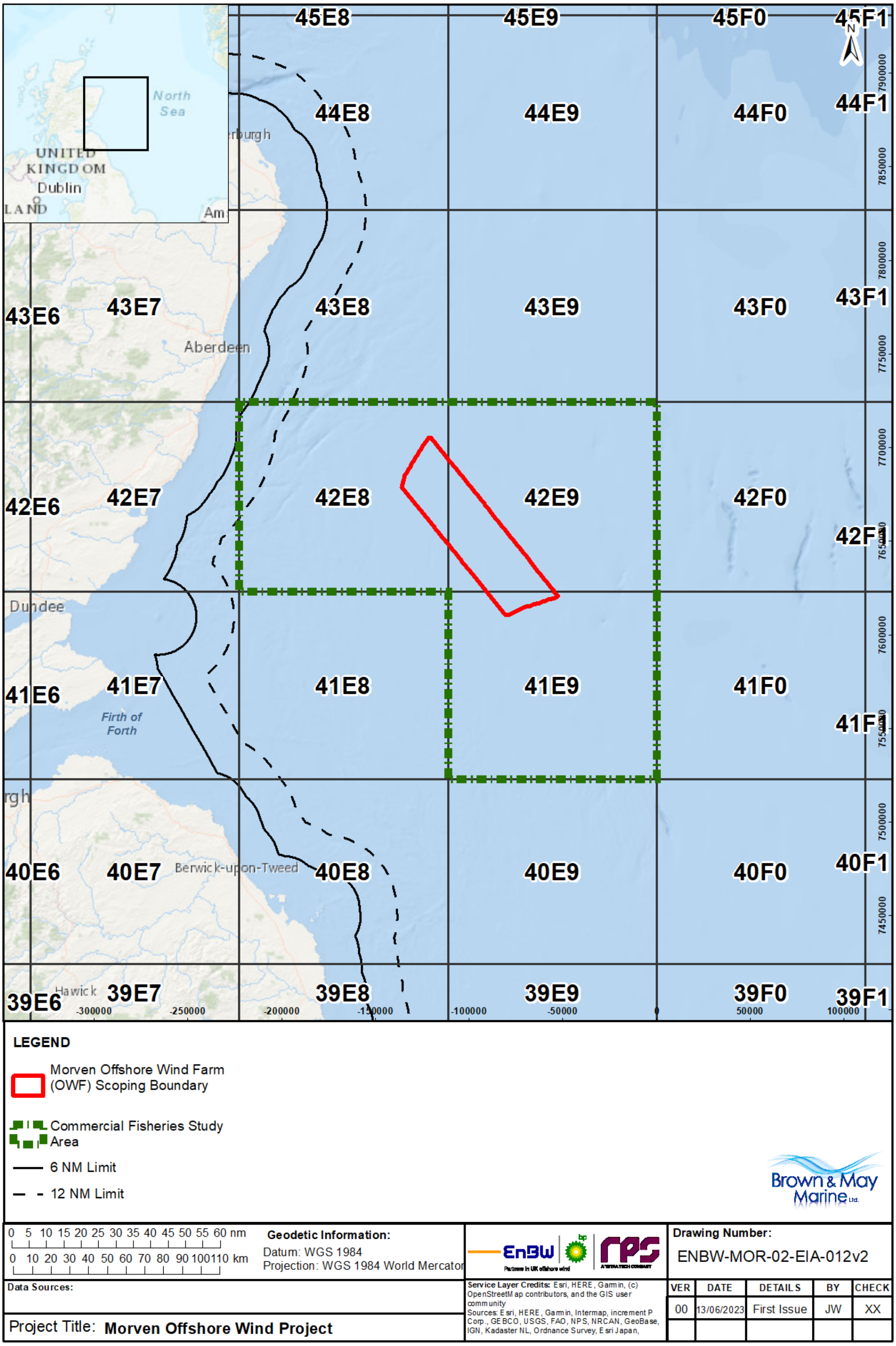


Figure 9.1: Commercial Fisheries Study Area

9.1.3 Data Sources

9.1.3.1 The sources of information presented in Table 9.1 will be used to inform the commercial fisheries baseline.

9.1.3.2 To date, no site specific surveys have been carried out to inform the commercial fisheries baseline. However, the findings from the benthic site specific survey, used to inform the benthic sub-tidal and intertidal ecology baseline, will be applied. Furthermore, information obtained for the fish and shellfish ecology assessment will be used. Automated Identification System (AIS) data will be plotted in the Shipping and Navigation Chapter of the EIA Report to give resolution to where fishing practices are. Vessel tracking plots obtained from the SWFPA will also be included in the EIA Report spatial analysis of fishing grounds as appropriate.

Table 9.1: Data sources used to inform the commercial fisheries assessment

Source	Summary
Marine Scotland/Marine Management Organisation (MMO) Fisheries data (2011 – 2021)	Surveillance sightings in UK Exclusive Economic Zone (EEZ) waters are recorded by fishery protection aircraft and surface craft to police fisheries legislation. This dataset provides information on fishing vessels observed within UK waters, regardless of vessel size, nationality and fishing activity.
Marine Scotland/MMO Fisheries Landings Data (2017 – 2021)	Provides information on landings of UK registered vessels by species and method as an annual average. The dataset includes UK fishing vessels of all sizes. The data is an average from 2017 to 2021.
European Commission's (EC) Scientific, Economic and Technical Committee on Fishing (STECF) (2010-2014)	Belgian landings by weight (tonnes) per ICES rectangle. This data is derived from official logbook databases for all vessels of ten metres and over.
European Commission's (EC) Scientific, Economic and Technical Committee on Fishing (STECF) (2012-2016)	French landings by weight (tonnes) per ICES rectangle. This data is derived from official logbook databases for all registered vessels 10m and over and from monthly declaration forms for fishing effort and catches per species by dates, locations and gears. Logbooks are not mandatory for registered vessels under ten metres, but they are covered by monthly declarative forms.
European Commission's (EC) Scientific, Economic and Technical Committee on Fishing (STECF) (2017-2021)	Dutch landings by weight (tonnes) per ICES rectangle. This data is derived from official logbook databases for all registered vessels ten metres and over and from monthly declaration forms for fishing effort and catches per species by dates, locations and gears.
EMODnet	Publicly available AIS records of fishing vessels, plotted to illustrate the combined tracks of fishing vessels of all nationalities.
Marine Scotland/MMO Fisheries Activity Data (2012 -2021)	The dataset provides summaries of fishing activity for UK commercial fishing vessels of 15m and over in length that are deemed to have been fishing over a specified time period. Vessel Monitoring System (VMS) data is provided using a grid based on 0.05-degree sub-rectangles. The data included in this report is presented in terms of fishing value (£).
Flanders Research Institute Agricultural, Fisheries and Food Research (ILVO) (2010 -2014)	Belgian VMS data combined with logbook data presented at 1/16th of an ICES rectangle scale; therefore, the data is of a lesser resolution than the UK VMS. Includes information for Belgian registered vessels of 12m and over in length. The data included in this report is presented as an annual average in terms of fishing value (€). More recent VMS data for Belgian vessels is not publicly available. The data presented in this report is part of Brown & May's in-house historic fisheries data sets for Belgian vessels, obtained via data request to Flanders Research Institute for Agricultural, Fisheries and Food Research (ILVO). More recent data has been requested from ILVO, but has not yet been received.

Source	Summary
Institute for Marine Resources and Ecosystem Studies (IMARES), Wageningen University and Research (2017-2021)	Dutch VMS data combined with logbook data presented at 1/16th of an ICES rectangle scale, therefore, this data is of a lesser resolution than the UK VMS. Includes information for Dutch registered vessels of 12m and over in length. The data included in this report is presented as an annual average in terms of fishing value (€).

9.1.3.3 It should be noted that the quantitative datasets identified in Table 9.1 may not capture all fishing activity in the Commercial Fisheries Study Area For instance, the VMS datasets only cover vessels ≥12m (ILVO and IMARES data) or ≥15m (MMO data) in length. However, other published data does provide a useful insight into fishing activity undertaken in inshore areas (e.g. Regional Inshore Fisheries Groups (RIFGs) publications and surveillance data). Consultation will be undertaken with relevant fisheries stakeholders in order to corroborate the findings of desk-based baseline data analysis and to provide insight into specific fishing grounds and the activity of any vessels regularly operating in the area under consideration. Consultation will also be important to obtain details and specifications for vessels and gears active in the Commercial Fisheries Study Area

9.1.3.4 Variations and trends in commercial fisheries activity are an important aspect of the baseline assessment. The time period considered in this scoping exercise (2012 to 2021) witnessed two events that significantly affected commercial fishing, i.e. the COVID-19 pandemic and the results of the United Kingdom's (UK) withdrawal from the European Union (EU) and its Common Fisheries Policy.

9.1.3.5 Following withdrawal from the EU, the UK and the EU have agreed a Trade and Cooperation Agreement (TCA), applicable on a provisional basis from 1 January 2021. The TCA sets out fisheries rights and confirms that from 1 January 2021, and during a transition period until 30 June 2026, UK and EU vessels will continue to access respective EEZs, i.e. 12-200nm, to fish.

9.1.3.6 Existing baseline data captures potential changes in commercial fisheries activity resulting from the COVID-19 pandemic, which will be included but appropriately qualified. Changes in fishing patterns resulting from the withdrawal of the UK from the EU and the Common Fisheries Policy would be expected in future data sets.

9.1.3.7 The assessment will further consider likely changes to the future baseline, primarily associated with withdrawal from the EU, including potential changes in quota allocations.

9.1.4 Consultation

9.1.4.1 The approach to consultation for the Array Project is set out in chapter 5: Consultation Process of the Scoping Report. A summary of the consultation undertaken to date relevant to commercial fisheries is set out in Table 9.2. Further detail on the Scoping Workshop and stakeholder plans for future engagement is set out in chapter 5: Consultation Process of the Scoping Report, supported by Appendix 3: Array Project Scoping Workshop Information and Appendix 4: Array Project Stakeholder Engagement Plans of the Scoping Report.

Table 9.2: Pre-application consultation relevant to commercial fisheries undertaken to date

Date	Overarching theme	Method of engagement	Stakeholder	Summary of stakeholder feedback	Applicant's response and relevant cross reference
18.04.23	Baseline data	Scoping Workshop session	SWFPA	Requested that data analysis be extended to 10 years to capture Brexit and COVID-19 pandemic influences.	The Applicant will review the potential to extend the period of VMS data.
18.04.23	Baseline characterisation	Scoping Workshop session	SFF	Mentioned that they object to the application of the International Cable Protection Committee standards on cables.	The assessment will refer to the ICPC guidance. Further clarification to be provided by the Applicant for the fishing industry.
18.04.23	Baseline data	Scoping Workshop session	SWFPA	Mentioned that they have access to plots of tracked data in the area that can be shared.	The Applicant has requested that this information is shared.
18.04.23	Assessment approach	Scoping Workshop session	SPFA	Suggested logbooks be used in analysis to discern the costs of displacement.	The Applicant has requested that this information is shared.
18.04.23	Consultation approach	Scoping Workshop session	SFF	Confirmed that public workshops should be held, where charts are shared for annotation and information gathering.	The Applicant confirmed this approach going forward.
18.04.23	Consultation approach	Scoping Workshop session	SFF	Stated that industry needed to know if fishing could continue within the Array Project.	The Applicant will provide clarification on this query in due course.
18.04.23	Assessment approach	Scoping Workshop session	SPWA	Asked if assessment would include cumulative impacts by other offshore energy projects.	The Applicant can confirm that this will be considered within the CEA.
21.06.23	Baseline data	Email	SWFPA	Provision of overview of SWFPA vessel tracking plots for vessels within the Array Project.	Vessel tracking plots obtained from the SWFPA to be included in the EIA Report spatial analysis of fishing grounds as appropriate.

9.1.5 Baseline Environment

9.1.5.1 Based on a review of the data sources outlined in Table 9.1, it is apparent that the Commercial Fisheries Study Area supports a range of commercial fishing activities such as potting, scallop dredging and demersal trawling.

9.1.5.2 No site specific surveys have been undertaken to inform the Scoping Report in relation to commercial fisheries. However, extensive consultation with fisheries stakeholders is planned to be undertaken to help inform the commercial fisheries baseline within the EIA Report. The benthic site specific survey data and shipping and navigation survey data will also be referenced as part of the EIA and integrated into the characterisation of the commercial fisheries baseline, as appropriate.

9.1.5.3 Table 9.3 gives an indication of the nationalities active in the Commercial Fisheries Study Area. The majority of activity appears to be undertaken by UK vessels, with negligible evidence of vessels from other countries.

9.1.5.4 The landings value data presented in Figure 9.2 suggests that dredging activity is concentrated in an area (the western sector of ICES rectangle 42E8), away from the Scoping Boundary. Whilst levels of potting are moderate, they are concentrated within a corner of rectangle 42E8.

9.1.5.5 In comparison to rectangle 42E8, there is minimal activity in the other two rectangles that comprise the Commercial Fisheries Study Area. That which does occur appears to be mostly demersal trawling, likely for Nephrops (Figure 9.3).

9.1.5.6 Figure 9.4 gives an indication of the distribution of values of fishing by all UK methods combined as derived from integrating VMS data with landings value data. This suggests that neither rectangle 42E9 nor rectangle 41E9 represents an area of high value for the UK fishing fleet. Conversely, rectangle 42E8 appears to represent an area of moderate value but with activity concentrated to the east of the Scoping Boundary. Figure 9.3 and Figure 9.4 suggest that the Scoping Boundary is located within an area sustaining low levels of commercial fishing activity.

Table 9.3: Surveillance sightings in the Commercial Fisheries Study Area by nationality and method (2011 – 2020) (Source: MMO, 2021)

Nationality	Vessel Type	Total Over 10 Years
United Kingdom	Scallop Dredger	212
	Potter	23
	Demersal Stern Trawler	15
	Pair Trawler (All)	13
	Bottom Seiner (Anchor/Danish/Fly/Scots)	5
	Trawler (All)	1
	Other Dredges (Including Mussel)	3
	Long Liner	2
	UK Total	274
Belgium	Scallop Dredger (French/Newhaven)	2
	Belgium Total	2
France	Trawler (All)	1
	France Total	1
Netherlands	Trawler (All)	1
	Netherlands Total	1

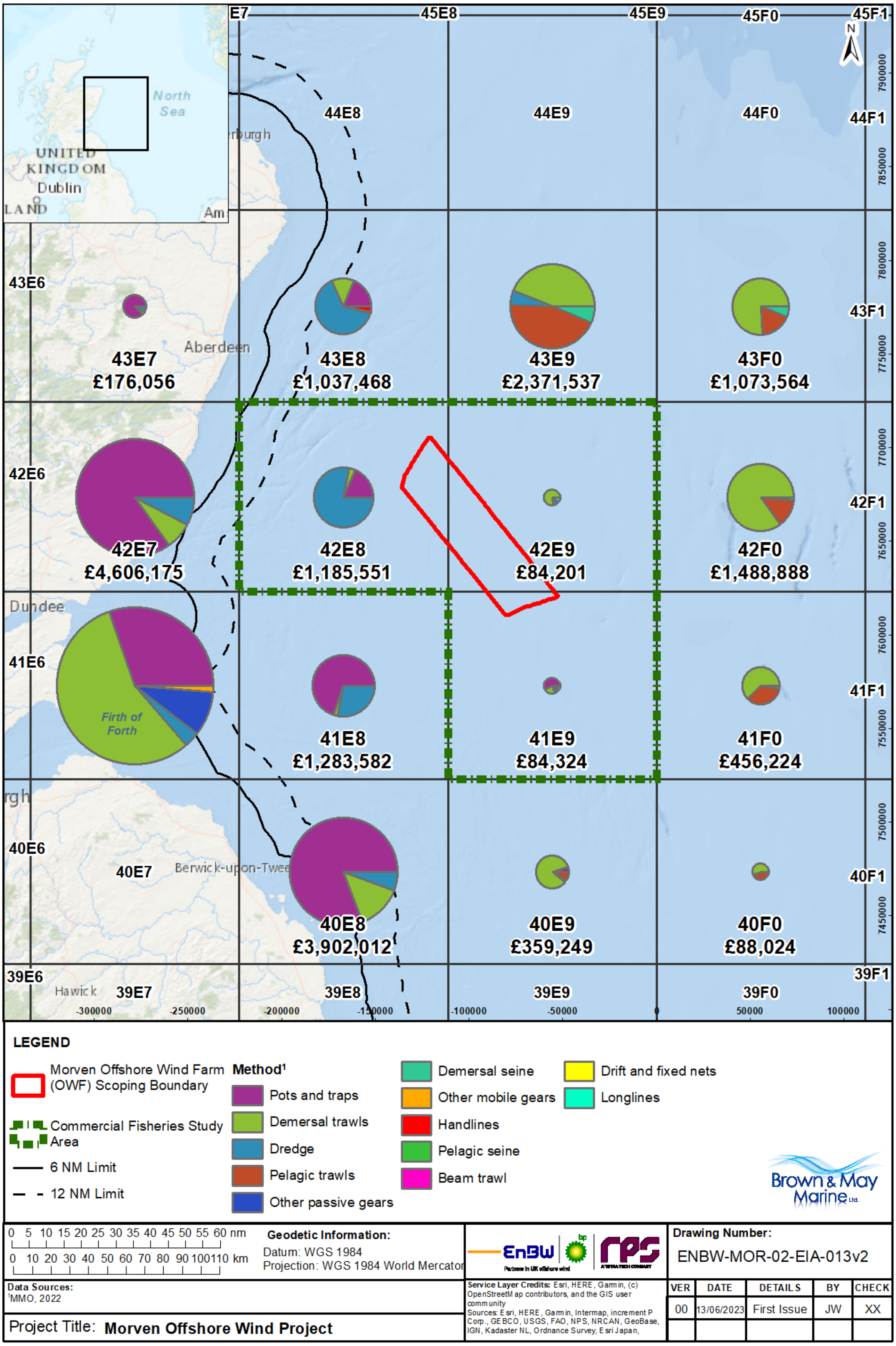


Figure 9.2: UK Landings (£) by Method in the Commercial Fisheries Study Area (Average 2017-2021)

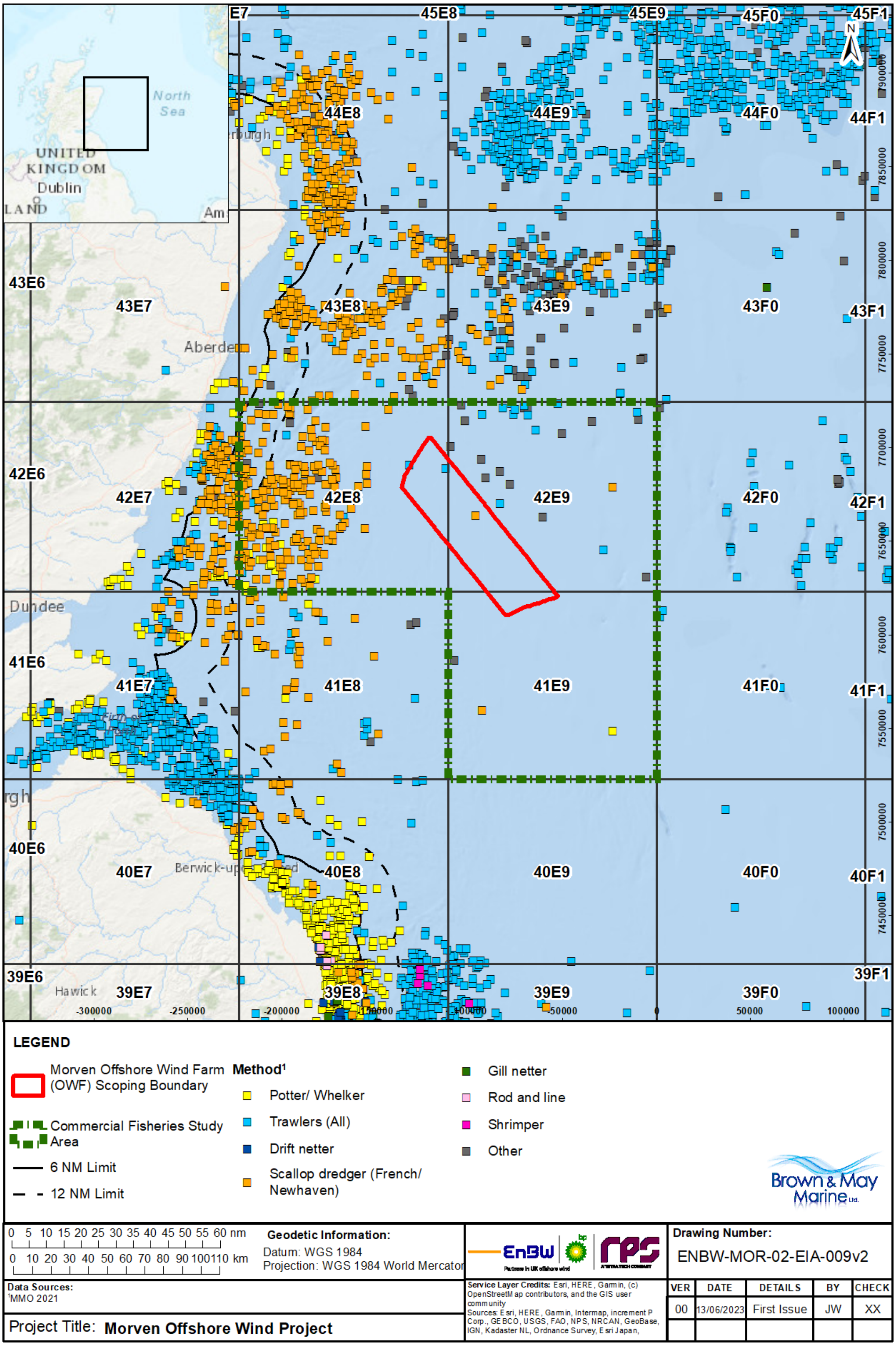


Figure 9.3: Surveillance Sightings by Method (2011 – 2020)

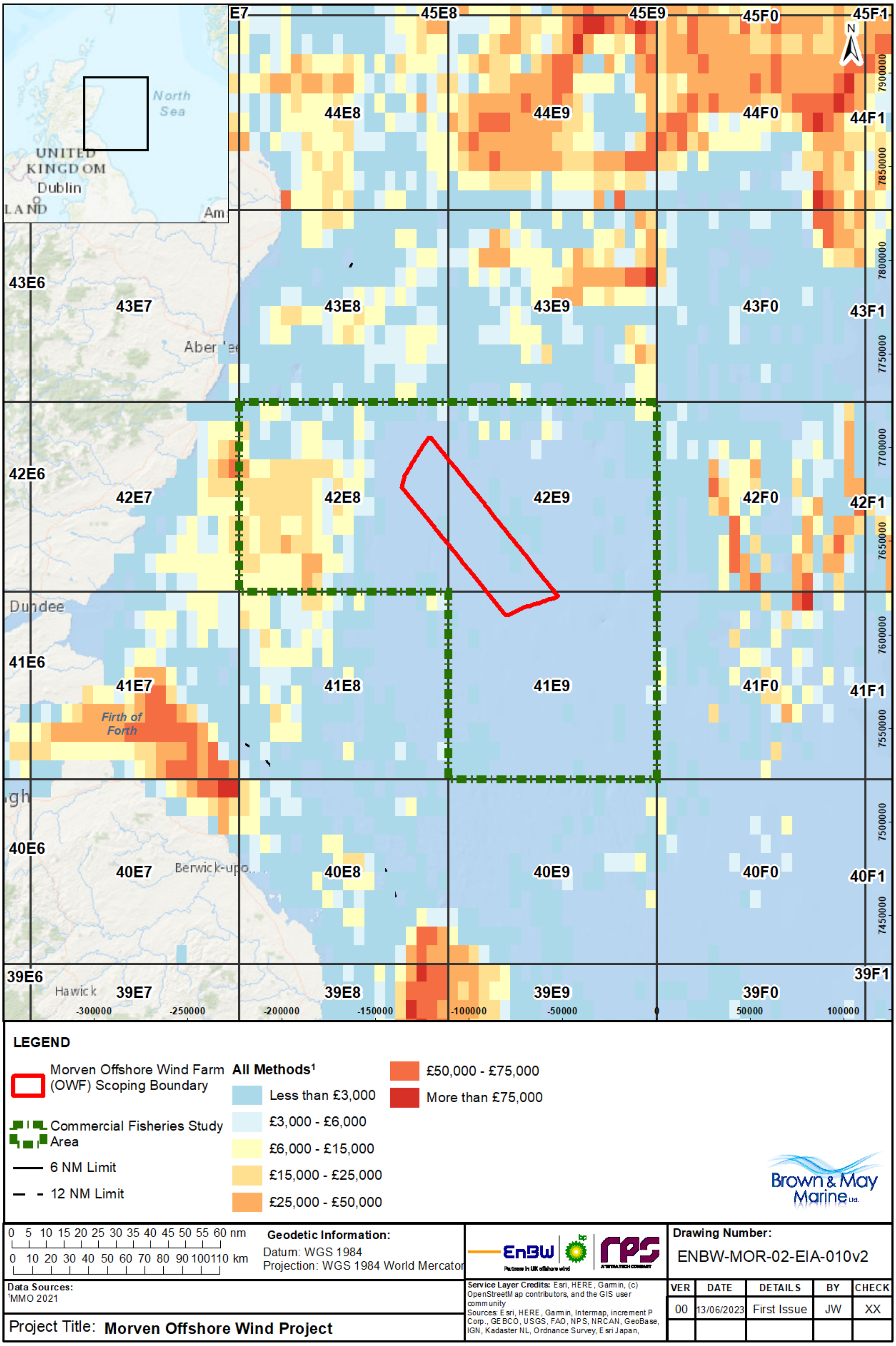


Figure 9.4: UK VMS (£) All Methods Combined (Average 2016 – 2020)

9.1.6 Potential Impacts of the Array Project

9.1.6.1 A range of potential impacts on commercial fisheries has been identified, which may occur during the construction, O&M and decommissioning phases of the Array Project.

9.1.6.2 The impacts that have been scoped into the assessment are outlined in Table 9.4 together with a description of any additional data collection (e.g., site specific surveys) and supporting analyses (e.g. modelling) that will be required to enable a full assessment of the impacts. Each impact will be assessed for each relevant fleet/fishery active in the Commercial Fisheries Study Area.

9.1.6.3 No potential impacts to commercial fisheries have been scoped out of the assessment.

Table 9.4: Impacts proposed to be scoped into the Array Project assessment for commercial fisheries

C = Construction phase, O = O&M phase, D = Decommissioning phase

Impact	Project phase			Justification	Data collection and analysis required to characterise the baseline environment	Summary of proposed approach to assessment
	C	O	D			
Temporary loss or restricted access to fishing grounds	✓	✓	✓	The presence of construction and decommissioning works, as well as the associated safety zones, can result in temporary loss of or restricted access to existing fishing grounds. For the purposes of the EIA, temporary is defined as up to five years.	Analysis of currently available fisheries data and information (see Table 9.1), as well as consultation with fisheries stakeholders.	No modelling will be required to assess this impact. A qualitative assessment will be undertaken to assess the significance of the impact. Additionally, scouting surveys for the presence of static gears may be required.
Displacement of fishing activity into other areas	✓	✓	✓	Loss of or restricted access to fishing grounds may result in fishers being temporarily displaced into other areas throughout the construction and O&M stages, as well as the decommissioning works.	Analysis of currently available fisheries data and information (see Table 9.1), as well as consultation with fisheries stakeholders.	No modelling will be required to assess this impact. A qualitative assessment will be undertaken to assess the significance of the impact. Additionally, scouting surveys for the presence of static gears may be required.
Interference with fishing activity	✓	✓	✓	Interference/conflict with fishing activity may arise as a result of transiting construction and O&M vessels, as well as decommissioning vessels.	Analysis of vessel traffic data, currently available fisheries data and information (see Table 9.1), as well as consultation with fisheries stakeholders.	No modelling will be required to assess this impact. A qualitative assessment will be undertaken to assess the significance of the impact. Additionally, scouting surveys for the presence of static gears may be required
Increased steaming distances and times	✓	✓	✓	Increases in steaming times and distances may arise due to the presence of safety zones around construction, operation, and decommissioning works, as well as any major maintenance works.	Analysis of currently available fisheries data and information (see Table 9.1), as well as consultation with fisheries stakeholders.	No modelling will be required to assess this impact. A qualitative assessment will be undertaken to assess the significance of the impact.

Impact	Project phase			Justification	Data collection and analysis required to characterise the baseline environment	Summary of proposed approach to assessment
	C	O	D			
					Outcomes of the shipping and navigation impact assessment.	Additionally, scouting surveys for the presence of static gears may be required.
Snagging risk – loss or damage to fishing gear	✓	✓	✓	The presence of: • pre-commissioned infrastructure associated with Array Project (i.e. foundations, cables awaiting burial or protection); • infrastructure associated with Array Project (i.e. foundations, cable protection); • decommissioning related infrastructure; • other seabed obstacles (i.e. accidentally dropped objects, etc.); • potentially pose a snagging risk to fishing vessels and could result in loss or damage to fishing gear; • snagging risk may also have implications with regard to the safety of fishing vessels and crews. The safety risks associated with potential gear snagging will be assessed together with navigational risks under shipping and navigation (see chapter 9.2: Shipping and Navigation of the Scoping Report).	Analysis of currently available fisheries data and information (see Table 9.1), as well as consultation with fisheries stakeholders.	No modelling will be required to assess this impact. A qualitative assessment will be undertaken to assess the significance of the impact. Additionally, scouting surveys for the presence of static gears may be required.
Long term loss or restricted access to fishing grounds	×	✓	×	As above	Analysis of currently available fisheries data and information (see Table 9.1), as well as	No modelling will be required to assess this impact. A qualitative assessment

Impact	Project phase			Justification	Data collection and analysis required to characterise the baseline environment	Summary of proposed approach to assessment
	C	O	D			
					consultation with fisheries stakeholders.	will be undertaken to assess the significance of the impact. Additionally, scouting surveys for the presence of static gears may be required.
Impacts on commercially exploited species	✓	✓	✓	As described in chapter 8.2: Fish and Shellfish Ecology of the Scoping Report)		

9.1.7 Designed In Measures and Mitigation

9.1.7.1 As part of the project design process, a number of designed in measures (primary and tertiary) will reduce the potential for impacts on commercial fisheries. The type of mitigation measures that are being proposed are presented in Table 9.5. The requirement for and feasibility of any mitigation measures will be consulted upon with statutory consultees throughout the EIA process.

9.1.7.2 Any further mitigation requirements for commercial fisheries will be dependent on the significance of the effects, as identified during the EIA process. This will be a two-stage process whereby an initial assessment will be undertaken and if required the appropriate mitigation will be considered, after which a subsequent assessment would be undertaken.

Table 9.5: Designed in measures of the Array Project, relevant to Commercial Fisheries

Reference number	Measures Adopted	Justification	Primary or tertiary
MM-1	Scour protection will be used around offshore structures as set out in chapter 3: Project Description of the Scoping Report.	There is the potential for scouring of seabed sediments to occur due to interactions between Metocean regime (wave, sand and currents) and foundations or other seabed structures. This scouring can develop into depressions around the structure. The use of scour protection around offshore structures and foundations will be employed, as described in detail in chapter 3: Project Description. The scour protection has been included in the modelled scenarios used within the assessment of effects to protect foundations from the effects of scour.	P
MM-2	Development and adherence to a Cable Plan.	There is a potential for cable exposure to occur due to interactions between Metocean regime (wave, sand and currents). Sediment transportation can lead to exposure of cables and infrastructure, although the use of a target cable burial depth alongside the cable installation strategy should provide sufficient depth to avoid exposure. The Cable Plan will outline the technical specifications of the cables used in the Array Project and describe the installation methodology; also includes cable protection to be installed.	P
MM-3	Any additional cable protection involving rock protection will be evaluated and will follow industry standard guidelines in terms of slope angle and rock grading. Secured through the OMP.	Cables to be reburied to where possible; cable protection to be reinstated as necessary and provide information on the cable reinstallation process and how specific activities will be controlled.	T
MM-7	A Navigation Safety and Vessel Management Plan will be developed, which will determine vessel routing to and from construction areas and ports to avoid areas of high risk.	The Navigation Safety and Vessel Management Plan will confirm the types and numbers of vessels engaged in the Array Project and consider vessel coordination, including indicative transit route planning. The plan will minimise disturbance of seabird species and allow the identification of standard routes.	T

Reference number	Measures Adopted	Justification	Primary or tertiary
MM-11	Promulgation of information as required (e.g., Notices to Mariners, Kingfisher Bulletin).	To maximise awareness of the Array Project, allowing other sea users and marine infrastructure receptors to plan in advance to ensure project vessels are suitably managed to minimise the likelihood of involvement in incidents and maximise the ability to assist in the event of a third-party incident.	T
MM-18	Ongoing consultation with the fishing industry and appointment of a Fisheries Liaison Officer (FLO).	To provide a point of contact to liaise and engage with the fishing industry.	T
MM-19	Adherence to good practice guidance with regards to fisheries liaison (e.g. FLOWW, 2014;2015).	To facilitate productive relationships with fisheries stakeholders and the implementation of an evidence-based approach to mitigation.	P
MM-20	Development of a Fisheries Management and Mitigation Strategy (FMMS). The FMMS will include details on the measures that are proposed to be implemented to minimise impacts on commercial fishing.	To detail the Applicant's proposed approach to fisheries liaison and facilitate co-existence.	T
MM-21	Participation in the Forth and Tay Commercial Fisheries Working Group (FTCFWG) and liaison with Fisheries Industry Representatives (FIRs), as appropriate.	To provide a forum for information sharing and discussion of key issues with fisheries stakeholders and other developers in the region.	P
MM-22	Consideration of the principle of cooperation agreements in instances where static gears may be required to be temporarily relocated.	To minimise potential adverse interactions between the Array Project and fishing activities.	P
MM-37	Appropriate marking on UKHO Admiralty charts.	To maximise awareness of the Array Project, allowing other vessels, sea users and marine infrastructure receptors to plan their activities in advance.	T
MM-39	Use of guard vessels and Offshore Fisheries Liaison Officers (OFLOs), as appropriate.	To facilitate engagement with fisheries stakeholders during work and minimise potential conflict between the Array Project and fishing activities.	P
MM-44	Undertaking of post-lay and cable burial inspection surveys and monitoring. Secured through the Cable Plan, as part of the OMP.	To minimise the risks of interactions with cable protection, anchor or fishing gear interaction with subsea cables.	P

9.1.8 Proposed Assessment Methodology

9.1.8.1 The assessment methodology for the commercial fisheries EIA will be as set out in chapter 4: EIA Methodology of the Scoping Report. Further detail on the assessment methodology is provided in Appendix 10: Commercial fisheries: Methodology Statement of the Scoping Report. Additionally, the following guidance will also be considered.

- FLOWW Best Practice Guidance for Offshore Renewables Developments: Recommendations for Fisheries Liaison: Fishing Liaison with Offshore Wind and Wet Renewables Group (FLOWW, 2014).

- FLOWW Best Practice Guidance for Offshore Renewables Developments: Recommendations for Fisheries Disruption Settlements and Community Funds. Fishing Liaison with Offshore Wind and Wet Renewables Group (FLOWW, 2015).
- Best practice guidance for fishing industry financial and economic impact assessments. UK Fisheries Economics Network (UKFEN, 2012).
- Options and opportunities for marine fisheries mitigation associated with wind farms (Blyth-Skyrme, 2010)
- Fishing and Submarine Cables - Working Together (ICPC, 2009).
- Spatial Squeeze in Fisheries - Final Report ABPmer no. R3900 June 2022.
- Good Practice Guidance for Assessing Fisheries Displacement (Marine Scotland, 2022).

9.1.8.2 Additionally, the commercial fisheries EIA for the Array Project will consider any new guidance, or any updates to existing guidance as appropriate. Opinions arising from stakeholder engagement will also be considered.

9.1.9 Potential Cumulative Impacts

9.1.9.1 There is potential for cumulative impacts on commercial fisheries to occur as a result of offshore projects or activities occurring simultaneously in waters surrounding the project. The cumulative effects assessment will follow the approach outlined in chapter 4: EIA Methodology.

9.1.9.2 Projects or activities included in the cumulative assessment may vary depending on the fishery under consideration (e.g., depending on the extent of grounds and operational range of the vessels involved).

9.1.9.3 All impacts scoped into the impact assessment for the project (Table 9.4) will be assessed in the CEA.

9.1.10 Potential Inter-Related Effects

9.1.10.1 The EIA will consider inter-related effects. Inter-related effects relate to effects arising from the Array Project, either across their own phases (project lifetime) or different effects on one receptor in one phase (receptor-led). The EIA will consider inter-related effects, in relation to the potential effects of multiple impacts from the construction, O&M and decommissioning phases of the Array Project, affecting one receptor. Inter-related effects are assessed through consideration of all effects on a receptor, considering both spatial and temporal overlaps, with the Array Project. This will ensure that the Array Project as a whole is appropriately considered within the EIA.

9.1.11 Potential Transboundary Impacts

9.1.11.1 A screening of transboundary impacts has been carried out and is presented in Appendix 1: Transboundary Screening. This screening exercise identified that there is potential for transboundary impacts on commercial fisheries due to construction, operational and maintenance, and decommissioning impacts of the Array Project. These include the potential effects on Belgian, French and Dutch commercial fishing fleets across all impact categories assessed, including exclusion from the Scoping Boundary and displacement effects.

9.1.11.2 Transboundary impacts are taken as being related to whether vessels from other nationalities have rights to fish in a given area.

9.2 Shipping and Navigation

9.2.1 Introduction

9.2.1.1 This chapter of the Scoping Report identifies the elements of shipping and navigation relevant to the Array Project and considers the potential impacts arising from the construction, O&M and decommissioning of the Array Project.

9.2.2 Study Area

9.2.2.1 The information presented within this chapter has been compiled with reference to a study area defined as a 10nm buffer around the Scoping Boundary, as presented in Figure 9.5 (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 turbines, OSP and inter-array and inter-connector cables associated with the Array Project. The proposed Shipping and Navigation Study Area was agreed on during consultation with the MCA, the NLB, and the UK CoS on 16 December 2022.

9.2.2.2 Where appropriate, features outside of the Shipping and Navigation Study Area, such as navigational features, the cumulative screening of other offshore developments within a 50nm buffer of the Array Project (a standard value within the industry) and taking international ports and operators into consideration, will be considered in the Navigational Risk Assessment (NRA). The CEA screening will include the Transmission Project and its features, due to it being consented separately from the Array Project.

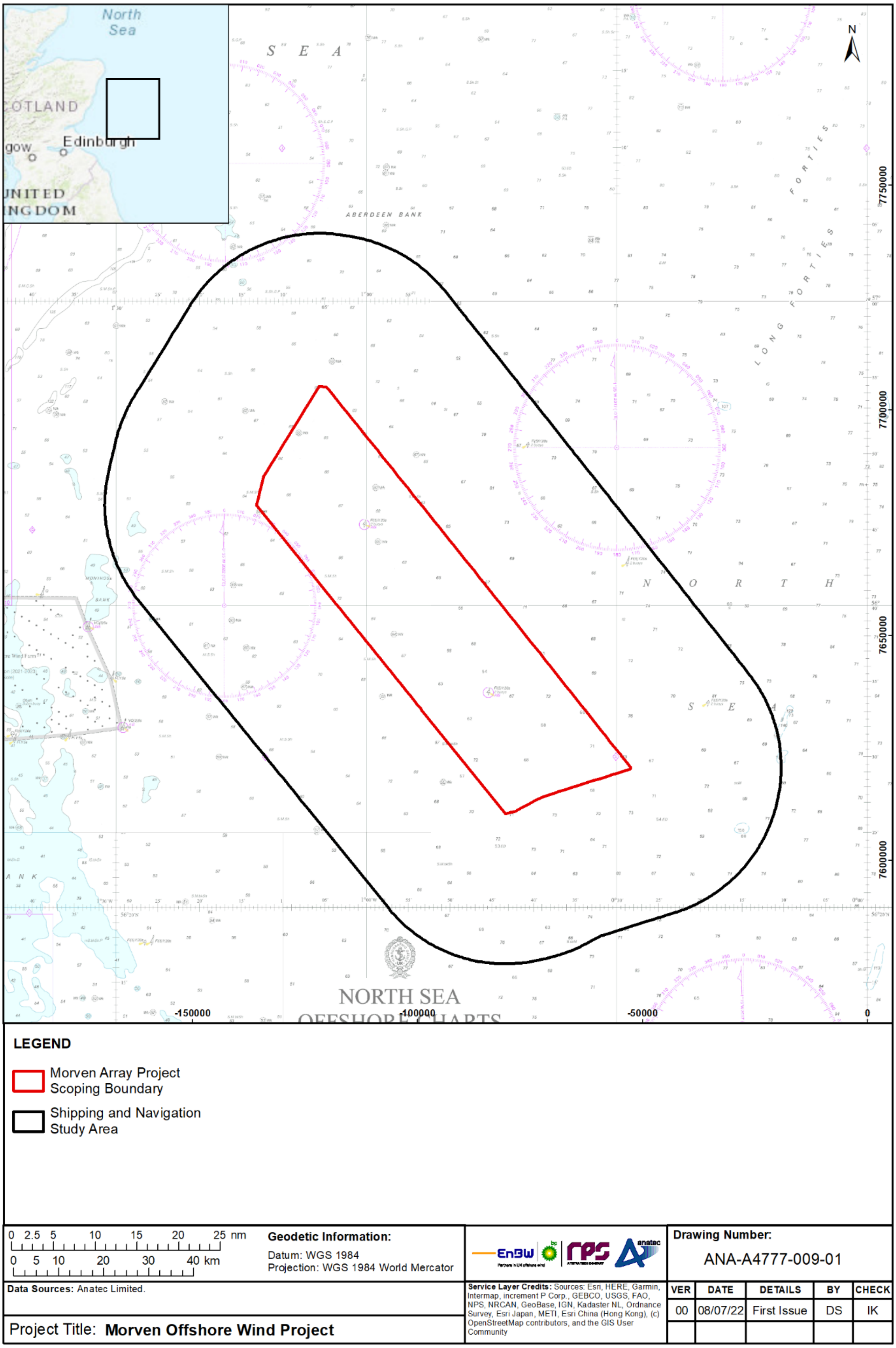


Figure 9.5: Overview of the Shipping and Navigation Study Area including the Scoping Boundary

9.2.3 Data Sources

9.2.3.1 The data sources that have been used to inform the shipping and navigation chapter of the Scoping Report are presented in Table 9.6.

Table 9.6: Summary of data sources used for the shipping and navigation baseline

Title	Source	Year	Author
Automatic Identification System (AIS) data for the period 21 November – 05 December 2022	Anatec Ltd	2022	Anatec Ltd
United Kingdom Hydrography Office (UKHO) Admiralty Charts 273, 278, 1407, 2409	UKHO	2022	UKHO
Admiralty Sailing Directions North Sea (West) Pilot NP54	UKHO	2022	UKHO
Marine Accident Investigation Branch (MAIB) incident data	MAIB	2010 – 2019	MAIB
Royal National Lifeboat Institution (RNLI) incident data	RNLI	2010 – 2019	RNLI

9.2.3.2 It is noted that AIS carriage and broadcast is not compulsory for fishing vessels less than 15m 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 Scoping Report.

9.2.4 Consultation

9.2.4.1 The approach to consultation for the Array Project is set out in chapter 5: Consultation of the Scoping Report. A summary of the consultation undertaken to date relevant to shipping and navigation is set out in Table 9.7. Further detail on the Scoping Workshop and stakeholder plans for future engagement is set out in the Scoping Report in chapter 5: Consultation, supported by Appendix 3: Summary of Scoping Workshop Consultation and Appendix 4: Draft Stakeholder Engagement Plan.

Table 9.7: Pre-application consultation relevant to shipping and navigation undertaken to date

Date	Overarching theme	Method of engagement	Stakeholder	Summary of stakeholder feedback	Applicant's response and relevant cross reference
15.11.22	Marine Traffic Survey Methodology	Email Correspondence	MCA	MCA approval of the winter 2022 shipping and navigation survey proposal was provided 16 November 2022, via email.	Survey undertaken for winter 2022.
16.12.22	Pre-Scoping Meeting to discuss Array Project and Cumulative Assessment	Meeting: Online via Teams	MCA NLB CoS	Discuss the Array Project and stakeholder expectations for cumulative assessment.	Follow up meeting to be held following progress of cumulative approach.
18.04.23	Shipping and Navigation Study Area	Scoping Workshop session	NLB CoS MCA Forth Ports Royal Yachting Association (RYA) Scotland Marine Scotland Montrose Port	No queries raised regarding the presentation (by the Applicant) of the Shipping and Navigation Study Area (defined as a 10nm buffer around the Scoping Boundary) and the baseline for navigational features.	Agreement noted.
18.04.23	Baseline data collection	Scoping Workshop session	CoS	Query regarding timeframe for the 12-month AIS data that has been analysed.	Confirmed that the 12-month AIS data is from October 2021 and September 2022 is considered appropriate as the main effects of the COVID-19 pandemic on shipping are considered to have passed.
18.04.23	Assessment Approach	Scoping Workshop session	All	No queries raised regarding the proposed methodology and the Applicant's stated intention to assess impacts on navigation quantitatively in the NRA in line with Marine Guidance Note (MGN) 654.	Agreement noted.

