Offshore Environmental Impact Assessment (EIA) Scoping Report

MUIR MHÒR
OFFSHORE WIND FARM
A joint venture between Fred. Olsen Seawind & Vattenfall

Muir Mhòr Offshore Wind Farm

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TABLE OF CONTENTS:

LIST OF FIGURES:

LIST OF TABLES:

GLOSSARY

Term	Definition
Action Levels	Non-statutory thresholds assigned to chemical contaminants in sediments, originally used to assess the suitability for disposal of dredged material, but subsequently broadened to consider sediment disturbance from any activity in the marine environment. Contaminant concentrations below Action Level 1 (AL1) are considered unlikely to cause adverse environmental effects, and concentrations above Action Level 2 (AL2) are considered likely to lead to adverse effects. Contaminant concentrations between the two values are subject to professional assessment/opinion.
Archaeological Exclusion Zone	An area around a heritage asset in which construction activities and anchoring are prohibited to avoid impacts to the asset.
Background Assessment Concentration	The assessment threshold for testing whether contaminant concentrations are 'near background' levels for man-made substances.
Bathing Water season	The 'season' wherein the water quality is tested at designated sites (Bathing Waters) on an annual basis, running from 15 May to 30 September.
Bathing Water	Bathing Waters can be coastal or inland waters, designated under the Bathing Waters Regulations. Bathing must either be explicitly authorised, or not prohibited and practiced traditionally by a large number of people.
Beam trawl	A method of bottom trawling with a net that is held open by a beam, which is generally a heavy steel tube supported by steel trawl heads at each end. Tickler chains or chain mats, attached between the beam and the ground rope of the net, are used to disturb fish and crustaceans that rise up and fall back into the attached net.
Benthic ecology	Benthic ecology encompasses the study of the organisms living in and on the sea floor, the interactions between them and impacts on the surrounding environment
Biologically Defined Minimum Population Scales (BDMPS)	BDMPS uses data on the demography of seabirds (survival rates, age of first breeding, productivity) to model population age structure to assess the numbers of immature birds that are associated with breeding populations, since it is not normally possible to census immature components of seabird populations.
Biotope	A region of habitat associated with a particular ecological community.
Birds of Conservation Concern (BoCC)	The list of BoCC is assessed based on the most up-to-date evidence available. Criteria include conservation status at global and European levels and, within the UK: historical decline, trends in population and range, rarity, localised distribution, and international importance.
Carbon	Used interchangeably to refer to greenhouse gas.
Coastal Character Area	A distinct, recognisable, geographical area which has a consistent overall character. Coastal character can be identified at different scales: Regional CCA at a strategic level (e.g., a loch within a larger system, a stretch of coastline or a whole island) or Local (shorter stretches of coast or shore).
Coastal Character Type	A distinct type of landscape, relatively homogenous in character. They are generic in nature and may occur and reoccur in different places. In Scotland, only the national level of coastal characterisation consists of character types (based on Guidelines for Landscape and Visual Impact Assessment, 3rd Edition (GLVIA 3)).

Term	Definition
Coefficient of Variation (CV)	The CV is the ratio of the standard deviation to the mean. The higher the coefficient of variation, the greater the level of dispersion around the mean. It is generally expressed as a percentage.
Collision Risk Model (CRM)	A CRM assesses the bird collision risk presented by offshore windfarm by considering parameters such as behaviour of the bird and the turbine details.
Confidence Interval (CI)	A confidence interval is the mean of your estimate plus and minus the variation in that estimate.
Controlled airspace	Defined airspace within which pilots must follow Air Traffic Control instructions implicitly. In the UK, Classes A, C, D and E are areas of controlled airspace.
Counterfactual Population Size (CPS)	CPS is the ratio of impacted to baseline population size.
Creel	Pots and traps are generally rigid structures into which fish or shellfish are guided or enticed through funnels that make entry easy but from which escape is difficult. There are many different styles and designs, each one has been designed to suit the behaviour of its target species. Creel is typically a Scottish term for a pot or trap deployed by an inshore vessel.
Cumulative Effects	The combined effect of Muir Mhòr in combination with the effects from a number of different projects, on the same single receptor/resource.
Cumulative Impact Assessment (CIA)	A CIA is a quantification and evaluation of potential effects by taking into consideration any other plans or projects proposed or existing, and where sufficient information is available, which, together with the proposed development have a likely significant effect on a receptor due to a common impact pathway and/or temporal or spatial overlap.
Demersal	Living on or near the seabed.
Developer	Muir Mhòr Offshore Wind Farm Limited
E2	The ScotWind Plan Option Area within which the proposed development is located
Effects Range-Low	The concentration at which adverse environmental effects are rarely observed (e.g., adverse impacts would not be expected).
Elasmobranch	Cartilaginous fishes such as sharks, rays, and skates.
Environmental Assessment Criteria	The OSPAR defined value for contaminants, below which chronic effects are not expected to occur in marine species.
Environmental Quality Standards	The Environmental Quality Standards are set concentration thresholds for individual substances, below which adverse environmental impacts are unlikely to occur.
Fish larvae	The developmental stage of fish which have hatched from the egg and receive nutrients from the yolk sac until the yolk is completely absorbed.
Fish stock	Any natural population of fish which an isolated and self-perpetuating group of the same species.
Fishery	A group of vessel voyages which target the same species or use the same gear.

Term	Definition
Fishing ground	An area of water or seabed targeted by fishing activity.
Fleet	A physical group of vessels sharing similar characteristics (e.g., nationality).
Flight Information Region (FIR)	Airspace managed by a controlling authority with responsibility for ensuring air traffic services are provided to aircraft flying within it.
Foundation anchors	The mooring structures which anchor the foundations to the seabed.
Foundations	The foundations on which the wind turbine generators or Offshore Electrical Platform(s) are installed.
Frontal zone	Zones marking boundaries between water masses with different oceanographic conditions.
Gear type	The method / equipment used for fishing.
Good Chemical Status	Chemical status is assessed, achieving either Pass or Fail/Poor (dependent on surface water and groundwater assessments). Chemical status is determined by compliance with the 'Priority Substances' and 'Priority Hazardous Substances' lists, with all Environmental Quality Standards (EQS') needing to be met for Good status to be achieved. All waterbodies have the target to achieve Good chemical status.
Good Ecological Potential	For heavily modified waterbodies, the ecological quality that could be achieved by affected waterbodies without significant adverse impacts on benefits provided by the waterbody, or significant adverse impacts on the wider environment.
Good Ecological Status	The assessment elements for achieving Good Ecological Status include biological (e.g., fish, invertebrates, phytoplankton), physico-chemical (dissolved inorganic nitrogen, dissolved oxygen), specific pollutants or supporting elements (e.g., hydromorphology). The lowest scoring element denotes the overall status, so to achieve good status, all elements must be at 'good' standard.
Greenhouse Gas (GHG)	A gas that absorbs and emits radiant energy at thermal infrared wavelengths causing the greenhouse effects.
Gross Value Added (GVA)	This is a measure of economic value added by an organisation, industry or region and is typically estimated by subtracting the non-staff operational costs from the turnover of an organisation.
Ground Sample Distance (GSD)	GSD refers to the amount of ground/surface area covered by a single image in flight.
Horizontal Directional Drilling (HDD)	A method of cable installation where the cable is drilled beneath a feature without the need for trenching.
Hydromorphological Designation	The designation distinguishing the waterbody as either heavily modified (and by what purpose) or artificial.
ICES statistical rectangles	International Council for the Exploration of the Seas (ICES) standardise the division of sea areas to enable statistical analysis of data. Each ICES statistical rectangle is '30 min latitude by 1 degree longitude' in size (approximately 30 x 30 nautical miles). Several rectangles are amalgamated to create ICES statistical areas.
Inter-array cables	Cables which link the wind turbines generators to each other and the Offshore Electrical Platform(s).

Term	Definition
Interconnector cables	Cables which link Offshore Electrical Platforms to one another to provide additional security of electrical supply.
Intertidal	The intertidal zone, sometimes referred to as the littoral zone, is the area where the marine and terrestrial environments meet between the tide's highest and lowest points. Intertidal ecology encompasses the substrate found in that zone, as well as the flora and fauna there.
Jigging	Jigging is a method of fishing that has evolved over many centuries, where hooks attached to artificial lures are used to attract and capture fish. The lures are designed to resemble small fish that the target species would normally feed on.
Jobs	This is a measure of employment which considers the headcount employment in an organisation or industry. This measure is used when considering long term impacts such as the jobs supported during the operation and maintenance phase of the Proposed development.
Landfall	The area above Mean Low Water Springs (MLWS) where the offshore export cable(s) will be brought onshore.
Landings	Quantitative description of the amount of fish returned to port for sale, in terms of value or weight.
Landscape	An area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors.
Nursery habitat	Habitats where high numbers of juveniles of a species occur, having a greater level of productivity per unit area than other juvenile habitats.
Offshore Electrical Platform (OEPs)	Offshore platforms potentially consisting of a combination of High Voltage Alternating Current (HVAC) substations, High Voltage Direct Current (HVDC) converter stations and/or a combined HVAC/HVDC substation depending on the final electrical set up of the Project.
Offshore Export Cable Corridor (ECC)	The area within which the offshore export cable(s) will be installed.
Offshore export cable(s)	The subsea electricity cable(s) running from the Offshore Electrical Platform(s) to the landfall which transmit the electricity generated by the offshore wind farm to the onshore export cable(s) for transmission onwards to the onshore substation and the national electrical transmission system.
Offshore transmission infrastructure	The proposed transmission infrastructure comprising: Offshore Electrical Platform(s) and associated foundations and substructures; the offshore export cable(s); and the landfall area up to Mean High Water Springs (MHWS).
Otter trawl	A net with large rectangular boards (otter boards) which are used to keep the mouth of the trawl net open. Otter boards are made of timber or steel and are positioned in such a way that the hydrodynamic forces, acting on them when the net is towed along the seabed, pushes them outwards and prevents the mouth of the net from closing.
Pelagic	Any part of the water column (i.e., the sea from surface to bottom sediments) that is not close to the seabed. Pelagic spawning species release their eggs into the upper layers of the sea.
Pelagic trawl	A net used to target fish species in the mid water column.

Term	Definition
Permanent Threshold Shift (PTS)	Permanent threshold shift (or PTS) is a permanent increase in the threshold of hearing (minimum intensity needed to hear a sound) at a specific frequency above a previously established reference level.
Population Viability Analysis (PVA)	A PVA is a modelling tool that estimates the future size and risk of extinction for population of organisms.
Primary Surveillance Radar (PSR)	A radar system that measures the bearing and distance of targets using the detected reflections of radio signals.
Project	Muir Mhòr Offshore Wind Farm – comprises the wind farm and all associated offshore and onshore components.
proposed development	The offshore Muir Mhòr Offshore Wind Farm project elements to which this Offshore Scoping Report relates.
Protocol for Archaeological Discoveries	A system implemented to ensure that chance discoveries of heritage during works are reported.
Quality elements for waterbodies	The elements assessed when determining the status of waterbodies, such as biological quality elements and chemical quality elements.
River Basin Management Plan (RBMP)	River Basin Management Plans are used to set legally binding, locally specific, environmental objectives that underpin regulation and planning activities for the aquatic environment. These plans are updated and published every six years.
Scallop dredge	A method to catch scallop using steel dredges with a leading bar fitted with a set of spring loaded, downward pointing teeth. Behind this toothed bar (sword), a mat of steel rings is fitted. A heavy net cover (back) is laced to the frame, sides and after end of the mat to form a bag.
Scottish seine	An encircling net shot in the open sea using very long ropes to lay out the net, and ropes on the seabed prior to towing the net closed and hauling from a boat under its own power.
Seascape	An area, as perceived by people, where the sea is a key element of the physical environment. In Scotland, this comprises the visual and physical conjunction of land and sea which combines maritime, coast and hinterland character.
Secondary Surveillance Radar (SSR)	A radar system that transmits interrogation pulses and receives transmitted responses from suitably equipped targets.
Shellfish Water Protected Areas (SWPAs)	These are areas designated under the Water Framework Directive, for the protection of shellfish growth and production. They are classed as sensitive areas, as adverse impacts on water quality could impact the production of quality shellfish.
Sound Exposure Level (SEL)	The decibel level of the time integral (summation) of the squared pressure over the duration of a sound event; units of dB re 1 $\mu Pa^2/s$.
Sound Pressure Level (SPL)	Is a means of characterising the amplitude of a sound. There are several ways sound pressure can be measured. The most common of these are the root-mean-square (rms) pressure, the peak pressure, and the peak-to-peak pressure.
Spawning	The release or deposition of eggs and sperm, usually into water, by aquatic animals

Term	Definition
Stock assessment	An assessment of the biological stock of a species and its status in relation to defined references points for biomass and fishing mortality.
Stratification	Density differences in the water column caused by varying temperature and salinity structure.
Subsea	Subsea comprises everything existing or occurring below the surface of the sea.
Subtidal	The region of shallow waters which are below the level of low tide.
Swept Area Ratio	Swept Area Ratio (derived from Vessel Monitoring System data) indicates the number of times in an annual period that a fishing gear contacts (or sweeps) the seabed surface. Surface Swept Area Ratio provides a proxy for fishing intensity.
Threshold of Hearing	The minimum intensity at which a sound of a specific frequency is reliably detected i.e., by marine mammals, in absolute quiet conditions. The intensity level (of the sound detected, measured in decibels (dB)) varies with frequency.
Uncontrolled Airspace	Defined airspace in which Air Traffic Control does not exercise exclusive authority but may provide basic information services to aircraft in radio contact. In the UK, Class G is uncontrolled airspace.
Urban Waste Water Treatment Directive (UWWTD) Sensitive Areas	Waterbodies which are found to be eutrophic, or at risk or becoming eutrophic in the near future, surface freshwaters intended for the abstraction of drinking water, and areas where further than secondary treatment is necessary. Sensitive areas could be freshwater bodies (e.g., lakes), estuaries, or coastal waters.
Years of Employment	This is a measure of employment which is equivalent to one person being employed for a year and is typically used when considering short to medium term employment impacts, such as those associated with the construction phase of the Proposed development.

ACRONYMS & ABBREVIATIONS:

Term	Definition
AA	Appropriate Assessment
AARA	Air to Air Refuelling Area
AD	Air Defence
AD&OW	Air Defence and Offshore Wind
ADD	Acoustic Deterrent Device
ADSFB	Association of District Salmon Fisheries Boards
AHTS	Anchor Handling Tug Supply
AIP	Aeronautical Information Publication
AIS	Automatic Identification System
AL1	Action Level 1
AL2	Action Level 2
ALARP	As Low As Reasonably Practicable
AMAA Act 1979	Ancient Monuments and Archaeological Areas Act 1979
AMSL	Above Mean Sea Level
ANSI	American National Standards Institute.
ATC	Air Traffic Control
AtN	Aid to Navigation
ATS	Air Traffic Service
BAC	Background Assessment Concentration
BAP	Biodiversity Action Plan
BDMPS	Biologically Defined Minimum Population Scales
BEIS	Department for Business, Energy and Industrial Strategy
BERR	Department for Business Enterprise and Regulatory Reform
BGS	British Geological Survey
BoCC	Birds of Conservation Concern
BOEMRE	Bureau of Ocean Energy Management

Term	Definition
BSI	British Standards Institution
BTO	British Trust for Ornithology
BWD	Bathing Water Directive
BWEA	British Wind Energy Association
CAA	Civil Aviation Authority
CAP	Civil Aviation Publication
CaP	Cable Plan
CAR	Controlled Activities Regulations
CBRA	Cable Burial Risk Assessment
CCA	Coastal Character Area
CCC	Committee on Climate Change
CCR	Climate Change Resilience
CCUS	Carbon Capture Utilisation and Storage
Cefas	Centre for Environment, Fisheries and Aquaculture
CES	Crown Estate Scotland
CES MU	Coastal East Scotland Management Unit
CFLO	Company Fisheries Liaison Officer
CGNS MU	Celtic and Greater North Seas Management Unit
CGR	Counterfactual of Growth Rate
CH_4	Methane
CI	Confidence Interval
CIA	Cumulative Impact Assessment
CIEEM	Chartered Institute of Ecology and Environmental Management
CIfA	Chartered Institute for Archaeologists
CIFA	Community Inshore Fisheries Alliance
CCTV	Closed Caption Television
CLV	Cable Lay Vessel

Term	Definition
CMS	Construction Method Statement
CNCFTC	Central North Sea Fibres Telecommunications Company
CNS	Central North Sea
CO_2	Carbon Dioxide
CoCP	Code of Construction Plan
COLREGs	International Regulators for Preventing Collisions at Sea
CoP	Construction Programme
COWRIE	Collaborative Offshore Windfarm Research Into the Environment
CPA	Coast Protection Act 1949
CPS	Counterfactual Population Size
CRM	Collision Risk Modelling
CSEMP	Clean Seas Environmental Monitoring Programme
CTA	Control Area
CTV	Crew Transfer Vessels
CV	Coefficient of Variation
DAS	Digital Aerial Survey
DCF	Data Collection Framework
DDV	Drop Down Video
DECC	Department for Energy and Climate Change
DEFRA	Department for Environment, Food and Rural Affairs
DfT	Department for Transport
DGC	Defence Geographic Centre
DM	Do-Minimum
DMRB	Design Manual for Roads and Bridges
DP	Decommissioning Programme
DPD	Detection Positive Days
DPO	Draft Plan Option

Term	Definition
DS	Design Statement
DSFB	District Salmon Fishery Board
DSLP	Development Specification and Layout Plan
DTI	Department of Trade and Industry
EAC	Environmental Assessment Criteria
EC	European Commission
ECC	Export Cable Corridor
ECOMMAS	East Coast Scotland Marine Mammal Acoustic Array
eDNA	Environmental DNA
EDR	Effective Deterrence Range
EEA	European Economic Area
EEC	European Economic Community
EEZ	Exclusive Economic Zone
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
EMF	Electromagnetic Field
EMODnet	European Marine Observation and Data Network
EMP	Environmental Management Plan
EOWDC	European Offshore Wind Deployment Centre
EPS	European Protected Species
EQS	Environmental Quality Standard
ERCoP	Emergency Response and Cooperation Plan
ERL	Effects Range-Low
ES	Environmental Statement
ESAS	European Seabirds at Sea
ESCA	European Subsea Cables Association
ESO	Electricity System Operator

Term	Definition
ETRS	European Terrestrial Reference System
EU	European Union
EUNIS	European Nature Information System
FAD	Fish Aggregation Device
FEPA	Food and Environment and Protection Act
FIR	Flight Information Region
FL	Flight Level
FLiDAR	Floating Light Detection and Ranging
FLO	Fisheries Liaison Officer
FLOWW	Fishing Liaison with Offshore Wind and Wet Renewables Group
FMMS	Fisheries Management and Mitigation Strategy
FSA	Formal Safety Assessment
FSL	Full Species List
GCS	Good Chemical Status
GEP	Good Ecological Potential
GES	Good Ecological Status
GHG	Greenhouse Gases
GIS	Geographic Information System
GLVIA3	Guidelines for Landscape and Visual Impact Assessment, 3rd Edition
GNS MU	Greater North Sea Management Unit
GPP	Guidance for Pollution Prevention
GPS	Global Positioning System
GSD	Ground Sample Distance
GT	Gross Tonnage
GVA	Gross Value Added
GW	Gigawatt
HAT	Highest Astronomical Tide

Term	Definition
HCA	Helicopter Certification Agency
HDD	Horizontal Directional Drilling
HEPS	Historic Environment Policy Statement for Scotland
HER	Historic Environment Record
HES	Historic Environment Scotland
HFC	Hydrofluorocarbons
HLV	Heavy Lift Vessel
HM	His Majesty
HMPA	Historic Marine Protected Area
HMRI	Helicopter Main Routing Indicator
HMS	His or Her Majesty's Ship
HMWB	Heavily Modified Waterbody
HND	Holistic Network Design
HNDFUE	Holistic Network Design Follow-Up Exercise
HPAI	Highly Pathogenic Avian Influence
HRA	Habitat Regulations Appraisal
HSE	Health and Safety Executive
HTV	Heavy Transport Vessel
HVDC	High Voltage Direct Current
I&OU	Infrastructure and Other Users
IAC	Inter-Array Cables
IALA	International Association of Marine Aids to Navigation and Lighthouse Authorities
IAMMWG	Inter-Agency Marine Mammal Working Group
ICAO	International Civil Aviation Organization
ICCI	In Combination Climate Change Impact
ICCP	Impressed Current Cathodic Protection
ICES	International Council for the Exploration of the Sea

Term	Definition
ICPC	International Cable Protection Committee
IEEM	Institute of Ecology and Environmental Management
IEMA	Institute of Environmental Management and Assessment
IFISH	Integrated Fisheries System Holding
IFP	Instrument Flight Procedure
IFR	Instrument Flight Rules
IHE	Institute of Highway Engineers
IHLS	The International Herring Larval Survey
IMO	International Maritime Organisation
INNS	Invasive Non-Native Species
INTOG	Innovation and Targeted Oil & Gas
IOF	Important Ornithological Features
IPCC	Intergovernmental Panel on Climate Change
iPCoD	Interim Population Consequences of Disturbance Model
IQI	Infaunal Quality Index
ISV	Installation Support Vessels
IUCN	International Union for Conservation of Nature
JCP	Joint Cetacean Protocol
JNCC	Joint Nature Conservation Committee
JUV	Jack-Up Vessel
JV	Joint Venture
LAT	Lowest Astronomical Tide
LCA	Landscape Character Area
LCT	Landscape Character Type
LiDAR	Light Detection and Ranging
LMP	Lighting and Marking Plan
LoD	Limit of Detection

Term	Definition
LSE	Likely Significant Effects
LUC	Land Use Consultants
LVIA	Landscape and Visual Impact Assessment
MAIB	Marine Accident Investigation Branch
MarESA	Marine Evidence Based Sensitivity Assessment
MARPOL	International Convention for the Prevention of Pollution from Ships
MBES	Multibeam Echo Sounder
MCA	Maritime and Coastguard Agency
MCAA	Marine Coastal Access Act
MCEU	Marine Consents and Environment Unit
mCRM	Migration CRM
MCZ	Marine Conservation Zone
MDA	Central Managed Danger Area
MDS	Maximum Design Scenario
MEDIN	Marine Environmental Data and Information Network
MGN	Marine Guidance Note
MHWS	Mean High Water Springs
MLS	Most Likely Scenario
MLWS	Mean Low Water Springs
MMMP	Marine Mammal Mitigation Plan
MMO	Marine Management Organisation
MOD	Ministry of Defence
MORL	Moray Offshore Renewables Limited
MPA	Marine Protected Area
MPCP	Marine Pollution Contingency Plan
MPS	Marine Policy Statement
MRSea	Marine Renewables Strategic Environmental Assessment

Term	Definition
MSA 1995	Merchant Shipping Act 1995
MSL	Mean Sea Level
MS-LOT	Marine Scotland: Licensing Operations Team
MSS	Management Scotland Science
MU	Management Unit
MW	Megawatt
MW&SQ	Marine Water and Sediment Quality
N_2O	Nitrous Oxide
NAFC	North Atlantic Fisheries College
NASA	National Aeronautics and Space Administration
NC MPA	Nature Conservation Marine Protected Area
NCCT	National Coastal Character Type
NERC	Natural Environment Research Council
NERL	NATS (En-Route) plc
NF_3	Nitrogen Trifluoride
NGR	National Grid Reference
NIEA	Northern Ireland Environment Agency
NLB	Northern Lighthouse Board
NMPi	National Marine Plan Interactive
NNR	National Nature Reserves
NPS	National Planning Statement
NRA	Navigational Risk Assessment
NRW	Natural Resources Wales
NS MU	North Sea Management Unit
NSP	Navigational Safety Plan
NSTA	North Sea Transition Authority
NTSLF	National Tide and Sea Level Facility

Term	Definition
O&M	Operation and Maintenance
OCV	Offshore Construction Vessel
OEP	Offshore Electrical Platform
OESEA	Offshore Energy Strategic Environmental Assessment
OEUK	Offshore Energies UK
OFFSAB	Outer Firth of Forth and St Andrews Bay Complex
OMP	Operation and Maintenance Plan
ONS	Office of National Statistics
OPEN	Optimised Environments
ORE-Catapult	Offshore Renewable Energy Catapult
OREI	Offshore Renewable Energy Installations
ORJIP	Offshore Renewables Joint Industry Programme
OS	Ordnance Survey
OSA	Offshore Safety Area
OSPAR	Oslo and Paris Conventions
OWF	Offshore Wind Farm
OWIC	Offshore Wind Industry Council
OWSMRF	Offshore Wind Strategic Monitoring and Research Forum
PAC	Pre-Application Consultation
PAD	Protocol for Archaeological Discoveries
PAH	Polycyclic Aromatic Hydrocarbon
PAN	Planning Advice Note
PAS	Publicly Available Specification
PBDE	Polybrominated Diphenyl Ether
PCB	Polychlorinated Biphenyl
PCH	Potential Collision Height
PEMP	Project Environmental Monitoring Plan

Term	Definition
PEXA	Practice and Exercise Area
PFC	Perfluorocarbons
PLGR	Pre-Lay Grapnel-Run
PMF	Priority Marine Feature
PMRA 1986	Protection of Military Remains Act 1986
PO	Plan Option
PS	Piling Strategy
PSA	Particle Size Analysis
PSR	Primary Surveillance Radar
PTS	Permanent Threshold Shift
PVA	Population Visibility Analysis
Radar	Radio Detection and Ranging
RAF	Royal Air Force
RBMP	River Basin Management Plan
rBWD	Revised Bathing Water Directive
RCP	Representative Concentration Pathway
RIAA	Report to Inform Appropriate Assessment
RIFG	Regional Inshore Fisheries Group
RLoS	Radar Line of Sight
RMP	Regional Marine Plans
RNLI	Royal National Lifeboat Institution
Ro-Ro	Roll-On/Roll-Off Cargo
ROV	Remotely Operated Vehicle
RSL	Reduced Species List
RSPB	Royal Society for Protection of Birds
RUK	Renewable UK
RYA	Royal Yachting Association

Term	Definition
SAC	Special Area of Conservation
SAR	Search and Rescue
SBP	Sub-Bottom Profiling
SCADA	Supervisory Control and Data Acquisition
SCDS	Supply Chain Development Statement
SCOS	Special Committee on Seals
SD	Standard Distance
SEA	Strategic Environmental Assessment
SEL	Sound Exposure Level
SEPA	Scottish Environmental Protection Agency
SF_6	Sulphur Hexafluoride
SFF	Scottish Fishermen's Federation
SLA	Special Landscape Area
SMP	Sectoral Marine Plan
SOV	Service Operations Vessel
SSEN	Scottish and Southern Electricity Networks
SSR	Secondary Surveillance Radar
SSS	Side Scan Sonar
SSSI	Site of Special Scientific Interest
STECF	Scientific, Technical and Economic Committee for Fisheries
SWFPA	Scottish White Fish Producers Association
SWPA	Shellfish Water Protected Area
SWT	Scottish Wildlife Trust
TAC	Total Allowable Catch
tCO_2e	Tonnes of carbon dioxide equivalent
TCPA	Town and Country Planning Act 1997
TLP	Tension Leg Platform

Term	Definition
TNS	Taylor Nelson Sofres
TRA	Temporary Reserved Area
TTS	Temporary Threshold Shift
UHI	University of Highlands and Islands
UHRS	Ultra-High Resolution Seismic
UK	United Kingdom
UKBAP	UK Biodiversity Action Plan
UKCP	United Kingdom Climate Projection
UKHO	United Kingdom Hydrographic Office
UNCLOS	United Nations Convention on the Law of the Sea
USEPA	United States Environmental Protection Agency
VMP	Vessel Management Plan
VWPWTG	Vattenfall Wind Power Ltd
WSP	Wet Storage Plan
WTG	Wind Turbine Generator

Executive Summary

In response to the Scottish Government's target of net-zero emissions of all greenhouse gases by 2045 and the aim to generate 50% of Scotland's overall energy consumption from renewable sources by 2030, the Crown Estate Scotland (CES) launched the ScotWind Leasing process in 2021, which released new areas of seabed within Scottish waters for future offshore development. The ambition was to offer 10 Gigawatts (GW) of offshore capacity within a series of Plan Options (POs) identified by the Scottish Government as the most suitable area for development as set out within the Sectoral Marine Plan for Offshore Wind.

As part of the CES ScotWind Leasing process in January 2022, Muir Mhòr Offshore Wind Farm Limited (a joint venture (JV) between Fred. Olsen Seawind Limited and Vattenfall Wind Power Limited (VWP) - hereafter the Developer) were identified as the successful bidder and awarded an Option Agreement (granting exclusive rights) for what the Developer has named the Muir Mhòr Offshore Wind Farm (OWF) (hereafter 'the Project'), located within the E2 PO area. The Muir Mhòr array area covers an area of approximately 200 km^2 and is located approximately 63 km east of Peterhead on the east coast of Scotland. The Project is anticipated to have a capacity of approximately 1 GW comprising floating offshore wind technology although it is not intended to seek a capacity cap on the consents, as environmental impacts are driven by the maximum design parameters of the proposed development e.g., tip height of the wind turbine generators (WTGs) rather than its capacity. There is precedent for this approach in Scotland.

The offshore elements of the Project are located within the Scottish Territorial Waters (extending to 12 nautical miles (nm) from shore) and the United Kingdom (UK) Exclusive Economic Zone (EEZ; between 12 and 200 nm). The offshore array area is located wholly within the EEZ, and the offshore export cable corridor is located within the EEZ and then into Scottish Territorial Waters to landfall. The Scottish Ministers are the Regulatory Authority in respect to the necessary consents and licences required for the construction and operation of an OWF project. To enable the Scottish Ministers to properly consider development proposals, developers are required to provide information which demonstrates compliance with the relevant legislation and allows for adequate understanding of the material considerations associated with the Project.

The Project will consist of the following components:

- Up to 67 offshore WTGs and associated infrastructure (nacelle and blades), floating foundations, and seabed anchorages;
- Up to three Offshore electrical platforms (OEPs) and foundations;
- Scour protection for WTG and OEP foundations;
- Inter-array cables – cables connecting the WTGs to each other on strings terminating at the OEP(s) and interconnector cables which link the OEPs to one another;
- Offshore export cables – these connect the OEPs with the shore;
- Cable protection on unburied or shallow buried sections of cables and at cable crossings as and when required; and
- Onshore transmission infrastructure to facilitate connection of the Project to the National Grid.

The Developer will submit separate consents, licences and permissions for the offshore (seaward of Mean High Water Springs (MHWS) and onshore (landward of MLWS)

infrastructure. This Offshore Environmental Impact Assessment (EIA) Scoping Report considers all the offshore infrastructure of the Project seaward of MHWS which is hereafter referred to as the 'proposed development'. A standalone Onshore EIA Scoping Report relating to impacts of onshore infrastructure associated with the Project on onshore receptors will be submitted separately. However, a combined view of offshore and onshore elements of the Project will be adopted for the EIAR, where appropriate, to develop a robust comprehensive EIA. For example, offshore cumulative impact assessment will include effects which could occur with the onshore elements of the Project.

The purpose of the Offshore EIA Scoping Report will be to request a formal Scoping Opinion from Marine Scotland – Licensing Operations Team (MS-LOT), on behalf of the Scottish Ministers in relation to the offshore elements of the Project, the scope of the Offshore EIA, and the content of the supporting Offshore EIA Report (EIAR) for the Project. A Scoping Opinion is being requested under Regulation 12 of the Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017 (as amended), Regulation 13 and Schedule 4 of the Marine Works (Environmental Impact Assessment) Regulations 2007 (as amended) (for Scottish offshore waters) and Regulation 14 of the Marine Works (Environmental Impact Assessment) (Scotland) Regulations 2017 (as amended) (for Scottish inshore waters) (herein referred to as "the EIA Regulations").

An Offshore Habitats Regulations Appraisal (HRA) Screening Report will be submitted to MS-LOT alongside this Offshore EIA Scoping Report, detailing the outcome of Likely Significant Effect (LSE) screening on the qualifying features of relevant European sites for the proposed development.

This Offshore EIA Scoping Report provides details of the proposed development, along with baseline environmental information currently available. The report also summarises key legislation and policy, outlines the proposed EIA methodology, identifies potential impacts that may arise as a result of the proposed development and describes how these impacts are proposed to be assessed. Within this Offshore EIA Scoping Report, studies and surveys are proposed to inform the EIA process and preliminary discussion on potential mitigation measures are included. For this Offshore EIA Scoping Report, the following technical topics have been considered:

- Marine and Coastal Processes;
- Marine Water and Sediment Quality;
- Benthic Subtidal and Intertidal Ecology;
- Fish and Shellfish Ecology;
- Offshore and Intertidal Ornithology;
- Marine Mammals;
- Commercial Fisheries;
- Shipping and Navigation;
- Marine Archaeology and Cultural Heritage;
- Military and Civil Aviation;
- Seascape, Landscape and Visual Resources;
- Socio-Economics, Tourism and Recreation;
- Climate; and
- Infrastructure and Other Users.

The Developer invites consultees to respond to this Offshore EIA Scoping Report by providing a response to the topic specific questions which are included in each technical section by providing a formal opinion on the key areas identified, the data sources, and the methodology proposed. The purpose of this scoping exercise is to seek formal consultation from stakeholders on the EIA for the proposed development.

1 Introduction

1.1 Background

1.1.1 In response to the Scottish Government's target of net-zero emissions of all greenhouse gases by 2045 and the aim to generate 50% of Scotland's overall energy consumption from renewable sources by 2030, the CES launched the ScotWind Leasing process in 2021, which released new areas of seabed within Scottish waters for future offshore development. The ambition was to offer 10GW of offshore capacity within a series of POs identified by the Scottish Government as the most suitable area for development as set out within the Sectoral Marine Plan for Offshore Wind.

1.1.2 As part of the CES ScotWind Leasing process in January 2022, Muir Mhòr Offshore Wind Farm Limited (a (JV) between Fred. Olsen Seawind Limited and Vattenfall - hereafter the Developer) were identified as the successful bidder and awarded an Option Agreement (granting exclusive rights) for what the Developer has named the Muir Mhòr OWF (hereafter 'the Project'), located within the E2PO area. The Muir Mhòr array area covers an area of approximately 200 km^2 and is located approximately 63 km east of Peterhead on the east coast of Scotland. The offshore array area is located wholly within the EEZ, and the offshore export cable corridor is located within the EEZ and then into Scottish Territorial Waters to landfall. The Project will have a capacity of approximately 1GW comprising floating offshore wind technology, although it is not intended to seek a capacity cap on the consents, as environmental impacts are driven by the maximum design parameters of the proposed development e.g., tip height of the wind turbine generators rather than its capacity. There is precedent for this approach in Scotland.

1.1.3 The Developer therefore intends to apply for the relevant consents and permissions required to enable construction, operation and maintenance (O&M) and decommissioning of the Project. This process will be subject to EIA, with an EIAR covering both offshore and onshore elements to be prepared to underpin any applications.

1.1.4 The purpose of the Offshore EIA Scoping Report will be to request a formal Scoping Opinion from MS-LOT, on behalf of the Scottish Ministers in relation to the offshore elements of the Project, the scope of the Offshore EIA, and the content of the supporting Offshore EIAR for the Project. This Offshore EIA Scoping Report considers all of the offshore infrastructure of the Project seaward of MHWS which is hereafter referred to as the 'proposed development'. A standalone Onshore EIA Scoping Report relating to impacts of onshore infrastructure associated with the Project on onshore receptors will be submitted separately.

1.1.5 The offshore infrastructure of the proposed development includes WTGs and associated floating foundations, the OEPs and associated foundations, the inter-array cables (IAC), offshore export cables and landfall. It is anticipated that the Scoping Opinion will be based on responses to this Scoping Report from statutory and non-statutory consultees and will be used to guide the EIA.

1.2 The Developer

1.2.1 As noted above, the Developer (Muir Mhòr Offshore Wind Farm Limited) is a JV between Fred. Olsen Seawind Limited and VWP. The Developer brings together a unique combination of financial, technical and project development capability, a commitment to delivery, and a clear vision for the Project.

1.2.2 Fred. Olsen Seawind Limited is an established offshore wind developer building on Fred. Olsen Renewables' 25 years wind track record, market presence and portfolio. In 2021, the Fred. Olsen Renewables offshore wind assets and activity was organised within a distinct

corporate structure in Fred. Olsen Seawind AS and is 100% controlled by Bonheur ASA. Fred. Olsen has extensive experience in Scotland gained through over 25 years of development, construction, and operation of onshore wind in the region. Fred. Olsen Seawind is active in Ireland, Norway and Scotland and is exploring opportunities in new markets.

Other entities include Fred. Olsen WindCarrier, who are responsible for the installation of 20% of the world's offshore wind turbines outside of China, and Fred. Olsen 1848 who develop and commercialise renewable energy innovations.

1.2.3 Vattenfall is one of Europe's largest producers and retailers of electricity and heat with approximately 20,000 employees. VWP has been working in the UK for more than ten years, developing fossil fuel-free energy projects. VWP have grown their wind business from one project in 2008 to 11 in 2023. VWP also continue to grow district heating and power networks businesses. VWP currently operates more than 1 GW of wind energy capacity in the UK. In Scotland, their operational wind farms comprise a total generating capacity of approximately 1 GW, powering over 130,000 homes. This includes the 96.8 megawatt (MW) European Offshore Wind Deployment Centre in Aberdeen Bay which offers the domestic supply chain the chance to test and demonstrate the latest innovations in a real-world environment. VWP is also constructing South Kyle, a 240 MW onshore wind project in south-west Scotland.

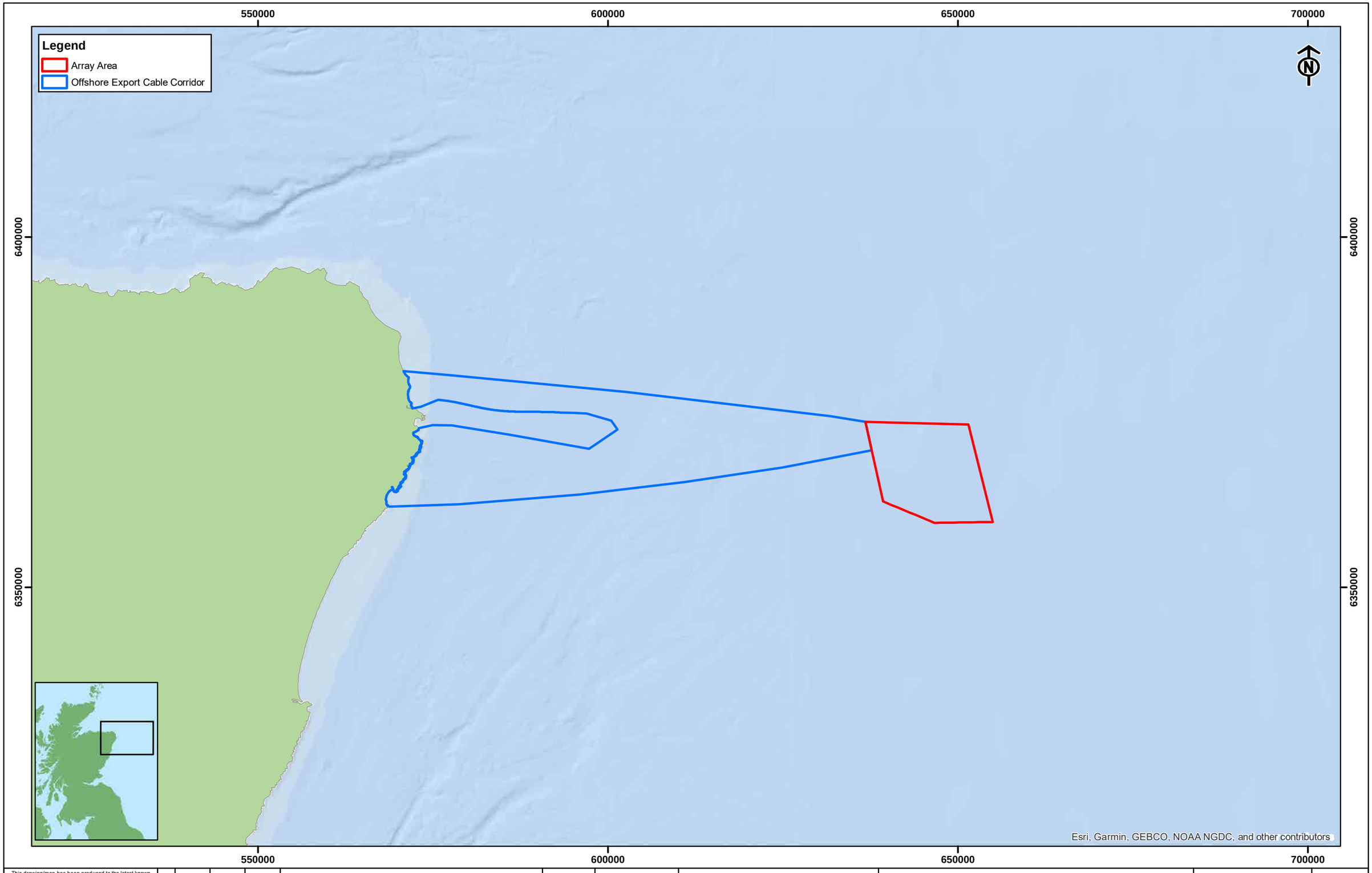
1.2.4 The Developer is being supported by GoBe Consultants Limited with respect to the delivery of the overall EIA (including Scoping Reports and EIAR), HRA and consents management aspects of the project, with assistance from Land Use Consultants Ltd (LUC) for the onshore EIA/HRA and consent aspects.

1.3 Project Overview

1.3.1 The location of the proposed development is shown in Figure 1-1. The proposed development will consist of the following components:

- Up to 67 offshore WTGs and associated infrastructure (nacelle and blades), floating foundations, and seabed anchorages;
- Up to three Offshore OEPs and foundations;
- Scour protection for WTG and OEP foundations;
- IAC – cables connecting the WTGs to the OEPs and linking OEPs to offshore export cables and interconnector cables which link the OEPs to one another;
- Offshore export cables – these connect the OEPs with the shore;
- Cable protection on unburied or shallow buried sections of cables and at cable crossings as and when required; and
- Onshore transmission infrastructure to facilitate connection of the Project to the National Grid.

1.3.2 Further details of the proposed development are provided in Chapter 3 (Proposed Development Description), specifically the individual offshore elements of relevance to this Offshore Scoping Report. This includes the design envelope for infrastructure within the array area and associated transmission infrastructure, such as the number of WTGs, foundation types, inter-array, interconnector and export cables, and other supporting infrastructure such as the OEPs.



This drawing/map has been produced to the latest known information at the time of issue. Please consult with the Vattenfall GIS team to ensure the content is still current before using the information contained on this map.

MUIR MHÒR OFFSHORE WIND FARM

A joint venture between Fred. Olsen Seawind & Vattenfall

Muir Mhòr Offshore Wind Farm Ltd, The Tun Building 4 Jackson's Entry, Holyrood Road, No 4 EH8 8PJ Edinburgh United Kingdom

Rev	Date	Drawn By	Checked By	Comment
A	13/04/23	BPHB	LK	First Issue

Datum	ETRS 1989
Projection	ETRS 1989 UTM Zone 30N
Plot	A3
Scale	1:500,000

0 4 8 12 16 20 km

MUIR MHÒR WIND FARM

Location of Proposed Development

Confidentiality Class	C1
Drg No	GoBe-0042
Rev	A
Layout	NA

Figure 1.1

Ref files: MMH_INT_Fig1.1_ProposedDevelopment_RevA

1.4 Offshore EIA Scoping Report Purpose

1.4.1 The Project is located within the Scottish Territorial Waters (extending to 12 nm from shore) and the (UK) EEZ (EEZ; between 12 and 200 nm). The Scottish Ministers are the Regulatory Authority in respect to the necessary consents and licences required for the construction and operation of an OWF project. To enable the Scottish Ministers to properly consider development proposals, developers are required to provide information which demonstrates compliance with the relevant legislation and allows for adequate understanding of the material considerations associated with the Project.

1.4.2 The purpose of the Offshore EIA Scoping Report will be to request a formal Scoping Opinion from MS-LOT, on behalf of the Scottish Ministers in relation to the offshore elements of the Project, the scope of the Offshore EIA, and the content of the supporting Offshore EIAR for the Project. A Scoping Opinion is being requested under Regulation 12 of the Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017 (as amended), Regulation 13 and Schedule 4 of the Marine Works (Environmental Impact Assessment) Regulations 2007 (as amended) (for Scottish offshore waters) and Regulation 14 of the Marine Works (Environmental Impact Assessment) (Scotland) Regulations 2017 (as amended) (for Scottish inshore waters) (herein referred to as “the EIA Regulations”).

1.4.3 This Offshore EIA Scoping Report considers all the offshore infrastructure of the Project seaward of MHWS - the proposed development. A standalone Onshore EIA Scoping Report relating to impacts of onshore infrastructure associated with the Project on onshore receptors will be submitted separately.

1.4.4 An Offshore HRA Screening Report (MMH-GBE-A004-CNT-0003) will be submitted to MS-LOT alongside this Offshore EIA Scoping Report, detailing the outcome of LSE screening on the qualifying features of relevant European sites for the proposed development.

1.5 Consenting Process

1.5.1 Consents, licences, and permissions to be sought by the Developer for the proposed development include:

- A Section 36 consent under the Electricity Act 1989;
- A Marine Licence under the Marine and Coastal Access Act (MCAA) 2009 for the generating assets of the proposed development which are located beyond the 12 nm limit within the EEZ; and
- A Marine Licence under the Marine (Scotland) Act 2010 (for the offshore transmission infrastructure which is within 12 nm of the coast) and under the MCAA (for the offshore transmission infrastructure which is located beyond the 12 nm limit within the EEZ).

1.5.2 The Developer will not seek deemed planning permission as part of the Section 36 consent application and a separate application for onshore infrastructure will be made under the Town and Country Planning (Scotland) Act 1997

1.5.3 An EIAR is required to be prepared and submitted to support applications for necessary offshore consents, licences, and permissions (see Chapter 2: Legislation and Policy for further detail) for the proposed development. The EIA is required to fulfil the requirements of the following regulations:

- In respect to a Section 36 consent application: The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017; and

- In respect to the Marine Licence applications: The Marine Works (Environmental Impact Assessment) (Scotland) Regulations 2017 and the Marine Works (Environmental Impact Assessment) Regulations 2007 (as relevant).

1.6 Scoping Report Structure and Objectives

1.6.1 The Offshore Scoping Report (this document) supports a request to MS-LOT, on behalf of the Scottish Ministers, for a formal Scoping Opinion in relation to the proposed development. It is anticipated that the Scoping Opinion issued by MS-LOT will be based on and informed by responses to this Offshore Scoping Report that are received from statutory and non-statutory consultees, and that the Scoping Opinion will then be used to guide the Developer in progressing the EIA. The EIA process is outlined in Chapter 4 (EIA Methodology).

1.6.2 As such, the primary objective of this Offshore Scoping Report is to engage with the Scottish Ministers, MS-LOT, and other relevant statutory and non-statutory consultees as part of the early stages of the EIA process, inviting each organisation to provide relevant information and to comment on the proposed approach to the EIA, to ensure that a robust and proportionate EIAR is submitted in support of any future consenting applications.

1.6.3 To engage in an informed manner, the Offshore Scoping Report provides information on the following:

- The proposed development;
- Offshore topics considered and proposed for scoping into the EIA, where potentially significant effects may result from the proposed development on the physical, biological and human environment;
- Offshore topics considered and proposed for scoping out of the EIA, where significant effects are not anticipated with consideration of embedded and industry best practice mitigation; and
- An outline of the proposed approach to be adopted to gain a full understanding of existing baseline conditions associated with the proposed development (and the future baseline assuming that the proposed development is not progressed) and to allow a robust environmental assessment of potential effects through the EIA process.

1.6.4 This Offshore Scoping Report sets out the potential environmental effects and identifies those that are considered significant and, therefore, proposed to be scoped into the EIA process. It also identifies those considered not significant and subsequently proposed for scoping out of the EIA process. The final list of topics to be considered in the EIA process for the proposed development will be confirmed following receipt of the Scoping Opinion and through further consultation with MS-LOT, NatureScot and other key stakeholders and consultees.

1.6.5 A proportionate EIA approach will be adopted as far as possible, with this Offshore Scoping Report seeking to scope out those issues which are increasingly shown (from repeated assessment in OWF EIA) to be non-significant. The report will also aim to confirm the scope of the Cumulative Impact Assessment (CIA) and relevant transboundary impacts that also require consideration. The Developer welcomes the opportunity for early engagement with stakeholders to obtain feedback on the proposed development and the proposed scope of offshore assessment within the EIAR.

1.6.6 The structure of this Offshore Scoping Report is set out in Table 1-1.

Table 1-1: Offshore Scoping Report Structure

Chapter	Title	Summary
1	Introduction	This chapter introduces the Developer, the proposed development and outlines the key objectives of the Offshore Scoping Report.
2	Legislation and Policy	Sets out the need for the proposed development and the relevant policy and legislative context.
3	Proposed Development Description	Provides a description of the key components that comprise the proposed development.
4	EIA Methodology	Describes the EIA methodology proposed and demonstrates the measures taken to progress a proportionate EIA.
5	Consultation	Outlines the approach to stakeholder consultation for the proposed development.
6 - 19	Technical offshore scoping topics	Marine and Coastal (Chapter 6) Marine Water and Sediment Quality (Chapter 7) Benthic Subtidal and Intertidal Ecology (Chapter 8) Fish and Shellfish Ecology (Chapter 9) Offshore and Intertidal Ornithology (Chapter 10) Marine Mammals (Chapter 11) Commercial Fisheries (Chapter 12) Shipping and Navigation (Chapter 13) Marine Archaeology and Cultural Heritage (Chapter 14) Military and Civil Aviation (Chapter 15) Seascape, Landscape and Visual Resources (Chapter 16) Socioeconomics, Tourism and Recreation (Chapter 17) Climate (Chapter 18) Infrastructure and Other Users (Chapter 19)
20	Summary of Offshore EIA Scoping and Next Steps	Provides a summary of the approach taken to scoping and the key findings of the Offshore Scoping Report and outlines the proposed structure of the EIAR, including Offshore and Onshore elements of the proposed development.
21	References	Sets out full reference to documents and publications used to inform the Offshore Scoping Report.
Appendix A	Commitments Register	Sets out a record of the embedded commitments that the proposed development will commit to and will be further developed as required during the EIA process.
Appendix B	Seascape, Landscape and Visual Resources Wirelines	Illustrative wirelines (without baseline photography) to support the Seascape, Landscape and Visual Resources assessment within this Offshore Scoping Report.

2 Legislation and Policy

2.1 Introduction

2.1.1 The need for a secure energy supply in the face of climate change has led to several international, national and local legislation and policies being put in place, designed to help guide development within the renewable energy sector. A number of these legislation and policies are of relevance to the proposed development. This chapter considers some of the key relevant legislation and guidance which relate to the development of OWFs, and thus of relevance to the consenting process for the proposed development.

2.2 Climate Change and Renewable Energy Policy

2.2.1 In reviewing legislation and policy relevant to renewable energy development, there is also the need to consider the legislative action required in the face of climate change, decarbonisation and driving the need to promote renewable energy generation.

2.2.2 The challenges of climate change, energy supply and security of supply are driving governmental policy and decision making on renewable energy developments. There are now a significant number of national and international policies, strategies and regulations relating to climate change and the development of renewable energy in Europe, the UK and Scotland. Scotland's long-term climate change targets will require net-zero greenhouse gas (GHG) emissions by 2045, in line with advice from the Committee on Climate Change (CCC). The ongoing development of the renewable energy sector will be required to meet these targets, with offshore wind playing a significant role as the development and operation costs are reduced. With each development round resulting in reduced costs, offshore wind is becoming one of the most competitively priced technologies to assist with delivery of energy targets.

2.2.3 The Scottish Offshore Wind Energy Policy Statement (Scottish Government, 2020), building upon the ambitions outlined within the Scottish Energy Strategy (Scottish Government, 2017), sets out the Scottish Government's ambition to capitalise on the potential that offshore wind development can bring to Scotland and the role this technology could play in meeting our commitment to reach net zero by 2045. The British Energy Security Strategy (HM Government, 2022) sets out the UK Government's ambition to deliver up to 50 GW of offshore wind energy development by 2030, including up to 5 GW of innovative floating wind, which aligns with Scottish Government's National ambitions of the same.

2.2.4 The proposed development will make an important contribution in helping to achieve relevant International, European, UK and Scottish policy aims.

2.3 Marine Planning Framework

National Marine Plan

2.3.1 Scotland's National Marine Plan was published in March 2015 and details strategic policies for the sustainable development of Scotland's marine resources out to 200 nm (i.e., the contribution of waters offshore from Scotland to the UK's EEZ). It is required to be compatible with the UK Marine Policy Statement (HM Government, 2011) and existing marine plans across the UK, in particular where there is interaction between England's inshore and offshore marine plans and Northern Ireland's Marine Plans. Sector-specific objectives (Offshore Wind and Marine Renewable Energy) of Scotland's National Marine Plan to the Proposed Development are as follows:

- Sustainable development of offshore wind, wave, and tidal renewable energy in the most suitable locations;
- Economic benefits from offshore wind, wave and tidal energy developments maximised by securing a competitive local supply chain in Scotland.
- Alignment of marine and terrestrial planning and efficient consenting and licensing processes including but not limited to data sharing, engagement, and timings, where possible;
- Aligned marine and terrestrial electricity transmission grid planning and development in Scottish waters.
- Contribute to achieving the renewables target to generate electricity equivalent to 100% of Scotland's gross annual electricity consumption from renewable sources by 2020;
- Contribute to achieving the decarbonisation target of 50 g CO_2/kWh by 2030 (to cut carbon emissions from electricity generation by more than four-fifths).
- Sustainable development and expansion of test and demonstration facilities for offshore wind and marine renewable energy devices; and
- Co-ordinated government and industry-wide monitoring.

Sectoral Marine Plan (SMP) for Offshore Wind Energy

2.3.2 The first Sectoral Marine Plan for Offshore Wind Energy (Marine Scotland, 2011) was adopted in 2011. In July 2013, Marine Scotland published the Draft Sectoral Marine Plan for Offshore Wind, Wave and Tidal energy in Scotland. It identified potential future options for commercial scale offshore wind energy developments. These draft plans were never formally adopted by Scottish Ministers, but the draft options were included in Scotland's National Marine Plan and are retained on Marine Scotland Maps for reference (Scottish Government, 2019).

2.3.3 In November 2017, CES announced their intention to run a further leasing round for commercial scale offshore wind energy projects in Scottish Waters. To inform the spatial development of this leasing round, MS-LOT, as Planning Authority for Scotland's Seas, were required to undertake a planning exercise in accordance with relevant UK and Scottish legislation.

2.3.4 The SMP for Offshore Wind Energy (Scottish Government, 2020), published in October 2020, provided the strategically planned spatial footprint for offshore wind development in Scotland. It identified the most sustainable Plan Options for the future development of commercial-scale offshore wind energy in Scotland, including deep water wind technologies and covered both Scottish inshore and offshore waters. It also contributed to achieving Scottish and the UK's energy and climate change objectives and was developed to ensure consistency with Scotland's National Marine Plan **(**reference: page 12)**.** In the recent ScotWind Leasing process, a total of 20 proposed OWF projects were awarded option agreements within 15 of these Plan Options, reaching ~30 GW of capacity. This includes 17 proposed OWF projects awarded in January 2022, with a further three sites awarded in August 2022 as part of the ScotWind 'Clearing' process.

2.3.5 The SMP for Offshore Wind Energy (Scottish Government, 2020a) summarised the following in relation to the E2 PO:

"there is potential for significant effects on bird species, for which previous wind farm consultations have raised significant concerns. The conclusion of these consultations based on potential risk to bird populations, specifically Kittiwake, Great Black-backed Gull, Razorbill,

Gannet and Guillemot is that currently there may be very limited capacity for further development on the east coast of Scotland, although these concerns are recognised to be more applicable to the inshore sites and risks are reduced in this case by the distance of E1 offshore.

In addition, within E2 there is potential for a significant effect on spawning fish and navigational safety. Effects on spawning fish have the potential to be mitigated through avoidance of piling activities during key spawning periods, whilst effects on navigational safety can be managed through appropriate spatial planning…"

2.3.6 These key issues relating to offshore ornithology, fish and shellfish, and shipping and navigation will be addressed as part of the EIA (and parallel HRA process for nature conservation designated sites).

2.3.7 The Developer acknowledges that Marine Scotland will undertake an iterative SMP review and will engage with this process, while attempting to facilitate the necessary evidence to inform the review of the E2 PO. It is noted that if the assessment of the proposed development concludes adverse effects on integrity, it may be necessary for the Project to seek a derogation and agreement on compensation measures.

2.3.8 CES has also announced the results of the first leasing round designed to enable offshore wind energy to directly supply offshore oil and gas platforms, termed Innovation and Targeted Oil & Gas (INTOG). As of March 2023, 13 INTOG projects have been offered initial agreements to start offshore wind development, while the Scottish Government completes the planning process for the INTOG iterative SMP.

Regional Marine Plan

2.3.9 Regional Marine Plans (RMP) are being developed which cover local Scottish Marine Regions (SMR) out to 12 nm. The plans will focus on marine planning and conservation issues specifically to that local area. The RMP will be developed in line with Scotland's National Marine Plan and the SMP for Offshore Wind. For example, RMP will need to consider the PO areas that were identified in the ScotWind Leasing round and will need to take into consideration grid connection requirements.

2.3.10 Elements of the proposed development are within the Northeast SMR, extending from MHWS out to 12 nm.

2.4 Consenting Process

Electricity Act 1989 (as amended)

2.4.1 The proposed development will be subject to an application to the Scottish Ministers under Section 36 of the Electricity Act 1989 (as amended) for consent to construct and operate an electricity generating station. The scope of this consent will include the construction, installation and O&M of WTGs and IAC.

2.4.2 Consent under Section 36 of the Electricity Act 1989 (as amended) is required for any proposal to construct, extend, or operate a generating station (an OWF) situated in:

- Scottish Territorial Waters (from shore out to 12 nm), which have a generating capacity more than 1 MW; or
- Scottish Offshore Region (from 12 to 200 nm), with a generating station more than 50 MW.

2.4.3 Scottish Minsters can grant consent under Section 36 of the Electricity Act 1989 with consideration of input and recommendations from MS-LOT.

Marine (Scotland) Act 2010

2.4.4 The Marine (Scotland) Act 2010 provides the legislative and management framework for the marine environment within Scottish Territorial Waters (from MHWS out to 12 nm). Under section 21 of the Marine (Scotland) Act 2010, the proposed development requires a Marine Licence for the construction and deposit of structures below MHWS.

2.4.5 Part 4 (Marine Licensing) of the Marine (Scotland) Act 2010 includes licensable marine activities (Section 21) for which the following would apply to the proposed development (noting other licensable activities may be identified as the project description is defined during the EIA):

(1) To deposit any substance or object within the Scottish marine area, either in the sea or on or under the seabed, from any of the following:

(a) a vehicle, vessel, aircraft or marine structure,

(b) a container floating in the sea, or

(c) a structure on land constructed or adapted wholly or mainly for the purpose of depositing solids in the sea.

(2) To deposit any substance or object anywhere in the sea or on or under the seabed from a vehicle, vessel, aircraft, marine structure or floating container which was loaded with the substance or object either:

(a) in Scotland, or

(b) in the Scottish marine area.

(5) To construct, alter or improve any works within the Scottish marine area either:

(a) in or over the sea, or

(b) on or under the seabed.

(6) To use a vehicle, vessel, aircraft, marine structure, or floating container to remove any substance or object from the seabed within the Scottish marine area.

(7) To carry out any form of dredging within the Scottish marine area (whether or not involving the removal of any material from the sea or seabed).

2.4.6 The Scottish Ministers can grant a Marine Licence under Part 4 of the Marine (Scotland) Act 2010 with consideration of input and recommendations from MS-LOT.

Marine and Coastal Access Act 2009

2.4.7 The Marine and Coastal Access Act 2009 provides devolved authority to Scottish Ministers for marine planning and conservation powers in the Scottish Offshore Region (from 12 to 200 nm). Under section 66 of the Marine and Coastal Access Act 2009 (in the context of the Scottish Offshore Region), the proposed development requires a Marine Licence for the construction and deposit of structures beyond 12 nm.

2.4.8 Part 4 (Marine Licensing) of the Marine and Coastal Access Act 2009 includes licensable marine activities (Section 66) for which broadly the same activities listed above for the Marine (Scotland) Act 2010 would apply to the proposed development (e.g., deposits, removals, and

construction). Scottish Minsters can grant a Marine Licence under Part 4 of the Marine and Coastal Access Act 2009 with consideration of input and recommendations from MS-LOT.

The Energy Act 2004

2.4.9 The Energy Act 2004 makes provision for, among other aspects, the development, regulation, and encouragement of the use of renewable energy sources and giving effect to international agreements relating to pipelines and offshore installations.

2.4.10 Under Section 95 of the Energy Act 2004, where a renewable energy installation is proposed to be constructed, and the Scottish Ministers consider it appropriate for safety reasons, designated areas may be declared as safety zones. Safety zones are intended to ensure the safety of the renewable energy installation or other installations in the vicinity during construction, operation, extension, or decommissioning. Safety zones may exclude non-OWF vessels from navigating through a designated area for a specific period. The Developer expects to apply for standard safety zones for the proposed development during construction and major maintenance activities, and around certain offshore structures (i.e., floating WTGs and OEPs).

2.4.11 Sections 105 to 114 of the Energy Act 2004 require a decommissioning scheme for an offshore renewable energy installation in Scottish Waters to be approved by the Scottish Ministers.

Harbours Act 1964

2.4.12 Works associated with the proposed development which are to be carried out within statutory Harbour and Port Limits, may require a Works Order under the Harbours Act 1964 and local harbour legislation from the relevant Port or Harbour authority (Harbour Works Order). The purpose of a Works Order is to ensure that all relevant consultations have been carried out and that there are no adverse effects on the safety of navigation within the Harbour or Port area. This may be required depending on the final offshore export cable corridor (ECC) and landfall site.

The Town and Country Planning (Scotland) Act 1997

2.4.13 The Developer plans to submit separate applications for the offshore and onshore elements of the Project and so the onshore elements of the Project will require separate planning consent under the Town and Country Planning (Scotland) Act 1997 as amended. A separate Onshore Scoping Report will be produced to support the EIA and associated planning application. This Act covers the onshore region of the Project down to MLWS, whilst the Marine (Scotland) Act 2010 extends up to MHWS. Due to this overlap in jurisdiction, the intertidal area will be assessed within this Offshore Scoping Report, as well as in the Onshore Scoping Report.

2.5 Environmental Impact Assessment

2.5.1 Requirements for EIA are defined in the EIA Directive (2011/92/EU, as amended by Directive 2014/52/EU) which has been transposed into Scottish law. The purpose of the EIA Directive is to ensure that the potential effects of a project on the environment are taken into consideration before relevant consents are granted. If a development is deemed to have the potential to have a significant effect on the environment by virtue of its scale, size and location, then an EIA is required. The competent authority cannot grant consent for an EIA development without considering the EIAR.

2.5.2 The requirements of the EIA Directive are enacted through relevant Scottish legislation for electricity generation projects requiring consent under Section 36 of the Electricity Act 1989 by the Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017

(as amended). In relation to marine licensing under the Marine (Scotland) Act 2010 and Marine and Coastal Access Act 2009, the requirements of the EIA Directive are enacted by the Marine Works (Environmental Impact Assessment) Regulations 2007 (as amended) and the Marine Works (Environmental Impact Assessment) (Scotland) Regulations 2017 (as amended). These EIA Regulations set out the statutory process and minimum requirements for EIA, to which the proposed development will adhere.

2.6 Pre-Application Consultation (PAC)

2.6.1 The Marine Licensing (Pre-application Consultation) (Scotland) Regulations 2013, commonly referred to as the PAC Regulations, apply to activities occurring within Scottish Territorial Waters (i.e., from MHWS out to 12 nm). Whilst these requirements do not apply in respect of relevant applications in the Scottish Offshore Region (beyond 12 nm), the principles of the PAC Regulations will be followed for all offshore aspects of the proposed development.

2.6.2 For a prescribed class of activity, within which offshore wind developments and the transmission infrastructure are captured, the PAC Regulations require developers to notify the Marine and Coastguard Agency (MCA), Northern Lighthouse Board (NLB), NatureScot and Scottish Environment Protection Agency (SEPA) along with any delegate for a relevant marine region (regulation 6). Developers must hold at least one pre-application consultation event for which notification is given to these bodies, and members of the public may provide comments to the developer. Developers must publish, within at least one local newspaper, a notice containing a description of the activity, detail as to where further information may be obtained, the date and place of the pre-application consultation (PAC) event, how and when comments should be submitted to the developer, and a statement that comments made to the developer are not representations to the Scottish Ministers and that if an application is made by the developer, there will be an opportunity for representations to be made to the Scottish Ministers (regulation 7). Under regulation 8, a PAC Report must then be submitted alongside the Marine Licence application to MS-LOT. Regulation 5 (Consultation Procedure) provides further details of planned consultation to support the proposed development.

2.7 Nature Conservation

Habitats Regulations

2.7.1 Article 3 of the European Union (EU) Directive on the Conservation of Natural Habitats and of Wild Fauna and Flora, commonly known as the Habitats Directive (92/43/EEC), requires the establishment of a European network of important high-quality conservation sites known as Special Areas of Conservation (SACs) that will contribute to conserving habitats and species identified in Annexes I and II of the Directive. The listed habitat types and species are those considered to be most in need of conservation at a European level (excluding birds). In accordance with Article 4 of the EU Directive on the conservation of wild birds, commonly known as the Birds Directive (2009/147/EC), Special Protection Areas (SPAs) are strictly protected sites classified for rare and vulnerable birds (Annex I of the Directive), and for regularly occurring migratory species.

2.7.2 As relevant for an OWF in Scotland's terrestrial and marine environment, the requirements of the Habitats and Birds Directives are largely transposed by the Conservation (Natural Habitats, &c.) Regulations 1994 (as amended) (up to 12 nm), the Conservation of Habitats and Species Regulations 2017 (of relevance to consents under Section 36 of the Electricity Act 1989), the Conservation of Offshore Marine Habitats and Species Regulations 2017 (beyond 12 nm) and the Wildlife and Countryside Act 1981 (as amended).

2.7.3 Following the UK's departure from the EU on 31 December 2020, the UK is no longer an EU Member State. Notwithstanding, the Conservation (Natural Habitats, &c.) (EU Exit) (Scotland) (Amendment) Regulations 2019 and the Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019 have transferred functions from the European Commission to the appropriate authorities in the UK/Scotland, with SACs and SPAs in the UK no longer forming part of the EU's Natura 2000 ecological network. These Habitats Regulations have created the UK's National Site Network on land and at sea, including both the inshore and offshore marine areas in the UK. This includes all existing SACs and SPAs, and new SACs and SPAs designated under the Habitats Regulations, noting policy on the protections and standards afforded to these sites remains unchanged. These European sites are still protected in Scotland and the rest of the UK and the terms "European site", "European marine site" and "European offshore marine site" have been retained.

2.7.4 Scottish Government policy notes that in Scotland, all Ramsar sites are also SACs and/or SPAs or sites of scientific special interest (SSSIs). Ramsar sites are wetlands of international importance designated under the Ramsar Convention (adopted in 1971 and came into force in 1975), providing a framework for the conservation and wise use of wetlands and their resources. For the purposes of the 'report to inform appropriate assessment' (RIAA), all relevant Ramsar sites will be considered alongside designated European sites.

2.7.5 The Habitats Regulations require that wherever a plan, project or activity, that is not directly connected to, or necessary to the management of a European/Ramsar site, is to have a LSE on a European/Ramsar site (directly, indirectly, alone or in-combination with other plans, projects or activities), then an Appropriate Assessment (AA) of the implications of that site in view of that site's Conservation Objectives must be undertaken by the competent authority. The HRA process, comprising Stage 1 (HRA Screening) and, if required, Stage 2 (AA), must be carried out before consent or authorisation can be given for the proposed development and there is no regulatory timescale for the competent authority to provide a HRA consent.

2.7.6 The Offshore HRA process will be progressed alongside the EIA, but it will be reported upon separately. The EIA and HRA will draw from, and cross reference, similar ecological information. The HRA Offshore Screening Report (MMH-GBE-A004-CNT-0003) will be submitted to MS-LOT alongside this Offshore Scoping Report, detailing the outcome of LSE screening on the qualifying features of relevant European sites for the proposed development.