Date	Overarching theme	Method of engagement	Stakeholder	Summary of stakeholder feedback	Applicant's response and relevant cross reference
18.04.23	Consultation approach	Scoping Workshop session	CoS	Queried if the Scoping Boundary will be refined to increase average generation per square kilometre.	There are no plans to change the Scoping Boundary.
18.04.23	Cumulative approach	Scoping Workshop session	CoS	Requested specific analysis on rig movements due to reactivation work in the Shipping and Navigation Study Area. Forth Ports may have further information.	Rig movements to be addressed in the EIA and Forth Ports to be engaged in the Hazard Workshop.
18.04.23	Cumulative hazards	Scoping Workshop session	CoS	Advised that consideration of cumulative hazards are key for the Array Project and consideration of other offshore windfarm development in the area outside the 10nm Shipping and Navigation Study Area.	Impacts from displacement of vessels caused by other projects will be considered and the Array Project will look at the wider, future case. Projects outside of the 10nm Shipping and Navigation Study Area will be considered on a case-by-case basis.
18.04.23	Consultation approach	Scoping Workshop session	MCA NLB	Intentions to use the gap between the Array Project and Ossian OWF could only be speculated, but feedback from the Regular Operators would be important in this regard. MCA and NLB offered to assist in seeking feedback from Regular Operators.	The Array Project has sought feedback from the Regular Operators and received one response to date. The MCA and NLB have offered to contact vessel operators to request further input.
18.04.23	Assessment approach	Scoping Workshop session	RYA Scotland	Advised that passage planning could be considered in the NRA and that passages made by recreational vessels between Scandinavia and Scotland should be considered.	Noted. The impacts from the Array Project will be considered cumulatively with other relevant plans and projects.
18.04.23	Hazards	Scoping Workshop session	All	No additional hazards identified in addition to those presented. It is clarified that the hazards may be refined and that the Commercial Fisheries chapter will cover impacts to vessel engaged in fishing.	Noted. It is recognised that impacts may need to be adjusted as neighbouring projects progress, or if the Array Project's vessel specifications change. Impacts and mitigations to be reviewed once AIS data and the summer survey are processed.

Date	Overarching theme	Method of engagement	Stakeholder	Summary of stakeholder feedback	Applicant's response and relevant cross reference
18.04.23	Project Information	Scoping Workshop session	NLB	Queried if the Array Project would be built in multiple phases.	The construction programme is not yet determined, but will be completed within 7 years.
18.04.23	Assessment approach	Scoping Workshop session	RYA Scotland	Advised recreational craft may end up spending more time within the Scoping Boundary due to the lack of commercial vessels present there and that this should be analysed.	Significant recreational activity in the Shipping and Navigation Study Area is not expected. A chart displaying the recreational data has been shared with the RYA Scotland and Marine Scotland.
18.04.23	Consultation approach	Scoping Workshop session	RYA Scotland	Confirmed that the Cruising Association would like to be involved with stakeholder engagement and the NRA.	Cruising Association to be invited to the Hazard Workshop
18.04.23	Cumulative approach	Scoping Workshop session	MCA	Confirmed they were aware of a few Innovation and Targeted Oil and Gas (INTOG) projects that are in early stages.	MCA to be engaged in the Hazard Workshop. INTOG to be considered cumulatively in the EIA. '4C Offshore' to be monitored.
18.04.23	Consultation approach	Scoping Workshop session	CoS Montrose Port	Noted that it will be important to speak to the Port of Aberdeen for any potential effects on their operations. East-west traffic should be considered.	The Port of Aberdeen will be invited to the Hazard Workshop but the effect on their operations is unlikely to be significant in EIA terms or in relation to their operations. Montrose Port will be contacted post-scoping for further feedback.

9.2.5 Baseline Environment

9.2.5.1 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 into the EIA.

Key navigational features

9.2.5.2 Navigational charts and Sailing Directions pertinent to the Array Project were studied to define charted features or key navigational practices. The key navigational features charted in proximity to the Scoping Boundary are presented in Figure 9.6. The only features within the Shipping and Navigation Study Area are 16 wrecks, four of which are within the Scoping Boundary itself.

9.2.5.3 Three pairs of buoys at three separate locations are located approximately 7nm east of the Scoping Boundary. These relate to the collection of meteorological ocean (Metocean) data for the Ossian OWF. The buoys consist of one Floating Light Detection and Ranging (FLiDAR) buoy and one Waverider buoy at each of the northern and southern sites, along with one guard buoy and one Waverider buoy at the central site. Charted buoyage for the under-construction Seagreen OWF is located approximately 15nm west of the Scoping Boundary. However, this will be removed once the OWF is operational, with commissioning of Seagreen expected in summer 2023, the construction buoyage will be removed in due course after.

9.2.5.4 Features of the future baseline case include the Bellrock, Bowdun and Ossian OWFs, all three of which are also in early planning/pre-scoping. At its closest point, Ossian OWF is located approximately 3nm east of the Scoping Boundary, with Bowdun OWF approximately 5nm to the northwest and Bellrock 19nm to the east.

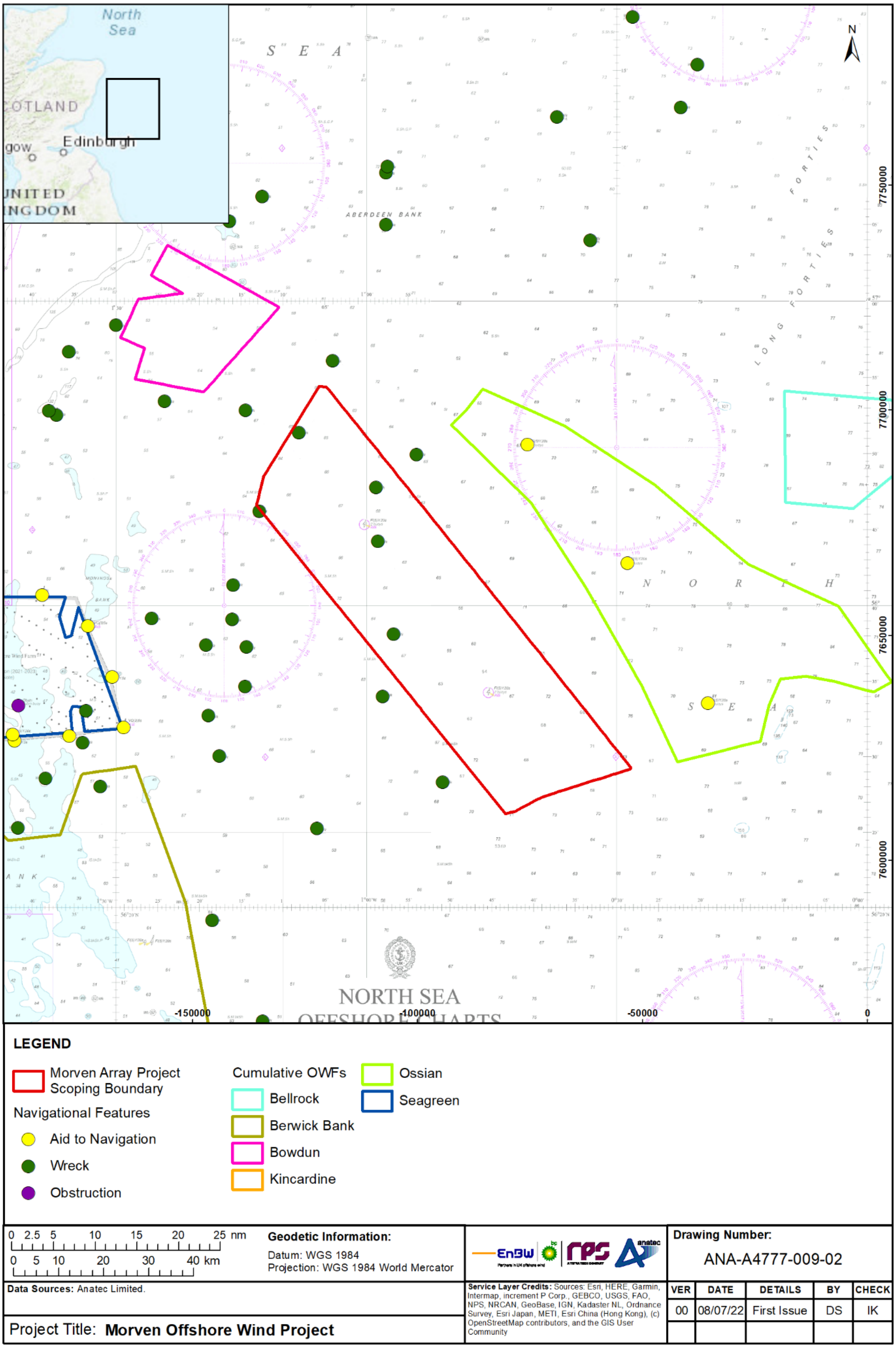


Figure 9.6: Navigational features in proximity to the Scoping Boundary

Vessel traffic

9.2.5.5 A dedicated 14-day winter vessel traffic survey was undertaken for the Array Project from 21 November to 5 December 2022. As per MGN 654 requirements of the completion of 28 days of seasonal vessel traffic data, a further 14-day summer vessel traffic survey was carried out in June 2023. The vessel traffic data collected within the Shipping and Navigation Study Area is presented in Figure 9.7, and is colour-coded by vessel type. Vessels deemed as constituting temporary traffic (e.g., vessels involved in construction of the Seagreen OWF and unmanned vessels engaged in surveys) have been removed on the basis that these are neither representative of the baseline, nor a likely future case scenario.

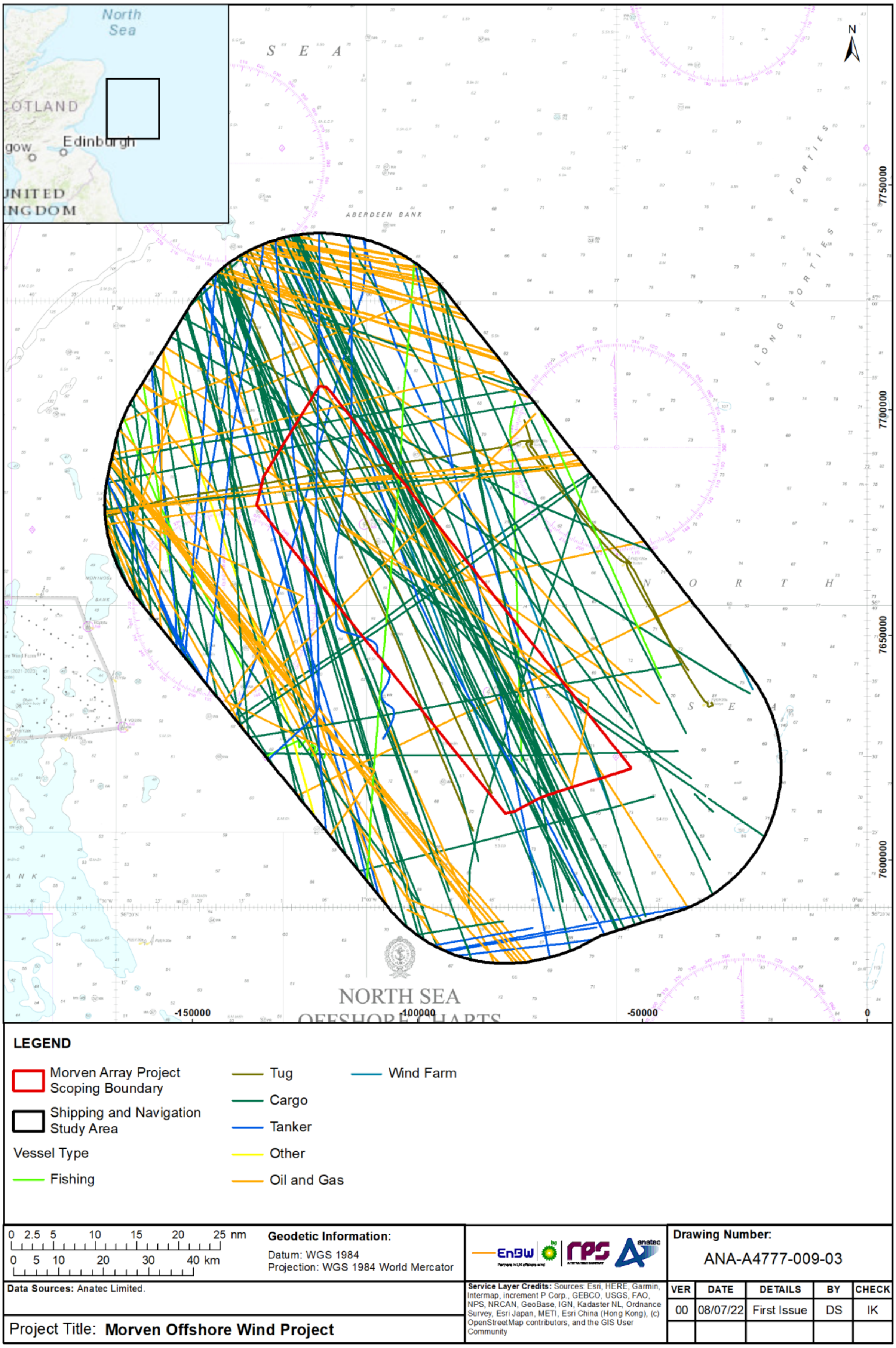


Figure 9.7: 14 days of vessel traffic by vessel type (winter 2022)

9.2.5.6 An average of 14 unique vessels per day were recorded within the shipping and navigation Study Area, with an average of five to six unique vessels per day recorded intersecting the Scoping Boundary. The most frequently recorded vessel types within the Shipping and Navigation Study Area during the survey period were cargo vessels (43%), oil and gas vessels (32%) and tankers (12%). Of the vessels intersecting the Scoping Boundary during the survey period, the most commonly recorded were again cargo vessels (59%), oil and gas vessels (16%) and tankers (11%).

9.2.5.7 A total of 14 main commercial routes[14] were identified, six of which pass through the Scoping Boundary. The busiest of these involved vessels routeing between Icelandic ports and Rotterdam. This route included a Smyril Line-operated Roll-on/Roll-off (RoRo) cargo vessel transiting between Þorlákshöfn (Iceland) and Rotterdam (Netherlands), which passed through the Shipping and Navigation Study Area twice per week.

9.2.5.8 Four of the six routes that intersect the Scoping Boundary are defined cargo routes, with the other two representing cargo and oil and gas routes. The potential for cumulative effects with Bellrock, Ossian and Bowdun OWFs (if these projects were to be consented) was identified for five routes intersecting the Scoping Boundary. The potential for cumulative effects with Bellrock and Ossian OWFs was also identified for one route, running between Montrose (UK) and Baltic ports and the Kyle North Block.

9.2.5.9 Most cargo vessels were recorded transiting on a northwest to southeast orientation between Rotterdam and various ports in the UK and Iceland. No passenger vessels were recorded in the dataset. Tankers were frequently recorded transiting to or from Grangemouth (UK).

9.2.5.10 Oil and gas vessels were recorded transiting between Aberdeen (UK) and the Noble Sam Hartley platform, Cygnus field and Catcher field, and between Montrose (UK) and the Elgin field.

9.2.5.11 Fishing activity was limited, with the few tracks present characteristic of vessel transit rather than active fishing. Given the limitations regarding AIS carriage, the NRA will consider consultation to fully characterise fishing vessel activity. No recreational vessel tracks were recorded, which may be expected due to the season and distance offshore. Seasonality effects will be further explored within the NRA, post-completion of the 14-day summer 2023 vessel traffic survey.

Marine incidents

9.2.5.12 The marine incident data assessed indicates that incident rates within the Shipping and Navigation Study Area are generally low. The RNLI data indicated eight incidents within the Shipping and Navigation Study Area over the ten-year period assessed (2012 – 2022), of which one was located within the Scoping Boundary. This incident occurred in 2016 and involved a yacht experiencing sail failure. A lifeboat from Montrose station responded to this incident.

9.2.5.13 The MAIB data indicates that six incidents occurred within the Shipping and Navigation Study Area, none of which occurred within the Scoping Boundary.

9.2.6 Potential Impacts of the Array Project

9.2.6.1 A range of potential impacts on shipping and navigation have been identified, which may occur during the construction, O&M, and decommissioning phases of the Array Project.

9.2.6.2 The impacts that have been scoped into the assessment are outlined in Table 9.8, together with a description of any additional data collection (e.g. site specific surveys) and supporting analyses (e.g. modelling) that will be required to enable a full assessment of the impacts. In line with MGN 654, no impacts will be scoped out of the assessment.

[14] Routes as defined under MGN 654.

Table 9.8: Impacts proposed to be scoped into the Array Project assessment for shipping and navigation

C = Construction phase, O = O&M phase, D = Decommissioning phase.

Impact	Project phase			Basis for impact	Data collection and analysis required to characterise the baseline environment	Summary of proposed approach to assessment
	C	O	D			
Increased vessel to vessel collision risk resulting from displacement (third party to third party)	✓	✓	✓	Baseline vessel traffic data indicates that certain vessels are likely to deviate to pass around the Scoping Boundary or buoyed construction/decommissioning area and, as such, collision risk in the area may increase. Non-AIS traffic will need to be considered and quantitative modelling undertaken to assess the risk.	A further vessel traffic survey was undertaken in summer 2023 to characterise vessel movements in the area, noting that a winter survey has already been completed. This data collection will be supported by a 12-month analysis of AIS data.	Modelling of collision risk will be undertaken for the O&M phase and the assessment of construction and decommissioning impacts will be carried out qualitatively. Non-AIS traffic will be qualified using desktop sources and consultation with interested parties.
Increased vessel to vessel collision risk resulting from displacement (third party to Array Project vessel)	✓	✓	✓	The increased levels of vessel traffic in the area associated with the construction, O&M, and decommissioning of the Array Project may lead to increased collision risk (third party vessel to Array Project vessel).	A further vessel traffic survey was undertaken in summer 2023 to characterise vessel movements in the area, noting that a winter survey has already been completed This data collection will be supported by a 12-month analysis of AIS data.	Qualitative assessment including consideration of baseline data, desktop sources, consultation and expert opinion.
Vessel to structure allision risk	✓	✓	✓	The presence of surface structures will create new allision risks to vessels under power or Not Under Command (NUC). Non-AIS traffic will need to be considered, and quantitative modelling will be undertaken to assess the risk.	A further vessel traffic survey was undertaken in summer 2023 to characterise vessel movements in the area, noting that a winter survey has already been completed. This data collection will be supported by a 12-month analysis of AIS data.	Modelling of allision risk will be undertaken for the O&M phase and the assessment of construction and decommissioning impacts will be carried out qualitatively. Non-AIS traffic will be qualified using desktop sources and consultation with interested parties.
Reduced access to local ports and harbours	✓	✓	✓	Array Project vessel transits and activities may impact access to local ports and harbours.	A further vessel traffic survey was undertaken in summer 2023 to characterise vessel movements in the area, noting that a winter	Qualitative assessment includes consideration of baseline data, desktop sources, consultation and expert opinion.

Impact	Project phase			Basis for impact	Data collection and analysis required to characterise the baseline environment	Summary of proposed approach to assessment
	C	O	D			
					survey has already been completed. This data collection will be supported by a 12-month analysis of AIS data.	
Reduction of under-keel clearance as a result of subsea infrastructure	×	✓	×	The presence of subsea infrastructure (e.g., cable protection) may increase under-keel interaction risk. Non-AIS traffic will need to be considered. Impacts are not considered for the construction and decommissioning phases because of the designed in measures that reduce the impact to acceptable parameters.	An assessment of the vessel traffic in proximity to the offshore export cable corridor will be undertaken (AIS-only) and assessed against water depths within the corridor to identify any areas where under-keel clearance may be of concern.	Qualitative assessment includes consideration of baseline data, desktop sources, consultation and expert opinion.
Anchor and fishing gear interactions with subsea cables	×	✓	×	The presence of subsea cables may lead to an increase in the risk of anchor and fishing gear interactions. Non-AIS traffic will need to be considered. Impacts are not considered for the construction and decommissioning phases because of the designed in measures in place that reduce the impact to acceptable parameters.	An assessment of vessel traffic in proximity to the offshore export cable corridor will be undertaken (AIS-only), including the identification of areas where anchoring activity occurs frequently.	Modelling of collision risk will be undertaken for the O&M phase. Non-AIS traffic will be qualified using desktop sources and consultation with interested parties.
Interference with navigation, communications, and position-fixing equipment	×	✓	×	The Array Project's infrastructure (e.g., wind turbines, subsea cables) may impact equipment onboard vessels, including potential effects of electromagnetic interference from cables. Impacts are not considered for the construction and decommissioning phases because of the designed in	A further vessel traffic survey was undertaken in summer 2023 to characterise vessel movements in the area, noting that a winter survey has already been completed. This data collection will be supported by a 12-month analysis of AIS data.	Qualitative assessment will include desktop sources and previous studies into effects.

Impact	Project phase			Basis for impact	Data collection and analysis required to characterise the baseline environment	Summary of proposed approach to assessment
	C	O	D			
				measures in place that reduce the impact to acceptable parameters.		
Reduction of Search and Rescue (SAR) capability	×	✓	×	There may be an increase in incident rates associated with the Array Project, which may reduce SAR capability. The layout of the structures may also impact access for SAR responders in the area. Impacts are not considered for the construction and decommissioning phases because of the designed in measures in place that reduce the impact to acceptable parameters.	Historical incident data will be assessed to characterise baseline incident rates.	Qualitative assessment includes consideration of baseline data, desktop sources, consultation and expert opinion.

9.2.7 Designed In Measures and Mitigation

9.2.7.1 As part of the project design process, a number of designed in measures (primary and tertiary) will reduce the potential for impacts on shipping and navigation receptors (Table 9.9). As there is a commitment to implement these measures, they are considered inherent to the design of the Array Project. The determination of magnitude and significance will assume the implementation of such measures. Some of these measures are considered standard industry practice for this type of development.

9.2.7.2 The requirement for any additional (secondary) mitigation measures will be dependent on the significance of the effects on shipping and navigation receptors. The requirement for and feasibility of any mitigation measures will be consulted upon with statutory consultees throughout the EIA process.

Table 9.9: Designed in measures of the Array Project, relevant to Shipping and Navigation

Reference number	Measures adopted	Justification	Primary or tertiary
MM-1	Scour protection will be used around offshore structures as set out in chapter 3: Project Description.	There is the potential for scouring of seabed sediments to occur due to interactions between Metocean regime (wave, sand and currents) and foundations or other seabed structures. This scouring can develop into depressions around the structure; the use of scour protection around offshore structures and foundations will be employed, as described in detail in chapter 3: Project Description. The scour protection has been included in the modelled scenarios used within the assessment of effects to protect foundations from the effects of scour.	P
MM-2	Development and adherence to a Cable Plan.	There is a potential for cable exposure to occur due to interactions between Metocean regime (wave, sand and currents). Sediment transportation can lead to exposure of cables and infrastructure, although the use of a target cable burial depth alongside the cable installation strategy should provide sufficient depth to avoid exposure. The Cable Plan will outline the technical specifications of the cables used in the Array Project and describe the installation methodology; also includes cable protection to be installed.	P
MM-5	Development of, and adherence to, an EMP, including actions to minimise INNS, MMMP and a MPCP, which will include planning for accidental spills, address all potential contaminant releases and include key emergency details.	Provides a means to ensure the efficient management and communication of commitments made for the management of the potential environmental impacts. The MMMP may include using marine mammal observers and PAM to monitor the mitigation zone (MZ, as determined by the underwater sound modelling) to ensure that animals are not observed within the MZ during piling. ADD may be used if required to deter animals from the MZ. For offshore water quality, measures will be adopted to ensure that the potential for release of pollutants from construction, and operations and maintenance, is	T

Reference number	Measures adopted	Justification	Primary or tertiary
		minimised. In this manner, the accidental release of contaminants from rigs and supply/service vessels will be strictly controlled, thus providing protection for birds and their prey species across all phases of the development. For benthic subtidal ecology, an MPCP will include planning for accidental spills, addressing all potential contaminant releases and include key emergency details. The INISMP will include measures for controlling INNS and their impact on fish and shellfish ecology receptors.	
MM-8	Development of, and adherence to, a Navigation Safety Plan (NSP) and Vessel Management Plan (VMP).	The NSP and VMP will describe measures put in place by the Applicant related to navigational safety, including information on Safety Zones, charting, construction buoyage, temporary lighting and marking and means of notification of Array Project activity to other sea users (e.g. via Notices to Mariners).	T
MM-11	Promulgation of information as required (e.g., Notices to Mariners, Kingfisher Bulletin).	To maximise awareness of the Array Project, allowing other sea users and marine infrastructure receptors to plan in advance to ensure Array Project vessels are suitably managed to minimise the likelihood of involvement in incidents and maximise the ability to assist in the event of a third-party incident.	T
MM-14	Compliance with Marine Guidance Note (MGN) 654 (MCA, 2021) and its annexes, where applicable.	To ensure the final Array layout is suitable for SAR operations and that reductions in under-keel clearance are acceptable.	T
MM-15	Development of, and adherence to, a Development Specification and Layout Plan (DSLP). The DSLP will ultimately confirm the layout and design parameters of the Array Project.	To ensure the final array layout is suitable for both surface and air based (for SAR purposes) navigation and to ensure accurate mapping for navigation.	T
MM-16	Marine coordination and communication to manage Array Project vessel movements through the NSP and VMP.	To ensure Array Project vessels are suitably managed to minimise the likelihood of involvement in incidents and maximise the ability to assist in the event of a third-party incident.	T
MM-17	Compliance of Array Project vessels with international marine regulations as adopted by the Flag State, including the International Regulations for Preventing Collisions at Sea (COLREGs) (IMO, 1972/77) and the International Convention for the Safety of Life at Sea (SOLAS)	To minimise the risk introduced due to the presence of Array Project vessels.	T

Reference number	Measures adopted	Justification	Primary or tertiary
	(IMO, 1974) through the NSP and VMP.		
MM-33	Application for safety zones of up to 500m during construction and periods of major maintenance.	To protect third-party vessels from project vessels involved in construction and major maintenance activities, which may be Restricted in their Ability to Manouevre (RAM).	T
MM-34	Appropriate lighting and marking of wind turbines and offshore substation platforms will be established in accordance with CAA regulations and guidance (CAP 393, the Air Navigation Order (ANO) and in accordance with the CAA and the DIO, which is responsible for the safeguarding of MoD assets. Secured through the development of, and adherence to, a LMP.	Up to date guidance on turbine lighting will be followed when producing the LMP to address aviation, shipping and ornithological requirements	T
MM-35	Marking and lighting of the site in agreement with the NLB and in line with International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA) Recommendation O-139 (IALA, 2021 (a)) and Guidance G1162 (IALA, 2021 (b)) through NSP and VMP.	Maximises awareness of the Array Project in both day and night conditions, including in restricted visibility and assists with SAR operations.	T
MM-37	Appropriate marking on UKHO Admiralty charts.	To maximise awareness of the Array Project, allowing other vessels, sea users and marine infrastructure receptors to plan their activities in advance.	T
MM-38	Buoyed construction area in agreement with NLB and described within the LMP, NSP and VMP.	To protect third-party vessels from Array Project vessels involved in construction and major maintenance activities, which may be RAM.	P
MM-39	Use of guard vessels and OFLOs, as appropriate.	To facilitate engagement with fisheries stakeholders during work and minimise potential conflict between the Array Project and fishing activities.	P
MM-43	A minimum blade tip height of 30m (LAT) will be used for the Array Project, accounting for pitch and roll as per MGN 654.	This minimum blade tip height clearance is considered appropriately conservative so as to minimise risk.	P
MM-45	Implementation, management and monitoring of cable protection (via burial or external protection where adequate burial depth, as identified via risk	Cable protection may be necessary in some locations where a sufficient target cable burial depth cannot be achieved or where cables become exposed during the lifetime of the Array Project.	P

Reference number	Measures adopted	Justification	Primary or tertiary
	assessment, is not feasible) with any damage, destruction or decay of cables notified to MCA, NLB, Kingfisher and UKHO no later than 24 hours after discovery. Secured through the NSP and VMP.	To ensure that the Cable Plan has been successfully implemented, monitoring will be undertaken as part of wider Array Project pre- and post-construction geophysical surveys and are likely to involve a combination of multibeam echosounder or high-resolution side-scan sonar. This minimises the risks of underwater allision with cable protection, anchor or fishing gear interaction with subsea cables and interference with magnetic position fixing equipment.	

9.2.7.3 Any further mitigation requirements for shipping and navigation will depend on the effects' significance, as identified during the EIA process.

9.2.8 Proposed Assessment Methodology

9.2.8.1 An assessment will be carried out to look at the potential impacts of the Array Project on commercial shipping routes in the Shipping and Navigation Study Area and the wider cumulative Study Area. This will include the shipping routes to and from the main ports in the area (i.e. in and out of Montrose and the ports in the Tay and the Forth). If appropriate, the assessment will also consider any deviations and associated commercial impacts on routes with respect to time and fuel use.

9.2.8.2 The approach to the assessment for shipping and navigation, including the EIA and NRA, was presented and agreed on with the MCA, NLB and UK Chamber of Shipping following consultation in 2022 (see chapter 5: Consultation Process of the Scoping Report). In addition, the approach has incorporated primary guidance on the assessment of shipping and navigation risk provided by the MCA. Specific to the shipping and navigation EIA, the following guidance documents will also be considered:

- MGN 654 Offshore Renewable Energy Installations (OREI): Guidance on UK Navigational Practice, Safety and Emergency Response (MCA, 2021).
- Revised Guidelines for Formal Safety Assessment (FSA) (IMO, 2018).
- 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)).
- The RYA's Position on Offshore Energy Developments: Paper 1 – Wind Energy (Royal Yachting Association (RYA, 2019).

9.2.8.3 As required under the MCA methodology (Annex 1 to MGN 654) (MCA, 2021) and in line with international marine risk assessment standards, the International Maritime Organization (IMO) Formal Safety Assessment (FSA) (IMO, 2018) approach will be applied to the assessment of effects. The FSA methodology is centred on risk control. The method assesses each 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 9.10. Any impact assessed as 'unacceptable' will require additional mitigation measures implemented beyond those considered designed in to reduce the impact to within 'tolerable' or 'broadly acceptable' parameters.

Table 9.10: IMO FSA risk matrix

Frequency of Occurrence						
	Frequent	Tolerable	Tolerable	Unacceptable	Unacceptable	Unacceptable
	Reasonably Probably	Broadly Acceptable	Tolerable	Tolerable	Unacceptable	Unacceptable
	Remote	Broadly Acceptable	Broadly Acceptable	Tolerable	Tolerable	Unacceptable
	Extremely Unlikely	Broadly Acceptable	Broadly Acceptable	Broadly Acceptable	Tolerable	Tolerable
	Negligible	Broadly Acceptable	Broadly Acceptable	Broadly Acceptable	Broadly Acceptable	Tolerable
		Negligible	**Minor**	**Moderate**	**Serious**	**Major**
		Severity of Consequence				

9.2.8.4 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 designed in measures;
- lessons learned from other offshore wind farm developments;
- level of stakeholder concern determined though the hazard log;
- consultation output;
- expert opinion.

9.2.8.5 The following statutory and non-statutory organisations deemed relevant to shipping and navigation will be included in further consultation, noting that additional organisations may be included if identified during the NRA process:

- MCA;
- NLB;
- UK Chamber of Shipping;
- RYA Scotland;
- Cruising Association;
- National Federation of Fishermen's Organisations and Scottish Fishermen's Federation;
- Regular commercial operators (identified from the vessel traffic survey data);
- Local fishing representatives.

9.2.8.6 Vessel traffic surveys were undertaken for the winter period in November – December 2022. A further 14 days survey have been undertaken in summer (June 2023). These dedicated surveys will also be supported by a 12-month AIS analysis (October 2021 - September 2022).

9.2.9 Potential Cumulative Impacts

9.2.9.1 All impacts identified on an in-isolation basis (in Table 9.8) will be considered within the NRA for the potential for cumulative effects, with this identified as a crucial aspect of the shipping and navigation analysis from consultation undertaken to date. Developments will be assessed based on the most recent publicly available information at the time. In terms of cumulative projects to be included, other developments or activities within 50nm of the Scoping Boundary will be screened in or out of the cumulative assessment based on a number of factors, including:

- Status of development;
- Data confidence level;
- Proximity to the Scoping Boundary;
- Location relative to routeing passing the site.

9.2.9.2 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. As per Section 9.2.2, the Offshore Transmission Project will be consented separately and so considered a distinct development to be included within the CEA. Vessel and rig movement in and around the Port of Dundee, associated with INTOG sites, will also be included, as well as vessels related to the Array Project and those transiting to and from other North Sea infrastructure, such as oil and gas platforms or other OWFs. Vessel data from the 12-month dataset will be used in conjunction with the vessel traffic survey data in this regard and relevant cumulative routeing will be shared, once identified.

9.2.10 Potential Inter-Related Effects

9.2.10.1 The EIA will consider inter-related effects. Inter-related effects relate to effects arising from the Array Project, either across their own phases (project lifetime) or different effects on one receptor in one phase (receptor-led). The EIA will consider inter-related effects, in relation to the potential effects of multiple impacts from the construction, O&M and decommissioning phases of the Array Project, affecting one receptor. Inter-related effects are assessed through consideration of all effects on a receptor, considering both spatial and temporal overlaps, with the Array Project. This will ensure that the Array Project as a whole is appropriately considered within the EIA.

9.2.10.2 For shipping and navigation, potential inter-related effects from other receptors exist and will be considered within the NRA.

9.2.11 Potential Transboundary Impacts

9.2.11.1 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 and used by vessels owned by international operators. Therefore, impacts listed in Section 9.2.6 may be relevant at a transboundary level.

9.3 Aviation (Military and Civil)

9.3.1 Introduction

9.3.1.1 This chapter of the Scoping Report identifies the aviation and radar receptors of relevance to the Array Project and considers the potential impacts on aviation receptors (civil and military) arising from the construction, O&M and decommissioning of the OWF.

9.3.2 Study Area

9.3.2.1 Whilst not definitive, the Civil Aviation Authority's (CAA) Civil Aviation Publication 764 *Policy and Guidelines on Wind Turbines* (CAA, 2016), provides criteria for assessing whether any wind turbine development might have an impact on aerodrome and radar related operations. Consideration of the Array Project's potential to affect aviation stakeholders and receptors has been undertaken in accordance with the CAA recommended consultation distance of within 30km of the Scoping Boundary.

9.3.2.2 However, and in relation to the CAA recommended 30km consultation distance, CAP 764 also states that the operational range of a radar system is dependent on the type of radar used and its operational requirement. CAP 764 provides a guide of 30km for the assessment of radar impact. Any impact is dependent on radar detectability of operational wind turbines, the radar's operational range and the use of airspace in which the development sits. Therefore, the operational assessment of effects has considered the orientation of approach and departure flight paths, physical safeguarding of flight, airspace characteristics and procedures as published in the UK Integrated Aeronautical Information Package (IAIP) (NATS, 2022) and the Military Aeronautical Information Publication (Mil AIP) (Ministry of Defence, 2022). The Scoping Boundary and Aviation Study Area are shown in Figure 9.8. The Aviation Study Area is defined as the airspace over the area delineated by the Scoping Boundary and the NATS-operated Allanshill Primary Surveillance Radar (PSR) on the UK mainland to the north, the Brizlee Wood Remote Radar Head (RRH) Air Defence Radar (ADR) to the south and Leuchars Station to the east.

9.3.2.3 A Preliminary Radar Line of Sight (RLoS) Analysis was undertaken within the Aviation Study Area for a maximum wind turbine blade tip height of 363m. It was found that there is a limited number of aviation radar systems that may be affected by the detection of wind turbines placed in the Scoping Boundary. Since the Preliminary RLoS Analysis was undertaken, a wind turbine blade tip of up to 390m is being considered for the Array Project. RLoS Analysis for a maximum wind turbine blade tip of 390m will be undertaken for (and provided as an appendix to) the Environmental Impact Assessment (EIA) Report. The larger a wind turbine is, the larger its radar cross section will be. This will result in more energy being reflected and an increased chance of it creating unwanted returns (non-aircraft), known as 'clutter' on the Radar Data Display Screens. Although an increase in wind turbine blade tip may increase theoretical detectability across the area, it is considered that no additional aviation radar systems would be identified by the RLoS Analysis for a wind turbine blade tip of up to 390m. The RLoS Analysis is expected to pick up the same aviation (military and civil) receptors but indicate a greater measure of effect (i.e. more wind turbines causing an effect). Accordingly, the Preliminary RLoS Analysis provides the basis for the identification of receptors in this chapter.

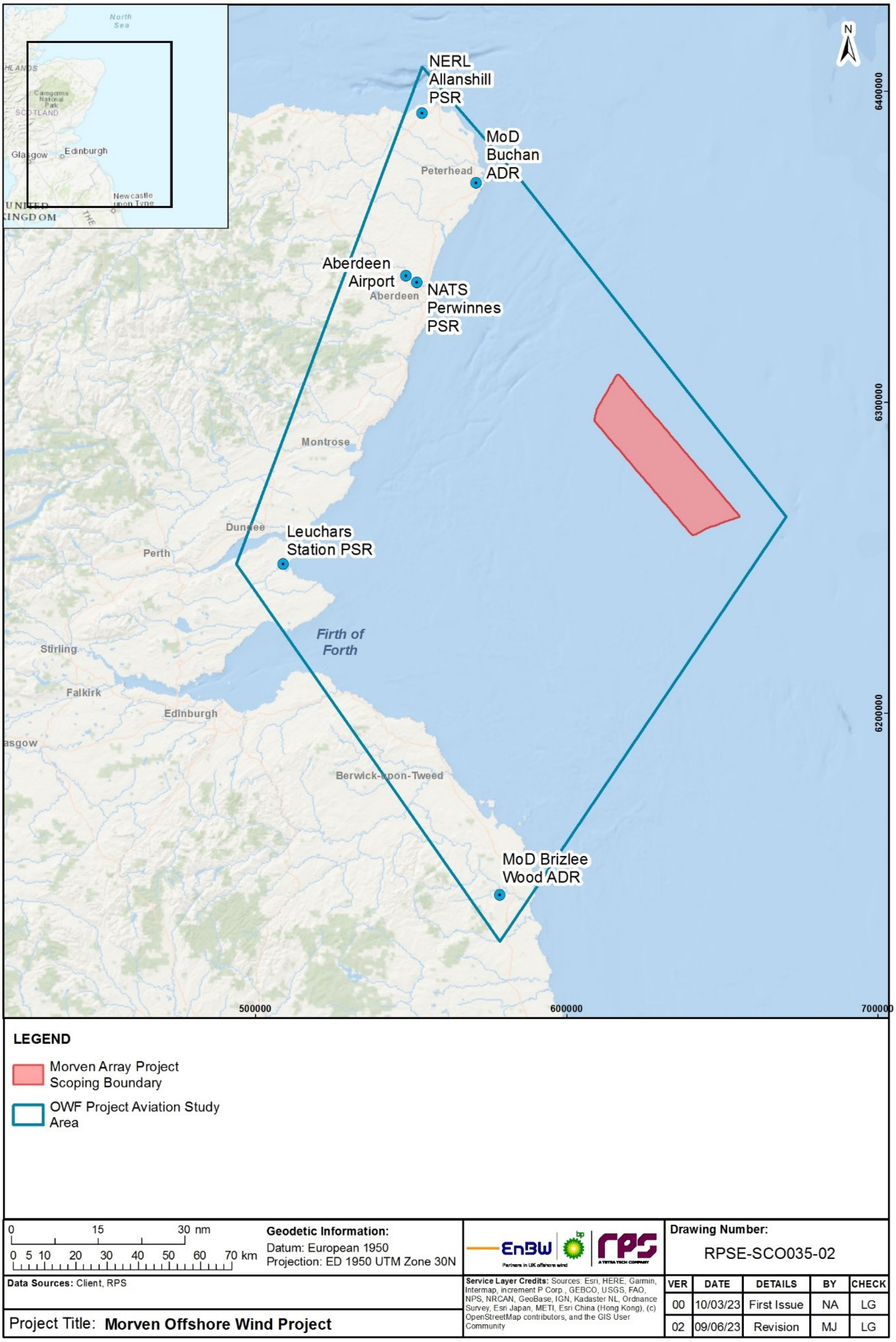


Figure 9.8: Offshore Wind Farm Aviation Study Area

9.3.3 Data Sources

An initial desk-based review of literature and data sources to support this Scoping Report has identified several data sources to inform the identification of aviation (military and civil) radar receptors within the Aviation Study Area. These information sources are summarised in Table 9.11.

Table 9.11: List of data sources

Title	Source	Year	Author
Document 8168 Ops/611 Procedures for Air Navigation Services Aircraft Operations (PANS-Ops) Fifth Edition (ICAO, 2006).	International Civil Aviation Authority (ICAO)	2006	ICAO
Annex 14 Aerodromes Design and Operations, Standards and Recommended Procedures (SARPs) Ninth Edition (ICAO, 2022).	International Civil Aviation Authority	2022	ICAO
Civil Aviation Publication 032 UKIAIP (Integrated Aeronautical Information Package) (CAA, 2023).	Civil Aviation Authority	2023	CAA
CAP 168 Licensing of Aerodromes (CAA, 2022).	Civil Aviation Authority	2022	CAA
CAP 393 The Air Navigation Order (ANO) (CAA, 2016 amended 2022).	Civil Aviation Authority	2016, amended 2022	CAA
CAP 437 Standards for Offshore Helicopter Landing Areas (CAA, 2023a).	Civil Aviation Authority	2023	CAA
CAP 670 Air Traffic Services Safety Requirements (CAA, 2019).	Civil Aviation Authority	2019	CAA
CAP 764 Policy and Guidance on Wind Turbines (CAA, 2016a).	Civil Aviation Authority	2016	CAA
Marine Guidance Notice (MGN) 654 Safety of Navigation: Offshore Renewable Energy Installations (OREI) Guidance on UK Navigational Practice, Safety and Emergency Response (MCA, 2021).	Maritime and Coastguard Agency	2021	MCA
Search and Rescue (SAR) Bases.	Bristow Group	2023	Bristow Group
Met Office Safeguarded Assets.	Met Office	2023	Met Office
Military Aeronautical Information Publication (MilAIP) (MoD, 2023).	Ministry of Defence	2023	MoD
UK Military Low Flying Handbook (UKLFH) (MoD, 2023a).	Ministry of Defence	2023	MoD
UK En Route Low Altitude North Sea West Off-Shore Installations (UK (L) 5 OIL (MoD, 2022).	Ministry of Defence	2022	MoD

9.3.4 Consultation

9.3.4.1 The approach to consultation for the Array Project is set out in chapter 5: Consultation of the Scoping Report. No pre-application pre-Scoping consultation has been undertaken to date for aviation (military and civil) receptors, but the Applicant is a member of the Offshore Wind Industry Council (OWIC) Aviation Working Group, which is working with key stakeholders to create a long term resolution for aviation radar issues across the UK and specifically on the East Coast.

9.3.5 Baseline Environment

9.3.5.1 The airspace within, above and around the Array Project is used by both civil and military aircraft, which are tracked by radar systems operated by both NATS and the MOD. The Array Project will be located within the Scottish Flight Information Region in an area of Class G uncontrolled airspace, which is established from the surface up to Flight Level (FL) 195 (approximately 19,500ft). Above this FL195 Class C Controlled Airspace (CAS) is established.

9.3.5.2 All aircraft operating within CAS must be in receipt of an Air Traffic Service (ATS) from NATS, or from military controllers based at a NATS Area Control Centre (ACC) or under the control of military or air defence controllers.

Civil aviation

Aberdeen Airport

9.3.5.3 The nearest UK civil airport to Array Project is Aberdeen International Airport, which is located on a bearing of approximately 295°/50nm (92.6km) northwest of the Array Project.

9.3.5.4 Airports with published Instrument Flight Procedures (IFP) have associated Minimum Sector Altitudes (MSA). A MSA defines the minimum safe altitude an aircraft can descend to within a sector of radius 25nm. These sectors provide obstacle clearance protection of at least 1,000ft to aircraft within that area. This allows pilots of aircraft flying under Instrument Flight Rules (IFR)[15] the reassurance of properly designated obstacles and terrain clearance protection whilst making an approach and landing at an airport in poor weather. Due to the distancing, the Array Project is unlikely to affect operations conducted at Aberdeen International Airport.

NATS

9.3.5.5 The Preliminary RLoS Analysis indicates that the NATS Perwinnes Primary Surveillance Radars (PSR) will theoretically detect the operational wind turbines at blade tip heights of 363m[16].

9.3.5.6 The Preliminary RLoS Analysis indicates that the occasional detection of the most north-easterly part of the Scoping Boundary by the NATS Allanshill PSR cannot be ruled out. Similarly, the Preliminary RLoS Analysis at a maximum blade tip height of 363m predicts the Allanshill PSR will likely intermittently detect operational wind turbines in the northern part of Scoping Boundary. Theoretical detection decreases towards the south of the Scoping Boundary as distance from the location of the PSR increases[17].

9.3.5.7 Radar detection of the operational wind turbines usually creates a detrimental effect on the operation of PSR. However, radar detection is not an automatic reason for stakeholder objection. The effect may be managed by radar manipulation or operationally through airspace management.

9.3.5.8 The Array Project lies outside the area of potential interaction with any aviation related Secondary Surveillance Radar (SSR) systems[18].

[15] Instrument Flight Rules (IFR) are rules that allow properly equipped aircraft to be flown under instrument meteorological conditions (IMC).

[16] For the reasons discussed at in section 9.3.2, wind turbines with a maximum blade tip height of 390m are expected to be visible to the NATS Perwinnes PSR (as the Preliminary RLoS Analysis indicates wind turbines with a lower maximum blade tip height of 363m would be visible). The RLoS Analysis may indicate a greater measure of effect (i.e. more wind turbines causing an effect) for this receptor.

[17] For the reasons discussed in section 9.3.2, wind turbines with a maximum blade tip height of 390m are expected to be visible to the Allanshill PSR (as the Preliminary RLoS Analysis indicates wind turbines with a lower maximum blade tip height of 363m would be visible). The RLoS Analysis may indicate that an additional number of wind turbines further to the southeast within the current Scoping Boundary would become visible to the Allanshill PSR. This represents a greater measure of effect on the same receptor (i.e. more wind turbines causing an effect).

[18] CAP764 Issue6 FINAL Feb.pdf (caa.co.uk) states SSR is only a consideration within 10km.

Military Aviation

Air Defence Radar (ADR)

9.3.5.9 The MoD, through the Air Surveillance and Control System (ASACS), is responsible for compiling a Recognised Air Picture (RAP) to monitor the airspace in and around the UK to enable a response to any potential airborne threat. This is achieved through the utilisation of a network of long-range ADR systems, some of which are located along the east coast of the UK. Any identified effect of wind turbines on the ASACS radar systems that serve the airspace above the Aviation Study Area may reduce the capability of the ASACS Force Command in response to a potential threat.

9.3.5.10 The nearest ADR to the Array Project is the Lockheed Martin Transportable Pulse-Radar Search (TPS) 77 (Type 92) ADR located at RRH Buchan, Aberdeenshire, which is located on a bearing of approximately 324°/50nm (75.93km) from the closest point of the Scoping Boundary. RRH Brizlee Wood in Northumberland operates a TPS 77 type ADR and is located on a bearing of approximately 209°/71nm (131.49km) from the closest point on the southwest Scoping Boundary.

9.3.5.11 The Preliminary RLoS Analysis predicts theoretical detection by the Buchan ADR of the operational wind turbines placed within the Scoping Boundary in relation to a blade tip height of 363m. The Preliminary RLoS Analysis indicates that the operation of Brizlee Wood ADR could be impacted by the detection of operational wind turbines in the southern part of the Scoping Boundary (closest to the radar location). The predicted impact is reduced across the Scoping Boundary (furthest away from the radar location as effect diminishes with range from the source radar due to electromagnetic wave energy dissipation and earth curvature) to the north of the area at a maximum blade tip height of 363m[19].

Leuchars Station

9.3.5.12 Leuchars Station PSR is located on a bearing of approximately 250°/60nm (111.12km). Although there is potential for this PSR to detect operational wind turbines within the Scoping Boundary, it is not envisaged that Leuchars air traffic controllers will be providing a radar service above the Scoping Boundary. The Leuchars Area of Responsibility (AoR) extends to 40nm radius from the position of the Leuchars Station PSR. As such, it is proposed that Leuchars Station PSR is scoped out of the EIA.

Low flying

9.3.5.13 Military low flying activities occur in uncontrolled airspace below 2,000ft, offshore, above mean sea level (amsl) within defined Low Flying Areas (LFA). The Array Project is located within LFA 14 and military low flying will likely occur above and around the Scoping Boundary. To mitigate any potential impact, it is common practice for the MoD to request aviation obstruction lighting to be fitted to wind turbines in accordance with CAP 393, however, there may be an additional MoD requirement for the fitting of infra-red lighting.

Practice and Exercise Area (PEXA)

9.3.5.14 The Array Project is not contained within the vertical limits of any military PEXA and, therefore, it is proposed that military PEXA is scoped out of the EIA.

Helicopter Operations

9.3.5.15 Commercial offshore helicopter operations in this region encompass support to offshore oil and gas exploitation and Search and Rescue (SAR) operations.

9.3.5.16 Bristow Helicopter Ltd. holds the UK Government national contract to deliver SAR operations on behalf of the MCA. The closest SAR base to the Array Project is Inverness Airport. SAR operations will often involve flying at low level. Assessment of potential impacts on SAR operations will be included within the EIA Report. Mitigation, if required, will adhere to the guidance set out in MGN 654.

9.3.5.17 Helicopters supporting offshore oil and gas, in the northern North Sea, use Helicopter Main Route Indicators (HMRI), radiating from Aberdeen Airport (the main support base) on a hub/spoke radial

[19] For the reasons discussed in section 9.3.2, these findings would be similar with respect to a maximum blade tip height of 390m.

pattern. These HMRIs lie to the north of the Array Project, the closest being HMRI 296, which lies approximately 13.41km to the north of the northeastern boundary of the Scoping Boundary. The CAA recommends within CAP 764 Policy and Guidance on Wind Turbines (CAA, 2016) that there should be no obstacles within 3.74km either side of a centreline of a HMRI. Moreover, the CAA also recommends that dependent on radar low level coverage and the type of radar service required, it may be necessary to maintain a greater buffer than 3.74km. Engagement with NATS (Aberdeen Radar) and offshore helicopter operators, at Aberdeen Airport, will be completed to establish any perceived impact.

Other radar communications

9.3.5.18 The Met Office safeguards its weather radar to a radius of 20km. The Array Project lies beyond this range from the nearest Met Office radar at Hill of Dudwick, Aberdeenshire. It is, therefore, proposed that Met Office radar systems are scoped out of the EIA.

9.3.6 Potential Impacts of the Array Project

9.3.6.1 A range of potential impacts on aviation has been identified, which may affect aviation (military and civil) receptors during the construction, O&M and decommissioning phases of the Array Project.

9.3.6.2 The impacts that have been scoped into the assessment are outlined in Table 9.12 (below), together with a description of any additional data collection and supporting analyses that will be required to enable a full assessment of the impacts.

9.3.6.3 Potential impacts scoped out of the assessment are presented in Table 9.13, with justification.

Table 9.12: Impacts proposed to be scoped into the Array Project assessment for aviation (military and civil)

C = Construction phase, O = O&M phase, D = Decommissioning phase.

Impact	Project phase			Basis for impact	Data collection and analysis required to characterise the baseline environment	Summary of proposed approach to assessment
	C	O	D			
Impact to Buchan (RRH) ADR	×	✓	×	Effect on aviation radar systems; wind turbine derived radar clutter (false returns) appearing on radar displays can adversely affect surveillance systems.	RLoS Analysis	Details of the Preliminary RLoS Analysis will be discussed with individual stakeholders to establish predicted impact to receptor operations. The RLoS Analysis will be updated for (and provided with) the EIA Report and if the parameters of Array Project change (wind turbine blade tip height and/or placement of wind turbines).
Impact to Brizlee Wood (RRH) ADR	×	✓	×	Effect on aviation radar systems; wind turbine derived radar clutter (false returns) appearing on radar displays can adversely affect surveillance systems.	RLoS Analysis	Details of the Preliminary RLoS Analysis will be discussed with individual stakeholders to establish predicted impact to receptor operations. The RLoS Analysis will be updated for (and provided with) the EIA Report and if the parameters of Array Project change (wind turbine blade tip height and/or placement of wind turbines).
Impact to Allanshill (NATS) PSR	×	✓	×	Effect on aviation radar systems; wind turbine derived radar clutter (false returns) appearing on radar displays can adversely affect surveillance systems.	RLoS Analysis	Details of the Preliminary RLoS Analysis will be discussed with individual stakeholders to establish predicted impact to receptor operations. The RLoS Analysis will be updated for (and provided with) the EIA Report and if the parameters of Array Project change (wind turbine blade tip height and/or placement of wind turbines).
Impact to Perwinnes (NATS) PSR	×	✓	×	Effect on aviation radar systems; wind turbine derived radar clutter (false returns) appearing on radar displays can adversely affect surveillance systems.	RLoS Analysis	Details of the Preliminary RLoS Analysis will be discussed with individual stakeholders to establish predicted impact to receptor operations. The RLoS Analysis will be updated for (and provided with) the EIA Report and if the parameters of Array Project change (wind turbine blade tip height and/or placement of wind turbines).

Impact	Project phase			Basis for impact	Data collection and analysis required to characterise the baseline environment	Summary of proposed approach to assessment
	C	O	D			
Impact to airborne SAR operations	✓	✓	✓	Creation of an obstruction; the presence of above-surface infrastructure within a previously open sea area may cause an obstruction to SAR operations.	Engagement with the MCA and Bristow Helicopter Ltd. (providing UK Government SAR delivery). Appraisal of (MGN) 654.	A range of designed in measures, in the form of appropriate notification to aviation stakeholders, lighting and marking to minimise effects to aviation flight operations, would apply to the Array Project as included in the commitments set out in paragraph 9.3.6. Pilots must plan their flying activities in advance and be familiar with any en-route obstacles they may encounter; however, during flight, weather conditions or operational requirements may necessitate route adjustments. In visual conditions, pilots are ultimately responsible for seeing and avoiding obstructions such as wind turbines and will be aware through notification procedures of the Array Project. When operating under instrument (poor weather) conditions, pilots will be utilising onboard radar, which detects obstructions and may be under the control of ATC with an appropriate level of radar service and flying at an altitude which provides the required separation from obstacles below them. Feedback provided at scoping will provide predicted stakeholder impact, which will inform the EIA Report.
Creation of an obstruction	✓	✓	✓	Creation of an obstruction; above surface infrastructure (wind turbines and substations) within and around the Array Project may create a physical obstruction to airspace users.	Engagement with stakeholders	A range of designed in measures, in the form of appropriate notification to aviation stakeholders, lighting and marking to minimise effects to aviation flight operations would apply to the Array Project as included in the commitments set out in paragraph 9.3.6. Pilots must plan their flying activities in advance and be familiar with any en-route obstacles they may encounter; however, during flight, weather conditions or operational requirements

Impact	Project phase			Basis for impact	Data collection and analysis required to characterise the baseline environment	Summary of proposed approach to assessment
	C	O	D			
						may necessitate route adjustments. In visual conditions, pilots are ultimately responsible for seeing and avoiding obstructions such as wind turbines and will be aware through notification procedures of the Array Project. When operating under instrument (poor weather) conditions, pilots will be utilising onboard radar which detects obstructions and may be under the control of ATC with an appropriate level of radar service and flying at an altitude which provides the required separation from obstacles below them. Feedback provided at scoping will provide predicted stakeholder impact, which will inform the EIA.

Table 9.13: Impacts proposed to be scoped out of the Array Project assessment for aviation (military and civil) receptors

Impact	Basis for impact
Impact to Aberdeen International Airport IFPs	No Aberdeen Airport IFPs extend over Array Project.
Impact to SSR	The Array Project lies outside the area of interaction with any aviation related SSR systems.
Impact to Leuchars Station	The Array Project lies outside the Leuchars AoR.
Impact to PEXA	The Array Project is located outside of the vertical extent of military PEXA.
Impact to Met Office weather radars	The Array Project lies outside the safeguarded area of 20km for Met Office weather radar systems.

9.3.7 Designed In Measures and Mitigation

9.3.7.1 As part of the project design process, a number of designed in measures (primary and tertiary) will reduce the potential for impacts on aviation (civil and military) receptors (Table 9.14). As there is a commitment to implement these measures, they are considered inherent to the design of the Array Project. The determination of magnitude and significance will assume the implementation of such measures. Some of these measures are considered standard industry practice for this type of development.

9.3.7.2 The requirement for any additional (secondary) mitigation measures will be dependent on the significance of the effects on aviation (civil and military) receptors. The requirement for and feasibility of any mitigation measures will be consulted upon with statutory consultees throughout the EIA process.

Table 9.14: Designed in measures and mitigation, relevant to aviation (military and civil) receptors

Reference number	Measures adopted	Justification	Primary or tertiary
MM-9	The Array Project operator will issue, as necessary, requests to the UK Aeronautical Information Service to submit Notification to Aviation Missions (NOTAM) in the event of any failure of aviation lighting.	To minimise the risks of temporary hazards.	T
MM-10	The DIO will be informed of the construction start and end dates, the maximum height of construction equipment and locations of substations.	To maximise awareness of temporary hazards.	T
MM-23	Procedures for helicopter hoist operations will be established in accordance with CAP 437.	To minimise the likelihood of incidents.	T
MM-24	Development of, and adherence to, and Emergency Response an Cooperation Plan (ERCoP), including consideration of helicopters.	To formulate robust emergency response plans and site safety.	T
MM-34	Appropriate lighting and marking of wind turbines and offshore substation platforms will be established in accordance with CAA regulations and guidance (CAP 393, The ANO) and in accordance with the CAA and the DIO,	Up to date guidance on turbine lighting will be followed when producing the LMP to address aviation, shipping and ornithological requirements	T

Reference number	Measures adopted	Justification	Primary or tertiary
	which is responsible for the safeguarding of MoD assets. Secured through the development of, and adherence to, a LMP.		
MM-36	Prior to the start of construction, the MoD Aeronautical Information Documents Unit (AIDU) and UKHO will be informed of the locations, heights, and lighting status of the offshore substation platforms, including estimated and actual dates of construction and operation activities, and the maximum height of any equipment to be used, to allow inclusion on aviation charts.	To allow inclusion on aviation charts.	T
MM-42	A minimum spacing of 500m shall be maintained between blade tip to blade tip of all surface infrastructure (for offshore substation platforms, this shall be taken as the outermost point of the infrastructure).	To facilitate access by SAR helicopters operating under instrument meteorological conditions (IMC) flight rules, in line with MCA guidance.	P

9.3.8 Proposed Assessment Methodology

9.3.8.1 The EIA for aviation receptors will follow the methodology in chapter 4: Environmental Impact Assessment Methodology of the Scoping Report. The EIA will be supported by further desk-based studies that will be undertaken, in parallel where appropriate, with engagement and meetings with specific stakeholders to provide a detailed understanding of potential impacts. The requirement for and feasibility of any further mitigation will be dependent on the significance of effects and will be consulted on with statutory consultees throughout the EIA process.

9.3.8.2 The aviation industry and the provision of Air Navigation Services (ANS) (including radar services) are regulated through extensive legislation; however, the main mechanism for regulating the relationship between aviation and offshore wind is through the consenting system. The documents listed Table 9.11 as a minimum, have been and will be considered during the EIA process.

9.3.9 Potential Cumulative Impacts

9.3.9.1 The cumulative effects assessment will consider the impacts cumulatively with other offshore wind farms and associated aviation activities. Potential cumulative effects on aviation (military and civil) from the Array Project, together with other offshore wind farm developments, will be assessed through engagement with the relevant aviation stakeholders.

9.3.9.2 There is a potential for increased radar interference (clutter) to PSRs and ADRs from the Array Project with other offshore wind farms. It is anticipated that a technical mitigation solution for this cumulative impact will need to be investigated.

9.3.9.3 There is a potential for an increase in low level air traffic, particularly helicopter support operations to the Array Project and other offshore developments in the area below 2,000ft amsl. Engagement with the MoD DIO, which safeguards military infrastructure, and offshore helicopter operators (at Aberdeen Airport) will be important.

9.3.10 Potential Inter-Related Effects

9.3.10.1 The EIA will consider inter-related effects. Inter-related effects relate to effects arising from the Array Project, either across their own phases (project lifetime) or different effects on one receptor in one phase (receptor-led). The EIA will consider inter-related effects, in relation to the potential effects of multiple impacts from the construction, O&M and decommissioning phases of the Array Project, affecting one receptor. Inter-related effects are assessed through consideration of all effects on a receptor, considering both spatial and temporal overlaps, with the Array Project. This will ensure that the Array Project as a whole is appropriately considered within the EIA.

9.3.11 Potential Transboundary Impacts

9.3.11.1 The Array Project is located wholly within UK airspace and, therefore, no transboundary impact is envisaged.

9.4 Marine Archaeology

9.4.1 Introduction

9.4.1.1 This chapter of the Scoping Report identifies the marine archaeology receptors of relevance to the Array Project. It considers the potential impacts arising from the construction, O&M and decommissioning of the Array Project. It is proposed to scope out all potential impacts on marine archaeology from the EIA Report and Table 9.15 sets out the justification for this approach.

9.4.2 Study Area

9.4.2.1 The Marine Archaeology Study Area is shown in Figure 9.9 and is defined as the Scoping Boundary plus a 2km buffer. This encompasses all elements of the Array Project and allows site specific data to be put into a wider context.

9.4.3 Data Sources

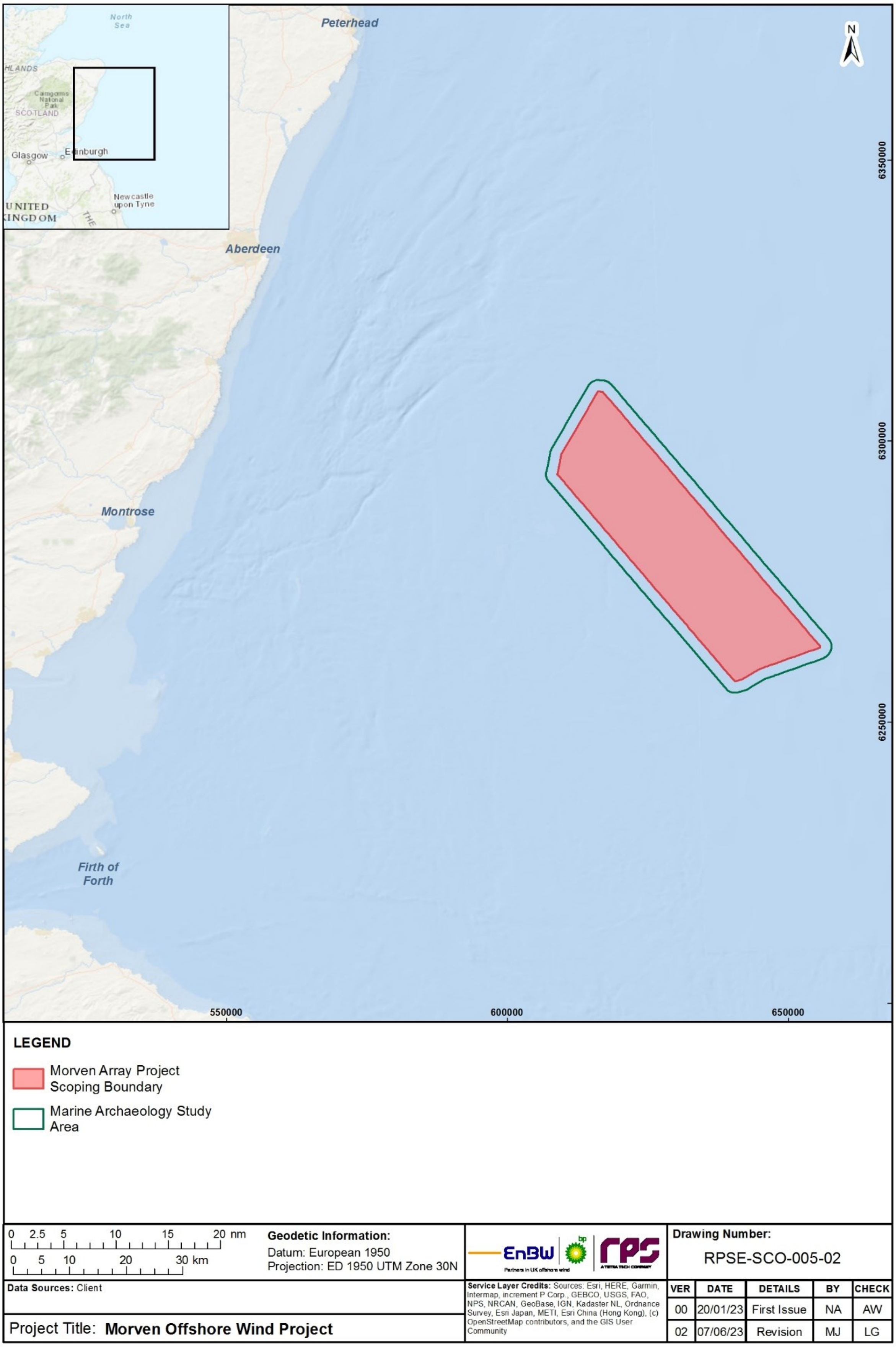
9.4.3.1 A number of data sources were consulted to inform the marine archaeology chapter of the Scoping Report and will be used to inform the marine archaeology Technical Report to be submitted with the EIA Report. East Lothian, Fife and Dundee Councils were contacted but held no records within the Marine Archaeology Study Area. Data sources of relevance to the Array Project comprise of:

- the UKHO wrecks database, containing recorded wreck and obstruction data;
- records held by Historic Environment Scotland (HES) which include:
  - monuments records;
  - archaeological event records;
  - maritime records;
  - aircraft crash sites;
  - find locations;
- Historic Environment Record (HER) data held by Aberdeenshire Council Archaeology Service;
- relevant mapping including Admiralty Charts, British Geological Survey (BGS), Ordnance Survey and historic maps;
- relevant primary and secondary sources and grey literature, available through the Archaeological Data Service (ADS) and other websites, including published and unpublished archaeological reports relevant to the vicinity of the Marine Archaeology Study Area.

9.4.3.2 To compile a marine archaeological baseline for the purposes of this Scoping Report, these sources were compiled into gazetteers (see Apppendix 13: Gazetteer of marine archaeology).

9.4.3.3 The historic environment records have been classified between records where material is known to be on the seabed and ‘recorded losses’. Recorded losses represent maritime and aviation losses that are known to have occurred in the vicinity but to which no specific location can be attributed.

9.4.3.4 Where multiple entries across the datasets occur that relate to the same archaeological receptor, the coordinates from the UKHO dataset have been used as they are most frequently updated with the latest survey positions.



VER	DATE	DETAILS	BY	CHECK
00	20/01/23	First Issue	NA	AW
02	07/06/23	Revision	MJ	LG

Figure 9.9: Marine Archaeology Study Area data sources

9.4.4 Site Specific Surveys

9.4.4.1 A geophysical survey took place from April to August 2022 within the Scoping Boundary. This included a MBES, SSS, Sub-Bottom Profiler (SBP), multichannel 2D Ultra-High Resolution Seismic (UHRS) and magnetometer survey. Data from this survey will be reviewed by a marine archaeologist specialising in geophysical data interpretation. This information will be used to inform the marine archaeology baseline for the marine archaeology Technical Report to be submitted with the EIA Report.

9.4.5 Consultation

9.4.5.1 No pre-application pre-Scoping consultation has been undertaken to date for Marine Archaeology receptors.

9.4.6 Baseline Environment

9.4.6.1 This chapter provides a summary of the marine archaeological baseline environment within the Marine Archaeology Study Area. The baseline environment is structured into the following categories:

- Submerged prehistoric archaeology: this includes palaeochannels and other inundated terrestrial landforms that may preserve sequences of sediment of palaeoenvironmental interest, Palaeolithic and Mesolithic sites and artefacts;
- Maritime archaeology: relates generally to craft or vessels and any of their associated structures and/or cargo;
- Aviation archaeology: this comprises all military and civilian aircraft crash sites and related wreckage.

9.4.6.2 There are no designated archaeological sites within the Marine Archaeology Study Area. A gazetteer of the known marine archaeology within the Marine Archaeology Study Area can be found in Apppendix 13: Gazetteer of Marine Archaeology of the Scoping Report.

Submerged prehistoric archaeology

9.4.6.3 The earliest evidence of human occupation in Scotland dates to the Late Upper Palaeolithic (LUP) in the form of the discovery of flint and chert assemblages at Howburn Farm in South Lanarkshire (Ballin *et al.*, 2010). It is likely that the east coast of Scotland would have seen human occupation at this time as early settlers would have moved north following the retreat of ice sheets at the end of the Last Glacial Maximum (LGM). The LGM began circa. 18,000 Before Present (BP) and ice sheets began to retreat around 13,000BP. It is thought that human and animal reoccupation of mainland Britain was swift and that this reoccupation came from crossing the now submerged palaeolandscape of Doggerland from mainland Europe (Fitch *et al*., 2011).

9.4.6.4 However, palaeocoastline modelling undertaken by Brooks *et al*. (2011) (Figure 9.10) suggests that the Marine Archaeology Study Area has been fully submerged throughout all periods of human occupation in Scotland. It is, therefore, unlikely that there is any potential for evidence of submerged prehistoric archaeology within the Marine Archaeology Study Area. Archaeological assessment of the geophysical and geotechnical survey data will further characterise the palaeolandscape and submerged prehistoric potential of the Marine Archaeology Study Area, the results of which will be presented in the Marine Archaeology Technical Report of the EIA Report.

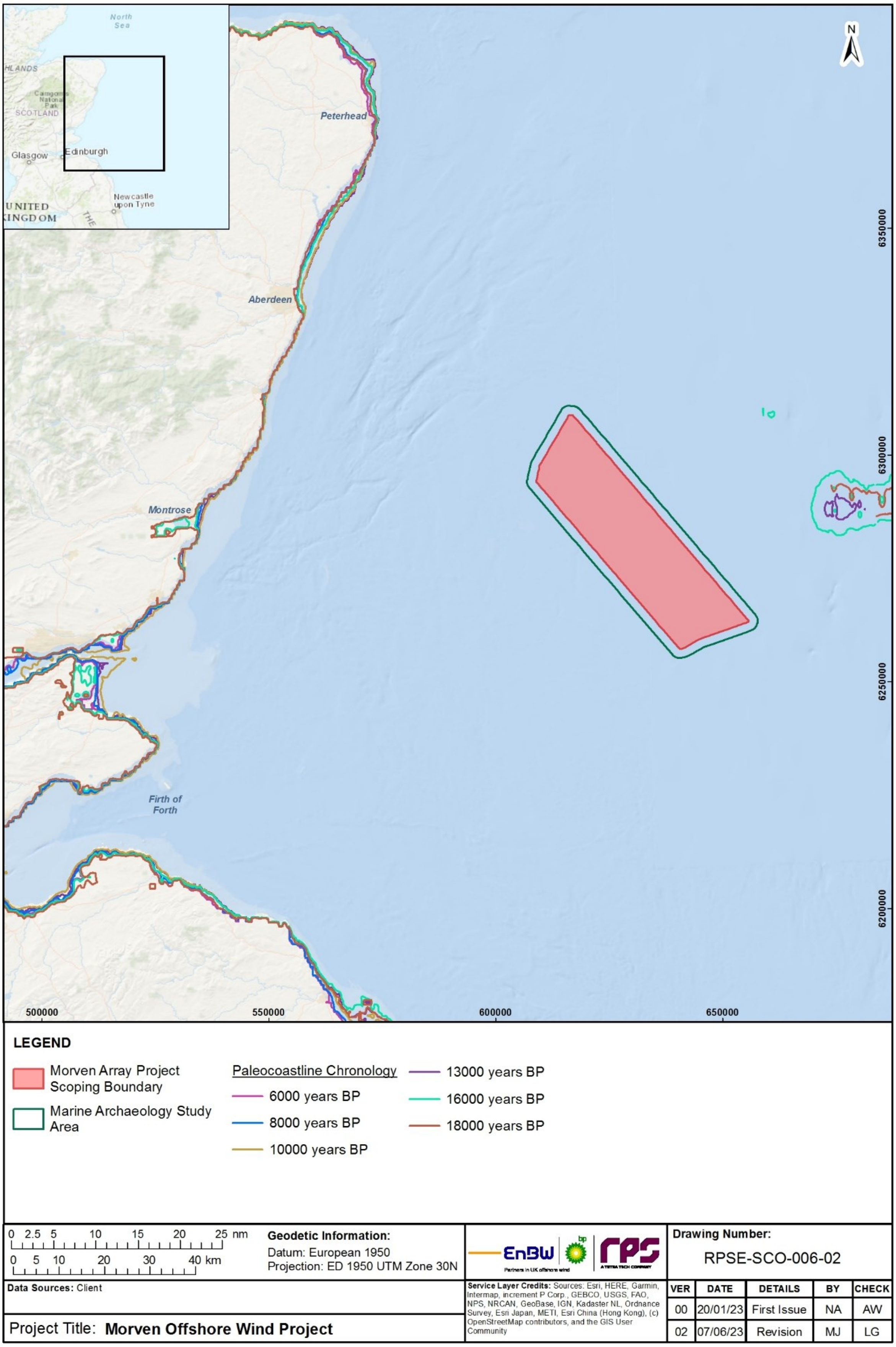


Figure 9.10: Palaeocoastlines in relation to the Marine Archaeology Study Area

Maritime and aviation archaeology

9.4.6.5 One previously unrecorded wreck has been identified in a preliminary assessment of geophysical data collected within the Marine Archaeology Study Area (Figure 9.11). The geophysical data has yet to undergo full archaeological assessment, the results of which will be presented in the Marine Archaeology Technical Report.

9.4.6.6 The desktop study has identified six known wrecks or possible wreck sites within the data for the Marine Archaeology Study Area. Of the six, one can be identified as the *Ailsa*, a World War One (WW1) iron steamship that was captured and sunk by a German submarine on 18 June 1915, 30 miles northeast of the Bell Rock. The other five sites are classed as unknown and possible wreck sites, the locations of which are shown in Figure 9.11 and details presented within Appendix 13: Gazetteer of Marine Archaeology.

9.4.6.7 Within the UKHO data for the Marine Archaeology Study Area there are three wreck sites which are listed as ‘dead’, indicating that no remains have been identified and, therefore, the wreck is considered not to exist at those locations. However, it is worth noting that ‘dead’ wrecks may still be present at the locations indicated but are buried or flattened and no longer represent a navigational hazard. Archaeological interpretation of the geophysical survey data will clarify whether archaeological material survives at these locations and will further characterise the maritime archaeology of the Marine Archaeology Study Area.

9.4.6.8 No aviation sites have been identified within the desktop data.

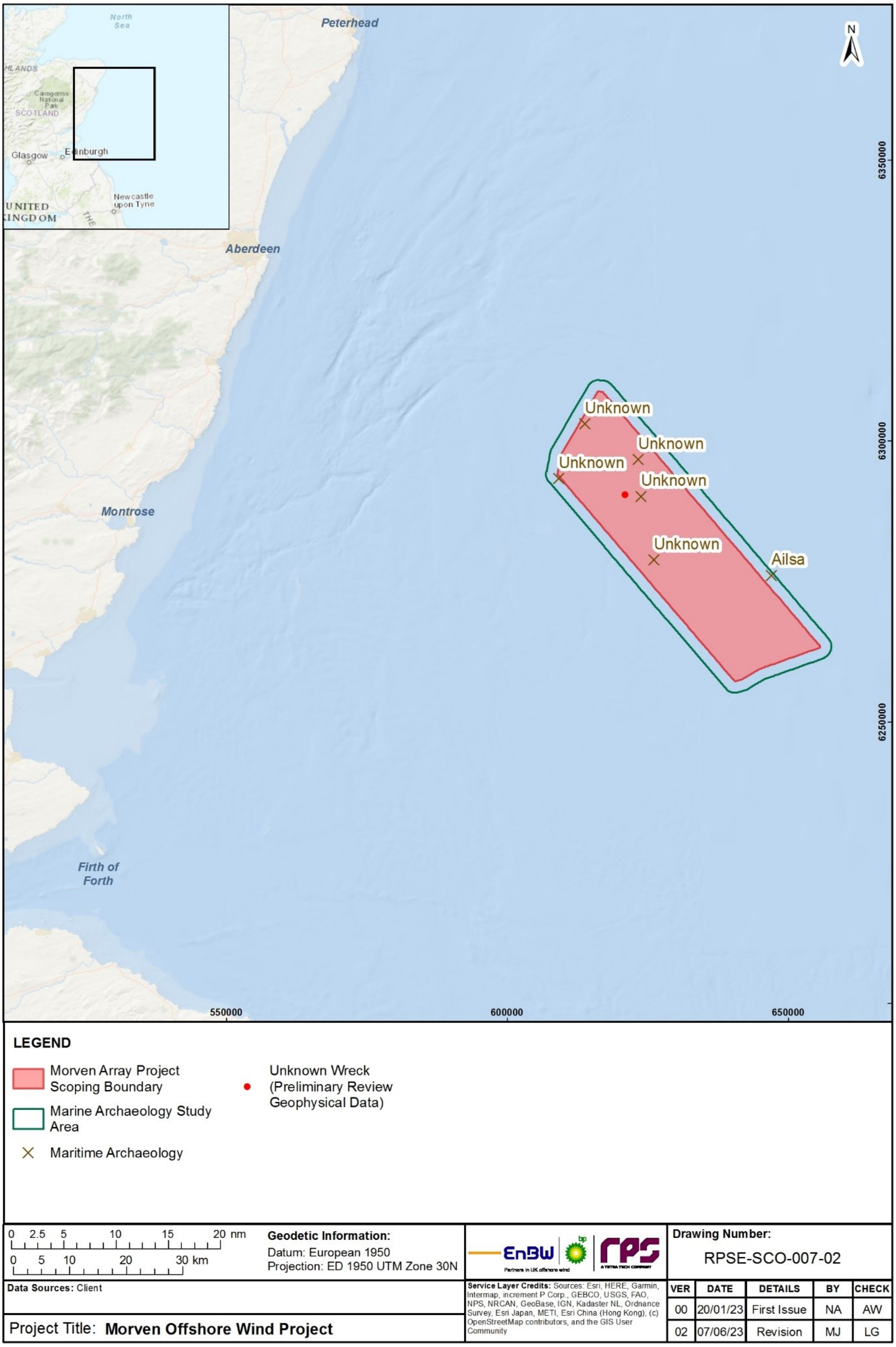


Figure 9.11: Maritime archaeology within the Marine Archaeology Study Area

Maritime and aviation archaeology potential

9.4.6.9 Maritime archaeological sites and materials can be defined as the physical remains of boats and ships that have been wrecked, sunk or have foundered, and artefacts that rest upon the seabed as the result of being jettisoned or lost overboard (for example, anchors, cannon or fishing gear).

9.4.6.10 Six recorded losses have been attributed to coordinates within the Marine Archaeology Study Area, the details of which are presented within Apppendix 14: Gazetteer of recorded losses. Recorded losses are often grouped with reference to a geographic, hydrographic or other point of reference, making the positional data of these records unreliable. However, they do provide information on the historical marine traffic of the general region.

9.4.6.11 Of the six recorded losses two are recorded as “Unknown 1920 ”and “Unknown 1921” and the other four are named losses. The *Valiant* is recorded as a motorised fishing vessel, the *Titan* as a 20th century steam trawler, the *Bosphorus* was an iron paddled steam trawler which foundered approximately 37 Nautical miles southeast of Girdle Ness in 1904 and the *Competitor* was a cargo schooner that was abandoned 70nm east of Montrose in 1852.

9.4.6.12 Records of known wreck sites and losses in UK waters are biased towards the recent, predominantly post-medieval and modern periods. Although the existence and survival of Palaeolithic watercraft are highly speculative in the UK, evidence of late Prehistoric and Roman sea going vessels cannot be ruled out and may have been lost in the North Sea.

9.4.6.13 The potential for the survival of medieval maritime archaeology is higher than from earlier periods but still rare, as ship construction during the medieval period relied heavily on organic building materials that are less likely to survive on and in the seabed.

9.4.6.14 The post medieval and modern periods present the greatest potential for unrecorded archaeology to be discovered. The increasing incorporation of metal structural elements into vessel designs during this period means that wrecks from the 19th and early 20th centuries are also often more visible on the seabed than their wooden predecessors. They are visible to bathymetric and geophysical survey, and also generate strong magnetic anomalies, and this greater visibility is reflected in the increased number of known wrecks (i.e. those that have been located on the seabed) in contrast to earlier periods.

9.4.7 Potential Project Impacts of the Array Project

9.4.7.1 It is proposed to scope out all potential impacts on marine archaeology from the EIA Report and Table 9.15 sets out the justification for this approach.

Table 9.15: Impacts proposed to be scoped out of the Array Project assessment for marine archaeology

Impact	Basis for impact
Impact of sediment disturbance and deposition leading to indirect impacts on marine archaeology receptors.	The Marine Archaeology Technical Report, together with associated data review of the geophysical data for the Array Project, will provide an overview of the identifiable marine archaeology features within the Marine Archaeology Study Area. This Marine Archaeology Technical Report will form the basis of an Written Scheme of Investigation (WSI) and Protocol for Archaeological Discoveries (PAD), which will be prepared for approval by HES. The development and implementation of a PAD will allow for the recording of any unexpected archaeological discoveries that may occur due to sediment disturbance and deposition during the Array Project.
Direct damage to maritime archaeology receptors (e.g. wrecks, debris, submerged prehistoric receptors (palaeolandscapes and associated archaeological receptors).	The Marine Archaeology Technical Report, together with associated data review of the geophysical data for the Array Project, will provide an overview of the identifiable marine archaeology features within the Marine Archaeology Study Area. The Marine Archaeology Technical Report will form the basis of an WSI and PAD, which will be prepared for approval by HES. The WSI will include proposed Archaeological Exclusion Zones (AEZs) for marine archaeology receptors identified within the geophysical survey data.

Impact	Basis for impact
	This mitigation will prevent direct damage to maritime archaeology receptors. The potential for prehistoric submerged archaeology within the Marine Archaeology Study Area is extremely low. Archaeological input into geotechnical survey design will aid in establishing the full potential for palaeolandscapes and associated archaeological material.
Direct damage to deeply buried marine archaeology receptors – submerged prehistoric receptors (e.g. palaeolandscapes and associated archaeological receptors).	The Marine Archaeology Technical Report, together with associated data review of the geophysical data for the Array Project, will provide an overview of the identifiable marine archaeology features within the Marine Archaeology Study Area. The Marine Archaeology Technical Report will form the basis of an WSI and PAD, which will be prepared for approval by HES. The WSI will include proposed AEZs for marine archaeology receptors identified within the geophysical survey data. This mitigation will prevent direct damage to maritime archaeology receptors. The potential for prehistoric submerged archaeology within the Marine Archaeology Study Area is extremely low. Archaeological input into geotechnical survey design will aid in establishing the full potential for palaeolandscapes and associated archaeological material.
Alteration of sediment transport regimes leading to indirect impacts on marine archaeology receptors.	The Marine Archaeology Technical Report, together with associated data review of the geophysical data for the Array Project, will provide an overview of the identifiable marine archaeology features within the Marine Archaeology Study Area. This Marine Archaeology Technical Report will form the basis of an WSI and PAD, which will be prepared for approval by HES. The development and implementation of a PAD will allow for the recording of any unexpected archaeological discoveries that may occur due to an alteration of sediment transport regimes as a result of the Array Project.

9.4.8 Designed In Measures and Mitigation

9.4.8.1 As part of the project design process, a number of designed in measures (primary and tertiary) will reduce the potential for impacts on marine archaeology (Table 9.16). As there is a commitment to implement these measures, they are considered inherent to the design of the Array Project. The determination of magnitude and significance will assume the implementation of such measures. Some of these measures are considered standard industry practice for this type of development.

9.4.8.2 The requirement for any additional (secondary) mitigation measures will be dependent on the significance of the effects on marine archaeology receptors. The requirement for and feasibility of any mitigation measures will be consulted upon with statutory consultees throughout the EIA process.

Table 9.16: Designed in measures and mitigation as part of the Array Project, relevant to Marine Archaeology

Reference number	Designed in measures	Justification	Primary or tertiary
MM-25	The implementation of AEZs around sites identified as having a known important archaeological potential.	AEZs will ensure offshore infrastructure avoids any known wrecks. The size of the AEZ will be evidence based and established using the precautionary principle to ensure that it is of sufficient size to protect the site from the nature of impact (Wessex Archaeology, 2007; Wessex Archaeology for The Crown Estate, 2021).	P
MM-26	Archaeological input into survey specifications for, and data analysis of, future preconstruction	This might include the presence of a geoarchaeologist on board the survey vessel and provision for advice on methodology	P

Reference number	Designed in measures	Justification	Primary or tertiary
	geophysical surveys, geotechnical surveys, preconstruction Remotely Operated Vehicle (ROV) or diver surveys and preconstruction site preparation activities.	including sampling, analysis and reporting of recovered cores. The results of all geoarchaeological investigations are to be compiled in a final report, that includes a sediment deposit model, if appropriate, to carry out watching briefs of such work. All anomalies of unconfirmed archaeological potential to be considered during pre-construction activities and final 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.	
MM-27	All anomalies of unconfirmed archaeological potential to be considered during pre-construction activities and final 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.	All anomalies of unconfirmed archaeological potential to be considered during pre-construction activities and final 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.	S
MM-28	Archaeologists to be consulted in advance of preconstruction site preparation activities and, if appropriate, to carry out watching briefs of such work.	To prevent damage occurring to unidentified archaeological finds.	T
MM-29	Micro-siting of wind turbine foundation anchors and mooring lines to avoid known wrecks if practicable.	Micro-siting to avoid known marine archaeology features such as wrecks.	T
MM-30	Mitigation of unavoidable direct impacts on known sites of archaeological importance during pre-construction and construction activities. Options include i) preservation by record, ii) stabilisation and iii) detailed analysis and safeguarding of otherwise comparable sites elsewhere.	Options include preservation by record, stabilisation and detailed analysis and safeguarding of otherwise comparable sites elsewhere.	P
MM-31	Development and adherence to a WSI and PAD.	The WSI will include proposed AEZs for marine archaeology receptors identified within the geophysical survey data to prevent direct damage to maritime archaeology receptors. The PAD will allow	T

Reference number	Designed in measures	Justification	Primary or tertiary
		for the recording, preservation and protection of any unexpected archaeological discoveries that may occur due to sediment disturbance and deposition during the Array Project.	

9.4.9 Proposed Assessment Methodology

9.4.9.1 Should it be required, and agreement to scope out is not reached, the marine archaeology chapter of the EIA Report will follow the methodology in chapter 4: EIA Methodology of the Scoping Report. The following guidance will also be consulted:

- Historic Environment Policy for Scotland (HES, 2019).
- Standard and Guidance for Historic Environment Desk-Based Assessment (Chartered Institute for Archaeologists (CIfA), 2014).
- Historic Environment Guidance for Offshore Renewable Energy Sector (Collaborative Offshore Wind Research into the Environment (COWRIE)) (Wessex Archaeology,2007).
- Guidance for Assessment of Cumulative Impacts on the Historic Environment from Offshore Renewable Energy (Wessex Archaeology for COWRIE, 2008).
- Code of Practice for Seabed Development (Joint Nautical Archaeology Policy Committee (JNAPC), 2006).
- Archaeological Mitigation for Offshore Wind Farms: Model Clauses for Written Schemes of Investigation (Wessex Archaeology for The Crown Estate (TCE), 2021).
- Protocol for Archaeological Discoveries: Offshore Renewables Projects (TCE, 2014).

9.4.10 Potential Cumulative Impacts

9.4.10.1 Most of the potential impacts on marine archaeological receptors arising from the construction, O&M and decommissioning phases of the Array Project are considered to be localised to within the footprint of the Scoping Boundary. All potential impacts on marine archaeology are proposed to be scoped out and, therefore, there is low potential for cumulative effects to arise from other projects or activities that may affect marine archaeological receptors. The development and implementation of a WSI and PAD will allow for the recording of any unexpected archaeological discoveries that may occur due to cumulative impacts.

9.4.10.2 Should agreement to scope out the marine archaeology assessment not be reached, the EIA Report will follow the cumulative effect assessment approach outlined in chapter 4: EIA Methodology of the Scoping Report.