Nature Conservation Marine Protected Areas (NC MPAs)

2.7.7 Under the Marine (Scotland) Act 2010 and the Marine and Coastal Access Act 2009, MS-LOT is required to consider whether a licensable activity can affect (other than insignificantly) a protected feature of an NC MPA or any protected ecological or geomorphological process on which the conservation of any protected feature of an NC MPA is dependent. Impacts on relevant NC MPAs will be considered within the EIAR.

European Protected Species (EPS)

2.7.8 EPS are animals and plants listed within Annex IV of the Habitats Directive and as such protected under the Habitats Regulations. Under these Regulations certain activities likely to cause disturbance or injury to EPS (e.g., through the introduction of underwater noise) which would otherwise constitute an offence, can be carried out legally under an EPS Licence, as follows:

2.7.9 Within 12 nm of the coast (Scottish Territorial Water): An EPS Licence may be required under the Conservation (Natural Habitats, &c) Regulations 1994 (as amended) where there is potential for the presence of vessels or underwater noise from the proposed survey activities to injure or cause disturbance to an EPS. EPS Licences are granted by NatureScot (for

scientific research) or MSLOT on behalf of the Scottish Ministers (e.g., for commercial activities such as geophysical surveys).

2.7.10 Outside 12 nm (Scottish Offshore Region): An EPS Licence may be required under the Conservation of Offshore Marine Habitats and Species Regulations 2017 where there is potential for the presence of vessels or underwater noise from the proposed survey activities to injure or cause significant disturbance to an EPS (population level effect rather than individual animals). MS-LOT is the licencing authority for EPS Licences.

2.7.11 The Developer will apply for EPS Licences as appropriate, including for relevant works associated with the proposed development. Should additional pre-construction licences be required (e.g., survey works), these will be discussed and agreed with the relevant consenting authority during the pre-construction phase of the proposed development.

Basking Shark

2.7.12 Basking sharks (*Cetorhinus maximus*) are protected under section 4A and Schedule 5 of the Wildlife and Countryside Act 1981 (as amended) which prohibits the killing, injuring or taking by any method of those wild animals listed on Schedule 5 of the Act. The Nature Conservation (Scotland) Act 2004, Part 3 and Schedule 6 make amendments to the Wildlife and Countryside Act 1981 (as amended), strengthening the legal protection for threatened species to include 'reckless' acts. The Act makes it an offence to intentionally or recklessly disturb basking sharks.

2.7.13 Licensing requirements under the Wildlife and Countryside Act 1981 (as amended) are similar to those for EPS described above. For basking sharks, a licence is required for commercial survey activities (e.g., geophysical surveys) and MS-LOT (on behalf of the Scottish Ministers) is the licensing authority under sections 16 and 16A of the Wildlife and Countryside Act 1981 (as amended).

Priority Marine Features (PMF)

2.7.14 In July 2014, Scottish Ministers adopted a list of 81 priority marine features (PMFs), many of which are features characteristic of the Scottish marine environment. The list, which covers a variety of habitats and species that are a priority for conservation in Scotland's seas, was developed by Marine Scotland, the Joint Nature Conservation Committee (JNCC) and Scottish Natural Heritage (SNH)1. PMFs include a range of intertidal and continental shelf habitats, deep sea habitats, mammals, fish, shellfish, and other invertebrates.

2.8 Relevant UK and Scottish Marine Policy

2.8.1 Various policy documentation is available from the UK/Scottish Government and from industry leaders which will be used to inform the EIA process. Table 2-1 sets out the key policy documents that will be reviewed as part of the EIA.

Table 2-1: Key UK and Scottish Marine Policy.

Subject Matter	Policy
All topic areas	UK Renewable Energy Roadmap: 2013 update (HM Government, 2013) UK Clean Growth Strategy (2012) (HM Government, 2017) UK Industrial Strategy (2017) (HM Government, 2017) UK Marine Policy Statement (HM Government, 2011) National Planning Framework 3 (Scottish Government, 2014) National Planning Framework 4 (Scottish Government, 2023) Scottish Planning Policy (Scottish Government, 2014) National Marine Plan (Scottish Government, 2015) Sectoral Marine Plan for Offshore Wind Energy (Scottish Government, 2020) Scottish Electricity Generation Policy Statement (Scottish Government, 2013) Scottish Energy Strategy (Scottish Government, 2017) Climate Change Plan, Third on Proposals and Policies (2018-2032) (Scottish Government, 208a) and update (Scottish Government, 2020)
Ornithology	The European Biodiversity Strategy for 2030 (European Commission, 2020) The Scottish Biodiversity Strategy (Scottish Government, 2022)
Marine Mammals	Scottish Priority Marine Features (NatureScot, 2020) The Scottish Biodiversity Strategy (Scottish Government, 2022)
Benthic Ecology	As above for Marine Mammals
Landscape and Seascape	Position Statement on Renewable Energy and the Natural Heritage (SNH, 2014)
Commercial Fishing	Assessments have referred to general policy and topic specific guidance rather than topic-specific policy

3 Proposed Development Description

3.1 Introduction

3.1.1 This chapter provides an overview of the key components of the proposed development design. The sections below detail the key parameters of the offshore infrastructure and provide a summary of the various activities associated with the construction, O&M and decommissioning phases of the proposed development.

3.2 Design Envelope Approach

3.2.1 As details of particular design components require further refinement, the Developer has adopted a design envelope approach to impact assessment (also known as a 'Rochdale Envelope'). In line with guidance from the Scottish Government (2022), the design envelope approach offers flexibility in the EIA process by enabling impact assessment to be carried out against several potential design options. On the condition that sufficient detail is provided, impact assessment can be undertaken against the worst-case design parameters identified from design options. This approach enables developers to meet the requirements of the EIA Regulations for Section 36 of the Electricity Act 1989 consent applications whilst the final detailed design for a project is still to be defined.

3.2.2 This chapter provides an indicative overview of the design options being considered for each of the key design components. Within each option, a range of values is provided for the key technical parameters which are considered influential to the relevant source-pathway-receptor relationships identified for the proposed development. From this range of values, a worst-case scenario will be established for each of the impact pathways which are scoped in for impact assessment within the EIAR.

3.2.3 Initial details on the key components for the proposed development are provided in the sections below. These parameters are indicative and will be refined as the proposed development progresses through the planning and development phase. The design envelope provided in the EIAR will provide additional details on key components of the proposed development as a reflection of design decisions made in the intervening period between Scoping and consent application submission. These design decisions will be informed by the stakeholder engagement, environmental survey work, and technical and engineering studies, all of which support the EIA Process.

3.3 Project Overview

3.3.1 The Project is split into four distinct areas, which are detailed below and depicted in Table 3-1.

1. **Array Area**: This is the offshore energy generation site, where the following key infrastructure is located:
   - Up to 67 WTGs;
   - Up to 67 WTG foundations, including their anchors & mooring lines;
   - Up to 250 km of IACs, which connect the individual WTGs to each other and then to the OEPs, and interconnectors linking OEPs;
   - Up to three OEPs, where the IAC transition to the export cables.

   The closest point of the Offshore Wind Farm Array Area is approximately 63 km due east of Peterhead, with water depths between 60 and 100 m below Lowest Astronomical Tide (LAT). The area itself is approximately 200 km^2.

2. **Offshore ECC:** This is the offshore area containing the export cables which connect the Array Area to the grid connection point on the Scottish mainland:
   - The Offshore ECC includes all the export cabling seaward of MHWS to the limit of the Array Area.
   - There are up to three export cables, each up to 120 km in length.
3. **Intertidal Area:** This is the area between MHWS and MLWS where the export cable transitions towards landfall and the onshore infrastructure.
4. **Onshore Export Cable Corridor & Onshore Substation**: These areas are all located landward of MLWS and are therefore considered as a part of the Onshore Scoping Report.

3.3.2 Details on onshore design elements are provided in the Onshore Scoping Report.

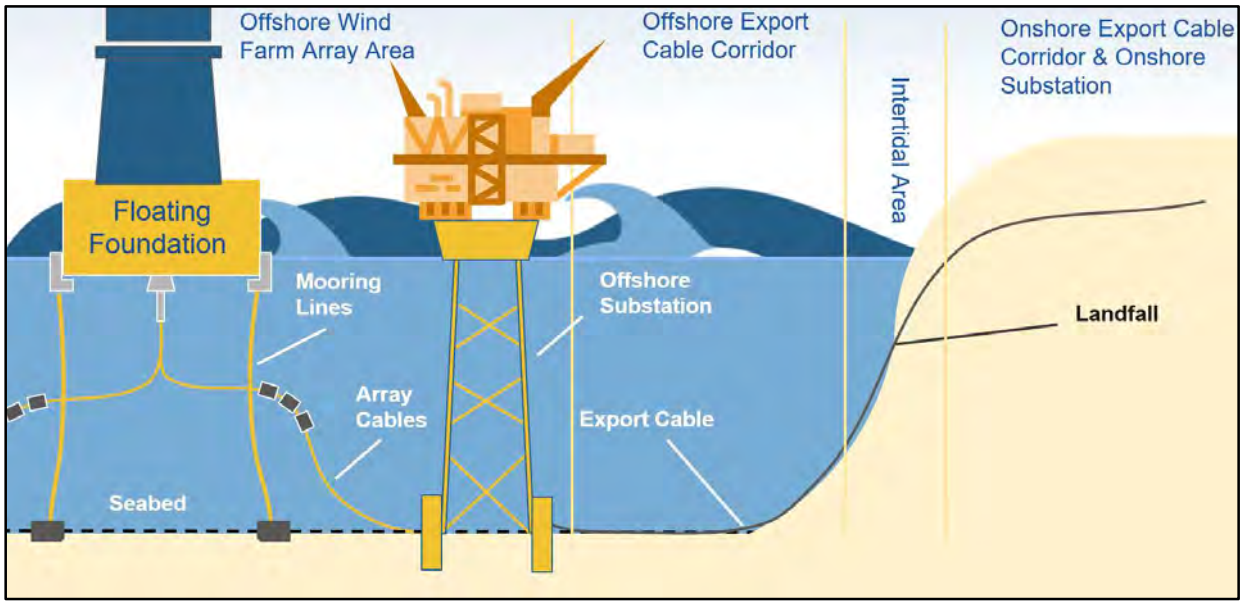


Figure 3-1: Project Overview

3.4 Identification of the Scoping Boundary for the Proposed Development

3.4.1 For the purposes of onshore EIA Scoping, an extensive onshore area of search around Peterhead, Aberdeenshire has been identified, within which it is anticipated that onshore elements of the Project will be constructed. The onshore scoping boundary has been informed by the identified options for the location of a new 400 kV substation in the Peterhead area, as published by SSEN, and potential landfall locations identified by the project team. The Offshore ECC has been identified in parallel with the onshore scoping boundary to ensure a joined up approach.

3.4.2 The Project is within the scope of the Holistic Network Design Follow-Up Exercise (HNDFUE). The National Grid Electricity System Operator (ESO) is responsible for the Holistic Network Design (HND) process which encompasses all ScotWind projects. It is an evolution of the traditional grid connection process which considers offshore and onshore transmission reinforcements in the round and out-turns a HND optimised for least-cost least-impact for Great British consumers and communities.

3.4.3 In addition to the need to link up with onshore cables, there are a number of factors influencing the positioning of the offshore export cables from the Array Area to the potential landfall locations within the onshore scoping boundary. These include aspects relevant to gaining regulatory consents and licenses, as well as factors relating to cable installation and protection. A number of environmental and technical constraints are being considered through the optioneering process; these include, but are not limited to constraints such as other OWFs, oil and gas infrastructure, designated sites, sensitive features, and commercial and recreational activities. It is important to note that the reasoning behind the split of the offshore ECC into two sections moving towards landfall is in order to avoid the Hywind Scotland OWF.

3.4.4 Whilst the routeing work for the proposed development is ongoing, factors including but not limited to the above are being considered in order to identify an offshore cable route that reduces, and where possible avoids, likely significant effects on the environment. Further detail on the optioneering and final route identification will be provided in the EIAR.

3.5 Key Design Components

3.5.1 This section provides details on the key design components for the proposed development, including those associated with energy generation, conversion, and transmission.

Wind Turbine Generators (WTGs)

3.5.2 The WTGs convert wind energy to electricity and consist of rotor blades, towers, gearboxes, transformers, power electronics and control equipment. WTG technology is constantly evolving, and several design options are currently under consideration by the Developer. The selection of the final model of WTG will be informed by the consultation and engagement undertaken during the EIA process.

3.5.3 All the WTG models being considered follow the traditional WTG design with three blades and a horizontal rotor axis. The blades will be connected to a central hub, forming a rotor which turns a shaft connected to the generator or gearbox (if required). The generator and gearbox will be located within a containing structure known as the nacelle, which is situated adjacent to the rotor hub. The nacelle will be supported by a tower structure affixed to the foundation, either directly or via a transition piece. A Supervisory Control and Data Acquisition (SCADA) computer system monitors and controls the output from each wind turbine. WTG lighting and navigation markings will adhere to best practice guidance and a detail methodology for their implementation will be developed in consultation with statutory and relevant stakeholders following consent determination.

3.5.4 Determining the optimum WTG layout is an iterative process, ensuring effective use of the available wind resource and the environmental effects and impacts on other marine users are kept to a minimum. Additional constraints include suitability of seabed conditions, metocean conditions, foundation/mooring/anchoring requirements, and navigational safety conditions. Confirmation of the final layout of the wind turbines will occur at the final design stage post-consent and in consultation with relevant stakeholders.

3.5.5 A WTG overview is presented in Figure 3-2 with key parameters in Table 3-1.

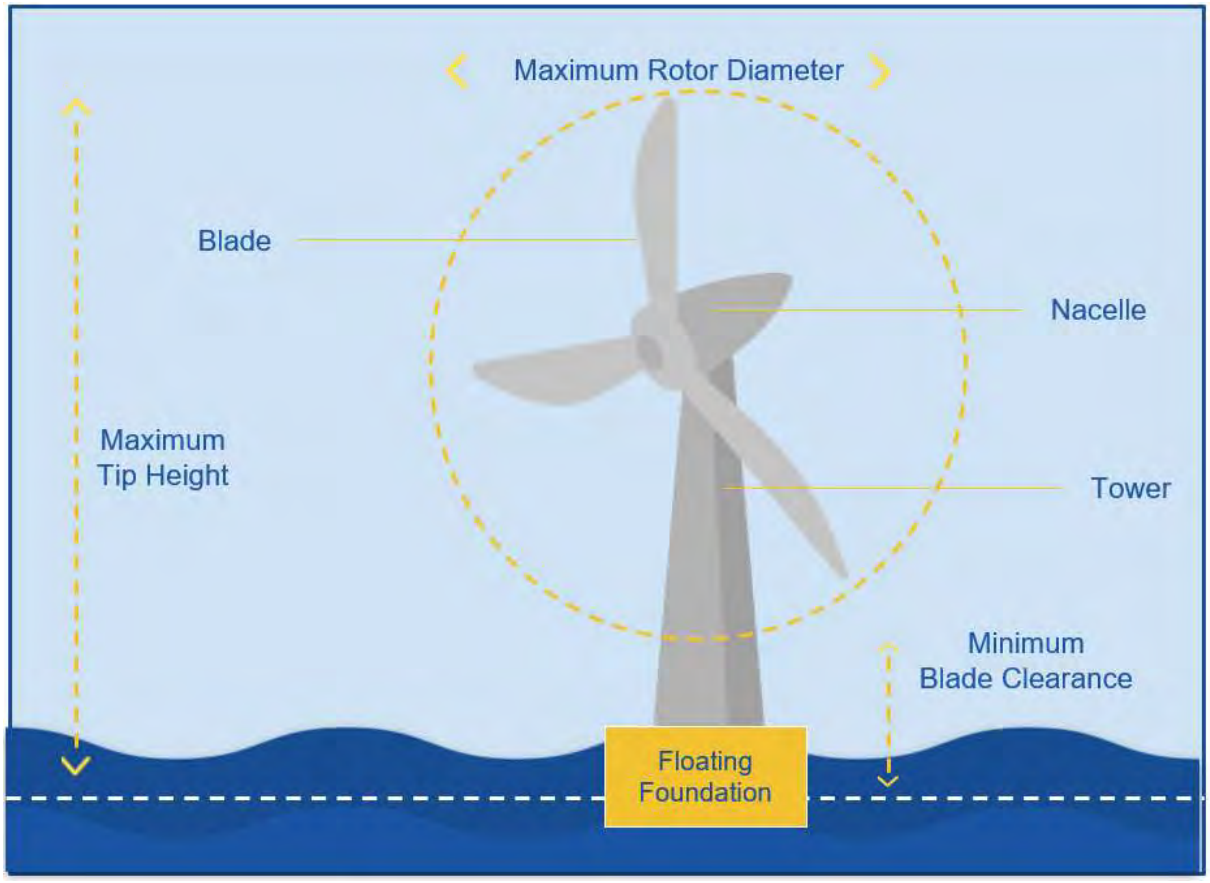


Figure 3-2: WTG Overview

Table 3-1: Anticipated WTG Maximum Design Scenario.

WTG Parameter	Maximum Design Envelope
Number of WTGs	≤ 67
Blade Tip Clearance [to MSL]	≥ 30m
Hub Height [to MSL]	≤ 195m
Rotor Diameter	≤ 300m
Maximum Tip Height (to MSL)	≤ 340m
Spacing between WTGs	≥ 1000m

3.6 Floating Foundations

3.6.1 The WTGs will be supported by a floating foundation with associated mooring and anchoring systems to keep the foundation 'on station'. There are a number of floating foundation types or 'topologies' under consideration by the project, which are illustrated in Figure 3-3; they include: Semi-Submersible, Barge, Tension Leg Platform (TLP), Spar, Multi-Tower Semi-

Submersible, Buoy and Semi-Spar. Each topology has a different method of ensuring the stability of the foundation to support the energy production of the WTG and they come in a range of sizes as presented in Table 3-2. Selection of the final foundation topology will occur post-consent as part of the engineering refinement of the optimised solution for the proposed development.

3.6.2 Floating foundations have several specific items which are being considered by the Developer such as active ballasting systems to maintain the foundation on an even keel and station keeping monitoring to ensure the foundation remains within the expected excursion radius.

3.6.3 Other typical components of foundations may include boat landings, ladders, a davit crane, wave monitoring equipment and closed caption television (CCTV).

3.6.4 The main foundation material will be either steel or concrete, which will be determined via the ongoing design development process.

3.6.5 The method of corrosion protection for the foundations will be either via sacrificial anodes or an Impressed Current Cathodic Protection (ICCP) system.

3.6.6 The method for foundation lighting and navigation marking will be developed with consultees post-consent decision, in accordance with industry best practice.

3.6.7 Floating foundation key parameters are presented in Table 3-2.

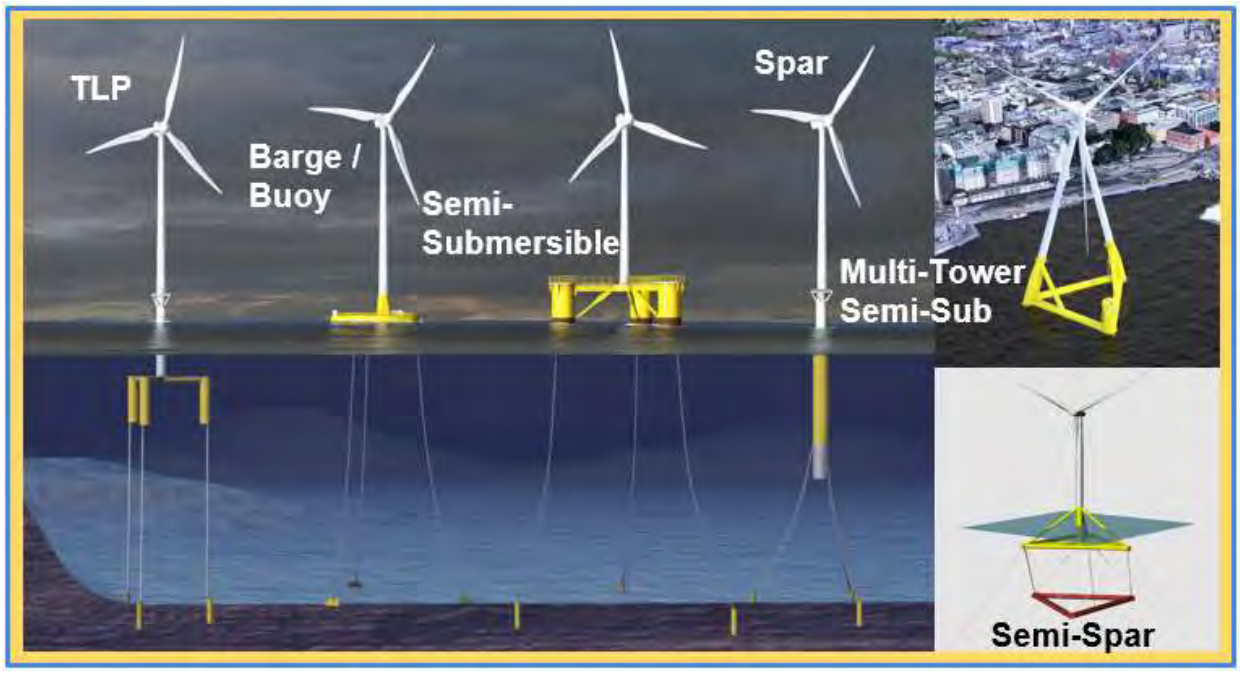


Figure 3-3: Foundation Topologies Overview.

Table 3-2: Anticipated Foundation Maximum Design Scenario.

Foundation Topology	Foundation Parameter	Maximum Design Envelope
Semi-Submersible	Dimensions (L x W x H)	≤ 140x140x60m
	Operational Draught	≤ 30m
	Height Above MSL	≤ 30m
Barge	Dimensions (L x W x H)	≤ 100x100x30m
	Operational Draught	≤ 30m
	Height Above MSL	≤ 30m
Tension-Leg Platform (TLP)	Dimensions (L x W x H)	≤ 140x140x90m
	Operational Draught	≤ 60m
	Height Above MSL	≤ 30m
Multi-Tower Semi-Submersible	Dimensions (L x W x H)	≤ 150x150x75m
	Operational Draught	≤ 30m
	Height Above MSL	≤ 30m
Buoy	Dimensions (L x W x H)	≤ 100x100x60m
	Operational Draught	≤ 30m
	Height Above MSL	≤ 30m
Spar	Dimensions (L x W x H)	≤ 30x30x200m
	Operational Draught	≤ 100m
	Height Above MSL	≤ 100x100x60m
Semi-Spar	Dimensions (L x W x H)	≤ 140x140x100m
	Operational Draught	≤ 70m
	Height Above MSL	≤ 30m

3.7 Mooring & Anchoring

3.7.1 The mooring and anchoring systems keep the foundation 'on station', essentially maintaining the position of the WTG and foundation within a nominal certain excursion radius. The excursion radius is the movement of the floating foundation around the "nominal" WTG centre location, which is a natural phenomenon of any moored structure. In order to ensure asset integrity, the proposed development may use monitoring systems for the mooring and anchoring setup across a selection of structures within the array area.

3.7.2 There are several mooring configurations under consideration for the proposed development, each with unique technical attributes, which are depicted in Figure 3-4. The tension mooring configuration is specific to the TLP foundation type, whilst the other mooring configuration options may be applied across the remaining foundation topology options. The other mooring configurations are likely to include a length of mooring line running along the seabed, which is a key part of stabilising the foundation, along with the anchoring setup.

3.7.3 Each mooring line is connected to an anchor at the seabed, with the anchor types under consideration for the proposed development illustrated in Figure 3-5. The anchor type used for the proposed development is highly dependent on the soil conditions at the array area and will be developed as part of the engineering refinement process. It is foreseeable that different anchoring solutions may be required if there is a large variance in soil conditions across the site.

3.7.4 Depending upon the prevailing soil conditions at the offshore site and the anchor type, scour protection may be required to prevent erosion of the seabed sediments around the anchor location. Scour protection can be via the placement of rock, rock bags, concrete mattresses, or frond mattresses.

3.7.5 Key parameters for mooring and anchoring are presented in Table 3-3.

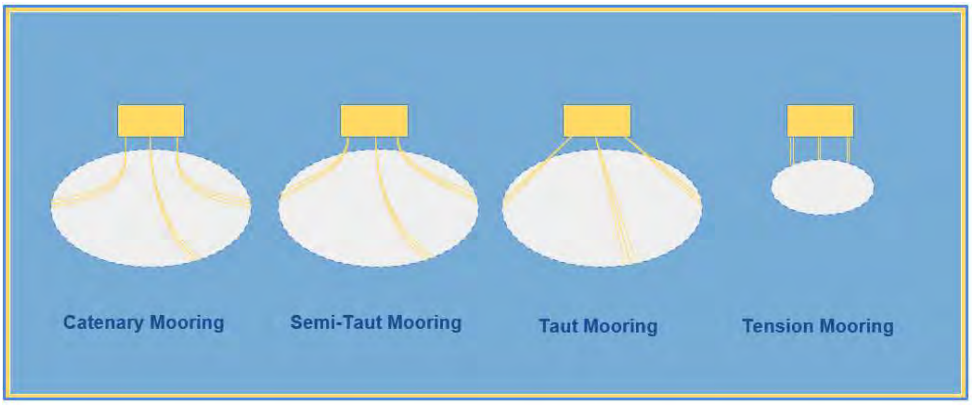


Figure 3-4: Mooring Configurations Overview

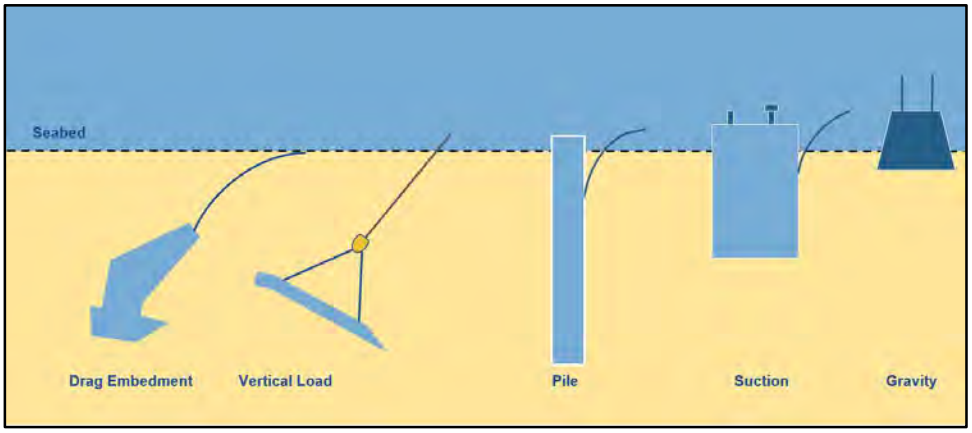


Figure 3-5: Anchoring Types Overview

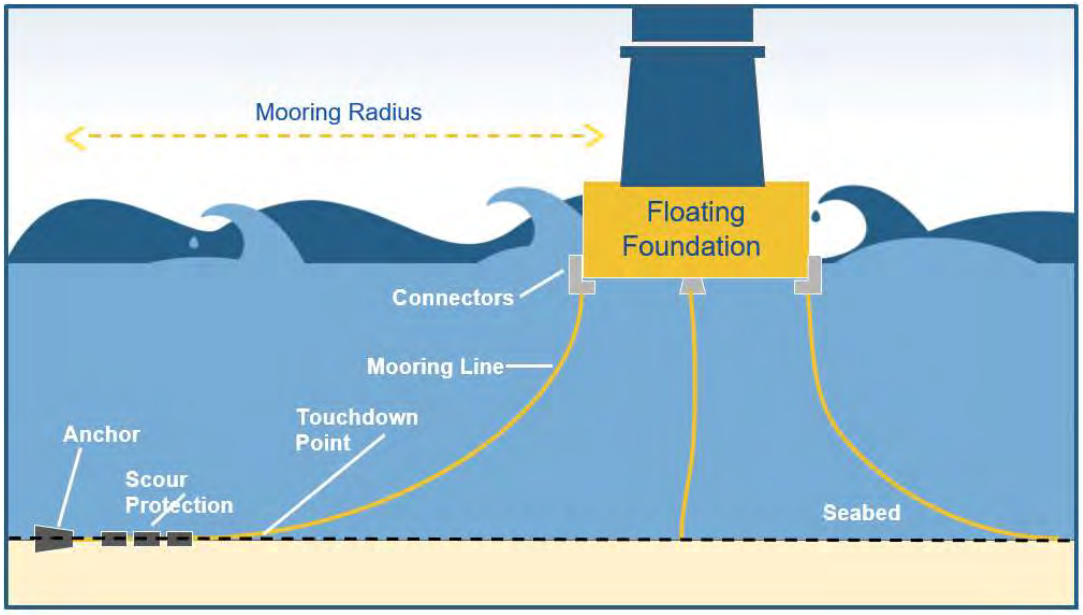


Figure 3-6: Foundation & Mooring System Overview

Table 3-3: Anticipated Mooring and Anchoring Maximum Design Scenario.

Mooring & Anchoring Parameter	Maximum Design Envelope
Mooring Line Type	Catenary Semi-Taut Taut Tension-Leg
Number of Mooring Lines	≤ 12 per floating foundation
Mooring Line Radius	≤ 1500m
Mooring Line Materials	Chain, Wire Rope, Synthetic Rope, or other materials may still be considered at this stage
Anchoring Method	Drag-embedded Vertical-load Pile (driven or drilled/drilled & grouted) Suction Gravity
Number of Anchors	≤ 12 per floating foundation
Anchor Seabed Footprint	Pile Diameter = ≤ 14m [applicable to piles & suction anchors] Definition of seabed footprint for other anchoring methods is part of engineering design refinement for the EIA application.
Anchor Penetration	≤ 70m

Inter-Array Cables (IACs)

3.7.6 The IACs connect the individual WTGs together and subsequently to the OEPs, typically in 'strings' of WTGs connected together with IACs. The setup of the strings of IAC is highly dependent upon the WTG layout and as such will be defined at the final design stage post-consent. It is likely that pairs of strings will have a "looped" connection at each end to connect them together, which is to allow for continued energy production when one of the floating foundations within the string is undergoing maintenance. The IACs are made up of conductors, insulation, filler and armouring, with an example cross section shown in Figure 3-7.

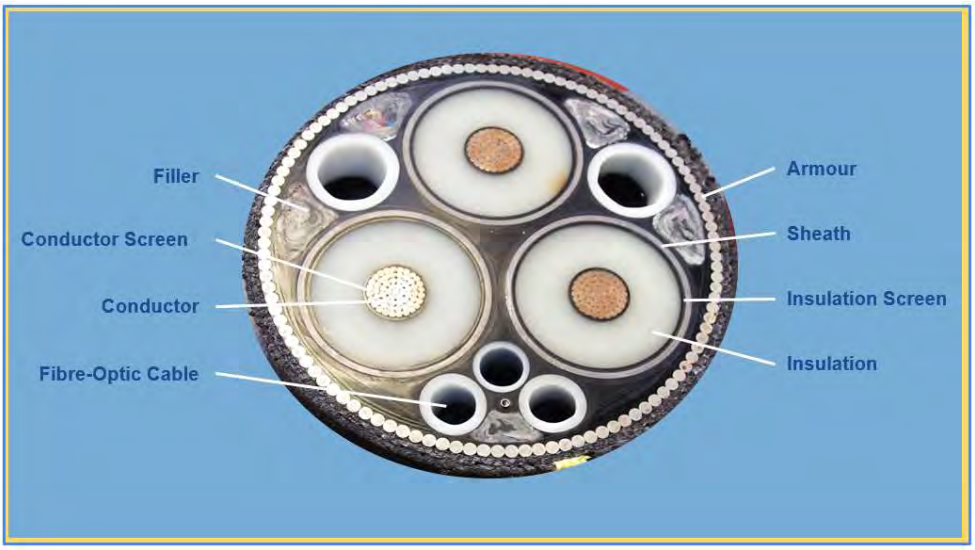


Figure 3-7: Example IAC Cross Section

3.7.7 As the foundations for the WTGs are floating, the IACs are 'dynamic' cables; this is because within the water column the cable needs to be flexible to accommodate the movement of the floating foundation. When the cables touch down onto the seabed they become 'static' and functionally similar to IACs for fixed-bottom offshore wind projects. An overview of dynamic IAC configurations is shown in Figure 3-8, including "lazy wave" and "tethered wave" (same as lazy wave but with a tether at the seabed) arrangements.

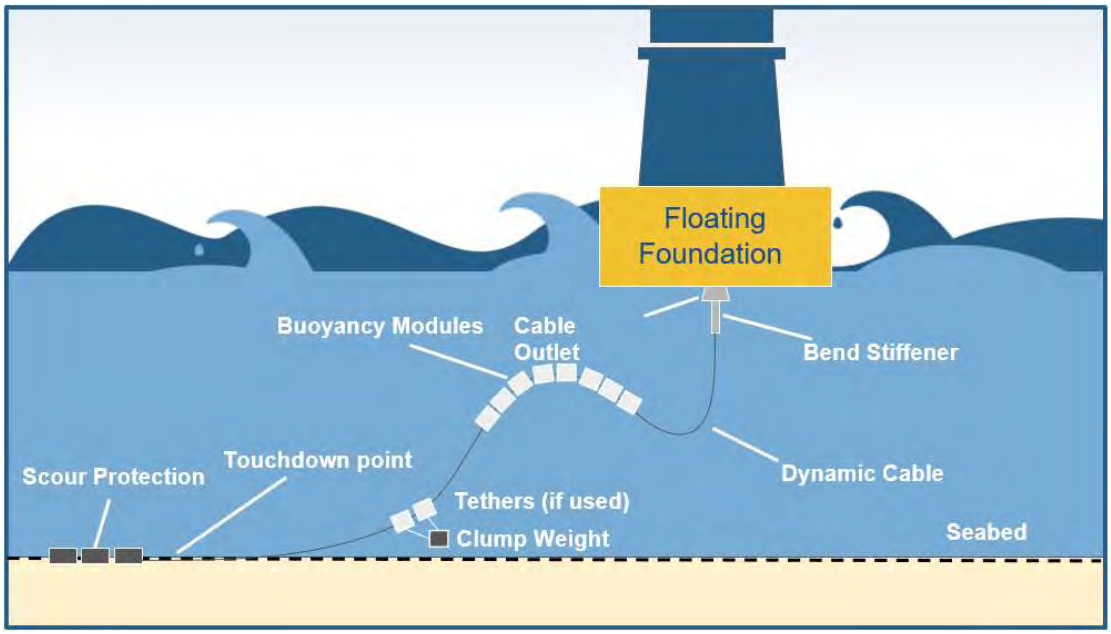


Figure 3-8: Example Dynamic IAC Arrangement

3.7.8 The IACs will be buried after the touchdown point onto the seabed. A detailed cable burial depth of lowering assessment will be undertaken to inform the Cable Burial Risk Assessment (CBRA) for the proposed development, in line with the relevant legislation and best practice guidance (e.g., Carbon Trust, 2015). The aim of the CBRA is to identify the depths of burial required to ensure snagging risks are suitably mitigated, based on technical, environmental, and societal factors, such as cable dimensions, localised seabed conditions, and area use by fishing and shipping vessels. If the optimum burial depth identified by the CBRA is not achieved during cable laying, then additional protection will be installed. Scour protection may also be required at the touchdown points of the IACs.

3.7.9 The maximum design scenario for the IACs, including metrics, materials, and installation and protection methods are provided in Table 3-4.

Table 3-4: Anticipated IAC Maximum Design Scenario.

IAC Parameter	Maximum Design Envelope
System Voltage	≤ 132kV
Conductor Material	Copper or Aluminium
Total Cable Length	≤ 250km
Cable Diameter	≤ 250mm
Cable Trench Width	≤ 5m
Cable Burial Depth	Typically, 1-2m
Cable Burial Techniques*	Jet Trenching Mechanical Trenching

IAC Parameter	Maximum Design Envelope
*Subject to CBRA output	Ploughing Mass Flow Excavation
Cable Protection / Additional Burial Materials* *Subject to CBRA output	Rock Placement Concrete Mattresses Grout/Rock Bags Frond Mattresses
Seabed Touchdown Point	Bend Restrictors or a Tether may be required. Scour Protection may be required (materials same as Additional Burial Materials above)

Offshore Electrical Platform (OEP)

3.7.10 The OEP is the location in which the electricity carried by the IACs is unified, transformed and then transmitted landward by the Offshore export cables.

3.7.11 Elements of the OEP design will be influenced by the type of current to be transmitted by the Offshore export cable infrastructure. The most likely scenario for the proposed development is an High Voltage Alternating Current (HVAC) OEP. However, the option of utilising a High Voltage Direct Current (HVDC) is additionally being considered by the Developer.

3.7.12 It is anticipated that an HVAC platform would be unmanned during operations, whereas an HVDC platform may require personnel on board. At this stage it is not considered that any reactive compensation platforms would be required along the Offshore export cable route to support energy transmission.

3.7.13 The OEP will either be designed as an above-sea (surface) platform with a fixed-foundation or as a subsea OEP, which lies on the seabed and does not include topsides. If more than one OEP is used by the proposed development, additional IACs are anticipated to run between each OEP in order to provide additional security of electrical supply.

3.7.14 The surface foundation designs under consideration for the fixed-foundation option are depicted in Figure 3-9. Topside and foundation parameters for this option are presented in Table 3-5 and Table 3-6 respectively.

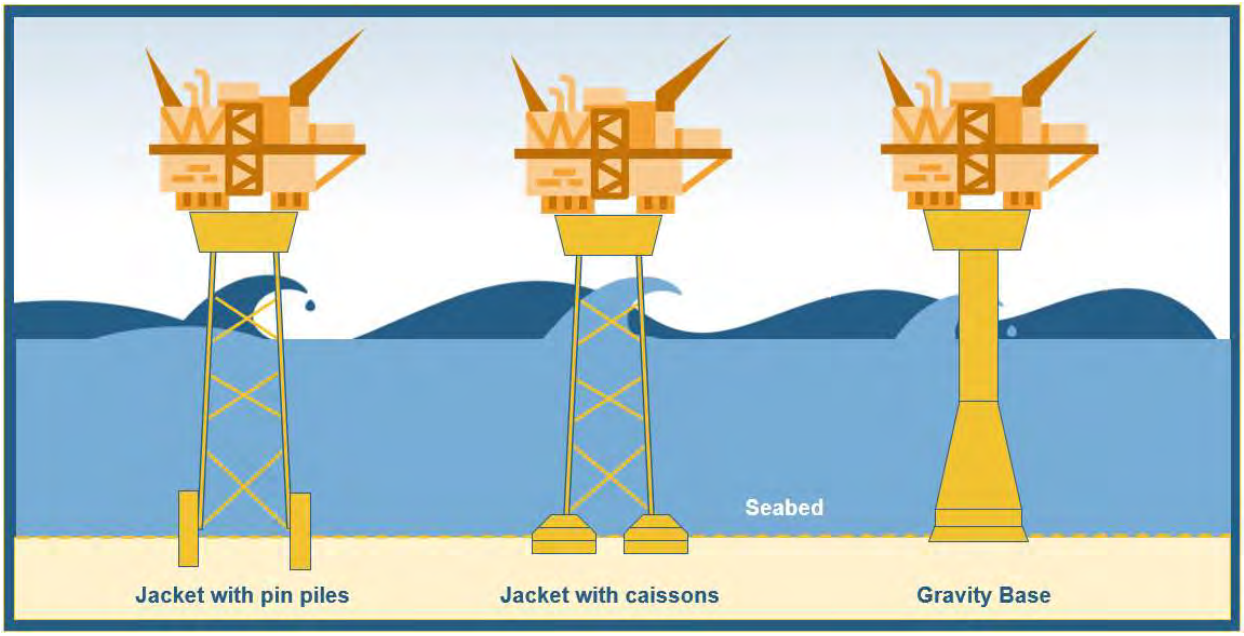


Figure 3-9: Example Surface OEP Foundations and Topside

Table 3-5: Anticipated Surface OEP Topside Maximum Design Scenario

OEP Topside Parameter	Maximum Design Envelope	
	HVAC	HVDC
Number of Platforms	1-2	1
Topside Length	≤ 60m	≤ 60m
Topside Width	≤ 50m	≤ 70m
Topside Height Above HAT (excluding crane antennas & helideck)	≤ 60m	≤ 60m

Table 3-6: Anticipated Surface OEP Foundation Maximum Design Scenario

OEP Foundation Parameter	Maximum Design Envelope	
	HVAC	HVDC
Jacket Seabed Footprint	≤ 60x60m	≤ 70x70m
Number of Jacket Legs	≤ 6	≤ 8
Number of Piles per Leg	≤ 2	≤ 3
Pile Diameter [Driven, Drilled or Drilled & Grouted Piles]	≤ 4m	≤ 5m

OEP Foundation Parameter	Maximum Design Envelope	
	HVAC	HVDC
Pile Penetration [Driven, Drilled or Drilled & Grouted Piles]	≤ 80m	≤ 100m
Suction Caisson Diameter	≤ 14m	≤ 14m
Suction Caisson Penetration	≤ 30m	≤ 40m
Gravity Base Seabed Diameter	≤ 70m	≤ 80m

3.7.15 As an alternative to a fixed surface platform, subsea OEPs are also under consideration by the Developer. This technology is less mature for offshore wind but is used in lower voltages for oil and gas infrastructure. Figure 3-10 and Table 3-7 provide an overview of the relevant design parameters for a Subsea OEP.

Figure 3-10: Example of a Subsea OEP

Table 3-7: Anticipated Subsea OEP Maximum Design Scenario

Subsea OEP Parameter	Maximum Design Envelope
Number of Platforms	≤ 3
Dimensions (L x W x H)	≤ 40x40x15m
Number of Piles per Platform	≤ 8
Pile Penetration [Driven, Drilled or Drilled & Grouted Piles]	≤ 25m

Offshore Export Cable

3.7.16 Offshore export cables transmit the transformed electricity from the OEP to the landfall area(s), where they are adapted and connect to the grid via the Onshore export cables. A maximum of three Offshore export cables are being considered as a part of the proposed development design.

3.7.17 The Offshore export cable options include both HVAC and HVDC options, and the selected design will influence the OEP design (see paragraph 3.7.11). Any seabed assets, such as cables and pipelines, which are crossed by the Offshore export cable will have a specific crossing design which will be agreed with the asset owner in advance of installation through a cable crossing agreement.

3.7.18 The Offshore export cable(s) are expected to be buried along the majority of their length, with optimum cable burial depth informed by the detailed depth of burial assessment undertaken as a part of the CBRA for the Project (see also paragraph 3.7.8). If the optimum burial depth identified by the CBRA is not achieved during cable laying, then additional protection may be installed. Scour protection may also be required at the Offshore export cable(s) touchdown point(s) near the OEP.

Table 3-8: Anticipated Export Cable Maximum Design Scenario

Export Cable Parameter	Maximum Design Envelope	
	HVAC	HVDC
Number of Export Cables	≤ 3	≤ 2
System Voltage	≤ 275 kV	≤ 320 kV
Total Cable Length	≤ 120 km per cable ≤ 360 km total	≤ 120 km per cable ≤ 240 km total
Individual Cable Diameter	≤ 310 mm	≤ 200 mm
Cable Trench Width	≤ 5 m	≤ 5 m
Cable Burial Depth	≤ 4 m	≤ 4 m
Cable Burial Techniques* *Subject to CBRA output	Jet Trenching Mechanical Trenching Ploughing Mass Flow Excavation	
Cable Protection / Additional Burial Materials* *Subject to CBRA output	Rock Placement Concrete Mattresses Grout/Rock Bags Frond Mattresses	

3.8 Project Programme

3.8.1 This section summarises the key project activities across all phases of the Project's lifecycle.

3.8.2 A high-level schedule of the Project phases is shown in Figure 3-11. Note that Decommissioning phase follows the end of the Operations phase.

Figure 3-11: Project Schedule

Development Phase

3.8.3 The development phase for the proposed development focuses on planning and design. This phase is ongoing and offshore activities to date have supported development and consent through data collection and contracted surveys, engineering refinement and detailed design. This phase of the proposed development also covers the initiation of procurement activities to facilitate the construction phase which follows the development phase.

Construction Phase

3.8.4 The offshore construction phase is expected to last approximately four years and is typically based on 24-7 operations when weather conditions allow. There are likely to be a number of pre-construction surveys which will be undertaken in the Array Area and Offshore ECC, such as geophysical, geotechnical and unexploded ordnance (UXO) surveys. If required as a result of these pre-construction surveys, boulder and UXO clearance activities may also be undertaken. During the offshore construction phase appropriate construction lighting, marking and aids to navigation will be deployed in agreement with the relevant stakeholders and guard vessels will be deployed. Helicopters may be used during the construction phase for transfer to vessels or assets.

Foundation & WTG Construction Overview

3.8.5 Anchor and mooring installation is expected to be completed as a part of the pre-construction site preparation campaign, which will be completed prior to the foundations and WTGs being installed. This enables foundation and WTG installation activities to be completed in benign weather conditions and optimises the overall construction process, including reducing the number of vessels required on site. The anchors and mooring lines may, therefore, be installed one to two years prior to connection with the foundations and WTGs. An alternative method is to install the moorings and anchors "just-in-time" alongside the foundations and WTGs. If any scour protection is required for the anchors and moorings, this will either be installed as part of the pre-construction campaign or may be combined with the IAC installation activities.

3.8.6 The foundations are likely to be assembled or marshalled in a large construction port. Once assembly is completed, they will be floated-off to free up quayside and storage space at the port facility. The method of float-off will be determined as part of the proposed development's detailed engineering phase; however, this activity will potentially include use of cranes, slipways, submersible platforms, and semi-submersible vessels. Once float-off is complete,

the foundations will be 'wet stored' in a suitable sheltered area which is expected to be in the vicinity of the port facility. Wet storage will be used to build up a reserve of completed foundations prior to their integration with the WTGs. This method of assembly is currently being employed for drilling rigs in the Cromarty Firth. It is anticipated that foundations may be wet stored for up to two years.

3.8.7 The WTG components are expected to be marshalled to a suitable port facility, in a similar manner to the method for fixed bottom offshore wind. The main difference with floating wind is that the integration of the WTG onto the foundation is anticipated to take place at the port facility rather than the Array Area. The WTG integration is likely to take place via a large 'ring crane' at the quayside, although an alternative is for a Jack-Up Vessel (JUV) to perform the WTG integration, either adjacent to the quayside or in a nearby sheltered location. During the WTG integration process the foundation may either remain floating or may be 'grounded' on the seabed to provide a stable base for lifting. The fully integrated WTG and foundation will also be wet stored prior to offshore installation, again to build up a buffer and also to complete any relevant initial commissioning activities. It is anticipated that the fully integrated WTG and foundation may be wet stored for up to one year.

3.8.8 The final phase is to tow-out the fully integrated WTG and foundation unit to the Array Area and hook-up to the mooring lines. The IAC installation and the commissioning and energisation process will then follow.

3.8.9 During this phase Anchor Handling Tug Supply (AHTS) vessels, towing tugs, harbour tugs, Installation Support Vessels (ISVs), Crew Transfer Vessels (CTVs) and rock placement vessels are anticipated to be required.

3.8.10 An example overview of the foundation and WTG construction process is shown in Figure 3-12.

Figure 3-12: Example Foundation & WTG Construction Process Flow

3.8.11 An alternative to the above-described process is for a "floating to floating" installation method, whereby foundations are directly deployed to the Array Area from a barge or Heavy Transport Vessel (HTV) using a Heavy Lift Vessel (HLV) and connected to the mooring lines. A HLV could also then be used to directly install the WTG onto the foundation.

IAC Construction Overview

3.8.12 The IACs may be marshalled at a suitable port facility on reels or carousels or will be loaded onto vessels direct to the Array Area, depending upon the manufacturing location. It is expected that pre-lay grapnel-runs (PLGR) will take place to prepare the seabed prior to IAC installation. To optimise the installation process, there is the potential that the IAC could be pre-installed and wet stored for up to 18 months, allowing a similar hook-up method to the fully integrated WTG and foundation as is anticipated for the moorings. The IAC will be buried along their static length and any additional protection installed. Following connection of the IAC to the fully integrated WTG and foundation, there is a period of termination and testing to complete the IAC installation.

3.8.13 For IAC installation, it is anticipated that Cable Lay Vessels (CLVs), AHTS vessels, Offshore Construction vessels (OCVs), ISVs, CTVs and rock placement vessels may be required.

OEP Construction Overview

3.8.14 The OEP foundation will be installed first using a HLV, with the foundation delivered to the Array Area on a barge or HTV. If piling and grouting operations are required (dependent upon the selected foundation solution), then these may be undertaken from the same HLV or a smaller OCV. The OEP topside installation is anticipated to follow the same installation vessel and delivery methods as for the foundation.

Offshore Export Cable Construction Overview

3.8.15 The Offshore export cable will follow a similar installation method to the IACs, with PLGR, installation and burial activities. The Offshore export cable will also potentially be pre-installed and wet stored for up to 18 months prior to pull in of the cables to the OEP.

3.8.16 Horizontal Directional Drilling (HDD) may be used as the cable makes landfall, with a section of the HDD commencing offshore. This is subject to detailed evaluation as part of the final Project design.

3.8.17 For Offshore export cable installation, it is anticipated that CLVs, AHTS vessels, OCVs, ISVs, CTVs and rock placement vessels may be required.

Energisation and Completions Activities Overview

3.8.18 It is expected that the energisation of WTGs will be phased across the Array Area, allowing connected WTGs to commence production of electricity as soon as is allowable following testing. To facilitate the commissioning and energisation activities on the OEP, a jack-up barge or similar platform to provide accommodation during the construction phase may be required.

3.8.19 Several construction completion activities will remain ongoing until the handover to operations is completed; these activities are expected to require ISV and CTV vessels.

Port Facilities During Construction

3.8.20 During the construction phase, several different port facilities may be required by the Project, dependent upon the final methodologies selected. Examples of potential port requirements are provided in Figure 3-13.

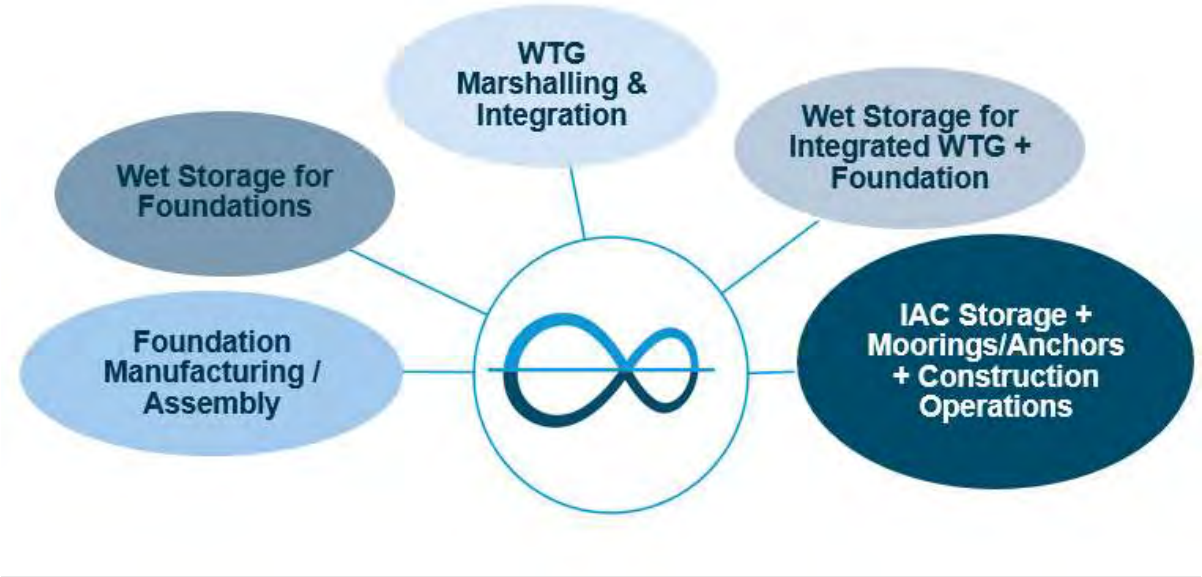


Figure 3-13: Potential Construction Port Requirements for the Project

Operations & Maintenance Phase

3.8.21 The O&M strategy for the proposed development is highly contingent upon the key infrastructure selected for the final proposed development design and will be confirmed post-consent.

3.8.22 It is anticipated that preventative, corrective, planned and unplanned maintenance activities will all be required. The associated 'day-to-day' O&M philosophy is anticipated to be undertaken by Service Operation Vessels (SOVs) based at the Array Area for a period and supported by CTVs and smaller workboats or 'daughter' craft within the field. Helicopter access will also be facilitated to the WTGs by means of a helihoist on the nacelle, as well as a helipad on the OEP. For major component replacement and large corrective maintenance issues, one advantage of floating wind is that the foundation and WTG can be disconnected from the mooring lines and IAC and towed-to-shore, allowing maintenance to be completed in a port facility. The vessels required for tow-to-shore would be the same as those for the tow-out and hook-up phase of construction (i.e., AHTS and relevant cable vessels).

3.8.23 It is expected that there will be a port serving as the main operations base for the proposed development on the East Coast of Scotland which will cover the 'day-to-day' O&M works, as detailed above. For any major component replacement activities requiring tow-to-shore, support from this main operations port facility will depend upon its size and ability to accommodate the dimensions of the floating foundation. There is potential that tow-to-port activities to support foundation maintenance may require a larger port facility.

3.8.24 As an alternative to the tow-to-shore method for major component replacement, innovative systems such as modular or climbing cranes on the WTG may be deployed. Additionally, a HLV or JUV could also be used for major component replacement.

3.8.25 The access methods to the offshore structures are anticipated to include (in no particular order): walk-to-work systems (i.e., using a gangway from a vessel directly to the offshore structure); personnel hoist systems; boat landings; and helicopter access.

3.8.26 Additional O&M support systems and vessels being considered by the proposed development include: the use of drones to support the O&M activities; offshore charging infrastructure within the Array Area to support low emissions vessels; and the use of autonomous vessels or Remotely Operated Vehicles (ROVs) to conduct regular maintenance surveys. It is noted that if Beyond Visual Line of Sight Aviation Drones are used, the Developer will work with stakeholders to ensure such operations comply within the legislation, regulations, standards and guidance appropriate at the time of operations.

3.8.27 Maintenance may also be required on cables (including repair), scour protection, as well as anchors and moorings. These activities would require cable vessels, rock placement vessels, supply vessels, offshore construction vessels and anchor handling vessels. The use of divers for maintenance and repair activities is not planned as the base case and would only be considered if there were no feasible alternatives.

Decommissioning Phase

3.8.28 The Energy Act 2004 and the Scotland Act 2016 contain statutory requirements for the decommissioning of offshore renewable energy installations (OREI) and require the Developer to provide a costed Decommissioning Programme for approval, prior to construction. Best practice will be followed by the proposed development for developing the Decommissioning Programme.

3.8.29 It is anticipated that the WTGs and their foundations will be removed in a reversal of their installation process, with the same anticipated for the OEP. Mooring lines for the foundations will also be removed along with all infrastructure above the seabed. For the IAC and export cables, the decommissioning options for the cables will be discussed with statutory and non-statutory stakeholders to ensure any potential impacts are minimised. This could include sections of the cable being left *in situ* to avoid unnecessarily disturbing the seabed but will be agreed with the relevant stakeholders.

4 Environmental Impact Assessment Methodology

4.1 Introduction

4.1.1 EIA is the process of systematically identifying the potential impacts that the proposed development could have on the environment. The process involves developing a detailed understanding of both the proposed development e.g., proposed installation, operation and decommissioning activities, and the environment within which the proposed development will be located. The potential impacts of the proposed development are then evaluated to determine how the proposed development would affect the environment, both individually and cumulatively with other proposed projects, and the significance of those impacts. Inter-related impacts as well as transboundary effects are also considered.

4.1.2 Where potential impacts are likely to be significant, specific measures will need to be taken to reduce or remove such impacts (mitigation measures). Mitigation measures can either take the form of management measures required by legislation of industry practices (tertiary mitigation), changes to the design of the proposed development (primary mitigation), or implementation of additional measures (secondary mitigation). The EIA process also requires consideration of whether it is appropriate to include proportionate measures to monitor the predicted impacts of the proposed development.

4.1.3 The following sections set out the proposed approach to the EIA for the proposed development, which will include the way impacts and effects will be presented throughout the EIA process. The processes and general EIA approach for the proposed development are described, but it is important to note that some topics may have a different approach, to align with topic-specific best practice guidance and standards. These different approaches will be clearly highlighted in each technical chapter of the Offshore Scoping Report and subsequent EIAR. Additionally, the EIA will be developed and refined through thorough discussion with relevant stakeholders.

4.2 EIA Legislative Basis and Guidance Documents

4.2.1 As discussed within Chapter 2 (Legislation and Policy), in compliance with the EIA Directive (2011/92/EU, as amended by Directive 2014/52/EU) in applying for Section 36 consent and marine licences for the proposed development, an EIAR is required.

4.2.2 2In addition to the legislative requirements, guidance and good practice documents have been developed to assist with the production of a robust and proportionate EIA. These include:

- Marine Scotland Consenting and Licensing Guidance: For Offshore Wind, Wave and Tidal Energy Applications (Marine Scotland, 2018) (Note the Developer is aware that Marine Scotland is currently consulting on updates to this guidance. Any updated guidance will be considered in the EIA Report);
- Guidelines for Ecological Impact Assessment in the UK and Ireland. Terrestrial, Freshwater, Coastal and Marine (Chartered Institute for Ecology and Environmental Management (CIEEM), 2018);
- Delivering Proportionate EIA. A Collaborative Strategy for Enhancing UK EIA Practice (Institute of Environmental Management and Assessment (IEMA), 2017);
- Environmental impact assessment for offshore renewable energy projects (British Standards Institute (BSI), 2015);

- Guidelines for data acquisition to support marine environmental assessments of offshore renewable energy projects (Centre for Environment, Fisheries and Aquaculture Science (Cefas), 2012);
- A Review of Assessment Methodologies for OWFs (Collaborative Offshore Wind Research into The Environment (COWRIE) METH-08-08) (Maclean et al., 2009);
- IEMA Environmental Impact Assessment Guide to Shaping Quality Development (IEMA, 2015);
- Planning Advice Note (PAN) 1/2013 Environmental Impact Assessment (Scottish Government, 2017);
- A Handbook on Environmental Impact Assessment (SNH, 2018);
- OWFs: Guidance Notes for EIA in Respect of Food and Environmental Protection Act (FEPA) and Coast Protection Act (CPA) Requirements: V2 (Cefas), 2004a);
- Guiding Principles for Cumulative Impacts Assessment in Offshore Windfarms (Renewable UK (2013));
- Assessment of the Environmental Cables (OSPAR, 2009);
- EIA of Projects – Guidance of Projects – Guidance on the preparation of the EIAR (European Commission, 2017); and
- Guidelines for the Assessment of Indirect and Cumulative Impacts as well as Impact Interactions (European Commission, 1999).

4.3 EIA Process

4.3.1 The EIA process can be broadly summarised of consisting of:

- Scoping: The Developer produces an Offshore EIA Scoping Report (this document) and requests a formal Scoping Opinion from Scottish Ministers;
- Consultation: The Developer is required to undertake pre-application consultation in relation to the proposed marine licence application and this will include some information relevant to the EIAR;
- EIA Report Preparation: The Offshore EIAR will be prepared, considering the responses to the consultation process and outcomes of the assessment of the LSE(as defined in EIA Regulations) of the proposed development during the construction, operation and maintenance, and decommissioning stages of the project lifecycle;
- EIA Report Consultation: The Offshore EIAR (and the application to which it relates) must be publicised, and the consultation bodies and the public must be given an opportunity to give their views about the proposed development and the Offshore EIAR;
- Determination: The competent authority must examine all the environmental information, including the Offshore EIAR and any comments and representations received, and must reach their reasoned conclusion on the significant effects of the development on the environment. The environmental information, and the conclusions reached, must be considered by the competent authority in deciding whether to give consent for the development. The competent authority must also consider whether any monitoring measures are appropriate; and
- Decision notice: The competent authority must inform the public and the consultation bodies of the decision and must publish a ‘decision notice’ which incorporates the

authority's reasoned conclusion on the significant effects of the development on the environment.

4.4 Key Considerations Within Offshore EIAR

4.4.1 Within the Offshore EIAR, each topic will consider the following:

- Identification of the study area for the topic-specific assessments;
- Description of the planning policy and guidance context;
- Summary of consultation activity, including comments received in the Scoping Opinion and PAC;
- Description of the environmental baseline conditions; and
- Presentation of impact assessment, which includes:
  - Identification of the maximum design scenario for each impact assessment;
  - A description of the measures adopted as part of the proposed development, including mitigation and design measures which seek to prevent, reduce, or offset environmental effects;
  - Identification of likely impacts and assessment of the significance of identified effects, considering any mitigation measures adopted as part of the proposed development;
  - Identification of any further mitigation measures required in respect of LSE'S (as defined by the EIA Regulations and in addition to those measures adopted as part of the proposed development), together with consideration of any residual effects;
  - Consideration of whether it is appropriate to include proportionate measures to monitor the predicted impacts of the proposed development;
  - Cumulative effects will be assessed by taking into consideration any other plans or projects proposed or existing, and where sufficient information is available, which, together with the proposed development have a likely significant effect on a receptor due to a common impact pathway and/or temporal or spatial overlap.
  - Assessment of any transboundary effects (i.e., effects on other European Economic Area (EEA) states).

4.4.2 Inter-related effects (i.e., inter-relationships between environmental topic areas) will be assessed in a separate standalone section which will consider the impacts of the proposed development on each of the identified receptor groups.

4.5 EIA Methodology

Baseline Characterisation

4.5.1 The characterisation of the existing baseline environment will be undertaken to determine the baseline conditions (and the future baseline assuming that the proposed development is not progressed) in the area covered by the Muir Mhòr array area, the offshore ECC and the relevant surrounding technical study areas for those issues scoped into the EIAR. There will be a stepwise approach which will be carried out as followed:

- Study area definition based on the relevant characteristics of the receptor (e.g., mobility/range);
- Review of all publicly available information;

- Review of available data from other OWF projects within the baseline study area;
- Review of likely or potential impacts that might be expected to arise from the Proposed Development based on a maximum design scenario following assessment of that scenario;
- Determination of whether there is sufficient data to make the EIA judgements with sufficient confidence;
- If further data is required, ensure that data gathered is targeted and directed at answering the key question and filling key data and knowledge gaps; and
- Review of information gathered to ensure the environmental baseline can be sufficiently characterised in appropriate detail.

Assessment of Potential Impacts

4.5.2 The potential environmental impacts of the proposed development are set out in this Offshore Scoping Report, and it has been determined which impacts will be scoped into or scoped out of the EIA process. Embedded commitment measures have been considered in the Offshore Scoping Report, which will be built into the proposed development concept through design or implementation of industry good practice.

4.5.3 For those potential impacts scoped into the EIA, the EIAR will describe the level of significance of effect expected to result from the proposed development using standard EIA methodology. The assessment process will consider the potential magnitude of the change to the baseline conditions (impact) arising from the proposed development and the sensitivity of the receptor under consideration, as well as any embedded mitigation measures.

Design Envelope Approach and Establishing the Maximum Design Envelope

4.5.4 The Design Envelope approach (also known as the Rochdale Envelope approach) will be adopted for the assessment of the proposed development, in accordance with current good practice and the "Rochdale Envelope Principle[1]". The Design Envelope 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 necessarily known at time of application submission.

4.5.5 Chapter 3 (Proposed Development Description) sets out the Design Envelope parameters and identifies the range of potential project design values for relevant components of the proposed development. For each of the topic sections within the Offshore EIAR and for each of the impacts assessed, the Design Envelope considered will be the scenario which would give rise to the greatest potential impact (hereafter referred to as the maximum design scenario).

4.5.6 The Developer has undergone a process of Design Envelope refinement prior to Offshore EIA Scoping Report submission, therefore the assessment presented in the final application will be based on as refined and focused Design Envelope as is practical whilst still retaining flexibility for new technology or design solutions in the post-consent phase.

Impacts and Effects

4.5.7 The proposed development has the potential to create a range of impacts and effects regarding the physical, biological, and human environment, for both terrestrial and marine receptors. For the purposes of the offshore EIA, the term 'impact' is defined as a change that is caused by an action. For example, the laying of an inter-array cable (action) is likely to

[1] Case law (i.e. R v Rochdale MBC ex parte Tew (1999) and R v Rochdale MBC ex parte Milne (2000)). In respect of S36 consent, whichever scheme is ultimately built must have been covered by the scope of the EIA.

result in seabed disturbance (impact). Impacts can be defined as direct, indirect, temporary, irreversible, secondary, cumulative and inter-related. They can also be either positive or negative, although the relationship between them is not always straightforward.

4.5.8 The term 'effect' is defined as the consequence of an impact. Using the inter-array cable laying example, the laying of an inter-array cable (action) results in seabed disturbance (impact), with the potential to disturb benthic habitats and species (effect). The significance of effects is determined by consideration of the magnitude of impact alongside the sensitivity of each receptor/receptor group.

4.5.9 The magnitude of an impact is the consideration of the extent, duration, frequency and reversibility of an impact. The magnitude of impacts is the severity in the level of change to pathways and receptors. This magnitude may vary depending on the pathway, receptor, or the technical assessment being implemented but will broadly follow:

- High: total change or major alteration to key elements/features of the baseline conditions;
- Medium: Partial change or alteration to one or more key elements/features of the baseline conditions;
- Low: Minor shift away from baseline conditions; and
- Negligible: Very slight change from baseline conditions.

4.5.10 In some cases, the proposed development may be both adverse and positive so magnitude definitions will be defined for both.

4.5.11 Receptors can be defined as the physical or biological resource or user group that could be affected by the potential impacts. In defining the sensitivity for each receptor/receptor group, the vulnerability, recoverability, and value/importance of that receptor will be taken into consideration. However, the EIA topic or receptor in question always determines the type of scale of sensitivity for its given receptor. The ability for a receptor to adapt to change, tolerate and/or recover from potential impacts is pertinent in assessing its sensitivity to the impact under consideration. The scale of sensitivity will be classes as: Negligible, Low, Medium, or High.

4.5.12 During topic specific assessments there is a more specific scale of increasing sensitivity which will be defined when appropriate. Guidance will also be taken from the value attributed to elements through designation or protection under law. When establishing the sensitivity of receptors, it is important to have expert judgement.

4.5.13 To ensure consistency in defining the significance of an effect, a matrix approach will be adopted in the Offshore EIAR as presented in Table 4-1.

Table 4-1: Significance of effect.

		Magnitude of Impact			
		Negligible	Low	Medium	High
Sensitivity of Receptor	Negligible	Negligible	Negligible	Negligible	Negligible
	Low	Negligible	Negligible	Minor	Minor
	Medium	Negligible	Minor	Moderate	Moderate
	High	Negligible	Minor	Moderate	Major

4.5.14 The EIA will provide topic-specific definitions of magnitude, sensitivity, and significance of effect as required. The topic specific definitions will consider guidance and specialist knowledge specific to the topic in question.

4.5.15 A level of effect of moderate or more will be considered a 'significant' effect for the purposes of the EIA. A level of effect of minor or less will be considered 'not significant'. Effects of moderate significance or above are therefore considered important in the decision-making process, whilst effects of minor significance or less warrant little, if any, weight in the decision-making process.

4.5.16 The matrix approach is consistent with the general approach described in the Design Manual for Roads and Bridges (DMRB) (Highways England et al., 2019) and Environmental Impact Assessment for Offshore Renewable Energy Projects – Guide (BSI, 2015). Several modifications have however been made in the interest of proportionality, including:

- A negligible magnitude impact will not be considered further because it will always lead to a non-significant effect; and
- Receptors of negligible importance, value or sensitivity will not be considered further because it will always lead to a non-significant effect.

4.5.17 Where significant effects are initially identified, the EIA will follow a "feedback loop" methodology. Through this process, an impact is initially assessed to determine the significance of the potential environmental effect. If the effect of an impact presents a major or moderate significant adverse outcome, mitigation measures, above and beyond any embedded commitments or design changes will be incorporated into the assessment process to avoid or reduce significant effects to acceptable (non-significant) levels.

4.5.18 This process is repeated until the EIA practitioner is satisfied that:

- The effect is reduced to a level that is not significant in EIA terms; or
- No further changes can be made to the proposed development design to reduce the magnitude of impact and therefore the significance of the effect. In these cases, an overall effect that is still significant in EIA terms may be presented.

4.5.19 Following this iterative approach ensures that the significance of effect presented for each identified impact may be presumed to be representative of the maximum residual adverse effect the proposed development may have on the receiving environment.

4.5.20 The commitments register is provided in Appendix A and details all commitments or mitigation adopted by the proposed development. The Commitments Register is a live document that will be updated and built upon as part of the EIA process and subject to consultation with stakeholders.