9.4.11 Potential Inter-Related Effects

9.4.11.1 Should it be required, and agreement to scope out is not reached, the EIA will consider inter-related effects. Inter-related effects relate to effects arising from the Array Project, either across their own phases (project lifetime) or different effects on one receptor in one phase (receptor-led). The EIA will consider inter-related effects, in relation to the potential effects of multiple impacts from the construction, O&M and decommissioning phases of the Array Project, affecting one receptor. Inter-related effects are assessed through consideration of all effects on a receptor, considering both spatial and temporal overlaps, with the Array Project. This will ensure that the Array Project as a whole is appropriately considered within the EIA.

9.4.12 Potential Transboundary Impacts

9.4.12.1 A screening of transboundary impacts has been carried out and is presented in Appendix 1: Transboundary Screening. This screening exercise identified that there is no potential for transboundary impacts upon marine archaeology due to construction, O&M or decommissioning impacts of the Array Project.

9.5 Other Sea Users, Marine Infrastructure and Communications

9.5.1 Introduction

9.5.1.1 This chapter of the Scoping Report identifies other sea users and marine infrastructure receptors of relevance to the Array Project. It considers the potential impacts arising from the construction, O&M and decommissioning of the Array Project on other sea users and marine infrastructure.

9.5.1.2 Potential impacts upon other sea users and marine infrastructure related to navigational safety are addressed in section 5.2 of chapter 9.2: Shipping and navigation of the Scoping Report. Potential impacts on helicopter access to oil and gas platforms are addressed in chapter 6.3: Aviation (civil and military) of the Scoping Report. The Environmental Impact Assessment (EIA) Report chapter on other sea users and marine infrastructure will only consider impacts that have likely significant effects on the undertaking of an identified marine activity or on the operational effectiveness of marine infrastructure.

9.5.2 Study Area

9.5.2.1 Two study areas have been defined for the assessment of different groupings of receptors for the Array Project. These are the Regional Other Sea Users and Marine Infrastructure Study Area, and Local Other Sea Users and Marine Infrastructure Study Area, as shown in Figure 9.12.

9.5.2.2 The regional Other Sea Users and Marine Infrastructure Study Area is based on one tidal excursion from the Scoping Boundary. This is considered to represent the maximum area within which increases in suspended sediments could arise from Array Project activities. The regional Other Sea Users and Marine Infrastructure Study Area is relevant to those human activity receptors that are susceptible to increases in suspended sediment concentrations, namely:

- marine aggregate extraction and disposal sites;
- scuba diving.

9.5.2.3 The Local Other Sea Users and Marine Infrastructure Study Area is defined as the Scoping Boundary with an additional 1km buffer. The 1km buffer has been included as oil and gas infrastructure, cables and pipelines and offshore wind farm structures undergoing maintenance will require a 500m safety zone or advisory clearance distance. This area includes the extent of potential direct physical overlap between the Array Project activities and the following receptors:

- recreational (including sailing, motor cruising and recreational fishing from boats);
- offshore energy projects (including offshore wind farms, oil and gas activities, carbon capture and storage);
- cable and pipeline operators;
- offshore microwave fixed communication links;
- Radar Early Warning Systems (REWS).

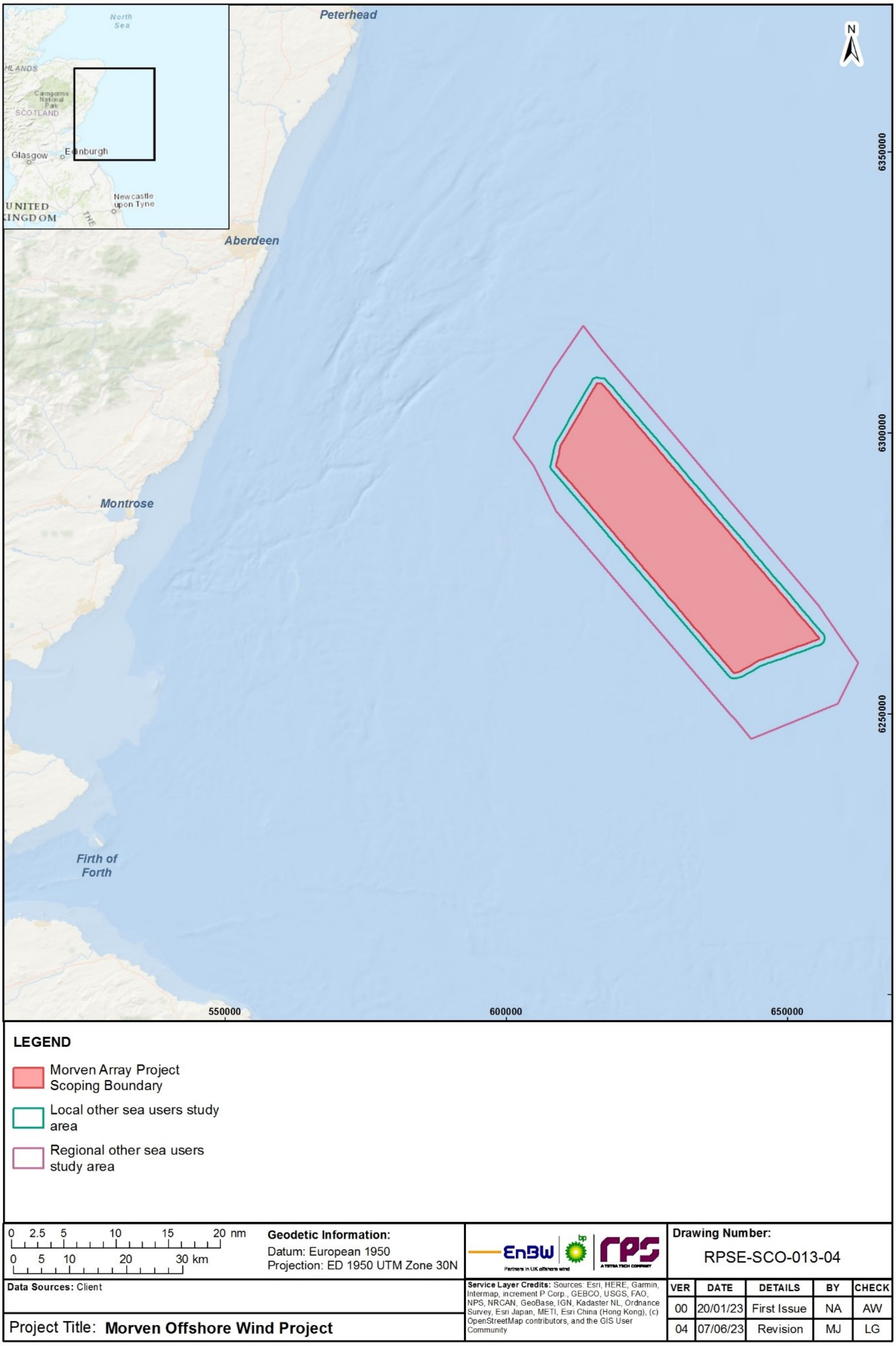


Figure 9.12: The Regional Other Sea Users and Marine Infrastructure Study Area and the Local Other Sea Users and Marine Infrastructure Study Area

9.5.3 Data Sources

Desktop data

9.5.3.1 An initial desk-based review of literature and data sources to support this Scoping Report has identified several data sources that provide coverage of the study areas. These are summarised in Table 9.17.

Table 9.17: Summary of key desktop datasets and reports

Title	Source	Year	Author
Diving sites	UKDiving.co.uk	2023	UK Diving
Disposal sites	EMODnet	2023	EMODnet
Cable routes	Kis-Orca	2023	Kis-Orca
Data from site specific two 14-day marine vessel traffic surveys (see section 9.2.3)	Anatec (commissioned by the Applicant)	2023	Anatec
Offshore wind farms	Global Offshore Renewable Map	2023	4C Offshore
Recreational fishing	National Marine Plan Interactive (NMPi) Webmap Service	2023	NMPi Webmap Service
Pipelines	North Sea Transition Authority[20]	2021	North Sea Transition Authority
Wells	North Sea Transition Authority	2021	North Sea Transition Authority
Oil and gas platforms	North Sea Transition Authority	2021	North Sea Transition Authority
Subsurface structures	North Sea Transition Authority	2021	North Sea Transition Authority
Hydrocarbon fields	North Sea Transition Authority	2021	North Sea Transition Authority
Oil and gas licence block	North Sea Transition Authority	2021	North Sea Transition Authority
United Kingdom Continental Shelf (UKCS) block	North Sea Transition Authority	2021	North Sea Transition Authority
Recreational vessel traffic	Automatic Identification System (AIS) Data	2019	Marine Management Organisation
Recreational activities	UK Coastal Atlas of Recreational Boating	2018	Royal Yachting Association (RYA)
Aggregate extraction	Scotland's National Marine Plan	2015	Scottish Government

9.5.4 Consultation

9.5.4.1 No pre-application pre-Scoping consultation has been undertaken to date for other sea users, marine infrastructure and communication receptors.

[20] Prior to March 2022, the North Sea Transition Authority was known as the Oil and Gas Authority.

9.5.5 Baseline Environment

9.5.5.1 This section provides a summary of the baseline environment of the Array Project. The receptors discussed in the sections below have been considered as part of the baseline environment for infrastructure and other sea users.

9.5.5.2 With the exception of marine traffic surveys, no site specific surveys have been undertaken to inform the Scoping Report. Due to availability of suitable data throughout the East Scotland Coast sea area, new data or modelling studies will not be required to characterise the other sea users and marine infrastructure baseline for the EIA Report.

Regional Other Sea Users and Marine Infrastructure

<u>Marine aggregate extraction</u>

9.5.5.3 Although Scotland has a considerable marine sand and gravel resource, the marine aggregate industry has historically been very small due to land supplies and more readily accessible marine resources elsewhere in UK waters. Marine aggregate licences have historically been issued to two sites in Scotland, one site in the Firth of Forth and the second site in the Firth of Tay (Scottish Government, 2015), which do not overlap the Regional Other Sea Users and Marine Infrastructure Study Area. There are currently no active licences for marine aggregate extraction in the Regional Other Sea Users and Marine Infrastructure Study Area (as shown in Figure 9.13). Marine aggregate extraction sites have, therefore, not been considered further within this Scoping Report.

<u>Disposal sites</u>

9.5.5.4 A review of potential active or closed marine disposal sites identified no active or closed disposal sites within the regional infrastructure and other sea users Study Area (EMODnet, 2023). Marine disposal sites have, therefore, not been considered further within this Scoping Report.

<u>Scuba diving</u>

9.5.5.5 There are no recreational dive sites within the regional Other Sea Users and Marine Infrastructure Study Area (UK Diving, 2023). Scuba diving has, therefore, not been considered further within this Scoping Report.

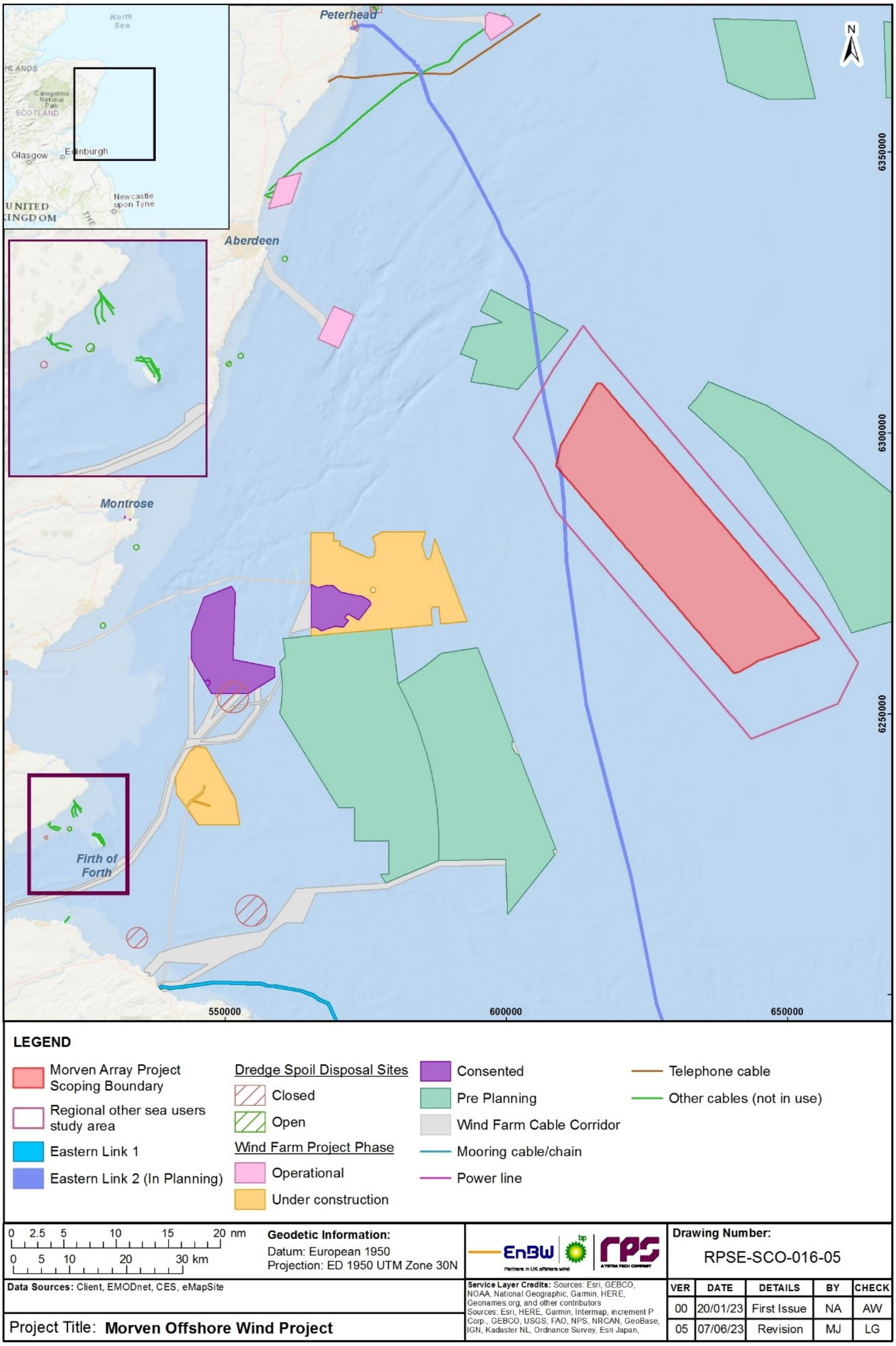


Figure 9.13: Disposal sites, offshore wind farms and cables within the Regional Other Sea Users and Marine Infrastructure Study Area and the Local Other Sea Users and Marine Infrastructure Study Area

Local Other Sea Users and Marine Infrastructure Study Area

Recreational sailing and motor cruising

9.5.5.6 Recreational sailing is generally divided into two categories: offshore and inshore. Offshore sailing is usually undertaken by yachts in the form of either cruising or organised offshore racing, although offshore racing can also involve powerboats. Inshore sailing is typically undertaken by smaller vessels including dinghies and recreational craft that are used for either cruising at leisure or racing in near-shore areas, predominantly within sight of a club facility. Cruising may include lengthy voyages, including across the North Sea between Scandinavia and Scotland, or short trips between local ports, harbours and marinas, which often include a return journey to the home port on the same day. Inshore racing takes place around racing marks and navigational buoyage. Due to the offshore location of the Array Project, activities that are generally associated with inshore recreational sailing are not expected. Round-UK offshore powerboating races have declined in popularity in recent years and are not anticipated to take place near the Array Project.

9.5.5.7 As noted in paragraph 9.5.1.2, navigational safety and risk to recreational vessels is considered in section 5.2 of chapter 9.2: Shipping and navigation of the Scoping Report. The chapter that considers other sea users and marine infrastructure in the EIA Report will only consider receptors undertaking recreational sailing and motor cruising as an activity.

9.5.5.8 Figure 9.14 illustrates that recreational sailing and motor cruising in the Local Other Sea Users and Marine Infrastructure Study Area is of a low to medium intensity. The RYA data are limited to inshore waters, but AIS data tracks show that recreational vessels also transit through the Local Other Sea Users and Marine Infrastructure Study Area. Due to the distance of the Array Project from the coast (~60km), any sailing would likely consist of offshore cruising and racing (RYA, 2019).

9.5.5.9 Data from the marine vessel traffic surveys and consultation activities carried out to inform the NRA (see section 5.2: chapter 9.3: Shipping and Navigation of the Scoping Report) will be used as an additional data source to inform the assessment on recreational sailing and cruising receptors.

Recreational fishing

9.5.5.10 There are very low levels of recreational angling in the Local Other Sea Users and Marine Infrastructure Study Area, likely due to the large distance (~60km) from land (NMPi, 2023). Consultation will take place with local operators to further understand activities and operational range.

9.5.5.11 Commercial fishing is considered in chapter 9.1: Commercial Fisheries of the Scoping Report. The chapter that considers other sea users and marine infrastructure in the EIA Report will only consider recreational fishing receptors.

Offshore wind farms

9.5.5.12 Offshore wind farms in the North Sea in proximity to the Local Other Sea Users and Marine Infrastructure Study Area are shown in Figure 9.13. There are no offshore wind farms within the Local Other Sea Users and Marine Infrastructure Study Area; the nearest operational OWF is Kincardine OWF, located approximately 40km to the northwest of the Scoping Boundary.

9.5.5.13 The nearest OWF at the pre-planning stage are the Bowdun OWF (formerly Cluaran Deas Ear) and Ossian OWF ~10km northwest and ~5km east of the Array Project, respectively (4C Offshore, 2023).

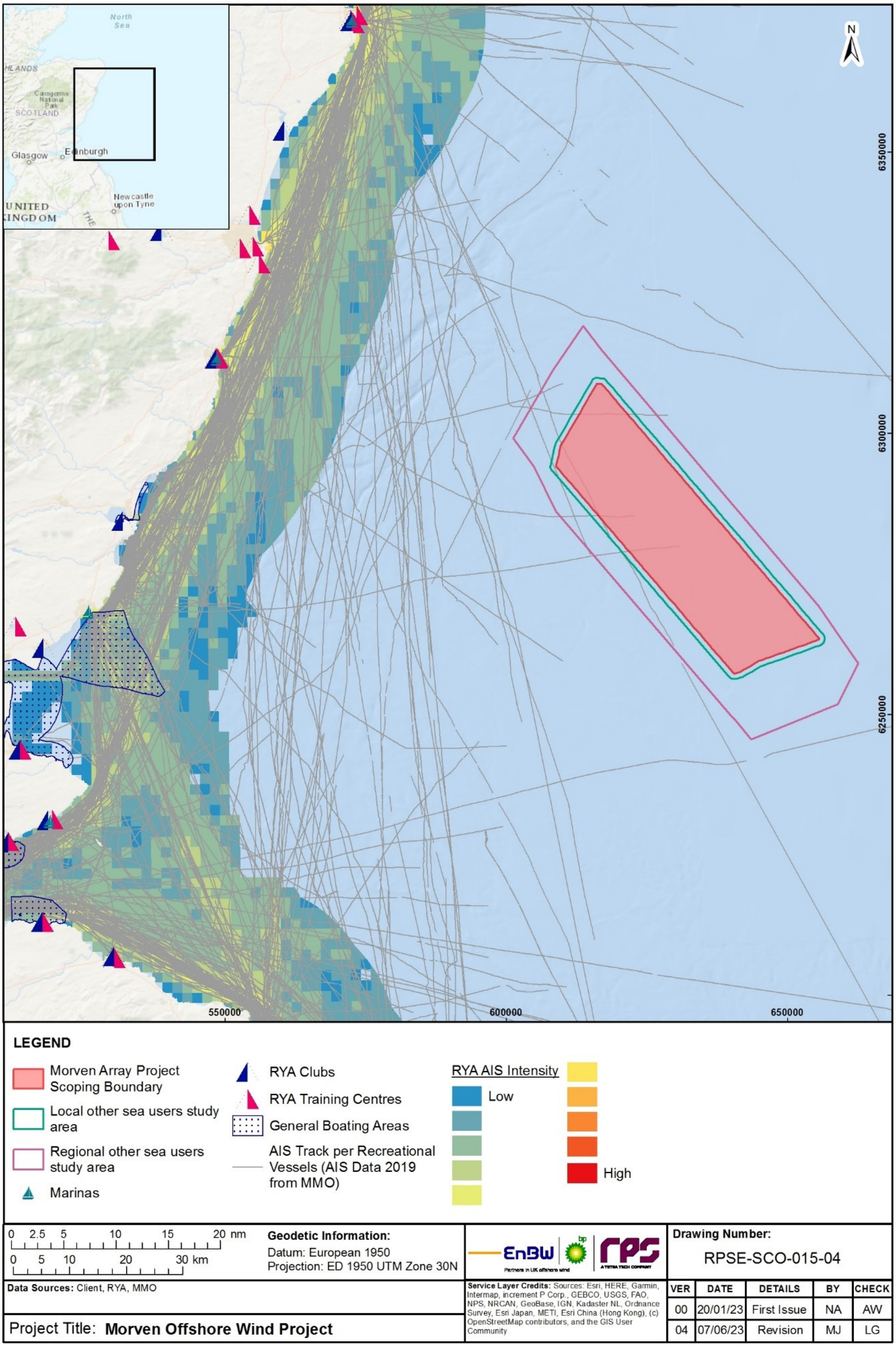


Figure 9.14: Recreational activities in the Regional Other Sea Users Study Area and the Local Other Sea Users Study Area

Oil and gas operations

9.5.5.14 The Firth of Forth supports oil and gas activities such as those associated with the Grangemouth refinery, oil storage and tanker terminals. However, there are currently no active licence blocks located within or near the Local Other Sea Users and Marine Infrastructure Study Area.

9.5.5.15 The closest active licence block, Block 27/9, currently licensed by North Sea Natural Resources Ltd., is located approximately 15km from the Scoping Boundary. There are no hydrocarbon fields or oil and gas platforms located within the Local Other Sea Users and Marine Infrastructure Study Area (Figure 9.15).

9.5.5.16 In October 2022, the North Sea Transition Authority (NSTA) launched the 33rd Offshore Licensing Round with, potentially, over 100 blocks to be consented across the main producing areas of the UK Continental Shelf (UKCS). Given the lack of existing activity in the area, there is likely to be limited potential for exploration in this area of the North Sea.

9.5.5.17 Subsurface structures (including protective structures, pipe junctions, manifolds, wellheads, trees and valves) are usually protected by a 500m safety zone. There are no subsurface structures located within the Local Other Sea Users and Marine Infrastructure Study Area, with the closest – a wellhead at Forth Approaches 26/4-A Well (Royal Dutch Shell) - located ~17km from the Scoping Boundary.

9.5.5.18 Wells are classified into the following 4 categories: completed wells (ready for production), drilling wells (wells in the process of being drilled), plugged and abandoned wells (where work has ceased because it has become non-productive or non-viable) and suspended wells (a well may be temporarily suspended if an operator intends to carry out further operations at a later date). Completed and drilling wells typically have a 500m safety zone. Plugged and abandoned and suspended wells do not have safety zones attached to their location. There are no plugged and abandoned wells located within the Local Other Sea Users and Marine Infrastructure Study Area. The nearest well (Well 26/14-1) is approximately ~19km from the Array Project and is abandoned.

9.5.5.19 The following services are associated with the oil and gas industry:

- Helicopters: the oil and gas industry relies on helicopters for personnel transfer and emergency evacuation. Helicopter and associated aviation considerations are addressed separately in chapter 9.3: Aviation (Military and Civil).
- Vessels: the oil and gas industry requires supply or support vessels for its operations. Vessels and associated navigational considerations are addressed separately in chapter 9.2: Shipping and Navigation.

Cables

9.5.5.20 There are no operational cables that cross the Local Study Area (Kis-Orca, 2023). However, the Eastern Link 2 HVDC cable and cable protection is currently in its early development stage and intersects the Scoping Boundary at its western corner (Figure 9.13).

9.5.5.21 In due course, where the Array Project cables (either inter-array or inter-connector cables) will be required to cross an active cable, it is intended that a commercial 'crossing agreement' on standard industry terms will be entered into with the cable operator. This is a formal arrangement that establishes the responsibilities and obligations of both parties and allows operations to be managed safely.

Pipelines

9.5.5.22 There are no oil and gas pipelines located within the Local Other Sea Users and Marine Infrastructure Study Area. The closest pipeline (Forties crude oil pipeline) is located approximately 60km from the Array Project (Figure 9.15). Pipelines have, therefore, not been considered further within this Scoping Report.

Carbon Capture and Storage (CCS)

9.5.5.23 There is no carbon capture and storage located within the Local Other Sea Users and Marine Infrastructure Study Area. Acorn carbon capture and storage licence area is located 119km north of the Scoping Boundary. Carbon capture and storage has, therefore, not been considered further within this Scoping Report.

Offshore microwave fixed communication links

9.5.5.24 Communication systems considered within this section include offshore microwave fixed links, which may be used to facilitate communications between offshore oil and gas platforms. Marine navigation, communications and position fixing equipment is addressed in chapter 9.2: Shipping and navigation of the Scoping Report.

9.5.5.25 It is considered unlikely that wireless fixed telecommunication links cross the Local Other Sea Users and Marine Infrastructure Study Area, due to the location of the offshore assets as presented in Figure 9.15. This will be further explored through a desk study and consultation for the EIA.

Radar Early Warning Systems (REWS)

9.5.5.26 The physical presence of wind turbines has the potential to interfere with the performance of REWS, through effects such as high radar returns, shadowing (effectively a shadow is cast by the wind turbines, which creates a region where the radar beam is unable to fully illuminate an object), increased number of detections and false alarm/track generation. This system is sometimes used by oil and gas operators as an integral part of their anti-collision safety systems for their offshore platforms.

9.5.5.27 The nearest manned offshore platform is Forth Approaches 26/4-A Well (Royal Dutch Shell) located 17km from the Array Project. At this distance, it is considered unlikely that REWS could be impacted by the Array Project. REWS have, therefore, not been considered further within this Scoping Report.

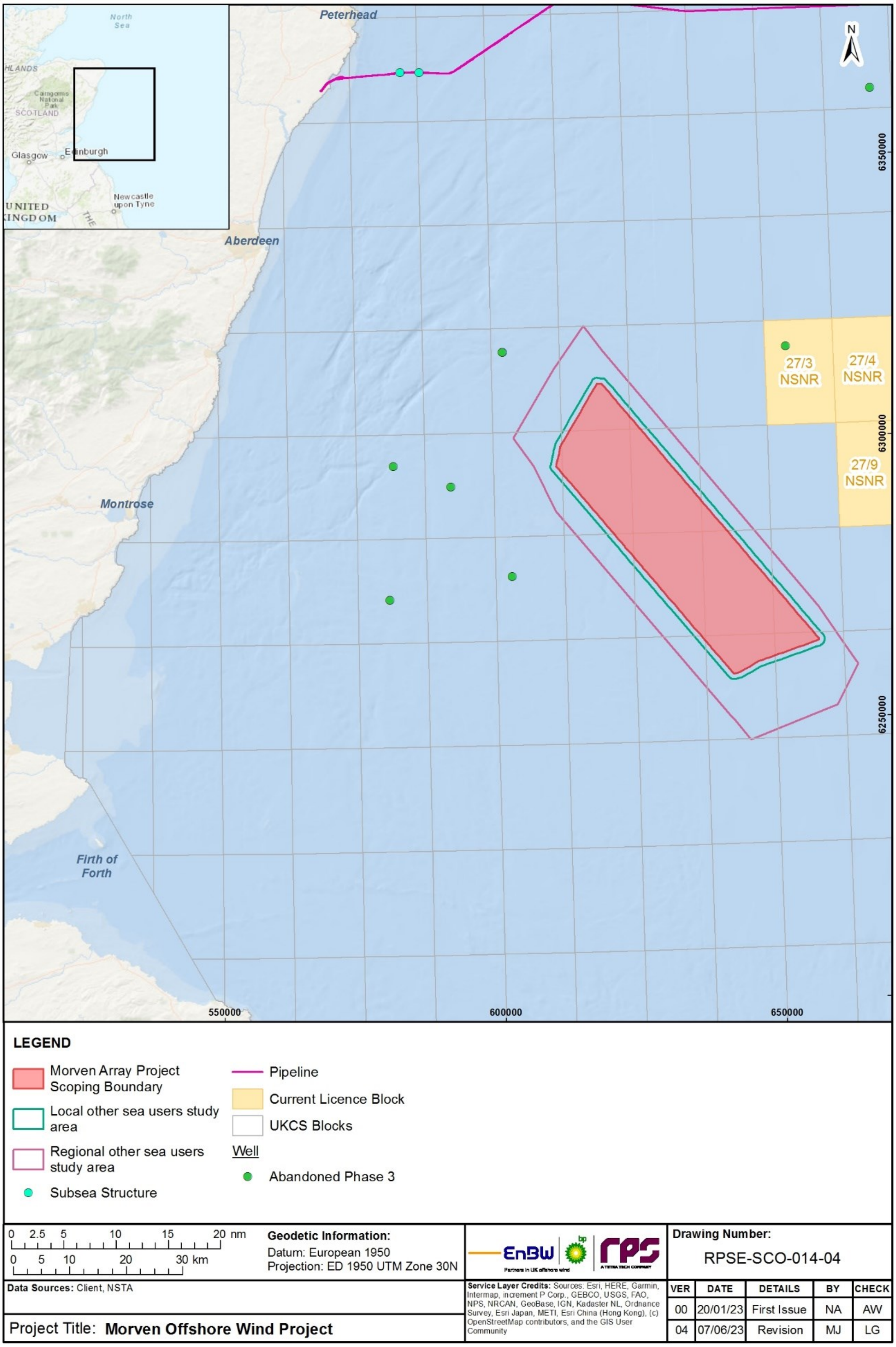


Figure 9.15: Oil and gas infrastructure within the Regional Other Sea Users and Marine Infrastructure Study Area and the Local Other Sea Users and Marine Infrastructure Study Area

9.5.6 Potential Project Impacts of the Array Project

9.5.6.1 A range of potential impacts on other sea users and marine infrastructure has been identified, which may occur during the construction, O&M and decommissioning phases of the Array Project.

9.5.6.2 The impacts that have been scoped into the assessment are outlined in Table 8.12 together with a description of any additional data collection (e.g., site specific surveys) and supporting analyses (e.g., modelling) that will be required to enable a full assessment of the impacts.

9.5.6.3 Potential impacts scoped out of the assessment are presented in Table 7.10, with justification.

Table 9.18: Impacts proposed to be scoped into the Array Project assessment for other sea users and marine infrastructure

C = Construction phase, O = O&M phase, D = Decommissioning phase.

Impact	Project phase			Justification	Data collection and analysis required to characterise the baseline environment	Summary of proposed approach to assessment
	C	O	D			
Displacement of recreational activities (including recreational sailing, cruising and recreational fishing).	✓	✓	✓	Safety zones and advisory clearance distances established during construction, maintenance and decommissioning activities may displace recreational activities.	Review of desktop data, including results of the marine vessel traffic surveys, supported by the outcome of consultation.	Qualitative assessment informed from the results of baseline data review and consultation.
Impacts to early development cables or pipelines or restrictions on access to cables or pipelines.	✓	✓	✓	There is one consented cable (Eastern Link 2 HVDC) within the Scoping Boundary and, therefore, there is potential for impacts to existing cables or restrictions on access to cables from installation, maintenance and decommissioning activities. Crossing and proximity agreements will be established where required with known existing cables operators.	Review of desktop data supported by the outcome of consultation.	Qualitative assessment informed from the results of baseline data review and consultation.
Interference with offshore microwave fixed communication links.	×	✓	×	The presence of wind turbines within the Scoping Boundary may affect offshore microwave fixed links between offshore oil and gas platforms.	Review of desktop data. Consultation with oil and gas operators to inform the assessment.	Qualitative assessment informed from the results of baseline data review and consultation.

Table 9.19: Impacts proposed to be scoped out of the Array Project assessment for other sea users and marine infrastructure

Impact	Basis for impact
Increased suspended sediment concentrations and associated deposition affecting recreational diving sites.	There are no recreational diving sites within the Regional Other Sea Users Study Area, as described in section 9.5.4. As such, there is no potential impact pathway and, therefore, it is proposed that this impact is scoped out of the EIA.
Increased suspended sediment concentrations and associated deposition affecting aggregate extraction areas.	There are no aggregate extraction areas within the Regional Other Sea Users Study Area, as described in section 9.5.4. As such, there is no potential impact pathway and, therefore, it is proposed that this impact is scoped out of the EIA.
Alterations to sediment transport pathways affecting aggregate extraction areas.	There are no aggregate extraction areas within the Regional Other Sea Users Study Area, as described in section 9.5.4. As such, there is no potential impact pathway, and, therefore, it is proposed that this impact is scoped out of the EIA.
Impact on marine disposal sites.	There are no marine disposal sites within the Infrastructure and Other Sea Users Study Area, as described in section 9.5.4. As such, impacts on marine disposal sites have been scoped out of the EIA.
Reduction or restriction of oil and gas exploration activities (including surveys, drilling and the placement of infrastructure)	There are no active oil and gas exploration blocks within the Infrastructure and Other Sea Users Study Area, as described in section 9.5.4. As such, there is no potential impact pathway and, therefore, it is proposed that this impact is scoped out of the EIA.
Impacts on carbon capture and storage.	There are no carbon capture and storage projects within the Infrastructure and Other Sea Users Study Area, as described in section 9.5.4. As such, there is no potential impact pathway and, therefore, it is proposed that this impact is scoped out of the EIA.
Interference with the performance of REWS located on oil and gas platforms.	There are no REWS within the Infrastructure and Other Sea Users Study Area, as described in section 9.5.4. As such, there is no potential impact pathway and, therefore, it is proposed that this impact is scoped out of the EIA.

9.5.7 Designed In Measures and Mitigation

9.5.7.1 As part of the project design process, a number of designed in measures (primary and tertiary) will reduce the potential for impacts on other sea users and marine infrastructure (Table 9.20). As there is a commitment to implement these measures, they are considered inherent to the design of the Array Project. The determination of magnitude and significance will assume the implementation of such measures. Some of these measures are considered standard industry practice for this type of development.

9.5.7.2 The requirement for any additional (secondary) mitigation measures will be dependent on the significance of the effects on other sea users and marine infrastructure receptors. The requirement for and feasibility of any mitigation measures will be consulted upon with statutory consultees throughout the EIA process.

Table 9.20: Designed in measures and mitigation as part of the Array Project, relevant to Other Sea Users, Marine Infrastructure and Communications

Reference number	Designed in measures	Justification	Primary or tertiary
MM-11	Promulgation of information as required (e.g., Notices to Mariners, Kingfisher Bulletin).	To maximise awareness of the Array Project, allowing other sea users and marine infrastructure receptors to plan in advance to ensure project vessels are suitably managed to minimise the likelihood of involvement in incidents and maximise the ability to assist in the event of a third-party incident.	T
MM-12	Consultation with oil and gas operators and other energy infrastructure operators, as required.	To promote and maximise cooperation between parties and minimise spatial and temporal interactions between conflicting activities.	P
MM-37	Appropriate marking on UKHO Admiralty charts.	To maximise awareness of the Array Project, allowing other vessels, sea users and marine infrastructure receptors to plan activities in advance.	T

9.5.8 Proposed Assessment Methodology

9.5.8.1 The other sea users and marine infrastructure EIA will follow the methodology set out in chapter 4: EIA Methodology of the Scoping Report. Specific to the other sea users and marine infrastructure EIA, the following guidance documents will also be considered, as appropriate:

- The RYA's position on offshore renewable energy developments: Paper 1 (of 4) – Wind Energy, June 2019 (RYA, 2019).
- European Subsea Cables Association (ESCA) guideline no. 6, The Proximity of Offshore Renewable Energy Installations and Submarine Cable Infrastructure in UK Waters (ESCA, 2016).
- International Cable Protection Committee (ICPC) Recommendations:
    1. Recommendation No.2-11B: Cable Routing and Reporting Criteria (ICPC, 2015);
    2. Recommendation No.3-10C: Telecommunications Cable and Oil Pipeline/Power Cables Crossing Criteria (ICPC, 2014);
    3. Recommendation No.13-2C: The Proximity of Offshore Renewable Wind Energy Installations and Submarine Cable Infrastructure in National Waters (ICPC, 2013).
- Pipeline Crossing Agreement and Proximity Agreement pack (Oil and Gas UK, 2021).

9.5.9 Potential Cumulative Impacts

9.5.9.1 There is potential for cumulative effects to arise from other projects or activities within the North Sea area where projects or activities could act collectively with the Array Project to affect other sea users and marine infrastructure receptors. The CEA will consider the Maximum Design Scenarios for each of the projects or activities.

9.5.9.2 The CEA will follow the approach outlined in chapter 4: EIA methodology of the Scoping Report.

9.5.10 Potential Inter-Related Effects

9.5.10.1 The EIA will consider inter-related effects. Inter-related effects relate to effects arising from the Array Project, either across their own phases (project lifetime) or different effects on one receptor in one phase (receptor led). The EIA will consider inter-related effects, in relation to the potential effects of multiple impacts from the construction, O&M and decommissioning phases of the Array Project, affecting one receptor. Inter-related effects are assessed through consideration of all effects on a receptor, considering both spatial and temporal overlaps, with the Array Project. This will ensure that the Array Project as a whole is appropriately considered within the EIA.

9.5.11 Potential Transboundary Impacts

9.5.11.1 A screening of transboundary impacts has been carried out and is presented in Appendix 1: Transboundary Screening. This screening exercise identified that there is no potential for transboundary impacts upon other sea users and marine infrastructure due to construction, O&M and decommissioning of the Array Project.

9.6 Socio-economics

9.6.1 Introduction

9.6.1.1 This section of the Scoping Report identifies the elements of socio-economics relevant to the Array Project and considers the potential impacts arising from the construction, O&M and decommissioning of the OWF.

9.6.2 Study Areas

9.6.2.1 Whilst the Array Project is located offshore, for most of the socio-economic effects, the relevant study areas will be onshore since the organisations, individuals and communities that might be affected by the offshore activities are based in onshore communities, including coastal communities.

9.6.2.2 The socio-economic 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 the Scottish Government (Scottish Government, 2022d). This guidance identified six principles for identifying local study areas for offshore development:

- Principle 1 (Dual Geographies): The local area for the supply chain and investment impacts should be separate from the local area(s) for wider socio-economic impacts, including tourism and recreation.
- Principle 2 (Appropriate Impacts): The appropriate impacts for assessments should be identified before defining the local areas (see section 9.6.6).
- 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 pre-existing economic or political geographies (community councils, local authorities, development agencies) to enhance accountability.
- Principle 5 (Understandable): The local areas should be defined so 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.

9.6.2.3 Whilst the details of the construction and O&M ports to be used will not be known until later in the development stage of the Array Project, the Applicant has committed to invest in the Aberdeen area, planning to establish a global offshore wind O&M Centre of Excellence, and is currently exploring the Port of Leith in the City of Edinburgh for marshalling activities. In addition, the Applicant has committed to building two large Service Operating Vessels and two Crew Transfer Vessels in Scotland, with shipyards on the Clyde well placed to secure these contracts. Therefore, the following study areas will be included:

- City of Edinburgh;
- Aberdeen City, Aberdeenshire and Angus Council areas;
- City of Glasgow.

9.6.2.4 Socio-economic effects will also be assessed at the level of the Scottish and UK economies. Additional study areas may be added, subject to any other locations or topics that emerge as being relevant as the Array Project is further developed, informed by the guidance for identifying local study areas for offshore development referred to above.

9.6.3 Data Sources

9.6.3.1 The following data sources will be consulted as part of the EIA baseline. The sources listed are the latest available data at the time of preparing this Scoping Report, although the latest data available at the time the socio-economic EIA is undertaken will be consulted. In addition, it is expected that, if available, information from the 2022 Scottish Census will be consulted.

Table 9.21: Key sources of Socio-economic data

Title	Source	Year	Author
Mid-2020 Population Estimates Scotland	National Records of Scotland (NRS)	2021	NRS
2020-based Principal Population Projections	NRS	2023	NRS
Principal Population Projections 2020-based	Office for National Statistics (ONS)	2022	ONS
Mid-Year Population Estimates 2020	ONS	2022	ONS
Business Register and Employment Survey 2021	ONS	2022	ONS
Annual Population Survey 2021	ONS	2022	ONS
Annual Survey of Hours and Earnings 2022	ONS	2022	ONS
People Skills Survey 2021-2026	Offshore Wind Industry Council	2021	Offshore Wind Industry Council
Offshore Wind O&M Opportunity	Offshore Renewable Energy Catapult	2020	Offshore Renewable Energy Catapult
The Offshore Wind Sector Deal	UK Government	2019	UK Government
The Green Book: Appraisal and Evaluation in Central Government.	UK Government	2022	UK Government

Title	Source	Year	Author
National Performance Framework	Scottish Government	2018	Scottish Government
Offshore Wind Policy Statement	Scottish Government	2020	Scottish Government
Scotland’s National Strategy for Economic Transformation	Scottish Government	2022a	Scottish Government
Offshore Renewables - Social Impact: Two Way Conversation with the People of Scotland	Scottish Government	2022b	Scottish Government
General Advice for Socio-Economic Impact Assessment	Scottish Government	2022c	Scottish Government
Defining 'Local Area' for Assessing the Impact of Offshore Renewable and Other Marine Developments: Guidance Principles.	Scottish Government	2022d	Scottish Government
Guidance on the Assessment of the Socio-economic Impacts of Offshore Wind Energy Projects	Scottish Government	In press	Scottish Government
Regional Economic Strategy: Securing the Future of the Northeast Economy	Opportunity Northeast	2015	Opportunity Northeast
Aberdeen City Region Deal: Annual Report	Aberdeen City Region	2022	Aberdeen City Region
Edinburgh Economy Strategy: Stronger, Greener, Fairer	City of Edinburgh Council	2021	City of Edinburgh Council
Glasgow Economic Strategy 2022-2030	Glasgow City Council	2022	Glasgow City Council
Guidance on assessing the socio-economic impacts of Offshore Wind Farms.	Glasson *et al.*	2018	Glasson *et al.*

9.6.4 Consultation

9.6.4.1 The approach to consultation for the Array Project is set out in chapter 5: Consultation of the Scoping Report. A summary of the consultation undertaken to date relevant to socio-economic is set out in Table 9.22. Further detail on the Scoping Workshop and stakeholder plans for future engagement is set out in chapter 5: Consultation of the Scoping Report, supported by Appendix 3: Summary of Scoping Workshop Consultation and Appendix 4: Draft Stakeholder Engagement Plan of the Scoping Report.

Table 9.22: Key consultation relevant to socio-economics

Date	Overarching theme	Method of engagement	Stakeholder	Summary of stakeholder feedback	Applicant's response and relevant cross reference
19.04.23	Guidance	Scoping Workshop session	Scottish Government's Marine Directorate's Marine Analytical Unit (MAU)	Additional social impact supporting document was provided. MAU guidance is to be published in 2023.	Reference added to data sources in section 9.6.3.
19.04.23	EIA approach and consultation	Scoping Workshop session	MAU	Engagement should be an iterative process and mapping of stakeholders, including at the local level undertaken. Social impacts should not be scoped out.	Approach to social impact and stakeholder engagement is set out in section 9.6.8.
19.04.23	EIA approach and consultation	Scoping Workshop session	MAU	Commercial fisheries as a community.	The community will be engaged via a fisheries specialist, with any impacts identified by the commercial fisheries assessment (chapter 9.1: Commercial Fisheries). Socio-economic consequences will be considered.
19.04.23	EIA approach	Scoping Workshop session	Aberdeenshire Council	Reference to be made to previous OWFs and the impacts of these, including on local employment.	The economic impact assessment will be informed by relevant evidence on the impacts of previous OWFs.
19.04.23	EIA approach	Scoping Workshop session	MAU	Suggested a high-level assessment of social impacts that could be relevant to all ports on the East Coast should be included in the EIA or explain why this is impossible.	The social impact assessment will focus on coastal communities in the local study areas identified.
19.04.23	EIA approach	Scoping Workshop session	MAU	Agreed that the Supply Chain Development Statement (SCDS) commitments plus a Maximum Design Scenario could be used for the assessment of the economic impacts of the Array Project.	Agreed that the economic impact assessment should take account of SCDS commitments and a Maximum Design Scenario.
19.04.23	EIA approach	Scoping Workshop session	MAU	Tourism and Recreation also need to be considered.	Agreed. The focus of tourism and recreation assessment will be on local study areas.

9.6.5 Baseline Environment

Socio-economics overview

9.6.5.1 The Scottish population, particularly the working age population, is projected to decrease over time (NRS, 2022) so the Scottish economy requires new growth drivers. The offshore renewables sector represents an opportunity of substantial scale for the Scottish economy and the wider UK economy.

9.6.5.2 The economies of Aberdeen City and Aberdeenshire have high levels of employment in the offshore oil and gas sector and its supply chain (ONS, 2022). This is expected to decline given the maturity of the North Sea oil and gas sector and as Scotland transitions to a net zero economy. There is potential for these offshore construction and engineering skills to be transferable to the offshore wind sector, suggesting that the area is well-placed to benefit from the opportunities associated with the Array Project. While the population of Aberdeen City and Aberdeenshire is expected to grow, the working age population is projected to decline (NRS, 2022).

9.6.5.3 The population of Edinburgh is expected to increase significantly (NRS, 2022), with a relatively high share of the working age population, suggesting strong economic opportunities. There are relatively high employment levels in professional, scientific and technical services, as well as in education and finance (ONS, 2022). The unemployment rate is lower than the national average (ONS, 2022), suggesting the labour market is relatively tight.

9.6.5.4 The overall population of Glasgow is expected to increase as is the working age population (NRS, 2022). This will require growth in employment opportunities. Whilst manufacturing employment in Glasgow has declined since the 1980s, the city retains a shipbuilding sector employing around 3,000 people; this is almost half of all Scottish employment in the sector (ONS, 2022).

9.6.5.5 Baseline characterisation will be expanded and further augmented if additional local socio-economic study area(s) are identified.

Strategic overview

9.6.5.6 The UK Government 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 (UK Government, 2019). Offshore wind is also expected to play a significant role in the transition to net zero, creating green jobs as part of the Build Back Greener agenda (UK Government, 2021)[21].

9.6.5.7 The Scottish Government, as outlined in its Offshore Wind Policy Statement (Scottish Government, 2020), expects offshore wind projects to play an important role in transitioning to a net zero economy, while contributing to sustainable economic growth with new, well-paid jobs in Scotland.

9.6.5.8 Energy, including renewable energy, has been identified as a key sector for the economies of Aberdeen City and Aberdeenshire (Opportunity North East, 2015)[22]. Recent investments have included over £350 million in the Net Zero Technology Centre, which focuses on reducing emissions, deploying offshore wind, and integrating the new energy system. A further £350 million has been invested in the Aberdeen South Harbour, which is intended to play a significant role in offshore wind and maximising the benefits of ScotWind (Aberdeen City Region, 2022).

9.6.5.9 Delivering a stronger, greener and fairer Edinburgh is key to the City of Edinburgh Council's vision for the city (City of Edinburgh Council, 2021), including ensuring that Edinburgh businesses can take advantage of new low carbon industries and that there is a just transition to net zero. The Council also supports the development of the Port of Leith to capitalise on opportunities such as the development of offshore renewables, as outlined in the Edinburgh Economy Strategy (City of Edinburgh Council, 2021).

9.6.5.10 The themes of Glasgow's economic strategy (Glasgow City Council, 2022) include Developing a Green Economy and Growing our Economy, recognising the role of employment and economic growth in addressing inequalities and providing opportunities.

9.6.5.11 The strategic baseline will be expanded and further augmented if any additional local socio-economic area(s) are identified.

9.6.6 Potential Impacts of the Array Project

9.6.6.1 A range of potential impacts on socio-economics have been identified, which may occur during the construction, O&M and decommissioning phases of the Array Project.

9.6.6.2 The impacts scoped into the assessment are outlined in Table 9.23, with a description of any additional data collection and supporting analyses that will be required to enable a full assessment of the impacts.

Table 9.23: Impacts proposed to be scoped into the Array Project assessment for socio-economics

C = Construction phase, O = O&M phase, D = Decommissioning phase.

Impact	Project phase			Justification	Data collection and analysis required to characterise the baseline environment	Summary of proposed approach to assessment
	C	O	D			
Employment and Gross Value Added (GVA) impacts associated with the construction, operation and decommissioning of the Array Project	✓	✓	✓	Expected to lead to changes in employment and economic activity in each socio-economic study area.	Collection of economic performance statistics will be used to inform an economic model that will assess the impact in terms of jobs and GVA supported.	Assess the economic impact in socio-economic study areas, considering the relative size and industrial baseline in each.
Demand for housing and other services	✓	✓	✓	Changes in local populations to meet the requirements for labour, related to economic opportunities, may place additional demands on housing and other services.	Collection of published statistics from desk based sources (see section 9.6.3 data sources) related to population and modelling of jobs supported during the construction phase.	Assess the increased labour force requirements in the context of existing population data.
Changes to visitor behaviour	✓	✓	✓	Increased offshore vessel activity, for example, at ports and harbours, can potentially affect visitor services, e.g., cruise terminals and visitor attractions close to ports and harbours.	Understanding key features associated with visitor assets, such as visitor numbers and visitors' use of port infrastructure, such as cruise terminals. The assessment will draw on relevant chapters and other supporting data.	Assess the potential effects on tourism assets, focusing on whether this will lead to changes in visitor behaviour.
Changes to commercial fisheries	✓	✓	✓	Any socio-economic consequences of any significant effects on fisheries identified in the commercial fisheries assessment will be considered.	The assessment will draw on the conclusions of other chapters, in particular Commercial Fisheries.	Assess the relationship between topic-specific effects and socio-economic effects.
Changes to shipping and marine recreation	✓	✓	✓	Any socio-economic consequences of any significant effects on these sectors that are identified will be considered.	The assessment will draw on the conclusions of other chapters, in particular Shipping and Navigation and Other Sea Users and Marine Infrastructure.	Assess the relationship between topic-specific effects and socio-economic effects.

9.6.7 Designed In Measures and Mitigation

9.6.7.1 As part of the project design process, a number of designed in measures (primary and tertiary) will reduce the potential for impacts on socio-economics receptors (Table 9.24). As there is a commitment to implement these measures, they are considered inherent to the design of the Array Project. The determination of magnitude and significance will assume the implementation of such measures. Some of these measures are considered standard industry practice for this type of development.

9.6.7.2 The requirement for any additional (secondary) mitigation measures will be dependent on the significance of the effects on socio-economics receptors. The requirement for and feasibility of any mitigation measures will be consulted upon with statutory consultees throughout the EIA process.

Table 9.24: Designed in measures of the Array Project, relevant to Socio-economics

Reference number	Measures adopted	Justification	Primary or tertiary
MM-13	Supply Chain Development Statement (SCDS) (bp/EnBW, 2022)	To analyse the commitments underpinning the SCDS and support economic growth with a commitment to approximately £1.2bn of spend in Scotland and £2.3bn to the UK, subject to market assumptions. Includes enhanced supply chain commitments as a Scottish Champion and investment in two Scottish ports – Port of Leith and Port of Aberdeen Harbour. These commitments will be updated over time, in agreement with the Crown Estate Scotland.	S

9.6.8 Proposed Assessment Methodology

9.6.8.1 The socio-economics EIA will follow the significance methodology set out in chapter 4; EIA Methodology of the Scoping Report. Specific to the socio-economic effects related to the offshore elements, the following guidance documents will also be considered:

- Glasson *et al.* (2018), Guidance on assessing the socio-economic impacts of Offshore Wind Farms;
- Scottish Government (2022c), General Advice for Socio-Economic Impact Assessment;
- Scottish Government (2022d), Defining 'Local Area' for Assessing Impact of Offshore Renewables and Other Marine Developments: Guidance Principles;
- Scottish Government (2022b), A Two Way Conversation with the People of Scotland on the Social Impact of Offshore Renewables;
- UK Government (2020), UK Offshore Wind Sector Deal;
- UK Government (2022), The Green Book: Appraisal and Evaluation in Central Government.

9.6.8.2 In addition, the Scottish Government is in the process of developing guidance on the assessment of the socio-economic impacts of offshore wind energy projects. It is expected that this will be published in 2023. This guidance will be adhered to once published and it is anticipated to build on current best practices.

Economic impacts

9.6.8.3 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 an organisation's turnover.
- Years of Employment: this is a measure of employment 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 Project's construction phase.
- Jobs: this measure of employment 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 O&M phase of the Project.

9.6.8.4 The assessment will focus on the direct and indirect (supply chain) effects, in line with the UK Offshore Wind Sector Deal (UK Government, 2019). These will include direct and indirect effects associated with activity at construction and O&M ports. In addition, the assessment will also consider the effects of staff spending and the economic impact that this subsequent increase in demand stimulates (the induced effect).

9.6.8.5 The socio-economic assessment will consider the lowest realistic levels of expenditure associated with the Array Project since that would represent the MDS in terms of the expected positive socio-economic effects. This will take account of the 'Commitment' scenario in the SCDS submitted as part of the ScotWind leasing process, though it will be revised to reflect any changes to the proposed scale of development and planned further iterations of the SCDS since the SCDS was published in April 2022.

9.6.8.6 The impact assessment will include direct, indirect and induced economic impacts and will consider deadweight, leakage, displacement and substitution. Sensitivity analysis will also be undertaken to account for risk, uncertainty and optimism bias, which could have economic implications.

9.6.8.7 The analysis for the Array Project will cover three phases:

- construction;
- O&M;
- decommissioning.

9.6.8.8 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 this phase. In addition to the total impact over the period, the assessment will consider the timings of impacts during this phase to understand the peaks and troughs of this activity.

9.6.8.9 The impacts during the O&M phase of the Array Project will be based on projected operational (including maintenance) expenditure.

9.6.8.10 In instances where impacts are expected to occur over a number of years, such as the O&M 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 (UK Government, 2022). On this basis, the decommissioning phase impacts are expected to be substantially lower than for the construction phase.

9.6.8.11 The quantified economic impacts will be assessed for significance by considering the sensitivity of the economy and the magnitude of impact.

9.6.8.12 To consider the sensitivity of an economy, it is necessary to consider resilience and agility. This will be done by taking a number of factors into account, including the scale of the economy, the diversity of sectors in the economy, the level of economic activity, the level of skills and education and the level of economic potential from utilising capital (natural, human, social, economic).

9.6.8.13 The magnitude of economic effects will be assessed by considering how the economic impacts are quantified, compared to the typical economic growth and employment rates. For example, an economic impact that was equal to or greater than the long term trend economic growth rate would be considered to be a high magnitude effect.

9.6.8.14 The assessment of economic effects will also include consideration of any tourism and recreation effects that might be associated with increased onshore activity in the local study areas that could potentially affect visitor infrastructure. The focus of the assessment will be on whether there could be changes in visitor behaviour.

Social impacts

9.6.8.15 A number of social impacts could also arise, associated with these economic impacts, as employment opportunities are created, retaining and attracting people to coastal communities, including those communities in the vicinity of construction and O&M ports.

9.6.8.16 Whilst the Array Project would be a substantial investment, the scale of the economic impacts is not expected to generate significant social impacts at the national level. The social impacts are, therefore, more likely to be relevant for local study areas.

9.6.8.17 The general advice from the Marine Directorate's Marine Analytical Unit includes a range of social impacts in addition to those identified in Table 9.23. These include housing and other local services. This advice will be considered in the socio-economics assessment, as will other available research on social impacts such as that published by the Scottish Government.

9.6.8.18 In many cases, the effects of these social impacts will depend on the economic impacts of the project and also on the market and government response (e.g. an increase in employment may lead to an increase in demand for housing, and the effects will depend on what happens to the supply of housing). The effects will also depend on the communities affected. The social impacts on urban communities of an increase in employment would be expected to be different to social impacts from an increase in employment of the same scale in a smaller rural community.

9.6.8.19 The socio-economic assessment will include a qualitative assessment of social impacts, including identifying those where the scale of impact may vary depending on the affected communities and any market or government response that may be desirable.

9.6.8.20 Some social impacts will also be considered in chapter 9.10: Human Health, including the social, economic, bio-physical, institutional and built environments, as they relate to wider determinants of health.

Stakeholder engagement

9.6.8.21 The socio-economic stakeholder engagement will focus on gathering evidence on the nature and scale of impacts to inform the socio-economic assessment.

9.6.8.22 The relevant national stakeholders are expected to include the Marine Directorate's Marine Analytical Unit and economic development agencies (including Scottish Enterprise). Regional and local stakeholders are expected to include local authority economic development departments, regional economic development agencies, port authorities, business associations and supply chain groups.

9.6.8.23 A consultation strategy will be developed once further information about the Array Project is known and the local study area(s) have been defined.

9.6.9 Potential Cumulative Impacts

9.6.9.1 There is the potential for the identified effects to interact with other projects, particularly other offshore wind farms being developed as part of the ScotWind and INTOG consenting processes. Cumulatively, the development of the ScotWind projects is expected to represent a substantial increase in demand at the Scottish and UK level for the industries that will be involved in the construction of these projects.

9.6.9.2 By making a substantial contribution to a critical mass, the Array Project will contribute to the cumulative case for potential indigenous or inward investors by making it more financially attractive to set up new manufacturing and fabrication facilities in Scotland, instead of relying on overseas facilities that may have higher transportation costs. Consideration will also be given to the cumulative effects on port facilities during the construction, O&M and decommissioning phases.

9.6.9.3 In addition to the impacts directly associated with the Array Project, the assessment will also consider the investments that the Applicant is making, including a commitment to approximately £1.2bn of spend in Scotland and £2.3bn to the UK, subject to market assumptions.

9.6.9.4 The CEA will follow the methodology set out in chapter 4: EIA Methodology of the Scoping Report.

9.6.9.5 The socio-economic impact of onshore and offshore elements will be considered as cumulative projects. This allows interlinkages between the two elements to be considered at the same time, where the study areas for onshore and offshore elements coincide. Whilst the socio-economic assessment of the Array Project will focus on the effects associated with the offshore elements, effects could be realised onshore. Cumulative effects of onshore and offshore elements within the relevant study area(s) will be considered.

9.6.9.6 In addition to the socio-economic assessment chapter of the EIA Report, a separate stand-alone socio-economic impact assessment report is proposed. This will encompass, as far as practicable, the socio-economic effects of the Array Project and Transmission Project combined in order to understand the scale of the opportunity across the projects to relevant local areas, Scotland and the UK.

9.6.10 Potential Inter-Related Effects

9.6.10.1 The EIA will consider inter-related effects. Inter-related effects relate to effects arising from the Array Project, either across their own phases (project lifetime) or different effects on one receptor in one phase (receptor led). The EIA will consider inter-related effects, in relation to the potential effects of multiple impacts from the construction, O&M and decommissioning phases of the Array Project, affecting one receptor. Inter-related effects are assessed through consideration of all effects on a receptor, considering both spatial and temporal overlaps, with the Array Project. This will ensure that the Array Project as a whole is appropriately considered within the EIA.

9.6.10.2 The following aspects will be considered:

- impacts on commercial fisheries, which may result in changes to activity in the sector;
- impacts on shipping and navigation and other sea users and marine infrastructure, which may have effects on marine recreation users;
- impacts on human health, which may include consideration of social impacts;
- impacts on seascape and visual impact and cultural heritage, which may result in changes to visitor behaviour.

9.6.11 Potential Transboundary Impacts

9.6.11.1 A screening of transboundary impacts has been carried out and is presented in Appendix 1: Transboundary Screening. This screening exercise identified that there is potential for transboundary impacts upon socio-economics due to construction, O&M and decommissioning impacts of the Array Project. These will be considered in the socio-economic assessment and include:

- socio-economic impacts taking place outside of the UK, relating to non-UK supply chain during the construction, O&M and decommissioning phases. These will be imports from outside of the UK and are expected to be positive in nature;
- impacts on commercial fisheries and other marine users based outside of the UK during construction, O&M and decommissioning.

9.7 Seascape, Landscape, Visual Impact (SLVIA) and Onshore Historic Environment

9.7.1 Introduction

9.7.1.1 This chapter of the Scoping Report identifies the seascape/landscape resource and visual amenity of relevance to the Array Project and considers the potential effects arising from the construction, O&M and decommissioning of the OWF, seaward of MHWS.

9.7.1.2 In addition to consideration of effects on seascape and visual receptors, this chapter of the Scoping Report also identifies the onshore heritage assets of relevance to the Array Project and considers the potential impacts to the setting of onshore heritage assets arising from the construction, O&M and decommissioning of the Array Project.

9.7.1.3 It is proposed to scope out both the seascape, landscape and visual impact assessment (SLVIA) and onshore historic environment from the Array Project EIA and this chapter of the Scoping Report sets out the rationale for scoping out both receptor groups in the following sections.

9.7.2 Study Area

SLVIA Study Area

9.7.2.1 The Institute of Environmental Management and Assessment (IEMA) Guidance (IEMA, 2015 and 2017) recommends a proportionate EIA, focused on the likely significant effects of a development, and a proportionate EIA Report aspect chapter. The SLVIA Study Area must, therefore, be large enough to capture all likely significant effects. However, an overly large SLVIA Study Area may be considered disproportionate if it makes understanding the key impacts of the Array Project more difficult by including extraneous baseline information and, hence, receptors that are unlikely to be significantly affected by the Array Project.

9.7.2.2 This is supported by the Landscape Institute (GLVIA3) (Landscape Institute, 2013) (paragraph 3.16), which recommends that '*The level of detail provided should be that which is reasonably required to assess the likely significant effects*.' Paragraph 5.2 also states that '*The study area should include the site itself and the full extent of the wider landscape around it which the project may influence in a significant manner*'.

9.7.2.3 The SLVIA Study Area is, therefore, based on professional judgement and includes those areas that are likely to be significantly affected by the Array Project. This judgement is based on the author's current understanding of the local landscape character and the scale of the construction and development proposed within the Scoping Boundary, as well as a review of study areas used for similar projects, including the Moray West, Moray East, Seagreen Phase 1, Berwick Bank and Beatrice OWFs.

9.7.2.4 The Scottish Natural Heritage (2017) Visual Representation of Wind Farms, Version 2.2 advises that the study area or Zone of Theoretical Visibility (ZTV) for wind turbines exceeding 150m to blade tip height is 45km from the outer-most wind turbine positions. The document advises, "*Greater distances may need to be considered for the larger turbines used offshore*" (p.12, section 48). It should be noted that the SLVIA study areas for the Moray West and Moray East OWFs were 50km from the outer-most wind turbine positions and 40km in respect of the Beatrice OWF. However, Scottish Ministers have recently advised that study areas may be greater than 50km due to visible turbine lighting (e.g. Berwick Bank Wind Farm Scoping Opinion, Marine Scotland, 2021).

9.7.2.5 The SLVIA Study Area for those offshore elements of the Array Project located within the Scoping Boundary is indicated in Appendix 12: SLVIA Onshore Heritage Assets Wirelines/ZTV as a 70km Study Area from the outer-most wind turbine positions, shown as the maximum possible area or 70km distance from the Scoping Boundary. The SLVIA Study Area considers areas of land, including the coastline and hinterland between 62-70km with the remainder of the Study Area comprising the sea.

9.7.2.6 The ZTV for SLVIA has been developed on a Maximum Design Scenario for SLVIA receptors, which is based on the design specification with the highest maximum turbine tip height (m). The ZTV presented in Appendix 12: SLVIA Onshore Heritage Assets Wirelines/ZTV is, therefore, based on a maximum turbine tip height of 393m, which is associated with a 32MW turbine and spacing of 1.4km between 101 turbines.

9.7.2.7 Although the maximum number of turbines presented in chapter 3: Project Description is 191 turbines, the 191 turbines design option does not have the greatest design specification for maximum turbine tip height. To ensure the ZTV presented for SLVIA illustrates the greatest range of potential visual impact, the ZTV is based on a 32MW turbine design option with 101 turbines, which has the greatest maximum turbine tip height of all turbine design options. Although an additional 90 turbines of smaller height may in some instances result in a greater density of infrastructure being visible, it is the larger apparent height and rotor diameter that contributes most to defining the MDS and greater effects are not predicted to arise should any other design option be developed to that considered in this chapter.

9.7.2.8 The offshore elements located within the Scoping Boundary include:

- wind turbines;
- offshore substation platforms;
- array cables.

Onshore Heritage Assets Study Area

9.7.2.9 The ZTV for the SLVIA (see figures within Appendix 12: SLVIA Onshore Heritage Assets wirelines/ZTV) extensd to approximately 70km and has, consequently, been used as the Study Area for considering effects on the historic environment through change to the setting. The SLVIA Study Area is shown in Appendix 12: SLVIA Onshore Heritage Assets Wirelines/ZTV.

9.7.3 Data sources

9.7.3.1 A range of desk and site-based data sources covering seascape, landscape, visual and onshore heritage receptors and other relevant cumulative development are included in Appendix 11: SLVIA Methodology Appendix.

9.7.4 Consultation

9.7.4.1 The approach to consultation for the Array Project is set out in chapter 5: Consultation of the Scoping Report. A summary of the consultation undertaken to date relevant to SLVIA and onshore historic environment is set out in Table 9.25. Further detail on the Scoping Workshop and stakeholder plans for future engagement is set out in chapter 5: Consultation of the Scoping Report, supported by Appendix 3: Summary of Scoping Workshop Consultation and Appendix 4: Draft Stakeholder Engagement Plan of the Scoping Report.

Table 9.25: Key consultation relevant to SLVIA and onshore historic environment

Date	Overarching theme	Method of engagement	Stakeholder	Summary of stakeholder feedback	Applicant's response and relevant cross reference
17.02.23	Viewpoint Agreement	Email	Aberdeen City Council	Requested three additional viewpoints: Baron's Cairn, Torry Battery and Broad Hill.	Included in the viewpoint list as viewpoints 8, 9 and 10. See Appendix 12: SLVIA Onshore Heritage Assets Wirelines/ZTV.
22.02.23	Viewpoint Agreement	Email	NatureScot	NatureScot agreement of proposed Study Area and viewpoint locations.	Noted.
22.02.23	Scope of SLVIA	Email	NatureScot	NatureScot content that SLVIA for the offshore elements is not required and can be scoped out of assessment.	Noted.
12.04.23	Scope of the onshore historic environment	Email	HES	Content that effects on the setting of the onshore heritage assets can be scoped out.	Noted
17.04.23	Scope of SLVIA	Email	Aberdeenshire Council	Content to scope out SLVIA.	Noted

Date	Overarching theme	Method of engagement	Stakeholder	Summary of stakeholder feedback	Applicant’s response and relevant cross reference
17.04.23	Scope of the onshore historic environment	Email	Aberdeenshire Council	Need view from Aberdeenshire Council Archaeologist on Dunnottar Castle to confirm approach to scoping out.	Noted
18.04.23	Scope of SLVIA	Scoping Workshop	Aberdeen City Council	Content to scope out SLVIA.	Noted
18.04.23	Scope of the onshore historic environment	Scoping Workshop	Aberdeen City Council	Content to scope out onshore historic environment.	Noted
18.04.23	Data sources	Scoping Workshop	Aberdeen City Council	Aberdeen Coastal Character Assessment (Aberdeen City Council, 2021) and the Aberdeen Beachfront Masterplan (Aberdeen City Council, 2023). References for these documents were provided.	Noted
25.05.2023	Scoping out	Written advice	NatureScot	Due to the location of this proposal, the distance from shore (60+ km), as well as the advice NatureScot provided during the Sectoral Marine Plan consultation, NatureScot advise that SLVIA for the offshore elements located within the Option Agreement Area (OAA) is not required and can be scoped out of assessment.	NatureScot position noted.

9.7.5 Baseline Environment

9.7.5.1 Information on the existing seascape, landscape, visual and onshore heritage receptors has been collected from Local Development Plans, Ordnance Survey maps and relevant literature, as well as information gathered from consultation with stakeholders. The baseline information set out in Appendix 11: Seascape, Landscape and Visual, and Onshore Historic Environment Methodology Statement which includes an inventory of the existing seascape, landscape, visual and onshore heritage receptors within the SLVIA Study Area. For onshore heritage receptors this includes figures which plots the onshore heritage receptors within the SLVIA Study Area.

9.7.6 Potential Impacts of the Array Project

9.7.6.1 It is proposed to scope out all potential impacts on seascape, landscape, visual and onshore heritage receptors from the EIA Report. Table 9.26 and sections 9.7.7 and 9.7.8 below set out the justification for this approach.

Table 9.26: Impacts proposed to be scoped out of the project assessment for seascape, landscape, visual and onshore heritage assets

Impact	Basis for impact
Effects on seascape/landscape character within the 70km SLVIA Study Area and within ZTV.	Significant effects not likely due to low sensitivity of receptors. See rationale below in section 9.7.7.
Effects on visual receptors within the 70km SLVIA Study Area and within ZTV (people at settlements/residents, on transport and recreational route and at tourist/visitor attractions, ferry routes).	Significant effects not likely due to limited visibility and long intervening distance (lower magnitude). See rationale below in section 9.7.7.
Effects on setting of onshore heritage assets within the 70km SVLIA Study Area.	Change to setting would be insufficient to give rise to any discernible adverse effects because of the distance of the Array Project from the onshore heritage assets and the limited visibility of the Array Project. See rationale below in section 9.7.8.

Potential project impacts on seascape, landscape and visual receptors

9.7.6.2 Potential impacts scoped out of the assessment are presented in Table 9.26 above. These impacts have been scoped out based on the knowledge of the baseline environment, the nature of planned works and existing best practice evidenced by the potential effects of other OWF development (e.g. Moray Offshore Windfarm (West) Limited (2018); Moray Offshore Renewables Limited (2019); and Seagreen Wind Energy (2018)).

9.7.6.3 The SLVIA Study Area is shown in Figure 12.1 (see Appendix 12: SLVIA Onshore Heritage Assets Wirelines/ZTV) as a 70km area from the Scoping Boundary. It is proposed that SLVIA receptors should be scoped out of the EIA Report. This approach has been backed by some stakeholders, including NatureScot, Aberdeenshire Council and Aberdeen City Council during pre-application scoping consultation (Table 9.25). Evidence to support this position is provided by the ZTV in Figures 12.1 and 12.2 (see Appendix 12: SLVIA Onshore Heritage Assets Wirelines/ZTV) and viewpoint wirelines in Figure 12.3 a-k (see Appendix 12: SLVIA Onshore Heritage Assets Wirelines/ZTV). The ZTVs indicate that the theoretical visibility would be limited between 62 and 70km distance and would reduce further beyond this distance from a notional maximum wind turbine (up to 393m to blade tip height) placed anywhere on or within the Scoping Boundary. There would be limited ZTV coverage on land beyond this distance, which would be well beyond the SLVIA Study Area of 50km used for other comparable OWFs developments and advised by NatureScot (Scottish Natural Heritage (2017) Visual Representation of Wind Farms, Version 2.2).

9.7.6.4 Figures 12.3a-k within Appendix 12: SLVIA Onshore Heritage Assets Wirelines/ZTV illustrates wirelines from 11 viewpoint locations which were consulted-on with stakeholders including NatureScot, Aberdeenshire Council, Aberdeen City Council and Angus Council. NatureScot confirmed on 22 February 2023 that they were content with the viewpoint selection. Aberdeen City Council requested three additional viewpoints (viewpoints 8-10), which have been included. Aberdeenshire Council confirmed on 17 April 2023 that they are content with the viewpoint selection and agreed to scope out the SLVIA. No response was received from Angus Council.

- Viewpoint 1: Montrose Seafront (Figure 12.3a within Appendix 12: SLVIA Onshore Heritage Assets Wirelines/ZTV :
  - The viewpoint is located at approximately 75km distance from the nearest point on the Scoping Boundary at Montrose waterfront. The people on the coast at this point would

have a higher visual receptor sensitivity, although the wireline indicates negligible or no visibility of the offshore elements of the Array Project, such that significant effects would be unlikely. Any significant cumulative effects are likely due to other offshore cumulative developments located closer to this viewpoint.

- Viewpoint 2: Johnshaven (Figure 12.3b within Appendix 12: SLVIA Onshore Heritage Assets Wirelines/ZTV):
  - The viewpoint is located at approximately 69km distance from the nearest point on the Scoping Boundary. It is representative of views from the A92 and residents in Johnshaven. At this point, the people on the coast would have a high to medium visual receptor sensitivity. The wireline indicates limited visual effects from the offshore elements of the Array Project that appear low against the horizon, such that significant effects would be unlikely, with greater visual effects likely from other offshore cumulative wind farms located notably closer to the viewpoint. Any significant cumulative effects are likely due to other offshore cumulative developments located closer to this viewpoint.
- Viewpoint 3: Inverbervie Beach/Picnic Site (12.3c within Appendix 12: SLVIA Onshore Heritage Assets Wirelines/ZTV):
  - The viewpoint is located at approximately 65km distance from nearest point on the Scoping Boundary. The people on the coast at this point would have a higher visual receptor sensitivity. However, the wireline indicates negligible visibility (blade tips) of the Array Project, such that significant effects would be unlikely. Any significant cumulative effects are likely due to other offshore cumulative developments located closer to this viewpoint.
- Viewpoint 4: Dunottar Castle (Figure 12.3d within Appendix 12: SLVIA Onshore Heritage Assets Wirelines/ZTV):
  - The viewpoint is located at approximately 62km distance from nearest point on the Scoping Boundary, at Dunottar Castle. Visitors to the castle would have a high visual receptor sensitivity. The wireline indicates limited visual effects with the Array Project appearing low against the horizon, such that significant effects would be unlikely with greater visual effects likely from other offshore cumulative wind farms located notably closer to the viewpoint. Any significant cumulative effects are likely due to other offshore cumulative developments located closer to this viewpoint.
- Viewpoint 5: Girdle Ness Lighthouse (Figure 12.3e within Appendix 12: SLVIA Onshore Heritage Assets Wirelines/ZTV):
  - The viewpoint is located at approximately 63km distance from nearest point on the Scoping Boundary, at Girdle Ness Lighthouse. Visitors to the lighthouse would have a high visual receptor sensitivity. The wireline indicates limited visual effects with the Array Project appearing low against the horizon, such that significant effects would be unlikely with greater visual effects likely from other offshore cumulative wind farms located notably closer to the viewpoint. Any significant cumulative effects are likely due to other offshore cumulative developments located closer to this viewpoint.
- Viewpoint 6: Royal Aberdeen Golf Course (Figure 12.3f within Appendix 12: SLVIA Onshore Heritage Assets Wirelines/ZTV):
  - The viewpoint is located at approximately 67km distance from nearest point on the Scoping Boundary, at the highest point on the Golf Course. Visitors would have a medium visual receptor sensitivity. The wireline indicates limited visual effects with the Array Project appearing low against the horizon, such that significant effects would be unlikely with greater visual effects likely from other offshore cumulative wind farms located notably closer to the viewpoint. Any significant cumulative effects are likely due to other offshore cumulative developments closer to this viewpoint.
- Viewpoint 7a: Meikle Carewe (Figure 12.3g within Appendix 12: SLVIA Onshore Heritage Assets Wirelines/ZTV):
  - The viewpoint is located at the summit of Meikle Carewe at approximately 70km distance from nearest point on the Scoping Boundary. Walkers at this point would have a higher

visual receptor sensitivity. The wireline indicates limited visual effects with the Array Project appearing low against the horizon, such that significant effects would be unlikely (due to the long intervening distance of over 70km), with greater visual effects likely from other offshore cumulative wind farms located notably closer to the viewpoint. Any significant cumulative effects are likely due to other offshore cumulative developments located closer to this viewpoint.

- Viewpoint 7b: Garvock (Figure 12.3h within Appendix 12: SLVIA Onshore Heritage Assets Wirelines/ZTV):
  - The viewpoint is located at approximately 75km distance from the nearest point on the Scoping Boundary, at an elevated viewpoint and picnic area on a minor road in Garvock. The people on the coast at this point would have a medium visual receptor sensitivity. The wireline indicates limited visual effects with the Array Project appearing low against the horizon, such that significant effects would be unlikely (due to the long intervening distance of over 70km) with greater visual effects likely from other offshore cumulative wind farms located notably closer to the viewpoint. Any significant cumulative effects are likely due to other offshore cumulative developments located closer to this viewpoint.
- Viewpoint 8: Baron’s Cairn (Figure 12.3i within Appendix 12: SLVIA Onshore Heritage Assets Wirelines/ZTV):
  - This viewpoint has been requested by Aberdeen City Council. It is located at approximately 63km distance from nearest point on the Scoping Boundary, at Baron’s Cairn, which is a Scheduled Ancient Monument at Tullos Hill. Visitors to the Cairn/Hill would have a high visual receptor sensitivity. The wireline indicates limited visual effects with the Array Project appearing low against the horizon, such that significant effects would be unlikely with greater visual effects likely from other offshore cumulative wind farms located notably closer to the viewpoint. Any significant cumulative effects are likely due to other offshore cumulative developments located closer to this viewpoint.
- Viewpoint 9: Torry Battery (Figure 12.3j within Appendix 12: SLVIA Onshore Heritage Assets Wirelines/ZTV):
  - This viewpoint has been requested by Aberdeen City Council. It is located at approximately 63.5km distance from nearest point on the Scoping Boundary, at Torry Battery, which is a Schedule Ancient Monument. Visitors to the Monument would have a high visual receptor sensitivity. The wireline indicates very limited visual effects with the Array Project appearing low against the horizon, such that significant effects would be unlikely with greater visual effects likely from other offshore cumulative wind farms located notably closer to the viewpoint. Any significant cumulative effects are likely due to other offshore cumulative developments located closer to this viewpoint.
- Viewpoint 10: Broad Hill (Figure 12.3k within Appendix 12: SLVIA Onshore Heritage Assets Wirelines/ZTV):
  - This viewpoint has been requested by Aberdeen City Council. It is located at approximately 66km distance from nearest point on the Scoping Boundary, at the summit of Broad Hill, which affords panoramic views of the surrounding landscape and seascape. Visitors to Broad Hill would have a high visual receptor sensitivity. The wireline indicates limited visual effects with the Array Project appearing low against the horizon, such that significant effects would be unlikely with greater visual effects likely from other offshore cumulative wind farms located notably closer to the viewpoint. Any significant cumulative effects are likely due to other offshore cumulative developments located closer to this viewpoint.

9.7.6.5 To conclude, due to the large, intervening distance (outwith an “accepted” 50km SLVIA Study Area from the Scoping Boundary) and limited visibility of the Array Project (as illustrated in the ZTVs in Figure 12.1 and Figure 12.2 within Appendix 12: SLVIA Onshore Heritage Assets Wirelines/ZTV and wirelines in Figures 12.3), there are unlikely to be any significant effects on the seascape, landscape and visual receptors. It is, therefore, proposed to scope out the SLVIA from the EIA.

Potential project impacts on onshore heritage assets

9.7.6.6 Potential effects on onshore heritage assets could, in this case, occur only because of visible change to setting arising from the visibility of the Array Project. There would be no onshore development activity within the SLVIA Study Area and the separation of the Array Project from the coast means that other perceptual change, most frequently audible change, would not be experienced. In addition, this separation would mean that it is only the upper elements of the wind turbines that could be perceptible and additional structures such as Offshore Substation Platforms (OSPs), would not be visible from shore.

9.7.6.7 It is anticipated that the potential for any effects would arise primarily during the operation of the Array Project. Visible change during construction would be very limited, and construction works, except to the upper elements of the proposed turbines, would be over the horizon and not visible from shore. Consequently, the Array Project would only become visible from shore during the final stages of construction and, while any change would be of an equivalent magnitude to that during operation, these effects would be of very limited duration. Similarly, decommissioning would represent the progressive reduction of any visible change as the array was dismantled .

9.7.6.8 Designated onshore heritage assets along the coast may be affected where:

- visibility of wind turbines and other offshore infrastructure gives rise to a change in a key view or aspect of setting that allows their function or purpose to be understood; i.e., visibility to seaward is important to understanding the function of an asset.
- where visibility of turbines would be incongruous to the setting of an asset, such as an asset valued for picturesque or scenic qualities arising from its coastal location.

9.7.6.9 All onshore heritage assets within the area that would have theoretical visibility of the Array Project, have settings that are not dependent on the visibility of the sea in a way that would be affected by what will be very distant visibility, primarily of blade tips. These assets include:

- structures such as industrial, urban and suburban listed buildings, isolated farmhouses, cottages and other agricultural buildings, which have settings that relate primarily to their immediate context and in which the sea is not a contributing element or contributes only to provide a sense of the location of the asset.
- structures and monuments in which views of the Array Project are screened by vegetation or intervening structures not reflected by the calculated ZTV.
- monuments that are not readily discernible and where distant views do not contribute to the setting.

9.7.6.10 It is, therefore, not proposed to further assess onshore heritage assets of this type.

9.7.6.11 Onshore heritage assets with settings that rely on visibility of, and proximity to, the sea to allow their design function to be fully appreciated include:

- promontory forts and prehistoric sites associated with more extensive viewsheds such as standing stones;
- castles and coastal defences;
- harbours, lookouts, lighthouses and other navigation sites.

9.7.6.12 The distance of the Array Project from the coast means that it is not in a location that was ever surveyed or visually connected to any of the onshore heritage assets, even in the very clearest conditions – visibility of vessels at sea, even with the visual aid of a telescope, would be up to around 30km from even relatively elevated positions on the coast.

9.7.6.13 In addition, it is by no means clear that distant visibility of anthropogenic structures to the seaward of these assets is necessarily antipathetic to this understanding of their former function. Consequently, it is considered that onshore heritage assets of this type would not be affected by visibility of the Array Project, and it is not proposed to assess these further unless there are further picturesque or similar considerations.

9.7.6.14 Some onshore heritage assets retain a picturesque or romantic historical context where the absence of discernibly modern elements in the setting invite more imaginative interaction with a heritage asset, and particularly where a visual connection with the sea informs or conditions that interaction. In general, the presence of turbines as constant and moving modern elements of the view would be taken as detracting from it where they appear with sufficient prominence to distract the viewer or intrude on this sense of historicity, for example by disrupting an architectural composition or where wind turbines out-scale a nearby heritage asset. The distance of the Array Project from any onshore heritage assets fulfilling these criteria is such that they would not appear with sufficient prominence to visually dominate. Any adverse effect could only arise where a designed or fortuitous composition of an onshore heritage asset that is valued for its architectural, artistic or scenic value would be affected, particularly where that value is derived primarily from the absence of visible evidence of the modern world. Even in these circumstances, an adverse effect would only occur where such assets as may be affected were of the highest sensitivity.

9.7.6.15 Onshore heritage assets within the SLVIA Study Area (names and reference numbers are cited as per HES spatial datasets) which meet these criteria comprise:

- Dunnottar Castle (SM986).
- Forvie Church and Deserted Village (Site Of) (SM7644).
- Castle of Cowie (SM9742) and Cowie Chapel, Chapel 180m N Of Cowie Castle (SM 5584).
- Kaim of Mathers Castle (SM10827).

9.7.6.16 Three further viewpoints which might inform any assessment of effects on onshore heritage assets were identified in consultation by Aberdeen City Council. These were:

- Baron’s Cairn Scheduled Ancient Monument (SM4126) at Tullos Hill, looking east, which represents a high point within the city, close to the coast affording clear coastal views.
- Torry Battery Scheduled Ancient Monument (SM9125) looking east, which is at a significantly higher elevation than the land adjacent to the lighthouse and provides clear views of it from a public space.
- Broad Hill summit, looking east, providing a clear viewpoint within a public open space area over the Category B listed Beach Ballroom (LB20314).

<u>Dunnottar Castle (SM986) (Figure 12.5a within Appendix 12: SLVIA Onshore Heritage Assets Wirelines/ZTV)</u>

9.7.6.17 Dunnottar Castle is a large, ruined castle, burial ground and chapel situated on a rocky promontory around 3km south of Stonehaven. The remains of extensive defensive and structural walls encompass a group of internal ruined buildings including the chapel. The castle is associated with numerous significant episodes in Scottish history. The site is now open to the public and promoted as a heritage-based tourist attraction approached by a winding path from the higher ground to the west, which affords dramatic views of the castle against the distant seaward views towards the horizon. It has also been used as a filming location.

9.7.6.18 Blade tips would theoretically be visible from 62km to the east under optimal viewing conditions by a viewer who was actively seeking them and would be visible only as very distant elements of the background close to, but not directly juxtaposed against the castle ruins in views from the approach path; the extent and prominence of this visibility would not be sufficient for any discernible effect to arise.

<u>Forvie Church and deserted village (site of) (SM7644) (Figure 12.5b within Appendix 12: SLVIA Onshore Heritage Assets Wirelines/ZTV)</u>

9.7.6.19 The monument comprises the remains of the medieval church of Forvie and of a nearby deserted village. Remains comprise a plain oblong structure, and building foundations of houses, along with paved floors and yards. The site represents a rare association of medieval parish church and deserted village undisturbed by later buildings, which together contribute to an understanding of medieval architecture and rural settlement. The settlement and church were probably conceived to occupy a fishing community in the medieval period. Strong ties to the coast, therefore, add to the value of the site and through association enable a better understanding of medieval maritime communities in Scotland.

9.7.6.20 This association with the coast is experienced through glimpsed views as the viewer moves around the site rather than in specific compositions., However, views of the site from the west clearly include the coastline and long views out to sea, which could be seen as contributing to the historical significance of the asset. Due to the low-lying location of the asset and the distance involved (71km), it unlikely that any elements of the Array Project would be readily visible and, therefore, no adverse effect is likely to arise.

Castle of Cowie (SM9742) and Cowie Chapel, Chapel 180m north of Cowie Castle (SM5584) (Figure 12.5c within Appendix 12: SLVIA Onshore Heritage Assets Wirelines/ZTV)

9.7.6.21 Cowie Castle and Cowie Chapel are located approximately 1.5km north of Stonehaven. The only remains of the castle visible today consist of a length of masonry which formed the plinth of a wall cutting across the promontory. The chapel is a ruinous single-chambered structure. Both assets are linked to historic royal visits. Cowie Chapel is a good example, although somewhat restored, of a thirteenth century chapel of ambitious design, later enlarged in the fifteenth century and retaining architectural details from both phases of its development. The current setting of the chapel is immediately adjacent to a golf course, which forms a part of the view of the asset from the west.

9.7.6.22 Blade tips would theoretically be visible at 62km to the east under optimal viewing conditions by a viewer who was actively seeking them and would not appear with sufficient prominence to give rise to any discernible adverse effect.

Kaim of Mathers Castle (SM10827) (Figure 12.5d with Appendix 12: Seascape, Landscape and Visual and Onshore Historic Environment Wirelines/ZTV)

9.7.6.23 The monument consists of the remains of a castle believed to date to the early 15th century and spectacularly situated on a promontory jutting into Montrose Bay, roughly 8km north of Montrose. The remains comprise a ruined tower at the extreme seaward end of a promontory, and part of a battlement along the eastern side of the isthmus. Only the north and east walls of the tower remain.

9.7.6.24 Its promontory location and defences are reminiscent of other castles along the north-east coast of Scotland, such as Old Slains and Dunnottar, although its position means that views from the castle are primarily in the arc from southeast to southwest, back along St Cyrus Bay and away from the Array Project.

9.7.6.25 The Array Project would be situated at 71m due east of the asset. At this distance, it is possible that blade tips may be visible as very distant elements of the background of minor views form the asset to a viewer who actively searches for them, and this visibility would not be sufficiently prominent to give rise to any discernible adverse effect.

Baron’s Cairn (SM4126) (Figure 12.5e with Appendix 12: Seascape, Landscape and Visual and Onshore Historic Environment Wirelines/ZTV)

9.7.6.26 Baron’s Cairn is in an area of rough moorland at Tullos, above Aberdeen, with an elevated location offering views over Girdle Ness and Nigg Bay. While the moorland location offers the Cairn a sense of remoteness, the visibility of the city of Aberdeen, dock infrastructure and offshore activity including vessel movements in and out of the harbour and the existing Aberdeen OWF means that this sense of remoteness is relative. Views are primarily to the northeast, looking down the hill towards Girdle Ness lighthouse, and the existing Aberdeen OWF is prominent; views towards the Array Project would be over the industrial estates adjacent to the Cairn. As a result of this discernibly modern wider context, particularly in views to the east and southeast, it is not considered that there is a potential for a significant adverse effect to arise through change to setting of Baron’s Cairn.

Torry Battery (SM9125) (Figure 12.5f with Appendix 12: Seascape, Landscape and Visual and Onshore Historic Environment Wirelines/ZTV)

9.7.6.27 Torry Battery is located on the south side of the entrance to Aberdeen Harbour and was located to control the immediate harbour approaches. Its main Battery consequently faced northwards, and minor fortifications were provided to guard against a landward approach from the south. During the 20th century occupation of the fort, this area was used for hutted accommodation rather than any tactical function. This location affords clear views northwards, which include Aberdeen Harbour and the breakwaters, as well as the Aberdeen OWF. Girdle Ness lighthouse appears in views eastwards from the fort across the headland. The Array Project would be visible in ideal conditions behind the lighthouse, but much lower on the horizon and would not challenge the visual prominence of the lighthouse, nor would it discernibly alter the visual relationship of Torry Battery and the lighthouse. It is, therefore, not considered that there is a potential for a significant adverse effect to arise through change to setting of Torry Battery.