4.6 Cumulative Impact Assessment (CIA)

4.6.1 As well as considering the impacts from the proposed development alone, the EIA Regulations require consideration of the potential impacts that could occur cumulatively with other relevant plans, projects, and activities. Cumulative impacts will be assessed by taking into consideration any other plans or projects proposed or existing, and where sufficient information is available, which, together with the proposed development have a likely significant effect on a receptor due to a common impact pathway and/or temporal or spatial overlap.

4.6.2 Each technical chapter of the EIAR will provide a CIA with regards to their respective receptors. Each technical chapter of this Offshore Scoping Report has provided a high-level overview of the cumulative impacts relevant to that topic and an indication as to whether cumulative impacts will be relevant at EIA.

4.6.3 A list of plans, projects and activities that may act cumulatively with the proposed development will be identified as part of the EIAR preparation and this will be consulted upon to ensure inclusion of all necessary plans, projects, and activities within the assessment. For each of these relevant plans, projects or activities, the most up-to-date publicly available project parameters will be used to inform the CIA. Where information is not publicly available, the Developer will seek to consult and collaborate to obtain project parameters for assessment. The assessment will consider the temporal and spatial extent of impacts associated with each phase of the proposed development to present an understanding of how these overlap with relevant other plans, projects, and activities. The onshore CIA will also be incorporated into the offshore CIA to cover all plans, projects and activities with the proposed development.

4.6.4 There are a variety of projects and plans that are in the vicinity of the proposed development that may contribute towards cumulative impacts on a range of receptors and pathways. CampionWind OWF is another ScotWind project located in the E2 PO which is in the pre-planning stage and Hywind Scotland is a floating OWF has been operational since 2017. Further details on projects in the vicinity of the proposed development is detailed in Chapter 19 (Infrastructure and Other Users).

4.6.5 The CIA for each technical chapter will take projects such as these (to the extent information is made available), as well as projects from other industries, into consideration when assessing the potential cumulative impacts of the proposed development on the surrounding environment.

4.6.6 When completing the CIA, it is important to consider that some proposed projects may not be taken forward and built out as currently described. Therefore, there is a level of uncertainty with respect to the potential impacts which may arise. The ‘phase’ of a project, in relation to the certainty or uncertainty over whether the proposed development will be brought forward as described, will be considered when drawing conclusions on cumulative effects. It will be assumed that projects that are built and already operational, along with active licensed activities, at the time that baseline data is collected will constitute part of the existing baseline

conditions as receptors would already be adapted to them. Any effect they might have had will be reflected in the baseline characterisation undertaken to inform the impact assessment, although it is noted that some built/operational projects will have ongoing effects which will need to be incorporated within the CIA (e.g., collision risk).

4.6.7 The potential in-combination effects on European sites will be considered through a separate HRA process. A list of in-combination projects will be determined from those of which are in planning, consented or in construction.

4.7 Inter-Related Effects

4.7.1 The Offshore EIA will consider inter-related effects, the potential effects of multiple impacts from the construction, O&M, and decommissioning of the proposed development, affecting one receptor. Inter-related effects are assessed through consideration of all effects on a receptor by the proposed development.

4.8 Transboundary Effects

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

4.8.2 If an EIA project is considered to have significant effects on the environment of another European Economic Area ("EEA") state, then Scottish Ministers must engage with that EEA state to allow consultation if that state wishes to participate" (Marine Scotland, 2018).

4.9 Proportionate EIA

4.9.1 This Offshore Scoping Report aims to deliver a robust, yet proportionate EIA. The importance of proportionate and accessible EIAs is recognised by regulators, stakeholders, and practitioners and IEMA has developed specific guidelines regarding this (IEMA, 2017).

4.9.2 The aim of ensuring a proportionate EIA has been considered from the offset of project planning and our approach includes:

- A robust EIA Scoping process: Scoping based on significant industry experience and local area knowledge of what the key impacts are likely be;
- Consideration of embedded and industry good practice commitments from the offset: commitments that are built into the proposed development concept rather than in response to a significant effect identified as part of the EIA process. A range of commitments have been applied to the proposed development concept and, therefore, considered within this Offshore Scoping Report;
- Commitments Register (Appendix A): A register of all the mitigation measures that have been committed to as part of the Proposed Development and how these will be secured in the Proposed Development consents/licences. This is kept as a 'live' document and will be developed through the Scoping and EIA process. The relevance of each mitigation measure to both project phase and environmental topic is presented;

4.10 Topics Being Scoped Out

4.10.1 The EIA Regulations state that an EIA must provide a description of the LSEs of the proposed development. Amendments to the EIA Regulations in 2017 broadened the scope of EIAs with the requirement to consider the following aspects:

- The risk to human health (e.g., due to accidents or disasters);
- The vulnerability of the works to risks of major accidents and/or disasters; and
- Climate and the vulnerability of the proposed development to climate change and potential for GHG.

4.10.2 The Offshore Scoping Report proposes to scope out human health and major accidents and/or disasters. The justification for this is set out in the following sections.

4.10.3 As a renewable energy project, it is not anticipated that the proposed development will have a significant adverse effect on climate or GHG, but there may be likely benefits. A separate chapter of this Offshore Scoping Report has been provided to consider Climate (Chapter 18). The topic will be scoped in for the EIA, with the assessment based on the design envelope and construction approach/details that are taken forward for assessment. As well as assessing potential adverse effects from the proposed development arising from emissions, the EIAR will outline the benefits that the proposed development will deliver in reducing GHG and meeting renewable energy targets. Climate resilience and in-combination climate change impact assessments will also be presented.

Human Health

4.10.4 A stand-alone chapter for human health has not been provided within this Offshore Scoping Report as potential effects on human health will be considered within technical topics such as airborne noise and air quality (forming part of the Onshore Scoping Report).

Offshore Airborne Noise and Vibration

4.10.5 Several potential airborne noise and vibration effects on human receptors have been identified, which may occur during the construction, O&M and decommissioning phases of the proposed development. This includes piling and auxiliary construction activities (vessels, use of other machinery and generators) generating airborne noise/vibration that may impact other marine users, cable installation activities (including in the intertidal area) generating noise/vibration that may impact marine users and onshore human receptors and operation of WTGs producing airborne noise/vibration. However, all effects are proposed to be scoped out of the assessment for offshore airborne noise and vibration.

4.10.6 Commercial vessels will maintain a minimum distance to pass construction activities. Vessels are transient in nature and therefore will only be in the vicinity of construction activities for a short period of time. Considering existing sources of anthropogenic and natural airborne noise, the effect of airborne noise from piling on receptors onboard other marine vessels, will be negligible. Auxiliary construction noise is expected to be localised around the vessels being used and unlikely to result in the significant propagation of airborne noise considering the existing vessel traffic within the area, other anthropogenic noise and natural noise sources.

4.10.7 Airborne noise associated with the installation of the cables will occur from the cable laying vessels. Noise emissions from vessels is generally low and localised around the vessels being used, will be of short duration, transient (as the vessel moves along the offshore cable route) and unlikely to result in significantly elevated noise levels beyond the baseline considering the existing vessel movements across the wider region, other anthropogenic noise, and natural noise sources.

4.10.8 Cable installation at the landfall will either be undertaken via an open cut trenching method, via a trenchless technique such as HDD, rockpinned or via a combination of each method. Any works undertaken above water in the intertidal area will be subject to the strict procedures and mitigation measures implemented for onshore construction noise (captured as part of the Onshore Scoping Report). Noise from intertidal cable burial equipment will be localised, temporary, transient and of short duration. It will also be in the context of existing anthropogenic noise sources including vessels, road traffic, residential and industrial noise and natural noise sources including precipitation, wave and wind action. As such, it is considered that works within the intertidal area (up to MHWS) are unlikely to result in a significant impact to onshore human receptors.

4.10.9 The movement of WTG blades is expected to result in low levels of airborne noise, which considering the distance and existing anthropogenic and natural sources of noise along the coastline (wind, wave and precipitation), is not considered audible by onshore receptors or transient marine users (vessels in the vicinity of the Muir Mhòr array area).

4.10.10 It is therefore proposed to scope out offshore airborne noise and vibration with regards to the offshore elements of the proposed development, noting the proposed embedded mitigation for the development of and adherence to a Construction Method Statement (CMS), Environmental Management Plan (EMP) and Piling Strategy (PS).

Offshore Air Quality

4.10.11 Engine emissions from construction vessels active during construction, O&M and decommissioning will contribute to atmospheric emissions at a small, localized scale. The Vessel Management Plan (VMP) will outline the final vessel construction, O&M and decommissioning strategies for the proposed development, ensuring the most efficient use of vessels where possible. It will also ensure compliance with relevant national and international air quality standards and legislation. The number of project-related vessels active on site would be limited in comparison with the number of vessels active regionally and would contribute a small amount of emissions to air relative to the current baseline. It is recognised that there might be a negligible increase in background emission levels within the immediate vicinity of vessels supporting the proposed development while they are operating; however, there are limited receptors nearby that are likely to be impacted by the increase, with the marine nature of the works limiting proximity to any onshore receptors.

4.10.12 Overall, the proposed development will be a source of clean, renewable energy and therefore as a whole will contribute positively to a reduction in emissions at a national and global level by facilitating a reduced reliance on fossil fuels and help move Scotland towards its 2045 goal of net zero emissions of all GHG.

4.10.13 Therefore, it is proposed that offshore air quality is scoped out of any further assessment as there is expected to be only a negligible impact upon the identified receptors, noting the proposed embedded mitigation for the development of and adherence to a CMS, EMP and VMP.

Major accidents and/or disasters

4.10.14 The potential for major accidents and/or disasters is inherently related to the nature of the activity (i.e., the proposed development) and proximity to high-risk infrastructure. The construction and O&M of OWFs is a well-established practice and, therefore, through careful site-selection, design, and planning, as well as the implementation of proposed embedded mitigation such as the development of and adherence to a CMS, EMP and VMP, the potential for major accidents and/or disasters is considered highly unlikely.

4.10.15 The Navigation Risk Assessment (NRA) that will be undertaken to support the Shipping and Navigation EIA (see Chapter 13) underpins the categorisation of the risk of collision and allision in terms of vessel activity.

4.10.16 Furthermore, the inclusion of Infrastructure and Other Users (see Chapter 19) as part of the EIA will assess the potential for interactions with other infrastructure in the area of relevance to such scenarios (e.g., oil and gas pipelines or existing OWFs). It is therefore proposed to scope out major accidents and/or disasters with regards to the offshore elements of the proposed development.

5 Consultation

5.1 Introduction

5.1.1 Stakeholder engagement and consultation is a key aspect in an EIA process for the successful delivery of a consent application for any OWF development. Without statutory stakeholder input and collaboration to address concerns, the achievement of UK and Scottish renewable energy targets and the provision of clean energy would not be possible. It may also be appropriate to consult other non-statutory bodies, interested parties and the general public in order to take into consideration aspects that can affect specialist interests (such as recreational activities or other marine users), livelihoods, employment and daily life activities. This approach to stakeholder consultation will ensure a robust application is made that takes into consideration all potential environmental and socio-economic receptors that might be impacted by the proposed development.

5.1.2 This chapter of the Offshore Scoping Report sets out the planned consultation process, including the anticipated timings for when the Developer and the wider project team intend to carry out engagement with relevant stakeholders, other interested parties and the public.

5.1.3 Stakeholder engagement comprises of two main elements: communication and consultation. The former is the provision of information to enable stakeholders to understand the progress of the proposed development, while the latter provides the opportunity for stakeholders to provide information and express views which influence the proposed development.

5.1.4 This leads to four basic objectives for the engagement strategy:

- Identify – identification of those stakeholders with an interest in the proposed development;
- Communicate – provide appropriate information on the proposed development to stakeholders including any potential positive (beneficial) or negative (adverse) impacts that the proposed development may have;
- Consult – seek and record views and potential concerns of stakeholders;
- Communicate again – provide information to stakeholders detailing the results of consultation and provide feedback to any concerns raised.

5.2 Consenting Procedure and Relevant Legislation

5.2.1 As highlighted in Chapter 2 (Legislation and Policy), the Developer will undertake the EIA process in line with legislative requirements, including the following:

- The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017;
- The Marine Works (Environmental Impact Assessment) (Scotland) Regulations 2017;
- The Marine Works (Environmental Impact Assessment) Regulations 2007; and
- The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2017.

5.2.2 These Regulations are collectively referred to as “the EIA Regulations” and they consider the requirement for public participation in offshore project planning and development.

5.2.3 The Aarhus Convention is created to empower the role of citizens and civil society organisations in environmental matters and is founded on the principles of participative democracy. The Aarhus Convention establishes several rights to the individuals and civil society organisations with regard to the environment. The Developer will undertake an EIA

in line with the Aarhus Convention which establishes the rights of the general public to environmental information. This includes the public's right to receive environmental information held by public authorities, the right to participation in decision-making regarding the environment and the right to review procedures and challenge decisions that have been made without due regard to public review or input.

5.2.4 The Developer will also provide, as part of their consent application, a RIAA under the HRA process, which is required under the Habitats Regulations which implement the EU Habitats Directive (see Chapter 2: Legislation and Policy). The content of this RIAA will follow and adhere to the guidance provided within the Offshore Scoping Opinion.

5.2.5 The Regulations listed above set out the statutory consultation requirements relevant to the pre-application stage, covering requirements such as advertising of consent applications. Additional PAC requirements are set out in the Marine (Scotland) Act 2010 and Marine Licensing (Pre-application Consultation) (Scotland) Regulations 2013.

5.3 Stakeholder Engagement

Background

5.3.1 The Developer will follow best practice guidelines as relevant and appropriate, as set out by Renewable UK with the aims of inclusiveness and equality. Stakeholders will be given the opportunity to determine how they wish to be consulted with regards to the proposed development. The Developer will also follow consenting guidance and advice given by statutory stakeholders, such as MS-LOT and NatureScot, on matters regarding engagement and stakeholders.

5.3.2 Development and consent of the proposed development will rely on engagement with relevant stakeholders from the pre-EIA phases through to consent application, and beyond.

Engagement To Date

5.3.3 The Developer understands the value of building and maintaining strong professional relationships with statutory stakeholders and communities from early project stages through to the consent application. The Developer has already actively begun the process of engaging with key statutory stakeholders during this scoping stage of development with meetings held to introduce stakeholders to the Project and the Developer. Starting in 2022, the Developer has participated in regular Quarterly Project Update Meetings with MS-LOT, Marine Scotland Science (MSS) and NatureScot to meet with the expectations of these stakeholders and their request for regular (and purposeful) meetings. Additionally, a Scoping Workshop was held in February 2023 with the Developer, MS-LOT and NatureScot to discuss the proposed offshore scoping strategy, the ornithological strategy for the Project and the proposed offshore survey strategy.

5.3.4 In recognition of the potential complex issues associated with ornithological interests with the East PO areas and wider region, the Developer has also been engaging and collaborating with the other developers that were awarded projects within the East PO region via the East Ornithology Group. In addition, the Developer has introduced the proposed development to the Aberdeenshire council, the Royal Society for the Protection of Birds (RSPB), MCA, NLB, Historic Environment Scotland (HES), NATS and the Civil Aviation Authority (CAA). Monthly meetings have also taken place where the proposed development has been discussed at a high level. The Developer has contacted the MOD (Ministry of Defence) to discuss the proposed development as part of the scoping, however the MOD stated they did not want to engage at this stage.

5.3.5 The Developer is committed to building on this initial engagement in preparation for the EIA. Relevant stakeholders being consulted/to be consulted across all stages of the proposed development (such as pre-application, application submission and review, pre-construction, construction, commissioning, O&M and decommissioning) include:

- National and local authorities;
- Local communities/councils;
- A long list of local and national interest organisations;
- Suppliers/industry;
- National/regional grid providers;
- Onshore landowners;
- Other users of the sea;
- Other users of the airspace;
- The owner of the seabed; and
- Other seabed leaseholders.

5.3.6 It is acknowledged that stakeholders will hold different information needs and will have different levels of involvement in the proposed development.

5.4 Planned Statutory Engagement

5.4.1 The Developer has initiated early consultation with MS-LOT/MSS and NatureScot to understand their preferred method of scheduling engagement and consultation throughout the EIA (which involves regular project update meetings throughout the proposed development consenting timeline). Previously, applicants have used MS-LOT's Protocol Agreement to specify meeting dates and agendas to be covered. MS-LOT have updated this approach and are now using quarterly project meetings instead to liaise with developers regarding projects and provide updates on progress.

5.4.2 The Developer will adhere to all statutory consultation requirements that are required as part of the consenting process. Engagement with stakeholders will be ongoing and iterative during the EIA process, but it is also expected to be focused on the following key stages:

- Formal submission and publication of this Offshore Scoping Report and request for a Scoping Opinion;
- Consultation with technical consultees on the survey scopes of work for key survey campaigns, and liaison regarding Marine Licence and EPS risk assessment requirements to allow surveys to proceed;
- Provision of key technical reports and data, used to inform the assessments, to relevant stakeholders for information and feedback;
- Completion of statutory PAC Report;
- Formal submission and publication of consent applications and the accompanying EIAR to seek views on the proposal; and
- Additional public/stakeholder-specific engagement events that will take place at appropriate intervals during the consenting process, together with the issue of project communications and documentation to the proposed development's website.

5.4.3 There is a proposed in-person consultation event, post PAC, to inform and gain feedback from local communities about the proposed development, in Peterhead, currently anticipated to take place between September and November 2023 and a second event planned in Q1 2024.

5.5 Stakeholder Identification

5.5.1 This section has been informed by the Developer team's experience of stakeholder engagement for other projects. The Developer understands the importance of early and continued engagement with stakeholders and in building strong relationships that are maintained with these stakeholders.

5.5.2 The Project has developed a list of anticipated stakeholders that will be relevant to the Project (Table 5-1). This list is not exhaustive and will be added to as the Project progresses through the EIA.

Table 5-1: Identification of key statutory and non-statutory stakeholders

Type	Stakeholder	
Governmental	• CES • Department for Transport (DfT) • MS-LOT • MSS • Scottish Government (Marine Scotland) Policy Team • NatureScot • JNCC • SEPA	• HES • Planning Authorities and Other Departments within the Scottish Government • NLB • MCA • MOD/RAF • Ofgem • OWIC • Scottish Offshore Wind Energy Council (SOWEC)
Politically Established	• Scottish Enterprise • Scottish Development International	• CCC • Highland and Island Enterprise
Local Authorities and Organisations	• Community Councils and representatives • Community and Local Religious/Faith Organisations	• Local Educational Institutions • Local Communities and representatives
Grid Operators	• National Grid ESO	• SSEN Transmission (Scottish and Southern Electricity Networks)
Environmental Organisations	• RSPB • Scottish Wildlife Trust (SWT) • National Trust for Scotland • Whale and Dolphin Conservation (WDC) • British Trust for Ornithology • Cetacean Research & Rescue Unit • Marine Conservation Society • Scottish Environment Link	• Association of District Salmon Fisheries Boards (ADSFB) • Atlantic Salmon Trust • Fisheries Management Scotland • National Nature Reserves (NNR) • Scottish/Local Wildlife Sites • Keep Scotland Beautiful • Bat Conservation Society

Type	Stakeholder	
Aviation	• NATS • CAA	• Aberdeen International Airport
Navigation	• Port and Harbour Authorities inclusive of the Harbour Master • Chamber of Shipping • UK Hydrographic Office (UKHO)	• Royal National Lifeboat Institution (RNLI) • Royal Yachting Association (RYA) • Commercial Shipping/Ferry Companies
Tourists and Recreation	• Local Tourists Board • Local Water Sports Groups • Visit Scotland	• Sub Aqua and Scuba Diving Clubs • Mountaineering Scotland • Surfers Against Sewage
Fisheries	• Marine and Fisheries Agency • Scottish Fisherman's Association (SFF) • The Scottish White Fish Producers Association (SWFPA) • North and West Coast Regional Inshore Fisheries Group	• Scotland's Scallop Sector Working Group • Relevant District Salmon Fishery Board (DSFB) • Fisheries Trusts • Local fishing organisations • Individual fishermen as identified by the Company Fisheries Liaison Officer/other means
Wind Energy Interest	• Scottish Renewables • Renewable UK (RUK) • Scottish Renewable Forum • OWIC and Offshore Wind Growth Partnership – funded by OWIC. • Offshore Renewable Energy (ORE) Catapult	• Deep Wind Cluster • SOWEC • Other Regional Advisory Group
Supply/Industry	• WTG, foundation, and substation manufacturing • Ship building and steel industry • Yards	• Cable suppliers • Suppliers of local services
Other	• Oil and Gas operators • Scottish gas distributors • Landowners • Other OWF Developers	• Media, Public Relations • Onshore utilities companies/Scottish Water • Transport Scotland • Offshore Energies UK (OEUK)

6 Marine and Coastal Processes

6.1 Introduction

6.1.1 This chapter of the Offshore Scoping Report identifies the marine and coastal processes receptors of relevance to the proposed development and considers the potential impacts from the construction, O&M, and decommissioning of the proposed development on marine and coastal processes, up to MHWS.

6.1.2 For the purposes of both this Offshore Scoping Report and the subsequent EIAR, marine and coastal processes include the following elements:

- Morphology, including bathymetry, geology, surficial sediments, seabed features and coastal form;
- Sediment transport, including bedload and suspended sediment; and
- Hydrodynamics, including tidal and non-tidal influences, and waves.

6.1.3 Marine and coastal processes pathways are closely linked to seabed, coastal and water quality receptors. This chapter covers the marine and coastal processes pathways and receptors present within the study area.

6.1.4 This chapter should be read alongside Chapter 7: Marine Water and Sediment Quality.

6.1.5 This chapter of the Offshore Scoping Report has been prepared by GoBe Consultants Limited.

6.2 Study Area

6.2.1 As presented in Figure 6-1, the marine and coastal processes study area is defined as the:

- Near-field, which includes the:
  - Array area;
  - Offshore ECC;
  - Proposed offshore export cable landfall areas; and
- Far-field, which includes the:
  - Coastal and seabed areas outside the near-field, but within the vicinity of the proposed development that may be influenced by marine and coastal processes.

6.2.2 The marine and coastal processes study area will be further refined during EIA with consideration to the tidal excursions and specifically sediment plume pathways to allow a definition of the Zone of Influence (ZoI).

6.3 Baseline Environment

Data Sources

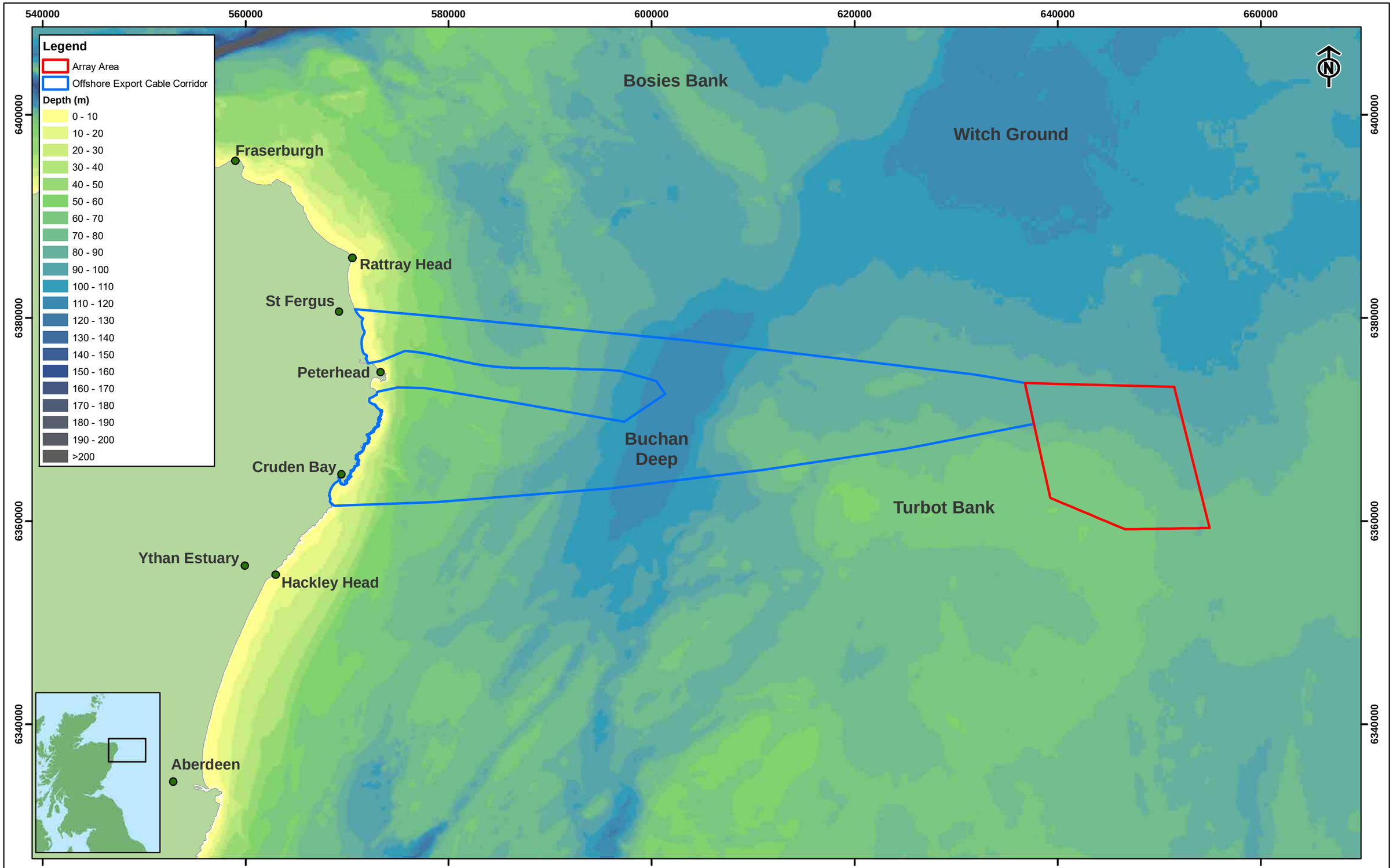
6.3.1 The data sources that have been used to inform the marine and coastal processes chapter of the Offshore Scoping Report are presented within Table 6-1. These data sources will be taken forward and used to inform the EIA, alongside any additional site-specific data that is to be collected for the proposed development.

Table 6-1: Key sources of marine and coastal processes data.

Source, Author and Year	Summary	Coverage of Muir Mhòr array area and ECC
Morphology (bathymetry, geology, surficial sediments, seabed features and coastal form)		
European Marine Observation and Data Network (EMODnet) Bathymetry Portal, EMODnet, 2020	Interactive bathymetry map.	Full coverage.
JNCC Coastal Directory Series: Regional Report 3 North East Scotland: Cape Wrath to St. Cyrus, Barne *et al*., 1996	Regional characterisation of geology, morphology, coastal processes and form.	Partial coverage.
Offshore GeoIndex Map, British Geological Society (BGS), 2020	Seabed sediment maps (based on Folk classification) and borehole records from point locations. Data gaps exist in the coastal zone.	Full coverage.
Project specific surveys, Muir Mhòr Offshore Wind Farm Limited, 2023	Project specific geophysical and benthic surveys. Geophysical surveys are planned to commence in March 2023 and June 2023 for the array area and offshore ECC, respectively. Benthic surveys are planned to commence in July 2023 for both the array area and the offshore ECC.	Full coverage.
Strategic Environmental Assessment 5 – (SEA5) Seabed and Superficial Geology and Sediments Survey Report, Holmes *et al*., 2004	Regional characterisation of geology, morphology, surficial sediments and sediment transport, including geophysical survey outputs.	Partial coverage.
Sediment Transport		
Coastal Cells in Scotland: Cell 2 – Fife Ness to Cairnbulg Point, Ramsay and Brampton, 2000	Regional characterisation of sediment transport, geology, morphology, and coastal form, focused on nearshore processes.	Partial coverage.
Suspended Sediment Climatologies around the UK, Centre for Fisheries and Aquaculture Science (Cefas, 2016)	Monthly and seasonal Suspended Particulate Matter (SPM) maps.	Full coverage.

Source, Author and Year	Summary	Coverage of Muir Mhòr array area and ECC
Metocean Data (tides, non-tidal influences, waves, and frontal zones and stratification)		
Atlas of UK Marine Renewable Energy Resources, ABPmer *et al*. 2008	Low resolution modelled hindcast wave, wind and hydrodynamic data. Summary data provided only.	Full coverage.
National Tide and Sea Level Facility (NTSLF), NTSLF, 2020	Tidal water levels from point locations at the coast.	Partial coverage.
SEASTATES Metocean Data and Statistics Interactive Map, ABPmer, 2018	Modelled hindcast wave and hydrodynamic data.	Full coverage.
Future Changes		
Coastal Futures Interactive Map, IHE (Institute of Highway Engineers) Delft, 2021	Sea level rise predictions for coastal locations.	Full coverage.
Dynamic Coast 2: Scotland's Coastal Change Assessment, Centre of Expertise for Waters, 2021	Sea level rise predictions for coastal locations around Scotland.	Partial coverage.
Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report: Impacts, Adaption and Vulnerability, IPCC, 2022	Sea level rise predictions for coastal locations.	Partial coverage.
Sea Level Projection Tool – National Aeronautics and Space Administration (NASA) Sea Level Change Portal, NASA, 2021	Sea level rise predictions for coastal locations.	Full coverage.
UK Climate Projections Science report (UKCP18) Marine Report, Palmer *et al*., 2018	Sea level rise predictions for coastal locations.	Partial coverage.
UK FUTURECOAST Project, Department for the Environment, Food and Rural Affairs (Defra), 2002	Sea level rise predictions for coastal locations and assessments of shoreline behaviour.	Partial coverage.

Source, Author and Year	Summary	Coverage of Muir Mhòr array area and ECC
General		
Hywind Scotland Pilot Park associated survey results and reports	Site-specific geotechnical and geophysical surveys, including desk-based characterisation and survey outputs.	Partial coverage.
Hywind Scotland Pilot Park Environmental Statement	Regional and site-specific characterisation of geology, morphology, surficial sediments, coastal processes, and hydrodynamics.	Partial coverage.
Hywind Scotland Pilot Park Scoping Report	Regional and site-specific characterisation of geology, morphology, surficial sediments, coastal processes, and hydrodynamics.	Partial coverage.
Marine Scotland National Marine Plan Interactive Mapping Tool (NMPi), Marine Scotland, 2022	Interactive map containing data on geology, morphology, surficial sediments, coastal processes, and hydrodynamics.	Full coverage.
Marine Scotland Regional Assessments, Marine Scotland, 2021	Regional summaries of coastal processes and hydrodynamics.	Partial coverage.
Offshore Energy Strategic Assessment 4 (OESEA4), Department for Business, Energy and Industrial Strategy (BEIS), 2022	Regional characterisation of geology, morphology, surficial sediments, coastal processes, and hydrodynamics.	Partial coverage.
SEA5, Department for Energy and Climate Change (DECC), 2004	Regional characterisation of geology, morphology, surficial sediments, coastal processes, and hydrodynamics.	Partial coverage.



MUIR MHÒR OFFSHORE WIND FARM
A joint venture between Fred Olsen Seawind & Vattenfall
Muir Mhòr Offshore Wind Farm Ltd, The Tun Building
4 Jackson's Entry, Holyrood Road, No 4 EH8 8PJ Edinburgh
United Kingdom

Rev	Date	Drawn By	Checked By	Comment
A	28/03/23	BPHB	LK	First Issue

Datum	ETRS 1989
Projection	ETRS 1989 UTM Zone 30N
Plot	A3
Scale	1:350,000

0 2 4 6 8 10 km

MUIR MHÒR WIND FARM

Marine and Coastal Processes Study Area

Confidentiality Class	C1
Drg No	GoBe-0001
Rev	A
Layout	NA

Figure 6.1

Ref files: MMH_MP_Fig6.1_StudyArea_RevA

6.4 Description of Baseline Environment

6.4.1 An understanding of the baseline marine and coastal processes which control the features, pathways and receptors within the study area has been derived from the available data sources and literature (Table 6-1). Regional context is provided where appropriate and dependent on the scale of the processes discussed. This baseline understanding, as presented below, will be further developed following completion of project-specific surveys and updated in following phases of the EIA process.

Morphology

6.4.2 This section provides an overview of the bathymetry, geology, surficial sediments and seabed features of relevance to the proposed development.

Bathymetry

6.4.3 Across the array area water depths range between, approximately, 60 and 100 m (LAT), as shown in Figure 6-1, with water depths increasing towards the north and east of the array area. Water depths along the offshore ECC generally range between, approximately, 40 and 100 m (LAT), with depths ranging between 100 and 120 m within the Buchan Deep. This seabed feature is located, approximately, 25 km east of Peterhead (Figure 1-1). Water depths typically shallow consistently and relatively steeply towards the coast from around 60 m (LAT), approximately 5 km offshore.

Geology

6.4.4 The bedrock geology across the study area is composed of a series of indurated sedimentary and igneous rock sequences dating from between the Palaeocene and Devonian, increasing in age westward toward the coast (BGS, 1982; Statoil, 2015). The array area is underlain by Eocene and Pliocene sedimentary rocks, whilst the offshore ECC crosses through areas of Palaeocene Permian and Triassic bedrock with a belt of Cretaceous chalk, approximately, 20 km offshore (BGS, 2020). From approximately 4 km offshore towards the coast, granite, and other igneous intrusions, as well as metamorphic bedrock, is present around Peterhead (BGS, 1982).

6.4.5 The bedrock geology is overlain by Quaternary sediments comprising of both marine and glaciomarine muds, silts and sands, which increase in thickness with distance offshore. Thicknesses of over 50 m have been reported within the array area (BGS, 1986; BGS, 2020). The near-surface Quaternary sediments include the Forth Formation and Witch Ground overlying the Coal Pit Formation, with localised outcrops of Wee Bankie Formation close to the coast, where bedrock may also be exposed (BGS, 1986). These Quaternary sediments are in turn overlain by a thin (less than 0.5 m) veneer of marine sands and gravels (Owens, 1981; Statoil, 2015).

Surficial Sediments

6.4.6 Surficial sediments within the array area are typically comprised of sands and gravelly sands, with increasing gravel content towards the south and west of the array area (Figure 6-2; BGS, 2020). The seabed within the offshore ECC is also typically characterized by surficial sand and gravel sediments, with some outcroppings of till and bedrock close to the coast, north of Peterhead (MMT, 2013; Xodus, 2013; BGS, 2020). Surficial sediments across the region are generally present in a thin veneer less than 0.5 m thick (Owens, 1981; BGS, 1986; Statoil, 2015).

550000
600000
650000
6400000
6350000

Legend

- Array Area
- Offshore Export Cable Corridor

Seabed Sediments (Folk, 1954) (EMODnet)

- 1.1.1 Mud
- 1.1.2 (gravelly) Mud
- 1.2.1 sandy Mud
- 1.2.2 (gravelly) sandy Mud
- 1.3.1 muddy Sand
- 1.3.2 (gravelly) muddy Sand
- 2.1.1 Sand
- 2.1.2 (gravelly) Sand
- 3.1.1 gravelly Sand
- 3.2.1 sandy Gravel
- 3.3.1 Gravel
- 4.1.1 gravelly Mud
- 4.2.1 muddy Gravel
- 4.3.1 gravelly muddy Sand
- 4.4.1 muddy sandy Gravel
- 5. Rock and Boulders

N

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Plot	A3
Scale	1:500,000

0 4 8 12 16 20 km

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Surficial Seabed Sediments within the Proposed Development (Folk, 1954)

Confidentiality Class	C1
Drg No	GoBe-0002
Rev	A
Layout	NA

Figure 6.2

Ref files: MMH_MP_Fig6.2_SeabedSediments_RevA

Seabed Features

6.4.7 The array area is located partly over and to the east of Turbot Bank, a relatively small shelf bank feature comprised of circalittoral coarse sediments and sometimes identified as part of the Aberdeen Bank (Holmes *et al.*, 2004; SNH and JNCC, 2013; Figure 6-2). Areas of large sandwaves (with heights up to 17 m and wavelengths of 200 m) are located in shallow coastal waters around Peterhead, often with smaller sandwaves or climbing megaripples located on their stoss side and showing convergent asymmetry towards the bed-load convergence zone. Approximately 50 km offshore, in water depths of between 60 m and 80 m, sandwaves up to 8 m high can be identified, with wavelengths between 160 m to 270 m. These features are anomalously large for the present hydraulic conditions and are thought to be relict features that may be active under extreme storm conditions (Owens, 1981; Gatliff *et al.*, 1994).

6.4.8 The offshore ECC crosses through the Buchan Deep (Figure 6-1), an enclosed basin which is potentially formed through the same mechanisms as others in the region, such as Devil's Hole, a subglacial tunnel valley thought to be created through catastrophic meltwater flooding. To the north of this is the southern extension of Bosies Bank, a large offshore moraine complex located, approximately, 50 km off the Scottish coastline. Further east, and north of the array area, is the Witch Ground Basin, a large topographic basin partially infilled by soft, mainly glaciomarine clays and silts of Quaternary age, with pockmark bedforms (Brookes *et al.*, 2013).

Coastal Form

6.4.9 The regional coastline is generally characterised by Devonian sedimentary rocks of the Old Red Sandstone Supergroup, with a few large masses of Caledonian intrusive rocks present on the coast. The largest of these is the Peterhead Granite, which outcrops for around 20 km between St. Fergus and Cruden Bay, forming rocky platforms and cliffs (Barne *et al.*, 1996).

6.4.10 East of Fraserburgh, the coastline consists of sandy beach with low outcrops of Dalradian rocks that extend offshore, with sand dunes fronted with drift deposits of blown sand (Ramsay and Brampton, 2000). Between St.Combs and the mouth of the River Ugie, the beach is backed by extensive dunes behind which lies the Loch of Strathbeg (Barne *et al.*, 1996). This is replaced at Peterhead by a rocky platform and red granite cliffs, with numerous stacks and caves, known as the Bullers of Buchan (Barne *et al.*, 1996; Ramsay and Brampton, 2000). These cliffs are resistant to marine erosion and provide little input of beach material (Statoil, 2015).

6.4.11 The Bullers of Buchan covers a stretch of approximately 3 km, with pink granite cliffs facing east, and are therefore exposed to storms and wave action from the North Sea. The cliffs vary in height from between around 20 m to 40 m, with steep lower cliffs cut into bedrock, and are capped by a 1 m to 3 m thick cover of glacial till, which is more gently sloping and subject to slumping and mass movement. Wave and spray action has acted to remove much of this superficial layer in the more southerly cliffs. Marine erosion has selectively eroded igneous dykes and exploited minor differences in geological structure, producing a complex coastline with numerous caves, arches, stacks and islands (Hansom, 2013).

6.4.12 The cliffs transition to a dune-backed bay-head beach at Cruden Bay, before continuing further south to Hackley Head. Beyond this point, the rocky shore disappears below the Sands of Forvie, a large area of spit sand dunes located at the mouth of the Ythan Estuary. Further south to Aberdeen, the coast is characterised by dune-backed sandy beaches (Barne *et al.*, 1996).

Sediment Transport

6.4.13 Regional scale assessments suggest bedload sediment is transported northwards along the coast before terminating in a bed-load convergence zone, indicated by the presence of large sandwaves (Gatliff *et al.*, 1994; Kenyon and Cooper, 2005). This sediment transport is controlled mainly by tidal currents, although the mobilisation of sediment is probably initiated by storm-wave-induced oscillatory currents. The combination of tidal and storm-wave-induced currents has the capacity to erode sediments up to gravel sizes and is most effective in the shallower water in the west. Further offshore, encompassing both the array area and far-field, storm-wave-induced orbital currents capable of initiating sand transport in water depths of 100 m are reported to be generated several times a year (Owens, 1981; Gatliff *et al.*, 1994).

6.4.14 Offshore and towards the array, coarse-grained sediment may be eroded and dispersed from bathymetric highs by a combination of tidal currents and storm-wave-induced oscillatory currents. However, sand transport rates are generally relatively low due to the increased depth and reduced tidal current strength, although sediment is mobilised during storms as outlined previously (Gatliff *et al.*, 1994). Relative topography may also influence bottom-current strength, with local acceleration around submarine bank features and bathymetric deeps (Owens, 1981; Gatliff *et al.*, 1994). Available evidence suggests that transport paths in the offshore area are aligned, approximately, north-south (Gatliffs *et al.*, 1994; DECC, 2004).

6.4.15 Longshore sediment transport within the regional sub-cell (as shown on Figure 6-3) is dominated by wave action, although tidal currents may also play a role especially at high tide (Ramsay and Brampton, 2000). Net littoral drift is generally low, as northward wave-induced drift is generally cancelled out by southward tidal currents (Barne *et al.*, 1996). Present-day fluvial input rates are low and will therefore not contribute any significant quantities of beach material. Further, the granite cliffs south of Peterhead are generally resistant to marine erosion and will similarly provide little input. North of Peterhead, cyclic seasonal effects of frontal dune undercutting and beach lowering under storm wave conditions and re-accretion due to swell wave and wind action are evident along the coast (Ramsay and Brampton, 2000). Further south at Cruden Bay, the dominant sediment transport mechanism is an onshore/ offshore regime controlled by the wave climate. There is little evidence of significant net longshore drift, with offshore transport occurring in both directions (Ramsay and Brampton, 2000).

6.4.16 SPM provides an indication of turbidity and is highly variable according to water depth and the marine physical processes in the area (i.e., tide, current and wind regimes). SPM concentrations are typically low in the array area, below approximately 5 mg/l (Figure 6-4) although near-bed SPM levels may be significantly elevated during storm events.

Hydrodynamics

6.4.17 This section provides an overview on the influences of tidal, non-tidal, and wave processes on the proposed development.

Tides

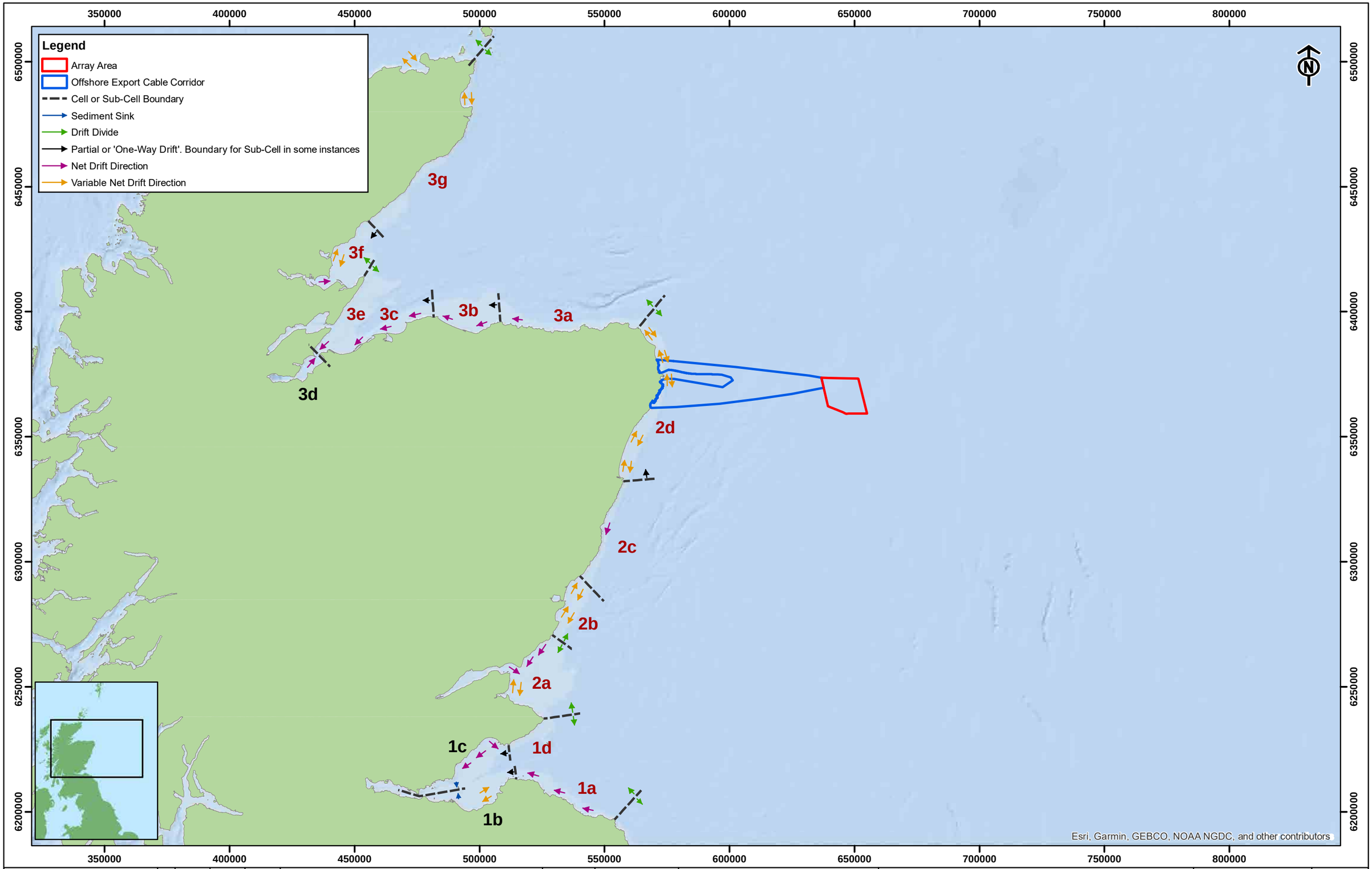
6.4.18 Modelled mean spring and neap tidal ranges across the array area are, approximately, 2.0 m and 1.0 m, respectively, with higher values along the offshore ECC as tidal range increases closer to the coast (ABPmer *et al.*, 2008). The tidal range measured at Peterhead (not part of the A-class tide gauge network[2]) is 3.3 m for springs and 1.6 m for neaps (Ramsay and Brampton, 2000). The closest A-class tidal gauge is located at Aberdeen (see Figure 6-1), approximately 30 km to the south of the proposed development, where the tidal range is measured as 3.62 m and 1.76 m for springs and neaps, respectively.

6.4.19 The flood tidal flow follows the coastline from the Moray Firth around Cairnbulg Point, meeting a southerly flowing stream from offshore and resulting in a southerly flowing flood tide, oriented parallel to the coastline (Ramsay and Brampton, 2000). Regional tidal ellipses are strongly rectilinear, with the ebb tide flowing northward along the coast (ABPmer *et al.*, 2008). Residual flow is generally directed towards the south (Marine Scotland, 2021).

6.4.20 Tidal currents are relatively weak in the offshore region of the far-field, with mean spring peak flow within the array area ranging from, approximately, 0.4 m/s to 0.8 m/s, with speeds increasing from north to south (Figure 6-5; ABPmer *et al.*, 2008). Current speeds increase inshore along the offshore ECC, due primarily to the acceleration of tidal currents around Rattray Head (shown on Figure 6-1) (Barne *et al.*, 1996). As shown in Figure 6-5, peak spring tidal flows generally range from 0.4 m/s at the eastern extent of the offshore ECC up to approximately 1.6 m/s in the west. Several kilometres (km) offshore, peak spring tidal current speeds exceed 1.0 m/s along much of the coastline, with peak neap currents of up to 0.7 m/s, before reducing closer to the coast (Ramsay and Brampton, 2000; ABPmer *et al.*, 2008).

6.4.21 Site-specific current measurements were recorded at Buchan Deep (described in paragraph 6.4.8 and shown in Figure 6-1 for the Hywind Scotland Pilot Park, located approximately 36 west of the array area. The results clearly indicate the dominant shore-parallel north-south current pattern, with residual flow towards the south. This pattern can be identified throughout the water column, with currents reducing towards the seabed (Statoil, 2014).

[2] This refers to the UK National Tide Gauge Network, owned and operated by the Environment Agency, which records tidal elevations at 44 locations around the coast of the UK. Data from this network has the highest data confidence for tidal levels around the UK.



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0 10 20 30 40 50 km

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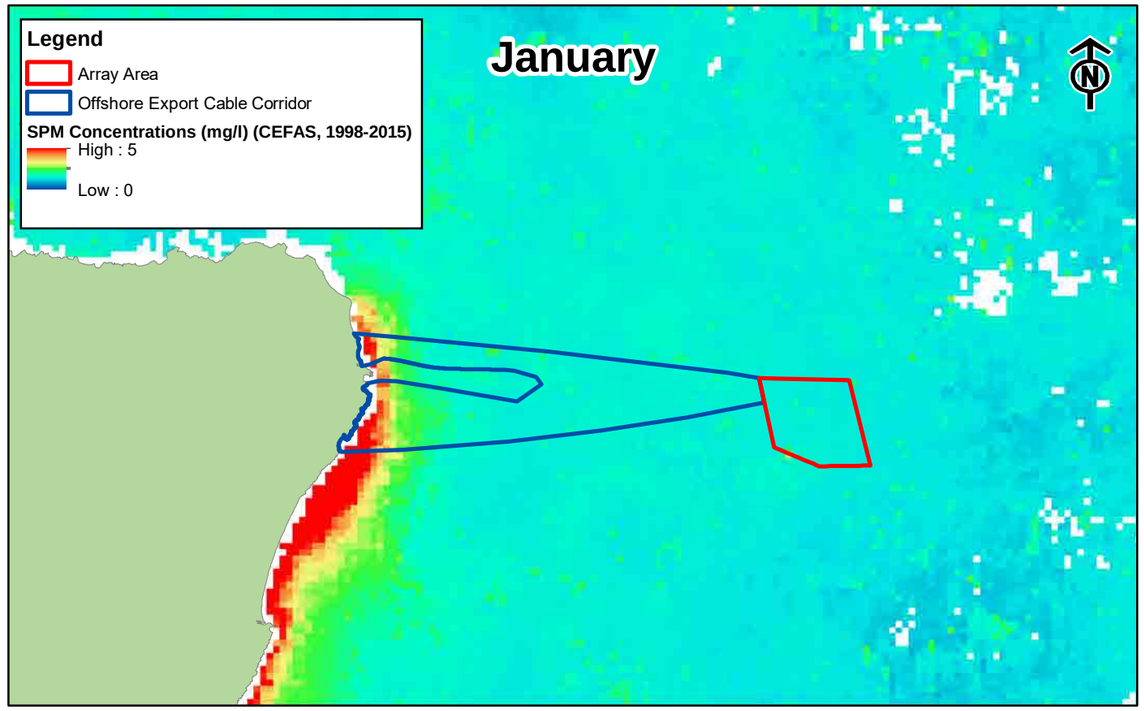
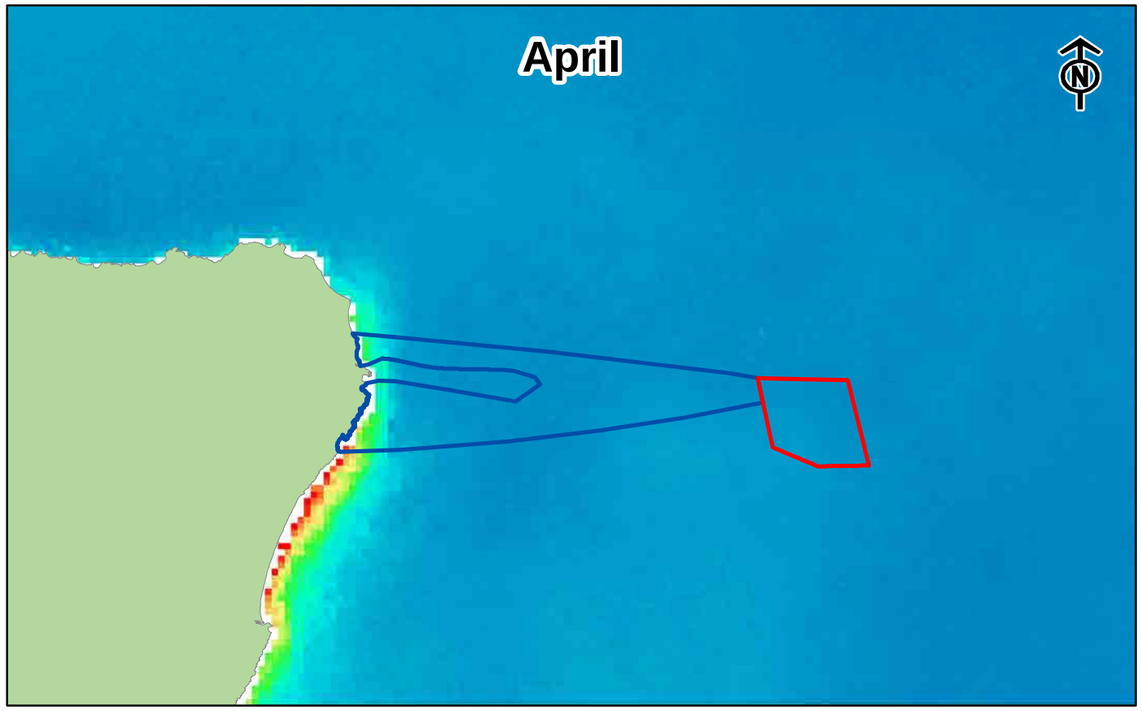
Regional Sediment Transport Pathways

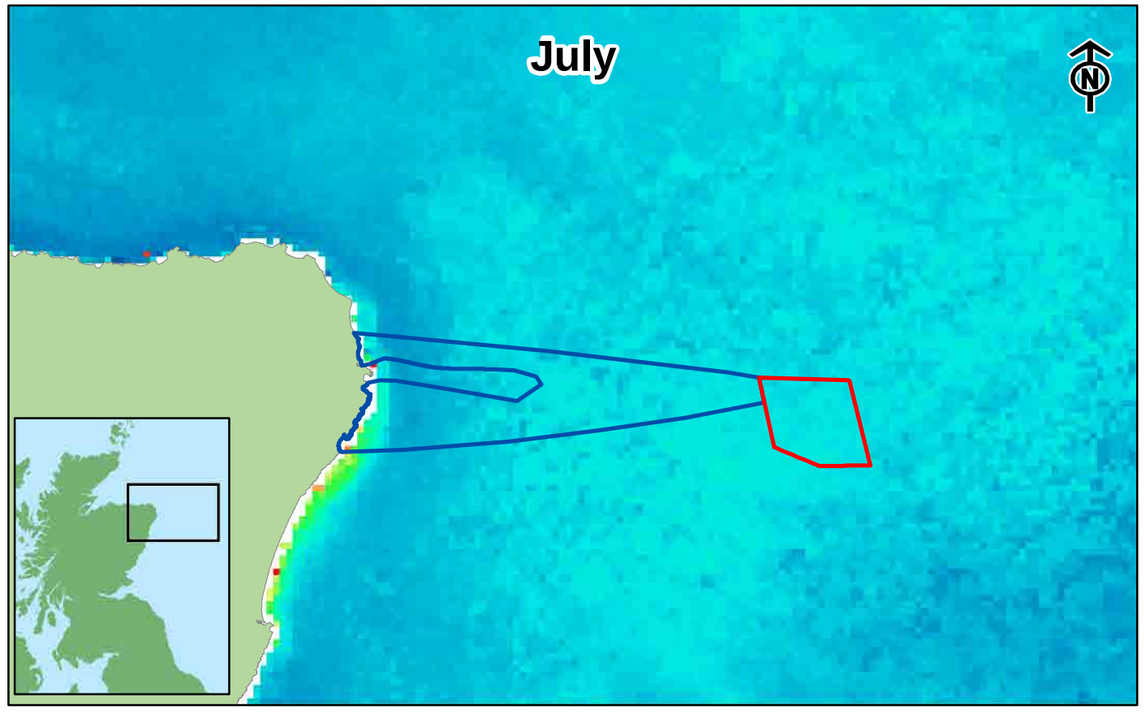
Confidentiality Class	C1
Drg No	GoBe-0003
Rev	A
Layout	NA

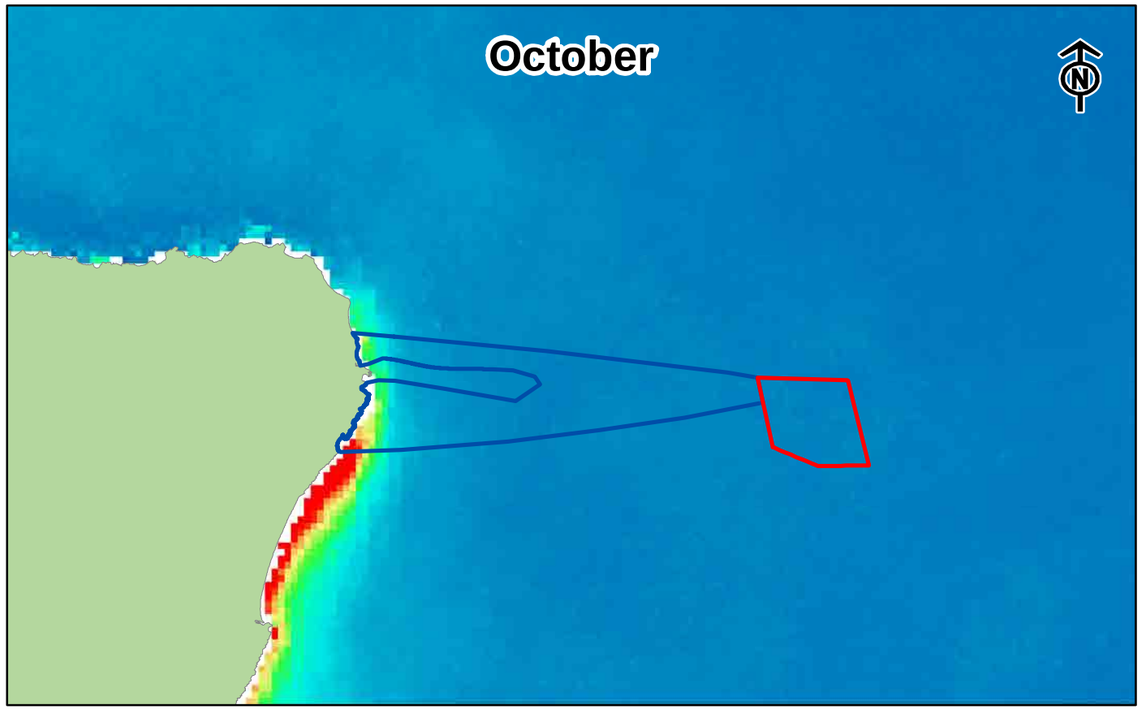
Figure 6.3

Ref files: MMH_MP_Fig6.3_RegionalSedimentPathways_RevA









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0 5 10 15 20 25 km

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Average Suspended Particulate Matter (Cefas, 2016)

Confidentiality Class	C1
Drg No	GoBe-0004
Rev	A
Layout	NA

Figure 6.4

Ref files: MMH_MP_Fig6.4_SPIM_RevA

550000 600000 650000

6400000

6350000

Legend

- Array Area
- Offshore Export Cable Corridor

Peak Flow for a Mean Spring Tide (m/s)

- 0.05 - 0.2
- 0.21 - 0.4
- 0.41 - 0.6
- 0.61 - 0.8
- 0.81 - 1
- 1.01 - 1.2
- 1.21 - 1.4
- 1.41 - 1.6

N

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0 4 8 12 16 20 km

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Peak Spring Tidal Current Speed (ABPmer et al., 2008)

Confidentiality Class	C1
Drg No	GoBe-0005
Rev	A
Layout	NA

Figure 6.5

Ref files: MMH_MP_Fig6.5_PeakSpringTidalCurrentSpeed_RevA

Non-tidal Influences

6.4.22 Superimposed upon regular tidal behaviours are various non-tidal influences, which mainly originate from meteorological effects. An example is surges, formed by rapid changes in atmospheric pressure causing the water levels to fluctuate considerably above or below the tidal level. This effect can be further impacted by the wind strength and direction. Moving low pressure systems and associated strong and persistent wind fields may generate strong positive surges, often referred to as a 'storm surge'. The height of a 1 in 50-year return period storm surge has been estimated as 1.25 m at Buchan Deep (Statoil, 2014).

6.4.23 Storm surges may cause short-term modification of astronomically driven tidal currents. Under an extreme (1 in 50-year return period) storm surge, current speeds may be more than twice that encountered under normal peak spring tide conditions.

6.4.24 The study area is also influenced by non-tidal residual circulation patterns, most notably the Fair Isle Current, which transports Atlantic water into the North Sea through the Fair Isle Channel before flowing southward down the Scottish east coast (Turrell *et al.*, 1990; BEIS, 2022b). This feature extends beyond the outer Moray Firth but becomes deflected eastward by the seabed topography off Rattray Head, flowing eastward as the Dooley Current (Svendsen *et al.*, 1991; McManus *et al.*, 1992). Wind stress has been identified as an important driver of regional circulation in the North Sea, with seasonal variation in circulation (in both strength and positioning) occurring as a result of changing wind patterns (Huthnance, 1991; Marine Scotland, 2021).

Waves

6.4.25 Mean annual significant wave heights[3] within the array area are, approximately, 2.0 m reaching up to 2.75 m in the winter months and decreasing closer to shore due to shallowing water effects (ABPmer *et al.*, 2008). Waves originate primarily from the north, as shown in Figure 6-6, with a smaller proportion from the south. This pattern is similar along the majority of the offshore ECC, apart from close to the coast, where the most frequent wave direction is from the south-east and north-east (ABPmer, 2018).

6.4.26 A detailed assessment of the metocean conditions was carried out at the Hywind Scotland Pilot Park (Statoil, 2014), located, approximately, 36 kmkm west of the array area. Modelled wave data showed that the wave climate at this location is dominated by waves from the north and south-west, with wave periods between 4 and 8 seconds, and annual significant wave heights of less than 2.0 m. Extreme significant wave heights were found to be of the order of 15.2 m, 17.8 m and 20.5 m for return periods of 1, 10 and 100 years, respectively (Statoil, 2014; 2015).

[3] Defined as the mean of the highest one third (33%) of waves (measured from trough to crest) occurring within a year.

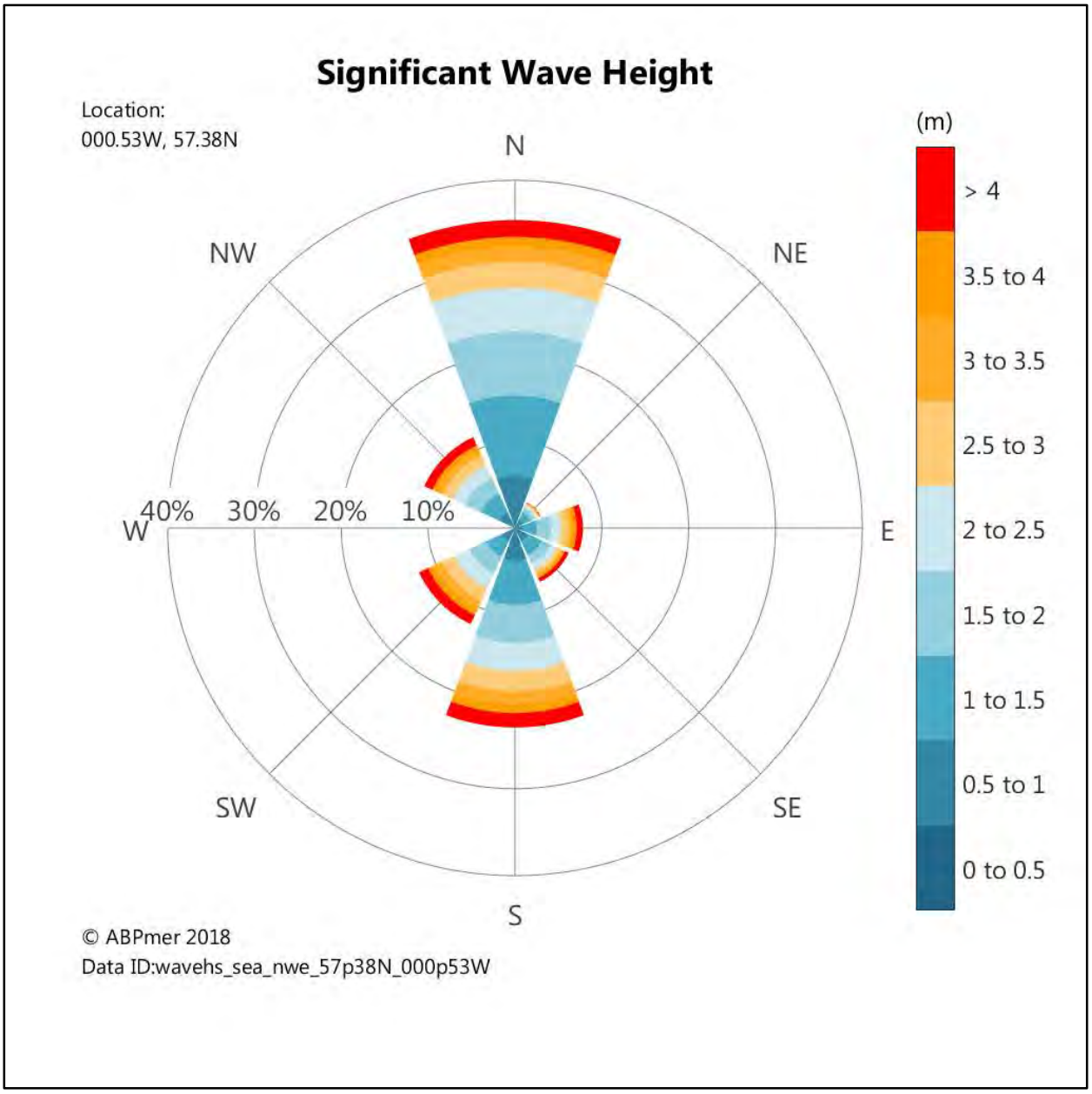


Figure 6-6: Significant wave height in the centre of the array area (ABPmer, 2018).

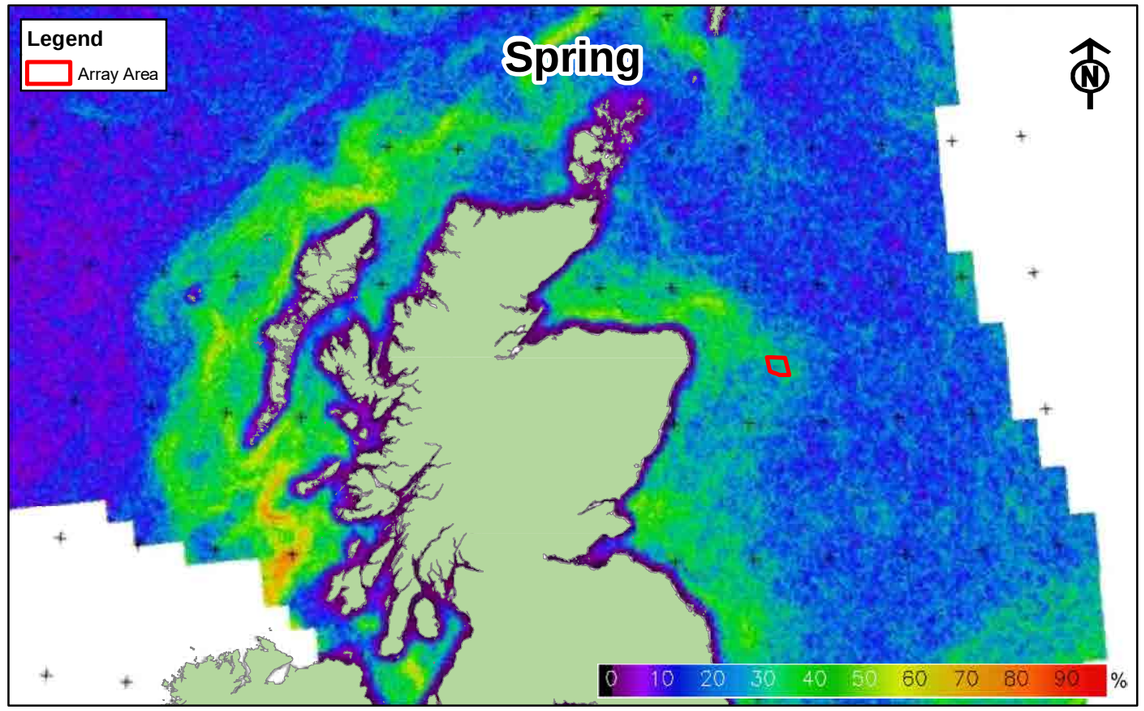
Frontal Zones and Stratification

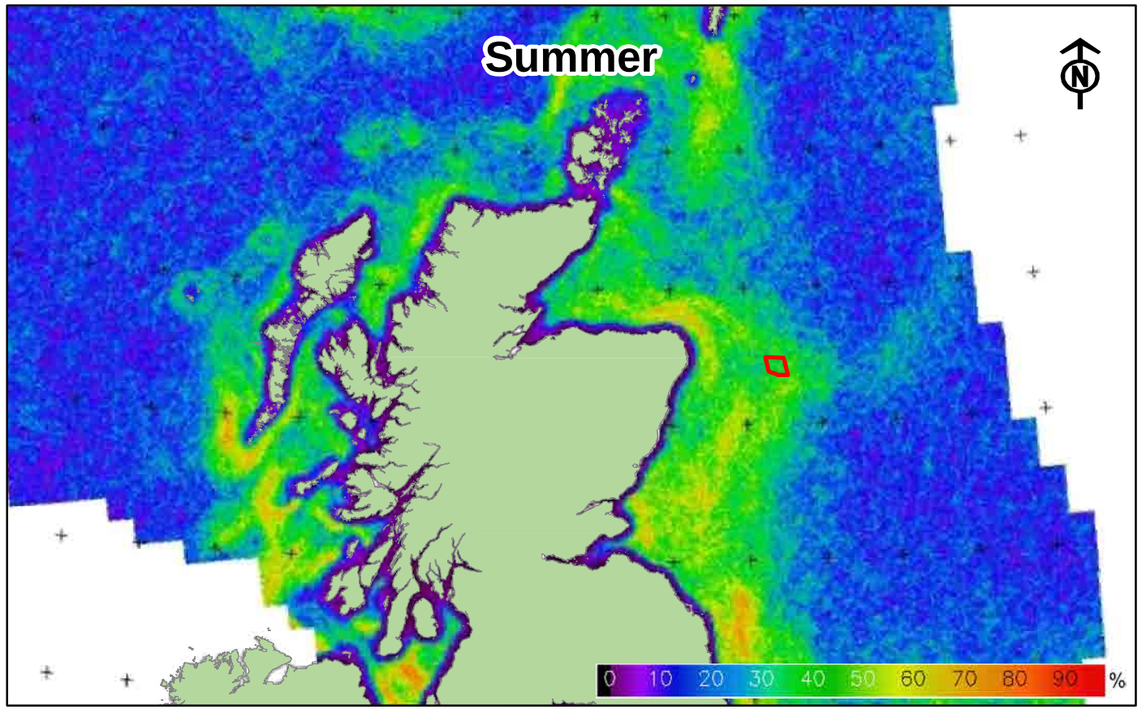
6.4.27 Frontal zones mark boundaries between water masses, including tidally mixed and stratified areas, and are numerous on the European continental shelf (BEIS, 2022b). Fronts play an important role in enabling the circulation and transport of nutrients and heat, and frequently reoccurring fronts (e.g., spatially and/or seasonally) are widely recognised as supporting enhanced biological activity (NatureScot, 2019).

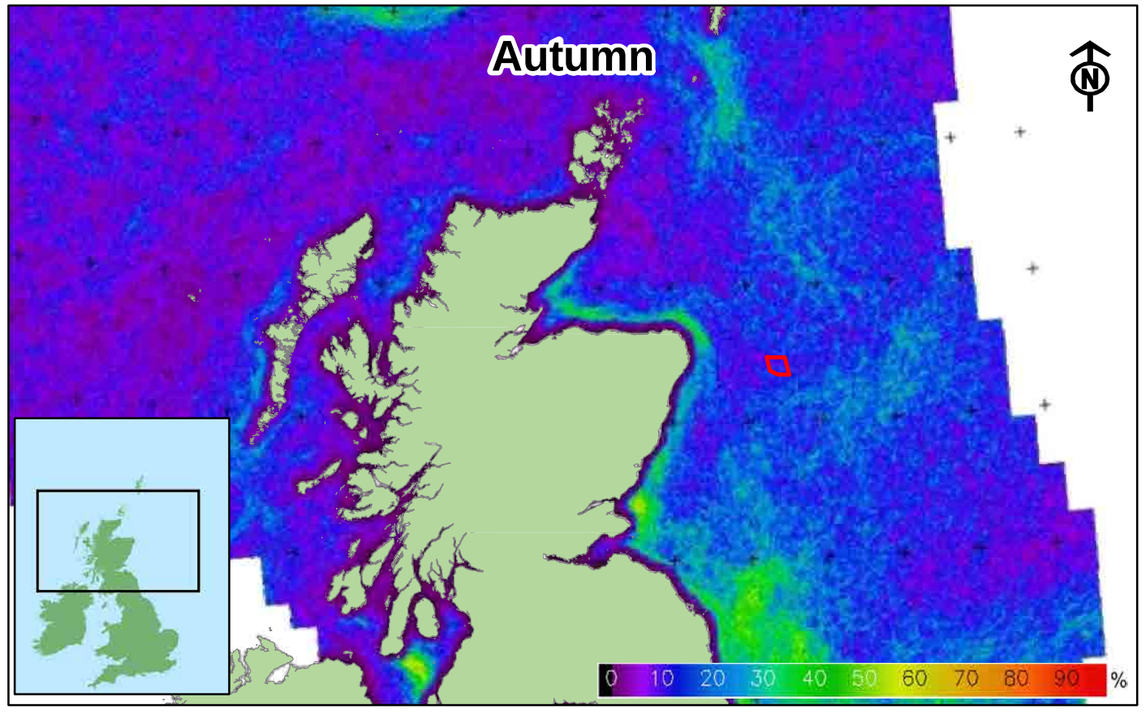
6.4.28 Stratification is a naturally occurring seasonal hydrodynamic feature relating to the distribution of sea water temperature and/or salinity. Vertical density stratification occurs

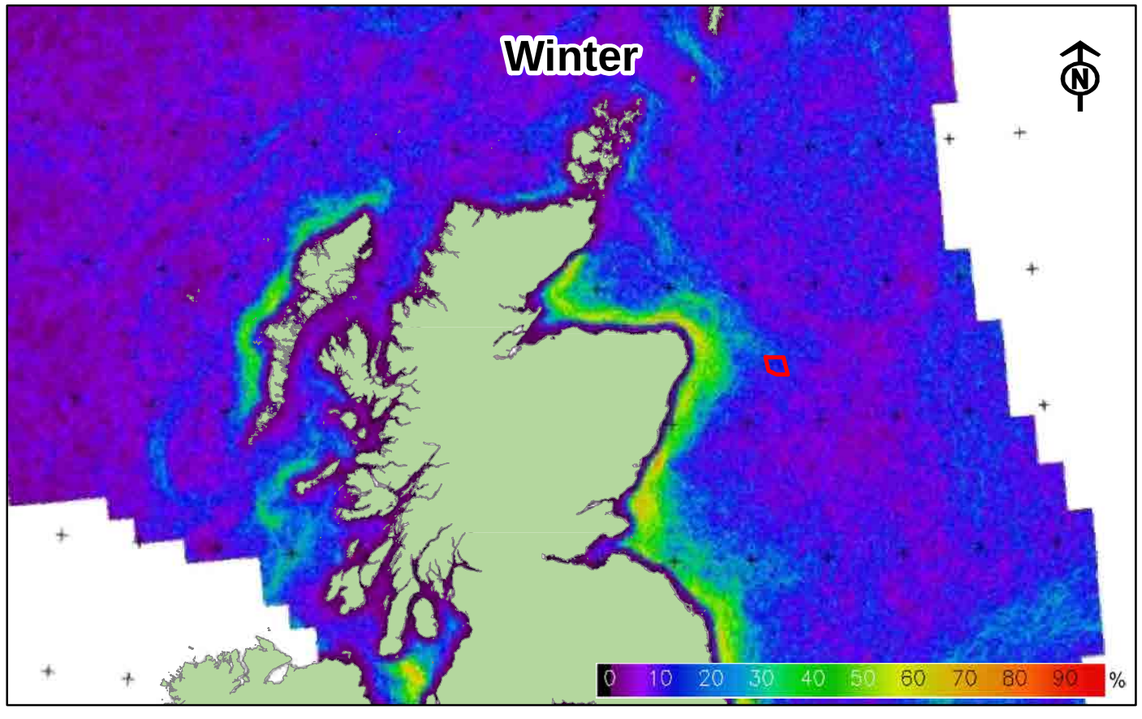
across the study area during the summer months due to solar heat input at the surface. At the boundary between seasonally stratified water and permanently mixed conditions, frontal jets occur which are associated with density fronts (Marine Scotland, 2021).

6.4.29 Frequent thermal fronts are present along the eastern Aberdeenshire coast and further offshore in the region of Rattray Head, which are thought to be a result of mixing in shallow coastal waters as tidal currents pass over a narrow shelf along the east coast (Figure 6-7). In addition to surface frontal features, Hill *et al.* (2008) describe a seasonal near-surface frontal jet running southwards along the eastern Aberdeenshire coast, driven by the presence of a bottom front. This feature is likely formed due to a cold pool of water trapped below the summer thermocline in the North Sea (Hill *et al.*, 2008; SNH and JNCC, 2012).









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0 40 80 120 160 200 km

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Comparison of Ocean Thermal Front Frequency for all Seasons (Miller *et al.*, 2014)

Confidentiality Class	C1
Drg No	GoBe-0030
Rev	A
Layout	NA

Figure 6.7

Ref files: MMH_MP_Fig6._ThermalFronts_RevA

Future Changes

6.4.30 A consideration of the future baseline, including the associated variation, is provided in the context of the operating lifetime of the proposed development. For the current purposes of this Offshore Scoping Report, the Representative Concentration Pathway (RCP) 8.5 (high-emissions) scenario (Palmer *et al.*, 2018) has been presented.

6.4.31 UKCP18 suggests an increase in Mean Sea Level (MSL) of 0.5 m to 0.6 m at 2100 along the Aberdeenshire coastline. Future changes in storm surges have been predicted to be indistinguishable from background variation (Lowe *et al.*, 2009), although extreme surge level event frequency is likely to increase (IPCC, 2021).

6.4.32 Wave energy is predicted to decrease, such that by 2100 a decrease larger than 10% has been modelled in the North Sea (RCP8.5 scenario; Bonaduce *et al.*, 2019; Meucci *et al.*, 2020). Inter-decadal variability may be largely due to the influence of local weather in the North Sea (EDF Energy, 2020).

6.4.33 In addition, the United Kingdom is affected by isostatic readjustment, a regional change in land surface elevation following the removal of the weight of the British-Irish Ice Sheet. Due to this post-glacial uplift the sea level in this region is estimated to change by approximately -0.6 mm to -0.9 mm/year (Palmer *et al.*, 2018), although this is outpaced by rates of global sea level rise (BEIS, 2022a).

Designated Sites and Protected Species

6.4.34 Designated sites in the vicinity of the study area, which are designated for the protection and conservation of marine habitats of relevance to marine and coastal processes are shown in Figure 6-8. A comprehensive list, with detail of the relevant (marine processes) protected features, is provided blow:

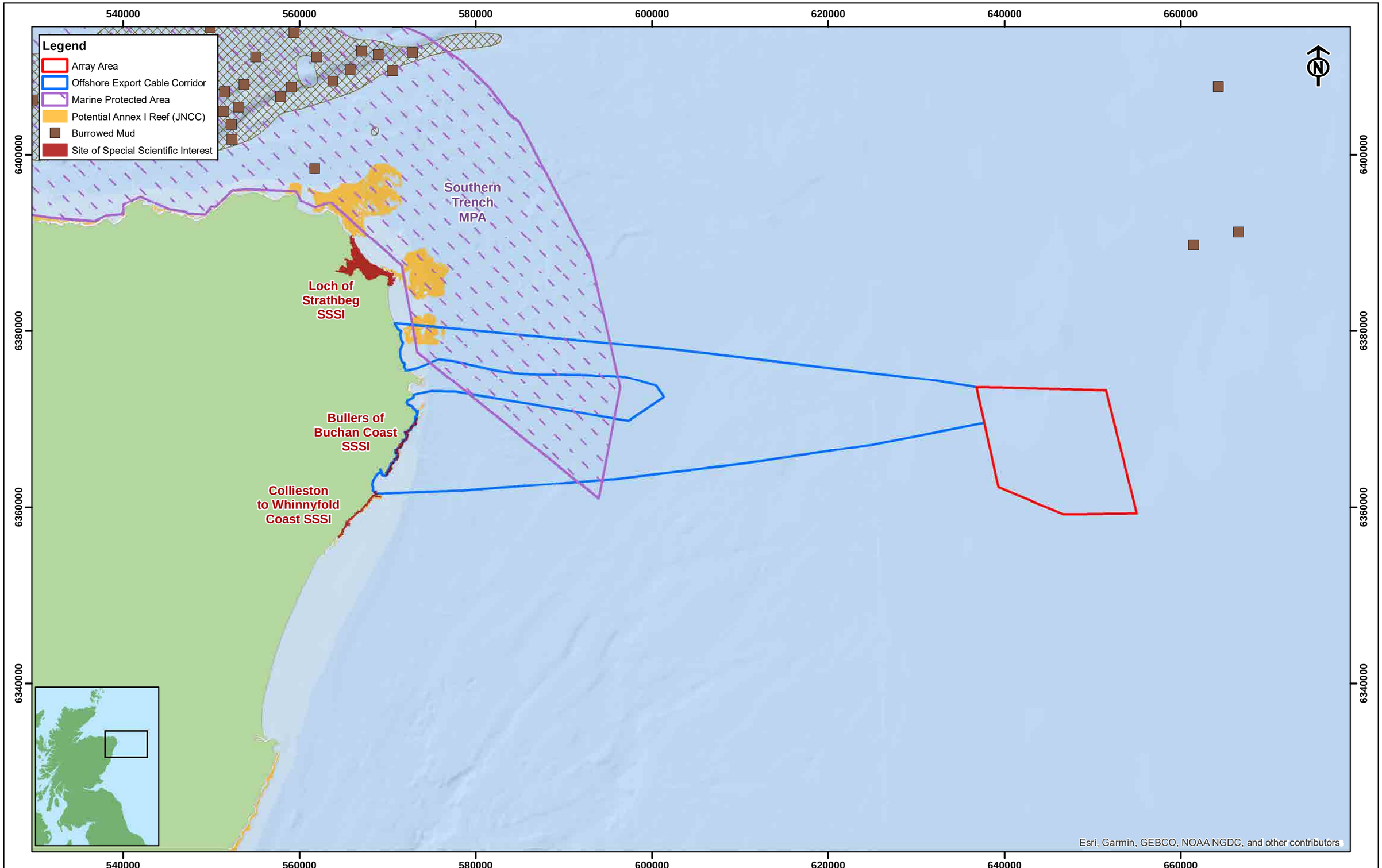
- Southern Trench NC MPA: Burrowed mud, fronts, Quaternary of Scotland, shelf deeps, submarine mass movement.

6.4.35 Several coastal SSSI are also present:

- Loch of Strathbeg: designated for coastal habitats (including saltmarsh and sand dunes) and coastal geomorphology of Scotland;
- Bullers of Buchan Coast: designated for coastal geomorphology of Scotland; and
- Collieston to Whinnyfold Coast: designated for coastal features (maritime cliff) and notable geology.

6.4.36 Although only the Bullers of Buchan Coast SSSI overlaps with the Project ECC, other designated sites which may be impacted by increases to suspended sediments or changes to seabed morphology which may affect littoral transport have also been identified as potential receptors.

6.4.37 Whilst relevant to this scoping stage of the EIA, project refinement including that of the offshore ECC, and associated landfall will inherently result in a refinement of the designated sites considered within the EIA stage of the proposed development.



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Plot	A3
Scale	1:400,000

0 2 4 6 8 10 km

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Designated Sites of relevance to Marine and Coastal Processes within the Study Area (Scottish Government, 2022)

Confidentiality Class	C1
Drg No	GoBe-0006
Rev	A
Layout	NA

Figure 6.8

Ref files: MMH_MP_Fig6.8_DesignatedSites_RevA

6.5 Summary and Key Issues

6.5.1 The key marine and coastal processes receptors within the marine and coastal processes study area are identified as follows:

- Seabed features including the Buchan Deep;
- The coast at the proposed landfall;
- Areas of undesignated seabed;
- The Southern Trench NC MPA; and
- The Bullers of Buchan Coast SSSI.

6.6 Embedded Commitments

6.6.1 As part of the project design process, several designed-in measures have been proposed to reduce the potential for impacts on environmental receptors. These are presented in Table 6-2 and in the Commitments Register (Appendix A) and will likely evolve over the development process as the EIA progresses and in response to stakeholder consultation.

Table 6-2: Embedded commitment measures of relevance to marine and coastal processes.

Code	Commitment	Type (Primary, Secondary or Tertiary)	How Commitment Secured
C-01	Scour protection or other appropriate mitigation to be employed around seabed infrastructure where there is the potential risk for significant scour to develop.	Tertiary	Cable Plan (CaP) CMS
C-02	Development of and adherence to a CaP. The CaP will confirm planned cable routing, installation methods, cable specifications and any additional protection and requirement for any post-installation monitoring.	Tertiary	CaP
C-03	Development of and adherence to a Development Specification and Layout Plan (DSLP). The DSLP will confirm layout and relevant design parameters.	Tertiary	DSLP
C-05	Development of a CMS. This will detail the construction procedures (including piling), good working practices for constructing the works, and how the construction-related mitigation steps are to be delivered.	Tertiary	CMS
C-09	Development of and adherence to a Decommissioning Programme (DP). The DP will outline measures for the decommissioning of the Proposed Development.	Tertiary	DP
C-29	Where practicable, cable burial will be the preferred means of cable protection. Cable burial will be informed by the CBRA and detailed within the CaP. In areas where CBRA deems burial not feasible, suitable implementation and monitoring of cable protection will be employed.	Primary	CaP
C-34	Offshore infrastructure will be micro-sited, where reasonably practicable (to an extent not resulting in a hazard for marine traffic and Search & Rescue capability), around any sensitive seabed habitats including Annex I	Primary	DSLP Project Environmental Monitoring Plan (PEMP)

Code	Commitment	Type (Primary, Secondary or Tertiary)	How Commitment Secured
	habitat (if present), informed through the undertaking of survey works pre-construction.		

6.6.2 As a result of the commitment to implement these measures, and to align the proposed development with various standard sectoral practices and procedures, the embedded mitigations are considered inherently part of the design of the proposed development and have therefore been included in the assessment presented in Section 6.7.

6.6.3 The requirement and feasibility of any additional mitigation measures will be dependent on the significance of the effects upon marine and coastal processes and will be consulted upon with statutory consultees throughout the EIA process.

6.7 Scoping of Impacts

6.7.1 An initial assessment of the likelihood of effects on marine and coastal processes due to proposed development activities for the scoping stage of the EIA process are presented in Table 6-3. The assessment is based on a combination of the following: the definition of the proposed development at the scoping stage; embedded commitments (as set out in Section 6.6, together with the means by which it will be secured); the level of understanding of the baseline at the scoping stage; the existing evidence base for marine and coastal processes effects due to project activities; relevant policy; and the professional judgement of qualified marine and coastal processes specialists.

6.7.2 Marine and coastal processes are typically best described as pathways in most cases, rather than receptors. accordingly, although outputs from the marine and coastal processes assessments will be reported in a stand-alone EIAR chapter, for the most part they will not be accompanied by statements of effect significance. instead, the information on changes to the marine and coastal processes pathways will be used to inform other EIA topic assessments, such as:

- Chapter 7: Marine Water and Sediment Quality;
- Chapter 8: Benthic, Subtidal and Intertidal Ecology;
- Chapter 9: Fish and Shellfish Ecology;
- Chapter 11: Marine Mammals; and
- Chapter 12: Commercial Fisheries.

6.7.3 The scoping of indirect impacts from the identified marine and coastal processes pathways will be assessed within the relevant topics.

6.7.4 The marine and coastal processes features that are considered as potential receptors will be guided by tidal excursion, as to be further quantified using project-specific numerical modelling, and will include the following features:

- The adjacent coastline;
- Nearby offshore, designated, sub-tidal sandbanks and sandwave areas; and
- Nationally or internationally designated sites with interest features below MHWS (seabed/sedimentary/geological interest features).

Table 6-3: Scoping assessment for Marine and Coastal Processes.

Impact Pathway	Embedded Commitments	Scoped In or Scoped Out	Justification
Construction (and Decommissioning)			
Increases in suspended sediment concentrations (SSCs) and changes to seabed levels.	C-01, C-02, C-03, C-05, C-09, C-29	Scoped In	Temporary elevations in SSCs due to construction (i.e., cable installation) activities. This could in turn result in changes to the underlying seabed/coastal bed levels, through deposition of the suspended material and changes to the surficial sediment type. Increases in SSC and associated deposition may have indirect, adverse impacts upon other receptor groups including Benthic, Subtidal and Intertidal Ecology (Chapter 8), Fish and Shellfish Ecology (Chapter 9), Marine Mammals (Chapter 11) and Commercial Fisheries (Chapter 12).
Potential impacts to seabed morphology (sandbanks and notable bathymetric depressions).	C-02, C-03, C-05, C-09, C-29, C-34	Scoped In	Activities such as seabed preparation, sandwave levelling and cable trenching have the potential to directly disturb the seabed morphology. This disturbance may have adverse impacts on other receptor groups including Benthic, Subtidal and Intertidal Ecology (Chapter 8), Fish and Shellfish Ecology (Chapter 9), and Commercial Fisheries (Chapter 12). Decommissioning activities relating to the removal of infrastructure (if required) have the potential to directly disturb the local seabed morphology.
Modifications to littoral transport and coastal behaviour (erosion), including at landfall.	C-02, C-05, C-29	Scoped In	Where the offshore export cable makes landfall, it must transition through the intertidal and coastal zones. The methods available for installing cables in such environments may physically disturb or disrupt the coastal morphology to differing degrees depending on the construction methods employed and any structures installed. At the time of construction, any disturbance is likely to be localised to the landfall site. This disturbance may have adverse impacts on other receptor groups including Benthic, Subtidal and Intertidal Ecology (Chapter 8). There is also the potential to impact the form of the Bullers of Buchan Coast SSSI, potentially impacting on the designated features. The methods identified for removing or decommissioning the cable and/or cable protection aspects may physically disturb the local morphology.
Operation and Maintenance			
Potential impacts to seabed morphology.	C-01, C-02, C-03, C-29	Scoped In	There is the potential for the introduction of localised seabed abrasion associated with wind farm infrastructure that moves, for example anchor or mooring chains, under the influence of waves, currents, and movement of the turbines (Maxwell *et al.*, 2022). This could result in localised change

Impact Pathway	Embedded Commitments	Scoped In or Scoped Out	Justification
			to seabed morphology. In addition, the offshore ECC may cross the Southern Trench NC MPA. The presence of the cable and any cable protection in this offshore area has the potential to change the form and function of the seabed locally, potentially impacting on the designated features of the NC MPA.
Modifications to the wave and tidal regime, and associated impacts to morphological features.	C-03	Scoped Out	The interaction between the planned infrastructure, for example the WTGs and OEP foundations, cable protection or cable crossings, and the baseline metocean regime (waves; tides) may result in localised changes to tidal current speeds, wave energy and turbulence. These changes may, in turn, impact on adjacent physical features, both offshore and along the coast. It is considered that the impacts potentially introduced by floating offshore structures will be greatly reduced relative to any resulting from the presence of fixed offshore structures, due to the vertical cross section of infrastructure in the water column being much less. Impact assessments for previous offshore wind developments, based on fixed turbine foundations, have demonstrated that there are no significant impacts on waves and tidal regime (Repsol and EDP Renewables, 2013; Moray Offshore Renewables Limited (MORL), 2014). In combination with generally low tidal currents in the area, with mean peak spring flows in the array area ranging between 0.4 m/s to 0.8 m/s, as well as distance offshore (approximately 60 km), these impacts are considered unlikely to significantly impact adjacent morphological features or the coast and are therefore proposed to be scoped out of further assessment.
Seabed scouring.	C-01, C-02, C-29	Scoped In	The wind farm infrastructure has the potential to cause localised seabed scouring, resulting in bathymetric changes and localised alterations to sediment transport patterns. This is likely to occur both around foundations for offshore electrical platform(s) as well as around anchors and clump weights that may be part of floating WTG infrastructure.
Modifications to stratification and frontal features.	C-03	Scoped Out	Interactions between planned infrastructure and the baseline metocean regime (waves, tides) may result in localised changes to tidal currents speeds, wave energy and turbulence. These changes result in the generation of localised turbulent wakes (Dorrell *et al.*, 2022). However, floating offshore windfarms in deeper water are expected to be less disruptive to current and wave regimes (and hence seasonal stratification) than fixed turbines in shallower waters (Farr *et al.*, 2021). The frontal features in the region are predominately coastal (Figure 6-7) thus due to distance from these features, the array area is expected to have limited impact on stratification.

6.8 Potential Cumulative Impacts

6.8.1 Chapter 4 (EIA Methodology) details how potential cumulative impacts will be assessed through a CIA and gives examples of the projects which are likely to be included in that assessment. For marine and coastal processes, cumulative interactions may occur with other planned OWFs as well as other activities, for example aggregate extraction, in the study area.

6.8.2 Impacts that are scoped into the assessment for the proposed development alone are generally spatially restricted to being within proximity to the array area and offshore ECC. However, certain potential impacts, such as an increase in SSC, have the potential to be observed over a wider area. Potential cumulative impacts on marine and coastal processes receptors will be guided by tidal excursions, to be further quantified using project specific numerical modelling.

6.8.3 The CIA for marine and coastal processes will consider the maximum adverse design scenario for each of the projects, plans and activities in line with the methodology outlined in Chapter 4 (EIA Methodology).

6.9 Potential Transboundary Effects

6.9.1 No transboundary impacts on marine physical process pathways are anticipated to occur as a result of the proposed development activities during construction, O&M or decommissioning. The proposed development is a significant distance from the nearest adjacent exclusive economic zone (EEZ) of another state and, therefore, it is considered that transboundary impacts will not occur and will therefore be scoped out from further consideration within the EIA.

6.10 Proposed Approach to EIA

Guidance

6.10.1 In addition to the general approach and guidance outlined in Chapter 4 (EIA Methodology), the assessment of Marine and Coastal Processes receptors will also comply with the following guidance documents where they are specific to this topic:

- EIA for offshore renewable energy projects (British Standards Institution (BSI), 2015);
- Coastal Process Modelling for Offshore Wind Farm EIA; 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);
- Guidelines for Data Acquisition to Support Marine Environmental Assessments of Offshore Renewable Energy Projects (Cefas, 2011);
- Marine Scotland Consenting and Licensing Guidance for Offshore Wind, Wave and Tidal Energy Applications (MS-LOT, 2018);
- National Resources Wales (NRW) Monitoring Evidence Report No: 243 Guidance on Best Practice for Marine and Coastal Physical Processes Baseline Survey and Monitoring Requirements to inform EIA of Major Development Projects (Brooks *et al.*, 2018);
- Review of Cabling Techniques and Environmental Effects applicable to the Offshore Wind farm Industry. Department for Business Enterprise and Regulatory Reform (BERR) in association with Defra (BERR, 2008);

- Offshore Windfarms: Guidance note for EIA in Respect of Food and Environmental Protection Act 1985 (FEPA) and Coast Protection Act 1949 (CPA) requirements (Cefas, 2004);
- Review of environmental data associated with post-consent monitoring of licence conditions of offshore wind farms. Marine Management Organisation (MMO) Project No: 1031 (Fugro-Emu, 2014);
- Offshore wind cabling: ten years' experience and recommendations (Natural England, 2018);
- Best Practice Advice for Evidence and Data Standards for offshore renewables projects (Natural England, 2022);
- Further review of sediment monitoring data (Collaborative Offshore Windfarm Research Into the Environment (COWRIE) ScourSed-09) (ABPmer *et al*., 2010);
- Review of Round 1 Sediment process monitoring data – lessons learnt (Sed01) (ABPmer *et al*., 2007);
- Dynamics of scour pits and scour protection – Synthesis report and recommendations (Sed02) (HR Wallingford *et al*., 2007); and
- Potential effects of offshore wind developments on coastal processes (ABPmer and METOC, 2002).

Additional data sources

6.10.2 A more detailed literature review will be developed for the EIA, building upon the high-level outline provided within this Offshore Scoping Report. Project-specific survey outputs will be used to enhance the understanding of the baseline conditions. These may include the following across the array area and offshore ECC:

- Geophysical surveys – commenced in March 2023 for the array area and June 2023 for the offshore ECC; and
- Benthic surveys – planned to commence in July 2023 for both the array area and the offshore ECC.

6.10.3 A wave buoy was deployed within the Muir Mhòr array area in early 2023, to collect metocean data for 12 to 24 months.

6.10.4 A numerical model will be developed to factor in the project-specific surveys, metocean data collection and a range of representative baseline conditions. This will involve a validated hydrodynamic model that will be used to drive any sediment plume scenarios defined following scoping. The model will be applied to investigate the source-pathway-receptor relationship for several of those issues scoped in (Table 6-3), based on the realistic maximum design scenario, as provided in Chapter 3 (Project Description) and following stakeholder consultation. Numerical model outputs will be supplemented with the evidence base, using existing studies from comparable projects.

Assessment Methodology

6.10.5 The EIA will follow the general approach outlined in Chapter 4(EIA Methodology) of this Offshore Scoping Report.

6.10.6 The study area for marine and coastal processes baseline within the EIA will be as currently outlined but will be further refined with consideration to the tidal excursions and specifically sediment plume pathways to allow a definition of the ZoI, as well as to focus on the final offshore ECC. The scope of the marine and coastal processes assessment is to characterise

and understand the marine and coastal processes present within the proposed development area, particularly with respect to the metocean regime and associated sediment transport processes. These will be used to inform other topic specific assessments, for example Benthic, Subtidal and Intertidal Ecology and Fish and Shellfish Ecology.

6.10.7 The marine and coastal processes assessment will consider the magnitude and duration of the impact, the reversibility of the impact and the timing and frequency of the activity. An assessment of the potential impacts of the proposed development will be undertaken through application of the evidence base, alongside outputs from numerical modelling activities. The significance of any changes will be evaluated against the likely naturally occurring variability in, or long-term changes to, the marine physical environment within the proposed development lifetime due to natural cycles, for example storm events, and/or climate change.

6.10.8 Consultation will be undertaken at pivotal points throughout the EIA process to ensure that the approach, including the application of the evidence base alongside numerical modelling, satisfies the requirements of both stakeholders and regulators.

6.11 Scoping Questions

6.11.1 The following scoping questions refer to the marine and coastal processes chapter and are designed to focus the scoping exercise and inform the scoping opinion:

- Do you agree with the study area(s) defined in Section 6.2 for marine and coastal processes?
- Do you agree with the use of those data listed in Section 6.3, and any additional anticipated data listed in Section 6.10, being used to inform the Offshore EIA?
- Are there any additional data sources or guidance documents that should be considered?
- Do you agree that all pathways, receptors, and potential impacts related to marine and coastal processes have been identified?
- Do you agree with the scoping in and out of impact pathways in relation to marine and coastal processes?
- Do you agree with the assessment of the potential for transboundary effects in relation to marine and coastal processes?
- Do you agree with the proposed approach to cumulative effects in relation to marine and coastal processes?
- Do you agree with the proposed assessment methodology for marine and coastal processes?

7 Marine Water and Sediment Quality

7.1 Introduction

7.1.1 This chapter of the Offshore Scoping Report identifies the Marine Water and Sediment Quality (MW&SQ) features of relevance to the proposed development and considers the potential impacts from the construction, O&M and decommissioning of the offshore components of the proposed development on MW&SQ up to MHWS. It is noted that MW&SQ is considered a receptor, while simultaneously providing an impact pathway to other receptors.

7.1.2 For the purposes of this Offshore Scoping Report and subsequent EIAR, MW&SQ includes the following elements:

- Water Quality (including surface temperature and salinity, Water Framework Directive (WFD) Protected Areas, Bathing Waters, Shellfish Water Protected Areas (SWPAs), Sensitive Areas); and
- Sediment Quality (including sediment contamination).

7.1.3 This chapter should be read alongside the following chapters:

- Chapter 6: Marine and Coastal Processes.

7.1.4 This chapter of the Offshore Scoping Report has been prepared by GoBe Consultants Limited.

7.2 Study Area

7.2.1 The MW&SQ study area is defined for the proposed development as follows:

- Near-field:
  - The array area;
  - The offshore ECC;
  - The proposed landfall areas for the ECC; and
- Far-field:
  - The coastal and seabed zones outside of those previously defined areas, but existing within the vicinity of the proposed development that may be impacted by changes to MW&SQ. This has been informed through further analysis of the Marine and Coastal Processes (Chapter 6) pathways.

7.2.2 The study area for MW&SQ is consistent with that defined within Chapter6, which is subject to further refinement during the EIA.

7.2.3 The study area used within this chapter is presented in Figure 6-1 of the Marine and Coastal Processes chapter (Chapter 6).

7.3 Baseline Environment

Data Sources

7.3.1 The data sources that have been used to inform this MW&SQ chapter are presented in Table 7-1. These data sources will be taken forward and used to inform the EIA, alongside any additional site-specific data will be collected for the proposed development. For the purposes of this Offshore Scoping Report, a desk-based review of existing and known/planned activities and projects was undertaken using relevant spatial and scientific data sources.

Table 7-1: Key sources of Marine Water and Sediment Quality data.

Source, Author and Year	Summary	Coverage of Muir Mhòr array area and ECC
SEPA(2021/2022), 'Bathing Waters results for Scotland'. https://www2.sepa.org.uk/bathingwaters/Locations.aspx [Accessed: March 2023].	SEPA monitors the water quality for the designated Bathing Waters in Scotland, through an annual sampling programme (running from 15 May to 30 September). Bathing Water profiles are provided online, giving a more detailed insight into the current status of individual Bathing Waters.	Bathing Water samples are taken annually, with some samples from the vicinity of the Muir Mhòr landfall area. These designations will be considered within the EIAR. This dataset provides partial coverage of the proposed development.
SEPA (2020), 'Water Classification Hub'. https://www.sepa.org.uk/data-visualisation/water-classification-hub/ [Accessed: March 2023].	SEPA provides an interactive mapping feature which presents the status of various quality elements for waterbodies in Scotland (e.g., surface waters, groundwaters, and protected areas).	Water quality elements of relevance to the Muir Mhòr offshore ECC and landfall areas, which will be considered within the EIAR. This dataset provides partial coverage of the proposed development.
Scottish Government (2019), 'Shellfish Water Protected Areas: Maps'. https://www.gov.scot/publications/shellfish-water-protected-areas-maps/ [Accessed: March 2023].	A map produced by the Scottish Government, presenting the designated shellfish water protected areas in Scottish waters. These waters are designated under the Shellfish Waters Directive (SWD).	Designated waterbodies under the SWD, of relevance to the Muir Mhòr offshore ECC and landfall areas, will be considered within the EIAR. This dataset provides partial coverage of the proposed development.
Department for Environment, Food and Rural Affairs (Defra) (2012),''Waste Water Treatment in the United Kingdom- 2012. Implementation of the European Union Urban Waste Water Treatment Directive- 91/271/EEC'. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/69592/pb13811-waste-water-2012.pdf [Accessed: March 2023].	This report provides an overview of the various sensitive waters in Scottish territorial and inshore limits. This data is caveated that maps produced reflected the spatial data reporting and submission guidelines, as opposed to legal designations.	The various 'designated' waterbodies of relevance to the Muir Mhòr offshore ECC and landfall areas will be considered within the EIAR. This dataset provides partial coverage of the proposed development.
SEPA (2019), 'Urban Waste Water Treatment Directive (UWWTD) Sensitive Areas'. https://www.gov.scot/publications/urban-waste-water-treatment-sensitive-areas-map/ [Accessed: March 2023].	A map produced by SEPA showing all the Scottish waters designated as sensitive to the effects of sewage discharges, under the Urban Waste Water Treatment (Scotland) Regulations.	Waterbodies designated under the (UWWTD, of relevance to the Muir Mhòr offshore ECC and landfall areas. This dataset provides partial coverage of the proposed development.

Source, Author and Year	Summary	Coverage of Muir Mhòr array area and ECC
Scottish Government and SEPA (2021), 'Welcome to the 2021 Update to the Water Environment Hub'. https://informatics.sepa.org.uk/RBMP3/ [Accessed: March 2023].	A report previously produced by SEPA and the Scottish Government described the function of the third River Basin Management Plan (RBMP) for Scotland. The data underpinning this report (and the full written report) is available on the interactive Water Environment Hub of the SEPA webpage.	The RBMPs of relevance for Muir Mhòr will be considered within the EIAR. This dataset provides partial coverage of the proposed development.
(NMPi (2017), 'Mean Monthly Sea Surface Temperature and Salinity'. https://marine.gov.scot/maps/72 [Accessed: March 2023]. https://marine.gov.scot/maps/74 [Accessed: March 2023].	This data is available on the NMPi, denoting the salinity and sea surface temperature of the Scottish Continental Shelf areas of the North Sea.	The salinity and sea surface temperature of waters relevant to the proposed development will be considered within the EIAR. These datasets provide full coverage of the proposed development.
UK Marine Monitoring and Assessment Strategy (UKMMAS) community (2010), 'Charting Progress 2'. https://tethys.pnnl.gov/sites/default/files/publications/UKMMAS_2010_Charting_Progress_2.pdf [Accessed: March 2023].	In 2005, the UK Government and Devolved Administrations published 'Charting Progress', which was an overall assessment of the current state of UK seas. In 2010, 'Charting Progress 2' was published, which built upon the original report and set out a more structured and co-ordinated approach on assessing UK seas.	The report is general and covers the UK seas, so applies to the entirety of the Muir Mhòr array area and offshore ECC. This dataset provides full coverage of the proposed development.
OSPAR Conventions Commission (2017), 'Intermediate Assessment 2017- Contaminants'. https://oap.ospar.org/en/ospar-assessments/intermediate-assessment-2017/pressures-human-activities/contaminants/ [Accessed: March 2023].	OSPAR produced a report in 2017 to assess the current status of the north-east Atlantic. This assessment considered sediment contamination from various chemical compounds, such as polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), polybrominated diphenyl ethers (PBDEs).	Assessments considered covered the Northern North Sea, which the Muir Mhòr array area and offshore ECC laid entirely within. This dataset provides full coverage of the proposed development.
Marine Scotland (2019), 'Contaminant and Biological Effect Data 1999-2017 for the 2018 Clean Seas Environmental Monitoring Programme (CSEMP) Assessment'. https://data.marine.gov.scot/dataset/contaminant-and-biological-effect-data-1999-2017-2018-csemp-assessment [Accessed: March 2023].	The UK has a long-term environmental monitoring set, which details various measures of contamination in UK waters (e.g., sediment contaminants, biological effects data). This dataset provides records from as early as 1999 and was last updated following the 2018 assessment for the UK's CSEMP.	Monitoring stations were chosen from within the 'East Scotland Coast' and 'Forties' regions, the regions that the Muir Mhòr array area and offshore ECC are within. These stations are not necessarily within the Muir Mhòr array area or offshore ECC but were included as notable differentiations are not expected within the regions.

Source, Author and Year	Summary	Coverage of Muir Mhòr array area and ECC
		This dataset provides partial coverage of the proposed development.
Cefas (2016), 'Suspended Sediment Climatologies Around the UK'. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/584621/CEFAS_2016_Suspended_Sediment_Climatologies_around_the_UK.pdf [Accessed: March 2023].	Cefas produced this report to support the Offshore Energy Strategic Environmental Assessment (OESEA3). The report provides background on the spatial and temporal variations in suspended sediment concentrations around the UK.	The report is general and covers the UK seas, so applies to both the Muir Mhòr array area and offshore ECC. This dataset provides full coverage of the proposed development.
Statoil (2013), 'Environmental Survey Report Hywind Offshore Windfarm, Appendix G Bedload Analysis Results'. https://marine.gov.scot/sites/default/files/environmental_survey_report_101462-sto-mmt-sur-rep-environ-03.pdf https://marine.gov.scot/sites/default/files/appendix_g_bedload_analysis_results.pdf [Accessed: March 2023].	This Appendix provided results from bedload analysis, which was presented in the Hywind Scotland Pilot Park. This was used to comment on background suspended sediment concentrations anticipated for the proposed development The relative proximity of the Hywind Scotland Pilot Park to the proposed development offshore ECC makes this an appropriate resource.	This report was produced for the Hywind Pilot Park, which is located near the Muir Mhòr offshore ECC. This dataset provides partial coverage of the proposed development.
Marine Scotland (2013), 'Scottish Marine and Freshwater Science Volume 4 Number 1: Annual Cycles of Physical, Chemical and Biological Parameters in Scottish Waters (2013 Update) Tables'. https://www.gov.scot/binaries/content/documents/govscot/publications/consultation-paper/2013/03/scottish-marine-freshwater-science-volume-4-number-1-annual-cycles/documents/00416607-pdf/00416607-pdf/govscot%3Adocument/00416607.pdf [Accessed: March 2023].	This report assessed the annual cycles of various physical, chemical, and biological parameters, including dissolved oxygen concentration at surface waters.	This report covers various defined data collection locations, one of which overlaps with a section of the Muir Mhòr offshore ECC area (the Northeast Coast location). This dataset provides partial coverage of the proposed development.

7.4 Description of Baseline Environment

7.4.1 The available data sources and literature shown in Table 7-1 allowed for derivation of an understanding for the MW&SQ baseline. Alongside the physical parameters associated with MW&SQ, this includes relevant designations and classifications of WFD protected areas and nutrient sensitive areas. This baseline understanding will be developed further upon completion of the project-specific site surveys (e.g., sediment and water column sampling) and updated in the following phases of the EIA process.

Water Quality

Water Quality

7.4.2 Annual mean surface temperature (°C) and salinity (‰) data along the Peterhead coast, specifically six cells of relevance to the Muir Mhòr array area (9836, 9986, 9988, 9838, 9837, and 9987) and 11 cells of relevance to the offshore ECC (9680, 9682, 9683, 9685, 9831, 9684, 9835, 9834, 9833, 9832, and 9830) have been collated from data available on Scotland's National Marine Plan Interactive Map[4] (Table 7-2). This data presents a three-decade summary of the salinity/surface temperature for regions of north-west European shelf seas. The mean monthly surface temperature and salinity were calculated and presented from the irregular original datasets (International Council for the Exploration of the Seas (ICES) and the World Ocean Data Centre (WODC)).

7.4.3 As shown in Table 7-2 and Figure 7-1, the mean monthly surface water temperatures within the Muir Mhòr array area and offshore ECC of the proposed development range from 5.8°C in March to 13.4°C in August. The annual average surface water temperature for the array area is 9.5°C and 9.4°C for the offshore ECC, as presented in Figure 7-1.

7.4.4 Mean monthly surface salinity values are less variable across the proposed development, as shown in Table 7-2 and Figure 7-2. The salinity value remained fully marine throughout the year, with minimal freshwater influence.

7.4.5 Within the array area of the Hywind OWF, located approximately 35.6 km to the west of the proposed development, SSCs are typically low. However, during events of increased turbidity (e.g., storm events) the SSCs near the seabed can be significantly increased for short durations, due to the waves stirring the seabed and bringing sediments into suspension. Coarser sediments may be transported across short distances after the initial disturbance, in the direction of the ambient flow, before settling onto the seabed once again. Finer material may remain in suspension for a longer duration and be transported in the direction of net tidal residual flow (Statoil, 2013). Refer to the Marine and Coastal Processes chapter (Chapter 6) for further details on sediment characterisation, sediment transport, and SSCs.

[4] https://marinescotland.atkinsgeospatial.com/nmpi/

Table 7-2: Mean monthly surface water temperature and salinity for pooled cells of relevance to the Muir Mhòr array area and offshore ECC. Source: Scotland's National Marine Plan Interactive Map.

Month	Mean Surface Water Temperature (°C)		Mean Surface Salinity (‰)	
	Array Area	Offshore ECC	Array Area	Offshore ECC
January	7.3	7.3	34.9	34.9
February	6.6	6.4	34.9	34.8
March	5.9	5.8	34.9	34.8
April	6.6	6.7	34.8	34.7
May	8.1	8.1	34.8	34.7
June	10.7	10.5	34.8	34.7
July	12.3	12.0	34.8	34.8
August	13.4	13.1	34.9	34.8
September	12.0	12.1	34.9	34.9
October	11.4	11.6	35.0	35.0
November	10.0	10.0	35.0	34.9
December	9.3	9.2	35.0	34.9

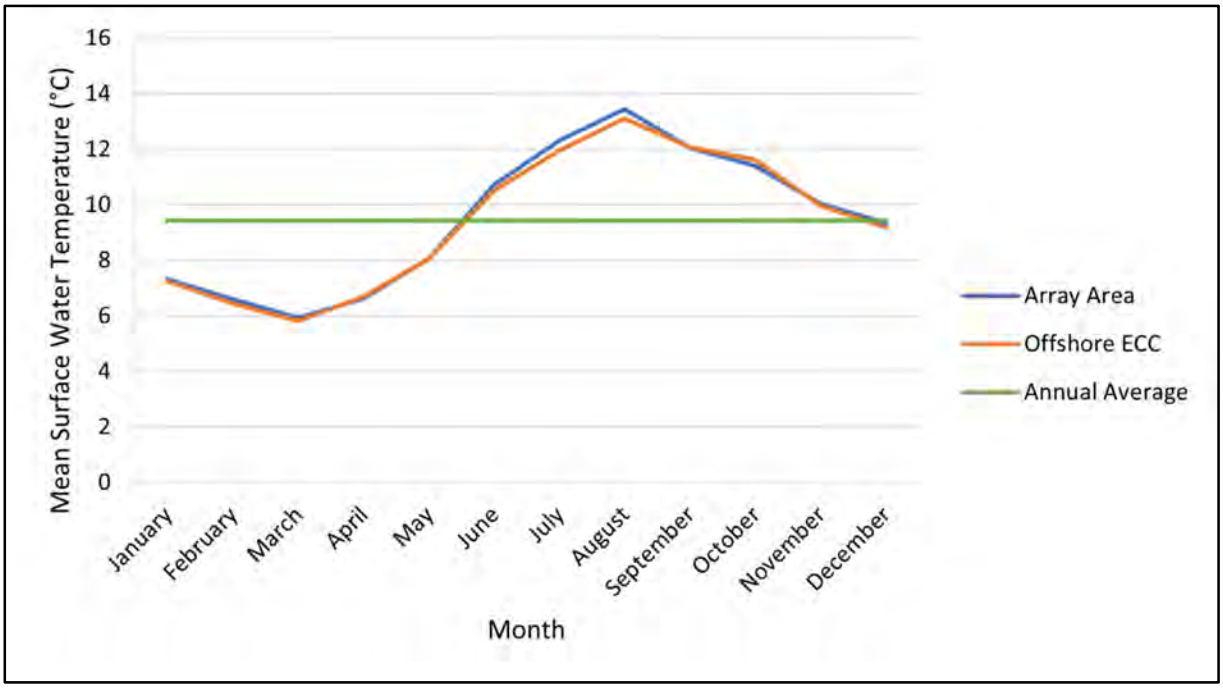


Figure 7-1: Mean monthly surface water temperatures (°C) from relevant cells in the Muir Mhòr array area and offshore ECC. Source: Scotland's National Marine Plan Interactive Map.

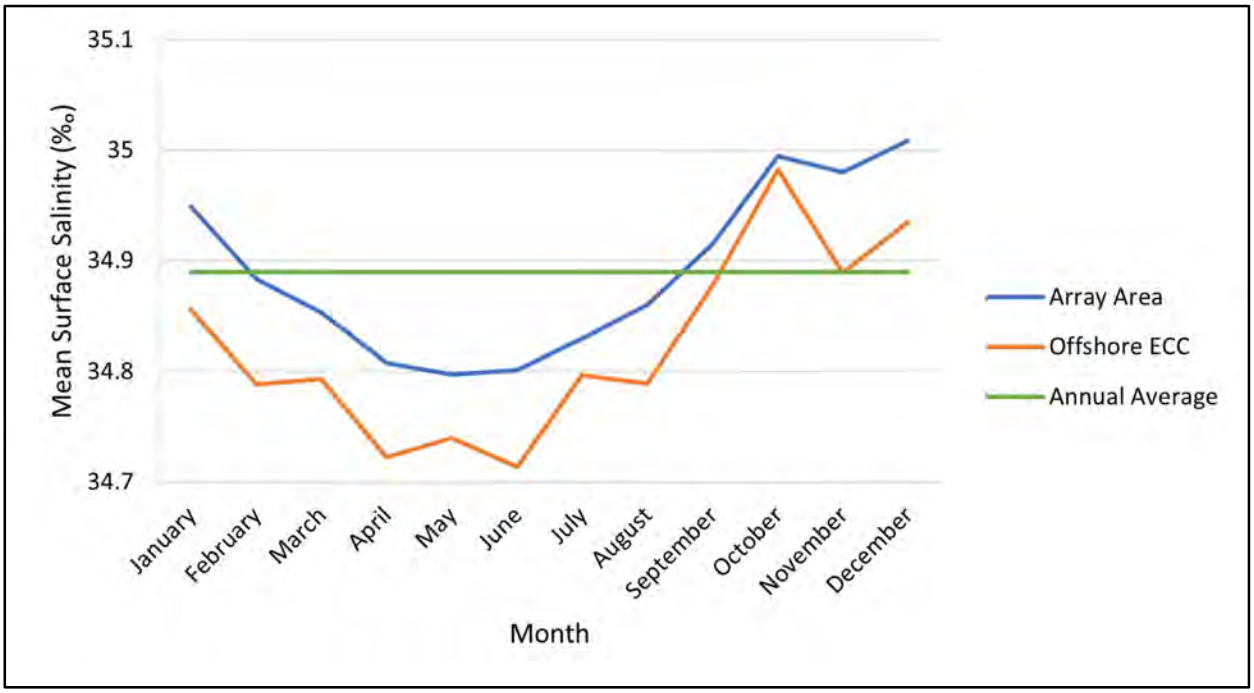


Figure 7-2: Mean monthly surface salinity (‰) from relevant cells in the Muir Mhòr array area and offshore ECC. Source: Scotland's National Marine Plan Interactive Map.

7.4.6 Data was also collected on dissolved oxygen concentration (% saturation) in a sampling location relevant to the proposed development (the Northeast Coast location). The mean oxygen concentration in surface waters varied throughout the year, with a low of 4% in August, and a high of 105% in January (Marine Scotland, 2013). This follows the expected seasonal variation wherein the dissolved oxygen levels would be lower in summer months than winter months.

Water Framework Directive

7.4.7 The (2000/60/EC) WFD establishes a framework for the protection and management of Europe's water resources. It is implemented in Scotland through the Water Environment and Water Services (Scotland) Act 2003 and the Water Environment (Controlled Activities) (Scotland) Regulations 2011 (as amended), commonly known as the Controlled Activities Regulations (CAR).

7.4.8 The WFD divides various interconnected waterbodies (seaward from low water to one nautical mile) into discrete surface waterbodies. Ecological and chemical objectives are set for each surface waterbody, with the over-arching goal to achieve 'Good' status. To achieve a 'Good' overall status the waterbody must attain 'Good Ecological Status' (GES) and 'Good Chemical Status' (GCS) (Article 4).

7.4.9 Chemical status is assessed as either 'Good' (e.g., pass) or 'Fail', whereas ecological status can be 'High', 'Good', 'Moderate', 'Poor', 'Bad' (Annex V).

7.4.10 Under Article 4, each discrete surface waterbody is assigned a hydromorphological designation, which describes how modified the waterbody is from its natural state. Waterbodies are assessed as either:

- Undesignated (e.g., un-affected by anthropogenic factors);
- Heavily Modified Waterbody (HMWB) (e.g., a surface waterbody which as a result of physical alterations by human activity is substantially changed in character); and
- Artificial Waterbody (AWB) (e.g., a surface waterbody created by human activity).

7.4.11 The default objective for HMWBs and AWBs (under the WFD) is to achieve Good Ecological Potential (GEP), which is a status aimed at protecting the ecology of the waterbodies whilst also considering the role of their human use (Article 4).

7.4.12 To assess the ecological status of surface waterbodies, multiple quality elements are utilised. These quality elements include biological (e.g., fish, phytoplankton, angiosperms, etc.), physico-chemical (e.g., dissolved oxygen and salinity), hydromorphological (e.g., hydrological regime), and several specific pollutants. Compliance with the chemical status objectives is assessed in the context of Environmental Quality Standards (EQS), which sets out a list of 'priority' and 'priority hazardous' substances. Subsequent amendments to the WFD outlines EQS for these specified substances (through the development of the Priority Substances Directive (2008/105/EC) and (2013/39/EU)). The Scotland River Basin District (Standards) Directions 2014 direct the appropriate regulator (in this instance, SEPA) on the application of environmental standards in the water environment.

7.4.13 The overarching objective of the WFD is to achieve GES/GEP and GCS in all inland and coastal waters. In an attempt to prevent a decline in the status of waterbodies, there is a general 'no deterioration' provision (Article 1).

7.4.14 Another requirement under the WFD is the development of river basin management plans, which define distinct River Basin Districts. These distinct districts can be assessed, and measures set out for improving quality of surface and groundwater bodies (where necessary). RBMPs are reviewed, and an updated version published on a six-yearly cycle (Article 13).

The first cycle of RBMPs was published in 2009, covering the period between 2009-2015, for the two districts in Scotland (the Solway Tweed and Scotland River Basin Districts, although a small portion of the Northumbria River Basin District is in Scottish waters). The second cycle report was published in 2015, which updated the status and objectives of the original report. The most recent update was published in 2021, which covers the third cycle (from 2021-2027).

7.4.15 Table 7-3 presents a summary of the latest classification status of the five coastal and transitional waterbodies relevant to the proposed development. All waterbodies are achieving High status, except for the Ugie Estuary to Buchan Ness (Peterhead) coastal waterbody (ID: 200131), which is currently classed as 'Good ecological potential'. The Ugie Estuary to Buchan Ness (Peterhead) coastal waterbody has been designated as heavily modified on account of physical alterations that cannot be addressed without a significant impact on navigation (hence classified as moderate for 'overall ecology', in relation to hydromorphology, but assumed to have potential to achieve good).

Table 7-3: Summary of the latest (2020) classification status for WFD coastal and transitional waterbodies in the vicinity of the proposed development (SEPA, 2020).

Parameter	Coastal and Transitional Waterbodies				
	Cairnbulg Point to Ugie Estuary	Ugie Estuary to Buchan Ness (Peterhead)	Buchan Ness to Cruden Bay	Cruden Bay	Ugie Estuary
Waterbody ID	200142	200131	200125	200118	200129
Waterbody type	Coastal	Coastal	Coastal	Coastal	Transitional
Waterbody size (km^2)	127.8	46.3	57.7	19.3	0.1
Overall status	High	Good ecological potential	High	High	High
Overall ecology	High	Moderate	High	High	High
Biological elements	High	Good	High	High	-
Invertebrate animals	High	Good	High	High	-
Imposex assessment	-	Good	-	-	-
Benthic invertebrates (Infaunal Quality Index (IQI))	High	High	High	High	-
Macroalgae	-	High	High	-	-
Macroalgae (Full Species List (FSL))	-	High	High	-	-

Parameter	Coastal and Transitional Waterbodies				
	Cairnbulg Point to Ugie Estuary	Ugie Estuary to Buchan Ness (Peterhead)	Buchan Ness to Cruden Bay	Cruden Bay	Ugie Estuary
Macroalgae (Reduced Species List (RSL))	-	Good	Good	-	-
Phytoplankton	High	High	High	High	-
Hydromorphology	High	Moderate	High	High	High
Morphology	High	Moderate	High	High	High
Water Quality	High	Good	High	High	-

Bathing Waters

7.4.16 In March 2006, the EU's revised Bathing Water Directive (rBWD; 2006/7/EC) was brought into force. This has been implemented in Scotland through the Bathing Waters (Scotland) Regulations 2008 (as amended), with the bathing waters still classified against the rBWD standards. This revised Directive provides more stringent standards than the previous Bathing Water Directive (BWD; 76/160/EEC), with more emphasis on making information publicly available. This rBWD was transposed and implemented in Scottish law (following the departure of the UK from the EU) through The Bathing Waters (Scotland) Amendment Regulations 2012.

7.4.17 The rBWD relies on fewer microbial indicators than the BWD, whilst setting higher standards. Bathing waters are classified according to the levels of certain bacteria (e.g., intestinal enterococci and *Escherichia coli*) in samples collected during the bathing season (which runs from May until September) (regulation 7). These bathing waters are monitored annually, and results reported against the rBWD indicators (regulation 9). The newer classification system considers all samples collected for the previous three bathing seasons for each bathing water, with classification of performance reported as:

- Excellent- the highest, cleanest class;
- Good- generally good water quality;
- Sufficient- water quality meets minimum required standards; and
- Poor- water quality does not meet the minimum required standards (regulation 10).

7.4.18 There is one bathing water located within the offshore ECC, Cruden Bay (see Figure 7-3). The other designated bathing waters of relevance along the Peterhead to Aberdeenshire coastline are reported to have achieved at least a 'good' classification in the most recent (2022/23) bathing season (see Table 7-4).

Table 7-4: Bathing water classifications in the vicinity of the proposed development (SEPA, 2022).

Bathing Water	Classification				
	2018/19	2019/20	2020/21*	2021/22	2022/23
Peterhead (Lido)	Excellent	Excellent	-	Excellent	Excellent
Cruden Bay**	-	Good	-	Good	Good
Collieston	Good	Good	-	Good	Good
Balmedie	Excellent	Excellent	-	Excellent	Excellent
Fraserburgh (Philorth)	Excellent	Excellent	-	Excellent	Excellent
Fraserburgh (Tiger Hill)	Sufficient	Good	-	Good	Excellent
Rosehearty	Good	Excellent	-	Excellent	Excellent

*: There were no classifications reported for 2020/21 due to the shortened season and reduced sampling during the COVID-19 pandemic.

**: The Cruden Bay Bathing Water was only classified in 2019, so data has only been collected from 2019 onwards

Shellfish Waters Protected Areas

7.4.19 The Shellfish Waters Directive (SWD) (2006/113/EC) was repealed in 2013, and subsequently subsumed within the WFD. It was brought into force in Scotland through the Water Environment (Shellfish Water Protected Areas; Designation) (Scotland) Order 2013 (as amended). This Order identified 84 waters within Scotland as shellfish waters, which are subject to WFD assessment, which are presented in a series of maps[5].

7.4.20 The Water Environment (Shellfish Water Protected Areas: Environmental Objectives, etc.) (Scotland) Regulations 2013 sets out that SEPA must set environmental objectives for SWPAs, with SEPA directed on the assessment and classification of these SWPAs through The Scotland River Basin District (Quality of Shellfish Water Protected Areas) (Scotland) Directions 2021.

7.4.21 SWPAs are classified as either 'Excellent', 'Good', or 'Insufficient' based on standard thresholds for the 'most probably numbers of *E. coli* per 100 g sample of shellfish flesh and intra-valvular liquid as a 90-percentile standard' (Direction 4).

7.4.22 There are no SWPAs within the vicinity of the proposed development, with the nearest (Cromarty Bay) being 134 km from the offshore ECC landfall. There are no classified SWPAs along the east coast of Peterhead to Aberdeen, where the proposed development will be located.

Sensitive Areas

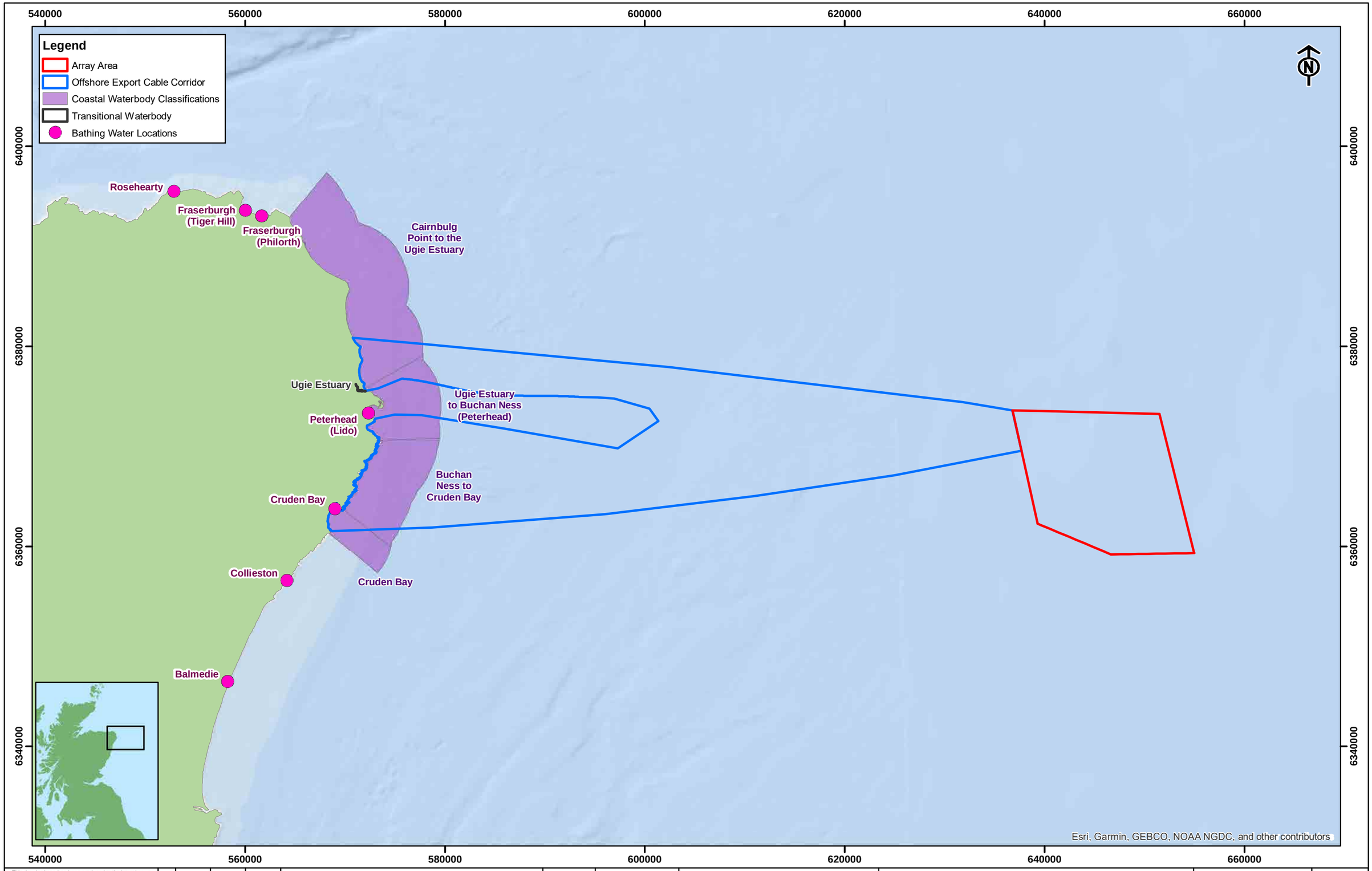
7.4.23 The Urban Wastewater Treatment Directive (UWWTD) (91/271/EEC) is implemented in Scotland through the Urban Waste Water Treatment (Scotland) Regulations 1994 (as

[5] https://www.gov.scot/publications/shellfish-water-protected-areas-maps/

amended). The UWWTD (and subsequent Regulations) aims to protect the environment from adverse impacts from the collection, treatment, and discharge process associated with urban wastewater. This Directive sets treatment levels for wastewater, based on the sizes of the sewage discharges and the sensitivity of the receiving waters.

7.4.24 The Directive generally requires that collected wastewater is treated to (at least) secondary treatment standard for significant discharges. Secondary treatment is a biological process wherein bacteria break down biodegradable matter (which will already be greatly reduced from original levels by the primary treatment process). Under the UWWTD, sensitive areas are defined as waterbodies affected by eutrophication or elevated nitrate concentrations, that act as indicators for if action is needed to prevent further pollution by nutrients.

7.4.25 There are three 'Sensitive Areas (Eutrophic and Freshwater Fish) Rivers' which drain into the offshore ECC area, which are 'Black Water – d/s St Fergus', 'River Ugie – North/South confl to tidal limit', and 'Water of Cruden'.



This drawing/map has been produced to the latest known information at the time of issue. Please consult with the Vattenfall GIS team to ensure the content is still current before using the information contained on this map.

MUIR MHÒR OFFSHORE WIND FARM

A joint venture between Fred Olsen Seawind & Vattenfall

Muir Mhòr Offshore Wind Farm Ltd, The Tun Building
4 Jackson's Entry, Holyrood Road, No 4 EH8 8PJ Edinburgh
United Kingdom

Rev	Date	Drawn By	Checked By	Comment
A	10/03/23	BPHB	LK	First Issue

Datum	ETRS 1989
Projection	ETRS 1989 UTM Zone 30N
Plot	A3
Scale	1:350,000

0 2 4 6 8 10 km

MUIR MHÒR WIND FARM

WFD Waterbodies and Bathing Waters

Confidentiality Class	C1
Drg No	GoBe-0020
Rev	A
Layout	NA

Figure 7.3

Ref files: MMH_MWSQ_Fig7.3_WFDBathingWaters_RevA

Sediment Quality

Sediment Quality

7.4.26 There is no formal quantitative EQS for sediments, unlike for water quality, with the standards presented in the EQS Directive mainly relating to concentrations of contaminants dissolved in the water column. As the proposed works will not result in the release of contaminants into the water column directly, assessment focuses on the potential to disturb sediment bound contaminants.

7.4.27 In the absence of quantified standards, common practice for characterizing baseline sediment quality conditions is to compare levels again the Action Levels for disposal of dredged material, as define by Marine Scotland (2017; Table 7-5). These Action Levels are used as part of a 'weight of evidence' approach to assessment of material suitable for disposal at sea. Generally, contaminant levels falling below Action Level 1 (AL1) are not of concern and are unlikely to impact the final licensing decision. If contaminant Levels fall above Action Level 2 (AL2), they are generally considered unsuitable for disposal at sea. Dredged material with sediment contaminant levels between AL1 and AL2 require professional judgement to be employed for a decision to be made. The Action Levels should not be viewed as a pass or fail system but provides an appropriate context for professional consideration for contaminant levels in sediment for activities which propose to disturb the seabed.

Table 7-5: Action Levels used in sediment contaminant assessment (Marine Scotland, 2017c).

Contaminant	Action Levels	
	Action Level 1 (mg/kg)	Action Level 2 (mg/kg)
Arsenic	20	70
Cadmium	0.4	4
Chromium	50	370
Copper	30	300
Lead	50	400
Mercury	0.25	1.5
Nickel	30	150
Zinc	130	600
Tributyltin (TBT)	0.1	0.5
PCBs	0.02	0.18
PAHs	0.1*	-
Total Hydrocarbons	100	-

* The AL1 for all contaminants within the United States Environmental Protection Agency (USEPA) Suite of 16 compounds is defined at 0.1, except Dibenzo(a,h)anthracene, which is set at 0.01 mg/kg.

7.4.28 The UK'sCSEMP[6] assessment in 2018 described the status and trends of contaminant and biological effect levels at monitoring stations in waters around the UK. The results of the individual time series at offshore and coastal monitoring points were utilised to assess the status and trends at a regional level. There were four monitoring stations located within the 'Forties' CSEMP region, and three within the 'East Scotland Coast' CSEMP region. Table 7-6 presents a summary of the metal concentrations reported at the relevant monitoring sites, at which data was collected for varying timescales, ranging from 1999-2017.

7.4.29 Contaminant concentrations in sediments were generally low, with the exceedance of AL1 only occurring for arsenic (EScotland_EScOpenSea_se01), cadmium (EScotland_EScOpenSea_se01), chromium (EScotland_EScIntermediate_se01 and East_Scotland_(St._Andrews)_seS), copper (EScotland_EScIntermediate_se01), and mercury (EScotland_EScOpenSea_se01). These locations were all within the 'East Scotland Coast' CSEMP Region, none of the Forties monitoring stations exceeded AL1 for any contaminant. There were no samples reported at any of the monitoring stations within the Forties or East Scotland Coast regions where concentrations exceeded the AL2s for any contaminant.

[6] https://data.marine.gov.scot/dataset/contaminant-and-biological-effect-data-1999-2017-2018-csemp-assessment

Table 7-6: Summary of contaminant concentrations in sediment analysed from monitoring stations in the Forties and East Scotland Coast as part of the CSEMP assessment (1999-2017) (Marine Scotland, 2019).