<u>Category B listed Beach Ballroom (LB20314). (Figure 12.5g with Appendix 12: Seascape, Landscape and Visual and Onshore Historic Environment Wirelines/ZTV)</u>

9.7.6.28 The view from Broad Hill over the Beach Ballroom also includes the intervening leisure centre and Aberdeen Harbour. This presents a discernibly modern townscape in which the architectural form of the Beach Ballroom is not readily appreciated, particularly when compared to views of the designed facade from Links Road. Visibility of the Array Project as very distant elements of the background to these views would not change the viewers' ability to appreciate the historic role or architectural value of the Beach Ballroom and, consequently, there is no potential for a significant adverse effect to arise.

9.7.6.29 In conclusion, the nature and setting of the onshore heritage assets considered above means that there is no potential for adverse effects to arise on any heritage assets because of visibility of the proposed Array Project at the distance involved. Therefore, effects on onshore heritage assets should be scoped out of the assessment.

9.7.7 Designed In Measures and Mitigation

9.7.7.1 No designed in measures are proposed for seascape, landscape, visual and onshore heritage receptors, as no impact pathways were identified for these receptors.

9.7.8 Potential Cumulative Impacts

9.7.8.1 No significant effects on seascape, landscape, or visual or onshore heritage receptors have been identified due to the geographic separation and distant visibility of the Array Project to these receptors. Therefore, no significant cumulative effects on these receptors are anticipated

9.7.9 Potential Inter-Related Effects

9.7.9.1 No inter-related effects on seascape, landscape, visual or onshore heritage receptors have been identified due to the geographic separation and distant visibility of the Array Project to these receptors.

9.7.10 Potential Transboundary Impacts

9.7.10.1 The potential effects from construction, O&M and decommissioning on seascape, landscape, visual and onshore heritage receptors are considered in Appendix 1: Transboundary Screening. No transboundary effects have been identified due to the lack of sensitive receptors in the offshore environment and distance of the Array Project beyond the limit of visibility from other nations' borders. There is, therefore, no potential for the Array Project to have a significant effect on the seascape, landscape, visual and onshore heritage receptors of an adjacent state.

9.8 Climate Change

9.8.1 Introduction

9.8.1.1 This chapter of the Scoping Report identifies the approach to assessing the impact of the Array Project on climate change through greenhouse gas (GHG) emissions associated with the Array Project and the approach to assessing the potential impacts of climate change on the Array Project (both in terms of resilience and impact significance) arising from the construction, O&M and decommissioning of the Array Project. Any future predicted climatic changes to the marine environment within this chapter draws on assessments undertaken within the Physical Processes chapter and Benthic Subtidal Ecology chapter (chapter 7.1 and chapter 8.1, respectively).

9.8.1.2 In accordance with the Environmental Impact Assessment (EIA) Regulations, the Environmental Impact Assessment Guide to Assessing Greenhouse Gas Emissions and Evaluating their Significance (IEMA, 2022) and the Environmental Impact Assessment Guide to Climate Change Resilience and Adaptation (IEMA, 2020), the following aspects are relevant to the assessment:

- the emission of GHGs contributing to climate change, including cumulative effects with other developments;
- the potential risks to the Array Project arising from a changing climate and its vulnerability to climate change;
- the potential inter-related effects of climate change with other environmental topics to be considered in the EIA Report.

9.8.2 Study Area

9.8.2.1 GHG emissions have a global effect rather than directly affecting any specific local receptor. The impact of GHG emissions occurring due to the Array Project on the global atmospheric mass of the relevant GHGs, expressed in carbon dioxide-equivalents (CO_2e), will, therefore, be considered in the climate change assessment. The assessment guidance for GHG emissions (IEMA, 2022) recommends that GHG emissions should be contextualised against pre-determined carbon budgets, or applicable existing and emerging policy and performance standards where a budget is not available. As such, the Array Project will be assessed as to whether it contributes to, and is in line with, the UK's policy for GHG emissions reductions, where these are consistent with science-based commitments to limit global climate change to an internationally-agreed level (as determined by the UK's Nationally Determined Contribution (NDC) to the Paris Agreement (HM Government, 2020).

9.8.2.2 The GHG emissions will be assessed on a life-cycle basis for activities required for the construction, O&M and decommissioning of the Array Project. GHG emissions will be caused directly and indirectly from various locations, including onsite activities (Array Project and the associated supply chain of offshore infrastructure required for the Array Project).

9.8.2.3 In addition, as the Array Project is proposed to generate renewable electricity it will avoid the use of alternative fossil fuel generators with higher GHG emissions. The emissions avoided by electricity exported to the UK electricity grid from the Array Project will be considered in the assessment of net effects.

9.8.2.4 The Climate Change Study Area for the Array Project is, therefore, defined in terms of an assessment boundary rather than geographical area. The assessment boundary and relevant sources of GHG emissions are set out in sections 9.8.5.4 and 9.8.8 of the Scoping Report respectively.

9.8.3 Data Sources

9.8.3.1 The data sources used to inform the assessment will primarily comprise published material publicly available online. No baseline surveys are required to support the climate change assessment for the Array Project. Where a date or edition has been specified, this is the current edition, but the latest version available at the time of assessment would be used. These data sources are summarised in Table 9.27 below.

Table 9.27: Data sources

Source	Summary
Climate Change Committee (CCC) – Progress Report to Parliament (2022).	Provides information regarding state of renewable energy generation in the UK.
Digest of UK Energy Statistics (DUKES) (2022)	Provide statistics on UK renewable energy and electricity generation.

Source	Summary
Published Environmental Product Declarations (EPDs), the outputs of lifecycle analysis studies – (LCAs)[23].	Use of published EPDs and LCA studies to establish the embodied carbon emissions for a typical wind turbine and associated switchgear, transformers and cabling.
Valuation of Energy Use and Greenhouse Gas: Supplementary guidance to the HM Treasury Green Book and supporting data tables (BEIS, 2023).	Used to establish baseline grid scenarios from which to compare the development.
UK Government GHG Conversion Factors for Company Reporting (BEIS, 2022).	Current UK grid carbon intensity and other GHG emissions factors.
Royal Institution of Chartered Surveyors (RICS, 2012), or OneClick Building Carbon Database for 'industrial/utilities' building.	Benchmark values per m^2 of gross internal area (GIA) for an 'industrial building', to aid assessment of offshore substations.
National Grid Future Energy Scenarios (2022).	Provides projected future energy scenarios to compare with the development's renewable energy generation potential.
The Met Office Hadley Centre 'UKCP18' marine report (Palmer *et al*., 2018). The UKCP18 marine report is subsequently reviewed within the UK Climate Risk Independent Assessment (CCRA3), Chapter 4: Infrastructure (Jaroszweski *et al*., 2021).	These resources will be utilised to examine future trends for wind speed, wave height and sea levels.

9.8.4 Consultation

9.8.4.1 No pre-application pre-scoping consultation has been undertaken to date for climate change receptors.

9.8.5 Baseline Environment

9.8.5.1 The baseline environment for this climate change chapter is concerned with two areas:

- existing biological carbon stores;
- carbon intensity of the National Grid during the operational phase of the Morven OWF.

GHG emissions from the Array Project associated with sea-bed change

9.8.5.2 The current baseline within the Scoping Boundary will be considered in the assessment and will be based on the information provided in the marine environment EIA Report chapters, including:

- Benthic Subtidal Ecology (chapter 8.1) considering the potential habitat that could be carbon stores along the relevant areas of the sea bed.
- Marine Archaeology (chapter 9.4) considering any potential ancient woodland now buried along the relevant areas of the sea bed.

GHG emissions saving that the operational use of the Array Project will provide to the National Grid

9.8.5.3 The current baseline with regard to the carbon intensity of grid-average electricity generation in the UK, without the Array Project and accounting for generation, excluding transmission and distribution losses, is 239.63 $kgCO_2e/MWh$.

[23] Specific EPDs will be identified during the development of the EIA Report chapter to ensure the most up to date and relevant data is utilised.

9.8.5.4 The UK Government (BEIS, 2021) has confirmed its commitment to decarbonise the electricity system by 2035. As such, the carbon intensity of baseline electricity generation is projected to reduce over time and, so too, would the intensity of the marginal generation source displaced at a given time.

9.8.5.5 The Array Project's operational GHG emissions savings from renewable energy generation for the grid will be compared with information from appropriate sources such as the Department for Business, Energy and Industrial Strategy (BEIS) or subsequent successor departments (e.g. the Department for Energy Security and Net Zero) projected marginal and grid average baseline scenarios and the National Grid's Future Energy Scenario publication (National Grid ESO, 2022).

Risks posed to the Array Project because of a changing climate

9.8.5.6 The assessment of climate risks will consider the potential climatic conditions specific to the Array Project, based on the Met Office Hadley Centre 'UKCP18' marine report (Palmer *et al*., 2018), which is subsequently reviewed within the UK Climate Risk Independent Assessment (CCRA3), Chapter 4: Infrastructure (Jaroszweski *et al*., 2021). The aforementioned resources will be utilised to examine future trends for wind speed, wave height and sea level change. The projections are based on Representative Concentration Pathway (RCP) 8.5 (which provides a conservative MDS for the purpose of a risk assessment), with data largely available for the end of the 21st Century. Whilst this is outside of the initial lifetime of the Array Project, these projections display climate trends that will begin to be felt throughout this century. Additional information shall be drawn from the Marine Climate Change Impacts Partnership (MCCIP) concerning sea temperature, sea-level change, waves and storms.

9.8.6 Potential Project Impacts of the Array Project

9.8.6.1 A range of potential impacts on climate change has been identified, which may occur during the construction, O&M and decommissioning phases of the Array Project.

9.8.6.2 The impacts that have been scoped into the assessment are outlined in Table 9.28 together with a description of any additional data collection and supporting analyses that will be required to enable a full assessment of the impacts.

9.8.6.3 Potential impacts scoped out of the assessment are presented in Table 9.29, with justification.

Table 9.28: Impacts proposed to be scoped into the Array Project assessment for climate change.

C = Construction phase, O = O&M phase, D = Decommissioning phase.

Impact	Project phase			Basis for Impact	Data collection and analysis required to characterise the baseline environment	Summary of proposed approach to assessment
	C	O	D			
Impact on climate change						
The impact of GHG emissions arising from seabed change.	✓	✓	✓	GHG emissions arising from seabed change during the construction, O&M and decommissioning phases, such as the potential for installation activities to enact sea bed change and disrupt carbon store habitats will be assessed.	It is anticipated that the baseline environment does not have high soil or vegetation carbon stocks (seabed) that would be subject to disturbance by construction of the development. No existing development is situated within the Scoping Boundary. Future baseline environment (estimated carbon intensity of UK electricity generation) will be based on BEIS or successor Department and/or National Grid projections for grid average marginal carbon intensity of electricity generation.	No modelling is proposed as part of the climate change assessment. Use of published carbon intensity benchmark values for structures and/or project specific materials estimates together with published EPDs concerning Life Cycle Assessment research into embodied carbon associated with construction of the offshore substation platforms and associated infrastructure.
The impact of GHG emissions arising from the manufacturing and installation of the Array Project including vessel movements.	✓	✗	✗	GHG emissions arising from the manufacturing and installation of the Array Project would contribute to the lifecycle total and net GHG balance of the Array Project.		No modelling is proposed as part of the climate change assessment Use of published EPDs concerning Life Cycle Assessment research into embodied carbon associated with construction of wind turbines and wind farm developments.
The impact of GHG emissions arising from the consumption of materials and activities required to facilitate the O&M phase and the impact of	✗	✓	✗	GHG emissions arising from the consumption of materials and activities required to facilitate the O&M phase would contribute to the lifecycle total and net GHG balance of the Array Project. Renewable energy generated from the Array Project contributes towards Scottish and UK net zero ambitions. The avoided emissions associated with the Array Project will be		No modelling is proposed as part of the climate change assessment The net reduction in UK electricity Grid GHG emissions as a result of the operation of the Array Project will be assessed based on the carbon intensity of the alternative grid average and the displaced marginal generation source (i.e. the generator that would be supplying the grid in the absence of the Array Project) and the GHG emissions arising from the consumption of

Impact	Project phase			Basis for Impact	Data collection and analysis required to characterise the baseline environment	Summary of proposed approach to assessment
	C	O	D			
estimated abatement of UK Grid emissions during the O&M phase.				assessed within the overall net GHG assessment.		materials and activities required to facilitate the O&M phase.
The impact of GHG emissions arising from decommissioning works (e.g. plant, fuel and vessel use) and the recovery (or disposal) of materials.	×	×	✓	GHG emissions arising from decommissioning works (e.g. plant, fuel and vessel use) and the recovery (or disposal) of materials would contribute to the lifecycle total and net GHG balance of the Array Project. Options for either recycling or re-powering wind turbines will be assessed at end of life.		No modelling is proposed as part of the climate change assessment The assessment will be informed by the most recently published EPDs concerning Life Cycle Assessment research into embodied carbon associated with recycling and recovery activities at the end of life for wind turbines and wind farm developments.
Climate change resilience and adaptation						
The vulnerability of the Array Project to climate change during the O&M phase.	×	✓	×	Offshore assets (wind turbines, inter-array cables, inter-connector cables and offshore substation platforms) are designed to be resilient to storm events with factors of safety incorporated into design. However, as the effects of climate change are likely to increase over time, risks posed by climate change to the Array Project will be assessed.	Future baseline environment will be based on the potential climatic conditions specific to the Array Project generation, based on the Met Office Hadley Centre 'UKCP18' marine report (Palmer *et al.*, 2018), which is subsequently reviewed within the UK Climate Risk Independent Assessment (CCRA3), Chapter 4: Infrastructure (Jaroszweski *et al.*, 2021). The aforementioned resources will be utilised to examine future trends for wind speed, wave height and sea levels.	An assessment of potential risks arising from projected climatic changes will be presented in a matrix format, considering the hazard, severity of impact on the Array Project and its users, probability of that impact, and level of influence the Array Project design can have on the risk. This will inform potential resilience measures to be considered within the detailed design.

Impact	Project phase			Basis for Impact	Data collection and analysis required to characterise the baseline environment	Summary of proposed approach to assessment
	C	O	D			
The in-combination climate impacts (ICCI) of the Array Project	×	✓	×	Changing climatic parameters can exacerbate a potential effect on an environmental receptor. Effects identified in other environmental topic chapters shall be considered where relevant.	Future baseline environment will be based on the potential climatic conditions specific to the Array Project generation, based on the Met Office Hadley Centre 'UKCP18' marine report (Palmer *et al.*, 2018), which is subsequently reviewed within the UK Climate Risk Independent Assessment (CCRA3), Chapter 4: Infrastructure (Jaroszweski *et al.*, 2021). The aforementioned resources will be utilised to examine future trends for wind speed, wave height and sea levels.	The ICCI assessment would follow the same approach to assessing impacts and determining significance as for each of the other environmental disciplines, but with the added consideration of future climate change projections

Table 9.29: Impacts proposed to be scoped out of the Array Project assessment for climate change

Impact	Basis for impact
The vulnerability of the Array Project to climate change during the construction and decommissioning phases.	The construction phase (expected duration of 7 years) will not be lengthy enough for significant climate change risks to occur, compared to the present-day baseline. The Applicant will employ industry standard health and safety practices with respect to risks such as heatstroke or storm events offshore. As with the construction phase, it is considered unlikely that the decommissioning phase would be lengthy enough for significant climate change risks beyond those considered within the O&M phase assessment. In addition, the Applicant will employ industry standard health and safety practices with respect to risks such as heatstroke or storm events offshore.

9.8.7 Designed In Measures and Mitigation

9.8.7.1 As part of the project design process, a number of designed in measures (primary and tertiary) will reduce the potential for impacts on climate change receptors (Table 9.30). As there is a commitment to implement these measures, they are considered inherent to the design of the Array Project. The determination of magnitude and significance will assume the implementation of such measures. Some of these measures are considered standard industry practice for this type of development.

9.8.7.2 The requirement for any additional (secondary) mitigation measures will be dependent on the significance of the effects on climate change receptors. The requirement for and feasibility of any mitigation measures will be consulted upon with statutory consultees throughout the EIA process.

Table 9.30: Designed in measures of the Array Project, relevant to Climate Change

Reference number	Measures adopted	Justification	Primary or tertiary
MM-5	Development of, and adherence to, an EMP, including actions to minimise INNS, MMMP and a MPCP, which will include planning for accidental spills, address all potential contaminant releases and include key emergency details.	Provides a means to ensure the efficient management and communication of commitments made for the management of the potential environmental impacts. The EMP will include a MMMP. The MMMP may include using Marine Mammal Observer(s) and PAM to monitor the mitigation zone (MZ), as determined by the underwater sound modelling)) to ensure that animals are not observed within the MZ during piling. ADD may be used if required to deter animals from the MZ. For offshore water quality, measures will be adopted to ensure that the potential for release of pollutants from construction, and O&M, is minimised. In this manner, the accidental release of contaminants from rigs and supply/service vessels will be strictly controlled, thus providing protection for birds and their prey species across all phases of the development. For benthic subtidal ecology, an MPCP and INISMP will be provided. The MPCP will include planning for accidental spills, addressing all potential contaminant releases and include key emergency details. The INISMP will include measures for controlling INNS and their impact on fish and shellfish ecology receptors.	T

9.8.8 Proposed Assessment Methodology

9.8.8.1 The assessment methodology for the climate change chapter of the EIA Report will be as set out in chapter 4: Methodology. Additionally, the following guidance will also be considered:

- Environmental Impact Assessment Guide ‘Assessing Greenhouse Gas Emissions and Evaluating Their Significance’ (IEMA, 2022);

- IEMA Guidance on Environmental Impact Assessment Guide to: Climate Change Resilience and Adaptation (IEMA, 2020).

Impact on climate change

9.8.8.2 The climate change assessment will take into account the IEMA Environmental Impact Assessment Guide 'Assessing Greenhouse Gas Emissions and Evaluating Their Significance' (IEMA, 2022). It will be undertaken on a lifecycle basis, calculating the GHG emissions associated with the construction, O&M and decommissioning of the Array Project.

9.8.8.3 GHG emissions would contribute to the effect of global climate change. Assessment guidance from (IEMA, 2022) describes five levels of significance for emissions resulting from a development, each based on how the project contributes towards achieving a net zero and 1.5°C aligned reduction trajectory. To aid in considering whether the effects are significant, the guidance recommends that resultant GHG emissions should be contextualised against pre-determined carbon budgets, or policy and performance standards where a budget is not available. It is a matter of professional judgement to integrate these sources of evidence and evaluate them in the context of significance.

9.8.8.4 The reduction in GHG emissions associated with the National Grid (carbon intensity for the UK electricity grid) as a result of the operation of the Array Project will be assessed based on the carbon intensity of the alternative marginal generator that is displaced (i.e. the generator that would be supplying the grid in the absence of the Array Project).

9.8.8.5 The magnitude of the impact will be expressed as tonnes of carbon dioxide equivalent (tCO_2e), using 100-year global warming potential values for non-CO_2 GHGs from the Intergovernmental Panel on Climate Change's Sixth Assessment Working Group 1 Report (IPCC, 2021) or as otherwise defined in literature sources to be used.

9.8.8.6 The sensitive receptor will be defined as the global atmospheric mass of GHGs. It will be characterised as having a 'high' sensitivity, given the severe consequences of climate change and the cumulative contributions of other sources.

9.8.8.7 In line with IEMA (2022) guidance, it is considered that broadly speaking, the significance of the Array Project GHG emissions can be contextualised in the following ways:

- with reference to the absolute magnitude of net GHG emissions as a percentage of applicable carbon budgets at the UK scale;
- through considering any increase/reduction in absolute GHG emissions and GHG intensity compared with baseline scenarios, including projections for future changes in those baselines;
- with reference to whether the Array Project contributes to, and is in line with, the UK's national carbon budget sectoral goals for GHG emissions reduction, which are consistent with science-based commitments to limit global climate change to an internationally agreed level.

9.8.8.8 The Climate Change Act 2008, as amended (2019), created a framework for setting a series of interim national carbon budgets and plans for national adaptation to climate risks. The Act requires the UK government to set carbon budgets for the whole of the UK. At present, the Third, Fourth, Fifth and Sixth Carbon Budgets, set through The Carbon Budget Orders 2009, 2011, 2016, and 2021 are 2.54 giga tonnes carbon dioxide equivalent ($GtCO_2e$) for 2018-2022, 1.95$GtCO_2e$ for 2023-2027, 1.73$GtCO_2e$ for 2028-2032 and 0.97 $GtCO_2e$ for 2033-2037 respectively. The Sixth Carbon Budget is the first Carbon Budget that is consistent with the UK's net zero target, requiring a 78% reduction in GHG emissions by 2035 from 1990 levels. The relevant budgets will be used to contextualise GHG emissions as set out above in paragraph 9.8.8.7.

9.8.8.9 Considering these factors, effects may be described as: major adverse, moderate adverse, minor adverse, negligible, or beneficial. Minor adverse and negligible effects are considered to be non-significant in EIA terms. The remaining levels of effect (major adverse, moderate adverse, beneficial), are all considered to be significant in EIA terms. The evaluation of significance will be carried out in accordance with the guidance, which will include the application of professional judgement to contextualise and determine levels of significance in a way that makes clear the relationship between the Array Project's net GHG balance and a reduction trajectory consistent with measures required in the UK to meet our Nationally Determined Contribution (NDC) towards the

Paris Agreement's 1.5°C target, as reaffirmed in COP26 (United Nations Framework Convention on Climate Change, 2021).

Climate change resilience and adaptation

9.8.8.10 The IEMA Guidance on Environmental Impact Assessment Guide to: Climate Change Resilience and Adaptation (IEMA, 2020) identifies that there are two key strands to addressing climate adaptation issues within the EIA Report:

- The risks from changes in the climate to the project (i.e. the resilience or conversely the vulnerability of the Array Project to future climate changes).
- The extent to which climate exacerbates or ameliorates the effects of the Array Project on the environment (i.e. 'in-combination' effects).

9.8.8.11 A high level screening risk assessment would be undertaken, considering the hazard, potential severity of impact on the Array Project and its users, probability of that impact, and level of influence the design can have on the risk.

9.8.8.12 Where potentially significant risks are identified at the high level screening stage prior to any mitigation, further assessment would be undertaken with consideration of appropriate designed in mitigation to determine whether significant residual risks are likely.

9.8.8.13 Consideration of the in-combination climate impacts (ICCI) shall be considered within each topic chapter as to how potential climatic changes may affect the future baseline, including the sensitivity or resilience of receptors.

9.8.9 Potential Cumulative Impacts

9.8.9.1 All developments that emit GHGs have the potential to impact the atmospheric mass of GHGs as a receptor, and so may have a cumulative impact on climate change. Consequently, cumulative effects due to other specific local development projects are not individually identified but would be considered when evaluating the impact of the Array Project by defining the atmospheric mass of GHGs as a high sensitivity receptor.

9.8.9.2 However, consideration of the net impact of the offshore wind turbines and associated infrastructure will be necessary to ensure the cumulative (generation and transmission assets) carbon and net emissions associated with both the onshore and offshore elements of the Array Project. As such, the Array Project will need to consider the cumulative effects of the Array Project together with the Transmission Project.

9.8.10 Potential Inter-Related Effects

9.8.10.1 The EIA will consider inter-related effects. Inter-related effects relate to effects arising from the Array Project, either across their own phases (project lifetime) or different effects on one receptor in one phase (receptor-led). The EIA will consider inter-related effects, in relation to the potential effects of multiple impacts from the construction, O&M and decommissioning phases of the Array Project, affecting one receptor. Inter-related effects are assessed through consideration of all effects on a receptor, considering both spatial and temporal overlaps, with the Array Project. This will ensure that the Array Project as a whole is appropriately considered within the EIA.

9.8.11 Potential Transboundary Impacts

9.8.11.1 All developments that emit GHGs have the potential to impact the atmospheric mass of GHGs as a receptor, and so may have a transboundary impact on climate change. Consequently, transboundary impacts of the Array Project are considered by defining the atmospheric mass of GHGs as a high sensitivity receptor. Each country has its own policy and targets concerning carbon and climate change, which are intended to limit GHG emissions to acceptable levels within that country's defined budget and international commitments. For the Array Project, the context regarding UK Carbon Budgets and climate related policy and objectives shall be referenced in the assessment.

9.9 Major Accidents and Disasters (MADS)

9.9.1 Introduction

9.9.1.1 This chapter of the Scoping Report considers the potential vulnerability of the Array Project to major accidents and disasters and considers the potential impacts arising from the construction, Operations and Maintenance (O&M), and decommissioning phases of the Array Project.

9.9.1.2 Guidance from the Institute of Environmental Management and Assessment (IEMA, 2020) defines a major accident (e.g. a major traffic collision) as an event that threatens immediate or delayed serious environmental effects on human health, welfare, and/or the environment. Additionally, major accidents can be caused by disasters resulting from both man made and natural hazards. A disaster can, therefore, be an external hazard (e.g. an act of terrorism) or a natural hazard (e.g. an earthquake) with the potential to create a scenario that meets the definition of a major accident.

9.9.1.3 The main risks presented by OWF are related to infrastructure (e.g. corrosion or blade failure), equipment, the safety of personnel (with fire as the main accident of focus) and navigation. The key risks to OWF are related to the weather (e.g. lightning strikes and gales), shipping and interactions with subsea cables (Mou *et al*., 2021). The risk of sabotage has also been considered in this chapter. Measures are proposed by the Array Project to improve the safety of infrastructure, equipment, personnel and navigation through all phases of the Array Project. These measures have been weighed together with the probability and relative importance of each risk to ascertain the degree of risk presented by, or to the Array Project. The safety hazards identified and explored are not considered to have the potential to amount to a major accident or disaster within the IEMA (2020) definition, or result in serious effects on environmental or social receptors. The safety hazards explored in this chapter are considered to represent minor incidents, likely from a single object, or with small, highly localised consequences. It is, therefore, proposed to scope out major incidents and disasters from the EIA. This chapter of the Scoping Report sets out the rationale for scoping out this topic.

9.9.2 Study Area

9.9.2.1 Consideration of the risks of major accidents and disasters considered offshore energy projects, offshore cables, carbon capture, natural gas storage and underground gasification, oil and gas infrastructure, commercial fisheries, civil and military aviation and shipping and navigation. The consideration of major accidents and disasters is reliant on the information collated within various technical topics:

- Physical Processes (chapter 7.1);
- Commercial Fisheries (chapter 9.1);
- Shipping and Navigation (chapter 9.2);
- Aviation (Military and Civil) (chapter 9.3);
- Other Sea Users and Marine Infrastructure (chapter 9.5).

9.9.2.2 The study areas for these baseline topics differ from each other due to different receptors with varying ranges for which impacts must be considered. However, notwithstanding these differences, all relevant study areas are appropriate for the consideration of major accidents and disasters.

9.9.3 Baseline Environment

9.9.3.1 The consideration of the major accidents and disasters baseline within this Scoping Report chapter comprises a summary of the information from the following chapters:

- Physical Processes (chapter 7.1);
- Commercial Fisheries (chapter 9.1);
- Shipping and Navigation (chapter 9.2);
- Aviation (Military and Civil) (chapter 9.3);
- Other Sea Users and Marine Infrastructure (chapter 9.5).

9.9.3.2 A summary is presented below based on the baseline environments within each of these chapters.

Physical Processes

9.9.3.3 This section provides an overview of the physical processes baseline, as described in detail in chapter 7.1.

9.9.3.4 The bathymetry across the Scoping Boundary ranges from c.64m to c.76m relative to the (LAT), with a maximum depth of c.76m recorded at the southeastern edge. The seabed has a gradient of <1o throughout and is dominated by megripples, which are typically 0.5m above the seabed and generally orientated from west to east. There is a sandbank in the southeastern part of the Scoping Boundary, measuring approximately 4km at its widest point and 4m high. One discrete feature in the south, rises 2m above the seabed with gradients up to 8o on its flanks.

9.9.3.5 Annual mean significant wave height ranged from approximately 1.77m to 2.00m, annual mean wave power ranged from approximately 14.3kW/m to 17.6kW/m and mean spring tidal ranges between approximately 2.3m to 2.7m across the Scoping Boundary (ABPmer, 2017).

Commercial Fisheries

9.9.3.6 This section provides an overview of the commercial fisheries baseline, as described in detail in chapter 9.1: Commercial Fisheries.

9.9.3.7 The Commercial Fisheries Study Area is defined by the International Council for the Exploration of the Sea (ICES) rectangles within which the Scoping Boundary is situated (illustrated in chapter 9.1, Figure 9.1), as follows:

- ICES rectangle 42E8: in which the western section of the Scoping Boundary is located.
- ICES rectangle 42E9: in which the majority of the Scoping Boundary is located.
- ICES rectangle 41E9: in which a small section of the southernmost part of the Scoping Boundary is located.

9.9.3.8 The Commercial Fisheries Study Area supports various commercial fishing activities such as potting, scallop dredging and demersal trawling. Most of the activity within the area is undertaken by UK vessels, with minimal activity from non-UK vessels.

9.9.3.9 The landings value data suggests that dredging activity is concentrated in an area (the western sector of ICES rectangle 42E8) that does not overlap with the Scoping Boundary. Whilst potting levels are moderate, they are concentrated within a corner of ICES rectangle 42E8, which does not overlap with the Scoping Boundary. Compared to ICES rectangle 42E8, there is minimal activity in the other two rectangles comprising the identified Commercial Fisheries Study Area (42E9 and 41E9) (as illustrated in chapter 9.1, Figure 9.2). The activity which does occur appears to be mostly demersal trawling, likely for *Nephrops*.

9.9.3.10 The Scoping Boundary is located within an area sustaining low levels of commercial fishing activity, as per data presented in chapter 9.1.

Shipping and Navigation

9.9.3.11 This section provides an overview of the shipping and navigation baseline, as described in detail in chapter 9.2: Shipping and Navigation.

9.9.3.12 A dedicated winter vessel traffic survey was undertaken for the Array Project from 21 November 2022 to 5 December 2022. An average of 14 unique vessels per day were recorded within 10 nautical miles (Nm) of the Scoping Boundary, with an average of five to six unique vessels per day recorded intersecting the Scoping Boundary. The most frequently recorded vessel types were cargo vessels (43%), oil and gas vessels (32%) and tankers (12%). Of the vessels intersecting the Scoping Boundary during the survey period, the most commonly recorded were again cargo vessels (59%), oil and gas vessels (16%) and tankers (11%). A total of 14 main commercial routes were identified, six of which pass through the Scoping Boundary. Four of the six routes that intersect the Scoping Boundary are key cargo routes, with the other two representing cargo and oil and gas routes. A dedicated summer vessel traffic survey took place in June 2023.

Aviation and Radar

9.9.3.13 This section provides an overview of the aviation (military and civil) baseline, as described in detail in chapter 9.3: Aviation and Radar. The Array Project is located within the Scottish Flight Information Region (FIR) in an area of Class G uncontrolled airspace, which is established from the surface up to Flight Level (FL) 195 (approximately 19,500ft). Above FL195 Class C Controlled Airspace (CAS) is established. All aircraft operating within CAS must be in receipt of an Air Traffic Service (ATS) from NATS, or from military controllers based at a NATS Area Control Centre (ACC) or under the control of the military or air defence controllers.

9.9.3.14 The nearest UK civil airport to the Array Project is Aberdeen International Airport, located on a bearing of approximately 295°/50nm (92.6km) southeast of the Scoping Boundary.

9.9.3.15 A preliminary Radar Line of Sight (RLoS) analysis indicates that the NATS Perwinnes Primary Surveillance Radars (PSR) will theoretically detect the operational wind turbines at a maximum blade tip height of 293m and 363m[24].

9.9.3.16 This analysis also indicated that NATS Allanshill PSR will theoretically not detect most operational wind turbines within the Scoping Boundary at a maximum blade tip height of 293m; however, analysis cannot rule out the occasional detection of the most northeasterly part of the Scoping Boundary. With a maximum blade tip height of 363m it is predicted that the Allanshill PSR will theoretically likely detect operational wind turbines in the northern part of Scoping Boundary, with theoretical detection decreasing towards the south of the Scoping Boundary as the distance from the location of the PSR increases.

9.9.3.17 The nearest Air Defence Radar (ADR) to the Scoping Boundary is the TPS-77 (Type 92) ADR located at Remote Radar Head (RRH) Buchan, Aberdeenshire, which is located on a bearing of approximately 324°/41nm (75.93km) from the closest point of the Scoping Boundary. RRH Brizlee Wood in Northumberland operates a TPS 77 type ADR and is located on a bearing of approximately 209°/71nm (131.49km) from the closest point on the southwest Scoping Boundary.

9.9.3.18 The RLoS analysis predicts theoretical detection by the Buchan ADR of the operational wind turbines for maximum blade tip heights of 293m and 363m. The Brizlee Wood ADR could be impacted by the detection of operational wind turbines in the southern part of the Scoping Boundary (closest to the radar location) for maximum blade tip heights of 293m and 363m. This impact is reduced across the Scoping Boundary (furthest away from the radar location) as the effect diminishes with range from the source radar due to electromagnetic wave energy dissipation and earth curvature) to the north of the area.

9.9.3.19 Military low flying activities occur in uncontrolled airspace below 2,000ft, offshore, above mean sea level (amsl) within defined Low Flying Areas (LFA). The Scoping Boundary is located within LFA 14, and military low flying will likely occur above and around the Scoping Boundary.

Other Sea Users and Marine Infrastructure

9.9.3.20 This section provides an overview of the other sea users and marine infrastructure baseline, as described in detail in chapter 9.5: Other Sea Users and Marine Infrastructure.

9.9.3.21 The closest operational offshore wind farm is Aberdeen Bay OWF, located approximately 60km northwest of the Scoping Boundary. The Bowdun and Ossian OWFs are in the pre-application stage and are located approximately 10km northwest and 5km east of the Scoping Boundary, respectively (4C Offshore, 2023).

9.9.3.22 No operational cables overlap with the Scoping Boundary (Kis-Orca, 2023). However, the Eastern Link 2 HVDC cable and cable protection is in its early development stage, with plans intersecting the Scoping Boundary at its western corner.

[24] For the reasons discussed at para 1.1.2 in Chapter 9.3: Aviation (Military and Civil), wind turbines with a maximum blade tip height of 390m are expected to be similarly visible to the receptors identified by the Preliminary RLoS Analysis. The RLoS Analysis (to be undertaken for a maximum blade tip height of 390m) would not identify additional receptors, only a greater measure of effect on the same receptors (i.e. more wind turbines causing an effect).

9.9.3.23 The Firth of Forth supports oil and gas activities, such as those associated with the Grangemouth refinery, oil storage and tanker terminals. There are currently no active licence blocks located within or near the Scoping Boundary. The closest active licence block, Block 27/9 – North Sea Natural Resources Ltd., is approximately 15km from the Scoping Boundary.

9.9.3.24 There are no oil and gas pipelines within the Scoping Boundary and the closest pipeline (Forties crude oil pipeline) is approximately 60km from the Scoping Boundary.

9.9.3.25 Due to the offshore location of the Array Project, activities generally associated with inshore recreational sailing are not expected to occur within the Scoping Boundary. Royal Yachting Association (RYA) data is limited to inshore waters but Automatic Identification System (AIS) data tracks show that offshore recreational vessels also transit through the Scoping Boundary. Due to the distance of the Scoping Boundary from the coast (~60km), any sailing would likely consist of offshore cruising and racing (RYA, 2019).

9.9.3.26 There are currently no active licences for marine aggregate extraction in the Forth and Tay marine region, active or closed disposal sites, carbon capture or storage areas, hydrocarbon fields, oil and gas platforms, subsurface structures (protective structures, pipeline junctions, manifolds, wellheads, trees and valves), plugged or abandoned wells or recreational dive sites within the Scoping Boundary.

9.9.4 Potential Hazards

9.9.4.1 A range of potential hazards have been identified that may arise during the construction, O&M and decommissioning phases of the Array Project. Many of these potential hazards will be assessed within their respective technical EIA Report chapters or will be managed via adherence to industry requirements, Risk Assessment Method Statements (RAMS) and/or management plans (see Table 9.33). Therefore, it is proposed to scope out all potential hazards resulting from the Array Project as having the potential to result in major accidents and disasters.

9.9.4.2 The hazards proposed to be scoped out of the assessment of the Array Project with respect to the Array Project's vulnerability to existing hazards are shown in Table 9.31. Hazards proposed to be scoped out of the assessment of the Array Project with respect to the Array Project's potential to cause accidents and disasters are presented in Table 9.32.

Table 9.31: Hazards proposed to be scoped out of the assessment of the Array Project with respect to the Array Project's vulnerability to existing hazards

Impact	Justification
Collision risk – shipping and navigation	The Array Project could increase the potential for collision risk from existing shipping and navigation, which could impact the construction, O&M and decommissioning of the Array Project. The approach to how this impact will be addressed is set out in chapter 9.2: Shipping and Navigation of the Scoping Report, and it is, therefore, proposed not to consider this impact in a major accidents and disasters assessment.
Collision risk – aviation (military and civil)	Considering the designed in measures outlined in Table 9.32 that are relevant to aviation (military and civil) (i.e. including but not limited to the use of appropriate lighting and marking of OSPs, communication with UKHO and adherence to ERCoP), aviation collision events are considered highly unlikely. It is, therefore, proposed not to consider this impact as part of a major accidents and disasters assessment.
Snagging risk – commercial fisheries	The Array Project could increase the potential for snagging risk from existing commercial fishing activities, which could impact the construction, O&M and decommissioning of the Array Project. The approach to how this impact will be addressed is set out in chapter 9.1: Commercial Fisheries of the Scoping Report. It is, therefore, proposed not to consider this impact as part of a major accidents and disasters assessment.

Impact	Justification
Risk of accident – cables and pipelines	The approach to how the Array Project impacts on early development cables or pipelines or restrictions on access to cables or pipelines is set out in chapter 9.5: Other Sea Users and Marine Infrastructure of the Scoping Report. Due to the measures employed to mitigate against these impacts, the risk of accidents occurring as a result of cables and pipelines will be very low. It is, therefore, proposed not to consider this impact as part of a major accidents and disasters assessment.
Risk of accidents – extreme weather (and storm surge)	There is considered to be no potential for the Array Project to increase the potential for risk of accidents from extreme weather events (and storm surges). It is, therefore, proposed not to consider this impact as part of a major accidents and disasters assessment.
Risk of accident – oil and gas infrastructure	There are no active oil and gas exploration blocks within the Other Sea Users and Marine Infrastructure Study Area, as described in section 9.5.4 of chapter 9.5: Other Sea Users and Marine Infrastructure of the Scoping Report. As such, there is no potential impact pathway.
Temperature changes, precipitation changes and sea revel rise	There is considered to be no potential for the Array Project to increase the potential for a major accident or disaster related to these weather changes or long-term climate driven changes.
Pollution of the marine environment (structures)	The quantity of chemicals in any Array structure is too low to result in any credible major accident or disaster resulting from pollution. The risk of such events is managed by the implementation of measures set out in standard post-consent plans (e.g. EMPs, including MPCPs). These plans include planning for accidental spills, address all potential contaminant releases and include key emergency contact details. They will also set out industry good practice and OSPAR (Oslo-Paris), IMO and MARPOL guidelines for preventing pollution at sea. The impact of pollution events is also considered separately for marine ecology receptors in the relevant chapters of the Scoping Report. It is, therefore, proposed not to consider this impact as part of a major accidents and disasters assessment.
Sabotage events	The UK government continues to implement methods of detection to monitor the likelihood of an attack in the UK, to ensure emergency response protocols are in place should such an attack happen. The Array Project will not cause such an attack and is no more vulnerable to this type of hazard than any other offshore development. The risk is considered to be very low but, should a sabotage event occur, any effects on water and air quality would dissipate quickly and would be isolated to a remote, offshore location. The implications of such events (i.e. marine pollution) would be dealt with at the UK level by the Secretary of State's Representative and could be reduced further through the implementation of measures set out in standard post-consent plans (e.g. MPCPs). It is, therefore, proposed not to consider this impact as part of a major accidents and disasters assessment.

Table 9.32: Hazards proposed to be scoped out of the assessment of the Array Project with respect to the Array Project's potential to cause accidents and disasters

Impact	Justification
Physical impacts (collision, allision)	There is the potential for major accidents and/or disasters due to collision/allision incidents involving the vessels associated with the Array Project, during all phases. The approach to how this impact will be addressed is set out in chapter 9.2: Shipping and Navigation of the Scoping Report. It is, therefore, proposed not to consider this impact as part of a major accidents and disasters assessment.
UXOs	Should UXOs require clearance, this will be identified by the Array Project and specific procedures and risk assessments will be undertaken to mitigate risk to personnel and infrastructure. It is, therefore, proposed not to consider this impact as part of a major accidents and disasters assessment.
Pollution of the marine environment (vessels)	Pollution events from vessels are considered unlikely. Should an event occur effects will be temporary, reversible and limited in spatial extent. In addition, it is anticipated that the magnitude of such events occurring will be managed by measures set out in standard post consent plans (e.g. a EMP including a MPCP), which will be implemented as part of the Array Project (Table 9.33). The impact of pollution events from vessels is also considered separately for marine ecology receptors in the relevant chapters of the Scoping Report and EIA Report. It is, therefore, proposed not to consider this impact as part of a major accidents and disasters assessment.
Fire at wind turbine/OSPs/Offshore convertor station platforms including from third-party interference	If a fire were to occur, which is considered unlikely given the standard health and safety plans and protocols implemented by the Array Project, any effects on water and air quality would dissipate quickly and would be isolated to a remote, offshore location. It is, therefore, proposed not to consider this impact as part of a major accidents and disasters assessment.
Snagging risk – commercial fisheries	Commercial fisheries operating in the area could snag during the O&M phase of the Array Project. The approach to how this impact will be addressed is set out in chapter 9.1: Commercial Fisheries of the Scoping Report. It is, therefore, proposed not to consider this impact as part of a major accidents and disasters assessment.
Collision risk – aviation (military and civil)	Considering the measures outlined in Table 9.33, which are relevant to aviation (military and civil) (including but not limited to the use of appropriate lighting and marking of offshore substation platforms, communication with UKHO and adherence to ERCoP), aviation collision events are considered highly unlikely. It is, therefore, proposed not to consider this impact as part of a major accidents and disasters assessment.

9.9.5 Designed In Measures and Mitigation

9.9.5.1 The Array Project has committed to various designed in measures and mitigation. These are set out within the chapters of relevance to major accidents and disaster assessment and are outlined in Table 9.33. The requirement for and feasibility of any mitigation measures will be consulted upon with statutory consultees throughout the EIA process.

Table 9.33: Measures of relevance to the likelihood and severity of major accidents and disasters

Reference number	Measure	Commercial Fisheries (chapter 9.1)	Shipping and Navigation (chapter 9.2)	Aviation (Military and Civil) (chapter 9.3)	Other Sea Users and Marine Infrastructure (chapter 9.5)	Physical Processes (chapter 7.1)
MM-1	Scour protection will be used around offshore structures as set out in chapter 3: Project Description.	✓	✓			✓
MM-2	Development and adherence to a Cable Plan.	✓	✓			✓
MM-18	Development of a FMMS which will include details on the measures that are proposed to be implemented to minimise impacts on commercial fishing.	✓				✓
MM-45	Implementation, management and monitoring of cable protection (via burial or external protection where adequate burial depth, as identified via risk assessment, is not feasible) with any damage, destruction or decay of cables notified to MCA, NLB, Kingfisher and UKHO no later than 24 hours after discovered. Secured through the NSP and VMP.	✓	✓		✓	
MM-19	Ongoing consultation with the fishing industry and appointment of a FLO.	✓	✓			
MM-36	Prior to the start of construction, the MoD AIDU and UKHO will be informed of the locations, heights, and lighting status of the offshore substation platforms, including estimated and actual dates of construction and operation activities, and the maximum height of any equipment to be used, to allow inclusion on Aviation Charts.			✓		
MM-44	Undertaking of post-lay and cable burial inspection surveys and monitoring. Secured through the Cable Plan, as part of the OMP.	✓				
MM-14	Compliance with MGN 654 (MCA, 2021) and its annexes, where applicable.		✓			
MM-15	Development of, and adherence to, a DSLP. The DSLP will ultimately confirm the layout and design parameters of the Array Project.		✓			

Reference number	Measure	Commercial Fisheries (chapter 9.1)	Shipping and Navigation (chapter 9.2)	Aviation (Military and Civil) (chapter 9.3)	Other Sea Users and Marine Infrastructure (chapter 9.5)	Physical Processes (chapter 7.1)
MM-5	Development of, and adherence to, an EMP, including actions to minimise INNS, MMMP and a MPCP, which will include planning for accidental spills, address all potential contaminant releases and include emergency details.	✓	✓			
MM-8	Development of, and adherence to, a NSP and VMP.		✓			
MM-34	Appropriate lighting and marking of wind turbines and offshore substation platforms will be established in accordance with CAA regulations and guidance (CAP 393, The ANO) and in accordance with the CAA and the DIO, which is responsible for the safeguarding of MoD assets. Secured through the development of, and adherence to, a LMP.		✓	✓		
MM-35	Marking and lighting of the site in agreement with the NLB and in line with IALA Recommendation O-139 (IALA, 2021 (a)) and Guidance G1162 (IALA, 2021 (b)) through NSP and VMP.		✓			
MM-42	A minimum spacing of 500m shall be maintained between blade tip to blade tip of all surface infrastructure (for OSPs, this shall be taken as the outermost point of the infrastructure).		✓			
MM-16	Marine coordination and communication to manage Array Project vessel movements through the NSP and VMP.		✓			
MM-17	Compliance of Array Project vessels with international marine regulations as adopted by the Flag State, including the COLREGs (IMO, 1972/77) and the SOLAS (IMO, 1974) through the NSP and VMP.		✓			
MM-38	Buoyed construction area in agreement with NLB and described within the LMP, NSP and VMP.		✓			
MM-43	A minimum wind turbine hub-height of 155m (above LAT) will be used for the Array Project. This provides for a lower blade tip height clearance of 30m LAT, accounting for pitch and roll as per MGN 654, will be used for the Array Project.		✓			

Reference number	Measure	Commercial Fisheries (chapter 9.1)	Shipping and Navigation (chapter 9.2)	Aviation (Military and Civil) (chapter 9.3)	Other Sea Users and Marine Infrastructure (chapter 9.5)	Physical Processes (chapter 7.1)
MM-10	The DIO will be informed of the construction start and end dates, the maximum height of construction equipment and locations of substations.			✓		
MM-24	Development of, and adherence to, and ERCoP, including consideration of helicopters.			✓		
MM-33	A minimum spacing of 500m shall be maintained between blade tip to blade tip of all surface infrastructure. For OSPs this shall be taken as the outermost point of the infrastructure.			✓		
MM-9	The Array Project operator will issue, as necessary, requests to the UK Aeronautical Information Service to submit NOTAM in the event of any failure of aviation lighting.			✓		
MM-23	Procedures for helicopter hoist operations will be established in accordance with CAP 437.			✓		
MM-12	Consultation with oil and gas operators and other energy infrastructure operators, as required.				✓	
MM-41	Sufficient spacing between wind turbines (at least 1,000m).					

9.9.6 Potential Cumulative Impacts

9.9.6.1 All hazards have been scoped out of the major accidents and disasters assessment within the EIA Report, due to the remote, offshore location of the Array Project. Therefore, it is proposed that the potential for cumulative effects to arise from other projects or activities within the North Sea will not be considered further in the EIA Report.

9.9.7 Potential Inter-Related Effects

9.9.7.1 The EIA will consider inter-related effects. Inter-related effects relate to effects arising from the Array Project, either across their own phases (project lifetime) or different effects on one receptor in one phase (receptor led). The EIA will consider inter-related effects, in relation to the potential effects of multiple impacts from the construction, O&M and decommissioning phases of the Array Project, affecting one receptor. Inter-related effects are assessed through consideration of all effects on a receptor, considering both spatial and temporal overlaps, with the Array Project. This will ensure that the Array Project as a whole is appropriately considered within the EIA.

9.9.8 Potential Transboundary Impacts

9.9.8.1 The potential effects from construction, O&M, and decommissioning phases of the Array Project as these relate to major accidents and disasters receptors are considered for the relevant topic areas (as identified in section 9.9.2.1) in Appendix 1: Transboundary Screening. Where impacts have proposed to be screened out of the Scoping Report, they have not been considered within this transboundary screening assessment, on the basis that no significant effects to the environment are predicted and, therefore, will not result in a significant effect in an adjacent state. There is considered to be no potential for the Array Project to have a significant effect on the potential for major accidents and disasters to occur in an adjacent state.

9.10 Human Health

9.10.1 Introduction

9.10.1.1 This chapter of the Scoping Report identifies the environmental, social, behavioural, economic and institutional determinants of health relevant to the Array Project. It considers the potential impacts arising from the construction, O&M and decommissioning of the OWF.

9.10.1.2 The potential for the Array Project to change population health outcomes may arise from various pathways. The health assessment will draw inputs from the residual effect conclusions of other EIA topic chapters, including offshore water quality, climate change, shipping and navigation and socioeconomics and the scoping conclusions for noise and vibration, air quality, seascape, landscape and visual and major accidents and disasters. The health chapter will also be informed by the project description for the Array Project and consultation.

9.10.2 Study Areas

9.10.2.1 The human health assessment will be informed by the study areas, ZoI and receptors impacted, or potentially impacted, by other EIA topic chapters. This will enable the effects on human health to be better understood. It is noted that the study areas for these topics do not necessarily define the boundaries of potential population health effects. As such, the human health assessment also defines human health study areas in order to broadly characterise representative population groups.

9.10.2.2 The Array Project ise located approximately 60km offshore and is, thus, remote from the nearest mainland receptor population. The relevant study areas include the coastal communities that might be affected by the offshore activities. These vary depending on the determinant of health discussed, therefore, a range of areas is required:

- Local Health Study Area: Aberdeen City, Dundee City, City of Edinburgh;
- Regional Health Study Area: Aberdeenshire, Angus, Fife, East Lothian, Kincardineshire;
- National Health Study Area: Scotland and the UK.

9.10.2.3 The following population groups are present in the study areas and will be considered:

- The 'general population' including residents, workers, service providers, and service users.
- The 'vulnerable group population' including those with potential vulnerability due to young age, older age, low income, poor health status, social disadvantage, restricted access, or geographic proximity to the activities associated with the Array Project.

9.10.3 Data Sources

9.10.3.1 The following data sources will be consulted as part of the EIA baseline.

Table 9.34: Health baseline data sources

Data Source	Evidence
Office for National Statistics (ONS); and official labour market statistics.	Population estimates.
National Records of Scotland (2022).	Population estimates including life expectancy data.
Scottish Index of Multiple Deprivation Mapping (Scottish Government, 2020).	Relevant small area deprivation mapping, including 'Index of multiple deprivation' and individual sub-domains.
Public Health Scotland (2022).	Relevant small area and comparator levels. Indicators from 'behaviours', 'economy' and 'life expectancy and mortality'.
Local health mapping.	Scottish maps, including local services; learning, leisure and culture; highways and transportation; countryside environment and waste; and crime and public safety.
Google Earth Pro.	Aerial and street level site location review.

9.10.3.2 In addition to the health data sources listed in Table 9.34, the following additional evidence will be used for the human health technical assessment:

- scientific literature;
- regulatory standards;
- other EIA technical assessments;
- project wide consultation.

9.10.3.3 No site specific survey will be undertaken to support the baseline assessment, as sufficient desktop data is available to inform the baseline from which the potential impacts can be assessed.

9.10.4 Consultation

9.10.4.1 No pre-application pre-Scoping consultation has been undertaken to date for human health receptors.

9.10.5 Baseline Environment

9.10.5.1 The following baseline data is from Public Health Scotland (2022). At this stage, baseline indicators have been selected to provide a general coverage of the wider determinants of health.

9.10.5.2 Demographic indicators show that the percentage of the population aged under 16 is slightly lower in Aberdeen City (16%), Dundee City (16%) and the City of Edinburgh (15%) compared to the national average of 17%. For older ages, compared to the average of Scotland, the percentage of the population aged 65+ is also lower for Aberdeen City (16%), Dundee City (18%) and the City of Edinburgh (15%) than the national average of 20%. In contrast, the percentage of the working age group (16-64) is higher in Aberdeen City (68%), Dundee City (66%) and the City of Edinburgh (70%) compared to the average of Scotland (64%) (National Records of Scotland, 2022).

9.10.5.3 Using deprivation as a health resilience indicator, the Scottish Deprivation Mapping shows pockets of deprivation within the local authority of Aberdeen City with 22 data zones falling into the 20% most deprived areas in Scotland (Aberdeen City Council, 2016). It is also noted that the majority of data zones classified as most deprived areas are in the coastal area of Aberdeen City. Dundee City shows relatively high levels of deprivation with 38% data zones classified as most deprived in Scotland (Scottish Government, 2020). The Scottish Index of Multiple Deprivation suggests low levels of deprivation in the City of Edinburgh, with pockets of deprivation including Leith, North Leith and Granton.

9.10.5.4 Overall health can be informed by life expectancy indicators. For men, life expectancy at birth is generally higher (better) in Aberdeen City (78.2) and the City of Edinburgh (78) and lower (worse) in Dundee City (73.5) than the average for Scotland (76.6). Similarly for women, the life expectancy at birth is higher (better) in Aberdeen City (81.8) and the City of Edinburgh (82.4), and lower (worse) in Dundee City (79.1) compared to the national average (80.8).

9.10.5.5 In relation to health inequalities in the local authority area, overall, healthy life expectancy[25] for females is 24.9 years more in the least deprived decile of Scotland (72.3 years) compared to the most deprived decile of Scotland (47.4 years). The difference for males increases to 26 years (71 to 44.9 years). It is noted that in the most deprived areas in Scotland, people spend more than a third of their life in poor health. According to deprivation mapping, Aberdeen City, Dundee City and the City of Edinburgh all have multiple data zones in the coastal areas that fall in the 20% most deprived areas of Scotland. The overall healthy life expectancy for males in Aberdeen City is similar to Scotland, lower in Dundee City and notably higher in the City of Edinburgh compared to the national average. On the other hand, the healthy life expectancy for females is higher in Aberdeen City and the City of Edinburgh and lower in Dundee City compared to the average of Scotland.

9.10.5.6 Changes to the physical, social and economic environment can influence health behaviours as measured through health lifestyle indicators. The prevalence of smoking is higher in the local authority of Aberdeen City (20.8%) and lower in Dundee City (11.7%) and the City of Edinburgh (15%) as compared to Scotland (18.6%). The rate of alcohol-related hospital admissions (per 100,000) is notably lower in Aberdeen City (410.5), and the City of Edinburgh (508.7) and higher in Dundee City (797.8) compared to the average in Scotland (610.9). The percentage of adults who actively travel to work as exercise in Aberdeen City (16.6%), Dundee City (20.2%) and the City of Edinburgh (28.8%) is higher than the national average (14.6%).

9.10.5.7 Socio-economic Status has correlations with health both for those directly employed and their dependants. The percentage of the working age population that is employment deprived[26] is lower in Aberdeen City (6.24%), and the City of Edinburgh (6.6%) and higher in Dundee City (12.4%) than the average of Scotland (9.29%).

9.10.6 Potential Impacts of the Array Project

9.10.6.1 A range of potential impacts on human health have been identified, which may occur during the construction, O&M , and decommissioning phases of the Array Project.

9.10.6.2 The impacts that have been scoped into the assessment are outlined in Table 9.35, with a description of any additional data collection and supporting analyses that will be required to enable a full assessment of the impacts.

9.10.6.3 The potential impacts that are scoped out of the assessment, and justification for their exclusion, are listed in Table 9.36.

[25] Average number of years that a person can expect to live in "full health" by taking into account years lived in less than full health due to disease and/or injury.

[26] Employment deprivation, as defined by the Scottish Index of Multiple Deprivation (SIMD), is a measure of the percentage of the working age population (men aged 16-64 and women aged 16-60) who are on the claimant count, those who receive Incapacity Benefit, Employment and Support Allowance or Severe Disablement Allowance, and Universal Credit claimants who are not in employment.

Table 9.35: Impacts proposed to be scoped into the Environmental Impact Assessment for Human Health

C = Construction phase, O = O&M phase, D = Decommissioning phase.

Categories	Wider determinants of health	Project phase			Justification (including consideration of embedded mitigation measures)	Data Collection and Analysis Required to Characterise the Baseline Environment for the EIA	Summary of Proposed Approach to Assessment
		C	O	D			
Economic environment	Employment and income	✓	✓	✓	Health effects from wider indirect economic impacts are considered. Any potential unemployment or adverse economic implications are scoped in, for example, the effects of the Array Project on commercial fisheries.	No new surveys. Use of existing public health data sources. Literature and policy review.	Qualitative assessment informed by quantitative analysis in the Socio-economics and Commercial Fisheries chapters of the EIA Report.
Biophysical environment	Climate change and adaptation	×	✓	×	Health effects of climate change are scoped in. The Array Project would be a part of a wider energy sector transition that reduces the severity of climate change.	No new surveys. Use of existing public health data sources. Literature and policy review.	Qualitative assessment informed by quantitative analysis in the Climate Change chapter of the EIA Report.
Institutional and built environment	Wider societal infrastructure and resources	×	✓	×	During operation, the wider societal contribution of the Array Project to supporting public health is scoped in. The Array Project would provide energy infrastructure that supports many aspects of public health.	No new surveys. Use of existing public health data sources. Literature and policy review.	Qualitative assessment informed by project description.

Table 9.36: Impacts proposed to be scoped out of the Environmental Assessment for Human Health

Categories	Wider determinants of health	Basis for Impact
Social Environment	Transport modes, access and connections	The potential impact of changes in shipping access to the mainland is scoped out. As no commercial passenger ferries were identified in the Shipping and Navigation winter vessel traffic survey, there is not considered to be any potential for significant population health effects due to changes in: routine or emergency health related journey travel times; access to health promoting goods and services; community severance.
	Community identity, culture, resilience and influence	The visual impact of OWF has the potential for the introduction of visual change in the seascape, which may affect community identity. However, the Array Project is c.60km offshore. As reported in chapter 9.7: Seascape and Visual Impact and Onshore Heritage Assets of the Scoping Report, due to the large, intervening distance (outwith an "accepted" 50km SLVIA Study Area from the Scoping Boundary) and limited visibility of the Array Project (as illustrated in the ZTVs and wirelines in Appendix 12: Seascape, Landscape and Visual and Onshore Historic Environment Wireline/ZTVs), there are unlikely to be any significant effects on the seascape, landscape and visual receptors. Therefore, this issue is proposed to be scoped out.
Health related behaviours	Physical activity	Health promotion within the workforces will be considered as a good practice enhancement measure but it is otherwise scoped out. Community physical activity will not be affected by offshore works or port operations.
	Risk taking behaviour	Issues of community health behaviours being detrimentally affected by the presence of the workforce are scoped out. The workforces comprise those based aboard vessels and those based at the ports. Those aboard vessels may be multinational professionals travelling back to their usual place of residence on a rotational basis. This may involve temporary accommodation, e.g. in a hotel close to the port or other travel hub, the night following disembarking and the night prior to reembarking. This is usual practice. Extended periods of leave spent within port, or other UK, communities is not expected. The port workforces are assumed to be predominantly existing residents within the regional area, commuting to work and returning home between shifts. There is not considered to be the potential for a likely significant population health effect associated with risk taking behaviour by the workforces afloat or ashore; this issue is scoped out. The issue of communicable illness, including in relation to the COVID-19 pandemic is noted but scoped out. The Array Project will operate appropriate measures to safeguard the project workforce and the public in line with Government guidance of the day and guidance issued by the IMO, including in relation to vessel crews. Risks are similar to other routine offshore construction and shipping activities.
	Diet and Nutrition	There are no effects on agricultural lands associated with offshore activities. Port activities are neither expected to require agricultural land take, nor disrupt food related production or transport. Potential effects on diet due to impacts to commercial fisheries have been considered. The changes are not considered likely to affect availability or price of food to a degree that could affect population health.

Categories	Wider determinants of health	Basis for Impact
Economic Environment	Employment and Income	Whilst the Array Project provide opportunities for good quality employment, which are noted as beneficial for health, these are not expected to be sufficiently localised at a scale with the potential for significant population level effects. This issue is, therefore, scoped out. Employment and economic impacts will be considered in the Socio-economics chapter.
	Education and training	Whilst the Array Project could support upskilling and career development in relation to its workforces, this is not expected to be sufficiently localised at a scale with the potential for significant population level effects. This issue is, therefore, scoped out. The Socio-economics chapter will consider the potential for cumulative effects of the Array Project together with investments that the Applicant is making elsewhere in Scotland, including supporting education and skills with an academic centre for offshore wind Research and Development (R&D) and a new skills capability accelerator.
Social Environment	Housing	Housing related issues are scoped out. No new housing is proposed. The workforce will have housing requirements, but it is expected that a high proportion will be resident in the regional area or would be based aboard their vessels unless travelling to their usual place of residence. Any temporary accommodation requirements would be met through usual capacity for such activities around ports. Health effects associated with housing are scoped out on the basis of anticipated capacity in the local housing market. Demographic changes and demand for housing impacts will be considered in the Socio-economics chapter. Only if significant local study area effects are identified in the Socio-economics chapter will housing health effects be considered further in terms of the potential for significant population health effects.
	Relocation	Neither offshore works nor port activities of the Array Project would involve compulsory land purchases of homes or community facilities. This issue is scoped out.
	Open space, leisure and play	Offshore and port activities are not expected to affect access to areas of open space that could significantly affect population health. This reflects use of existing port areas and designated shipping routes near ports. Furthermore, offshore activities would be a considerable distance from land, so have limited potential to effect marine leisure on a scale that could be influential to public health. This issue is scoped out.
	Transport modes, access, and connections	Vehicle transport is expected to predominantly relate to the movement of goods, materials, people and plant to and from an operational port location associated with the offshore works. The road infrastructure to ports, in general, is good. It is considered reasonable to assume that an existing major port would be selected with appropriate existing consents that have taken transport impacts into account, including in relation to any transporation connected with cruise tourism. The Array Project does not include port construction or redevelopment works. Any potential environmental effects are expected to be considered in accordance with any consents and permits that may be required by the ports themselves. This issue is, therefore, scoped out.

Categories	Wider determinants of health	Basis for Impact
	Community safety	The Array Project requires skilled technical roles. There are not anticipated to be community safety or security issues associated with worker behaviour in ports or communities. The Array Project would operate appropriate safeguarding and modern slavery policies. The potential for widespread actual or perceived crime that could affect population health is unlikely. This issue is, therefore, scoped out.
	Community identity, culture, resilience and influence	Demographic changes that could affect community identity are not anticipated, as there would not be a large in-migration or out-migration of workers to local communities. Visual impacts of offshore activities are expected to be limited due to their distance offshore. Employment opportunities are not expected to be at a scale have a strong localised influence on community identity. These issues are, therefore, scoped out.
	Social participation, interaction and support	The Array Project will not directly affect land used for community interaction (e.g. meeting places, village greens, community centres, etc.) that promote community voluntary, social, cultural or spiritual participation. This issue is, therefore, scoped out. Any indirect impacts on access to such spaces is addressed under the “Transport modes, access and connection” health determinant.
Bio-physical environment	Climate change and adaptation	Embodied carbon and climate altering pollutant emissions associated with construction and decommissioning activities are not of a scale to have the potential for population level effects. This issue is, therefore, scoped out.
	Air quality	During all phases, the Array Project is not expected to generate offshore air quality emissions that could affect onshore populations to a degree that there could be potentially significant adverse effects. Operational port related air quality effects are scoped out on the basis of compliance with any consents and permits that may be required by the ports themselves. The Array Project does not include port construction or redevelopment works. This issue is, therefore, scoped out.
	Water quality or availability	Offshore pollutant spills have potential to affect coastal bathing water quality, which can result in toxin exposures through dermal contact and ingestion. However, the Array Project would adopt standard best practice, spill avoidance and response measures that would be secured through management plans. The Array Project does not include port construction or redevelopment works. This issue is scoped out on the basis of the anticipated effectiveness of such measures and the distance of the Array from coastal bathing waters.
	Land quality	Offshore works would not affect land quality. Operational port activities are unlikely to result in public exposures to contaminated soils. The Array Project does not include port construction or redevelopment works. Any new or historic contamination that may be mobilised by activities will be managed by existing port consents, standard best practice contamination avoidance and response measures. This issue is scoped out.
	Noise and vibration	The offshore airborne noise effects to human health are scoped out. Operational port activities would generate noise, but this is not expected to be of a scale, timing or character that differs from existing operational port levels. The Array Project does not include port construction or redevelopment works. This issue is scoped out.

Categories	Wider determinants of health	Basis for Impact
	Radiation	Non-ionising EMF effects are scoped out. Offshore electrical infrastructure, including offshore substations, are not located in proximity to communities. Relevant occupational safeguards would be followed. No EMF risk is, therefore, likely for offshore aspects of the Array Project. No ionising radiation sources are proposed. These issues are scoped out.
Institutional and built environment	Health and social care services	Effects on health and social care are scoped out. The workforce for the Array Project is assumed to include a high proportion of people who are resident in the regional area. The UK workforce would have the National Health Service (NHS) entitlement irrespective of place of residence or place of working activity. UK workers away from their usual place of residence for a prolonged period would be able to register with local primary healthcare on a temporary basis. This would facilitate NHS funding for their care. The expectation is that the great majority of healthcare needs of the offshore workforce will be met either by occupational provision aboard their vessel or by their usual healthcare provider when they return to their usual place of residence during rotation. Any multinational workers are assumed to be covered by health insurance provisions that would allow the NHS to recoup costs to an extent that avoided any significant adverse effect on healthcare services. This is routine practice across industries and sectors. The Array Project will operate appropriate occupation health services. It is not expected that a high proportion of workers would move to the area with dependants requiring social care. Health protection measures such as screening and immunisations are expected to continue from the workers' usual place of residence. Similarly, routine dental appointments are assumed to be with the worker's dental practice close to their usual place of residence. Other health services are not expected to be affected as no large scale in-migration is expected and the workforce of skilled technical roles would return to their usual places of residence when ashore. This issue is, therefore, scoped out.
	Built environment	Offshore utilities disruption is unlikely, and any crossing of existing power or communications cables would be managed to avoid interruption. Appropriate waste management practices would be used, including regard to the International Convention for the Prevention of Pollution from Ships (MARPOL) Regulations on disposal of waste at sea and relevant legislation covering disposal and/or recycling of wastes from vessels when in port. Significant population health implications are not anticipated and are scoped out. The Array Project would introduce new elements in the built environment; however, the distance offshore means there is very limited direct impacts on human receptors. Port or offshore operational activities are not considered to have waste management, land use or infrastructure use implications on a scale that could affect population health, reflecting compliance with statutory and regulatory regimes. These issues are scoped out
	Wider societal infrastructure and resources	The Array Project energy infrastructure would not generate public health benefits during construction and decommissioning. This issue is scoped out

9.10.7 Designed In Measures and Mitigation

9.10.7.1 The human health assessment will take as its input the residual effect conclusions of the inter-related technical disciplines. In this regard, the health assessment relies on the designed in measures of the Array Project set out in those chapters and does not repeat them. This avoids duplication and keeps the assessment proportionate.

9.10.8 Proposed Assessment Methodology

9.10.8.1 The wider determinants of health and health inequalities are key considerations when undertaking an assessment of human health as part of EIA.

9.10.8.2 A population health approach will be taken, informed by discussion of receptors within other EIA chapters. For each determinant of health, the Human Health chapter will identify relevant inequalities through consideration of disproportionate or differential effects between the 'general population' of the study area and effects to the 'vulnerable population group' of that study area.

9.10.8.3 The methodology will use best practice, as published by the Institute of Environmental Management and Assessment, and relevant health impact assessment (HIA) and health in EIA guidance, as listed in Table 9.37.

Table 9.37: Relevant guidance for human health assessment

Guidance	Relevance
Institute of Environmental Management and Assessment (IEMA) 2022 Guidance on Health in EIA series, Effective Scoping (Pyper et al., 2022a) and Determining Significance (Pyper *et al.*, 2022b).	Practitioner guidance on the coverage of human health in EIA for England, Wales, Scotland, Northern Ireland and the Republic of Ireland. This includes methods for determining population health sensitivity, magnitude and significance. This is the key methods citation.
Institute of Public Health (IPH), Guidance, Standalone Health Impact Assessment and health in environmental assessment, 2021 (Pyper *et al.,* 2021).	Sets current good practice for the assessment of human health in EIA, including assessment methods. This updates the 2009 guidance from the IPH. This guidance for Northern Ireland and Republic of Ireland can be applied more broadly in the UK.
International Association for Impact Assessment (IAIA) and European Public Health Association (EUPHA). A reference paper on addressing Human Health in EIA (Cave *et al.*, 2020).	This international consensus piece informed the IPH 2021 guidance. The publication explains EIA for public health stakeholders and sets out transparent assessment approaches adopted by the IPH.
International Association for Impact Assessment. Health Impact Assessment International Best Practice Principles, 2021 (Winkler *et al*, 2021).	Confirms the relationship between HIA and EIA. Confirms the application of HIA principles when undertaking health in EIA.
Scottish Health and Inequality Impact Assessment Network (SHIIAN). Health Impact Assessment Guidance for Practitioners, 2019. (SHIAAN, 2016).	Practitioner guidance on HIA practice in Scotland. It is intended primarily for people working in Scotland and identifies relevant Scottish resources.

9.10.8.4 The methods use the World Health Organization (WHO) definition of health, which states that health is a "*state of complete physical, mental and social wellbeing and not merely the absence of disease or infirmity*" (World Health Organization, 2020).

9.10.8.5 The methods use the WHO definition for mental health, which is a "a state of mental well-being that enables people to cope with the stresses of life, to realise their abilities, to learn well and work well, and to contribute to their communities" (World Health Organization, 2022).

9.10.8.6 A range of data sources will be collated and analysed in line with good practice guidance. Scientific evidence, baseline data and local health priorities will be referenced. Policy analysis, regulatory standards and consultation themes will also inform the significance conclusions. Magnitude and sensitivity considerations will be reported for each determinant of health, including for the general population and vulnerable groups. A qualitative analysis setting out reasoned conclusions will provide an evidence-based narrative for each determinant of health.

9.10.8.7 Where significant adverse population health effects are identified, including for vulnerable groups, then mitigation will be proposed to avoid or reduce the effects. Mitigation will be secured as part of the Projects' design or development consent. In line with good practice, a proportionate approach will be taken for identifying opportunities to enhance beneficial population health effects, including for vulnerable groups.

9.10.8.8 Where proportionate, monitoring will be proposed and governance described, for example, in relation to any residual significant adverse effects or instances where there is high uncertainty on the efficacy of secured mitigation.

9.10.9 Potential Cumulative Impacts

9.10.9.1 The Cumulative Effects Assessment (CEA) will follow the methodology set out in section 9.10.8. Where proportionate, the need for further mitigation and/or monitoring will be considered, including relevant governance.

9.10.10 Potential Inter-Related Effects

9.10.10.1 The EIA will consider inter-related effects. Inter-related effects relate to effects arising from the Array Project, either across their own phases (project lifetime) or different effects on one receptor in one phase (receptor-led). The EIA will consider inter-related effects, in relation to the potential effects of multiple impacts from the construction, O&M and decommissioning phases of the Array Project, affecting one receptor. Inter-related effects are assessed through consideration of all effects on a receptor, considering both spatial and temporal overlaps, with the Array Project. This will ensure that the Array Project as a whole is appropriately considered within the EIA.

9.10.11 Potential Transboundary Impacts

9.10.11.1 No transboundary effects are expected, and therefore scoped out.

10 Other Environmental Topics

10.1 Introduction

10.1.1.1 This chapter summarises the approach for topics where an Environmental Statement chapter is not proposed. In the case of waste generated by the Array Project, this topic will not have a stand alone chapter but will be considered within the relevant receptor chapters and will be addressed through the production of a Waste Management Plan (WMP), see paragraph 10.1.2.1 to 10.1.2.5. Air quality and airborne noise will not have stand alone chapters as these topics have been scoped out of the EIA process, justifications are provided below in paragraph 10.1.3 and 10.1.4.1, respectively.

10.1.2 Waste

10.1.2.1 Waste will be generated by the Array Project, with most of the waste expected to be generated during the construction and decommissioning phases.

10.1.2.2 A WMP will describe procedures for handling waste materials and will form part of the EMP for the Array Project. The WMP will describe and quantify the waste types arising from the Array Project activities and how these will be managed (dispose of, reuse, recycle or recover). The WMP will also provide information on the management arrangements for the identified waste types and management facility near of the Array Project.

10.1.2.3 The roles and responsibilities of the person(s) overseeing the implementation of waste management procedures during the construction phase will be identified in the WMP, including relevant mandatory training requirements (e.g. toolbox talks, method statements).

10.1.2.4 The WMP will also set out requirements for ongoing monitoring (e.g. regular site inspections) to ensure that construction waste is managed appropriately according to the waste management procedures prescribed in the WMP.

10.1.2.5 The WMP will be provided before construction when further detailed design information becomes available.

10.1.3 Air Quality

10.1.3.1 Throughout construction, there can be potential minor impacts from residues and emissions on air quality. For most OWF projects, this stems from the onshore work, which this Scoping Report does not cover. The guidance on impacts on air quality can depend on the site location in relation to Air Quality Management Areas. Since the particulates released into the air are minor, and the Array Project is located c.60km offshore, none of these onshore areas will be impacted. Therefore, potential air quality changes have been scoped out of the EIA process.

10.1.4 Airborne Noise

10.1.4.1 During construction operations such as pile-driving, airborne noise can affect bird species and people within the area. Also, during operations, there will be noise generated from the wind turbine while the blades move through the air. This topic has been scoped out due to the Array Project being located c.60km offshore and, therefore, any risks being deemed negligible.

11 Array Project Scoping: Summary

11.1 Overview

11.1.1.1 An EIA is being progressed for the Array Project to understand the likely significant environmental effects of the proposal, supported by environmental and survey studies. This Scoping Report has been produced as part of that process. It has identified potentially significant effects associated with the construction, O&M and decommissioning phases of the Array Project on a range of receptors. These are detailed in chapters 7 to 9 of this Scoping Report.

11.1.1.2 Topics scoped in and out of at this stage are summarised in Table 11.1. Impact-receptor pathways that have been scoped in and out at this stage are summarised in Table 11.2.

Table 11.1: Overview of Technical Topics within this Scoping Report that have been Scoped In/Out

Topic	Scoped in (✓)/scoped out (×)
Offshore Physical Environment	
Physical Processes	✓
Underwater Sound	✓
Offshore Water Quality	×
Offshore Biological Environment	
Benthic Subtidal Ecology	✓
Fish and Shellfish Ecology	✓
Marine Mammals	✓
Offshore Ornithology	✓
Offshore Human Environment	
Commercial Fisheries	✓
Shipping and Navigation	✓
Aviation (Civil and Military)	✓
Marine Archaeology	×
Other Sea Users, Marine Infrastructure and Communications	✓
Socio-economics	✓
Seascape, and Visual Impact and Onshore Historic Environment	×
Climate Change	✓
Major Accidents and Disasters	×
Human Health	✓

11.2 Cumulative Effects Summary

11.2.1.1 Potential cumulative effects associated with each topic are summarised within each topic chapter of this Scoping Report. A detailed cumulative effects assessment will be undertaken per the methodology outlined in chapter 4: EIA methodology of this Scoping Report to support the EIA Report.

11.2.1.2 Projects and activities that will be considered within the cumulative effects assessment include:

- other offshore wind projects and their associated cabling and infrastructure;
- onshore wind farms;

- other energy projects (i.e. tidal; wave; and carbon capture and storage);
- oil and gas infrastructure;
- other forms of cabling (e.g. telecommunications and interlinks);
- shipping and navigation;
- marine aggregate extraction and dredge disposal;
- coastal developments.

11.3 Transboundary Impacts

11.3.1.1 The transboundary screening assessment for the Array Project is presented in Appendix 1: Transboundary Screening of this Scoping Report.

11.3.1.2 Topics that have been screened for further consideration in the EIA Report include:

- fish and shellfish ecology;
- marine mammals;
- offshore ornithology;
- shipping and navigation;
- climate change;
- commercial fisheries.

11.4 Consultation

11.4.1.1 The approach to stakeholder engagement is outlined in Appendix 4: Array Project Stakeholder Engagement Plans of this Scoping Report. The Array Project Stakeholder Engagement Plans provide an overview of the proposed approach for future consultation with statutory and non-statutory stakeholders throughout the EIA and Habitats Regulations Appraisal (HRA) process. Appendix 4 will aid the Applicant in delivering a proportionate EIA Report and Report to Inform an Appropriate Assessment (RIAA). These reports will incorporate advice from stakeholders throughout the development process to address concerns and develop appropriate mitigation, and compensation measures where required. Key topic areas have been identified for further stakeholder discussion as part of an iterative EIA and HRA process. This will ensure that stakeholder advice is fully incorporated into the Array Project EIA Report and RIAA.

11.5 Next Steps

11.5.1.1 The Applicant will participate in pre-application consultation with key consultees in preparation for the EIA Report.

Table 11.2: Impacts proposed to be scoped in/scoped out of the Array Project EIA Report

C = Construction phase, O = O&M phase, D = Decommissioning phase.

Impact pathway	Project phase			Scoped in (✓)/scoped out (✗)	Justification
	C	O	D		
Physical Processes					
Increased suspended sediments concentrations (SSCs) and associated deposition	✓	✓	✓	✓	There is potential for increased SSCs and associated deposition in all three project phases. This impact could occur due to seabed preparation activities, foundation installation activities and cable installation activities in the construction phase, cable repair and reburial in the O&M phase and decommissioning activities, such as cable and foundation removal.
Impacts to the wave regime due to the presence of infrastructure		✓		✓	The presence of infrastructure in the water column (such as turbine foundations and offshore substation platforms (OSPs)) could alter the wave regime and could potentially impact physical features and physical processes receptors (such as the Firth of Forth Banks Complex MPA).
Impacts to the tidal regime due to the presence of infrastructure		✓		✓	The presence of infrastructure in the water column (listed above) may interact with the tidal regime. This could potentially alter sediment transport and sediment transport pathways and impact physical features and physical processes receptors (such as the Firth of Forth Banks Complex MPA).
Impacts to sediment transport and sediment transport pathways due to the presence of infrastructure		✓		✓	The presence of infrastructure within the water column could alter the tidal regime and impact sediment transport and pathways as a result. Furthermore, the presence of infrastructure on the seabed could directly disrupt sediment transport and sediment transport pathways, which may affect physical features and physical processes receptors (such as the Firth of Forth Banks Complex MPA).
Underwater Sound					
Increased underwater sound from pile driving activity	✓			✓	Pile driving activity related to wind turbine foundation installation generates impulsive sound, which can affect marine fauna.
Increased underwater sound from	✓			✓	UXO clearance, required as preparatory work before OWF asset installation, generates impulsive sound which, can affect marine fauna.

Impact pathway	Project phase			Scoped in (✓)/scoped out (×)	Justification
	C	O	D		
unexploded ordnance (UXO) clearance					
Increased underwater sound from non-impulsive sound sources	✓	✓	✓	✓	Effects of non-impulsive sound on marine fauna are assessed against different criteria to impulsive sound. The exact sources of non-impulsive sound have not yet been explicitly defined but are likely to include: • vessel activity during all Array Project phases; • construction activities such as cable laying, drilling and cable protection installation during the construction phase; • wind turbine operational sound during the O&M phase; • geophysical surveys during all Array Project phases; • decommissioning activities such as cutting and removal of piles and cables; • additional sound sources will be considered as needed when raised throughout the EIA process.
Offshore Water Quality					
Impacts to sediment transport, sediment transport pathways, due to the presence of infrastructure				×	The presence of infrastructure within the water column for the lifetime of the Array Project could alter the tidal regime, impact sediment transport and pathways. Such changes could affect water quality, depending on where sediment is redirected and in what volumes. Furthermore, the presence of infrastructure on the seabed could potentially disrupt sediment transport and sediment transport pathways directly, which may, in turn, increase sediment disturbance and affect water quality. It is anticipated that the physical processes modelling undertaken for the Array Project will demonstrate that impacts to sediment transport or sediment transport pathways would be spatially restricted to within the boundaries of the Array Project and the surrounding area. Considering the distance the Array Project is located from shore (c. 60km), any effects on water quality would dissipate quickly and be isolated to a remote, offshore location. This impact is proposed to be scoped out of further consideration within the EIA with respect to offshore water quality receptors.
Increased SSC and associated deposition				×	Sediment disturbance arising from construction activities (e.g. foundation and cable installation – including drilling and any deposits arising, UXO clearance and seabed preparation); maintenance operations (e.g. cable repair/reburial, use of jack-up vessels to facilitate wind turbine component repairs etc.); and decommissioning activities (e.g. foundation removal) may result increases in suspended solids and siltation rate changes. However, any increases in suspended sediment concentrations are predicted to be short term, returning to baseline levels on subsequent tides. Considering the distance at which the Array Project is located offshore (c.60km), any effects would dissipate quickly and would be isolated to a remote, offshore location, significant impacts on offshore water quality are not predicted. This impact is proposed to be scoped out of further consideration within the EIA with respect to offshore water quality receptors.

Impact pathway	Project phase			Scoped in (✓)/scoped out (×)	Justification
	C	O	D		
Increased risk of introduction and spread of INNS				×	There is potential for an increased risk of introduction and spread of INNS through the vessel movements required during all phases of the Array Project. This risk will be assessed in the benthic subtidal ecology chapter of the EIA Report and mitigated through the designed in measures set out in Table 7.11. An Environmental Management Plan will be implemented, which will aim to manage and reduce the risk of potential introduction and spread of INNS so far as reasonably practicable and vessels will be required to comply with the IMO ballast water management guidelines. Therefore, significant impacts on offshore water quality because of the introduction and spread of INNS are not predicted. This impact is proposed to be scoped out of further consideration within the EIA with respect to offshore water quality receptors.
Accidental pollution during construction, O&M and decommissioning.				×	There is a risk of pollution being accidentally released during the construction, O&M and decommissioning phases of the Array Project from sources including vessels/vehicles, equipment/machinery and operational painting and cleaning of marine growth. However, the risk of such events is managed by the implementation of measures set out in standard post-consent plans (e.g. EMP, including MPCPs) (see Table 7.11). These plans include planning for accidental spills, addressing all potential contaminant releases and including key emergency contact details. They will also set out industry good practice and OSPAR, IMO and MARPOL guidelines for preventing pollution at sea. Therefore, the likelihood of accidental pollution occurring is very low, and in the unlikely event that such events did occur, the magnitude of these will be minimised through measures such as a MPCP. This impact is proposed to be scoped out of further consideration within the EIA with respect to offshore water quality receptors.
Impacts from the release of sediment-bound contaminants				×	Seabed disturbance associated with construction, maintenance and decommissioning activities (e.g. foundation and cable installation) could lead to the remobilisation of sediment-bound contaminants that may result in harmful and adverse effects on benthic communities. Site specific sampling within the Benthic Subtidal Ecology Study Area has shown levels of sediment contaminants are very low (see chapter 8.1: Benthic Subtidal Ecology of the Scoping Report). Sediment contamination analysis identified that all sample stations except for one were below Cefas AL1 and AL2 as well as below Canadian TEL and PEL for metals, PCBs and PAHs. The exception to this was one station, which was above Cefas AL1 and Canadian TEL for arsenic. However, it should be noted that this station is located outside of the Scoping Boundary and, therefore, is unlikely to be directly disturbed. Background levels were reviewed as part of the evidence base in the application of the Cefas action levels to put the values in context. The risk of sediment-bound contaminants being present in concentrations likely to be harmful to benthic receptors is considered negligible. This potential impact is proposed to be scoped out of further consideration within the EIA, subject to consultation with the SNCBs.
Benthic Subtidal Ecology					
Temporary habitat loss/disturbance	✓	✓	✓	✓	There is potential for temporary, direct habitat loss and disturbance during the construction phase because of site preparation activities in advance of installation activities, cable installation activities (including UXO clearance, pre-cabling seabed clearance and anchor placements), and placement of spud-can legs from jack-up operations. Temporary habitat loss/disturbance may occur during the O&M phase because of operations (e.g. cable repair/reburial, use of jack-up vessels to facilitate wind turbine component repairs etc.). The impacts associated with these operations are likely to be similar in nature to those associated with the construction phase,

Impact pathway	Project phase			Scoped in (✓)/scoped out (×)	Justification
	C	O	D		
					although of reduced magnitude. There is potential for temporary, direct habitat loss and disturbance due to decommissioning activities, resulting in potential effects on benthic ecology.
Increased SSCs and associated deposition	✓	✓	✓	✓	Sediment disturbance arising from construction activities (e.g. foundation and cable installation – including drilling and any deposits arising, UXO clearance and seabed preparation); maintenance operations (e.g. cable repair/reburial, use of jack-up vessels to facilitate wind turbine component repairs, etc.); and decommissioning activities (e.g. foundation removal) may result in indirect impacts on benthic communities due to temporary increases in SSCs and associated sediment deposition (i.e. smothering effects). Changes in SSCs can impact benthic receptors through changes in water clarity and reduced feeding due to increases in suspended solids and smothering and siltation rate changes. This assessment will consider the potential impacts on benthic subtidal ecology.
Long term habitat loss	✓	✓	✓	✓	There is the potential for long term habitat loss to occur directly under all foundation structures and associated scour protection, and under any cable protection required. As foundations are installed throughout the construction phase this impact is also relevant to the construction phase although this impact will largely occur throughout the O&M phase. Permanent habitat loss may occur under any infrastructure that is not decommissioned at the end of the Array Project's lifetime, such as cable or scour protection.
Increased risk of introduction and spread of invasive non-native species (INNS)	✓	✓	✓	✓	There is potential for an increased risk of introduction and spread of INNS through the vessel movements required during all phases of the Array Project.
Colonisation of hard structures			✓	✓	Artificial structures placed on the seabed (i.e. foundations and scour/cable protection) in the offshore environment are expected to be colonised by a range of marine organisms leading to localised increases in biodiversity. These structures may also facilitate the spread of marine INNS.
Changes in physical processes		✓		✓	The presence of foundation structures, associated scour protection and cable protection may introduce localised changes to the tidal flow and wave climate, resulting in potential changes to the sediment transport pathways and associated effects on benthic ecology.
Removal of hard substrates			✓	✓	The removal of foundations during decommissioning has the potential to lead to loss of species/habitats colonizing these structures.
Impacts to benthic invertebrates due to electromagnetic fields (EMF)		✓		✓	The presence of an additional EMF from operational subsea cables may affect benthic subtidal ecology by changing the behaviours and physiology of relevant benthic ecology receptors.
Accidental pollution				×	There is a risk of pollution being accidentally released during the construction, O&M and decommissioning phases from sources including vessels/vehicles and equipment/machinery. However, the risk of such events is managed by the implementation of measures set out in standard post-consent plans (e.g. EMP, including MPCPs). These plans include planning for accidental spills,

Impact pathway	Project phase			Scoped in (✓)/scoped out (×)	Justification
	C	O	D		
					address all potential contaminant releases and include key emergency contact details. It will also set out industry good practice and OSPAR, IMO and MARPOL guidelines for preventing pollution at sea. Therefore, the likelihood of an accidental spill occurring is very low and in the unlikely event that such events did occur, the magnitude of these will be minimised through measures such as a MPCP. As such, it is intended that this impact is scoped out of further consideration within the benthic subtidal ecology EIA Report.
Release of sediment-bound contaminants				×	Seabed disturbance associated with construction, maintenance and decommissioning activities (e.g. foundation and cable installation) could lead to the remobilisation of sediment-bound contaminants that may result in harmful and adverse effects on benthic communities. Site specific sampling within the Benthic Subtidal Ecology Study Area has shown levels of sediment contaminants are very low. Sediment contamination analysis identified that all sample stations except for one were below Cefas AL1 and AL2 as well as below Canadian TEL and PEL for metals, PCBs and PAHs. The exception to this being one station which was above Cefas AL1 and Canadian TEL for arsenic; however, it should be noted that this station is located outside of the Array Project Area and, therefore, is unlikely to be directly disturbed. The risk of sediment-bound contaminants being present in concentrations likely to be harmful to benthic receptors is considered negligible. This potential impact is proposed to be scoped out of further consideration within the benthic subtidal ecology EIA Report subject to consultation with the SNCBs following submission of the Scoping Report.
Impacts to benthic invertebrates due to thermal emissions from subsea electrical cables				×	Thermal emissions generated by the subsea electrical cabling may affect benthic subtidal receptors. However, there is limited evidence for subsea cables significantly changing the temperature of the sea floor and surrounding water and, therefore, the impact of heat on benthic invertebrates. A review by Taormina *et al.* (2018) of the current knowledge on the impacts of subsea cables, including thermal emissions, identified that buried cables can warm the sediment in direct contact with the cable. which can then have an impact on the chemical and physical properties of the substrate. The thermal profile of a cable, however, can depend heavily on physical characteristics of the burial and the sediment (Taormina *et al.,* 2018). In addition, the temperature change at the seabed is reduced for buried cables due to the distance between the cable and the seabed surface because of the increased dissipation of heat with distance from the cable (Meißner *et al.,* 2007). A study conducted at Nysted Offshore Wind Farm in Denmark (Meißner *et al.,* 2007) found the temperature change in the top 30cm sediment (where most infauna live) above a high voltage cable (132kV) to be a maximum of 2°C which is well within the thermal tolerance for most benthic organisms. For cables that are unburied and instead protected by thick concrete mattresses or rock berms, the heat conduction is likely to be negligible due to the density of the structures. Based on their review Taormina *et al.* (2018) concluded the small area associated with these cable corridors and the expected weakness of thermal radiation would not produce a significant impact. A Cable Plan for the Array Project will include cable burial where possible or cables will be protected as necessary, therefore, there is limited scope for impacts to benthic invertebrates due to heat from subsea cables.