Metal	Sediment Concentration (mg/kg)						
	Forties CSEMP Region				East Scotland Coast CSEMP Region		
	Forties_Forties-OpenSea_se01 (2015)	Forties_Forties-OpenSea_se02 (2015)	Forties_Forties-OpenSea_se03 (2015)	Forties_Forties-OpenSea_se04 (2015)	EScotland_EScIntermediate_se01 (2006-2017)	East_Scotland_(St._Andrews)_seS (2012-2016)	EScotland_EScOpenSea_se01 (1999-2017)
Arsenic	$\bar{X}$= 3.92, n=1	$\bar{X}$= 3.94 (3.61-4.3), n=3	$\bar{X}$= 3.8 (3.56-4.08), n=3	$\bar{X}$= 4.69 (4.19-4.98), n=3	$\bar{X}$= 7.58 (3.84-13.8), n=59	$\bar{X}$= 7.61 (6.14-9.23), n=23	$\bar{X}$= 10.78 (1.13-**22.9**), n=52
Cadmium	$\bar{X}$= 0.06, n=1	$\bar{X}$= 0.07 (0.06-0.07), n=3	$\bar{X}$= 0.07 (0.06-0.08), n=3	$\bar{X}$= 0.06 (0.06-0.07), n=3	$\bar{X}$= 0.08 (0.03-0.19), n=59	$\bar{X}$= 0.08 (0.06-0.15), n=23	$\bar{X}$= 0.16 (0.06-**1.21**), n=52
Chromium	$\bar{X}$= 27.0, n=1	$\bar{X}$= 23.37 (16.4-28.3), n=3	$\bar{X}$= 24.17 (22.3-25.7), n=3	$\bar{X}$= 25.13 (20.5-31.6), n=3	$\bar{X}$= 40.54 (15.6-**74.3**), n=58	$\bar{X}$= 45.54 (32.0-**81.3**), n=23	$\bar{X}$= 20.17 (10.3-35.9), n=52
Copper	$\bar{X}$= 2.89, n=1	$\bar{X}$= 2.72 (1.94-3.55), n=3	$\bar{X}$= 2.86 (2.69-3.04), n=3	$\bar{X}$= 2.69 (2.21-3.06), n=3	$\bar{X}$= 5.84 (3.31-**74.3**), n=58	$\bar{X}$= 3.77 (3.08-4.83), n=23	$\bar{X}$= 3.07 (1.89-7.17), n=52
Lead	$\bar{X}$= 11.8, n=1	$\bar{X}$= 12.7 (12.1-14.), n=3	$\bar{X}$= 12.23 (11.3-13.4), n=3	$\bar{X}$= 12.93 (11.5-13.8), n=3	$\bar{X}$= 16.42 (10.07-25.1), n=58	$\bar{X}$= 14.47 (11.6-18.3), n=23	$\bar{X}$= 13.61 (10.6-28.3), n=52
Mercury	$\bar{X}$= 0.01, n=1	$\bar{X}$= 0.01 (0.01-0.01), n=3	$\bar{X}$= 0.01 (0.01-0.02), n=3	$\bar{X}$= 0.01 (0.01-0.01), n=3	$\bar{X}$= 0.02 (0.01-0.05), n=52	$\bar{X}$= 0.01 (0.01-0.02), n=23	$\bar{X}$= 0.06 (0.01-**0.4**), n=52
Nickel	$\bar{X}$= 6.65, n=1	$\bar{X}$= 6.25 (4.32-8.2), n=3	$\bar{X}$= 6.66 (5.96-7.26), n=3	$\bar{X}$= 6.2 (5.11-7.27), n=3	$\bar{X}$= 13.23 (6.52-21.8), n= 57	$\bar{X}$= 11.93 (9.29-19.0), n=23	$\bar{X}$= 4.19 (3.01-7.21), n=52
Zinc	$\bar{X}$= 16.9, n=1	$\bar{X}$= 16.53 (13.4-20.3), n=3	$\bar{X}$= 17.17 (15.2-19.8), n=3	$\bar{X}$= 16.5 (13.8-19.1), n=3	$\bar{X}$= 37.09 (24.0-64.9), n= 57	$\bar{X}$= 34.57 (26.9-119.0), n=23	$\bar{X}$= 21.14 (9.88-73.0), n=52

`X = mean concentration (range of values in brackets), n= number of samples. Text in bold with underline indicates where AL1 has been exceeded.

7.4.30 The Intermediate Assessment 2017 (OSPAR, 2017) reviewed and compared the concentrations of various contaminants (mercury, cadmium, lead, organotin, PCB, PAH, and PBDE) in sediments between OSPAR contaminant assessment areas (including data collected for the CSEMP assessment). The seven monitoring stations of relevance to the proposed development are within the Northern North Sea region.

7.4.31 The Intermediate Assessment 2017 (OSPAR, 2017) showed that concentration of mercury and lead in sediment were equal to or above the Background Assessment Concentrations (BAC) in the Northern North Sea region, while lead was also above the Effects Range-Low (ERL) value. The mean concentrations of cadmium were measured below the BAC. The concentrations of PCBs are noted to be decreasing in the northern North Sea, with most congeners measured at low levels. Congeners measured in the northern North Sea region fell below the Environmental Assessment Criteria (EAC) value, but congener 118 concentration was above the BAC. In other assessment regions, this congener was also above the EAC. The mean PAH values measured in the northern North Sea region were statistically significantly below the ERL, but not the BAC. For the PCBE monitoring, there were not enough years of data in the northern North Sea to carry out temporal analysis of trends, although the majority of PBDE concentrations measured were low (often below the limits of detection). This indicates the PBDE concentrations are currently showing no statistically significant changes in the region.

Blue Carbon Assessment

7.4.32 In 2014, SNH commissioned a report assessing the blue carbon stores around the Scottish coast. This report led to the output of various blue carbon maps, showing the predicted and observed habitat extent for various blue carbon stores (e.g., seagrass, saltmarsh meadows). These maps indicate there is predicted to be kelp habitat in the vicinity of the proposed development's landfall, which will need consideration in the full assessment. There are no predicted kelp habitats within the array area, and no predicted saltmarsh within the array area or offshore ECC (Burrows *et al.,* 2014).

7.4.33 Coastal and offshore sediments are known to be the main repositories of carbon in the marine environment, with an estimated 18,000,000 t of organic carbon stored in the top 10 cm of sediments in Scotland's marine regions (Burrows *et al.,* 2014). Phytoplankton and kelp are the main sources of carbon entering carbon storage, with coastal species (such as saltmarsh and seagrass) contributing, although less significantly due to the limited habitat extent.

7.4.34 A full blue carbon assessment will be undertaken in the EIAR. This will build further upon assessments conducted within the Benthic, Subtidal and Intertidal Ecology chapter (Chapter 8), with a focus on potential impacts of the proposed development on marine sediments.

7.5 Summary and Key Issues

7.5.1 The key MW&SQ receptors within the MW&SQ study area are identified as follows:

- Designated waterbodies in the vicinity of the proposed developments landfall area:
  - Cairnbulg Point to Ugie Estuary (coastal waterbody);
  - Ugie Estuary to Buchan Ness (coastal waterbody);
  - Buchan Ness to Cruden Bay (coastal waterbody);
  - Cruden Bay (coastal waterbody); and
  - Ugie Estuary (transitional waterbody).
- Designated bathing waters in the vicinity of the proposed developments landfall area:

- Peterhead (Lido);
- Cruden Bay;
- Collieston;
- Balmedie;
- Rosehearty;
- Fraserburgh (Philorth); and
- Fraserburgh (Tiger Hill).

- Sediment contaminant concentrations near inshore regions:
  - Particularly in the East Scotland Coast CSEMP Region, where AL1 was exceeded.
- WFD Sensitive Areas:
  - Urban Wastewater Treatment Directive Sensitive Areas:
    - Black Water-d/s St Fergus;
    - River Ugie-North/South confl to tidal limit; and
    - Water of Cruden.
  - Bathing Water Sensitive Areas:
    - Cruden Bay.

7.6 Embedded Commitments

7.6.1 As part of the project design process, numerous designed-in measures have been proposed to reduce the potential for impacts on environmental receptors. These are presented in Table 7-7 and in the Commitments Register (Appendix A) and will likely evolve over the development process as the EIA progresses and in response to stakeholder consultation.

Table 7-7: Embedded commitment measures of relevance to marine water and sediment quality.

Code	Commitment	Type (Primary, Secondary or Tertiary)	How Commitment Secured
C-01	Scour protection or other appropriate mitigation to be employed around seabed infrastructure where there is the potential risk for significant scour to develop.	Tertiary	CaP CMS
C-02	Development of and adherence to a CaP. The CaP will confirm planned cable routing, installation methods, cable specifications and any additional protection and requirement for any post-installation monitoring.	Tertiary	CaP
C-05	Development of a CMS. This will detail the construction procedures (including piling), good working practices for constructing the works, and how the construction-related mitigation steps are to be delivered.	Tertiary	CMS
C-08	Development of and adherence to an EMP. This will set out mitigation measures and procedures relevant to environmental management, including but not limited to chemical usage, invasive and non-native species, pollution prevention and waste management.	Tertiary	EMP

Code	Commitment	Type (Primary, Secondary or Tertiary)	How Commitment Secured
C-09	Development of and adherence to a DP. The DP will outline measures for the decommissioning of the Proposed Development.	Tertiary	DP

7.6.2 As a result of the commitment to implement these measures, and to align the proposed development with various standard sectoral practices and procedures, the embedded commitments are considered inherently part of the design of the proposed development and have, therefore, been included in the assessment presented in Section 12.7.

7.6.3 The requirement and feasibility of any additional mitigation measures will be dependent on the significance of the effects upon MW&SQ and will be consulted upon with statutory consultees throughout the EIA process.

7.7 Scoping of Impacts

7.7.1 Table 7-8 sets out an initial assessment of the likelihood of effects on MW&SQ receptors due to the proposed development activities for the scoping stage of the EIA process. The assessment is based on a combination of the following: the definition of the proposed development at the scoping stage; embedded commitments (as set out in Section 7.6, together with the means by which it will be secured); the level of understanding of the baseline at the scoping stage; the existing evidence base for MW&SQ effects due to proposed development activities; relevant policy; and the professional judgement of qualified MW&SQ specialists.

7.7.2 It should be noted that MW&SQ also provides an impact pathway for other marine receptors, so information relating to MW&SQ pathways will be used to inform other EIA topic assessments, namely:

- Chapter 6: Marine and Coastal Processes;
- Chapter 8: Benthic, Subtidal and Intertidal Ecology;
- Chapter 9: Fish and Shellfish Ecology;
- Chapter 11: Marine Mammals; and
- Chapter 12: Commercial Fisheries.

Table 7-8: Scoping assessment for MW&SQ.

Impact Pathway	Embedded Commitments	Scoped In or Scoped Out	Justification
Construction and Decommissioning			
Deterioration in water quality due to suspension of sediments.	C-01, C-02, C-05, C-08, C-09	Scoped In	Temporary elevations in SSCs arising from construction activities (such as foundation installation or cable laying) may result in adverse effects on marine water quality. This reduction in water quality may be indicated by changes in levels of nutrients and dissolved oxygen, a reduction in water clarity, and changes in primary production levels.
Deterioration in water clarity due to release of drilling mud.	C-02, C-05, C-08, C-09	Scoped In	To undertake trenchless cable installation techniques (such as HDD) which may be required at landfall, drilling mud, such as bentonite (or another inert mud) may be required. This may result in the release of drilling mud at the punch out point. In MW&SQ terms, the primary issue relating to bentonite release comes from potential increase in SSC in the water column, and potential reduction in bacterial mortality.
Release of sediment-bound contaminants from disturbed sediments.	C-02, C-05, C-08	Scoped In	Temporary elevations in SSC from construction activities may lead to release of sediment-bound contaminants into the water column. This temporary re-suspension and redistribution of existing contaminant may have adverse effects on water quality.
Accidental releases or spills of materials or chemicals	C-05, C-08, C-09	Scoped Out	There is potential for some substances (such as grease, oil, fuel, grouting materials, anti-fouling paints, etc.) to be accidentally released/spilt into the marine environment. There are no discharges (either continuous or intermittent) of construction materials or chemicals which may be toxic or persistent in the environment proposed during the construction phase of the proposed development. Still, impacts are likely to be localised and short-lived. In the event of an accidental chemical or oil spill, hydrocarbons released would be rapidly dispersed or diluted. All vessels working on the proposed development will be required to adhere to strict environmental controls set out in the EMP which will minimise the risks and set out provisions for responding to spills. Due to the implementation of control measures, and small quantities of chemical and hydrocarbons, it is proposed to scope this impact out of further consideration within the EIA.
Deterioration in Bathing Water quality.	C-02, C-05, C-08, C-09	Scoped In	The activities associated with the construction and decommissioning of the proposed development have the potential to result in deterioration to Bathing Water classifications. For example, increased

Impact Pathway	Embedded Commitments	Scoped In or Scoped Out	Justification
			turbidity resulting from sediment plumes may reduce bacterial mortality, impacting the Bathing Water classifications for that bathing season. It is anticipated that potential impacts to Bathing Waters would be limited to works associated with the landfall and offshore export cables.
Deterioration in status of WFD coastal and/or transitional waterbodies.	C-02, C-05, C-08, C-09	Scoped In	Activities associated with construction and decommissioning have potential to result in a deterioration in status of nearby coastal and transitional waterbodies. However, given the boundaries of WFD waterbodies only extend to one nautical mile from the low water mark, it is anticipated that potential impacts would be associated with works for the offshore export cable and landfall. A WFD compliance assessment will be produced as part of the EIA to assessment potential impacts to WFD waterbodies and protected areas.
Operation and Maintenance			
Deterioration in water quality due to the suspension of sediments from O&M activities.	C-01, C-02, C-08, C-09	Scoped In	Should a section of the offshore export cable become exposed or damaged, there would be a requirement for reburial or replacement. Cable reburial (or replacement) would be undertaken using similar techniques to those which were used to originally install the cables.
Deterioration in water quality due to re-suspension and deposit of sediments from scour.	C-01, C-02, C-08	Scoped Out	There is potential for elevated SSC resulting from scour around infrastructure, including foundations and cable protection. Considering that the volume of suspended sediment released during operation via scour would be far lower than then released during construction or repair activities, it is proposed for this impact to be scoped out from further consideration within the EIA. Moreover, the effects will be highly localised and associated volumes of mobile sediments are considered within the range of natural variability.
Changes in water and sediment quality associated with the cleaning of infrastructure.	C-08	Scoped Out	Some routine maintenance activities on infrastructure (such as removal/cleaning of biofouling) has potential to result in reduced water and sediment quality in the immediate vicinity of the activity. These operational cleaning activities may release some substances, such as anti-fouling paint into the marine environment. Any potential impacts from these activities are expected to be highly localised, small scale, temporary, and short-lived. Risks will be managed through the embedded commitment measures presented.

Impact Pathway	Embedded Commitments	Scoped In or Scoped Out	Justification
Accidental release or spills of materials or chemicals.	C-08, C-09	Scoped Out	There is potential for accidental spills or release of materials/chemicals during maintenance works from associated vessels during the O&M phase. However, impacts are anticipated as being short-lived and highly localised. In the event of an accidental spillage, hydrocarbons would be rapidly dispersed or diluted. Moreover, vessels associated with the proposed development will be required to comply with strict environmental controls set out in the EMP, which will minimise risk and set out provisions for responses to spills during O&M activities. Due to the implementation measures, and small quantities of chemical and hydrocarbons, it is proposed to scope this impact out of further consideration within the EIA.
Deterioration in Bathing Water quality.	C-02, C-08, C-09	Scoped In	The activities associated with the O&M of the proposed development have the potential to result in deterioration to Bathing Water classifications. For example, increased turbidity resulting from sediment plumes may reduce bacterial mortality, impacting the Bathing Water classifications for that bathing season. It is anticipated that potential impacts to Bathing Waters would be limited to works associated with the offshore export cables.
Deterioration in status of WFD coastal and/or transitional waterbodies.	C-02, C-08, C-09 O&M Plan	Scoped In	Activities associated with O&M have potential to result in a deterioration in status of nearby coastal and transitional waterbodies. However, given the boundaries of WFD waterbodies only extend to one nm from the low water mark, it is anticipated that potential impacts would be associated with works for the offshore export cable. A WFD compliance assessment will be produced as part of the EIA to assessment potential impacts to WFD waterbodies and protected areas.

7.8 Potential Cumulative Impacts

7.8.1 The EIA Methodology chapter (Chapter 4) details how potential cumulative impacts will be assessed through a CIA and gives examples of the projects which are likely to be included in that assessment. For MW&SQ cumulative interactions may occur with other planned OWFs as well as other activities in the study area.

7.8.2 Impacts that are scoped into the assessment for the proposed development alone are generally spatially restricted to being within close proximity to the Muir Mhòr array area and offshore ECC. However, certain potential impacts, such as an increase in SSC, have the potential to be observed over a wider area. Potential cumulative impacts on MW&SQ receptors will be guided by project-specific modelling conducted for Marine and Coastal Processes (Chapter 6).

7.8.3 The CIA for MW&SQ will consider the maximum adverse design scenario for each of the projects, plans and activities in line with the methodology outlined in Chapter 4.

7.9 Potential Transboundary Effects

7.9.1 There are no transboundary impacts on MW&SQ pathways anticipated to occur as a result of the proposed development activities during the construction, O&M, and decommissioning phases. The proposed development is a significant distance from the nearest adjacent exclusive economic zone (EEZ) of another state and, therefore, it is considered that transboundary impacts will not occur and will therefore be scoped out from further consideration within the EIA.

7.10 Proposed Approach to EIA

Guidance

7.10.1 In addition to the general approach and guidance outlined in Chapter 4, the assessment of MW&SQ receptors will also comply with the following guidance documents where they are specific to this topic:

- EIA for offshore renewable energy projects (BSI, 2015);
- Coastal Processes Modelling for Offshore Wind Farm Environment Impact Assessment: Best Practice Guidance (Lambkin *et al.,* 2009);
- Marine Scotland Consenting and Licensing Guidance for Offshore Wind, Wave and Tidal Energy Applications (Marine Scotland, 2018);
- Pre-disposal Sampling Guidance. Version 2 – November 2017 (Marine Scotland, 2017c);
- Guidance for Pollution Prevention (GPP) Note 5 (GPP5) – Works and maintenance in or near water produced by NRW, and Northern Ireland Environment Agency (NIEA) and SEPA (2018);
- Review of Cabling Techniques and Environmental Effects Applicable to the Offshore Wind Farm Industry (BERR, 2008);
- OSPAR Assessment of the Environmental Impacts of Cables (OSPAR, 2009); and
- Guidelines for Data Acquisition to Support Marine Environmental Assessments of Offshore Renewable Energy Projects (Cefas, 2011).

7.10.2 In the absence of formal guidance for the preparation of WFD compliance assessments in Scotland, the Environment Agency's 'Clearing the Waters for All' process will be used to form

the basis of the assessment[7], along with Advice Note Eighteen: The Water Framework Directive (Planning Inspectorate, 2017) (unless an alternative is suggested during consultation). This guidance outlines how impact(s) of activities on coastal and transitional waterbodies should be assessed, set out in the following stages:

- Screening: excludes any activities that do not need to go through the scoping or impact assessment stages;
- Scoping: identifies the receptors and quality elements that are (potentially) at risk from a proposed activity and need further detail assessment; and
- Impact Assessment: considers the potential impacts of a proposed activity, identifies ways to minimise avoid or minimise impacts, and determine if a proposed activity may cause deterioration or jeopardise the waterbody achieving good status.

Additional data sources

7.10.3 A more detailed literature review will be developed for the EIA, building upon the high-level outline provided within this Offshore Scoping Report. Project-specific survey outputs will be used to enhance the understanding of the baseline conditions. These may include the following across the array area and offshore ECC:

- Geophysical survey; and
- Benthic ecology surveys.

7.10.4 A detailed desk-based data collection exercise will be undertaken to provide updated information for the EIA (e.g., updated classifications for WFD waterbodies and Bathing Waters). The Developer will request any MW&SQ data held by SEPA for areas of the Peterhead to Aberdeenshire coastline of relevance to the proposed development. This will be supplemented by the site-specific surveys, which will provide details of particle size distribution and contaminant concentrations in sediments within the offshore ECC and array area. The survey specification has been presented to and discussed with Marine Scotland at the Scoping Workshop for the proposed development in advance of the surveys being undertaken. It is noted that the planned surveys works will include both water and sediment sampling (water sampling every 500 m out to three nautical miles).

Assessment Methodology

7.10.5 The EIA will follow the general approach outlined in Chapter 4 (EIA Methodology) of this Offshore Scoping Report.

7.10.6 The study area for the MW&SQ baseline within the EIA will be refined further to focus on the final offshore ECC. The scope of the MW&SQ assessment is to characterise and understand the physical (e.g., SSCs, dissolved oxygen) and chemical (sediment-bound contaminants) conditions present within the study area, and how these could be impacted from the proposed development. This will be used to assess the potential impacts to the MW&SQ receptor in isolation, as well as be used to inform other topic assessments, for example Benthic, Subtidal and Intertidal Ecology and Fish and Shellfish Ecology.

7.10.7 The MW&SQ assessment will consider the magnitude and duration of the potential impact, the reversibility of the potential impact, and the timing and frequency of the activity (e.g., an important factor for assessing Bathing Waters during the bathing season from May until September). An assessment of the potential impacts of the proposed development will be undertaken through application of the Evidence Base (which will including site-specific

[7] https://www.gov.uk/guidance/water-framework-directive-assessment-estuarine-and-coastal-waters

sediment contamination data), alongside the outputs from numerical modelling activities to be undertaken described in the Marine and Coastal Processes chapter (Chapter 6). The significance of any changes will be evaluated against the likely naturally occurring variability in, or long-term changes to, the marine physical environment within the lifetime of the proposed development due to natural cycles (e.g., storm events).

7.10.8 Consultation will be undertaken at key stages throughout the EIA process to ensure that the approach (and application of the Evidence Base) satisfies the requirements for regulators and stakeholders.

7.11 Scoping Questions

7.11.1 The following Scoping questions refer to the MW&SQ chapter and are designed to focus the Scoping exercise and inform the Scoping Opinion:

- Do you agree with the study area(s) defined in Section 7.2 for MW&SQ?
- Do you agree with the use of those data listed in Section 7.3, and any additional anticipated data listed in Section 7.10, being used to inform the EIA?
- Are there any additional data sources or guidance documents that should be considered?
- Do you agree that all receptors related to MW&SQ have been identified?
- Do you agree with the scoping in and out of impact pathways in relation to MW&SQ?
- Do you agree with the assessment of the potential for transboundary effects in relation to MW&SQ?
- Do you agree with the assessment of the proposed approach to cumulative effects in relation to MW&SQ?
- Do you agree with the proposed assessment methodology for MW&SQ?
- Do you agree on the suitability of the proposed embedded commitments of relevance to MW&SQ that have been identified for the proposed development?

8 Benthic Subtidal and Intertidal Ecology

8.1 Introduction

8.1.1 This chapter of the Offshore Scoping Report identifies the benthic subtidal and intertidal ecology receptors of relevance to the proposed development and considers the potential impacts from the construction, O&M, and decommissioning of the proposed development on benthic subtidal and intertidal ecology up to MHWS.

8.1.2 This chapter should be read alongside the following Chapters:

- Chapter 6: Marine and Coastal Processes;
- Chapter 7: Marine Water and Sediment Quality; and
- Chapter 9: Fish and Shellfish Ecology.

8.1.3 This chapter of the Offshore Scoping Report has been prepared by GoBe Consultants Limited.

8.2 Study Area

8.2.1 The benthic subtidal and intertidal ecology study area (Figure 8-1) is defined by the proposed development footprint (includes the array area and the offshore ECC, the intertidal landfall), plus a buffer which represents a wider ZoI associated with secondary impacts.

8.2.2 The ZoI for benthic subtidal and intertidal ecology, encompasses the area over which suspended sediment might travel following disturbance, as a result of the proposed development. For the purposes of scoping, the area that sediment might travel has been defined by the spring tidal excursion distance, which was recorded as 12 to 15 km (ABPmer *et al.*, 2008). A maximum precautionary ZoI distance has therefore been defined as 15 km.

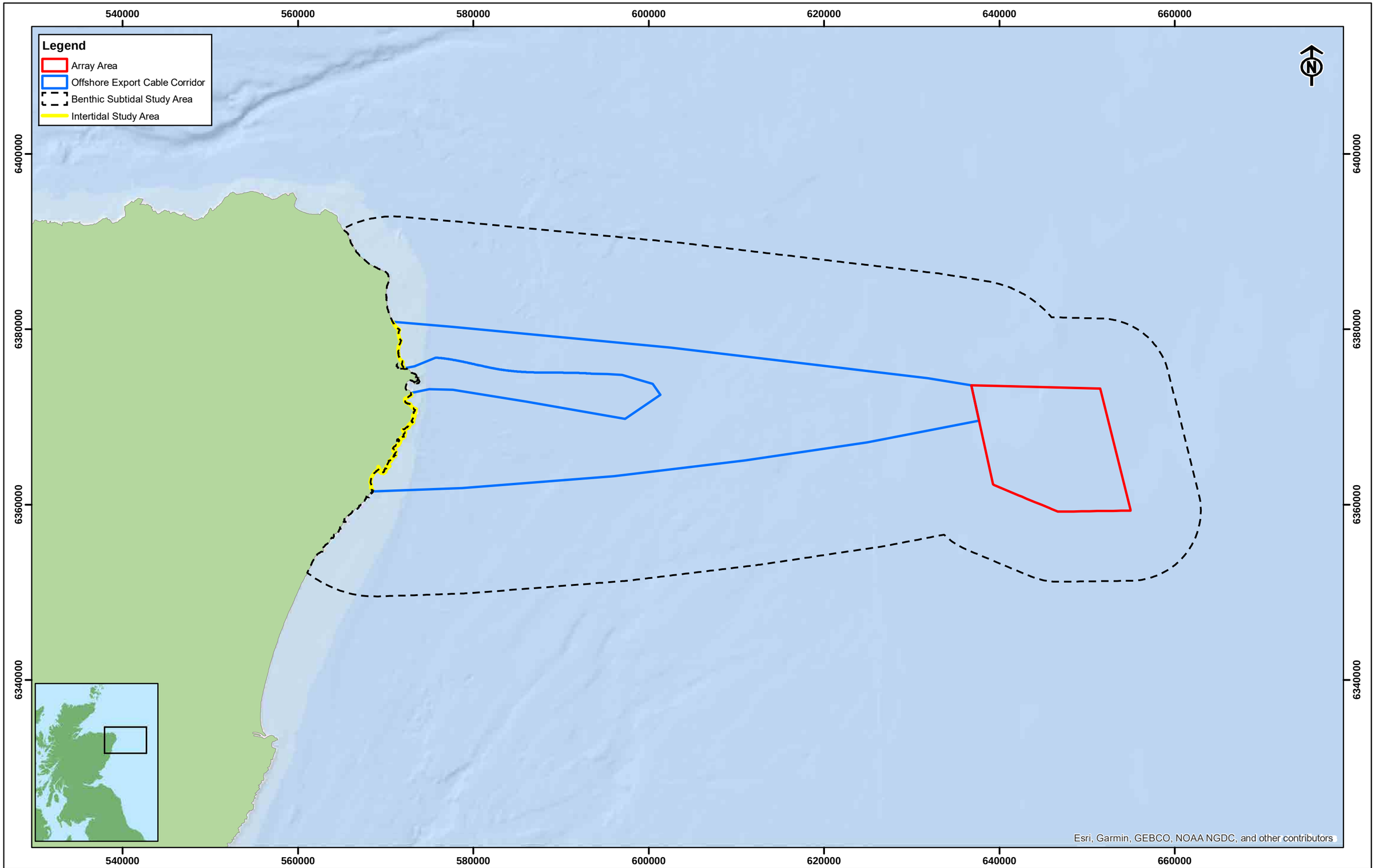
8.2.3 This study area is likely to be refined, as required, at post-scoping stages to reflect site-specific sediment plume modelling work that will be undertaken as part of the Marine and Coastal Processes assessment (see Chapter 6), as well as stakeholder consultation and refinements to the project design. This will result in an adapted and refined study area for the EIAR which will be based on all activities carried out throughout the proposed development stages.

8.2.4 The intertidal ecology study area is defined by the intertidal zone extending up to MHWS within the offshore ECC (Figure 8-1).

8.3 Baseline Environment

Data Sources

8.3.1 The data sources that have been used to inform this Benthic Subtidal and Intertidal Ecology chapter are presented within Table 8-1. These data sources will be taken forward and used to inform the EIA baseline characterisation, alongside any additional site-specific data that will be collected for the study area.



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MUIR MHÒR OFFSHORE WIND FARM

A joint venture between Fred. Olsen Seawind & Vattenfall

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A	12/04/23	BPHB	LK	First Issue

Datum	ETRS 1989
Projection	ETRS 1989 UTM Zone 30N
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Scale	1:400,000

0 2 4 6 8 10 km

MUIR MHÒR WIND FARM

Benthic Subtidal and Intertidal Ecology Study Area

Confidentiality Class	C1
Drg No	GoBe-0007
Rev	A
Layout	NA

Figure 8.1

Ref files: MMH_BEN_Fig8.1_StudyArea_RevA

Table 8-1: Key sources of benthic subtidal and intertidal ecology data.

Source, Author and Year	Summary	Coverage of Muir Mhòr array area and ECC
Existing Offshore Windfarm (OWF) Data		
Hywind Scotland Pilot Park: Environmental Statement (ES) (Statoil, 2015).	An ES submitted in 2015 in relation to the Hywind Scotland Pilot OWF, detailing the baseline characterisation of site-specific surveys and likely environmental effects of the project on the features present within the direct and surrounding areas.	Located within the study area, overlapping with the offshore ECC. There is no coverage of the Muir Mhòr array area.
Environmental Survey Report: Hywind OWF (MMT, 2013).	A site-specific survey report detailing the results from the marine environmental survey along the export corridor and within the development site for the Hywind OWF.	Located within the study area, overlapping with the offshore ECC.
Beatrice OWF Post-Construction Monitoring Year 2 (2021): Benthic Grab Survey Report (APEM, 2022).	A site-specific benthic grab survey at the Beatrice OWF site in July 2021 as part of the year two post construction surveys for the project.	No direct coverage. Located to the north of the proposed development in the Moray Firth.
Moray Offshore Renewables Ltd ES – Subtidal Ecology Characterisation (Moray East) (Fugro EMU Ltd, 2014).	A site-specific subtidal survey report for the Moray Firth OWF characterising the subtidal benthic ecology of the proposed cable route corridor and transmission infrastructure.	No direct coverage. Located to the north of the proposed development in the Moray Firth.
Moray Offshore Renewables Ltd ES – Benthic Ecology Characterisation Survey (Moray East) (EMU Limited, 2011).	A site-specific benthic ecology survey report for the Moray Firth OWF characterising and defining the benthic environment within the array area.	No direct coverage. Located to the north of the proposed development in the Moray Firth.
Publicly Available Datasets		
EMODnet Broad-Scale Seabed Habitat Map for Europe (EUSeaMap) (2021) European Nature Information System (EUNIS) 2019 habitat types (EMODnet, 2021).	Broad-scale seabed habitat map for Europe.	Covers all European waters.

Source, Author and Year	Summary	Coverage of Muir Mhòr array area and ECC
Marine Protected Area (MPA) Network[8].	A definition and overview of the Scottish MPA Network.	Covers all Scottish Waters[9].
Kelp bed data[10].	Scottish kelp bed habitat data layers.	Covers all Scottish Waters.
Burrowed mud data[11].	Scottish burrowed mud habitat data layers.	Covers all Scottish Waters.
Ocean Quahog data[12].	Records of ocean quahog in Scottish waters data layers.	Covers all Scottish Waters.

[8] https://marine.gov.scot/node/12790

[9] Refers to both subtidal and intertidal features.

[10] https://marine.gov.scot/node/14689

[11] https://marine.gov.scot/node/14626

[12] https://marine.gov.scot/node/12704

Site-Specific Surveys

8.3.2 An environmental baseline survey will be completed in 2023 in the Muir Mhòr array area and offshore ECC. This will include a geophysical survey (Multibeam Echo Sounder (MBES bathymetry, Side-scan Sonar (SSS), Sub-Bottom Profiling (SBP) and Ultra-High Resolution Seismic (UHRS) and magnetometer) and environmental sampling (e.g. grab sampling for faunal, environmental DNA (eDNA), contaminants and particle size analyses, video and still photography). The survey results will be incorporated in the EIA. Intertidal surveys will also be conducted at the landfall locations.

8.4 Description of Baseline Environment

8.4.1 The characterisation of the species found within the benthic subtidal and intertidal ecology study area has drawn upon work that was undertaken by OWF developments in the vicinity of the proposed development as well as wider information from publicly available sources (Table 8-1). Hywind Scotland Pilot OWF is located approximately 35.6 km from the Muir Mhòr array area and overlaps with the offshore ECC. Data have therefore been drawn upon for this chapter. The Moray West OWF, Moray East OWF and the Beatrice OWF are located 85.5 km, 77.6 km and 94.7 km, respectively, from the closest point of the proposed development. Whilst there is no spatial overlap between these sites and the proposed development, data from these OWFs have been drawn upon for this chapter as they provide useful contextualisation of the wider area and the sedimentary habitats found within these areas.

Array area

8.4.2 Figure 8-2 shows Cefas seabed sediment modelling data across the Muir Mhòr array area (Cefas, 2015). These data indicate that the array area is mainly characterised by sand and muddy sand, with patches of coarse sediments located towards the south of the array area.

8.4.3 A total of two broadscale sediment habitats have been identified within the array area through a review of the EUSeaMap (2021) data. Figure 8-3 demonstrates that the array area is characterised by deep circalittoral sand in the north of the array, with deep circalittoral coarse sediment in the south of the array. The Cefas seabed sediment modelling data and the EUSeaMap data correspond to one another as the coarse sediment patches modelled in the Cefas (2015) data is in the same region of the array area as the deep circalittoral coarse sediment in the EUSeaMap (2021) data.

8.4.4 Benthic and geophysical surveys carried out in the neighbouring Hywind Scotland Pilot OWF (approximately 35.6 km and 0 km from the Muir Mhòr array area and offshore ECC, respectively) included the acquisition of drop-down video (DDV) and sediment grab data. Results indicated that seabed habitats were characterised by extensive areas of circalittoral fine sand, gravel with mega-ripples and very fine pebbles that become more prevalent towards the nearshore portion of the Hywind Scotland Pilot offshore ECC (MMT, 2013). In some areas of the Hywind Scotland Pilot OWF site, primarily in the southwestern corner of the array area, habitats comprising scattered boulders were detected (MMT, 2013).

8.4.5 The following habitats (or slight variants of) were recorded across the Hywind Scotland OWF array area:

- Offshore circalittoral sand;
- Offshore circalittoral mixed sediment; and
- *Sabellaria spinulosa* on stable circalittoral mixed sediment.

8.4.6 The Hywind Scotland Pilot ES (2015) reported similar macrofauna present at all stations in the array area, with stations dominated by the burrowing brittlestar (*Amphiura filiformis)*, the epifaunal brittlestar (*Ophiocten affinis)*, amphipods (*Urothoe* spp., *Bathyporeia* spp. and *Harpinia* spp.*)* the razor clam (*Antalis entalis)* and the polychaetes (*Scoloplos armiger, Spiophanes* spp., *Diplocirrus glaucus, Owenia fusiformis* and *Galathowenia oculata*). In addition, the sea urchin (*Echinocyamus pusillus)* was also recorded along the cable route.

8.4.7 The Hywind Scotland site-specific survey did not detect any PMF listed habitats within the array area (Statoil, 2015). However, outside of the Hywind Scotland array area, an ocean quahog (*Arctica islandica*) was recorded. The ocean quahog is designated as a PMF. The survey detected varied and scattered *S. spinulosa* coverage of approximately 10% of the array area, which were classified as 'low graded reef' as per the Hendrick Foster-Smith (2006) reef scoring guidance criteria.

8.4.8 The Beatrice OWF is located 150.3 km northwest of the Muir Mhòr array area and the sediment type across the entire survey area was predominantly made up of sandy sediments, with mud and gravel representing a very small proportion of the total sediment composition. The most dominant biotope recorded during the post-construction survey was *E.pusillus, Ophelia borealis and Abra prismatica* in circalittoral fine sand (APEM, 2022).

8.4.9 Site-specific surveys conducted for the Moray East OWF identified the presence of five habitat biotopes across the array area which is located 131.7 km northwest of the Muir Mhòr array area. These biotopes included sublittoral sand and muddy sediments with patches of circalittoral coarse sediment, seapens and burrowing megafauna in circalittoral fine mud as well as cobbles, boulder, and bedrock reef habitat with encrusting algae present. Coarser sediments were also located across Moray West, with variable coarse/mixed sediments with sand or sandy gravel and patchy stones/cobble recorded at the eastern fringe. Occasional areas of more consolidated surface cobble were recorded, particularly which included a small area likely to be considered stony reef (EMU Limited, 2011).

Offshore ECC

8.4.10 Figure 8-2 shows that the offshore ECC is mainly characterised by sand and muddy sand, with a band of coarse sediment present to the west (Cefas, 2015).

8.4.11 The EUSeaMap (2021) data indicates that there are five broadscale habitats present within the offshore ECC. The offshore ECC is mainly characterised by deep circalittoral sand with patches of circalittoral coarse sediment. There is a strip of deep circalittoral coarse sediments across the southwest of the offshore ECC towards the array area. The inshore region of the offshore ECC is dominated by deep circalittoral coarse sediment with smaller areas of Atlantic and Mediterranean high energy circalittoral rock, Atlantic and Mediterranean moderate energy circalittoral rock, faunal communities on deep moderate energy circalittoral rock, deep circalittoral sand and circalittoral fine sand (Figure 8-3, Figure 8-4).

8.4.12 EUSeaMap (2021) data corresponds to Cefas (2015) data which shows the offshore region of the offshore ECC to be dominated by sand and muddy sand, with a band of coarse sediments in the inshore region and to the south closer to the array area (Figure 8-2).

8.4.13 EUNIS habitat survey point data exist for the inshore region of the offshore ECC (EUSeaMap, 2021) (Figure 8-3). These habitat points present information from site-specific surveys from a range of sources and therefore present detail that is not defined in the broadscale habitat mapping data. For example, in the region classified as infralittoral coarse sediment under broadscale mapping data, habitat survey point data describes the presence of Atlantic and Mediterranean high energy infralittoral rock, Atlantic and Mediterranean moderate energy infralittoral rock and features of infralittoral rock.

8.4.14 Within the offshore ECC, faunal clusters have been identified, predominantly across the deep circalittoral coarse sediment. Clusters are fairly homogenous across the sample area with only MB4 (infralittoral mixed sediments) and MA5 (littoral sand) being recorded within the inshore section of the offshore ECC (Figure 8-3). Associated taxa with cluster MB4 include Spionidae, Glyceridae and Nemertea and associated taxa with cluster MA5 include Amphyiuridae, Nephtyidae and Lumbrineridae. Within the further offshore areas of the ECC, clusters MB6 (infralittoral mud) were recorded.

8.4.15 Figure 8-3 also presents the biologically informed habitat map from Cooper *et al*. (2019). Offshore portions of the ECC and wider study area were characterised by the following macrofaunal assemblages:

- A2a – was characterised by Sabellariidae, Spionidae, Polynoidae, Terebellidae, Nemertea, Phyllodocidae, Lumbrineridae, Pholoidae, Cirratulidae, Capitellidae, Syllidae, Semelidae and Porcellanidae. This group is likely to be located on sublittoral coarse sediment and / or sublittoral mixed sediments;
- C1a – was characterised by the polychaetes Spionidae, Terebellidae, Serpulidae, Syllidae, Capitellidae, Cirratulidae, Lumbrineridae, Sabellariidae, Nemertea, Glyceridae and the nematode family Nemertea. This group is likely to be located on a variety of sandy substrates;
- D2a – represented a faunal assemblage that was characterised by the polychaetes Spionidae, Glyceridae, Terebellidae, Capitellidae, Phyllodocidae and the nematode family Nemertea. This group is likely to be located on a variety of sandy substrates;
- D2c – represented a faunal assemblage that was characterised by polychaetes including Nephtyidae, Spionidae and Opheliidae. All of which are typically found in sands and muddy sands; and
- D2b – was characterised by Spionidae, Amphiuridae, Nephtyidae, Lumbrineridae, Oweniidae, Cirratulidae, Capitellidae, Nemertea, Semelidae, Ampharetidae. D2b is widely found across the northern North Sea and Celtic Shelf, is typically associated with deep water, low bottom temperature, muddy habitats with low bottom current flows, high salinity and low chlorophyll.

8.4.16 As part of the Hywind Scotland Pilot OWF site specific survey, the particle size analyses (PSA) identified that the offshore ECC, which overlaps with the Muir Mhòr study area, was dominated by sand, with occasional shell fragments (MMT, 2013).

8.4.17 The following biotopes (or slight variants of) were recorded across the Hywind Scotland Pilot OWF ECC:

- MB1215– *Laminaria hyperborea* with dense foliose red seaweeds on exposed Atlantic infralittoral rock;
- MC12811 – *Sabellaria spinulosa* with a bryozoans turf and barnacles on silty turbid Atlantic circalittoral rock;
- MC1216 – *Flustra foliacea* and colonial ascidians on tide-swept moderately wave-exposed Atlantic circalittoral rock;
- MC12243 – *Alcyonium digitatum* with *Securiflustra securifrons* on tide-swept moderately wave-exposed Atlantic circalittoral rock;
- MB12211 – Foliose red seaweeds with dense *Dictyota dichotoma* and/or *Dictyopteris membranacea* on exposed lower infralittoral rock;

- MB121A3 – Grazed *Laminaria hyperborea* forest with coralline crusts on upper infralittoral rock;
- MC4213 – *Flustra foliacea* and *Hydrallmania falcata* on tide-swept circalittoral mixed sediment;
- MD4211 – Polychaete-rich deep *Venus* community in offshore circalittoral mixed sediment;
- MC52 – Atlantic circalittoral sand;
- MB52 – Atlantic infralittoral sand;
- MB5231– Sparse fauna in Atlantic infralittoral mobile clean sand;
- MC2211 – *Sabellaria spinulosa* on stable Atlantic circalittoral mixed sediment; and
- MD5 – Offshore circalittoral sand.

8.4.18 The Hywind Scotland Pilot OWF ECC follows a similar route to the Muir Mhòr offshore ECC. Site-specific surveys of the Hywind Scotland ECC (MMT, 2013) indicated that the offshore region of the Hywind Scotland Pilot ECC was mostly fine, sandy mud with patches of mixed coarse sand, gravel and shell material. The taxa that were recorded from infaunal grab samples included sea pens, *Virgularia mirabilis* and *Pennatula phosphorea.* The sediment type was more varied with mixed sediment types being recorded including cobbles, boulders and exposed bedrock further inshore.

8.4.19 Infaunal samples taken during the Hywind Scotland Pilot OWF survey along the offshore regions of the ECC detected sparse epifaunal communities. The regions of the ECC closer to inshore identified a variety of bivalve molluscs, including *Clausinella fasciata*, the pea urchin *Echinocyamus pusillus* and the polychaetes *Laonice bahusiensis, Ophelia borealis* and *Glycera lapidum.*

8.4.20 During the Hywind Scotland Pilot benthic survey of the ECC, two PMF species were recorded: Raitt's sandeel (*Ammodytes marinus)* and the lesser sandeel (*Ammodytes tobianus)*. One specimen of each sandeel was detected at two separate survey stations, with both sites situated within areas of fine sand along the ECC.

8.4.21 As with the array area for Beatrice OWF, the post-construction monitoring benthic survey revealed that the most dominant biotope recorded during across the Beatrice ECC (located 94.7 km from the Muir Mhòr offshore ECC) was MC5211 *Echinocyamus pusillus, Ophelia borealis* and *Abra prismatica* in circalittoral fine sand (APEM, 2022).

8.4.22 Contaminant analysis of sediment grab samples across the Moray West OWF site (Moray OWF (West) Limited, 2018) revealed that all metals were at concentrations below respective guidelines (where available) with no samples above UK limits or Dutch/Canadian standards. PAH concentrations were also low and generally below the limit of detection (LOD) for the analytical tests although LODs for Acenaphthene, Acenaphthylene, Dibenzo(ah)anthracene were slightly higher than the Canadian threshold effect levels values.

8.4.23 The environmental assessment at Moray East concluded that sediment contaminants were below guideline values so that no deleterious effects on marine life were expected as a result of the proposed scheme (EMU Limited, 2011).

8.4.24 The deeper water regions of the Moray West OWF ECC were characterised by areas of sandy mud or very muddy sand as well as the sea pen (*Pennatula phosphorea).* There was also an abundance of burrows and pits present on the seabed. Taxa that were present included slender sea pen (*Virigularia mirabilis*), curled octopus (*Eledone cirrhosa*) sparse hydroids/bryozoans and plaice (*Pleuronectes platessa*). Areas of burrowed mud habitat were

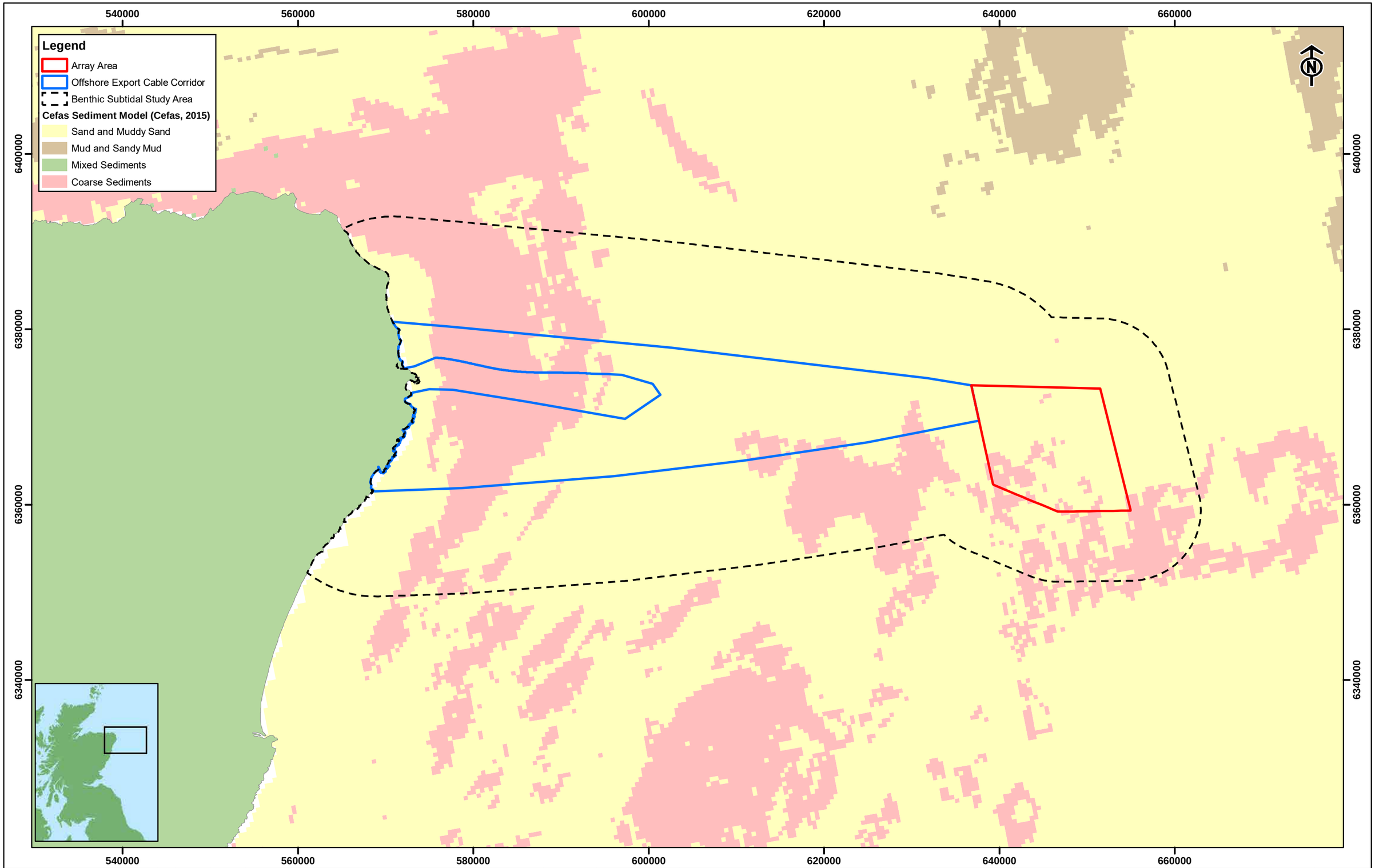
recorded, which is classified as a PMF. Inshore areas were characterised by relatively clean sublittoral sand with small portions of shell grit or fine gravel. There were also areas of coarse mixed sediments and some areas of cobbles and boulders, which were often characterised by patchy hydroid and/or bryozoan turf. Brittle star beds were also recorded across the Moray West OWF ECC.

Landfall Site

8.4.25 At the point of writing, a landfall site has not yet been confirmed, but several landfall sites fall within the Muir Mhòr offshore ECC along the south-eastern Scottish coastline between Peterhead and Cruden Bay (Figure 8-2). The intertidal zone along this stretch is characterised by a mixture of sandy and gravelly sediments where there are bays with a backdrop of cliffs. MagicMap also highlights that there are rock platforms between the sand inlets and bays across this stretch of coastline (MagicMap, 2023).

8.4.26 Site-specific surveys carried out for the Hywind Scotland Pilot OWF project included intertidal surveys of the landfall site at Peterhead, which lies within the Projects intertidal study area. The Hywind Scotland Pilot OWF site-specific survey of the landfall area described it as being dominated by outcropping bedrock that is affected by strong tidal waves, with the bedrock being covered with large kelp beds towards the intertidal areas with different species of red seaweed. The habitats present were classified as *Laminaria* with dense foliose red seaweed on exposed infralittoral rock and Faunal and algal crusts on exposed to moderately wave-exposed circalittoral rock (Statoil, 2015). All landfall bedrock areas at Peterhead during the survey fulfilled the criteria of a bedrock reef and fall under Annex I of the European Commission (EC) Habitats Directive (MMT, 2013). In addition to the bedrock, patches of sand were identified as infralittoral fine sand habitat. The habitat was classified as infralittoral mobile clean sand with sparse fauna (MMT, 2013).

8.4.27 Bennett and McLeod (1998) described the river Ugie, the mouth of which is to the north of the intertidal study area, as supporting an abundance of the fucoid wrack *Fucus ceranoides*. Irving (1996) reported that the intertidal shore along the north-east coast of Scotland from Fraserburgh in the north to St. Cyrus in the south comprises a mixture of extensive stretches of sand, interspersed with rocky shores backed by cliffs, about which little has been published. In terms of exposure to weather and wave action, this coastal region is classified as high energy (JNCC, 2010b) and is generally regarded as exposed.



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Plot	A3
Scale	1:400,000

0 2 4 6 8 10 km

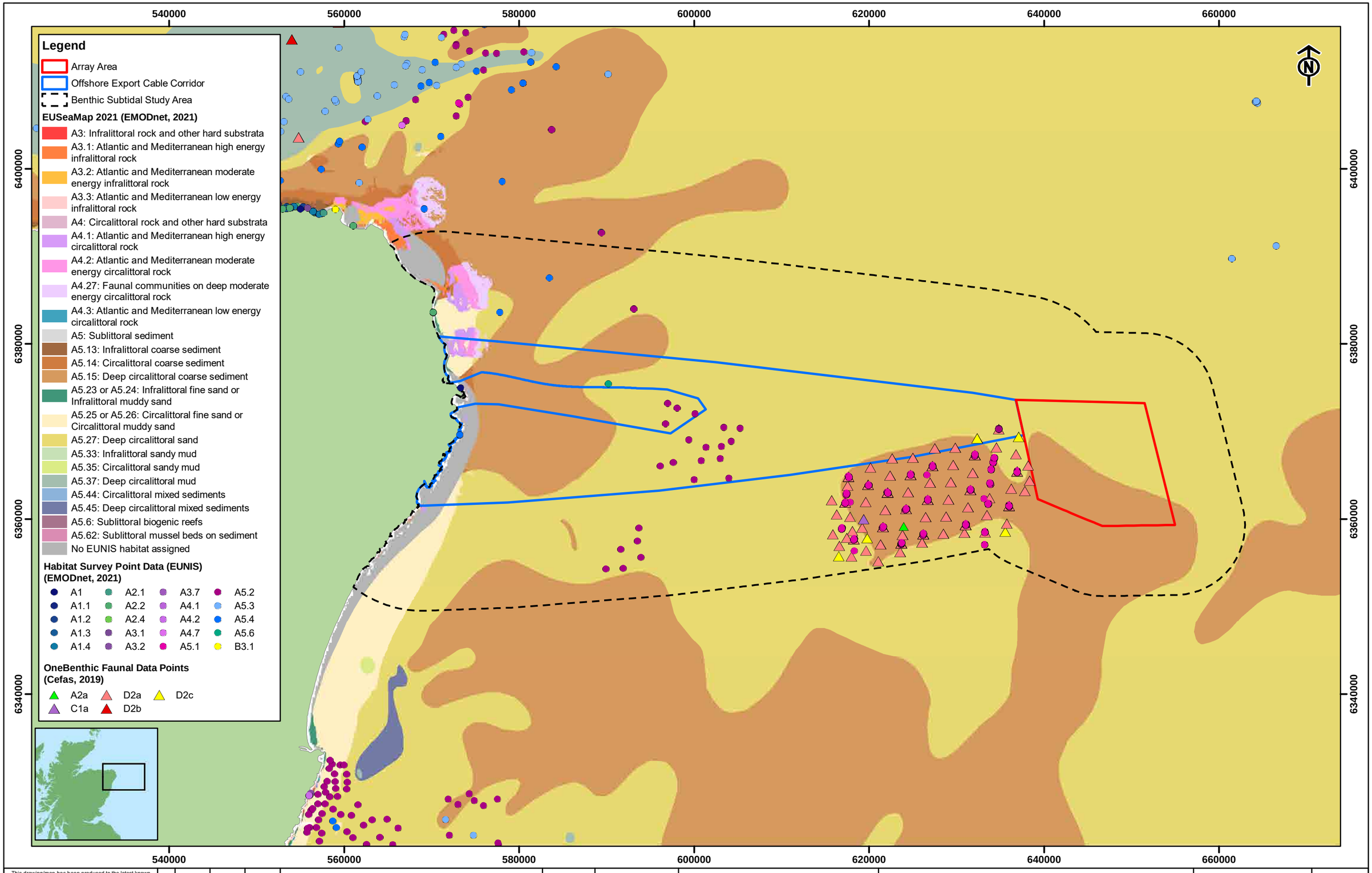
MUIR MHÒR WIND FARM

Sediment Modelling Data across the Benthic Ecology Study Area

Confidentiality Class	C1
Drg No	GoBe-0017
Rev	A
Layout	NA

Figure 8.2

Ref files: MMH_BEN_Fig8.2_CefasSedimentModel_RevA



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MUIR MHÒR OFFSHORE WIND FARM

A joint venture between Fred. Olsen Seawind & Vattenfall

Muir Mhòr Offshore Wind Farm Ltd, The Tun Building
4 Jackson's Entry, Holyrood Road, No 4 EH8 8PJ Edinburgh
United Kingdom

Rev	Date	Drawn By	Checked By	Comment
A	12/04/23	BPHB	LK	First Issue

Datum	ETRS 1989
Projection	ETRS 1989 UTM Zone 30N
Plot	A3
Scale	1:400,000

0 2 4 6 8 10 km

MUIR MHÒR WIND FARM

Seabed Substrate Data, overlayed Habitat Survey Point Data (EUNIS) and Faunal Point Data

Confidentiality Class	C1
Drg No	GoBe-0018
Rev	A
Layout	NA

Figure 8.3

Ref files: MMH_BEN_Fig8.3_SurveyData_RevA

560000 570000 580000 590000

6380000

6370000

6360000

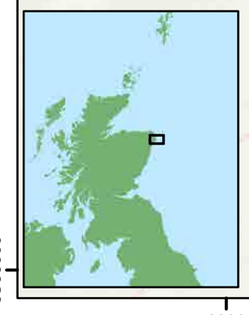
Legend

- Offshore Export Cable Corridor

Intertidal Substrate Foreshore (BGS)

- Sand
- Sand and Gravel
- Mud
- Gravel
- Rock Platform
- Rock Platform with Boulders / Loose Rock
- Boulders / Loose Rock
- Made Ground (Man Made)
- Unspecified
- Not Present

N



Esri, Garmin, GEBCO, NOAA NGDC, and other contributors

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Plot	A3
Scale	1:100,000

0 0.5 1 1.5 2 2.5 km

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Intertidal Seabed Substrates

Confidentiality Class	C1
Drg No	GoBe-0029
Rev	A
Layout	NA

Figure 8.4

Ref files: MMH_BEN_Fig8.4_IntertidalSubstrateForeshore_RevA

Designated Sites and Features of Conservation Interest

8.4.28 As part of the benthic subtidal and intertidal ecology scoping exercise, a review has been undertaken to identify sites designated for nature conservation as well as protected species found within the study area.

8.4.29 Several designated sites have been identified within the study area, some of which directly overlap with the Muir Mhòr offshore ECC. Sites designated for nature conservation within or in close proximity to the proposed development have been illustrated in Figure 8-5. Only sites that have qualifying feature related to benthic subtidal or intertidal ecology and that overlap with the proposed development have been listed within Table 8-2.

8.4.30 Of the designated sites highlighted in Figure 8-5, the Buchan Ness to Collieston Coast SPA, Ythan Estuary Sands of Forvie and Meikle Lock SPA and Troup, Pennan and Lion's Head SPA do not have any benthic designated features or fall outside of the benthic subtidal and intertidal ecology study area, and therefore have not been considered or discussed further.

8.4.31 The southeastern edge of the offshore ECC intersects with the Turbot Bank MPA (Figure 8-5, Table 8-2), which has been designated for the protection of sandeels, Raitt's sandeel, (as detected within the Hywind Scotland Pilot benthic survey) which are closely associated with the circalittoral sediment habitats within the area (JNCC, 2021). Sandeel species have been discussed further as a feature of conservation interest within Chapter 9: Fish and Shellfish Ecology and therefore will not be discussed further in this chapter.

8.4.32 The Southern Trench NC MPA, which overlaps with the proposed development ECC, is designated for its burrowed mud feature as well as marine mammal and geological features. Burrowed mud is mainly found in deep water or sheltered conditions where there is very little water movement and provides habitat for burrowing marine animals, like Norway lobster (*Nephrops norvegicus*), fireworks anemone (*Pachycerianthus multiplicatus*) and sea pens including *Virgularia mirabilis, Pennatula phosphorea* and *Funiculina quadrangularis*. Burrowed mud is a PMF and an OSPAR threatened and/or declining habitat. Conservation advice for this MPA includes minimising the potential impact of renewable energy development on burrowed mud habitats via the existing licensing process.

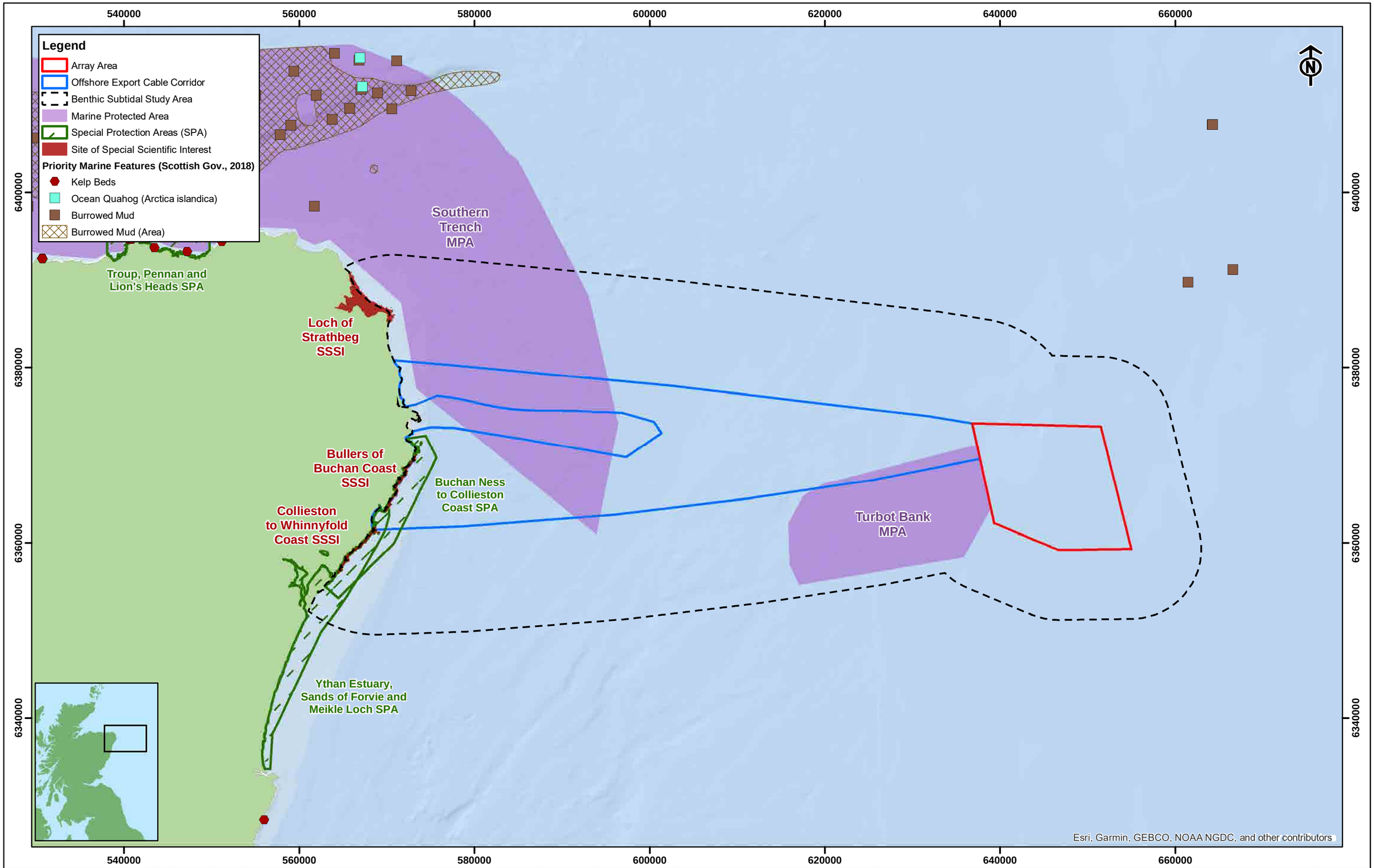
8.4.33 Several SSSIs are located at the landfall and at adjacent areas (Figure 8-5), however are not designated specifically for benthic qualifying features. The Bullers of Buchan SSSI overlaps with the offshore ECC and is protected for its important nesting sites for colonies of seabirds, including guillemots, razorbills, puffins, fulmars, and kittiwakes. The Collieston to Whinnyfold SSSI overlaps with offshore ECC and is 68.7 km from the array area and is designated for nationally important colonies of cliff nesting seabirds, including kittiwake, guillemot, razorbill, fulmar, and shag. The Loch of Strathbeg SSSI is located 4.2 km north of the offshore ECC. This site is designated for shallow nutrient-rich loch constituting the largest dune slack pool in Britain. This site provides wintering habitat for numerous important wetland bird species. Whilst these sites aren't designated for benthic ecology features, the supporting habitat is protected for ornithology, so impacts to any supporting features will be considered within the EIAR.

8.4.34 Scottish Ministers identified a list of 81 PMFs in 2014 that were named for their significant role within Scottish marine ecosystems. As discussed in paragraphs 8.4.8 and 8.4.21, the site-specific benthic survey of the Hywind Scotland Pilot OWF detected three PMFs, two of which (Raitt's sandeel and lesser sandeel) were encountered within the ECC, and the ocean quahog was encountered outside of the array area. Ocean quahog are a large, slow growing and long-lived species. They are found in the subtidal benthic environment around the UK, with 70% of records being from Scottish seas including within the offshore ECC for the Project. It is also an OSPAR threatened and/or declining species.

8.4.35 It is possible that kelp beds might be found within the nearshore portion of the offshore ECC. Kelp beds form a key part of marine ecosystems throughout Scottish seas, providing food and shelter for fish, invertebrates, and marine mammal species. Coralline algae often forms on the rocks below the kelp canopy, and this supports fauna such as sponges, sea squirts and sea anemones. Crustaceans and worms will often live on the holdfasts and sea urchins and snails will graze on the kelp itself, whilst fish species will use the kelp to hide from predators. Kelp beds are also a Biodiversity Action Plan (BAP) priority habitat and activities that alter wave exposure or tidal flow can impact kelp beds and the associated ecosystem they create.

Table 8-2: Sites designated for nature conservation for benthic features within the benthic subtidal and intertidal ecology study area.

Site	Location (Relative to the proposed development)	Benthic Qualifying Feature
Turbot Bank MPA	Overlap with Muir Mhòr offshore ECC, 0.03 km from the array area	Sandeels (Sandeel species have been discussed further as a feature of conservation interest within Chapter 9: Fish and Shellfish Ecology)
Southern Trench MPA	Overlap with Muir Mhòr offshore ECC, 40.4 km from the array area	Burrowed mud



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0 2 4 6 8 10 km

MUIR MHÒR WIND FARM

Sites Designated for Nature Conservation and Priority Marine Features

Confidentiality Class	C1
Drg No	GoBe-0016
Rev	A
Layout	NA

Figure 8.5

Ref files: MMH_BEN_Fig8.5_DesignatedSitesPMF_RevA

8.5 Embedded Commitments

8.5.1 As part of the project design process, several designed-in measures have been proposed to reduce the potential for impacts on environmental receptors. These are presented in Table 8-3 and in the Commitments Register (Appendix A) and will likely evolve over the development process as the EIA progresses and in response to stakeholder consultation.

Table 8-3: Embedded commitment measures of relevance to benthic subtidal and intertidal ecology.

Code	Commitment	Type (Primary, Secondary or Tertiary)	How Commitment Secured
C-01	Scour protection or other appropriate mitigation to be employed around seabed infrastructure where there is the potential risk for significant scour to develop.	Tertiary	CaP CMS
C-02	Development of and adherence to a CaP. The CaP will confirm planned cable routing, installation methods, cable specifications and any additional protection and requirement for any post-installation monitoring.	Tertiary	CaP
C-08	Development of and adherence to an EMP. This will set out mitigation measures and procedures relevant to environmental management, including but not limited to chemical usage, invasive and non-native species, pollution prevention and waste management.	Tertiary	EMP
C-09	Development of and adherence to DP. The DP will outline measures for the decommissioning of the Proposed Development.	Tertiary	DP
C-10	Development of and adherence to a VMP. The VMP will confirm the anticipated types and numbers of vessels that will be engaged on the proposed development and consider vessel coordination including indicative transit route planning.	Tertiary	VMP
C-29	Where practicable, cable burial will be the preferred means of cable protection. Cable burial will be informed by the CBRA and detailed within the CaP. In areas where CBRA deems burial not feasible, suitable implementation and monitoring of cable protection will be employed.	Primary	CaP
C-34	Offshore infrastructure will be micro-sited, where reasonably practicable (to an extent not resulting in a hazard for marine traffic and Search & Rescue capability), around any sensitive seabed habitats including Annex I habitat (if present), informed through the undertaking of survey works pre-construction.	Primary	DSLP PEMP

8.5.2 As a result of the commitment to implement these measures, and to align the proposed development with various standard sectoral practices and procedures, the embedded commitments are considered inherently part of the design of the proposed development and have, therefore, been included in the assessment presented in Section 8.6.

8.5.3 The requirement and feasibility of any additional mitigation measures will be dependent on the significance of the effects upon benthic intertidal and subtidal ecology and will be consulted upon with statutory consultees throughout the EIA process.

8.6 Scoping of Impacts

8.6.1 sets out an initial assessment of the likelihood of effects on benthic subtidal and intertidal ecology due to the proposed development activities for the scoping stage of the EIA process. The assessment is based on a combination of the following: the definition of the proposed development at the scoping stage; embedded commitments (as set out in Section 8.5, together with the means by which it will be secured); the level of understanding of the baseline at the scoping stage; the existing evidence base for benthic subtidal and intertidal ecology effects due to the proposed development activities; relevant policy; and the professional judgement of a qualified benthic subtidal and intertidal ecologists.

Table 8-4: Scoping assessment for benthic subtidal and intertidal ecology.

Impact Pathway	Embedded Mitigation	Scoped In or Scoped Out	Justification
Construction & Decommissioning			
Temporary increases in SSCs and changes to seabed levels.	C-02, C-29	Scoped In	Temporary elevations in SSCs due to construction (i.e., cable installation) activities. This could in turn result in changes to the underlying seabed/coastal bed levels, through deposition of the suspended material and changes to the surficial sediment type. Increases in SSC and associated deposition may have indirect, adverse impacts upon other receptor groups including, Fish and Shellfish Ecology (Chapter 9) and Commercial Fisheries (Chapter 10).
Temporary habitat disturbance	C-02, C-09, C-34	Scoped In	There is potential for temporary, direct habitat disturbance during construction activities in the array area and along the offshore ECC due to seabed preparation, cable laying, foundation installation and the use of jack up vessels or vessel anchoring.
Direct and indirect seabed disturbance leading to release of sediment contaminants	C-08, C-09	Scoped In	Seabed disturbance during construction could lead to the mobilisation of existing sediment contaminants that could have an impact on the benthos. Effects on benthic subtidal and intertidal ecology because of changes in water quality will be informed by the conclusions of the marine and sediment quality assessments.
Permanent and/or long-term habitat loss/alteration due to the removal of infrastructure	C-09	Scoped In	Following the decommissioning of proposed development there is potential for long-term habitat loss or alteration directly associated with the removal of infrastructure
Accidental pollution even during construction or decommissioning activity	C-08	Scoped Out	Chemical and oil inventories on vessels working during construction and decommissioning stages will be small in size. In the event of an accidental chemical or oil spill, hydrocarbons would rapidly be dispersed or diluted. As well as this, all vessels on the project will be required to comply with strict environmental controls set out in the EMP which will minimise the risk and set out provisions for responding to spills during construction or decommissioning. Due to the implementation of control measures and small quantities of hydrocarbons and chemicals it is proposed to scope this impact out of further consideration within the EIA.