Impact pathway	Project phase			Scoped in (✓)/scoped out (×)	Justification
	C	O	D		
Fish and Shellfish Ecology					
Temporary habitat loss and disturbance of habitats	✓	✓	✓	✓	There is potential for temporary, direct habitat loss and disturbance due to pre-foundation installation activities, cable installation works (including unexploded ordnance (UXO) detonation, anchor placements and pre-cabling seabed clearance) and spud-can leg placement from jack-up operations. Temporary habitat loss/disturbance may occur during the O&M phase because of operations (e.g. cable repair/reburial, use of jack-up vessels to facilitate wind turbine component repairs, etc.). Impacts associated with these operations are likely to be similar to those associated with the construction phase, albeit of reduced magnitude. There is potential for temporary, direct habitat loss and disturbance due to decommissioning activities to remove array cables resulting in potential effects on fish and shellfish ecology.
Underwater sound impacting fish and shellfish receptors	✓		✓	✓	There is potential for disturbance, injury and mortality to sensitive fish and shellfish species due to construction activities such as pre-construction site investigation surveys, pile-driving, UXO clearance and similar potential for decommissioning activities.
Increased SSCs and associated sediment deposition	✓	✓	✓	✓	Sediment disturbance arising from construction activities (e.g. foundation and cable installation including drilling and any deposits arising, UXO clearance, and seabed preparation), maintenance operations (e.g. cable repair/reburial etc.), and decommissioning activities (e.g. cable and foundation removal) may result in indirect impacts on fish and shellfish communities due to temporary increases in SSCs and associated sediment deposition (i.e. smothering effects).
Long-term habitat loss	✓	✓	✓	✓	There is the potential for long term habitat loss to occur directly under all foundation structures and associated scour protection, and under any cable protection required. As foundations are installed throughout the construction phase this impact is also relevant to the construction phase, although this impact will largely occur throughout the O&M phase. Permanent habitat loss may occur under any infrastructure that is not decommissioned at the end of the Array Project lifetime, such as cable or scour protection.
Colonisation of hard structures		✓		✓	It is expected that artificial seabed structures (i.e. scour/cable protection and foundations) will become colonised by a variety of marine organisms in the offshore environment, leading to localised biodiversity increases. The spread of INNS may also be facilitated at these structures.
EMF from subsea electrical cabling		✓		✓	The predator/prey relationship may be impacted, by EMF generated through the subsea cables installed, by impacting the behaviours of fish and shellfish species behaviours with the changes to background EMFs.
Accidental release of pollutants				×	Sources such as vessels, vehicles, machinery, and other equipment have the potential to accidentally release pollution during phases of development. Measures setting out standards of procedure within post consent plans such as EMPs will help manage the risk. The plans will address accidental spills, discuss all potential contaminant releases, and include details in case of an emergency. The management plan will also set out good practice techniques and use information and guidelines from the IMO, and the International Convention for the Prevention of Pollution from Ships. The likelihood of spills occurring through the development stages is very low and if a spill was to occur the magnitude will be minimised due to the measures undertaken throughout the Project. With the

Impact pathway	Project phase			Scoped in (✓)/scoped out (×)	Justification
	C	O	D		
					assessment of the Impact of accidental pollutant release, pending consultation with stakeholders, relevant groups and feedback from the Scoping Report, it is proposed that this impact is scoped out of consideration within the EIA for fish and shellfish ecology.
Release of sediment-bound contaminants				×	Seabed disturbance associated with construction, maintenance and decommissioning activities (e.g. foundation and cable installation) could lead to the remobilisation of sediment-bound contaminants that may result in harmful and adverse effects on fish and shellfish communities. Site specific sampling within the Array Project Fish and Shellfish Ecology Study Area has shown levels of sediment contaminants are very low, in line with background levels. Samples from all stations except ENV054, located outside of the Scoping Boundary were below Cefas AL1 and AL2 as well as below Canadian TEL and PEL for metals, PCBs and PAHs. Station ENV054 was above Cefas AL1 and Canadian TEL for arsenic and showed elevated levels of other elements. The risk of sediment-bound contaminants being present in concentrations likely to be harmful to benthic receptors is considered negligible, as station ENV054 is located outside of the Array Project and is, therefore, unlikely to face direct disturbance. This potential impact is proposed to be scoped out of further consideration within the fish and shellfish ecology EIA chapter subject to consultation with the SNCBs following submission of the Scoping Report.
Underwater sound from wind turbine operation				×	Sound Pressure Levels (SPL) and frequencies from operational wind turbines are low (Andersson *et al.,* 2011); as such, behavioural changes amongst fish occur only within a few metres of a wind turbine (Sigray and Andersson, 2011). Underwater sound from wind turbine generation should, therefore, be scoped out of the EIA Report for fish and shellfish ecology as the potential effects on fish and shellfish receptors from wind turbine noise are likely to be insignificant.
Underwater sound from vessels				×	Underwater sound from vessels is considered low during O&M and any effects upon fish and shellfish would only occur if these receptors were near a vessel for several hours. It is, therefore, suggested that this impact be scoped out of the fish and shellfish ecology EIA.
Marine Mammals					
Injury and disturbance from underwater sound generated from piling	✓			✓	Impact piling during construction may result in hearing damage/auditory injury or behavioural disturbance/displacement (including barrier effects) of marine mammals.
Injury and disturbance from underwater sound generation from UXO clearance	✓			✓	UXO clearance may result in hearing damage/auditory injury or behavioural disturbance/displacement (including barrier effects) of marine mammals.
Disturbance to marine mammals from vessel use and other (non-	✓	✓	✓	✓	The impact of vessel use during all phases of the Array project may result in behavioural disturbance/displacement (including barrier effects) of marine mammals. Other (non-piling) related sound-producing activities could also result in disturbance including construction activities (e.g. drilling, trenching, and rock placement), O&M activities and decommissioning activities.

Impact pathway	Project phase			Scoped in (✓)/scoped out (×)	Justification
	C	O	D		
piling) sound-producing activities					
Injury to marine mammals due to collision with vessels	✓	✓	✓	✓	Increased vessel traffic during construction activities, O&M activities and decommissioning activities may result in collisions with marine mammals.
Effects on marine mammals due to changes in prey availability	✓	✓	✓	✓	Changes in prey abundance and distribution resulting from construction activities, O&M activities and decommissioning activities may impact on the ability of marine mammals to forage in the area.
Disturbance to marine mammals from pre-construction site investigation surveys.	✓			✓	Geophysical surveys in the pre-construction phase may result in behavioural disturbance/displacement of marine mammals.
Accidental pollution				×	There is a risk of pollution(e.g. fuel or oil) being accidentally released during the construction, O&M and decommissioning phases from sources including vessels/vehicles and equipment/machinery. This may lead to direct mortality of marine mammals or a reduction in prey availability, either of which may affect species' survival rates. However, the risk of such events is managed by the implementation of measures set out in standard post-consent plans (e.g. EMP, including MPCP). These plans include planning for accidental spills, address all potential contaminant releases and include key emergency contact details. It will also set out industry good practice and OSPAR, IMO and MARPOL guidelines for preventing pollution at-sea. Therefore, the likelihood of an accidental spill occurring is very low and in the unlikely event that such events did occur, the magnitude of these will be minimised through measures such as MPCP. As such, this impact will be scoped out from further consideration within the marine mammal EIA chapter.
Increased SSC and associated sediment deposition				×	Disturbance to water quality because of construction operations can have both direct and indirect impacts on marine mammals. Indirect impacts would include effects on prey species (which is scoped in). Direct impacts include the impairment of visibility and, therefore, foraging ability, which might be expected to reduce foraging success. Marine mammals are well known to forage in tidal areas where water conditions are turbid and visibility conditions poor. For example, harbour porpoise and harbour seal in the UK have been documented foraging in areas with high tidal flows (e.g. Pierpoint, 2008; Marubini *et al.,* 2009; Hastie *et al.,* 2016); therefore, low light levels, turbid waters and suspended sediments are unlikely to negatively Impact marine mammal foraging success. When the visual sensory systems of marine mammals are compromised, they can sense the environment in other ways; for example, seals can detect water movements and hydrodynamic trails with their mystacial vibrissae, while odontocetes primarily use echolocation to navigate and find food in darkness.

Impact pathway	Project phase			Scoped in (✓)/scoped out (×)	Justification
	C	O	D		
					Whilst elevated levels of SSC arising during construction of the Project may decrease light availability in the water column and produce turbid conditions, the maximum mpact range is expected to be localised with sediments rapidly dissipating over one tidal excursion. In addition, there is a large natural variability in the SSC within the Array Project Marine Mammal Study Area, so marine mammals living here will be tolerant of any small scale increases, such as those associated with the construction activities. As such, this impact will be scoped out of further consideration within the marine mammal EIA chapter.
Impact of EMF (from surface lain or buried cables)				×	Based on the data available to date, there are uncertainties of EMF related to marine renewable devices having impact (either positive or negative) on marine mammals (Copping, 2018). Threshold values for EMF effects are only available for a few species (mainly elasmobranchs), leaving major uncertainties in several important taxonomic groups (cetaceans, pinnipeds, fish, crustaceans, etc.). There is currently no evidence that seals can detect or respond to EMF, however, some species of cetaceans may be able to detect variations in magnetic fields (Normandeau *et al.,* 2011). To date, the only marine mammal known to show any response to EMF is the Guiana dolphin (*Sotalia guianensis*), which has been shown to possess an electroreceptive system that uses the vibrissal crypts on their rostrum to detect electrical stimuli like those generated by small to medium sized fish (Czech-Damal *et al.,* 2013). However, this has not been shown in any other species of marine mammal and this species does not occur within the Array Project Marine Mammal Study Area. As such, this impact will be scoped out of further consideration within the marine mammal EIA chapter.
Disturbance to marine mammals from operational sound from wind turbine operation				×	The MMO (MMO, 2014) review of post-consent monitoring at OWFs found that available data on the operational wind turbine sound, from the UK and abroad, in general showed that sound levels from operational wind turbines are low and the spatial extent of the potential impact of the operational wind turbine sound on marine receptors is generally estimated to be small, with behavioural response only likely at ranges close to the wind turbines. This is supported by several published studies which provide evidence that marine mammals are not displaced from operational wind farms. At the Horns Rev and Nysted OWFs in Denmark, long term monitoring showed that both harbour porpoise and harbour seal were sighted regularly within the operational OWFs and, within two years of operation, the populations had returned to levels that were comparable with the wider area (Diederichs *et al.,* 2008). Similarly, a monitoring programme at the Egmond aan Zee OWF in the Netherlands reported that significantly more porpoise activity was recorded within the OWF compared to the reference area during the operational phase (Scheidat *et al.,* 2011). Other studies at Dutch and Danish OWFs (Lindeboom *et al.,* 2011) also suggest that harbour porpoise may be attracted to increased foraging opportunities within operating OWFs. In addition, tagging work by Russell *et al.* (2014) found that some tagged harbour and grey seals demonstrated grid like movement patterns as these animals moved between individual wind turbines, strongly suggestive of these structures being used for foraging. Other reviews have also concluded that operational wind farm sound will have negligible effects (Madsen *et al.,* 2006; Teilmann *et al.,* 2006a; Teilmann *et al.,* 2006b; Cefas, 2010; Brasseur *et al.,* 2012). As such, this impact will be scoped out of further consideration within the marine mammal EIA chapter.

Impact pathway	Project phase			Scoped in (✓)/scoped out (×)	Justification
	C	O	D		
Offshore Ornithology					
Permanent habitat loss				×	Area affected by permanent habitat loss due to the presence of the Array Project components on the seabed is negligible when compared to the foraging areas across which bird species that may interact with the array area may utilise.
Direct temporary habitat loss/disturbance	✓	✓	✓	✓	The impact of construction/decommissioning activities and activities associated with the maintenance of operational wind turbines such as increased vessel activity and underwater sound may result in direct disturbance of birds from important feeding and roosting areas. Impact could occur within the Scoping Boundary and an associated buffer and between the Scoping Boundary and relevant points along the coastline (based on worst assumptions for vessels associated with the Array Project and could occur throughout the lifetime of Array Project.
Indirect temporary habitat loss/disturbance	✓	✓	✓	✓	The impact of construction activities such as increased vessel activity and underwater/above water noise may result in disturbance or displacement of prey from important bird feeding areas. In addition, changes in hydrological energy, wave exposure, suspension of sediments etc. arising from the physical presence of structures in the marine environment or the activities associated with installing such structures in the marine environment may also displace prey. Impact could occur within the Scoping Boundary and an associated 15km buffer (based on tidal extent) and between the Scoping Boundary and relevant points along the coastline based on worst case assumptions for vessels associated with the Array Project. Impact could occur throughout the lifetime of the Array Project.
Collision with rotating blades		✓		✓	Mortality arising from birds colliding with wind turbine structures. Impact is restricted to the Scoping Boundary and will occur in the O&M phase of the Array Project.
Displacement		✓		✓	The impact of physical displacement from an area due to the physical presence of wind turbines and other ancillary structures during the operational phase of the development may result in effective habitat loss and reduction in species survival rates and fitness. Impact could occur within the Scoping Boundary and an associated buffer during the operational phase of the Array Project.
Accidental pollution				×	With the implementation of the designed in measures described in section 8.4.6, it is considered that the likelihood of any impact occurring is very low. As part of recent Scoping Opinions for projects in Scottish waters, the Scottish Ministers have agreed that this impact should be scoped out (see, for example, Marine Scotland, 2022). For projects where assessments have been undertaken, it has been agreed that through the implementation of such measures that complete mortality within the equivalent extent of a windfarm's array plus buffer area is considered very unlikely to occur, and a major incident that may impact any species at a population level is considered very unlikely.
Attraction to light		✓		✓	The impact of attraction to lit structures by migrating birds may cause disorientation, reduction in fitness and possible mortality.
Commercial Fisheries					
Temporary loss or restricted access to fishing grounds	✓		✓	✓	The presence of construction and decommissioning works, as well as the associated safety zones can result in temporary loss of, or restricted access to existing fishing grounds. For the purposes of the EIA temporary is defined as up to five years.

Impact pathway	Project phase			Scoped in (✓)/scoped out (×)	Justification
	C	O	D		
Displacement of fishing activity into other areas	✓	✓	✓	✓	Loss of or restricted access to fishing grounds may result in fishers being temporarily displaced into other areas throughout the construction and O&M stages, as well as the decommissioning works.
Interference with fishing activity	✓	✓	✓	✓	Interference/conflict with fishing activity may arise because of transiting construction and O&M vessels, as well as decommissioning vessels.
Increased steaming distances and times	✓	✓	✓	✓	Increases in steaming times and distances may arise due to the presence of safety zones around construction, operation, and decommissioning works, as well as any major maintenance works.
Snagging risk – loss or damage to fishing gear	✓	✓	✓	✓	The presence of: • pre-commissioned infrastructure associated with Array Project (i.e. foundations, cables awaiting burial or protection); • infrastructure associated with Array Project (i.e. foundations, cable protection); • decommissioning related infrastructure; • other seabed obstacles (i.e. accidentally dropped objects, etc.) potentially pose a snagging risk to fishing vessels and could result in loss or damage to fishing gear. This snagging risk may also have implications about the safety of fishing vessels and crews. The safety risks associated with potential gear snagging, will be assessed together with navigational risks under Shipping and Navigation.
Long term loss or restricted access to fishing grounds		✓		✓	The presence of: • pre-commissioned infrastructure associated with Array Project (i.e. foundations, cables awaiting burial or protection); • infrastructure associated with Array Project (i.e. foundations, cable protection); • decommissioning related infrastructure; • other seabed obstacles (i.e. accidentally dropped objects, etc.) potentially pose a snagging risk to fishing vessels and could result in loss or damage to fishing gear. This snagging risk may also have implications for the safety of fishing vessels and crews. The safety risks associated with potential gear snagging will be assessed together with navigational risks under Shipping and Navigation.
Impacts on commercially exploited species	✓	✓	✓	✓	As described in chapter 8.2: Fish and Shellfish Ecology.

Impact pathway	Project phase			Scoped in (✓)/scoped out (×)	Justification
	C	O	D		
Shipping and Navigation					
Increased vessel to vessel collision risk resulting from displacement (third party to third party)	✓	✓	✓	✓	Baseline vessel traffic data indicates that certain vessels are likely to deviate to pass around the Scoping Boundary or buoyed construction/decommissioning area and, as such, collision risk in the area may increase. Non-AIS traffic will need to be considered and quantitative modelling undertaken to assess the risk.
Increased vessel to vessel collision risk resulting from displacement (third party to Array Project vessel)	✓	✓	✓	✓	The increased levels of vessel traffic in the area associated with the construction, O&M and decommissioning of the Array Project may lead to increased collision risk (third party vessel to Array Project vessel).
Vessel to structure allision risk	✓	✓	✓	✓	The presence of surface structures will create new allision risks to vessels under power or Not Under Command (NUC). Non-AIS traffic will need to be considered and quantitative modelling will be undertaken to assess the risk.
Reduced access to local ports and harbours	✓	✓	✓	✓	Array Project vessel transits and activities may impact access to local ports and harbours.
Reduction of under-keel clearance as a result of subsea infrastructure		✓		✓	The presence of subsea infrastructure (e.g., cable protection) may increase under-keel interaction risk. Non-AIS traffic will need to be considered. Impacts are not considered for the construction and decommissioning phases because of the designed in measures that reduce the impact to acceptable parameters.
Anchor and fishing gear interactions with subsea cables		✓		✓	The presence of subsea cables may lead to an increase in the risk of anchor and fishing gear interactions. Non-AIS traffic will need to be considered. Impacts are not considered for the construction and decommissioning phases because of the designed in measures in place that reduce the impact to acceptable parameters.
Interference with navigation, communications, and position-fixing equipment		✓		✓	The Array Project's infrastructure (e.g., wind turbines, subsea cables) may impact equipment onboard vessels, including potential effects of electromagnetic interference from cables. Impacts are not considered for the construction and decommissioning phases because of the designed in measures in place that reduce the impact to acceptable parameters.

Impact pathway	Project phase			Scoped in (✓)/scoped out (×)	Justification
	C	O	D		
Reduction of Search and Rescue (SAR) capability		✓		✓	There may be an increase in incident rates associated with the Array Project, which may reduce SAR capability. The layout of the structures may also impact access for SAR responders in the area. Impacts are not considered for the construction and decommissioning phases because of the designed in measures in place that reduce the impact to acceptable parameters.
Aviation (Military and Civil)					
Impact to Buchan Remote Radar Head (RRH) Air Defence Radar (ADR)		✓		✓	Effect on aviation radar systems; wind turbine derived radar clutter (false returns) appearing on radar displays can adversely affect surveillance systems.
Impact to Brizlee Wood (RRH) ADR		✓		✓	Effect on aviation radar systems; wind turbine derived radar clutter (false returns) appearing on radar displays can adversely affect surveillance systems.
Impact to Allanshill (NATS) PSR		✓		✓	Effect on aviation radar systems; wind turbine derived radar clutter (false returns) appearing on radar displays can adversely affect surveillance systems.
Impact to Perwinnes (NATS) PSR		✓		✓	Effect on aviation radar systems; wind turbine derived radar clutter (false returns) appearing on radar displays can adversely affect surveillance systems.
Impact to airborne Secondary Surveillance Radar (SAR) operations	✓	✓	✓	✓	Creation of an obstruction; the presence of above-surface infrastructure within a previously open sea area may cause an obstruction to SAR operations.
Creation of an obstruction	✓	✓	✓	✓	Creation of an obstruction; above surface infrastructure (wind turbines and substations) within and around the Array Project may create a physical obstruction to airspace users.
Impact to Aberdeen International Airport Instrument Flight Procedures (IFPs)				×	No Aberdeen Airport IFPs extend over Array Project.
Impact to SSR				×	The Array Project lies outside the area of interaction with any aviation related SSR systems.
Impact to Practice and Exercise Area (PEXA)				×	The Array Project is located outside of the vertical extent of military PEXA.
Impact to Met Office weather radars				×	The Array Project lies outside the safeguarded area of 20km for Met Office weather radar systems.

Impact pathway	Project phase			Scoped in (✓)/scoped out (×)	Justification
	C	O	D		
Marine Archaeology					
Impact of sediment disturbance and deposition leading to indirect impacts on marine archaeology receptors				×	The Marine Archaeology Technical Report, together with associated data review of the geophysical data for the Array Project, will provide an overview of the identifiable marine archaeology features within the Marine Archaeology Study Area. This Marine Archaeology Technical Report will form the basis of an WSI and PAD, which will be prepared for approval by HES. The development and implementation of a PAD will allow for the recording of any unexpected archaeological discoveries that may occur due to sediment disturbance and deposition during the Array Project.
Direct damage to maritime archaeology receptors (e.g. wrecks, debris, submerged prehistoric receptors (palaeolandscapes and associated archaeological receptors)				×	The Marine Archaeology Technical Report, together with associated data review of the geophysical data for the Array Project, will provide an overview of the identifiable marine archaeology features within the Marine Archaeology Study Area. The Marine Archaeology Technical Report will form the basis of an WSI and PAD, which will be prepared for approval by HES. The WSI will include proposed AEZs for marine archaeology receptors identified within the geophysical survey data. This mitigation will prevent direct damage to maritime archaeology receptors. The potential for prehistoric submerged archaeology within the Marine Archaeology Study Area is extremely low. Archaeological input into geotechnical survey design will aid in establishing the full potential for palaeolandscapes and associated archaeological material.
Direct damage to deeply buried marine archaeology receptors – submerged prehistoric receptors (e.g. palaeolandscapes and associated archaeological receptors)				×	The Marine Archaeology Technical Report, together with associated data review of the geophysical data for the Array Project, will provide an overview of the identifiable marine archaeology features within the Marine Archaeology Study Area. The Marine Archaeology Technical Report will form the basis of an WSI and PAD, which will be prepared for approval by HES. The WSI will include proposed AEZs for marine archaeology receptors identified within the geophysical survey data. This mitigation will prevent direct damage to maritime archaeology receptors. The potential for prehistoric submerged archaeology within the Marine Archaeology Study Area is extremely low. Archaeological input into geotechnical survey design will aid in establishing the full potential for palaeolandscapes and associated archaeological material.
Alteration of sediment transport regimes leading to indirect impacts on marine archaeology receptors				×	The Marine Archaeology Technical Report, together with associated data review of the geophysical data for the Array Project, will provide an overview of the identifiable marine archaeology features within the Marine Archaeology Study Area. This Marine Archaeology Technical Report will form the basis of an WSI and PAD, which will be prepared for approval by HES. The development and implementation of a PAD will allow for the recording of any unexpected archaeological discoveries that may occur due to an alteration of sediment transport regimes because of the Array Project.

Impact pathway	Project phase			Scoped in (✓)/scoped out (×)	Justification
	C	O	D		
Other Sea Users, Marine Infrastructure and Communications					
Displacement of recreational activities (including recreational sailing, cruising and recreational fishing)	✓	✓	✓	✓	Safety zones and advisory clearance distances established during construction, maintenance and decommissioning activities may displace recreational activities.
Impacts to early development cables or pipelines or restrictions on access to cables or pipelines	✓	✓	✓	✓	There is one early development cable within the Scoping Boundary and, therefore, there is potential for impacts to existing cables or restrictions on access to cables from installation, maintenance and decommissioning activities. Crossing and proximity agreements will be established, where required, with known existing cables operators.
Interference with offshore microwave fixed communication links		✓		✓	The presence of wind turbines within the Scoping Boundary may affect offshore microwave fixed links between offshore oil and gas platforms.
Increased SSC and associated deposition affecting recreational diving sites				×	There are no recreational diving sites within the Regional Other Sea Users Study Area. As such, there is no potential impact pathway and, therefore, it is proposed that this impact is scoped out of the EIA.
Increased SSC and associated deposition affecting aggregate extraction areas				×	There are no aggregate extraction areas within the Regional Other Sea Users Study Area. As such, there is no potential impact pathway and, therefore, it is proposed that this impact is scoped out of the EIA.
Alterations to sediment transport pathways affecting aggregate extraction areas				×	There are no aggregate extraction areas within the Regional Other Sea Users Study Area. As such, there is no potential impact pathway and, therefore, it is proposed that this impact is scoped out of the EIA.
Impact on marine disposal sites				×	There are no marine disposal sites within the Infrastructure and Other Sea Users Study Area. As such, impacts on marine disposal sites have been scoped out of the EIA.

Impact pathway	Project phase			Scoped in (✓)/scoped out (×)	Justification
	C	O	D		
Reduction or restriction of oil and gas exploration activities (including surveys, drilling and the placement of infrastructure)				×	There are no active oil and gas exploration blocks within the Infrastructure and Other Sea Users Study Area. As such, there is no potential impact pathway and, therefore, it is proposed that this impact is scoped out of the EIA.
Impacts on carbon capture and storage				×	There are no carbon capture and storage projects within the infrastructure and other users Study Area. As such, there is no potential impact pathway and, therefore, it is proposed that this impact is scoped out of the EIA.
Interference with the performance of Radar Early Warning System (REWS) located on oil and gas platforms				×	There are no REWS within the Infrastructure and Other Sea Users Study Area. As such, there is no potential impact pathway and, therefore, it is proposed that this impact is scoped out of the EIA.
Socio-economics					
Employment and Gross Value Added (GVA) impacts associated with the construction, operation and decommissioning of the Array Project	✓	✓	✓	✓	Expected to lead to changes in employment and economic activity in each socio-economic study area.
Demographic changes and demand for housing and other services	✓	✓	✓	✓	This may lead to an increase in local populations to meet the demand for labour related to economic opportunities.
Changes to visitor behaviour	✓	✓	✓	✓	Increased onshore activity, for example, at ports and harbours, has the potential to affect visitor infrastructure, e.g. cruise terminals and visitor attractions located close to ports and harbours.
Changes to commercial fisheries	✓	✓	✓	✓	Any socio-economic consequences of any significant effects on fisheries identified in the commercial fisheries assessment will be considered.

Impact pathway	Project phase			Scoped in (✓)/scoped out (×)	Justification
	C	O	D		
Changes to shipping and marine recreation	✓	✓	✓	✓	Any socio-economic consequences of any significant effects on these sectors that are identified will be considered.
Seascape, Landscape and Visual, and Onshore Historic Environment					
Effects on seascape/landscape character within the 70km SLVIA Study Area and within ZTV				×	Significant effects not likely due to low sensitivity of receptors.
Effects on visual receptors within the 70km SLVIA Study Area and within ZTV (people at settlements/residents, on transport and recreational route and at tourist/visitor attractions, ferry routes)				×	Significant effects not likely due to limited visibility and long intervening distance (lower magnitude).
Effects on setting of onshore heritage assets within the 70km heritage SVLIA Study Area				×	Change to setting would be insufficient to give rise to any discernible adverse effects because of the distance of the Array Project from the onshore heritage assets and the limited visibility of the Array Project.
Climate Change					
The impact of Green House Gases (GHG) emissions arising from seabed change	✓	✓	✓	✓	GHG emissions arising from seabed change during the construction, O&M, and decommissioning phases will be assessed concerning carbon store habitats.
The impact of GHG emissions arising from	✓			✓	GHG emissions arising from the manufacturing and installation of the Array Project would contribute to the lifecycle total and net GHG balance of the Array Project.

Impact pathway	Project phase			Scoped in (✓)/scoped out (×)	Justification
	C	O	D		
the manufacturing and installation of the Array Project including vessel movements					
The impact of GHG emissions arising from the consumption of materials and activities required to facilitate the O&M phase and the impact of estimated abatement of UK Grid emissions during the O&M phase		✓		✓	GHG emissions arising from the consumption of materials and activities required to facilitate the O&M phase would contribute to the lifecycle total and net GHG balance of the Array Project. Renewable energy generated from the Array Project contributes towards Scottish and UK net zero ambitions. The avoided emissions associated with the Array Project will be assessed within the overall net GHG assessment.
The impact of GHG emissions arising from decommissioning works (e.g. plant, fuel and vessel use) and the recovery (or disposal) of materials			✓		GHG emissions arising from decommissioning works (e.g. plant, fuel and vessel use) and the recovery (or disposal) of materials would contribute to the lifecycle total and net GHG balance of the Array Project. Options for either recycling or re-powering wind turbines will be assessed at end of life.
The vulnerability of the Array Project to climate change during the O&M phase		✓		✓	GHG emissions arising from decommissioning works (e.g. plant, fuel and vessel use) and the recovery (or disposal) of materials would contribute to the lifecycle total and net GHG balance of the Array Project. Options for either recycling or re-powering wind turbines will be assessed at end of life.
The vulnerability of the Array Project to climate change during the O&M phase		✓		✓	Offshore assets (wind turbines, inter-array cables, inter-connector cables and offshore substation platforms) are designed to be resilient to storm events with factors of safety incorporated into design. However, as the effects of climate change are likely to increase over time, risks posed by climate change to the Array Project will be assessed.

Impact pathway	Project phase			Scoped in (✓)/scoped out (×)	Justification
	C	O	D		
The vulnerability of the Array Project to climate change during the construction and decommissioning phases				×	The construction phase (expected duration of 7 years) will not be lengthy enough for significant climate change risks compared to the present-day baseline to occur. The Applicant will employ industry standard health and safety practices with respect to risks such as heatstroke or storm events offshore. As with the construction phase, it is unlikely that the decommissioning phase would be lengthy enough for significant climate change risks beyond those considered within the O&M phase assessment. In addition, the Applicant will employ industry-standard health and safety practices with respect to risks such as heatstroke or storm events offshore.
Major Accidents and Disasters – with respect to the Array Project's vulnerability to existing hazards					
Collision risk – shipping and navigation				×	The Array Project could increase the potential for collision risk from existing shipping and navigation, which could impact the construction, O&M and decommissioning of the Array Project. The approach to how this impact will be addressed is set out in chapter 9.2: Shipping and Navigation of the Scoping Report, and it is, therefore, proposed not to consider this impact in a major accidents and disasters assessment.
Collision risk – aviation (military and civil)				×	Considering the designed in measures which are relevant to aviation (military and civil) (i.e. including but not limited to the use of appropriate lighting and marking of offshore substation platforms, communication with UKHO and adherence to ERCoP, aviation collision events are considered highly unlikely. It is, therefore, proposed not to consider this impact as part of a major accidents and disasters assessment.
Snagging risk – commercial fisheries				×	The Array Project could increase the potential for snagging risk from existing commercial fishing activities, which could impact the construction, O&M and decommissioning of the Array Project. The approach to how this impact will be addressed is set out in chapter 9.1: Commercial Fisheries of the Scoping Report. It is, therefore, proposed not to consider this impact as part of a major accidents and disasters assessment.
Risk of accident – cables and pipelines				×	The approach to how impacts to early development cables or pipelines or restrictions on access to cables or pipelines is set out in chapter 9.5: Other Sea Users and Marine Infrastructure of the Scoping Report. Due to the measures employed to mitigate against these impacts, the risk of accidents occurring because of cables and pipelines will be very low. It is, therefore, proposed not to consider this impact as part of a major accidents and disasters assessment.
Risk of accidents – extreme weather (and storm surge)				×	There is no potential for the Array Project to increase the risk of accidents from extreme weather events (and storm surges). It is, therefore, proposed not to consider this impact as part of a major accidents and disasters assessment.
Risk of accident – oil and gas infrastructure				×	There are no active oil and gas exploration blocks within the Other Sea Users and Marine Infrastructure Study Area. As such, there is no potential impact pathway.

Impact pathway	Project phase			Scoped in (✓)/scoped out (✗)	Justification
	C	O	D		
Temperature changes, precipitation changes and sea level rise				✗	There is no potential for the Array Project to increase the risk of a major accident or disaster related to these weather changes or long-term climate-driven changes.
Pollution of the marine environment (structures)				✗	The quantity of chemicals in any Array structure is too low to result in any credible major accident or disaster resulting from pollution. The risk of such events is managed by the implementation of measures set out in standard post-consent plans (e.g. EMPs, including MCPSs). These plans include planning for accidental spills, addressing all potential contaminant releases and including key emergency contact details. They will also set out industry good practice and OSPAR, IMO and MARPOL guidelines for preventing pollution at sea. The impact of pollution events is also considered separately for marine ecology receptors in the relevant chapters of the Scoping Report. It is, therefore, proposed not to consider this impact as part of a major accidents and disasters assessment.
Sabotage events				✗	The UK government continues to implement methods of detection to monitor the likelihood of an attack in the UK, to ensure emergency response protocols are in place should such an attack happen. The Array Project will not cause such an attack and is no more vulnerable to this type of hazard than any other offshore development. The risk is considered to be very low but, should a sabotage event occur, any effects on water and air quality would dissipate quickly and would be isolated to a remote, offshore location. The implications of such events (i.e. marine pollution) would be dealt with at the UK level by the Secretary of State's Representative and could be reduced further through the implementation of measures set out in standard post-consent plans (e.g. MPCPs). It is, therefore, proposed not to consider this impact as part of a major accidents and disasters assessment.
Major Accidents and Disasters - with respect to the Array Project's potential to cause accidents and disasters					
Physical impacts (collision, allision)				✗	There is the potential for major accidents and/or disasters due to collision/allision incidents involving the vessels associated with the Array Project, during all phases. The approach to how this impact will be addressed is set out in chapter 9.2: Shipping and Navigation of the Scoping Report. It is, therefore, proposed not to consider this impact as part of a major accidents and disasters assessment.
UXOs				✗	Should UXOs require clearance, this will be identified by the Array Project and specific procedures and risk assessments will be undertaken to mitigate risk to personnel and infrastructure. It is, therefore, proposed not to consider this impact as part of a major accidents and disasters assessment.
Pollution of the marine environment (vessels)				✗	Pollution events from vessels are considered unlikely. Should an event occur, effects will be temporary, reversible and limited in spatial extent. In addition, it is anticipated that the magnitude of such events occurring will be managed by measures set out in standard post consent plans (e.g. an EMP including an MPCP), which will be implemented as part of the Array Project. The impact of pollution events from vessels is also considered separately for marine ecology receptors in the relevant chapters of the Scoping Report and EIA Report. It is, therefore, proposed not to consider this impact as part of a major accidents and disasters assessment.
Fire at wind turbine/Offshore Substation Platforms				✗	If a fire were to occur, which is considered unlikely given the standard health and safety plans and protocols implemented by the Array Project, any effects on water and air quality would dissipate quickly and would be isolated to a remote, offshore location. It is, therefore, proposed not to consider this impact as part of a major accidents and disasters assessment.

Impact pathway	Project phase			Scoped in (✓)/scoped out (×)	Justification
	C	O	D		
(OSPs)/Offshore converter station platforms, including from third-party interference					
Snagging risk – commercial fisheries				×	Commercial fisheries operating in the area could snag during the O&M phase of the Array Project. The approach to how this impact will be addressed is set out in chapter 9.1: Commercial Fisheries of the Scoping Report. It is, therefore, proposed not to consider this impact as part of a major accidents and disasters assessment.
Collision risk – aviation (military and civil)				×	Considering the measures outlined for aviation (military and civil) (including but not limited to the use of appropriate lighting and marking of offshore substation platforms, communication with UKHO and adherence to ERCoP, aviation collision events are considered highly unlikely. It is, therefore, proposed not to consider this impact as part of a major accidents and disasters assessment.
Human Health					
Employment and income	✓	✓	✓	✓	Health effects from wider indirect economic impacts are considered. Any potential unemployment or adverse economic implications are scoped in, for example, the effects of the Array Project on commercial fisheries.
Climate change and adaptation		✓		✓	Health effects of climate change are scoped in. The Array Project would be a part of a wider energy sector transition that reduces the severity of climate change.
Wider societal infrastructure and resources		✓		✓	During operation, the wider societal contribution of the Array Project to supporting public health is scoped in. The Array Project would provide energy infrastructure that supports many aspects of public health.
Transport modes, access and connections				×	The potential impact of changes in shipping access to the mainland is scoped out. As no commercial passenger ferries were identified in the Shipping and Navigation winter vessel traffic survey, there is not considered to be any potential for significant population health effects due to changes in: routine or emergency health related journey travel times; access to health promoting goods and services; community severance.
Community identity, culture, resilience and influence				×	The visual impact of OWF has the potential for the introduction of visual change in the seascape, which may affect community identity. However, the Array Project is c.60km offshore and due to the large, intervening distance (outwith an “accepted” 50km SLVIA Study Area from the Scoping Boundary) and limited visibility of the Array Project (as illustrated in the ZTVs and wirelines in Appendix 12: Seascape, Landscape and Visual and Onshore Historic Environment Wireline/ZTVs), there are unlikely to be any significant effects on the seascape, landscape and visual receptors. Therefore, this issue is proposed to be scoped out.
Physical activity				×	Health promotion within the workforces will be considered as a good practice enhancement measure but it is otherwise scoped out. Community physical activity will not be affected by offshore works or port operations.

Impact pathway	Project phase			Scoped in (✓)/scoped out (×)	Justification
	C	O	D		
Risk taking behaviour				×	Issues of community health behaviours being detrimentally affected by the presence of the workforce are scoped out. The workforces comprise those based aboard vessels and those based at the ports. Those aboard vessels may be multinational professionals travelling back to their usual place of residence on a rotational basis. This may involve temporary accommodation, e.g. in a hotel close to the port or other travel hub, the night following disembarking and the night prior to reembarking. This is usual practice. Extended periods of leave spent within port, or other UK, communities is not expected. The port workforces are assumed to be predominantly existing residents within the regional area, commuting to work and returning home between shifts. There is not considered to be the potential for a likely significant population health effect associated with risk taking behaviour by the workforces afloat or ashore; this issue is scoped out. The issue of communicable illness, including in relation to the COVID-19 pandemic is noted but scoped out. The Array Project will operate appropriate measures to safeguard the project workforce and the public in line with Government guidance of the day and guidance issued by the International Maritime Organization, including in relation to vessel crews. Risks are like other routine offshore construction and shipping activities.
Diet and Nutrition				×	There are no effects on agricultural lands associated with offshore activities. Port activities are neither expected to require agricultural land take, nor disrupt food related production or transport. Potential effects on diet due to impacts to commercial fisheries have been considered. The changes are not considered likely to affect availability or price of food to a degree that could affect population health.
Employment and Income				×	Whilst the Array Project provide opportunities for good quality employment, which are noted as beneficial for health, these are not expected to be sufficiently localised at a scale with the potential for significant population level effects. This issue is, therefore, scoped out. Employment and economic impacts will be considered in the Socio-economics chapter.
Education and training				×	Whilst the Array Project could support upskilling and career development in relation to its workforces, this is not expected to be sufficiently localised at a scale with the potential for significant population level effects. This issue is, therefore, scoped out. The Socio-economics chapter will consider the potential for cumulative effects of the Array Project together with investments that the Applicant is making elsewhere in Scotland, including supporting education and skills with an academic centre for offshore wind Research and Development (R&D) and a new skills capability accelerator.
Housing				×	Housing related issues are scoped out. No new housing is proposed. The workforce will have housing requirements, but it is expected that a high proportion will be resident in the regional area or would be based aboard their vessels unless travelling to their usual place of residence. Any temporary accommodation requirements would be met through usual capacity for such activities around ports. Health effects associated with housing are scoped out on the basis of anticipated capacity in the local housing market. Demographic changes and demand for housing impacts will be considered in the Socio-economics chapter. Only if significant local study area effects are identified in the Socio-economics chapter will housing health effects be considered further in terms of the potential for significant population health effects.
Relocation				×	Neither offshore works nor port activities of the Array Project would involve compulsory land purchases of homes or community facilities. This issue is scoped out.

Impact pathway	Project phase			Scoped in (✓)/scoped out (×)	Justification
	C	O	D		
Open space, leisure and play				×	Offshore and port activities are not expected to affect access to areas of open space that could significantly affect population health. This reflects use of existing port areas and designated shipping routes near ports. Furthermore, offshore activities would be a considerable distance from land, so have limited potential to effect marine leisure on a scale that could be influential to public health. This issue is scoped out.
Transport modes, access, and connections				×	Vehicle transport is expected to predominantly relate to the movement of goods, materials, people and plant to and from an operational port location associated with the offshore works. The road infrastructure to ports in general is good. It is considered reasonable to assume that an existing major port would be selected with appropriate existing consents that have taken transport impacts into account. The Array Project does not include port construction or redevelopment works. Any potential environmental effects are expected to be considered in accordance with any consents and permits that may be required by the ports themselves. This issue is, therefore, scoped out.
Community safety				×	The Array Project requires skilled technical roles. There are not anticipated to be community safety or security issues associated with worker behaviour in ports or communities. The Array Project would operate appropriate safeguarding and modern slavery policies. The potential for widespread actual or perceived crime that could affect population health is unlikely. This issue is, therefore, scoped out.
Community identity, culture, resilience and influence				×	Demographic changes that could affect community identity are not anticipated, as there would not be a large in-migration or out-migration of workers to local communities. Visual impacts of offshore activities are expected to be limited due to their distance offshore. Employment opportunities are not expected to be at a scale have a strong localised influence on community identity. These issues are, therefore, scoped out.
Social participation, interaction and support				×	The Array Project will not directly affect land used for community interaction (e.g. meeting places, village greens, community centres, etc.) that promote community voluntary, social, cultural or spiritual participation. This issue is, therefore, scoped out. Any indirect impacts on access to such spaces is addressed under the "Transport modes, access and connection" health determinant.
Climate change and adaptation				×	Embodied carbon and climate altering pollutant emissions associated with construction and decommissioning activities are not of a scale to have the potential for population level effects. This issue is, therefore, scoped out.
Air quality				×	During all phases, the Array Project is not expected to generate offshore air quality emissions that could affect onshore populations to a degree that there could be potentially significant effects. Operational port related air quality effects are scoped out based on compliance with any consents and permits that may be required by the ports themselves. The Array Project does not include port construction or redevelopment works. This issue is, therefore, scoped out.
Water quality or availability				×	Offshore pollutant spills have potential to affect coastal bathing water quality, which can result in toxin exposures through dermal contact and ingestion. However, the Array Project would adopt standard best practice, spill avoidance and response measures that would be secured through management plans. The Array Project does not include port construction or redevelopment works. This issue is scoped out based on the anticipated effectiveness of such measures.

Impact pathway	Project phase			Scoped in (✓)/scoped out (×)	Justification
	C	O	D		
Land quality				×	Offshore works would not affect land quality. Operational port activities are unlikely to result in public exposures to contaminated soils The Array Project does not include port construction or redevelopment works. Any new or historic contamination that may be mobilised by activities will be managed by existing port consents standard best practice contamination avoidance and response measures. This issue is scoped out.
Noise and vibration				×	The offshore airborne noise effects to human health are scoped out. Operational port activities would generate noise, but this is not expected to be of a scale, timing or character that differs from existing operational port levels. The Array Project does not include port construction or redevelopment works. This issue is scoped out.
Radiation				×	Non-ionising electro-magnetic field (EMF) effects are scoped out. Offshore electrical infrastructure, including offshore substations, are not located in proximity to communities. Relevant occupational safeguards would be followed. No EMF risk is therefore likely for offshore aspects of the Array Project. No ionising radiation sources are proposed. These issues are scoped out.
Waste					
Waste receptors				×	A Waste Management Plan will describe procedures for handling waste materials and will form part of the Environmental Management Plan (EMP) for the Array Project. The WMP will describe and quantify the waste types arising from the Array Project activities and how these will be managed (dispose of, reuse, recycle or recover). The WMP will also provide information on the management arrangements for the identified waste types and management facility near of the Array Project. The WMP will be provided before construction when further detailed design information becomes available, therefore this topic has been scoped out.
Air Quality					
Air quality receptors				×	Throughout construction, there can be potential minor impacts from residues and emissions on air quality. For most OWF projects, this stems from the onshore work, which this Scoping Report does not cover. The guidance on impacts on air quality can depend on the site location in relation to Air Quality Management Areas. Since the particulates released into the air are minor, and the Array Project is located c.60km offshore, none of these onshore areas will be impacted. Therefore, potential air quality changes have been scoped out of the EIA process.
Airborne Noise					
Airborne noise receptors				×	During construction operations such as pile-driving, airborne noise can affect bird species and people within the area. Also, during operations, there will be noise generated from the wind turbine while the blades move through the air. This topic has been scoped out due to the Array Project being located c.60km offshore and, therefore, any risks being deemed negligible.

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12.1 Introduction

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