Impact Pathway	Embedded Mitigation	Scoped In or Scoped Out	Justification
Operation & Maintenance			
Permanent and/or long-term habitat loss/alteration due to the addition of infrastructure to the area	C-02, C-08, C-34	Scoped In	Following the construction of the proposed development there is potential for long-term habitat loss or alteration directly associated with the presence of, for example, WTG and OEP foundations, scour and cable protection.
Temporary habitat disturbance	C-02, C-08, C-34	Scoped In	There is the potential for direct habitat disturbance of the seabed during planned and unplanned maintenance through (e.g., the use of jack up vessels or cable repair or replacement).
Colonisation of hard substrates	C-08, C-29	Scoped In	Man-made substructures such as WTG and OEP foundations and any associated scour/cable protection on the seabed are expected to be colonised by marine organisms. This colonisation is expected to then result in an increase in local biodiversity and alterations to the near field benthic ecology of the area.
Changes in physical processes resulting from the presence of the proposed development 's subsea infrastructure e.g., scour effects, changes in wave/ tidal current regimes and resulting effects on sediment transport	C-08	Scoped In	With embedded mitigation measures implemented it is unlikely there will be significant impacts to benthic ecology features from changes in physical processes as impact will be spatially and temporally minimal. Physical processes modelling of other OWF projects has predicted small, local impacts on benthic communities from disturbances of this nature. However, this impact will be fully assessed.
Accidental pollution evens during O&M activity	C-08	Scoped Out	See justification described for accidental pollution events during construction and decommissioning activity above.
Increased risk of introduction and/or spread of Invasive Non-Native Species (INNS)	C-08	Scoped Out	This impact is proposed to be scoped out in consideration of the mitigation and control of invasive species measures in line with International Maritime Organization (IMO, 2019). These standards and procedures will be incorporated into the EMP and are embedded in the project design and as such ensure that no significant effects arise from INNS.

Impact Pathway	Embedded Mitigation	Scoped In or Scoped Out	Justification
Electromagnetic field (EMF) effects generated by inter-array and export cables. This may have indirect effects on benthic ecology.	C-08	Scoped Out	Impacts from changes in EMFs arising from cables are not considered to have a significant effect on benthic subtidal and intertidal ecology receptors. EMFs are likely to be generated by subsea cables and detectable above background levels near the cables. Although burial does not mask EMFs, it increases the distance between species that may be affected by them and their source. As the cable will be buried or protected, any behavioural responses are likely to be mitigated. Many marine invertebrates are thought to be magneto-sensitive, with this often being used for navigational purposes (migration etc.). One recent study (Hutchinson *et al*., 2020) has suggested potential changes to exploratory behaviour in American lobster (*Homarus americanus*) in response to DC B-fields when in tanks placed near a subsea cable, however the authors noted there was no indication that the behavioural change was related to the differing EMF strengths within the enclosure. Recent studies have also identified both behavioural (Scott *et al*., 2018) and physiological (Scott *et al*., 2021) reactions in brown crab (*Cancer pagurus*) from EMF. Scott *et al*. (2018) suggests that the natural roaming behaviour, where individuals will actively seek food and/or mates has been overridden by an attraction to the source of the EMF (strength 2,800 µT to 40,000 µT). However, the exposure to EMF does not affect the activity levels of the crabs but affects their ability to select a site to rest. Scott *et al*. (2021) investigated the effects of EMF (strengths 250 µT, 500 µT and 1000 µT) from submarine power cables on edible crab. This showed limited physiological and behavioural effects on the crabs exposed to EMF of 250 µT. EMF of 500 µT or above showed physiological stress in crabs, and changes to behavioural trends, specifically an attraction to EMF. It is to be noted however, that these studies investigated EMF strengths significantly higher than those that receptors will typically be exposed to because of offshore wind cables in the marine environment. Specifically, the lowest experimental EMF used in Scott *et al*. (2021) was a factor of ten higher than that expected for the proposed development, with no impacts identified at this EMF strength. Effects were only noted in those studies using EMF strengths which were a factor of 20 – 1,000 higher than those expected from the proposed development cables. Therefore, it is considered unlikely there would be any impacts to crustaceans from EMF. Another recent study examined the difference in invertebrate communities along an energised and nearby unenergized surface laid cables. The study identified there were no functional differences between the communities on and around the cables up to three years after installation (Love *et al*., 2017). The same study also identified that EMF levels reduce to background levels generally within one metre of the cable. For invertebrate receptor species, it is difficult to translate the patchwork of knowledge about individual-level EMF effects into assessments of biologically or ecologically significant impacts on populations (Gill and Bartlett, 2010). However, given the evidence

Impact Pathway	Embedded Mitigation	Scoped In or Scoped Out	Justification
			presented, it is predicted that EMFs have no significant impact on mobile or sessile benthic invertebrates, including if the cable is surface laid. Furthermore, a small number of studies have suggested that some invertebrates may be able to detect electric fields (Patullo and Macmillan, 2007; Steullet, *et al*., 2007), however the electric fields are thought to trigger chemo- and mechano-sensory neurons rather than specialised electric field receptors (unlike the ampullae of Lorenzini present in elasmobranchs) (Tricas & Gill, 2011). The studies were undertaken using voltages which were orders of magnitude greater than those predicted from the proposed development (Patullo and Macmillan, 2007; Steullet, *et al*., 2007). Jakubowska *et al*., (2019), conducted a laboratory study assessing the effects of environmentally realistic, low-frequency B-field exposure on the behaviour and physiology of the common ragworm *Hediste diversicolor* and did not find any evidence of avoidance or attraction behaviours. The polychaetes did, however, exhibit enhanced burrowing activity when exposed to the B-field, with plausible consequences for their metabolism; however, knowledge about the biological relevance of this response is currently absent (Jakubowska *et al*., 2019). Therefore, it can be considered unlikely there would be any impacts to crustaceans from EMF. Taking this into consideration, any effects on marine invertebrates are anticipated to only occur in the immediate vicinity of the cable. Overall, it is considered unlikely that EMFs will result in a significant behavioural response that will cause a change in benthic communities. Therefore, the magnitude of the impact is considered to be negligible and the impact is proposed to be scoped out.

8.7 Potential Cumulative Impacts

8.7.1 Chapter 4 (EIA Methodology) details how potential cumulative impacts will be assessed through a CIA. For benthic subtidal and intertidal ecology, cumulative interactions may occur with other planned OWFs as well as other activities in the study area.

8.7.2 Impacts that are scoped into the assessment for the project alone, are generally spatially restricted to being within close proximity to the array area and offshore ECC. However, certain potential impacts, such as an increase in SSC, have the potential to affect the benthic subtidal communities over a more significant area. It is proposed that impacts with limited spatial extent, that do not have an effect on a designated species, site or feature, are scoped out of any further assessment within the EIA.

8.7.3 For this reason, only the following impact on benthic subtidal and intertidal ecology receptors is being proposed for further consideration within the EIA, subject to route refinement:

- Temporary increase in SSC and sediment deposition.

8.8 Potential Transboundary Effects

8.8.1 Transboundary impacts related to benthic subtidal and intertidal ecology are not anticipated to arise from construction, O&M or decommissioning stages of the proposed development. Any impacts on benthic subtidal and intertidal ecology receptors will be localised in nature and any indirect effects will likely be limited to one tidal excursion from the impact source. The proposed development is a significant distance from the nearest adjacent EEZ of another state and, therefore, it is considered that transboundary impacts will not occur and will therefore be scoped out from further consideration within the EIA.

8.9 Proposed Approach to EIA

Site-Specific Survey and Baseline Characterisation

8.9.1 In addition to those readily available data sources outlined in Table 8-1, site-specific survey data is planned to inform the EIA as detailed in Table 8-5.

8.9.2 The current scope of work for the geophysical survey of the proposed development aims for 100% coverage of the proposed development array area and offshore ECC. The objectives of this geophysical survey campaign are to determine the bathymetry, seabed features, classification and morphology, as well as the presence of any geohazards and infrastructure. The survey will comprise MBES bathymetry, SSS, SBP, UHRS and magnetometer.

8.9.3 Geophysical survey outputs will be used to inform the location of the benthic ground-truthing survey campaign to get a representative spread of samples across the seabed features identified, as well as targeting any potential conservation features to understand location and extent. The layout of the benthic survey campaign will also be informed by pre-existing broadscale habitat mapping. Grab samples and DDV surveillance will be used to characterise the array area and offshore ECC. Samples will be used to classify the sediment type present across the study area, as well as monitor contaminants and the fauna that are present. Data from these surveys will be used to confirm or dispute existing data from across the survey area.

Table 8-5: Relevant data sources to inform EIA for benthic subtidal and intertidal ecology.

Title	Detail	Year
Muir Mhòr OWF Geophysical Data Collection	Site-specific geophysical data and corresponding survey report to inform benthic survey planning and the EIA.	2023
Muir Mhòr OWF Site-Specific Benthic Subtidal Ecology Baseline Characterisation Survey	Site-specific surveys will be carried out in order to characterise the benthic ecology of the study area and inform the EIA. Subtidal benthic habitats will be sampled via a combination of targeted benthic infaunal grab sampling and DDV surveys, with particular focus on any habitats of conservation interest. Sediment samples will also be collected, and PSA and contaminants analysis undertaken. eDNA samples will also be taken.	2023
Muir Mhòr OWF Site-Specific Benthic Intertidal Ecology Baseline Survey	Intertidal benthic habitats will be characterised via a Phase I and Phase II habitat survey.	2023

Guidance

8.9.4 In addition to the general approach and guidance outlined in Chapter 4 (EIA Methodology), the assessment of benthic subtidal and intertidal ecology receptors will also comply with the following guidance documents where they are specific to this topic:

- Guidelines for Ecological Impact Assessment in the UK and Ireland. Terrestrial Freshwater, Coastal and Marine (CIEEM), 2018);
- Guidelines for Ecological Impact Assessment in Britain and Ireland. Marine and Coastal. Final Document, August 2010 (CIEEM, 2010);
- Guidance document on wind energy developments and EU nature legislation (2021);
- Strategic Review of Offshore Wind farm Monitoring Data Associated with FEPA 1985 Licence Conditions (Cefas, 2004a);
- Cumulative impact assessment guidelines, guiding principles for cumulative impacts assessments in OWF (Renewable UK, 2013);
- Guidance note for EIA in respect of FEPA and Coast Protection Act 1949 (CPA) requirements (Cefas, 2004b);
- Guidelines for data acquisition to support marine environmental assessments of offshore renewable energy projects (Judd, 2012);
- Guidance on Environmental Considerations for Offshore Wind Farm Development (OSPAR, 2008); and
- Sensitivity of features based upon the Marine Evidence-based Sensitivity Assessment (MarESA) framework where possible (Tyler-Walters *et al.*, 2018).

Assessment Methodology

8.9.5 The EIA will follow the general approach outlined in Chapter 4 (EIA Methodology) of this Offshore Scoping Report.

8.9.6 To enable the potential impact of the proposed development to be assessed, a description of the existing benthic communities, focusing particularly on any areas of conservation interest, will be produced. Potential impacts that may occur on the subtidal and intertidal

physical, chemical and biological environment as a result of the planned construction, O&M and decommissioning will then be identified. The sensitivities of the communities present to the types of impact expected from wind farm construction, O&M and decommissioning activities will be assessed. Where necessary, measures will be proposed to mitigate the impacts.

8.9.7 In the event that the proposed development has a direct impact on any sites that are designated for conservation at the European (SAC or SPA; now forming part of the UK's National Site Network) or international level (Ramsar), as a result of qualifying habitats or species that they support, then the requisite information will be provided separately alongside the EIA to assist the competent authority to carry out an AA A separate Offshore HRA Screening Report has been produced and submitted alongside this Offshore Scoping Report which considers/evaluates the potential connectivity of European or international sites within the assessment, and apportions the impacts identified back to the sites impacted.

8.9.8 Cumulative effects will be assessed by taking into consideration any other plans or projects proposed or existing, and where sufficient information is available, which, together with the proposed development have a likely significant effect on a receptor due to a common impact pathway and/or temporal or spatial overlap.

8.10 Scoping Questions

8.10.1 The following Scoping questions refer to the benthic subtidal and intertidal ecology chapter and are designed to focus the scoping exercise and inform the Scoping Opinion:

- Do you agree with the study area(s) defined in Section 8.2 for benthic subtidal and intertidal ecology?
- Do you agree with the use of those data listed in Section 8.3, and any additional anticipated data listed in Section 8.9, being used to inform the Offshore EIA?
- Are there any additional data sources or guidance documents that should be considered?
- Do you agree that all receptors related to benthic subtidal and intertidal ecology have been identified?
- Do you agree with the scoping in and out of impact pathways in relation to benthic subtidal and intertidal ecology?
- Do you agree with the assessment of the potential for transboundary effects in relation to benthic subtidal and intertidal ecology?
- Do you agree with the assessment of the proposed approach to cumulative effects in relation to benthic subtidal and intertidal ecology?
- Do you agree with the proposed assessment methodology for benthic subtidal and intertidal ecology?

9 Fish and Shellfish Ecology

9.1 Introduction

9.1.1 This chapter of the Offshore Scoping Report identifies the fish and shellfish receptors of relevance to the proposed development and considers the potential impacts from construction, O&M and decommissioning of the proposed development on these fish and shellfish ecology receptors.

9.1.2 This chapter should be read alongside the following chapters:

- Chapter 6: Marine and Coastal Processes;
- Chapter 8: Benthic Subtidal and Intertidal Ecology;
- Chapter 11: Marine Mammals; and
- Chapter 12: Commercial Fisheries.

9.1.3 This chapter of the Offshore Scoping Report has been prepared by GoBe Consultants Limited.

9.2 Study Area

9.2.1 The fish and shellfish ecology study area is presented in Figure 9-1 and has been defined at three spatial scales. For primary impacts, the study area includes the array area of the proposed development and the offshore ECC. For secondary impacts, a wider ZoI has been used, encompassing the area over which suspended sediment might travel following disturbance as a result of the proposed development's activities. This secondary ZoI a buffer around the proposed development defined by the mean spring tidal excursion which represents the expected maximum distance that suspended sediments may be transported on a mean spring tide in a flood and /or ebb direction (although most suspended sediments are expected to be deposited much closer to the disturbance activity). The tidal excursion distances surrounding the Muir Mhòr array area and the ECC range from 12 to 15 km from the proposed development. Therefore, as a precautionary measure, the secondary ZoI has been defined as a 15 km buffer from the Muir Mhòr array area and offshore ECC.

9.2.2 The largest ZoI relates to underwater noise from piling in the array area. Until recently, fish were assumed to flee the noise stimulus at a rate of 1.5 m/s, however recent projects (Awel y Môr OWF, Sheringham Shoal and Dudgeon OWF Extension Projects, Hornsea Four OWF and Norfolk Boreas OWF) have been advised to also consider stationary receptor modelling for some species groups. The maximum impact ranges for both stationary (e.g., spawning herring *Clupea harengus*) and fleeing receptors from recent OWF applications have been presented in Table 9-1 below. Taking the maximum impact ranges as informed by underwater noise modelling for recent OWF projects, a 50 km ZoI for underwater noise impacts is deemed suitably precautionary for the proposed development. The underwater noise ZoI is shown in Figure 9-1.

Table 9-1: Impact Ranges from Underwater Noise Modelling for Recent Offshore Wind Applications.

Project	Maximum impact range for a fleeing receptor	Maximum impact range for a stationary receptor
Awel y Môr OWF (RWE, 2022)	17 km	36 km
Sheringham Shoal and Dudgeon OWF Extension Projects (Equinor, 2022)	10 km	19 km
Hornsea Four OWF (Ørsted, 2021)	26 km	38 km
Norfolk Boreas (Vattenfall, 2019)	6.5 km	18 km

9.2.3 The study areas may be refined as required at post-scoping stages to reflect site-specific sediment plume modelling work (see section 6.10.4) that will be undertaken as part of the marine and coastal processes assessments well as stakeholder consultation and refinements to the proposed development's design. The study areas for underwater noise element of the EIAR will also be defined based on site-specific underwater noise modelling to account for potential impacts from noise, which will be considered in relation to the species and habitats found throughout the study area and wider northern North Sea biogeographic region and data available on the spawning and nursery grounds within this area.

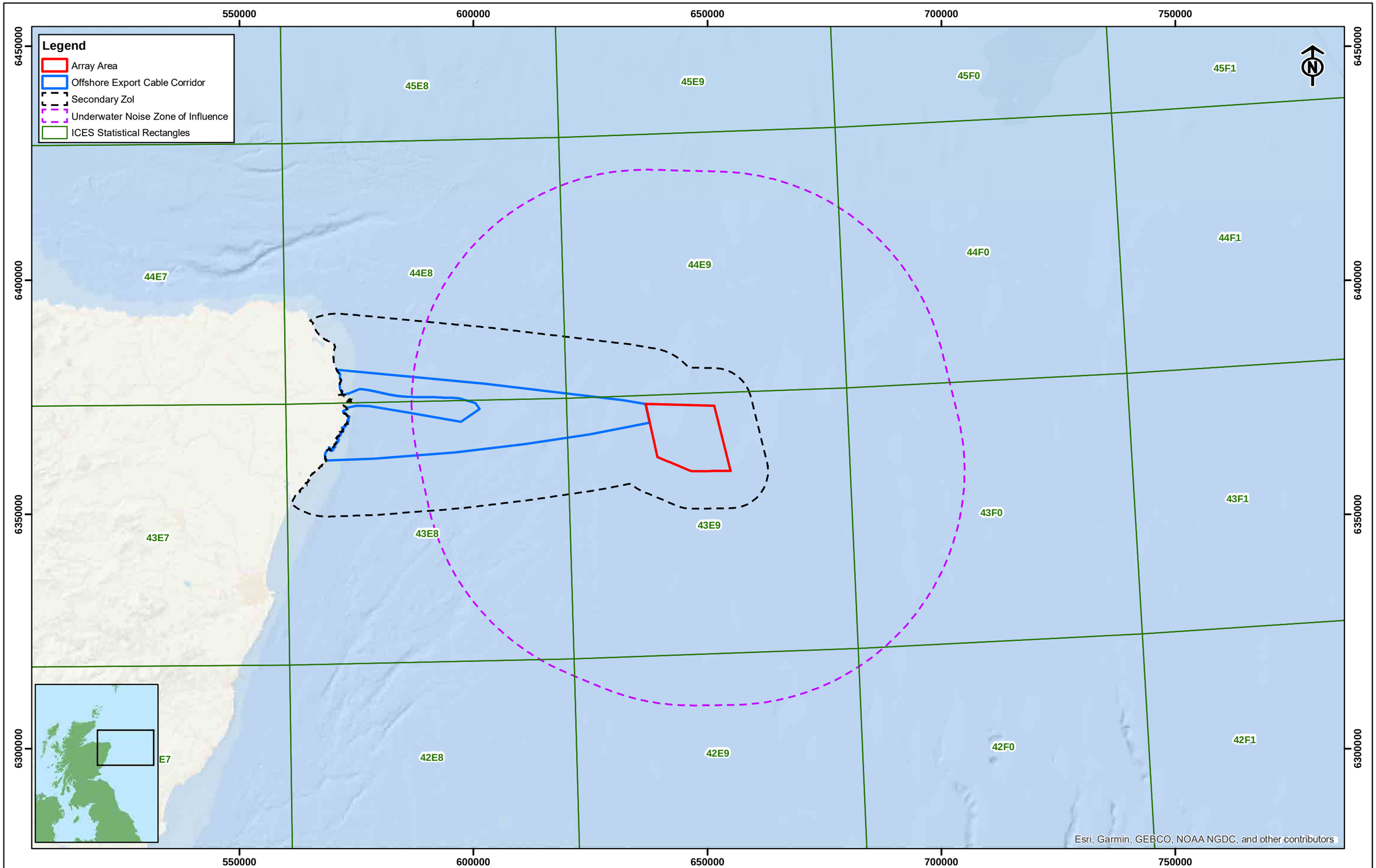
9.3 Baseline Environment

Data Sources

9.3.1 The data sources that have been used to inform this chapter of the Offshore Scoping Report are presented within Table 9-2. These data sources will be taken forward and used to inform the EIA, alongside any additional site-specific data that will be collected for the proposed development.

Site-Specific Surveys

9.3.2 An environmental baseline survey will be completed in 2023 in the Muir Mhòr array area and offshore ECC. This will include a geophysical survey (MBES bathymetry, SSS, SBP and UHRS and magnetometer) and environmental sampling (e.g., grab sampling for faunal, eDNA, contaminants and particle size analyses, video and still photography). The survey results will be incorporated in the EIA. Intertidal surveys will also be conducted at the landfall locations.



This drawing/map has been produced to the latest known information at the time of issue. Please consult with the Vattenfall GIS team to ensure the content is still current before using the information contained on this map.

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Rev	Date	Drawn By	Checked By	Comment
A	03/04/23	BPHB	LK	First Issue

Datum	ETRS 1989
Projection	ETRS 1989 UTM Zone 30N
Plot	A3
Scale	1:750,000

0 5 10 15 20 25 km

MUIR MHÒR WIND FARM
Fish and Shellfish Study Area

Confidentiality Class	C1
Drg No	GoBe-0008
Rev	A
Layout	NA

Figure 9.1

Ref files: MMH_FS_Fig9.1_StudyArea_RevA

Table 9-2: Key sources of fish and shellfish data.

Source, Author and Year	Summary	Coverage of Muir Mhòr array area and ECC
Existing OWF Data		
Hywind Scotland Pilot Park: ES, Chapter 10: Fish and Shellfish Ecology (Statoil, 2015)	Provides an analysis of data collected across the wider northern North Sea biogeographic region and has been drawn upon to inform this chapter.	The Hywind Scotland OWF is located within the fish and shellfish study area, overlapping with the offshore ECC.
Hywind Scotland Pilot OWF Benthic and Geophysical Survey Report (MMT, 2013)	Site-specific survey report characterising the benthic and geophysical environment of the Hywind Scotland Pilot OWF study area.	
Moray East OWF ES Technical Appendices – Fish and Shellfish Ecology Technical Report (Moray Offshore Renewables Limited, 2011)	Provides an analysis of data collected across the wider northern North Sea biogeographic region and has been drawn upon for this scoping section.	The Moray East OWF lies within the Moray Firth. The Muir Mhòr offshore ECC lies approximately 50 km from Moray East OWF.
Moray East OWF ES Technical Appendices – Sandeel Survey Report (Moray Offshore Renewables Limited, 2012)	Site-specific survey report investigating and detailing the distribution of sandeels within the Moray East project area.	
Moray East OWF ES – Chapters 7.2and 10.2: Fish and Shellfish Ecology (Moray Offshore Renewables Limited, 2011)	Provides an analysis of data collected across the wider northern North Sea biogeographic region and has been drawn upon to inform this chapter.	
Moray West OWF ES – Chapter 8: Fish and Shellfish Ecology (Moray OWF (West) Limited,2018)	Provides an analysis of data collected across the wider northern North Sea biogeographic region has been drawn upon to inform this chapter.	The Moray West OWF lies within the Moray Firth. The Muir Mhòr offshore ECC lies approximately 77 km from the Moray West OWF.
Beatrice OWF ES – Annex 11A: Fish and Shellfish Ecology Technical Report (Beatrice OWF Ltd, 2012a)	Details the fish and shellfish ecology baseline for the Beatrice OWF development.	The Beatrice OWF lies within the Moray Firth. The Muir Mhòr offshore ECC lies approximately 84 km from the Beatrice OWF.
Beatrice OWF ES – Chapter 11: Fish and Shellfish Ecology (Beatrice OWF Ltd, 2012b)	Provides an analysis of data collected across the wider northern North Sea biogeographic region and has been drawn upon to inform this chapter.	

Source, Author and Year	Summary	Coverage of Muir Mhòr array area and ECC
Beatrice OWF Farm Pre-Construction Baseline Sandeel Survey – Technical Report (Beatrice OWF Ltd, 2014)	Pre-construction monitoring reports describing the sandeel distributions within the project area, through data collection (modified shellfish dredge).	
Beatrice OWF Farm Post-Construction Baseline Sandeel Survey – Technical Report (Beatrice OWF Ltd, 2021)	Post-construction monitoring reports describing the sandeel distributions within the project area, through data collection (modified shellfish dredge).	
Beatrice OWF – Pre-Construction Cod (*Gadus morhua*) Spawning Survey – Technical Report (Beatrice OWF Ltd, 2015)	Pre-construction monitoring reports describing the degree of cod spawning activity throughout the project area.	
Beatrice OWF – Post-Construction Cod (*G.morhua*) Spawning Survey – Technical Report (Beatrice OWF Ltd, 2021)	Post-construction monitoring reports describing the degree of cod spawning activity throughout the project area.	
Beatrice OWF Pre-Construction Baseline Herring Larval Surveys Summary Technical Report (Beatrice OWF Ltd, 2016)	Pre-construction monitoring report to form a baseline data set of herring larvae density within the project area during spawning.	
Beatrice OWF– Atlantic Salmon *Salmo Salar* smolt movements survey (Beatrice OWF Ltd, 2017)	Survey on Atlantic Salmon *S.Salar* smolt movements in the Cromarty and Moray Firths.	
Publicly available datasets		
ICES North Sea International Bottom Trawl Survey (2019-2023) (ICES, 2010a)	Data of the species caught during a North Sea Bottom Trawl survey.	Surveys cover the greater North Sea regions including the study area.
ICES Offshore Beam Trawl Surveys (2019-2023) (ICES, 2010b)	Data of the species caught during a beam trawl survey.	Surveys cover the greater North Sea regions including the study area.
UK sea fsheries annual statistics reports (MMO, 2019)	Information on landings of the UK fishing fleet, and the status of commercial fish stocks.	Full coverage of the study area and wider North Sea.

Source, Author and Year	Summary	Coverage of Muir Mhòr array area and ECC
EMODnet broad scale seabed habitat map for Europe (EUSeaMap) (EMODnet 2023)	EUSeaMap is a predictive habitat map covering the North Sea. Habitats are described in the EUNIS 2019 classification system.	These maps cover the entire array area, as well as inshore regions where the offshore ECC will be situated.
Fisheries datasets available from the NMPi)[13], including ScotMap data	An interactive map providing a data overview of the Scottish marine environment.	Full coverage of the study area and northern North Sea.
BGS Marine Sediment Particle Size dataset sourced from the BGS GeoIndex Offshore portal[14]	National PSA dataset.	This is a national dataset providing full coverage of the fish and shellfish ecology study area.
International Herring Larval Survey (IHLS) data[15] (ICES, 2023)	Herring larvae surveys conducted across the North Sea and adjacent areas to provide quantitative estimates of herring larval abundance used as a relative index of changes of herring spawning stock biomass.	This is an international dataset providing full coverage of the fish and shellfish ecology study area.
IFISH (Integrated Fisheries System Holding) Database[16]	Fisheries data, including landings and fishing effort data.	This is a national database providing full coverage of the fish and shellfish ecology study area.
Cefas research publications and broad scale survey data[17]	Broadscale trawl survey data.	This is a national dataset providing full coverage of the fish and shellfish ecology study area.
Boyle and New (2018) Offshore Renewable Joint Industry Programme (ORJIP) Impacts from Piling on Fish at Offshore Wind Sites: Collating Population Information, Gap Analysis and Appraisal of Mitigation Options.	The study report presents a spatial analysis of the IHLS herring larval data collected over a ten-year period.	Provides data covering the North Sea and relevant herring stocks in the vicinity of the study area and wider region.

[13] https://marinescotland.atkinsgeospatial.com/nmpi/

[14] https://mapapps2.bgs.ac.uk/geoindex_offshore/home.html?_ga=2.180987503.950258115.1631718927-1084102068.1631718927

[15] https://obis.org/dataset/94829f49-bab5-48a5-9a64-38425f8ec640

[16] https://data.cefas.co.uk/search/1/ifish

[17] https://data.cefas.co.uk/

Source, Author and Year	Summary	Coverage of Muir Mhòr array area and ECC
North Sea fish spawning and nursery grounds (Coull *et al*, 1998; Ellis *et al*, 2010)	These studies map the distribution of North Sea fish and/ or shellfish species' spawning and nursery grounds using various survey data.	These are national datasets providing full coverage of the fish and shellfish ecology study area.
Information on species of conservation interest (JNCC (2007)[18]	Species specific data, of native species of conservation interest.	This data source provides species specific data of native species of conservation interest. National datasets providing full coverage of the fish and shellfish ecology study area.
ICES Reports and Research Publication[19]	International research reports and publications.	Reports and publications to inform the assessment. No spatial coverage.

[18] https://hub.jncc.gov.uk/assets/98fb6dab-13ae-470d-884b-7816afce42d4#UKBAP-priority-fish.pdf

[19] https://www.ices.dk/Science/publications/Pages/Scientific-reports.aspx

Description of Baseline Environment

9.3.3 This characterisation of the species found within the fish and shellfish ecology study area has been completed by drawing upon work that was undertaken in support of various OWF projects in the vicinity of the proposed development as well as wider information from publicly available sources (Table 9-2). Hywind Scotland Pilot OWF is located approximately 35.6 km from the Muir Mhòr array area and overlaps with the offshore ECC. Data have therefore been drawn upon for this chapter. The Moray West OWF, Moray East OWF and the Beatrice OWF are located 85.5 km, 77.6 km and 94.7 km, respectively, from the closest point of the proposed development. Data from these OWFs have been drawn upon to inform this chapter, as the species and habitats found within these areas are broadly similar.

Species Present

9.3.4 Bottom trawl and beam trawl surveys were undertaken throughout the greater North Sea, inclusive of the study area from 2019 and 2023 as part of the North Sea International Bottom Trawl Survey and the North Sea Beam Trawl Surveys[20]. The trawl surveys identified an assemblage across the region of haddock (*Melanogrammus aeglefinus),* whiting *(Merlanguis merlangus),* herring *(C.harengus),* plaice *(Pleuronectes platessa),* Norway pout (*Trisopterus esmarkii)*, cod (*G.morhua*) and Atlantic mackerel (*Scomber scombrus*). The surveys also recorded the presence of several species of conservation importance, notably; Raitt's sandeel (*A.marinus*), (*Amblyraja radiata*), herring, anglerfish (*Lophius piscatorius*) and cod; all of which are PMFs.

9.3.5 The Hywind Scotland Pilot OWF ES (Hywind Scotland Pilot OWF, 2015) described similar assemblages, being principally made up of the pelagic species, herring and sprat (*Sprattus sprattus*) and mackerel. Demersal fish assemblages were vastly made up of; lesser sandeel (*A.tobianus*), cod, haddock, whiting, plaice, lemon sole (*Microstomus kitt*), anglerfish, ling (*Molva molva*), European hake (*Merluccius merluccius*), Norway pout, saithe (*Pollachius virens*), spotted ray (*Raja montagui*), common skate complex (*Dipturus batis*), spurdog (*Squalus acanthias*) and tope (*Galeorhius galeus*) (Hywind Scotland Pilot OWF, 2015). As part of the Hywind Scotland Pilot OWF benthic survey (MMT, 2013), site-specific samples taken throughout the ECC also identified the presence of Raitt's sandeel and lesser sandeel. Raitt's Sandeel is listed on the UK Biodiversity Action Plan (UKBAP) species list.

9.3.6 The Hywind Scotland Pilot OWF ES (Hywind Scotland Pilot OWF, 2015) described the following diadromous migratory species as having the potential to transit through the project and surrounding area; Atlantic salmon (*Salmo salar*), sea trout (*Salmo trutta*), European eel (*Anguilla anguilla*), river lamprey (*Lampetra fluviatillis*) and sea lamprey (*Petromyzon marinus*), all of which are PMFs.

9.3.7 The Hywind Scotland Pilot OWF ES identified the following shellfish as present within the project area (as informed by landings data); veined squid (*Loligo forbesi*), brown crab (*Pagurus cancer*), velvet crab (*Necora puber*), scallop (*Pecten maximus*), Norway lobster (*N. norvegicus*) and European lobster (*Homarus gammarus*).

9.3.8 As part of the Hywind Scotland Pilot OWF benthic survey (MMT, 2013), site-specific samples taken throughout the ECC identified the presence of ocean quahog (*Artica islandica*) which is also a PMF. The ocean quahog is also listed as threatened or under decline by the OSPAR commission (OSPAR, 2008).

[20] https://datras.ices.dk/home/descriptions.aspx

9.3.9 Epibenthic beam trawl surveys conducted in the Moray West OWF site between May and June 2017 (Moray OWF (West) Limited, 2018) revealed a species assemblage typical of this area of the North Sea. The fish community was largely characterised by demersal species recorded in abundance during surveys, including dragonet (*Callionymus lyra*), dab *(Limanda limanda)* and plaice. Lemon sole, pogge (*Agonus cataphractus)* and grey gurnard (*Eutrigla gurnardus*) were also recorded. Typically, areas with higher diversity tended to be recorded in more heterogenous seabed habitats often present in these areas which included patches of coarser mixed sediment, gravels and stones/cobble and a similar trend was evident at both the Moray East and Beatrice OWF surveys (Moray Offshore Renewables Limited, 2011; Beatrice OWF Limited, 2011). Other fish species recorded included monkfish (*Lophius spp.*), Norwegian topknot (*Phrynorhombus norvegicus*), sandeel and elasmobranchs such as the cuckoo ray (*Leucoraja naevus)* and lesser spotted dogfish (*Scyliorhinus canicular*), (Moray OWF (West) Limited, 2018).

9.3.10 Results from sandeel surveys across the Beatrice OWF site in December 2020 indicated patchy distribution with low abundance, with Raitt's sandeel being the most prevalent species (Beatrice OWF Limited, 2021). The Beatrice OWF post-construction survey findings indicated an increase in sandeel abundance, and consequently concluded that there was no indication that the construction of the Beatrice OWF resulted in negative impacts on the local sandeel population (Beatrice OWF Limited, 2014; 2021).

9.3.11 Otter trawl surveys conducted in March 2021 to identify cod distributions across the Beatrice OWF site revealed haddock was the most abundant species accounting for the majority of the total by-catch, followed by whiting and squid, whilst cod abundance was relatively low (Beatrice OWF Limited, 2021).

9.3.12 Elasmobranch species are also known to be present in the Moray Firth area (Scottish Government, 2011). Elasmobranch populations identified within the region include spurdog (*Squalus spp.*), lesser spotted dogfish, starry ray (*Amblyraja radiata*), cuckoo ray, thornback ray (*Raja clavata)* and spotted ray (Ellis *et al.,* 2004; ICES, 2022).

9.3.13 Basking shark (*Cetorhinus maximus*) (a species of conservation importance) migrate from the western English Channel in spring to west Scottish waters, where they spend the summer and early autumn before moving offshore in winter. This is supported by a survey subcontracted to inform the Hywind Scotland Pilot ES, which recorded no basking shark observations (NRP, 2015).

Species of Commercial Importance

9.3.14 Detailed information on species of commercial importance is provided in Chapter 12: Commercial Fisheries of the Offshore Scoping Report. Landings within the region by UK vessels in 2021 were dominated by shellfish and pelagic fish species. Specifically, landings were dominated in both quantity (tonnage) and value by *Nephrops*, scallop, crab spp. And squid spp. Landings of pelagic species were dominated in mackerel, blue whiting (*Micromesistius poutassou*) and herring (MMO, 2023). Landings into the region in from 2016 to 2020 were dominated in pelagic species, namely herring and mackerel. Landings of demersal species within the region were dominated in haddock, whiting, sandeel and anglerfish species, whilst shellfish landings largely consisted of scallops, *Nephrops* and brown crab (MMO, 2019).

9.3.15 Shellfish are considered to be potentially sensitive to the proposed development, based on their limited mobility and therefore are considered less able to avoid potential disturbances compared to more mobile species.

Spawning and Nursery Grounds

9.3.16 The spawning and nursery grounds of several fish and shellfish are known to be located within or in close proximity to the study area (Coull *et al.,* 1998; Ellis *et al.,* 2010). Spawning grounds for cod, sandeel, plaice, Norway pout and whiting overlap with the study area as well as extending over much of the North Sea (see Figure 9-2 Figure 9-3) (Coull *et al.,* 1998; Ellis *et al.,* 2010).

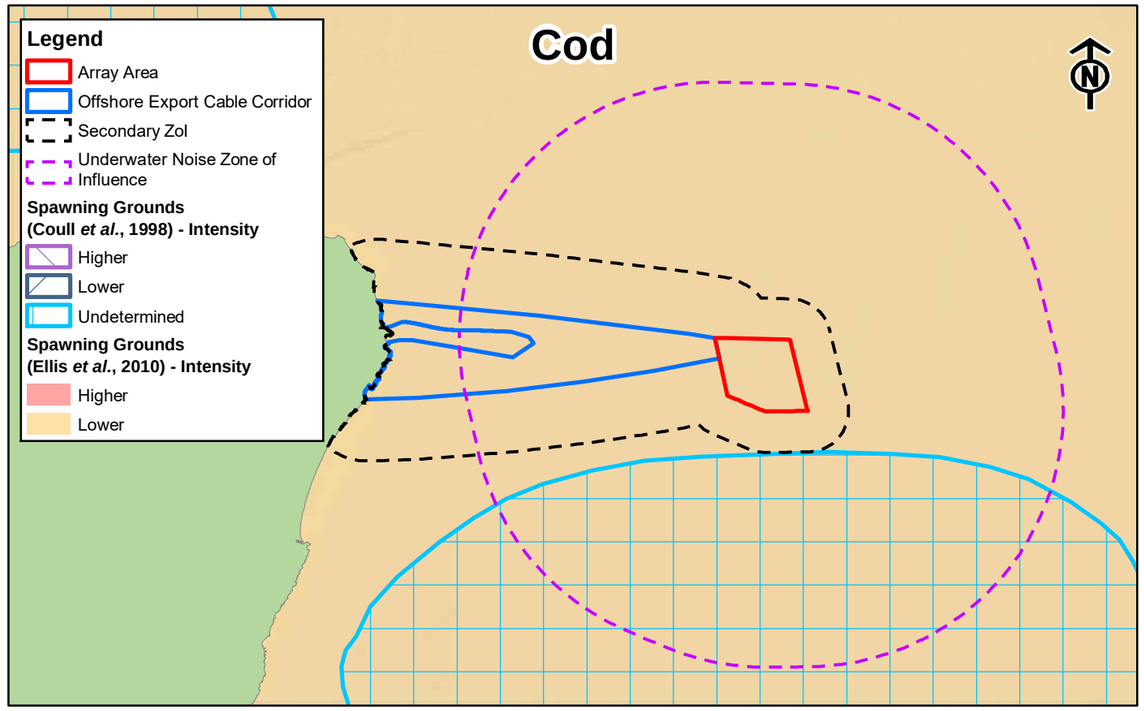
9.3.17 A large sandeel spawning ground interacts with the proposed development throughout both the ECC and the array area (Figure 9-3). Much of the proposed development overlaps high intensity sandeel spawning grounds with low intensity spawning grounds to the north and south of the 50 km underwater noise study area (Coull *et al.,* 1998; Ellis *et al.,* 2010). Sandeel are of relevance when considering noise disturbance impacts to spawning areas as they are demersal spawners that lay their eggs onto or into seabed sediments; they also exhibit substrate dependency, preferring sandy substrates on which to spawn. Sandeel surveys were undertaken by both Moray East OWF and Beatrice OWF, in 2012 and 2014 respectively. Both surveys reported similar findings, indicating patchy sandeel distribution across the sites, with sandeel recorded in relatively low numbers (Moray Offshore Renewables Limited, 2012; Beatrice OWF Limited, 2014). Post construction monitoring at Beatrice OWF undertaken in 2021 reported significant increases in sandeel numbers when compared to the 2014 pre-construction surveys (Beatrice OWF Ltd, 2014; 2021).

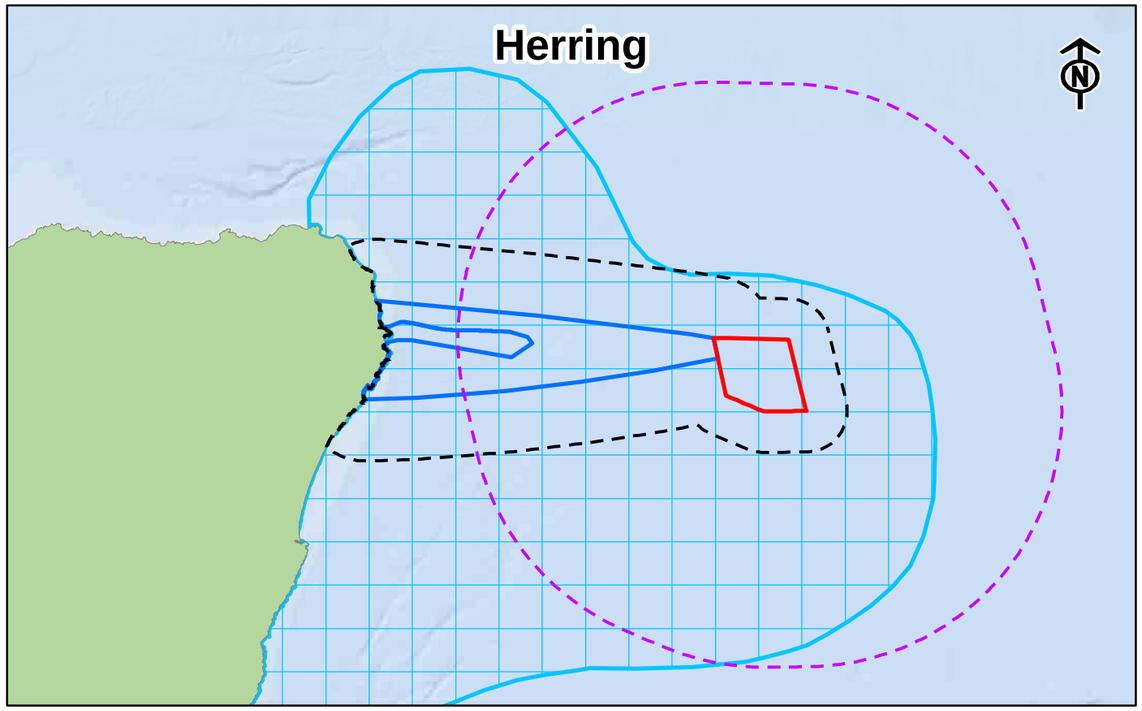
9.3.18 The study area overlaps with a low intensity cod spawning area (with spawning occurring in winter) and a low intensity nursery ground (Coull *et al.,* 1998; Ellis *et al.,* 2010). Cod are of particular importance due to their sensitivity to noise (cod possess a swim bladder which is involved in hearing; Popper *et al.,* 2014). Cod spawning surveys were conducted across the Moray East OWF in 2013 (Brown and May Marine, 2013) and more recently otter trawl surveys were conducted for pre- and post-construction monitoring of the Beatrice OWF (Beatrice OWF Ltd, 2015; 2021). Results from these surveys found spawning cod densities to be very low across the sites.

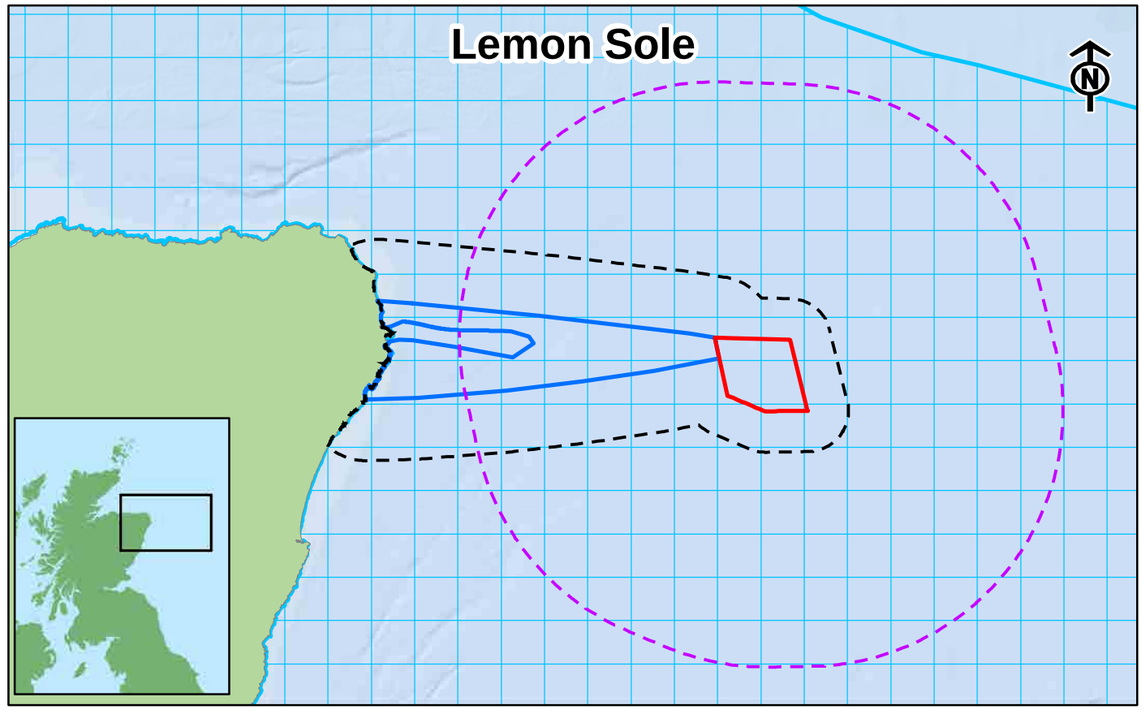
9.3.19 There is a large herring spawning ground that runs along much of the east coast of Scotland and extends offshore, which intercepts the Muir Mhòr offshore ECC and array area (Coull *et al.,* 1998; Ellis *et al.,* 2010). Herring are also demersal spawners that lay their eggs onto or into seabed sediments, they also exhibit substrate dependency, with a preference for gravelly substrates on which to spawn. Furthermore, herring are particularly sensitive to noise impacts as they have swim bladders involved in hearing (Popper *et al.,* 2014). Pre-construction herring larvae surveys were undertaken by Beatrice OWF Limited in 2014 and 2015 (Beatrice OWF Ltd, 2014; 2016), as well as for the Moray East OWF (Moray Offshore Renewables Ltd, 2019). The data collected across Beatrice OWF identified larvae in the north of the Beatrice OWF array area, with the larvae originating from well-established spawning grounds located around Orkney and Shetland transported south with the tides and currents. Larval spatial distributions reported in the Moray East OWF identified lower larval densities in the vicinity of the OWF array and ECC compared to areas around Shetland and Orkney. The spatial distribution of herring larvae indicated the highest distributions were found north-east of the Moray East array area. However, the smallest larvae were generally found to the south of the array and the largest were found to the north of the Moray East OWF array area (Moray Offshore Renewables Limited, 2012).

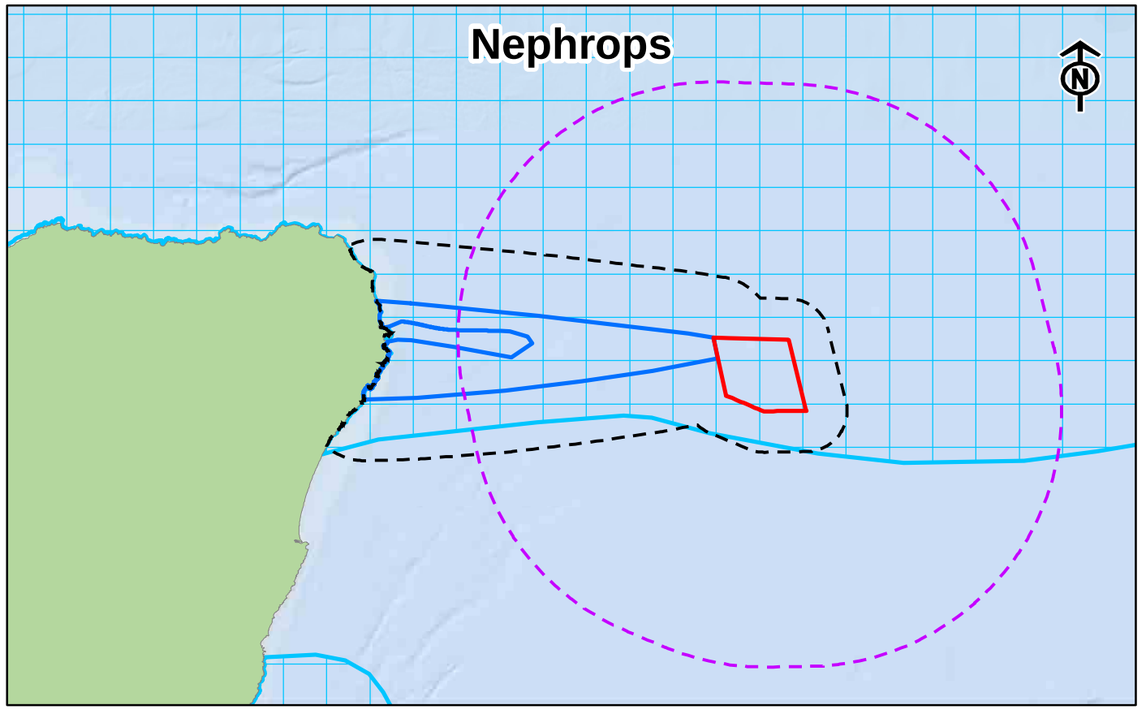
9.3.20 The fish and shellfish ecology study area also coincides with high intensity herring and whiting nursery grounds, and many low intensity nursery grounds including tope shark, spurdog, spotted ray, sandeel, plaice, saithe, ling, mackerel and European hake (Figure 9-9, Figure 9-8, Figure 9-7, Figure 9-6). Other species nursery grounds present across the study area include lemon sole, haddock, *Nephrops*, Norway pout, saithe and sprat (Coull *et al.,* 1998; Ellis *et al.,* 2010).

9.3.21 In a broader context, the study area has a spatially limited interaction with a small portion of the overall spawning sites and nursery grounds for the above-mentioned species. The spawning and nursery grounds of these species in the study area form part of far greater spawning and nursery grounds within the North Sea system.









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Rev	Date	Drawn By	Checked By	Comment
A	03/04/23	BPHB	LK	First Issue

Datum	ETRS 1989
Projection	ETRS 1989 UTM Zone 30N
Plot	A3
Scale	1:1,200,000

0 10 20 30 40 50 km

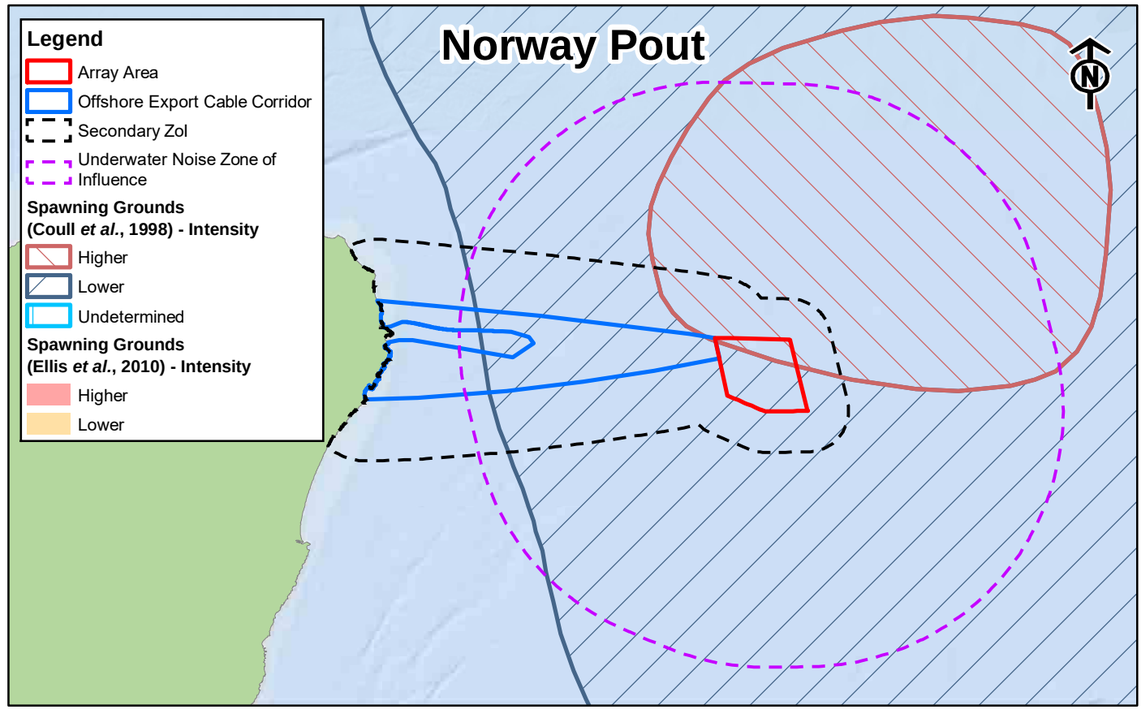
MUIR MHÒR WIND FARM

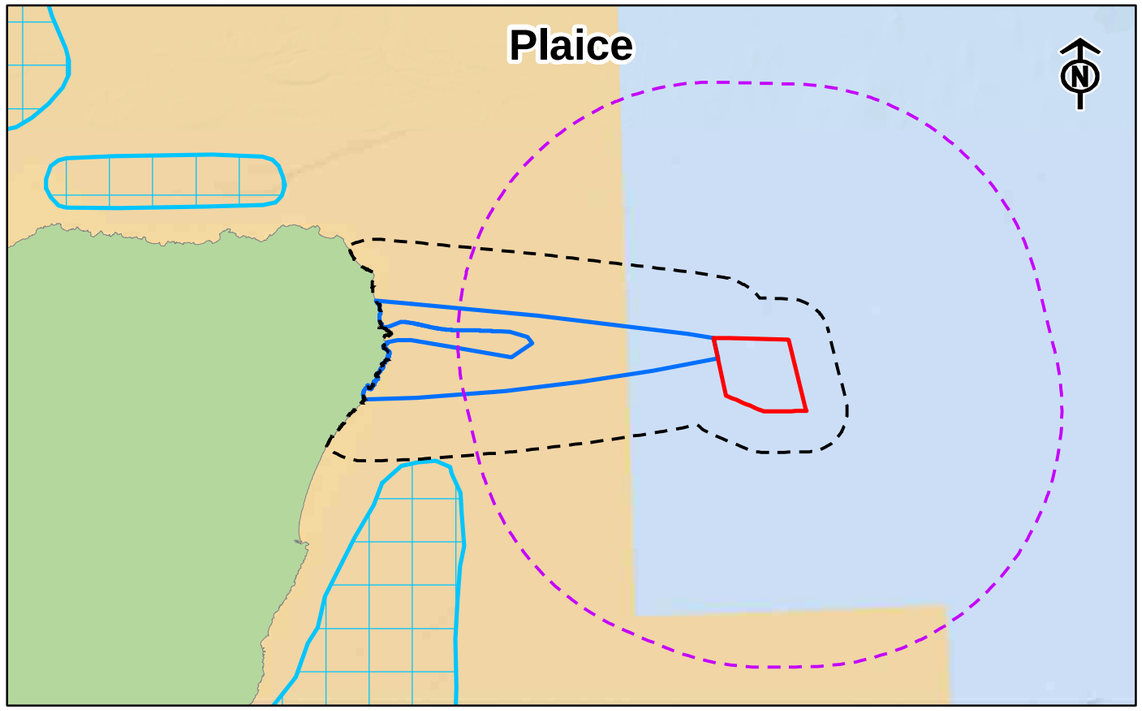
Spawning Grounds Relative to the Proposed Development
(Coull *et al.*, 1998; Ellis *et al.*, 2010)

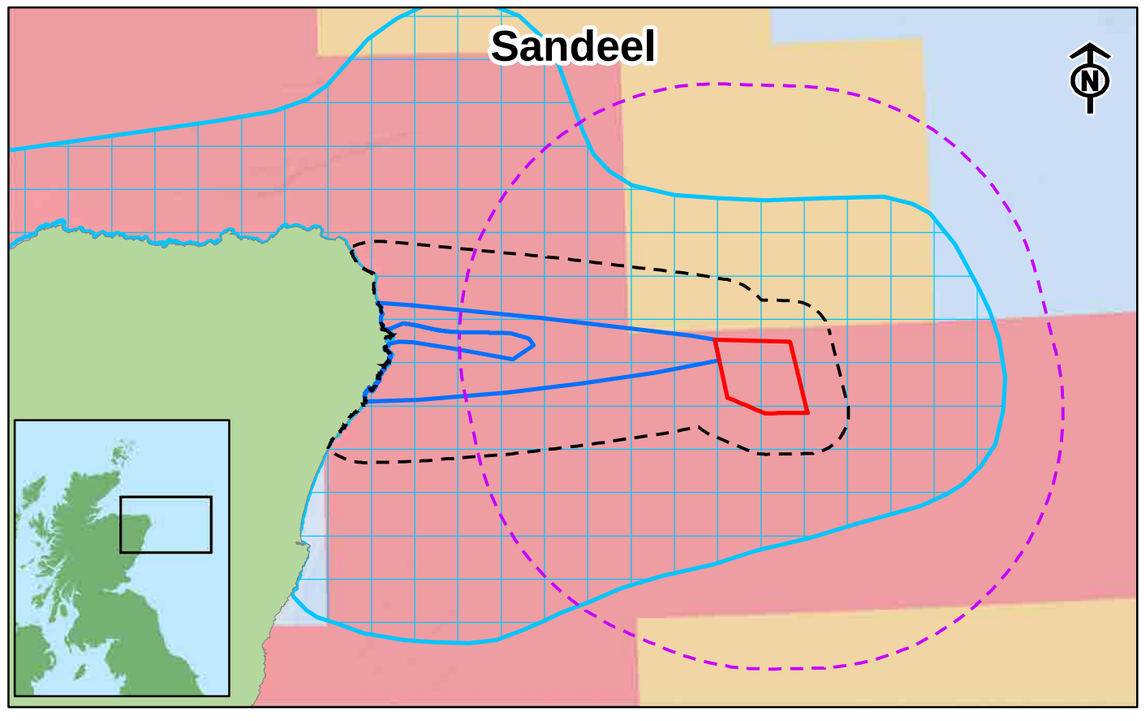
Confidentiality Class	C1
Drg No	GoBe-0021
Rev	A
Layout	NA

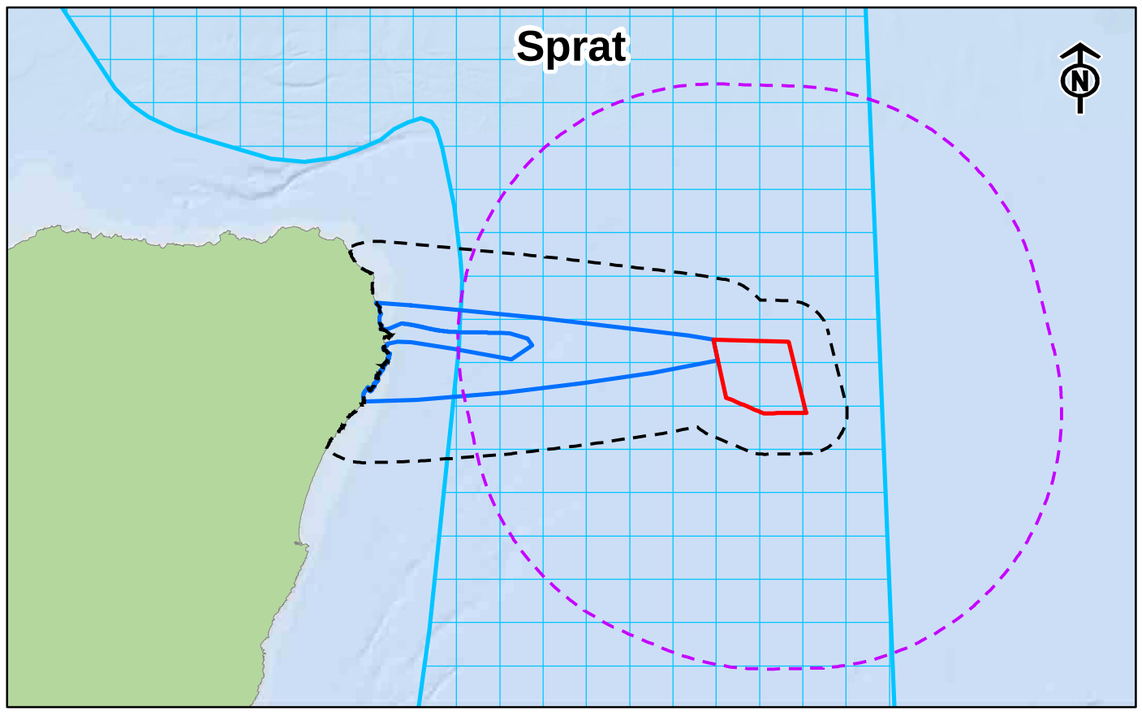
Figure 9.2

Ref files: MMH_FS_Fig9.2_SpawningGrounds1_RevA









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Plot	A3
Scale	1:1,200,000

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MUIR MHÒR WIND FARM

Spawning Grounds Relative to the Proposed Development
(Coull *et al.*, 1998; Ellis *et al.*, 2010)

Confidentiality Class	C1
Drg No	GoBe-0022
Rev	A
Layout	NA

Figure 9.3

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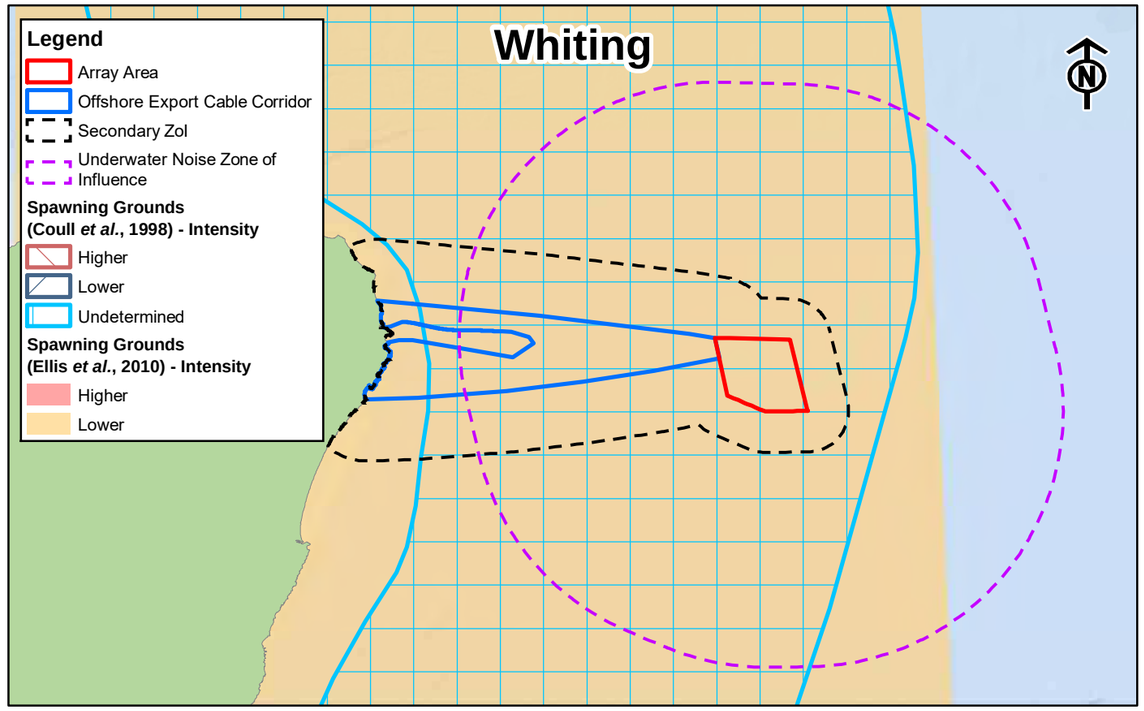

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MUIR MHÒR WIND FARM

Spawning Grounds Relative to the Proposed Development
(Coull *et al.*, 1998; Ellis *et al.*, 2010)

Confidentiality Class	C1
Drg No	GoBe-0023
Rev	A
Layout	NA

Figure 9.4

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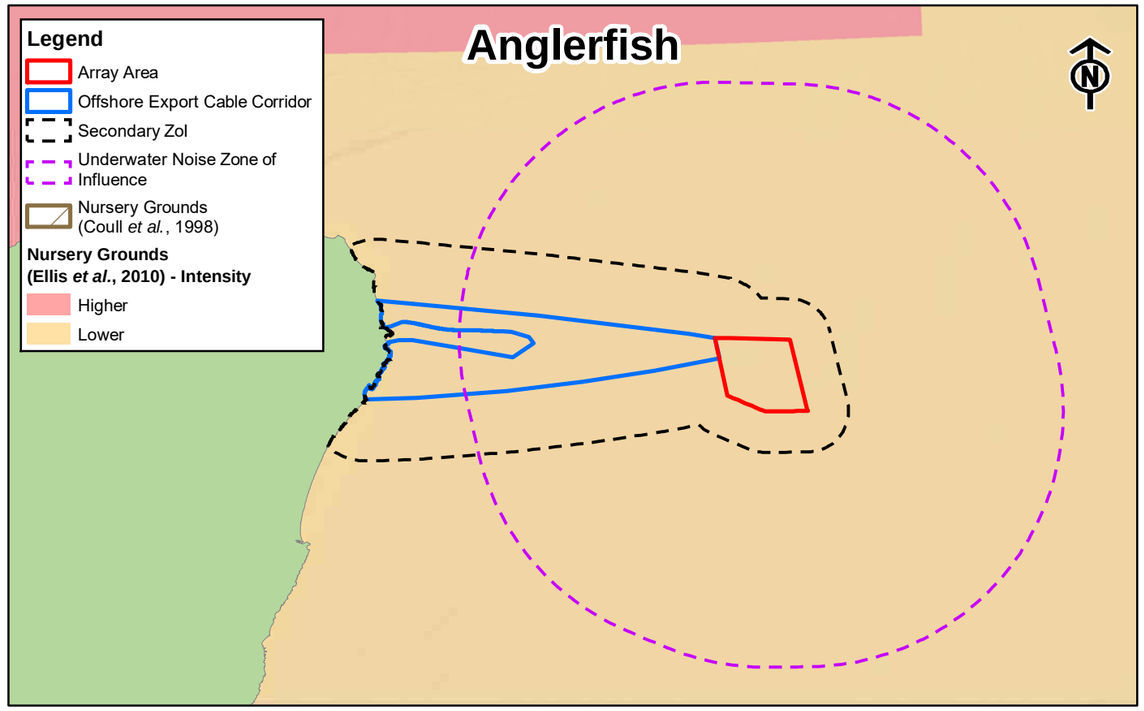

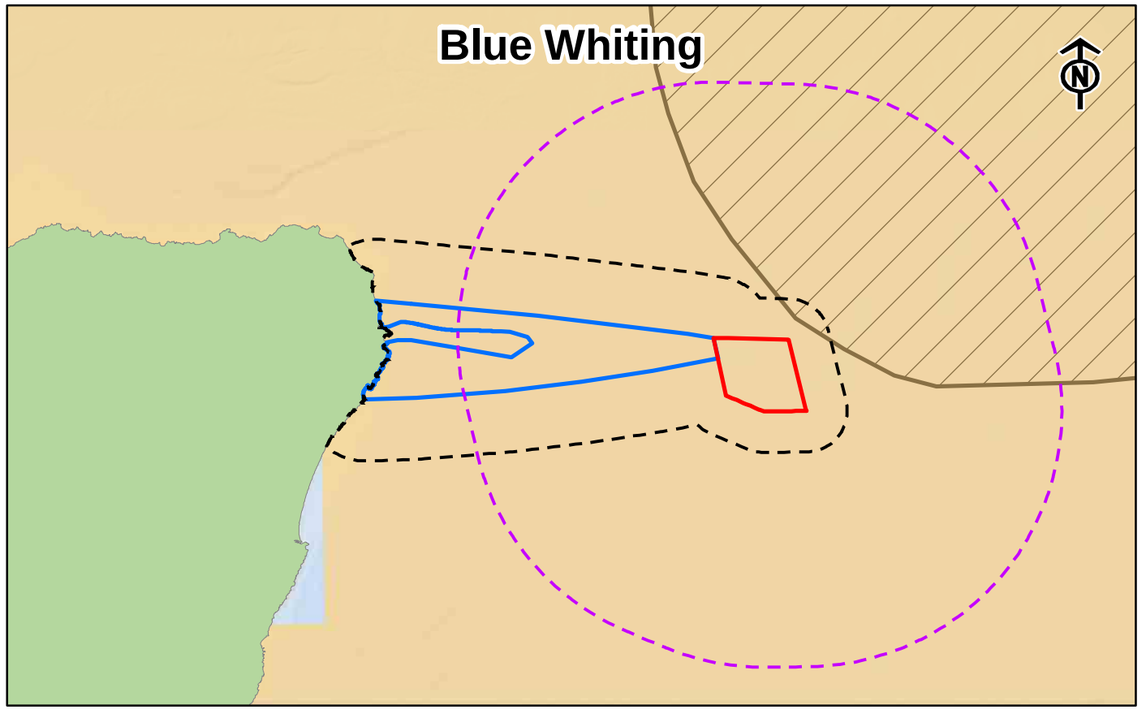

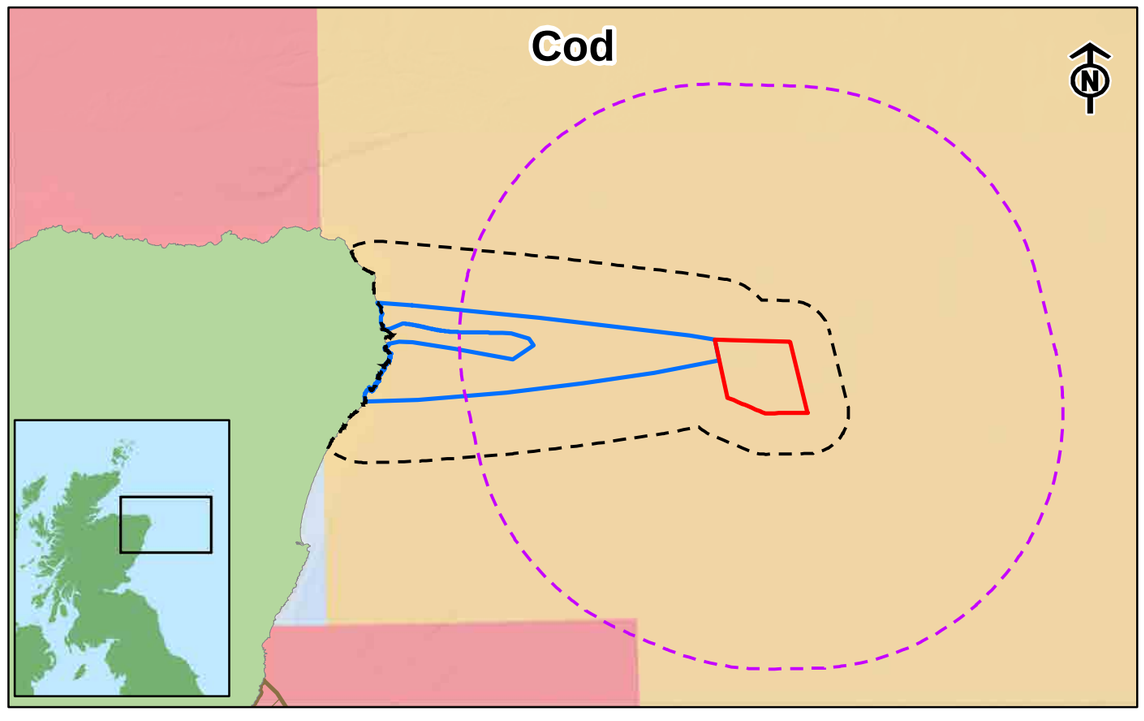

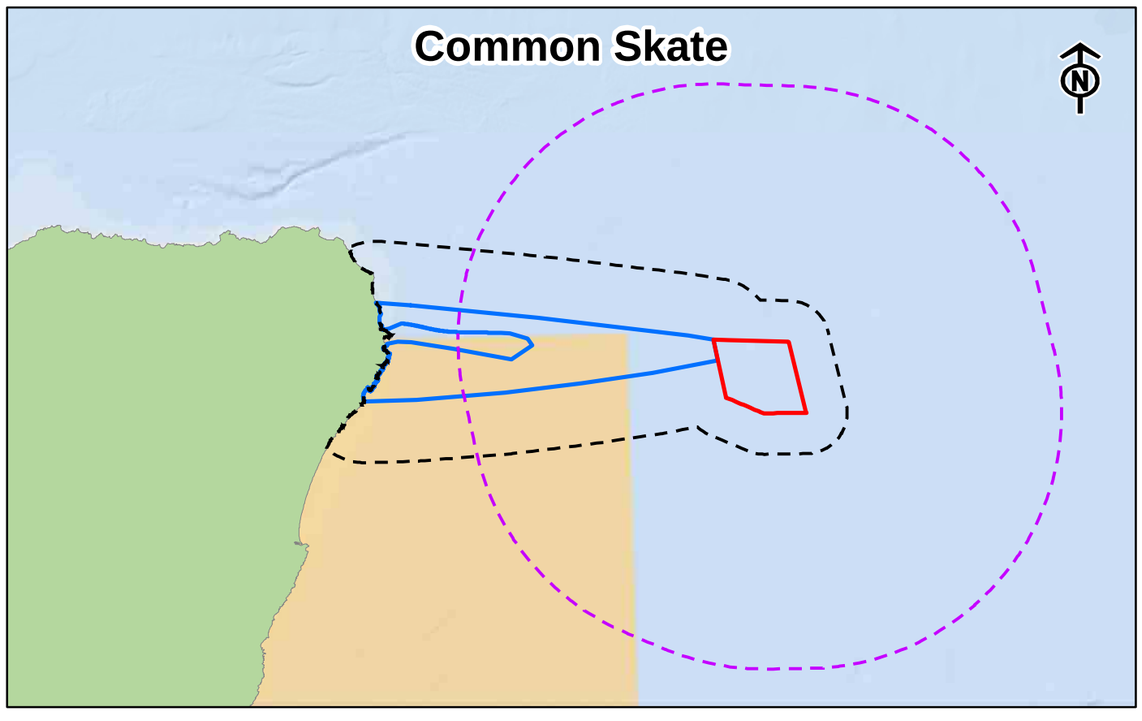

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United Kingdom

Rev	Date	Drawn By	Checked By	Comment
A	03/04/23	BPHB	LK	First Issue

Datum	ETRS 1989
Projection	ETRS 1989 UTM Zone 30N
Plot	A3
Scale	1:1,200,000

0 10 20 30 40 50 km

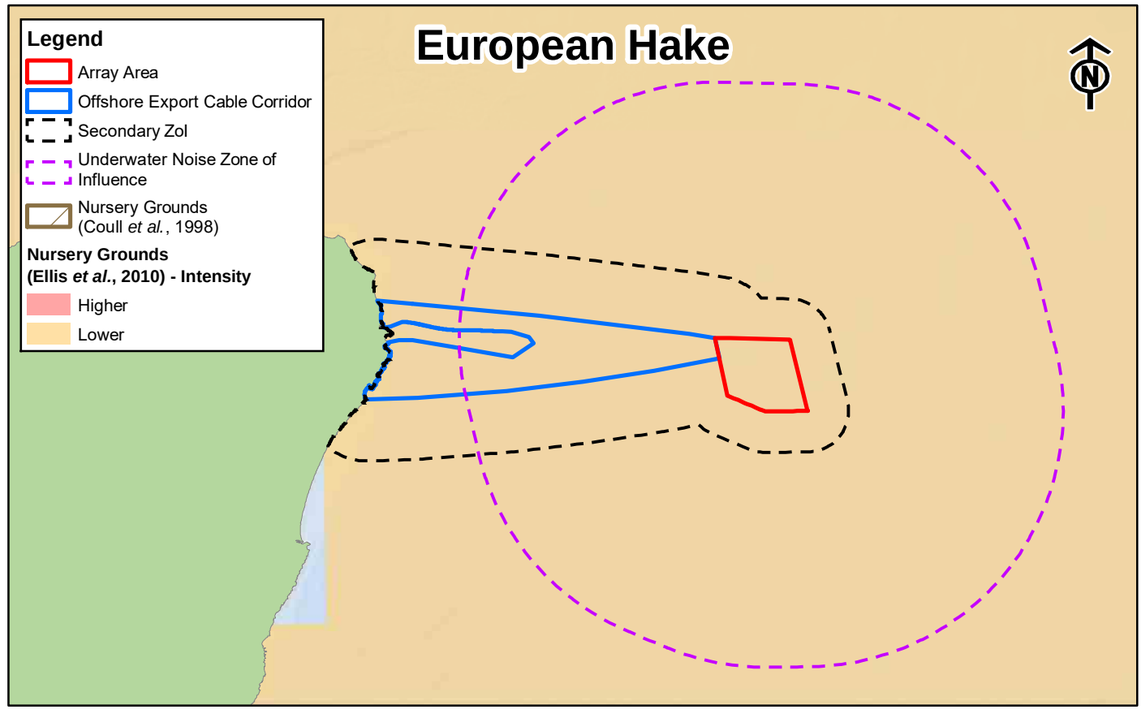
MUIR MHÒR WIND FARM

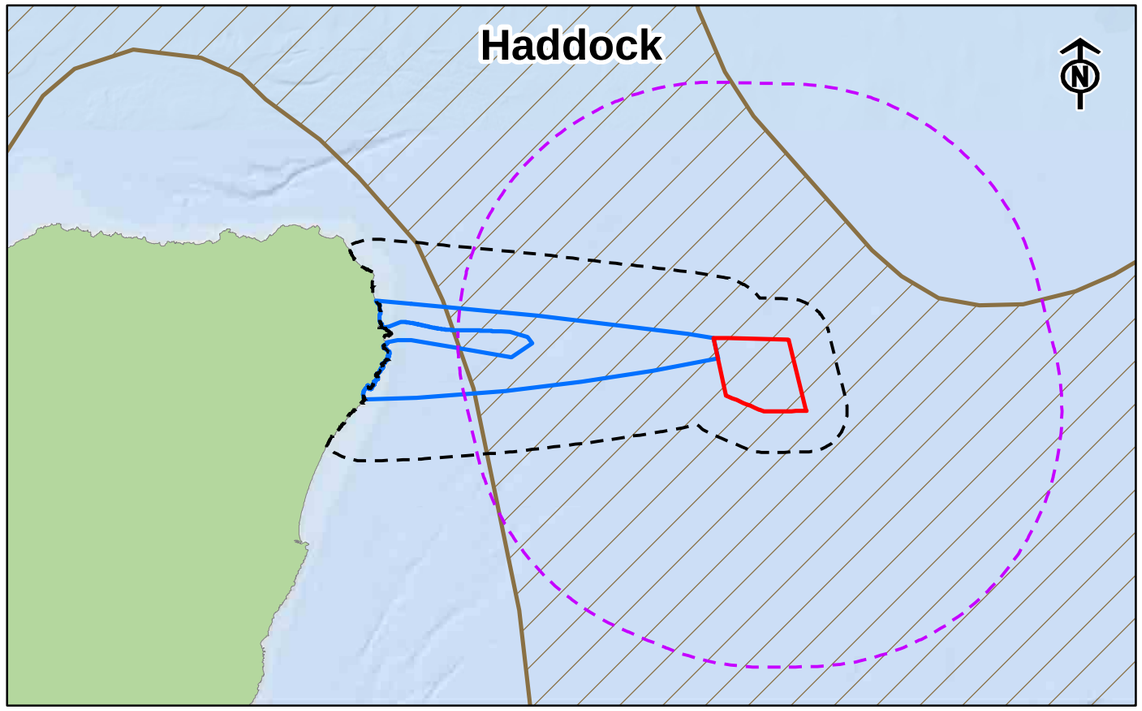
Nursery Grounds Relative to the Proposed Development
(Coull *et al.*, 1998; Ellis *et al.*, 2010)

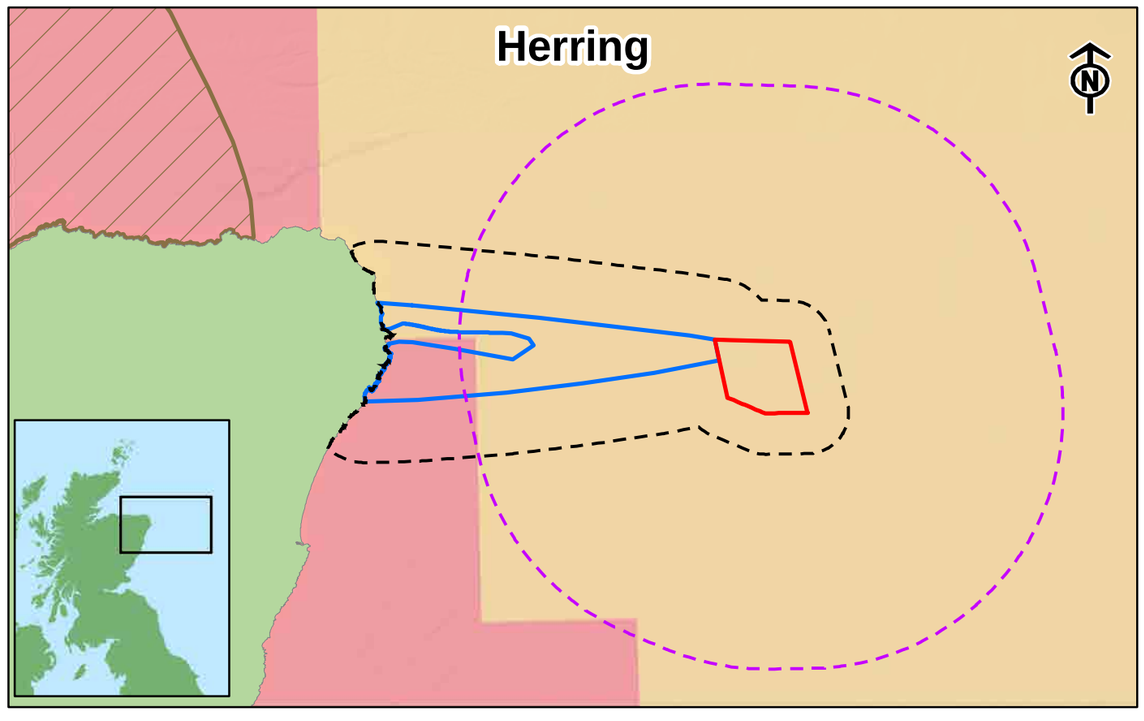
Confidentiality Class	C1
Drg No	GoBe-0024
Rev	A
Layout	NA

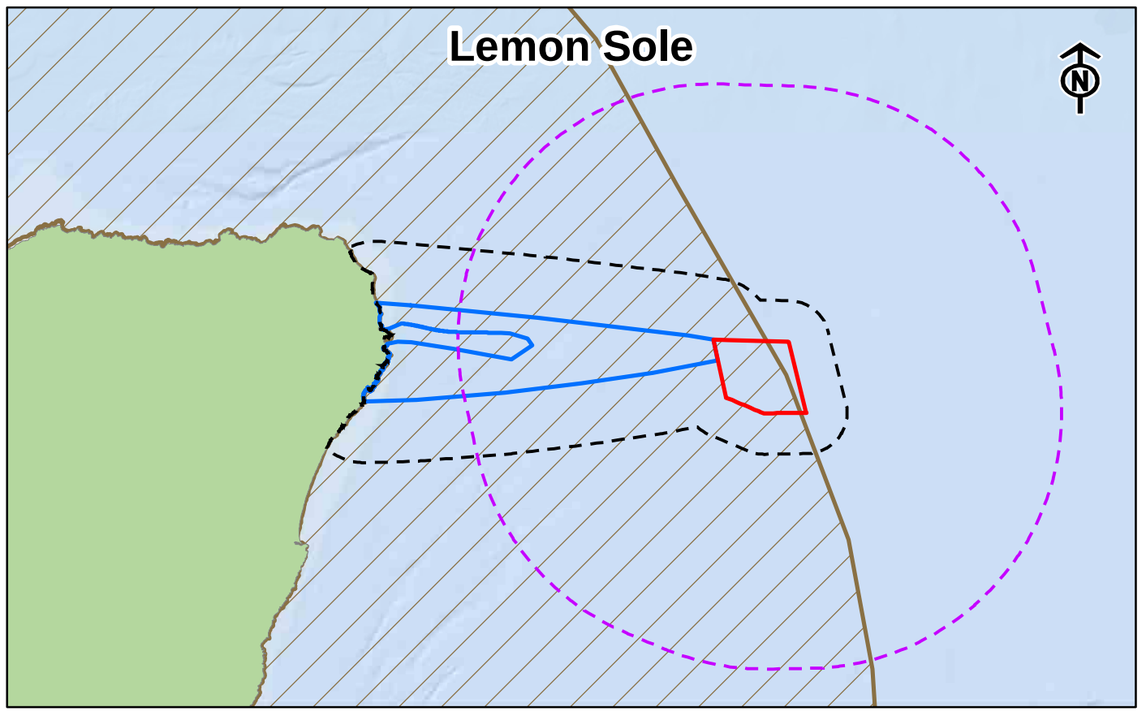
Figure 9.5

Ref files: MMH_FS_Fig9.5_NurseryGrounds1_RevA









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Scale	1:1,200,000

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MUIR MHÒR WIND FARM

Nursery Grounds Relative to the Proposed Development
(Coull *et al.*, 1998; Ellis *et al.*, 2010)

Confidentiality Class	C1
Drg No	GoBe-0025
Rev	A
Layout	NA

Figure 9.6

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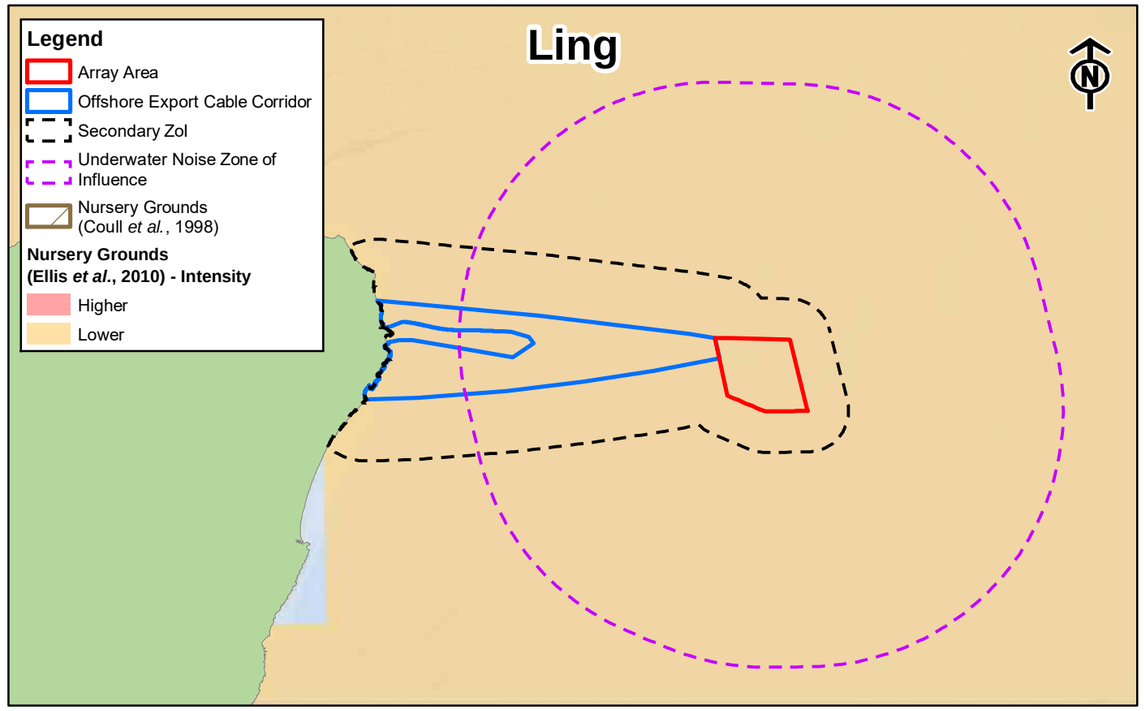

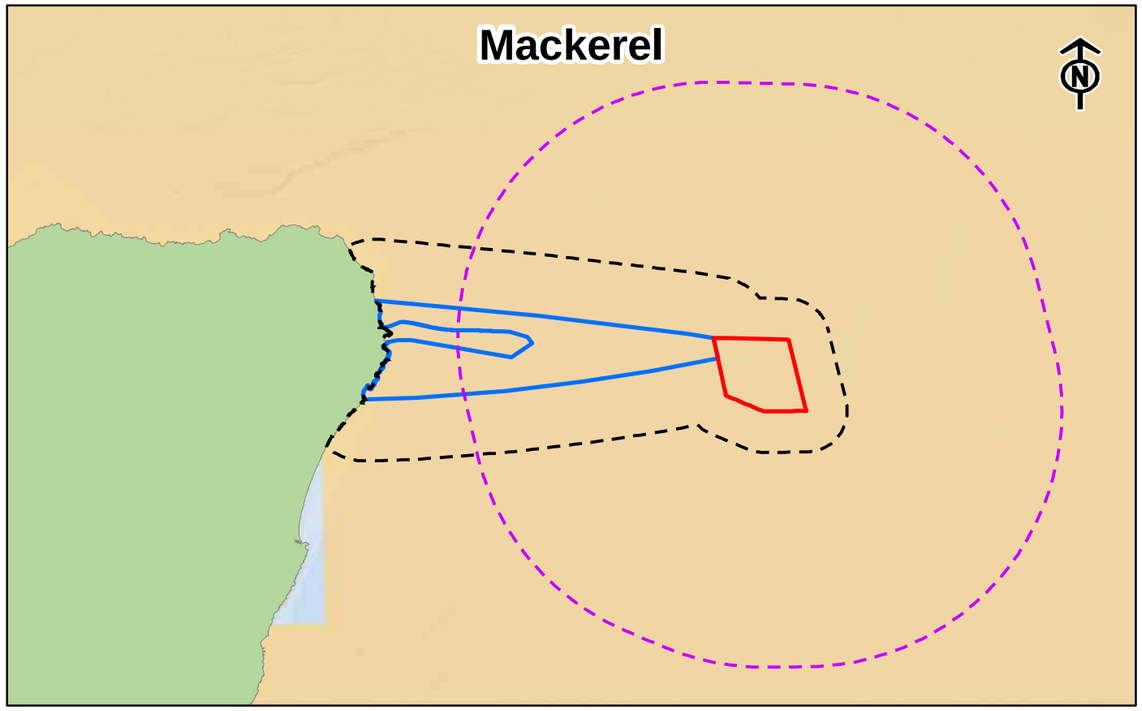

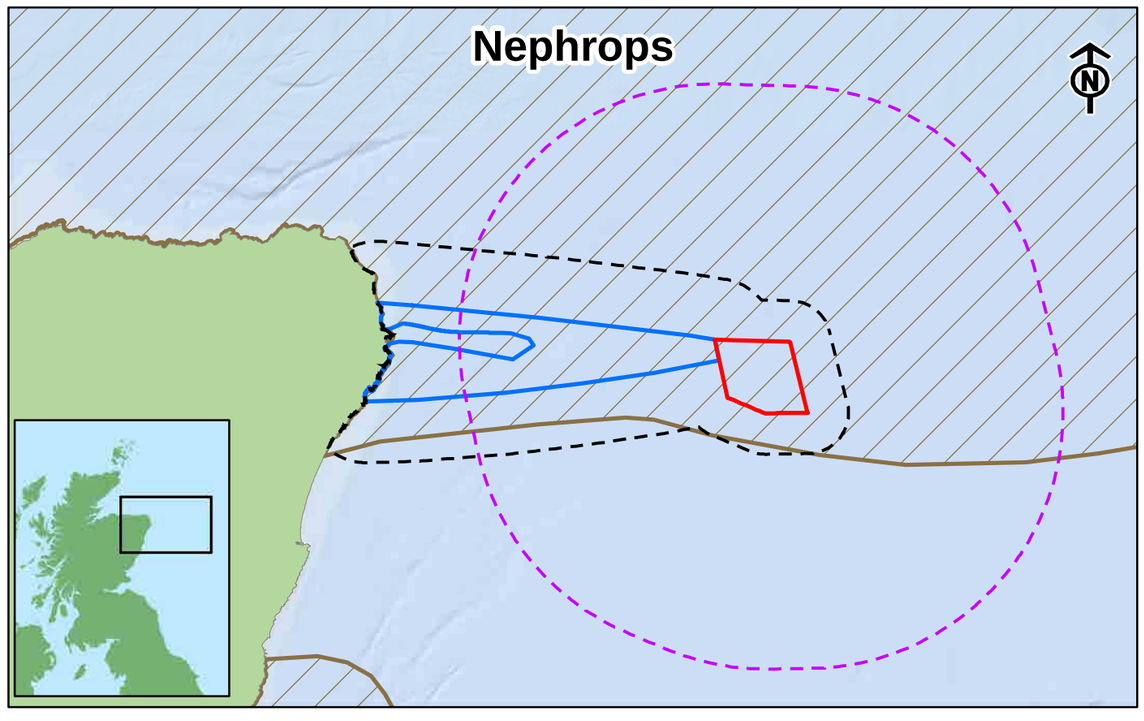

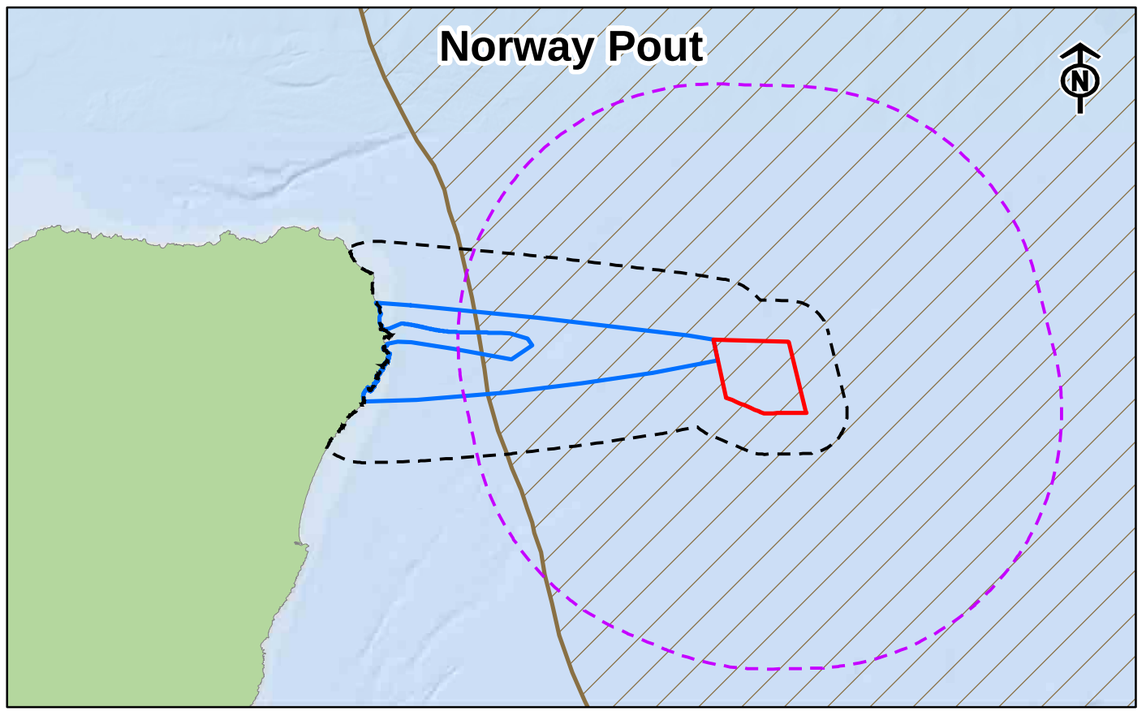

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0 10 20 30 40 50 km

MUIR MHÒR WIND FARM

Nursery Grounds Relative to the Proposed Development
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Confidentiality Class	C1
Drg No	GoBe-0026
Rev	A
Layout	NA

Figure 9.7

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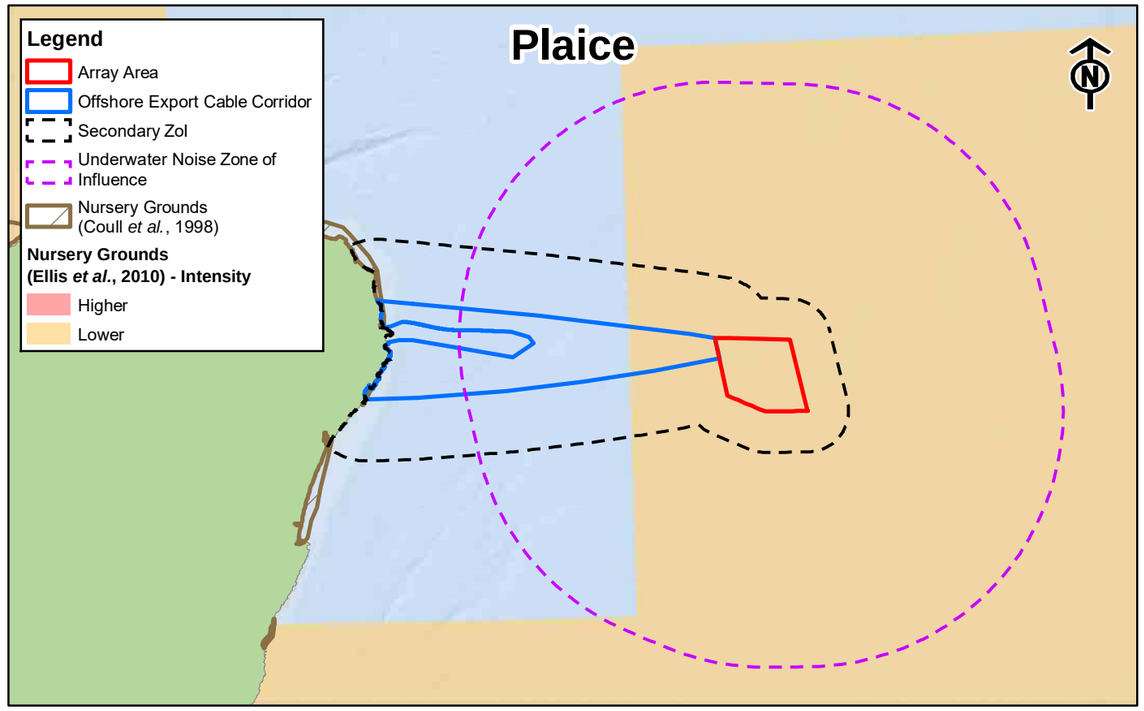

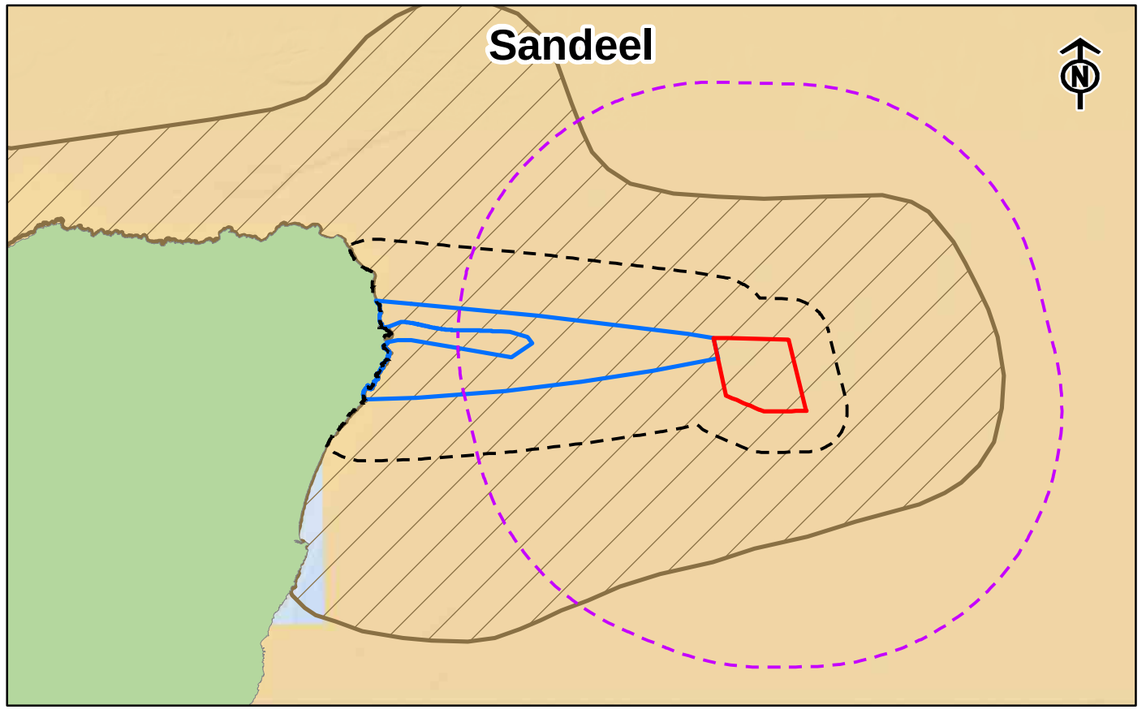

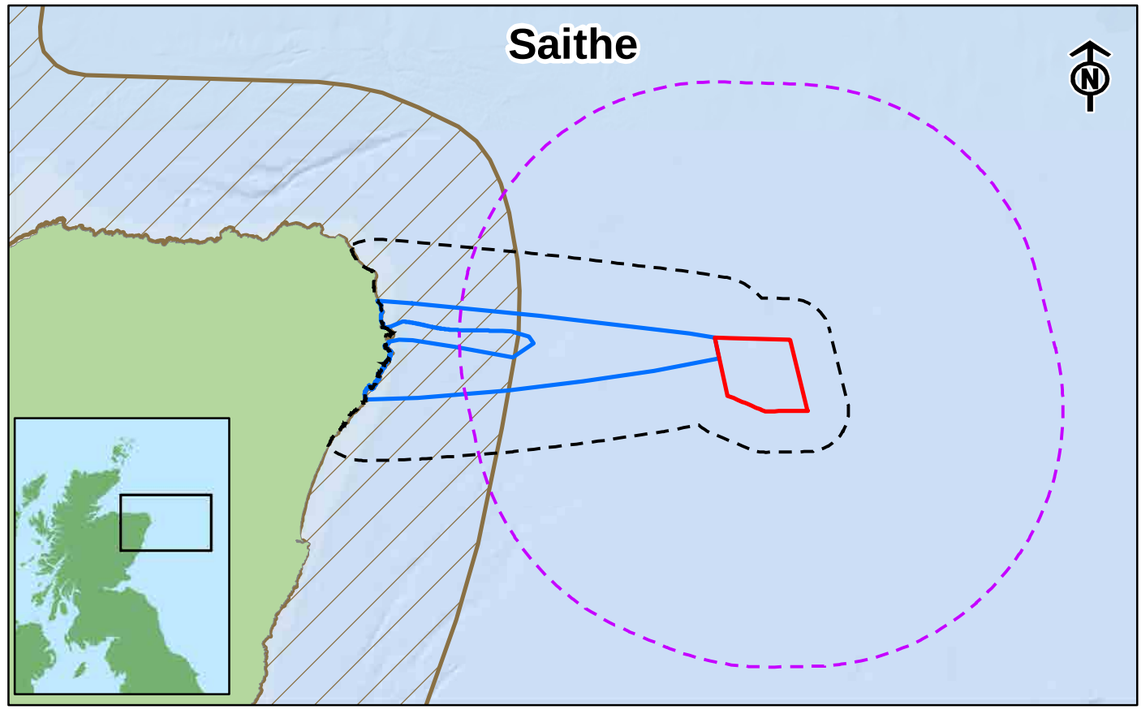

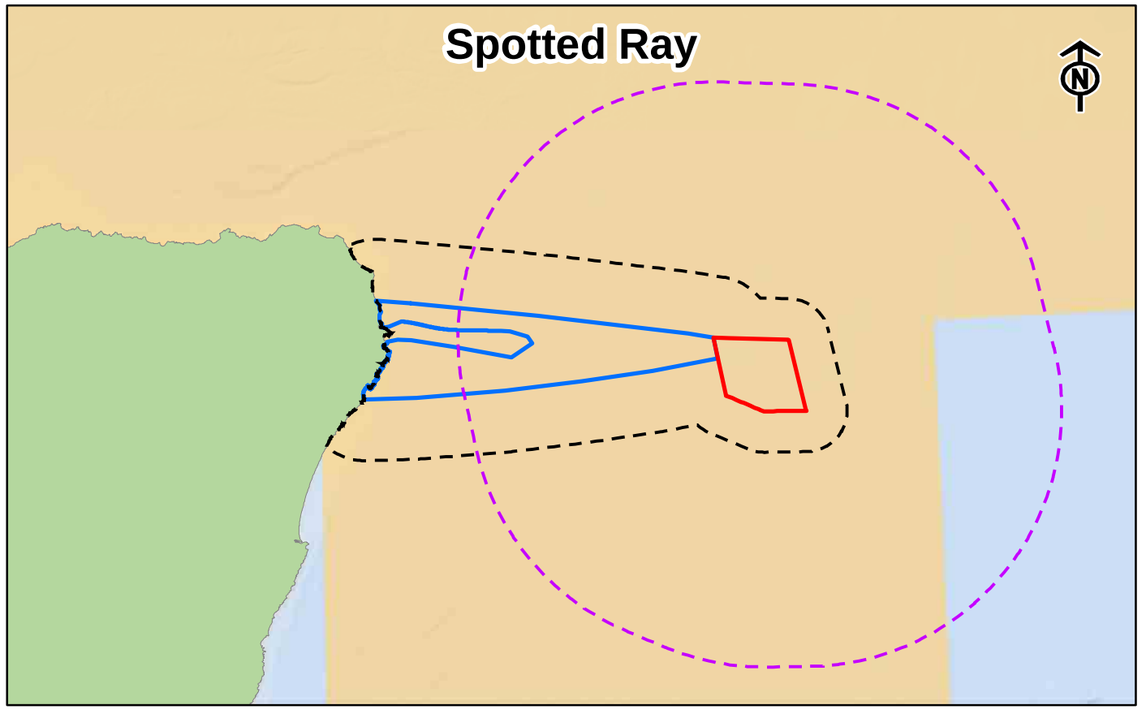

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0 10 20 30 40 50 km

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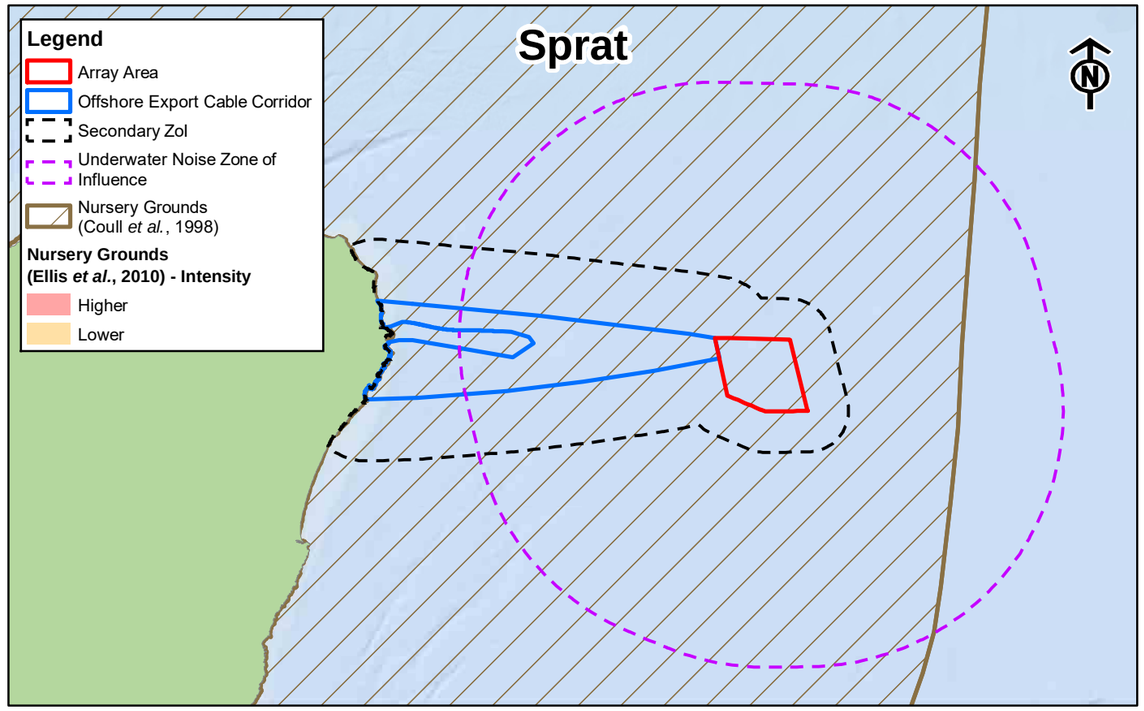
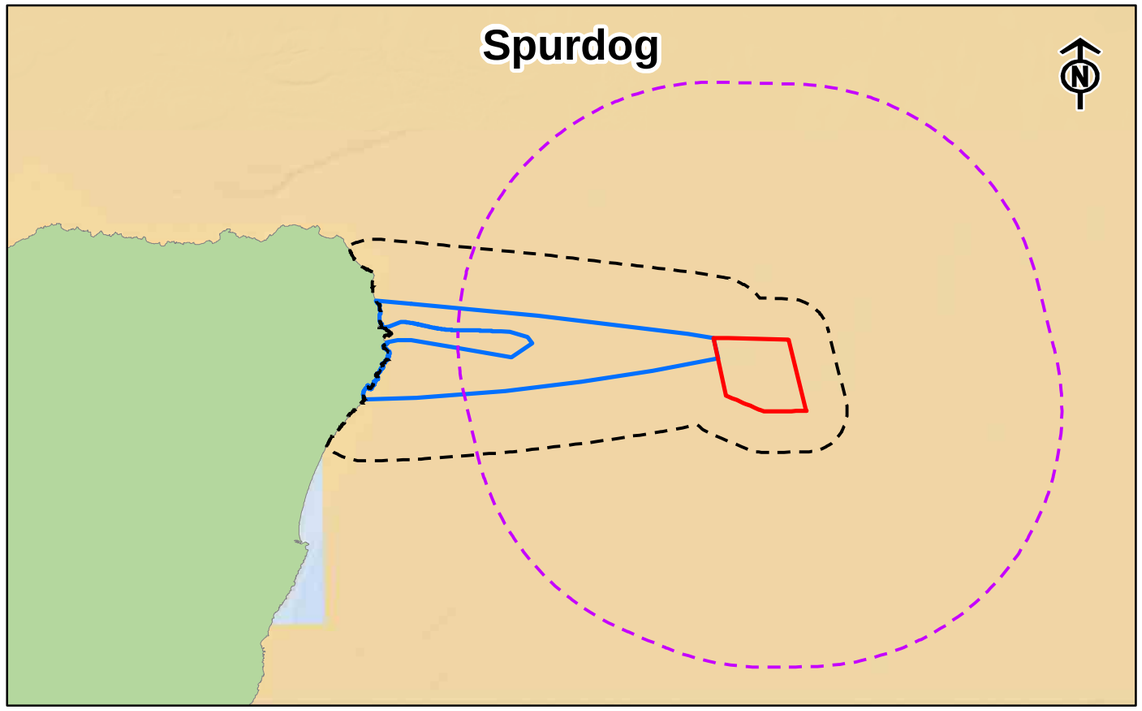
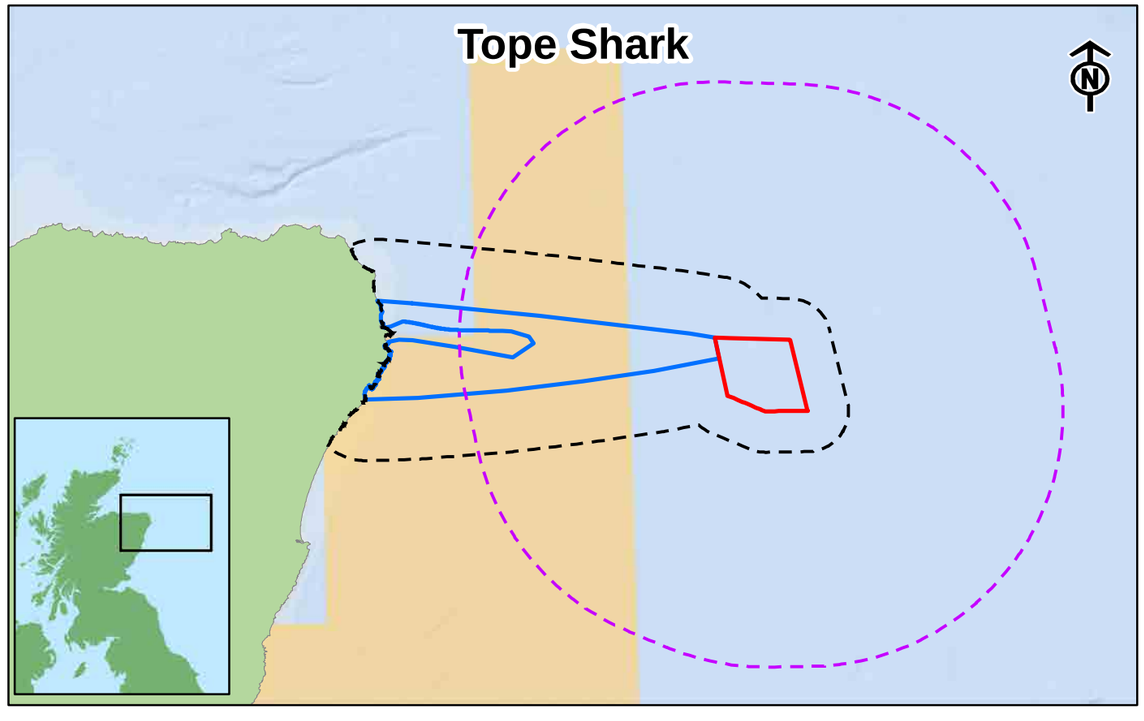
Confidentiality Class	C1
Drg No	GoBe-0027
Rev	A
Layout	NA

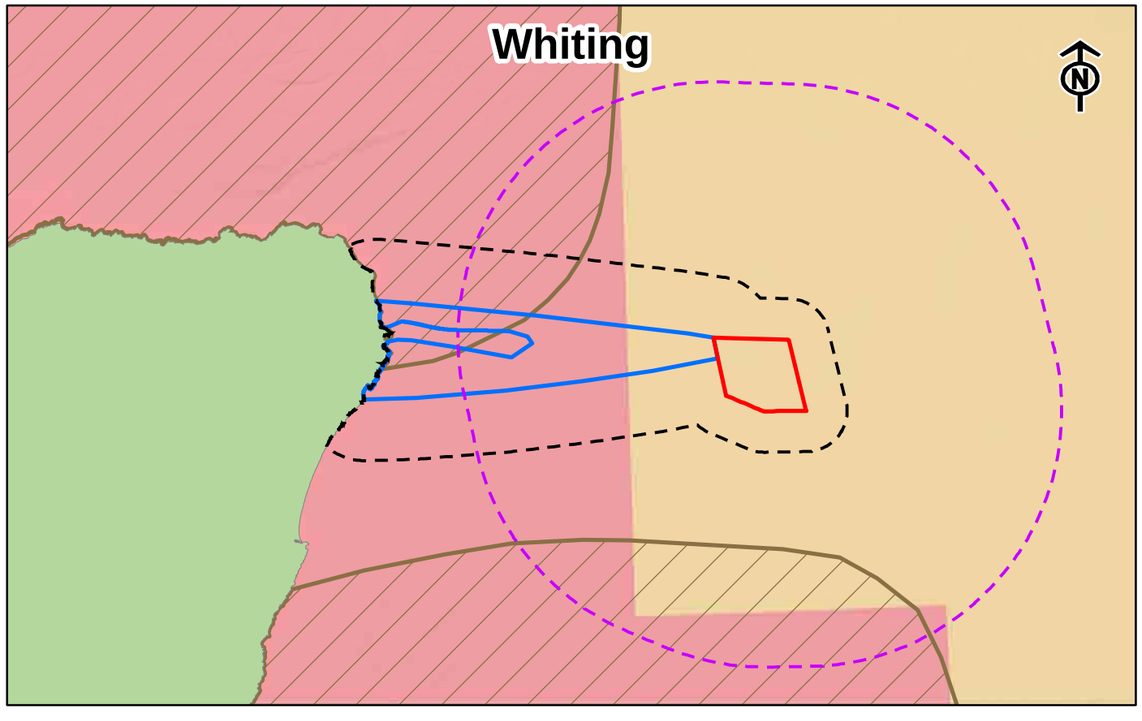
Figure 9.8

Ref files: MMH_FS_Fig9.8_NurseryGrounds4_RevA









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Plot	A3
Scale	1:1,200,000

0 10 20 30 40 50 km

MUIR MHÒR WIND FARM

Nursery Grounds Relative to the Proposed Development
(Coull *et al.*, 1998; Ellis *et al.*, 2010)

Confidentiality Class	C1
Drg No	GoBe-0028
Rev	A
Layout	NA

Figure 9.9

Ref files: MMH_FS_Fig9.9_NurseryGrounds5_RevA

Species of Conservation Importance

9.3.22 Within the northern North Sea region, there are records of several marine and estuarine species protected under national, European, and international legislation.

9.3.23 Species of conservation importance that have the potential to be present within the fish and shellfish ecology study area are listed below in Table 9-3 alongside their associated designations.

9.3.24 On account of the conservation importance of these species to the region, all species are considered sensitive receptors to the proposed development and, therefore, potential impacts on these species from the proposed development will be taken into consideration in the fish and shellfish ecology assessment.

Table 9-3: Fish and shellfish species that are protected or considered threatened/declining, which are potentially present within the fish and shellfish study area and wider northern North Sea biogeographic region

Fish and Shellfish Species	
OSPAR List of threatened and/or declining species	
• Allis shad; • Atlantic salmon; • Cod; • European eel; • Basking shark; • Spurdog; • Spotted ray; • Thornback ray;	• Greenland hablibut *Reinhardtius hippoglossoides;* • Sea lamprey; • Gulper Shark *Centrophorus granulosus;* • Leafscale gulper shark *Centrophorus squamosus;* • Porbeagle *Lamna nasus;* • Portuguese dogfish *Centroscymnus coelolepi;* • Common skate *Dipturus batis*; and • White skate *Dipturus alba.*
UK Post-2010 Biodiversity Framework Priority Species	
• Allis shad; • Anglerfish; • Atlantic halibut; • Basking shark; • Blue ling *Molva dipterygia;* • Blue shark *Prionace glauca;* • Cod; • Common skate; • European eel • Greenland halibut; • Gulper Shark; • Hake; • Horse mackerel; • Leafscale gulper shark;	• Ling; • Mackerel; • Plaice; • Porbeagle; • Portuguese dogfish; • Raitt's sandeel; • Sandy ray *Leucoraja circularis;* • Sea trout; • Smelt; • Spurdog; • Tope*;* • Twaite shad (*Alosa fallax*); • White skate; and • Whiting.

Fish and Shellfish Species	
• Lesser sandeel;	
Scottish Marine Priority Features	
• Anglerfish; • Blue ling; • Ling; • Norway pout; • Lesser sandeel; • Whiting (juveniles); • Common skate;	• Mackerel; • Cod; • Herring; • Saithe (juveniles); • Raitt's sandeel; • Basking shark; and • Spurdog.
Nature Conservation (Scotland) Act 2004	
• Basking Shark	
International Union for Conservation of Nature (IUCN) Red List	
• Atlantic salmon (Vulnerable); • Cod (Vulnerable); • European eel (Critically Endangered); • Basking shark (Endangered); • Blue shark (Near Threatened) • Spurdog (Vulnerable); • Tope (Vulnerable); • Sandy ray (Vulnerable); • Thornback ray (Near Threatened);	• Atlantic Halibut (Endangered); • Greenland Halibut (Near threatened); • Gulper Shark (Vulnerable); • Leafscale gulper shark (Vulnerable); • Porbeagle (Vulnerable); • Portuguese dogfish (Near Threatened); • Common skate (Critically Endangered); • Long-nosed skate (Near Threatened); and While skate (Endangered).
Annex II Fish Species EU Habitats Directive (92/43/EEC)	
• Allis shad; • Atlantic salmon; • European eel;	• River lamprey; • Sea lamprey; and • Twaite shad.

Designated Sites

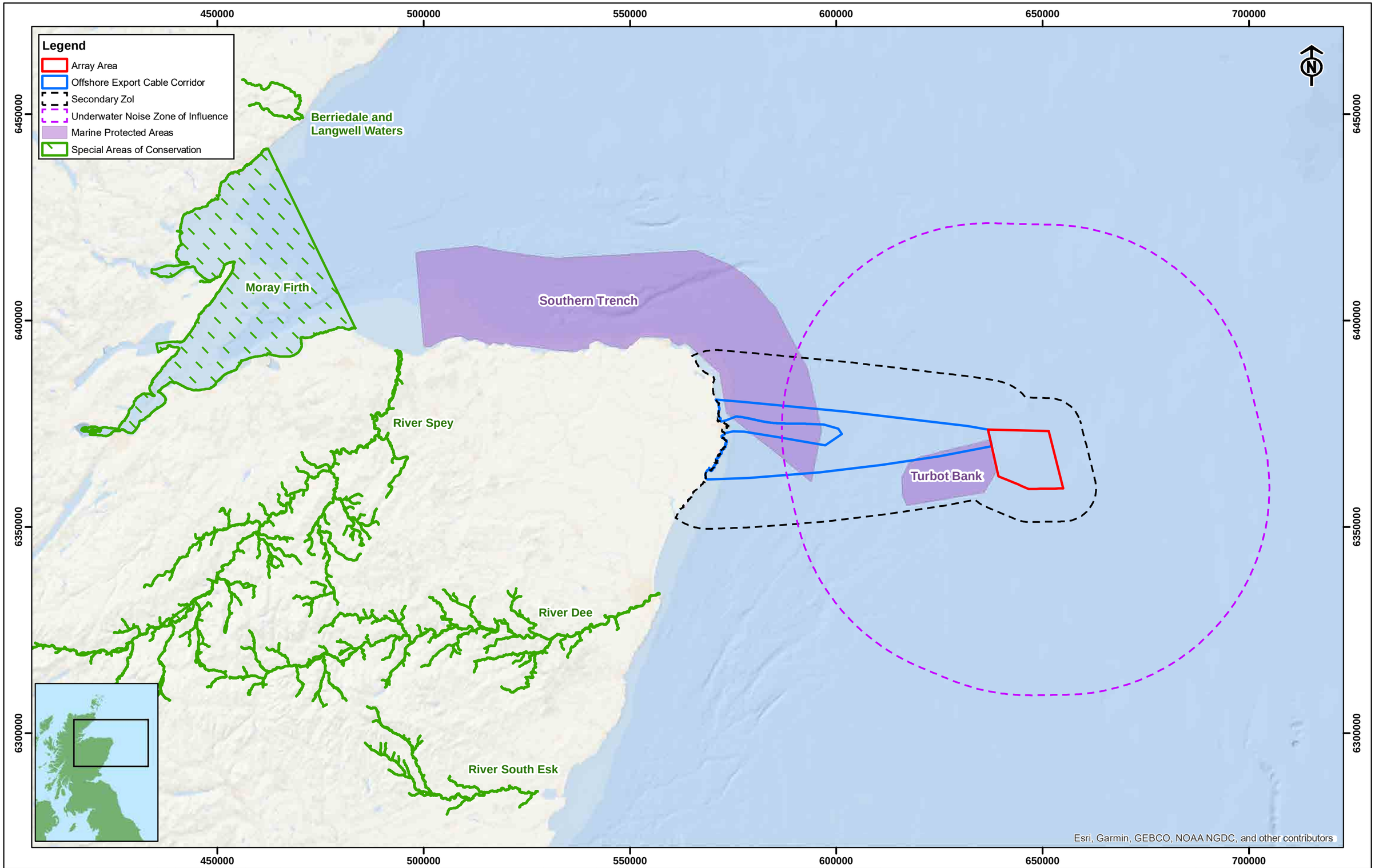
9.3.25 Sites designated for nature conservation within or in proximity to the fish and shellfish study area have been detailed in Table 9-4 and illustrated in Figure 9-10. Sites within proximity include the Turbot Bank Marine Protected Area (MPA), the River South Esk SAC, the River Dee SAC and the River Spey SAC. Sites that have qualifying feature related to fish and shellfish ecology, have been listed within this table.

9.3.26 The south-eastern edge of the ECC scoping area intersects with the Turbot Bank MPA, which has been designated for the protection of sandeels. The three river SACs shown in Figure 9-10 (River Dee, River Spey and River South Esk) all contain diadromous fish designated features. None of the river SACs identified overlap with the fish and shellfish study area, however, as these sites contain designated migratory species which have the potential to

transit the proposed development during migration, these sites have therefore been given due consideration.

9.3.27 The Southern Trench NC MPA intersects with the Muir Mhòr offshore ECC and has been designated for the minke whale (*Balaenoptera acutorostrata*). The NC MPA has a conservation objective to maintain productivity and feeding conditions for local mobile species and the minke whale as both juveniles and adults are regularly observed feeding (non-spiny fish such as sandeel, herring, whiting and cod, squid and sprat) in the NC MPA.

9.3.28 The Moray Firth SAC is designated for the Annex II species bottlenose dolphin (*Tursiops truncates*). The SAC has a conservation objective to maintain the availability of prey for the species.



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Datum	ETRS 1989
Projection	ETRS 1989 UTM Zone 30N
Plot	A3
Scale	1:850,000

0 5 10 15 20 25 km

MUIR MHÒR WIND FARM

Designated Protected Areas in relation to the Fish and Shellfish Ecology Study Area

Confidentiality Class	C1
Drg No	GoBe-0019
Rev	A
Layout	NA

Figure 9.10

Ref files: MMH_FS_Fig9.10_Designations_RevA

Table 9-4: Sites Designated for Nature Conservation in the Vicinity of the Fish and Shellfish Study Area.

Site	Location (relative to the proposed development)	Fish and Shellfish Qualifying Feature
Turbot Bank NC MPA	Overlap with Muir Mhòr offshore ECC, 0.03 km from the array area	Sandeel
Southern Trench MPA	Overlap with Muir Mhòr offshore ECC, 40.4 km from the array area	Included for presence of herring, mackerel, and cod as prey species for minke whales
Moray Firth SAC	115.3 km from the Muir Mhòr array area, 89.2 km from the offshore ECC	Included for presence of herring and mackerel as prey species for bottlenose dolphins
River Spey SAC	140.8 km to the Muir Mhòr array area, 72.3 km to offshore ECC	Atlantic salmon Freshwater pearl mussel (*Margaritifera margaritifera*)
River Dee SAC	86.9 km to the Muir Mhòr array area, 30 km to offshore ECC	Atlantic salmon Freshwater pearl mussel
River South Esk SAC	135.4 km to the Muir Mhòr array area, 86 km to offshore ECC	Atlantic salmon Freshwater pearl mussel

Migratory Species

9.3.29 Migratory fish are species that spend part of their life cycle in freshwater and part in seawater; such species are termed diadromous (migrate between freshwater and saltwater) and anadromous (migrating up rivers from the sea to spawn). Several migratory fish species have the potential to occur in the fish and shellfish ecology study area, migrating to and from rivers and other freshwater bodies in the area. The rivers of particular importance and focus in this chapter are those outlined in Figure 9-10.

9.3.30 Migratory fish species that have the potential to occur in the nearby rivers and estuaries near to the proposed development include Atlantic salmon, sea trout, European eel, smelt, Twaite Shad, and Allis shad. Several species of fish living in Scottish rivers migrate between the sea and the upper reaches of rivers during their life cycle. Atlantic salmon, sea trout and lampreys spend most of their adult lives in the oceans but return to freshwater to reproduce. European eel are also migratory diadromous fish, but their lifestyle differs from anadromous fish; adult eels migrate out to sea to spawn and their larvae make the return journey (termed catadromous).

9.3.31 Some diadromous species may cross the proposed development as part of their migration or transit surrounding areas as part of their foraging activity. Salmon are present in the River Ugie, which is directly to the north of the proposed development's cable landfall area (Hywind Scotland Pilot OWF, 2015; Gilbey *et al.,* 2021). The rivers Dee, South Esk and Spey (30 km, 86 km and 72.3 km from the proposed development, respectively), are the closest SACs with a qualifying interest in diadromous species (all Atlantic salmon), whose dominant migratory routes have potential to pass through the Muir Mhòr array area and offshore ECC (Hywind Scotland Pilot OWF, 2015; Gilbey *et al.,* 2021).

Elasmobranchs

9.3.32 Elasmobranchs (sharks and rays) are a particularly sensitive species group due to their slow growth rates and low fecundity (Marine Scotland, 2020). All sharks and rays living in Scottish waters are included in the OSPAR list of threatened and/ or declined species (Marine Scotland, 2020). There are low intensity nursery grounds for common skate, spotted ray, spurdog and tope shark throughout the proposed development study area and ZoI (Ellis *et al.,* 2010; Coull *et al.,* 1998) (Figure 9-8, Figure 9-9).

9.4 Embedded Commitments

9.4.1 As part of the project design process, several designed-in measures have been proposed to reduce the potential for impacts on environmental receptors. These are presented in Table 9-5 and in the Commitments Register (Appendix A) and will likely evolve over the development process as the EIA progresses and in response to stakeholder consultation.

Table 9-5: Embedded commitment measures of relevance to fish and shellfish ecology.

Code	Commitment	Type (Primary, Secondary or Tertiary)	How Commitment Secured
C-02	Development of and adherence to a Cable Plan. The CaP will confirm planned cable routing, installation methods, cable specifications and any additional protection and requirement for any post-installation monitoring.	Tertiary	CaP
C-05	Development of a CMS. This will detail the construction procedures (including piling), good working practices for constructing the works, and how the construction-related mitigation steps are to be delivered.	Tertiary	CMS
C-08	Development of and adherence to an EMP. This will set out mitigation measures and procedures relevant to environmental management, including but not limited to chemical usage, invasive and non-native species, pollution prevention and waste management.	Tertiary	EMP
C-09	Development of and adherence to a DP. The DP will outline measures for the decommissioning of the Proposed Development.	Tertiary	DP
C-14	Development of and adherence to a PS (applicable where piling is undertaken). The PS will detail the method of pile installation and associated noise levels. It will describe any mitigation measures to be put in place (e.g., soft starts and ramp ups, use of Acoustic Deterrent Devices) during piling to manage the effects of underwater noise on sensitive receptors.	Tertiary	PS
C-15	Development of and adherence to Marine Mammal Mitigation Plan (MMMP). This will identify appropriate mitigation measures during offshore activities that are likely to produce underwater noise and vibration levels capable of potentially causing injury or disturbance to marine mammals. This will be developed alongside the PS and referred to in European Protected Species (EPS) licence applications.	Tertiary	MMMP
C-29	Where practicable, cable burial will be the preferred means of cable protection. Cable burial will be informed by the CBRA and detailed within the CaP. In areas where CBRA deems burial not	Primary	CaP

Code	Commitment	Type (Primary, Secondary or Tertiary)	How Commitment Secured
	feasible, suitable implementation and monitoring of cable protection will be employed.		
C-31	Unexploded ordnance (UXO) hazards will be avoided where practicable and appropriate. If avoidance is not possible, decision making will relate to removal, with detonation considered if avoidance or removal is not possible. If detonation is required, and where practicable and appropriate, low-order deflagration will be the preferred method. Licencing of UXO clearance works will be subject to a standalone Marine Licence (and EPS licence) application. These applications will provide details of measures to minimising impacts on marine mammals where appropriate.	Tertiary	-
C-37	Development of and adherence to an Entanglement Management Plan to reduce the potential entanglement risk to marine life.	Tertiary	Entanglement Management Plan
C-39	The Turbot Bank NC MPA will not be crossed by the offshore ECC.	Primary	DSLP CaP

9.4.2 As a result of the commitment to implement these measures, and to align the proposed development with various standard sectoral practices and procedures, the embedded mitigations are considered inherently part of the design of the proposed development and have, therefore, been included in the assessment presented in Section 9.5.

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

9.5 Scoping of Impacts

9.5.1 Table 9-6 sets out an initial assessment of the likelihood of effects on fish and shellfish ecology due to proposed development activities for the scoping stage of the EIA process. The assessment is based on a combination of the following: the definition of the proposed development at the scoping stage; embedded mitigation (as set out in Section 9.4, together with the means by which it will be secured); the level of understanding of the baseline at the scoping stage; the existing evidence base for fish and shellfish ecology effects due to proposed development activities; relevant policy; and the professional judgement of qualified fish and shellfish ecology specialists.

Table 9-6: Scoping assessment for fish and shellfish ecology.

Impact Pathway	Embedded Commitments	Scoped In or Scoped Out	Justification
Construction and Decommissioning			
Increases in SSCs and changes to seabed levels.	C-02, C-09, C-29	Scoped In	Temporary elevations in SSCs have the potential to occur during construction (i.e., cable and foundation installation) activities and decommissioning activities. This could in turn lead to smothering of slow moving or sessile species and also localised changes in sediment type which may potentially impact seabed dependent species (e.g., sandeel and herring).
Temporary habitat disturbance	C-02, C-09, C-39	Scoped In	There is potential for temporary, direct habitat disturbance during construction activities in the array area and along the offshore ECC due to seabed preparation, cable laying, foundation installation and the use of jack up vessels or vessel anchoring. Temporary habitat disturbance has the potential to negatively impact species that are dependent on the seabed for some or all of their life cycle.
Direct and indirect seabed disturbance leading to release of sediment contaminants	C-08, C-09	Scoped In	Seabed disturbance during construction could lead to the mobilisation of existing sediment contaminants that could have an impact on fish and shellfish receptors. Effects on fish and shellfish ecology as a result of changes in water quality will be informed by the conclusions of the marine and sediment quality assessments.
Direct damage (e.g., crushing) and disturbance to mobile demersal and pelagic fish and shellfish species	C-02, C-09, C-39	Scoped Out	There is potential for direct damage to occur during construction activities in the array area and along the offshore ECC due to seabed preparation, cable laying, foundation installation and the use of jack up vessels or vessel anchoring. There is also the potential for direct damage to occur as a result of decommissioning activities. Affected species are however likely to be mobile and can move away from disturbance, furthermore, crushing impacts on stationary receptors will be small scale, and will not result in population level effects.
Mortality, injury, behavioural impacts and auditory masking arising from noise and vibration	C-05, C-14, C-15, C-31	Scoped In	Potential effects from construction activities may arise from noise and vibrations from pile-driving for the installation of OEP foundations. Cable laying, dredging and vessel movements also have the potential to result in underwater noise. Noise from piling has the potential to cause significant impacts to fish and shellfish species ranging from lethal trauma to behavioural changes in susceptible fish species.

Impact Pathway	Embedded Commitments	Scoped In or Scoped Out	Justification
Accidental pollution even during construction or decommissioning activity	C-08	Scoped Out	Accidental releases of pollutants may arise as a result of accidental spills from vessels or other equipment and have detrimental effects on fish and shellfish. However, the risk and impact of accidental releases of hazardous substances will be reduced through the implementation of the EMP, including measures for compliance with international requirements of the International Convention for the Prevention of Pollution from Ships MARPOL) convention, as well as best practice for works in the marine environment (e.g., preparation of Shipboard Oil Pollution Emergency Plans (SOPEP)). In this manner, accidental release of potential contaminants from construction vessels will be strictly controlled and procedures will be in place to minimum the impact of any accidental release if it occurs, and hence the impact has been scoped out of the EIA.
Increased risk of introduction and/or spread of INNS	C-08	Scoped Out	This impact is being proposed to be scoped out in consideration of the mitigation and control of invasive species measures in line with International Maritime Organization (IMO, 2019). These standards and procedures will be incorporated into the EMP and are embedded in the project design and as such ensure that no significant effects arise from INNS.
Operation & Maintenance			
Permanent and/or long-term habitat loss/alteration due to the addition of infrastructure to the area	C-02, C-39	Scoped In	Potential effects during the operational phase will mostly result from the physical presence of infrastructure (i.e., anchors, foundations, scour and cable protection above the seabed) which will result in long-term habitat loss. For floating foundations, abrasion from the mooring lines / anchor chains may also result in long-term habitat disturbance and will be considered. These effects have the potential for impacts on substrate dependent fish and shellfish, in particular those that have substrate specific spawning behaviours (e.g., sandeel), or those with designated conservation status.
Direct disturbance resulting from maintenance during operational phase	C-02	Scoped Out	There is the potential for direct habitat disturbance of the seabed during planned and unplanned maintenance activities (e.g., the use of jack up vessels or cable repair or replacement). However, affected fish and shellfish species are likely to be mobile and can move away from disturbance.

Impact Pathway	Embedded Commitments	Scoped In or Scoped Out	Justification
EMF effects arising from cables during operational phase	C-02, C-29	Scoped In	EMF may impact sensitive species, including elasmobranchs, teleost fish (i.e. flat fish, salmonids and gadoids) and crustaceans (e.g. brown crab (Scott et al., 2018; Scott et al., 2021)) by altering foraging or migratory behaviour (Hutchison et al., 2020). The magnitude of this impact will depend in part on the project design and the burial and cable protection measures which are utilised. For floating foundations, EMF effects will be considered for suspended cables in the water column. It is acknowledged that there is limited, but emerging research on EMF impacts on fish and shellfish, especially for dynamic cables. The impact assessment will draw on the latest relevant available literature on this impact.
Ghost fishing due to lost fishing gear becoming entangled in installed infrastructure	C-37	Scoped In.	There is the potential for lost gear to become entangled within mooring lines and suspended cables associated with floating substructures, if this technology is utilised, leading to ghost fishing which may negatively impact fish and shellfish.
Introduction of new hard substrates and potential for fish aggregation	C-08, C-29, C-37	Scoped In	Installed infrastructure may introduce new hard substrate for colonisation by encrusting marine organisms, including by marine fauna that are not currently found in the existing environment. The EMP will include measures to reduce the spread of invasive species. Offshore infrastructure may act as a fish aggregation device (FAD), providing refuge for some species and also habitat for some shellfish and benthic species, whilst also potentially attracting larger predators which could indirectly increase entanglement or collision risk for both fish and marine mammal species.
Accidental pollution events during O&M activity	C-08	Scoped Out	See justification described for accidental pollution events during construction and decommissioning activity above.
Increased risk of introduction and/or spread of INNS	C-08	Scoped Out	This impact is being proposed to be scoped out in consideration of the mitigation and control of invasive species measures in line with IMO (IMO, 2019). These standards and procedures will be incorporated into the EMP and are embedded in the project design and as such ensure that no significant effects arise from INNS.

Impact Pathway	Embedded Commitments	Scoped In or Scoped Out	Justification
Underwater noise	N/A	Scoped Out	Underwater noise as a result of operational turbines, has a relatively low frequency and pressure level (Andersson *et al.,* 2011). Operational noise generated from maintenance vessel traffic is likely to be low would only have an impact on fish species if they remained in close proximity to the vessel for hours. For this reason, it is considered that the risk of impact from noise from operational turbines is not significant and will be scoped out.

9.6 Potential Cumulative Impacts

9.6.1 Chapter 4 (EIA Methodology) details how potential cumulative impacts will be assessed through a CIA. For fish and shellfish ecology, cumulative interactions may occur with other planned OWF as well as other activities in the study area.

9.6.2 Impacts that are scoped into the assessment for the project alone, are generally spatially restricted to being within close proximity to the array area and offshore ECC for the proposed development. However, certain potential impacts, such as an increase in SSC, and underwater noise have the potential to affect the fish and shellfish communities over a more significant area. It is proposed that impacts with limited spatial extent, that do not have an effect on a present species, site or feature, are scoped out of any further assessment within the EIA.

9.6.3 For this reason, the following impacts on fish and shellfish ecology receptors are being proposed for further consideration within the CIA, subject to route refinement:

- Temporary increase in suspended sediment and sediment deposition arising from construction and decommissioning activities; and
- Mortality, injury and behavioural changes resulting from underwater noise arising from construction and decommissioning activities.

9.7 Potential Transboundary Effects

9.7.1 Transboundary impacts related to fish and shellfish ecology are not anticipated to arise from construction, O&M or decommissioning stages of the proposed development. Any impacts on fish and shellfish receptors will be localised in nature (including those giving rise to the greatest footprint of effect such as underwater noise from piling), and any indirect effects will likely be limited to one tidal excursion from the impact source. The proposed development is a significant distance (approximately 150 km from the nearest adjacent EEZ of another state and, therefore, it is considered that transboundary impacts will not occur and will be scoped out from further consideration within the EIA.

9.8 Proposed Approach to EIA

Guidance

9.8.1 In addition to the general approach and guidance outlined in Chapter 4 (EIA Methodology), the assessment of fish and shellfish ecology cumulative receptors will also comply with the following guidance documents where they are specific to this topic:

- Guidelines for Ecological Impact Assessment in the UK and Ireland. Terrestrial, Freshwater, Coastal and Marine from the CIEEM (CIEEM, 2018);
- Guidance note for EIA in respect of the Food and Environment Protection Act, 1985 (FEPA and CPA, 1949 (CPA) requirements (Cefas *et al.,* 2004);
- Strategic Review of OWF Monitoring Data Associated with FEPA Licence Conditions (Walker *et al*, 2009);
- Guidelines for Data Acquisition to Support Marine Environmental Assessments of Offshore Renewable Energy projects (Judd, 2011); and
- Guidance on Environmental Considerations for OWF Development (OSPAR, 2008).
- Sensitivity of features based upon the MarESA framework where possible (MarLIN, 2022).

- Sound Exposure Guidelines for Fishes and Sea Turtles: A Technical Report (Popper *et al.,* 2014).
- Information gaps in understanding the effects of noise on fishes and invertebrates (Hawkins *et al.,* 2014).
- A sound approach to assessing the impact of underwater noise on marine fishes and invertebrates (Hawkins and Popper, 2016).
- Monitoring Guidance for Underwater Noise in European Seas, Part II Monitoring Guidance Specifications (Dekeling *et al.,* 2014);
- Options and opportunities for marine fisheries mitigation associated with wind farms (Blyth-Skyrme, 2010);
- Offshore Wind Marine Environmental Assessments: Best Practice Advice for Evidence and Data Standards - Phase I (Natural England, 2021a);
- Offshore Wind Marine Environmental Assessments: Best Practice Advice for Evidence and Data Standards - Phase III (Natural England, 2021b); and
- Overarching National Planning Statement (NPS) for Energy (EN-1) (Biodiversity and Geological Conservation) (DECC), 2011a), NPS for Renewable Energy (EN-3) (OWF Impacts - Fish) (DECC, 2011b), Draft Overarching NPS for Energy (EN-1) (DECC, 2021a), Draft NPS for Renewable Energy Infrastructure (EN-3) (DECC, 2021b), The UK Marine Policy Statement (HM Government, 2011) along with local planning policies.

Additional data sources

9.8.2 A detailed literature review will be developed for the baseline characterisation in support of the EIA, building upon the data sources listed in Table 9-2. Project-specific survey outputs will be used to enhance the understanding of the baseline conditions.

9.8.3 It is proposed that the characterisation of the fish and shellfish species found within the vicinity of the proposed development will be completed by drawing upon work that has been undertaken in support of various OWF projects in the region, as well as wider information from publicly available sources. The results of the benthic ecology surveys (e.g., habitat maps and PSA) will be used to understand the suitability of the seabed habitat at the proposed development for sandeel and herring spawning. In addition, information on fish and elasmobranch communities in the vicinity of the proposed development will be provided by the eDNA sampling and analysis.

9.8.4 It is considered considers that the use of publicly available datasets for fish and shellfish ecology combined with site-specific eDNA data is sufficient to establish a robust baseline for an OWF at this specific location and provide the basis for the EIA for the proposed development.

Assessment Methodology

9.8.5 To enable the potential impact of the proposed development to be assessed, a description of the existing fish and shellfish populations, focusing particularly on any species of conservation interest, will be produced. Potential impacts that may occur on fish and shellfish ecology as a result of the planned construction, O&M and decommissioning will then be identified. The sensitivities of the populations present to the types of impact expected from wind farm construction, O&M and decommissioning will be assessed. Where necessary, measures will be proposed to mitigate the impacts.

9.8.6 If the proposed development has a likely significant effect on any sites that are designated for conservation at the European (SAC, now forming part of the UK's National Site Network)

or international level (Ramsar), as a result of qualifying habitats or species that they support, then the requisite information will be separately alongside the EIAR to assist the competent authority to carry out an AA. A separate Offshore HRA Screening Report has been produced and submitted alongside this Offshore Scoping Report which considers/evaluates the potential connectivity of European Sites (including SACs with migratory fish features) within the assessment, and apportions the impacts identified back to the European Sites impacted.

9.8.7 Cumulative effects will be assessed by taking into consideration any other plans or projects proposed or existing, and where sufficient information is available, which, together with the proposed development have a likely significant effect on a receptor due to a common impact pathway and/or temporal or spatial overlap.

Underwater Noise Modelling

9.8.8 Underwater noise modelling will be undertaken to assess the impact of activities, such as piling or OEPs, during construction on fish and shellfish receptors. The assessment will focus on noise-sensitive species, including sprat, herring, gadoids (e.g., whiting and cod) and diadromous fish, and will consider the potential for underwater noise to act as a barrier to diadromous fish migration. Available literature on piling impacts on fish and shellfish (e.g., Boyle and New, 2018) will be reviewed.

9.9 Scoping Questions

9.9.1 The following questions are designed to focus the fish and shellfish scoping exercise and inform the Scoping Opinion:

- Do you agree with the study area(s) defined in Section 9.2 for fish and shellfish ecology?
- Do you agree with the use of those data listed in Section 9.3, and any additional anticipated data listed in Section 9.8, being used to inform the Offshore EIA?
- Are there any additional data sources or guidance documents that should be considered?
- Do you agree that all receptors related to fish and shellfish ecology have been identified?
- Do you agree with the scoping in and out of impact pathways in relation to fish and shellfish ecology?
- Do you agree with the assessment of the potential for transboundary effects in relation to fish and shellfish ecology?
- Do you agree with the assessment of the proposed approach to cumulative effects in relation to fish and shellfish ecology?
- Do you agree with the proposed assessment methodology for fish and shellfish ecology?

10 Offshore and Intertidal Ornithology

10.1 Introduction

10.1.1 This chapter of the Offshore Scoping Report identifies the offshore and intertidal ornithological receptors of relevance to the proposed development. It identifies the potential impacts from the construction, O&M and decommissioning of the proposed development on offshore and intertidal ornithology up to MHWS and sets out the proposed scope of the EIA. The proposed methods of assessment for the EIA are also presented, along with embedded mitigation measures. Offshore ornithological receptors are those that naturally occur at sea and may have the potential to be affected by offshore renewable energy developments. This includes those species classed as 'seabirds', plus migratory species such as geese and swans as well as waders, raptors, and passerines.

10.1.2 Seabirds typically follow life histories by which adults breed at coastal colonies during the breeding season (broadly April to September, though this varies for individual species), and disperse into the wider marine environment during the non-breeding season (broadly October to March). The breeding seabird features of many colonies are designated as features of SPAs.

10.1.3 Intertidal ornithology typically relates to coastal species that occur between MLWS and MHWS, such as waders, wildfowl, and other waterbirds. Some intertidal waterbirds and intertidally occurring seabirds are listed as designated features of coastal SPAs; sites which may be important as wintering or staging areas for waders, wildfowl, and other waterbirds.

10.1.4 Given that there is a relationship between marine and intertidal ornithology and fish and shellfish populations (some bird species featured in this chapter are piscivorous), this chapter should therefore be read alongside Chapter 9: Fish and Shellfish Ecology.

10.1.5 This chapter of the Offshore Scoping Report has been prepared by Natural Power Consultants Ltd. (Natural Power).

10.2 Study Area

10.2.1 The offshore and intertidal ornithological study area is defined as the proposed development footprint and an appropriate buffer. This buffer considers that impacts such as displacement can take place beyond the extent of the proposed development area and includes protected sites with ornithological features that may use the area of the proposed development.

10.2.2 Site-specific ornithological surveys of the proposed development area were undertaken using a Digital Aerial Survey (DAS) methodology, utilising 26 south-west to north-east orientated transects spaced 2.5 km apart (Natural Power, 2023) (Figure 10-1). The survey area includes the array area and a 4 km buffer and extends east to include a larger section of the E2 PO area. Surveys took place between April 2021 and March 2023. Data collected during site-specific DAS will be used to determine ornithological baseline conditions at the proposed development. This dataset can subsequently be used to inform comparisons between pre- and post-construction ornithological conditions at the site.

10.2.3 A regional DAS was being undertaken to include the wider E1 and E2 PO areas (Figure 10-2), as per the recommendation in the SMP (Scottish Government, 2022). These surveys took place between March 2022 and February 2023, and are intended to put the site-specific surveys into wider context.

620000 640000 660000 680000 700000

6380000

6360000

6340000

Legend

- Array Area
- 4 km buffer of array area
- E2 plan option area
- Wider survey area within E2 plan option area
- 4 km buffer around wider survey area
- Aerial transects

1:3,000,000
0 20 40 60 80 100 km

MUIR MHÒR OFFSHORE WIND FARM

Muir Mhòr Offshore Wind Farm Ltd, The Tun Building
4 Jackson's Entry, Holyrood Road, No 4 EH8 8PJ Edinburgh
United Kingdom

Rev	Date	Drawn By	Checked By	Comment
A	12/05/23	JO	CP	First issue

Datum	ETRS 1989
Projection	ETRS 1989 UTM Zone 30N
Plot	A3
Scale	1:280,000

0 2 4 6 8 10 km

MUIR MHÒR WIND FARM

Digital Aerial Survey (DAS) Area and Transects

Confidentiality Class	C1
Drg No	GB204098_M_027
Rev	A
Layout	NA

Figure 10.1

Ref files: GB204098_M_027_A

This drawing/map has been produced to the latest known information at the time of issue. Please consult with the Vattenfall GIS team to ensure the content is still current before using the information contained on this map.

MUIR MHÒR OFFSHORE WIND FARM

A joint venture between Fred Olsen Seawind & Vattenfall

Muir Mhòr Offshore Wind Farm Ltd, The Tun Building
4 Jackson's Entry, Holyrood Road, No 4 EH8 8PJ Edinburgh
United Kingdom

Rev	Date	Drawn By	Checked By	Comment
A	12/05/23	JO	CP	First issue

Datum	ETRS 1989
Projection	ETRS 1989 UTM Zone 30N
Plot	A3
Scale	1:650,000

0 5 10 15 20 25 km

MUIR MHÒR WIND FARM

Regional E1 and E2 PO DAS Areas

Confidentiality Class	C1
Drg No	GB204098_M_028
Rev	A
Layout	NA

Figure 10.2

Ref files: GB204098_M_028_A

10.2.4 The intertidal ornithology surveys cover two currently proposed offshore export cable landfall search areas, located to the north and south of the town of Peterhead, Aberdeenshire. The survey methodology involved walking 500m each side of the landfall locations to record birds. The surveys will take place monthly from October 2022 to September 2023, following the waterfowl survey methodology for non-estuarine coastlines as outlines in Gilbert *et al.*, 1998.

10.3 Baseline Environment

Data Sources

10.3.1 The data sources that have been used to inform the Offshore and Intertidal Ornithology chapter of the Offshore Scoping Report are presented within Table 10-1. These data sources will be taken forward and used to inform the EIA, alongside the site-specific data that are being collected for the proposed development.

Site-specific survey methodology

10.3.2 DAS were carried out by HiDef Aerial Surveying Ltd. (HiDef) between April 2021 and March 2023, following their standardised approach to the collection of digital video datasets, which is in line with current aerial surveying guidance.

10.3.3 Surveys encompassed the offshore array area and a large remainder of the ScotWind E2 Plan Option Area, including a 4 km survey buffer (Figure 10-1). Of the 26 survey transects described in Section 10.2, 12 pass through the array area and/or its associated 4 km buffer. Transects were separated by 2.5 km, with an analysed strip width of 250 m resulting in an area coverage of 10%. Surveys are undertaken at a flight heigh of 500-550 m, which minimises the potential for birds being flushed by the plane.

The camera system

10.3.4 The survey rig is mounted to a fixed winged aircraft (Webb & Nehls, 2019). This survey rig uses four separate cameras, with data from two of these being analysis to provide 10% coverage; this leaves the data from the additional two cameras as back-up footage.

10.3.5 The rig contains four extreme high-resolution digital video cameras. Flying at 500-550 m altitude, the cameras and lenses survey a total strip width of c.500 m, with footage from two of the four cameras being analysed. This gives a total effective strip-width of 250 m (i.e., two cameras analysed, each with an individual strip-width of c. 125 m). The Ground Sample Distance (GSD) image resolution is approximately 2 cm. A gap of approximately 20 m is maintained between each video strip. This has the benefit of ensuring no overlap between strips. Surveys are flown at a ground speed of 220 kph (approximately 120 knots). This set-up has been found to create the best imagery suitable for data collection without negatively impacting on seabirds from disturbance, but also by flying at a safe and legal height, reducing risk to air crew and client. The cameras use a global shutter, which ensures no blurring effects of cameras unlike using rolling shutters. The cameras are designed so that fast shutter speeds, in excess of 1/10,000th of a second, are possible at low light levels. During the survey while the aircraft turns between transects, the camera rig is rotated to ensure that it is always pointed either forwards or backwards to an angle from vertical and away from the sun. This eliminates bias in animal detection rates caused by sun glare on the sea. Digital video imagery is recorded continuously to a solid-state hard drive for each camera separately. Also recorded is the position of the aircraft at one second intervals from a differential Global Positioning System (GPS) device (with two metre positional accuracy).

10.3.6 This bespoke rig has the cameras orientated at 30 degrees from vertical. Not only does this keep sun glare to a minimum and negates the need to stop surveys for two hours per day (sun glare in photographic, plan-view rigs is difficult to avoid and results in parts of images

being removed and survey effort reduced), but it also allows better species identification by replicating the view of a visual observer, making diagnostic features on the side of animals clearer.

10.3.7 The use of video technology means multiple frames are acquired in which each object is present. Typically, six to eight images of an object occur as the aircraft passes over, all from a slightly different angle.

Data processing

10.3.8 Raw video data are converted into a format for further analysis on data review stations. The survey images are viewed by trained, experienced HiDef reviewers using high resolution viewing screens and an image management software package that allows the reviewer to adjust and control the appearance of the images. Reviewers are not required to identify objects but simply mark the images as requiring further analysis, with this spatial information providing an accurate record of an individual's (or object's) location. A sample of a minimum of 20% of material is subjected to a 'blind' re-review; if the agreement is less than 90% then a further review of the material, and re-training, is initiated as required.

10.3.9 Images that have been marked as requiring further analysis are passed to experienced marine ornithologists. Images can be managed using software to enhance their appearance and assist in identifying the object. For this proposed development, the ornithologists will identify down to species level where possible and record any other information which is available (behaviour, flight or swimming direction, sex, age, etc.).

10.3.10 A randomly selected sample of at least 20% of material is identified independently by a separate group of experts within the ID team and this requires that there is no more than 10% disagreement with the first identification of birds. The outputs of these results are then compared, and any discrepancies reviewed by a further set of experts within the ID team. In the case of any significant discrepancies (i.e., more than 10% disagreement for the whole audit), then the images are reviewed once more by a third expert who acts as an adjudicator in the process to correctly identify the species observed. While tools are used to assist in object identification, species identification is not automated.

10.3.11 The presence of other anthropogenic features (such as fixed structures, dredgers, construction vessels, ferries, yachts or recreational vessels, etc.) which might influence the behaviour of birds and marine mammals are also recorded and assessed in the analyses.

Table 10-1: Key sources of offshore and intertidal ornithology data.

Source, Author, and Year	Summary	Coverage of Muir Mhòr array area and ECC
Muir Mhòr Offshore Windfarm: Baseline Ornithology Report, Natural Power, 2023.	A summary of information relating to DAS undertaken at the proposed development during the period April 2021 to March 2022 (the first 12 months of survey).	Muir Mhòr array area plus a 4 km buffer, as well as a wider area within the E2 PO area, plus a 4 km buffer (Figure 10-1).
Desk-based revision of seabird foraging ranges used for HRA screening, Woodward *et al.,* 2019.	A review of seabird foraging range data which will serve to determine connectivity between the proposed development and surrounding seabird colonies during the breeding season.	Data are collected from around the UK to inform this review.
Non-breeding season populations of seabirds in UK waters: Population sizes for Biologically Defined Minimum Population Scales (BDMPS), Furness, R. W, 2015.	A review of non-breeding season population estimates for seabirds in UK waters. This will serve to estimate non-breeding population sizes of seabirds that could have connectivity with the proposed development.	The regions covered include the Muir Mhòr array area and ECC.
The UK SPA network: its scope and content. JNCC, Peterborough. Stroud *et al.,* 2001.	Provides information on designated sites in the UK.	This covers all designated sites in the UK.
European Seabirds At Sea (ESAS). International Council for the Exploration of the Sea (ICES), 2022.	ICES monitoring data on seabirds and marine mammals.	Coverage includes the Muir Mhòr array area and the wider E2 PO area.
Distribution maps of cetacean and Seabird Populations in the North-East Atlantic. Waggitt *et al*., 2019.	Distribution maps of seabirds and cetaceans at basin and monthly scales created using aerial and vessel surveys.	Northeast Atlantic and North Sea, with coverage including the E2 PO area.
Breeding Density, Fine-scale Tracking and Large-scale Modelling Reveal the Regional Distribution of Four Seabird Species. Wakefield *et al.*, 2017.	Estimation of at-sea distribution of kittiwake, shag, razorbill and guillemot from 5,500 UK and Irish breeding colonies. Predictions are made on space used by birds from unobserved colonies and at-sea distributions of each species are mapped at both colony and regional level. At-sea space use by all four species is concentrated in Scottish coastal waters.	UK breeding colonies in the study included those in proximity to the proposed development.
Combining Habitat Modelling and Hotspot Analysis to reveal the Location of High-Density	Uses a combination of GPS data and existing UK seabird distribution maps to identify important areas of high seabird density at sea.	UK breeding colonies in the study included those in proximity to the proposed development.

Source, Author, and Year	Summary	Coverage of Muir Mhòr array area and ECC
Seabird Areas across the UK. Cleasby *et al.*, 2018.		
Three-dimensional Tracking of a Wide-ranging Marine Predator: Flight Heights and Vulnerability to Offshore Wind Farms. Cleasby *et al.*, 2015.	Tracking shows that gannets tagged at Bass Rock forage within PO areas. Data gathered on flight height to explores how different methods used to determine flight height affects predicted risk to gannets from Collision Risk Modelling (CRM) outputs.	Gannet tracking from Bass Rock (Forth Islands SPA) includes tracks which cover the E2 PO area.
Seabird tracking database. Data retrieved March 10, 2023, from https://data.seabirdtracking.org/	Online database of historic and contemporary tracking data for multiple seabird species from many authors. This will include species such as Europeans storm petrel and Leach's storm petrel, for which there is the possibility that nocturnal use of the site may differ from daytime use as recorded by DAS.	Tracking data are available from this database which overlap the E2 PO area.
Seabird Monitoring Programme. JNCC (n.d.). Retrieved 10 March 2023, from https://app.bto.org/seabirds/public/index.jsp	Annual monitoring of 25 species of seabird that breed regularly in Britain and Ireland, which has been undertaken since 1986.This is inclusive of the British Trust for Ornithology (BTO) census data.	Colony monitoring includes sites within foraging range of the E2 PO area.
Mapping the Distribution of Feeding Pink-footed and Greylag Geese in Scotland. Mitchell, 2012.	Maps are provided with the results of feeding wintering pink-footed and Icelandic greylag geese. A list of sites is given with counts for both species.	Wintering pink-footed and Icelandic greylag goose wintering areas included are along the Scottish east coast.
Status and distribution of Icelandic-breeding geese: results of the 2020 international census. Brides *et al.*, 2021.	The 61st consecutive annual census of Pink-footed and Greylag Geese, which took place during autumn and early winter 2020.	Wintering pink-footed and Icelandic greylag goose wintering areas included are along the Scottish east coast.

10.4 Description of Baseline Environment

10.4.1 The Muir Mhòr array area is situated approximately 63 km off Peterhead, off the north-east Aberdeenshire coast. North Sea waters off the Scottish east coast host internationally important numbers of seabird species, including gannet, auks, kittiwake and other gull species (Cleasby *et al.*, 2018; Waggitt *et al.*, 2019). These species, among others, are features of several key breeding seabird SPAs which are situated along the Scottish east coast.

10.4.2 Baseline characterisation is being undertaken through assessment of existing available datasets which are relevant to the study area, as well as through site-specific surveys and the consultation process. This section summarises the offshore and intertidal ornithological baseline during the breeding and non-breeding seasons, as well as during the spring and autumn migration periods.

Breeding Season: Seabirds

10.4.3 The results of the first breeding season DAS (April 2021 to September 2021) indicate the occurrence of seabird species which are typically expected to be found in this region of the North Sea during these months of the year. These include gulls, auks, fulmar and gannet, as well as small numbers of Manx shearwater, European storm petrel and terns. Seasonal summaries for key seabird species are given below.

Fulmar

10.4.4 Analysis of the first year of breeding season data give an estimated provisional peak abundance of 5,363 fulmar within the array area plus a 2 km buffer. This species is not considered to be at high risk of collision impacts, as fulmar flight height is generally close to the sea surface and below Potential Collision Height (PCH). This species is also considered to have very low susceptibility to anthropogenic disturbance and a very low level of habitat specialisation (Bradbury *et al.*, 2014; Furness *et al.*, 2013); it is not considered to be sensitive to displacement mortality impacts from OWF projects (Furness *et al.*, 2013). Fulmars were relatively uniformly distributed throughout the surveyed area during breeding season 2021 surveys.

Guillemot

10.4.5 For guillemot, a provisional peak abundance of 19,321 individuals within the site plus a 2 km buffer was estimated through analysis of April to September 2021 DAS data (note that availability bias was not accounted for in this estimation). This relatively high peak abundance is expected, given the high numbers of breeding guillemot present along the Scottish east coast during this time of year (Wakefield *et al.*, 2017). The low flight height distribution of guillemot at sea (i.e., away from coastal breeding colonies) means this species is not considered to be sensitive to collision mortality impacts from OWFs but is considered to be sensitive to displacement (Bradbury *et al.*, 2014; Furness *et al.*, 2013).

Gannet

10.4.6 The closest SPA for which gannet is designated as a breeding feature is the Forth Islands SPA (approximately 174 km south-west of the Muir Mhòr array area), which incorporates the internationally important Bass Rock gannet breeding colony. The proposed development lies within foraging range of gannets from the Forth Islands SPA (Cleasby *et al.* 2015; Wakefield *et al.*, 2013; Woodward *et al.*, 2019). Analysis of breeding season 2021 baseline survey data gave an estimated peak seasonal abundance of 1,666 birds. Given the relatively large proportion of flight activity undertaken by this species at altitudes which correspond with the rotor swept range of offshore wind turbines (compared to flight activity of other seabird

species), this species is considered to be sensitive to collision mortality impacts, as well as displacement, from offshore wind farm projects (Bradbury *et al*., 2014; Furness *et al*., 2013).

10.4.7 Gannet were found to be relatively evenly distributed throughout the surveyed area during 2021 breeding season surveys.

Kittiwake

10.4.8 The Scottish east coast supports several SPA seabird colonies, under which breeding kittiwake are designated as features. The closest of these include the Buchan Ness to Collieston Coast SPA (approximately 61 km west of the Muir Mhòr array area), Fowlsheugh SPA (approximately 102 km south-west of the Muir Mhòr array area) and the Troup, Pennan and Lion's Heads SPA (approximately 90 km west of the Muir Mhòr array area using the shortest distance by sea). The provisional estimated peak abundance of kittiwake within the site-specific surveyed area was 1,094 birds. Kittiwake are considered to be at risk of collision (Bradbury *et al*., 2014; Furness *et al*., 2013) and displacement. During breeding season 2021 surveys, kittiwake were found throughout the surveyed area, with relatively higher densities occurring towards the west and south-west regions of the area.

Puffin

10.4.9 Puffin were recorded in moderately high numbers during the site-specific 2021 breeding season surveys. A provisional seasonal peak of 1,574 birds was estimated for the breeding season (not accounting for availability bias). Although this species is not considered to be at high risk in terms of collision (Bradbury *et al*., 2014; Furness *et al*., 2013), there is potential for puffin to be displaced from the Muir Mhòr array area. The proposed development lies within foraging range of puffin breeding at the Forth Islands SPA, approximately 171.6 km to the south-west of the proposed development and under which this species is designated as a breeding feature. Puffin were distributed relatively uniformly throughout the 2021 surveyed area, with slightly lower densities recorded towards the east of E2.

Razorbill

10.4.10 As with the other auks, whilst razorbill are considered to be at low risk of collision due to their typically low flight height distribution at sea, they are considered to be sensitive to displacement (Bradbury *et al*., 2014; Furness *et al*., 2013). Razorbill was recorded in lower numbers than the other auk species, and was distributed throughout the surveyed area, with relatively higher density towards the west of E2 and the Muir Mhòr array area. The provisional estimated peak count for razorbill in the breeding season within the Muir Mhòr array area plus a 2 km buffer was 762 birds (not accounting for availability bias). Razorbill is listed as a breeding feature of several breeding seabird SPAs that lie within this species' foraging range of the Muir Mhòr array area, including the Buchan Ness to Collieston Coast SPA, Fowlsheugh SPA and Troup, Pennan and Lion's Heads SPA.

Non-breeding Season: Seabirds

10.4.11 As expected, site-specific aerial surveys undertaken during the 2021/2022 non-breeding season recorded seabird species in smaller numbers compared to the breeding season. During the post-breeding and subsequent winter period, seabirds disperse into the wider marine environment, with distances to wintering grounds varying between both species and individual populations.

10.4.12 Of the key species recorded as being present in numbers during the breeding season, the greatest percentage decrease in provisional peak abundance estimated during the non-breeding season was in razorbill (89%), followed by guillemot (86%) and fulmar (76%). The species with the least percentage decrease in provisional peak abundance estimated during the non-breeding season compared to the breeding season was puffin (32.9%), followed by

gannet (45%). There was a 73% decrease in the provisional estimated peak abundance of kittiwake in the non-breeding season compared to the breeding season.

10.4.13 Great black-backed gull was absent from the surveyed area during the 2021 breeding season; however this species was recorded in small numbers both on sea and in flight within the Muir Mhòr array area and associated buffers during the 2021/2022 non-breeding season. Herring gull were largely absent during breeding season 2021 surveys; however some birds were recorded within the E2 survey area during the 2021/2022 non-breeding season.

Spring and Autumn Migration Periods

10.4.14 The North Sea between the UK's east coast and continental Europe and Scandinavia is considered to be part of the East Atlantic Flyway, a major north-south migration route for many species of birds, including wildfowl, waders, other non-passerine species including birds of prey and passerines. Many birds travelling to and from the likes of Norway (including Svalbard), Denmark, Iceland and Greenland make landfall along Scotland's east coast (Mitchell; 2012). Several SPAs under which migratory wildfowl and waders are listed as wintering features are situated along the coast, approximately adjacent to the Project. These include the Ythan Estuary, Sands of Forvie and Meikle Loch SPA, the Loch of Strathbeg SPA and the Montrose Basin SPA.

10.4.15 Pink-footed goose is a wintering feature of these three SPAs, with graylag goose also being listed under the Loch of Strathbeg and Montrose Basin SPAs. In addition, Svalbard barnacle goose is listed as a wintering feature of the Loch of Strathbeg SPA. Although there is potential for migrating geese to interact with anthropogenic structures at sea, tracking evidence suggests birds travelling closer to the coastline (Griffin *et al.*, 2011).

Intertidal Ornithological Baseline Environment

10.4.16 Two stretches of coastline, to the north and south of the town of Peterhead, Aberdeenshire, are currently being considered for cable landfall options.

10.4.17 The northern stretch of coastline does not overlap with any designated sites.

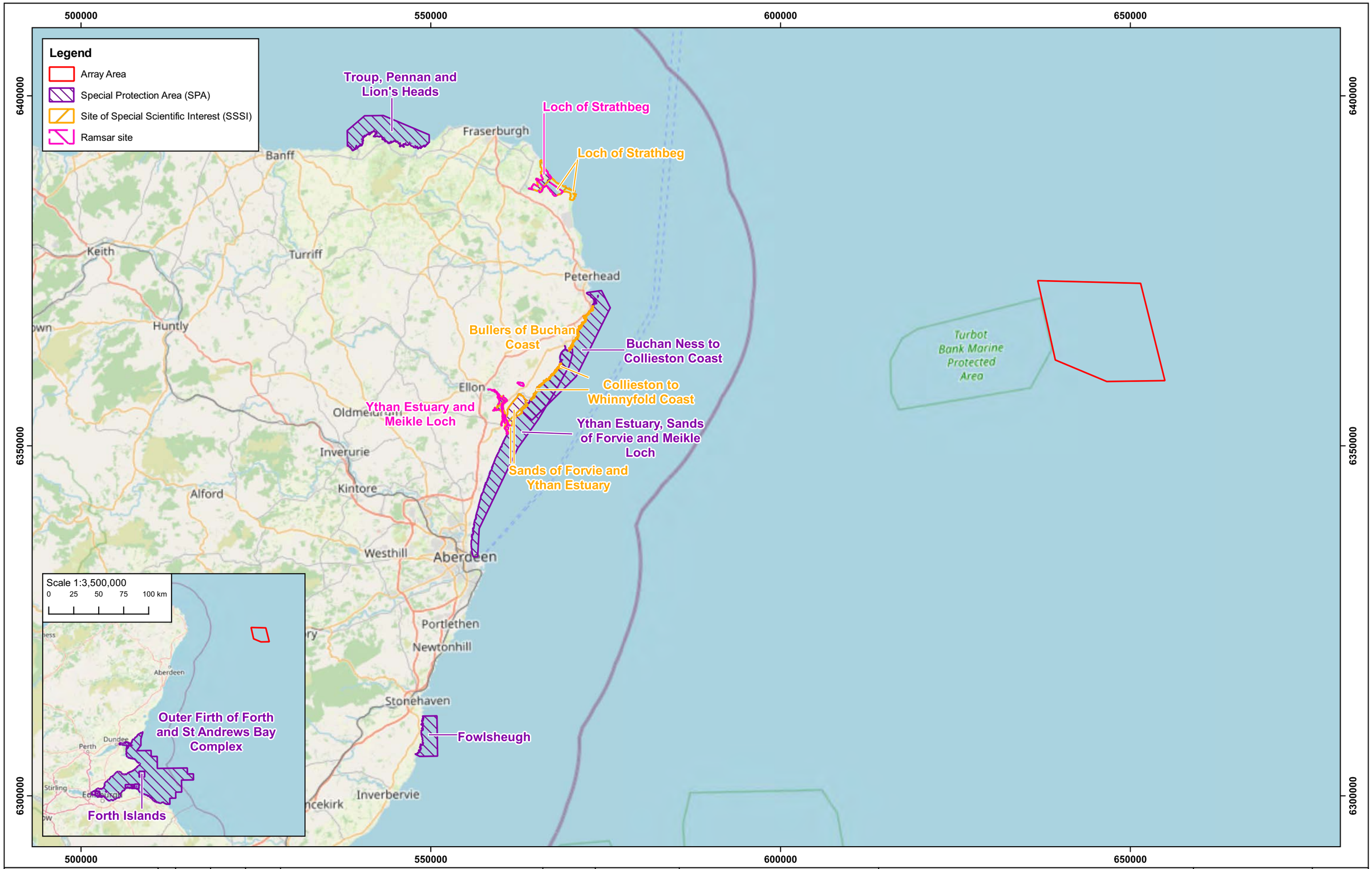
10.4.18 The southern stretch of coastline, from Peterhead to Cruden Bay, overlaps with the Buchan Ness to Collieston Coast SPA for its full length. This rocky coastline SPA is designated for breeding seabirds. The southern landfall search area also incorporates approximately 3 km of the northern extent of the Ythan Estuary, Sands of Forvie and Meikle Loch SPA, which is designated for breeding common, Arctic and Sandwich terns, as well as wintering pink-footed geese.

Designated sites

10.4.19 Seabirds and migratory bird species may travel long distances during both the breeding and non-breeding seasons. As such, there is the potential for sites which are designated for ornithological features to have connectivity with the proposed development. Although there is no overlap between the Muir Mhòr array area and any such designated sites (the nearest SPA being some 61.3 km to the west), a list of key sites with the potential to have connectivity is given below and in Figure 10-3 (note that a separate review of European sites will be undertaken as part of the Offshore HRA screening).

- Buchan Ness to Collieston Coast SPA;
- Fowlsheugh SPA;
- Troup, Pennan and Lion's Heads SPA;
- Loch of Strathbeg SPA;
- Ythan Estuary, Sands of Forvie and Meikle Loch SPA;

- Forth Islands SPA;
- Outer Firth of Forth and St Andrews Bay Complex (OFFSAB) SPA;
- Bullers of Buchan Coast SSSI;
- Collieston to Whinnyfold Coast SSSI;
- Loch of Strathbeg SSSI;
- Sands of Forvie and Ythan Estuary SSSI;
- Loch of Strathbeg Ramsar; and
- Ythan Estuary and Meikle Loch Ramsar.



This drawing/map has been produced to the latest known information at the time of issue. Please consult with the Vattenfall GIS team to ensure the content is still current before using the information contained on this map.

MUIR MHÒR OFFSHORE WIND FARM

A joint venture between Fred. Olsen Seawind & Vattenfall

Muir Mhòr Offshore Wind Farm Ltd, The Tun Building 4 Jackson's Entry, Holyrood Road, No 4 EH8 8PJ Edinburgh United Kingdom

Rev	Date	Drawn By	Checked By	Comment
A	12/05/23	JO	CP	First issue

Datum	ETRS 1989
Projection	ETRS 1989 UTM Zone 30N
Plot	A3
Scale	1:500,000

0 4 8 12 16 20 km

MUIR MHÒR WIND FARM

Key Designated Sites with Ornithological Features with Potential Connectivity to the Muir Mhòr OWF

Confidentiality Class	C1
Drg No	GB204098_M_029
Rev	A
Layout	NA

Figure 10.3

Ref files: GB204098_M_029_A

10.5 Summary and Key Issues

Conservation value of Important Ornithological Features (IOF)

10.5.1 IOF are those species considered to be of highest priority when considering impacts arising from the proposed development in an EIA. Typically, these include species which are recorded both during site-specific surveys and identified as being present during desk-based data reviews, as well as being features of designated sites which are identified as having connectivity to the proposed development.

10.5.2 Table 10-2 provides a summary of IOFs considered likely to be assessed as part of the EIA. Inclusion of species as IOF in Table 10-2 is based on several factors, including:

- Initial analysis of the site-specific survey data;
- Proximity to designated sites for ornithological features; and
- Other key sources of information (provided in Table 10-1), including seabird colony counts and tracking databases, non-breeding season data and distribution studies.

10.5.3 This preliminary list of key IOF is subject to continued review. Species may be added (or removed) pending information from forthcoming DAS data, as well as consultation with stakeholders.

10.5.4 The BoCC 5 Red List (Stanbury et al., 2021) is the most recent review of the conservation status of birds in the UK, the Channel Islands, and the Isle of Man. The criteria and protocols used to assign species to green, amber and red categories of conservation concern are standardised from a range of ornithological NGOs, including the BTO, RSPB, JNCC and NatureScot, and include consideration of factors such as each species' population trends and range, scarcity, historical decline and international importance.

Table 10-2: Important Ornithological Features (IOF) and their species conservation values.

Species	Nature Conservation Value	
	BoCC[21]	International Union for Conservation of Nature (IUCN) Red List[22] status (Global)
Wildfowl		
Pink-footed goose	Amber	Least Concern
Greylag goose	Amber	Least Concern
Sea ducks		
Common scoter	Red	Least Concern
Grebes		
Great crested grebe	Green	Least Concern

[21] Stanbury *et al.*, (2021)

[22] IUCN (2023).

Species	Nature Conservation Value	
	BoCC[21]	International Union for Conservation of Nature (IUCN) Red List[22] status (Global)
Gulls		
Kittiwake	Red	Vulnerable
Great black-backed gull	Amber	Least Concern
Herring gull	Red	Least concern
Lesser black-backed gull	Amber	Least Concern
Terns		
Sandwich tern	Amber	Least Concern
Common tern	Amber	Least Concern
Arctic tern	Amber	Least Concern
Skuas		
Arctic skua	Red	Least concern
Auks		
Guillemot	Amber	Least Concern
Razorbill	Amber	Near Threatened
Puffin	Red	Vulnerable
Divers		
Red-throated diver	Green	Least Concern
Great northern diver	Amber	Least Concern
Procellarids		
European storm petrel	Amber	Least Concern
Fulmar	Amber	Least Concern
Manx shearwater	Amber	Least Concern
Gannet		
Gannet	Amber	Least Concern

10.5.5 The key offshore and intertidal ornithological receptors, and associated impacts, within the study area are identified as follows:

Guillemot

10.5.6 The key issues for guillemot to consider will be:

- Potential displacement impacts upon the regional breeding population (particularly cumulative impacts); and
- Potential displacement impacts upon the regional non-breeding population (particularly cumulative impacts).

Gannet

10.5.7 The key issues for gannet to consider will be:

- Potential collision mortality impacts upon the regional breeding population (particularly cumulative impacts);
- Potential collision mortality impacts upon the regional non-breeding population (particularly cumulative impacts);
- Potential displacement impacts upon the regional breeding population (particularly cumulative impacts); and
- Potential displacement impacts upon the regional non-breeding population (particularly cumulative impacts).

Kittiwake

10.5.8 The key issues for kittiwake to consider will be:

- Potential collision mortality impacts upon the regional breeding population (particularly cumulative impacts); and
- Potential displacement impacts upon the regional breeding population (particularly cumulative impacts).

Puffin

10.5.9 The key issues for puffin to consider will be:

- Potential displacement impacts upon the regional breeding population (particularly cumulative impacts); and
- Potential displacement impacts upon the regional non-breeding population (particularly cumulative impacts).

Razorbill

10.5.10 The key issues for razorbill to consider will be:

- Potential displacement impacts upon the regional breeding population (particularly cumulative impacts); and
- Potential displacement impacts upon the regional non-breeding population (particularly cumulative impacts).

Seasonal Definitions

10.5.11 Bird behaviour and abundance is recognised to differ across a calendar year dependent upon their life history stage during any given month or season. Separate seasons are recognised to establish the level of importance any seabird species has within the area of interest during

any particular period. NatureScot guidance (NatureScot, 2020) provides seasonal periods for birds in the Scottish marine environment.

10.5.12 The seasons as defined within NatureScot (2020) are defined as follows (Table 10-3):

- Breeding period when birds are strongly associated with the nest site;
- Breeding site attendance, when birds arrive at the colony but are not yet closely associated with the nest site;
- Flightless moult period, for auks;
- Winter period, the non-breeding period; and
- Not present in significant numbers, when birds are not present in significant numbers in the Scottish marine area.

Table 10-3: Seabird seasons as given by NatureScot (2020).

Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Kittiwake	Winter/non-breeding	Winter/non-breeding	Winter/non-breeding	(early) Attending (late) Breeding	Breeding	Breeding	Breeding	Breeding	Winter/non-breeding	Winter/non-breeding	Winter/non-breeding	Winter/non-breeding
Guillemot	Winter/non-breeding	Attending	Attending	Breeding	Breeding	Breeding	Breeding	(early) Breeding (late) Attending Flightless moult period	Winter/non-breeding	Winter/non-breeding	Winter/non-breeding	Winter/non-breeding
Razorbill	Winter/non-breeding	Winter/non-breeding	Attending	Breeding	Breeding	Breeding	Breeding	(early) Breeding (late) Attending	Winter/non-breeding Flightless moult period	Winter/non-breeding	Winter/non-breeding	Winter/non-breeding
Puffin	Winter/non-breeding	Winter/non-breeding Flightless moult period	(early) Winter/non-breeding (late) Attending	Breeding	Breeding	Breeding	Breeding	(early) Breeding (late) Attending	Winter/non-breeding	Winter/non-breeding	Winter/non-breeding	Winter/non-breeding
Gannet	Winter/non-breeding	(early) Winter/non-breeding (late) Attending	Attending	Breeding	Breeding	Breeding	Breeding	Breeding	Breeding	Winter/non-breeding	Winter/non-breeding	Winter/non-breeding
Fulmar	Winter/non-breeding	Winter/non-breeding	Winter/non-breeding	Breeding	Breeding	Breeding	Breeding	Breeding	(early) Breeding (late) Winter/non-breeding	Winter/non-breeding	Winter/non-breeding	Winter/non-breeding
	Not present in significant numbers	Not present in significant numbers	Migration period	Migration period	Not present in significant numbers	Not present in significant numbers	Not present in significant numbers	Not present in significant numbers	(early) Not present in significant numbers	Migration period	Migration period	Not present in significant numbers

Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Pink-footed goose									(late) Migration period			
Greylag goose	Not present in significant numbers	Not present in significant numbers	Migration period	(early) Migration period (late) Not present in significant numbers	Not present in significant numbers	Not present in significant numbers	Not present in significant numbers	Not present in significant numbers	Migration period	Migration period	(early) Migration period (late) Not present in significant numbers	Not present in significant numbers

10.6 Embedded Commitments

10.6.1 As part of the project design process, several designed-in measures have been proposed to reduce the potential for impacts on environmental and socio-economic receptors. These are presented below in Table 10-4 and in the Commitments Register (Appendix A) and will likely evolve over the development process as the EIA progresses and in response to stakeholder consultation.

Table 10-4: Embedded Commitment measures of relevance to offshore and intertidal ornithology.

Code	Commitment	Type (Primary, Secondary or Tertiary)	How Commitment Secured
C-05	Development of a CMS. This will detail the construction procedures (including piling), good working practices for constructing the works, and how the construction-related mitigation steps are to be delivered.	Tertiary	CMS
C-08	Development of and adherence to an EMP. This will set out mitigation measures and procedures relevant to environmental management, including but not limited to chemical usage, invasive and non-native species, pollution prevention and waste management.	Tertiary	EMP
C-09	Development of and adherence to a Decommissioning Programme. The DP will outline measures for the decommissioning of the Proposed Development.	Tertiary	DP
C-10	Development of and adherence to a VMP. The VMP will confirm the anticipated types and numbers of vessels that will be engaged on the proposed development and consider vessel coordination including indicative transit route planning.	Tertiary	VMP
C-14	Development of and adherence to a PS(applicable where piling is undertaken). The PS will detail the method of pile installation and associated noise levels. It will describe any mitigation measures to be put in place (e.g., soft starts and ramp ups, use of Acoustic Deterrent Devices) during piling to manage the effects of underwater noise on sensitive receptors.	Tertiary	PS
C-33	Minimum blade clearance of 30 m above MSL.	Primary	DSLP CMS
C-34	Offshore infrastructure will be micro-sited, where reasonably practicable (to an extent not resulting in a hazard for marine traffic and Search & Rescue capability), around any sensitive seabed habitats including Annex I habitat (if present) , informed through the undertaking of survey works pre-construction.	Primary	DSLP PEMP
C-35	Adherence by vessels to guidelines laid out in the Scottish Marine Wildlife Watching Code	Tertiary	VMP
C-36	Development of and adherence to a Lighting and Marking Plan (LMP). The LMP will confirm appropriate lighting and marking mitigation whilst ensuring compliance with legal requirements with regards to shipping, navigation and aviation marking and lighting.	Tertiary	LMP
C-37	Development of and adherence to an Entanglement Management Plan to reduce the potential entanglement risk to marine life.	Tertiary	Entanglement Management Plan
C-40	Development of and adherence to a Wet Storage Plan (WSP) to provide details on requirements (if applicable) for assembled	Tertiary	WSP

Code	Commitment	Type (Primary, Secondary or Tertiary)	How Commitment Secured
	WTGs and cabling. WTGs to be held at a nearshore wet storage location before being transported to site.		

10.6.2 As a result of the commitment to implement these measures, and to align the proposed development with various standard sectoral practices and procedures, the embedded mitigations are considered inherently part of the design of the proposed development and have, therefore, been included in the assessment presented in Section 10.7.

10.6.3 The requirement and feasibility of any additional mitigation measures will be dependent on the significance of the effects upon offshore and intertidal ornithology and will be consulted upon with statutory consultees throughout the EIA process.

10.7 Scoping of Impacts

10.7.1 Table 10-5 sets out an initial assessment of the likelihood of effects on offshore and intertidal ornithology due to proposed development activities for the scoping stage of the EIA process. The assessment is based on a combination of the following: the definition of the proposed development at the scoping stage; embedded mitigation (as set out in Section 10.6, together with the means by which it will be secured); the level of understanding of the baseline at the scoping stage; the existing evidence base for offshore and intertidal ornithology effects due to proposed development activities; relevant policy; and the professional judgement of qualified ornithological specialists.

Table 10-5: Scoping assessment for offshore and intertidal ornithology.

Impact Pathway	Embedded Commitments	Scoped In or Scoped Out	Justification
Construction/Decommissioning			
Disturbance and temporary loss of habitat	C-05, C-09, C-10, C-14, C-35	Scoped in	It is expected that construction activities, including vessel traffic, taking place at sea may have the potential to cause disturbance to seabirds at sea. Given that the proposed development is to be installed using floating foundations, the level of impact of underwater noise is expected to be lesser in magnitude when compared to fixed (i.e., piled) foundations. Nevertheless, diving seabird species such as auks have been recorded within the Muir Mhòr array area (breeding season 2021 and non-breeding season 2021/2022 surveys). It is considered that such species be reviewed in relation to any underwater noise during construction phase.
Indirect effects on seabird prey species arising from construction and/or decommissioning activities	C-05, C-09, C-14	Scoped in	There is potential for seabirds to experience indirect effects as a result of construction and decommissioning of OWFs via potential impacts on forage fish such as sandeels. Disruption of the seabed as a result of anthropogenic activities may result in changes to populations of sandeels (van Deurs *et al*., 2012). This could in turn disrupt the foraging behaviours of breeding and non-breeding seabirds and may lead to increased seabird mortality.
Indirect effects on seabird prey species arising from accidental pollution during construction and/or decommissioning activities	C-08	Scoped out	There is potential for the accidental spillage of materials hazardous to the environment to lead to impacts on the marine and/or intertidal environment during construction and/or decommissioning activities. This could result in mortality to ornithological features by means of prey and/or habitat effects. It is considered that, subject to the adoption of and adherence to an appropriate EMP, any such potential impacts arising through accidental pollution will be mitigated such that they will be considered to be not significant, in terms of temporal and spatial scale of impact.
Direct and indirect effects to seabirds via UXO clearance	-	Scoped in	Detonation of UXO may risk injury or death to diving seabirds within the vicinity. There is also the potential for UXO clearance to impact the availability of seabird prey species.
Impacts arising to ornithological features via wet storage of floating turbines	C-40	Scoped out	It is considered that any potential displacement effects to seabirds arising through the presence of wet-stored turbines will be temporary and short-lived. Furthermore, the blades of wet-stored

Impact Pathway	Embedded Commitments	Scoped In or Scoped Out	Justification
			WTGs will be static and as such present no collision risk to birds. It is therefore proposed that wet storage be scoped out of the assessment.
			Operation
Collision with operational WTGs	C-33	Scoped in	There is potential for seabirds to collide with wind turbines, which may in turn lead to population level effects. The probability of this happening is dependent on a number of factors, including species present and their abundances and densities, seabird flight height and behaviour within the array area, time of year (and day) and OWF and turbine parameters, such as OWF location, proximity to seabird colonies and 'hotspots' and height of e.g., the rotor-swept zone. The Buchan Ness to Collieston Coast SPA lies approximately 61 km to the west of the Muir Mhòr array area and within mean max. foraging range (Woodward *et al*., 2019) of designated breeding seabird features which are known to be sensitive to collision risk (Furness & Wade, 2012); namely kittiwake. Other breeding seabird SPAs that are located within mean max. foraging distance (Woodward *et al*., 2019) of the Muir Mhòr array area include Fowlsheugh SPA (102 km) and Throup, Pennan and Lion's Heads SPA (90.1 km). There is potential of collision risk to migratory species, wildfowl. Two SPAs for which these species are designated as wintering features are situated along the coastline approximately adjacent to the Muir Mhòr array area. These are the Ythan Estuary, Sands of Forvie and Meikle Loch SPA (69.1 km), Montrose Basin SPA (131.3 km) and Loch of Strathbeg SPA (68.8 km).
Disturbance and/or displacement from WTGs and associated vessels and maintenance activities including wet storage activities	C-10, C-35, C-40	Scoped in	There is potential for birds to be disturbed by anthropogenic activities at sea and/or the presence of anthropogenic objects at sea. Certain seabird species are particularly sensitive to vessel movements, including divers and seaduck (i.e., scoters). Auks may also be disturbed by vessel activity, albeit to a lesser extent by the metrics upon which species were assessed in the seabird vulnerability index (Furness & Wade, 2012). Regular maintenance vessel transits are expected to take place during the operational phase. Assessment as to the extent of the presence of sensitive seabird species and at which times of year will inform the levels of potential disturbance impacts on breeding and non-breeding seabird populations.

Impact Pathway	Embedded Commitments	Scoped In or Scoped Out	Justification
Indirect effects through permanent habitat loss	C-34	Scoped in	The physical presence of anthropogenic structures may remove habitat that was previously available to birds. Species' ability to cope with habitat loss will be assessed, based on the predicted impacts of loss of habitat on birds and the scale/nature of seabed areas rendered inaccessible.
Barrier effects	-	Scoped in	There is potential for the Muir Mhòr array area to act as a barrier to movement for seabirds transiting between breeding colonies along the Aberdeenshire coast and foraging areas at sea. Species such as auks, fulmar and gulls from the Buchan Ness to Collieston Coast SPA (61 km) and Fowlsheugh SPA (102 km) may be subject to increased energetic expenditure as they fly further to avoid transiting between turbines. These additional energetic demands may lead to increased mortality which could in turn lead to population-level impacts on seabird species (Searle *et al.*, 2022).
Impacts to birds through marine lighting	C-36	Scoped in	It is known that burrow-nesting seabirds, including puffins, petrels and shearwaters, can become attracted to artificial lighting, leading to disorientation, grounding and possibly collision (Harris and Davis., 1998; Deakin *et al.*, 2022). Attraction to vessel and other marine lighting can also lead to increased energetic expenditure which could in turn result in increased mortality. Puffin has been frequently recorded during the DAS campaign for the proposed development (breeding season 2021; non-breeding season 2021/2022). The Muir Mhòr array area also lies within mean max. foraging range (Woodward *et al.*, 2019) an SPAs for which puffin is listed as a breeding feature: the Forth Islands SPA (171.6 km).
Entanglement	C-37	Scoped in	Fouling of the anchoring structures by lost fishing nets may present a secondary entanglement endangerment to pursuit diving seabirds within the water column and benthic habitats such as auks, divers. The Buchan Ness to Collieston Coast SPA lies approximately 61 km to the west of the Project array area and within mean max. foraging range plus 1 Standard Distance (SD). (Woodward *et al.*, 2019) of guillemot, have the potential to be sensitive to secondary entanglement. Troup, Pennan and Lion's Heads SPA (90.1 km) is designated for breeding guillemot and razorbill and lies within mean max. foraging range plus 1 SD (Woodward *et al.*, 2019) of both species, whilst Fowlsheugh SPA (102 km) lies within mean max. foraging range plus 1 SD (Woodward *et al.*, 2019) of razorbill.

Impact Pathway	Embedded Commitments	Scoped In or Scoped Out	Justification
Indirect effects on seabirds via prey effects and habitat change	C-08	Scoped in	There is potential for seabirds to experience indirect effects as a result of the presence of WTGs. The presence of an OWF could have impacts on forage fish populations by means of reef effects on artificial structures in the water. Disruption of the seabed as a result of anthropogenic activities may result in changes to populations of sandeels (van Deurs *et al*., 2012). This could in turn disrupt the foraging behaviours of breeding and non-breeding seabirds and may lead to increased seabird mortality.

10.8 Potential Cumulative Impacts

10.8.1 Chapter 4 (EIA Methodology) details how potential cumulative impacts will be assessed through a CIA and gives examples of the projects which are likely to be included in that assessment. For marine and intertidal ornithology, cumulative interactions may occur with other existing and planned projects in the vicinity of the proposed development, including existing and consented OWFs off the Scottish east coast and wider marine environment (as appropriate) and other anthropogenic activities.

10.8.2 Other projects may be scoped into the CIA based on the foraging ranges given in Woodward *et al.* (2019). For the non-breeding season, any projects or activities taking place within the BDMPS regions published by Furness *et al.* (2015) will be taken into consideration (except for guillemot, which remain relative to the breeding colony throughout the year (Buckingham *et al.*,2022). It is proposed that the offshore and intertidal ornithology CIA will draw on guidance from COWRIE (King *et al.*, 2009).

10.8.3 The CIA for offshore and intertidal ornithology will consider the maximum adverse design scenario for each of the projects, plans and activities in line with the methodology outlined in Chapter 4 (EIA Methodology).

10.8.4 The Cumulative Effects Framework (CEF) tool will be used if available and working, with appropriate guidance on its use from NatureScot, in time to inform the EIAR. The aim of this tool is to assist with the collation of cumulative impacts in a standardised manner. If the CEF tool, or associated guidance, are not available then cumulative impacts will be gathered manually through reference to relevant EIAs and additional information where appropriate.

10.9 Potential Transboundary Effects

10.9.1 The proposed development is not meant to significantly impact marine intertidal ornithology breeding seasons during construction, O&M or decommissioning phases, Although, fulmar has a very large foraging range (mean max. + 1 s.d. = 1,200.2 km; Woodward *et al.* 2019), it is considered that any effects on fulmar populations of distant SPAs will be diluted, with birds being apportioned to multiple distant colonies. Any impacts to any such distant colonies are considered to be negligible.

10.9.2 The proposed development is a significant distance from the nearest adjacent exclusive economic zone (EEZ) of another state and, therefore, it is considered that transboundary impacts will not occur and will therefore be scoped out from further consideration within the EIA.

10.9.3 There is the potential for birds originating from non-UK colonies to be present within the vicinity of the proposed development during the non-breeding season, with birds dispersing more widely into the marine environment and potential passage of migrant seabirds.

10.9.4 Potential impacts on birds from non-UK colonies will be considered as part of the EIAR.

10.10 Proposed Approach to EIA

Guidance

10.10.1 In addition to the general approach and guidance outlined in Chapter 4 (EIA Methodology), the assessment of marine and intertidal ornithology receptors will also comply with the following guidance documents where they are specific to this topic:

- NatureScot guidance (NatureScot, 2023);
- EIA guidance issued by the CIEEM (CIEEM, 2018);

- Additional guidance notes arising from strategic research and monitoring projects, including:
  - Scottish Marine Energy Research (ScotMer);
  - The ORJIP; and
  - The Offshore Wind Strategic Monitoring and Research Forum (OWSMRF); and
- Expert opinion.

Additional data sources

10.10.2 A more detailed literature review will be developed for the EIA, building upon the high-level outline provided within this Offshore Scoping Report. Project-specific survey outputs will be used to enhance the understanding of the baseline conditions. These may include the following across the array area and offshore ECC:

- Post-construction ornithological monitoring reports from OWFs;
- Any new tracking data added to the Seabird Tracking Database (BirdLife International, n.d.);
- Any updates to colony counts as part of the Seabird Monitoring Programme; and
- Potentially BTO Wetland Bird Survey (WeBS) data to inform intertidal ornithology baseline.

10.10.3 As well as the already-detailed site-specific DAS, regional DAS and intertidal ornithology surveys will also be undertaken. The methodologies used to collect regional DAS and intertidal ornithology data are provided below.

Regional DAS

10.10.4 As recommended by the SMP (Scottish Government, 2022), a regional DAS survey campaign was undertaken to include the wider E1 and E2 PO areas. These monthly surveys were carried out By HiDef from March 2022 to February 2023, and utilised the same standard DAS methodology as is currently being used for the site-specific DAS survey campaign (see Section 10.3).

10.10.5 Surveys covered the ScotWind E1 and E2 Plan Option Areas and included a 12 km buffer. These surveys therefore encompass the Muir Mhòr array area and its 4 km site-specific survey buffer.

10.10.6 Regional DAS were undertaken following a transect based approach, with a total of 30 transects orientated along a north-east to south-west axis. Transects were separated by a distance of 5 km, with an overall area coverage of 10%. Survey area, transect locations, and relevant buffers are shown in Figure 10-2.

Intertidal ornithology surveys

10.10.7 Baseline intertidal ornithology surveys are being carried out monthly between October 2022 and April 2023. These surveys cover the non-breeding period, when wintering waders and wildfowl are present at coastal sites along the Scottish east coast.

10.10.8 Surveys follow the WeBS methodology (BTO, 2017), whereby an observer carries out a walkover survey within a predetermined area of coastal or wetland habitat and records counts of all waterbird species present. “Waterbirds”, in the context of the WeBS counts, includes:

- Wildfowl (i.e., ducks, geese and swans);
- Waders;

- Cormorants and shags;
- Divers and grebes;
- Herons and egrets;
- Rails;
- Kingfisher; and;
- Other infrequent waterbirds such as cranes and spoonbill.

Assessment Methodology

10.10.9 The EIA will follow the general approach outlined in Chapter 4 (EIA Methodology) of this Offshore Scoping Report. The marine and intertidal ornithological EIA will also include technical appendices, namely;

- A baseline characterisation report;
- Collision risk modelling;
- Displacement modelling; and
- Population Viability Analysis (PVA).

10.10.10 In addition, an offshore HRA Screening Report will assess the potential for connectivity with SPAs and Ramsar sites within the UK and Europe. This will include apportionment of impacts to protected sites and will be submitted jointly with this scoping report.

10.10.11 Further details on the technical appendices to be included as part of the EIA are provided below.

Baseline Characterisation Report

10.10.12 This report will follow the updated NatureScot guidance (NatureScot, 2023). The report will provide a detailed account of the ornithological baseline conditions within the vicinity of the proposed development and its associated infrastructure and will draw on results of site-specific DAS and intertidal data, as well as data sources available from other relevant projects. A desk study will be carried out utilising additional available resources to provide context.

Accounting for records not identified to species level.

10.10.13 The site-specific DAS data will be used to produced abundance and density estimates.

10.10.14 For individuals which are not identified to species level (e.g., guillemot/razorbill), species ratios from records that were identified to species level (in this example, those identified as either guillemot or razorbill) will be used to adjust density estimates to estimate species-specific densities and abundances. For each grouping, ratios will be calculated separately for each broad season (i.e., April to August for breeding season and September to March for non-breeding season) and behaviour (i.e., in flight and on sea), but not for individual surveys or location (e.g., array area or 4 km buffer). This enables differences in ratios among seasons and behaviours to be captured, whilst providing sufficient sample sizes to be representative.

10.10.15 The calculations will be carried out hierarchically so that smaller groupings are assigned first and then used to calculate the ratios for the larger groups. For example, observations of unidentified guillemot/razorbill will be divided according to the ratio of guillemot and razorbill from identified records and then added to the counts of guillemot and razorbill respectively to give adjusted count data. These data will then be used alongside the observations of puffins to calculate the ratios for the unidentified auk species grouping.

10.10.16 Adjusted numbers based on these ratios will then be combined with the Manx shearwater observations to apportion the "unidentified auk/shearwater" grouping. This methodology assumes that all species within groupings are equally likely to be assigned to an unidentified species group and that the ratio of different species within groupings does not vary within season/behaviour combinations.

Density Modelling

10.10.17 For each month and biologically defined season, densities and abundances of key seabird species will be calculated for the Muir Mhòr array area, to indicate birds at risk of collision. The Muir Mhòr array area plus a 2 km buffer and the array area plus a 4 km buffer (to indicate birds at risk of displacement) will also be modelled.

10.10.18 Birds in flight and birds on the sea surface will be modelled separately. Occurrence of seabirds will be summarized by summing the number of each key species observed in each combination of behavioural state (in flight or on sea), survey, and area (site, 2 km buffer or 4 km buffer). Seabird density will be calculated by dividing occurrence by the relevant area surveyed ("Survey effort"). Survey effort is calculated by multiplying the length of the indicative transects falling within the relevant region by the 250 m effective strip width (derived from analysed data from two cameras, each with a strip width of 125 m). Abundances, for both birds in flight and birds on the sea surface, will be calculated by multiplying densities by the total area of the corresponding region. Standard deviations of the densities and abundances will be calculated by block bootstrapping (resampling with replacement), with transect as the blocking unit for 1,000 iterations. These will be presented alongside the coefficient of variation (the proportion of the mean represented by the standard deviation).

10.10.19 The Marine Renewables Strategic Environmental Assessment (MRSea) framework will be used to fit species-specific spatial density models (MacKenzie *et al.* 2013), where there are sufficient data, meeting NatureScot (2022) guidance. Generally, it would be considered that around 100 observation positive segments would be required to fit a robust density surface, however, the suitability of data for use with MRSea will be assessed on a species-specific basis, depending on the specific characteristics of each dataset. This method accounts for spatial dependency in the data and has been developed to incorporate smoothing algorithms and model selection techniques appropriate for predicting the complex spatial distributions displayed by seabirds. A range of candidate covariates will be considered for inclusion within the models including month, distance to coast, water depth and other biologically relevant covariates. Final covariates to include will be determined based on minimising Akaike's Information Criterion (AIC), a comparative measure of model fit. Final models will be used to predict onto a prediction grid with cell width equal to transect segment size, with cells covering the survey area. Predictions will be bootstrapped with 1,000 iterations to provide confidence intervals.

Collision Risk Modelling

10.10.20 The species selected for collision risk modelling will be those that are susceptible to collision impacts (per Garthe & Hüppop 2004, Furness & Wade 2012, Bradbury *et al*. 2014), based on biological parameters and abundance within the Muir Mhòr array area, as estimated from the DAS. Flight densities will be calculated from the number of birds in flight within the array area only (with the survey buffers excluded) and interpolated to account for the portions of the array area which were not explicitly covered by the DAS transects.

10.10.21 The CRM to be used is that based on Band (2012), using the R code underlining the Shiny stochastic app (MacGregor *et al.*, 2018), as recommended by SNCB guidance (NatureScot,

2023). It is proposed that this will be run stochastically using Option 2 (basic model) for all relevant species using generic flight height data from Johnston *et al*. (2014a, 2014b).

10.10.22 The models will also use the parameters presented in Table 10-6, as per NatureScot (2023) guidance. Given NatureScot (2023) guidance does not provide nocturnal activity rates for most species for stochastic CRM, we instead refer to Natural England (2022). As recommended by the SMP roadmap (Scottish Government, 2022) and NatureScot (2023), available evidence that update these values will be reviewed and discussed with NatureScot and Marine Scotland Science.

10.10.23 Based on DAS data collected to date, collision risk modelling is likely to be required for Arctic tern, great black-backed gull, gannet, herring gull and kittiwake to support robust EIA (input parameters have been provided in Table 10-6 for lesser black-backed gull and great skua, in the event that further survey evidence supports their inclusion in the collision risk assessment).

Table 10-6: Parameters of ornithological receptors used in stochastic CRM, as recommended in NatureScot (2023) guidance (unless otherwise stated).

Species	Body length (m)	Wingspan (m)	Flight speed (ms^{-1})	Nocturnal activity (% of daytime activity)	Flight type	Avoidance rate (option 2 stochastic)
Gannet	0.935 (± 0.0325)	1.73 (± 0.0375)	14.9	8% (± 10%)	Gliding	0.993 (± 0.0003)
Kittiwake	0.39 (± 0.005)	1.08 (± 0.0625)	13.1	37.5% (± 6.37%)*	Flapping	0.993 (±0.0003)
Great black-backed gull	0.71 (±0.035)	1.58 (± 0.0375)	13.7	37.5% (± 6.37%)*	Flapping	0.994 (±0.0004)
Herring gull	0.595 (±0.0225)	1.44 (±0.03)	12.8	37.5% (± 6.37%)*	Flapping	0.994 (±0.0004)
Lesser black-backed gull	0.58 (± 0.03)	1.43 (± 0.0375)	13.1	37.5% (± 6.37%)*	Flapping	0.994 (±0.0004)
Great skua	0.56	1.36	14.9	0%*	Flapping	0.991 (±0.0004)
Arctic tern	0.34	0.80	10.9	0%*	Flapping	0.991 (±0.0004)

**Values for Nocturnal Activity Factor are taken from Natural England (2022) guidance*

Assessment of Migratory Birds

10.10.24 There are several tools available to quantify risk to migratory birds, including the Strategic Ornithological Support Services (SOSS) Migration Assessment Tool (Wright *et al*., 2012). However, the conclusions of a Marine Scotland Science report on offshore wind impacts to migratory birds (Bradbury *et al*., 2014) state that impacts at a population level will be low for projects in Scotland. Therefore, it is proposed that migratory bird receptors be scoped out of quantitative modelling for the assessment of impacts associated with the array area (i.e., CRM, displacement analysis, etc.).

10.10.25 It is acknowledged that there is an ongoing strategic review on impacts to migratory birds due to offshore wind development (Scottish Government, 2022; NatureScot 2023), including the development of a stochastic migration CRM (mCRM). The Muir Mhòr team welcomes the opportunity to discuss the scope and details of this review with Marine Scotland in the context of the proposed development during the Scoping process.

Displacement Analysis

10.10.26 The species selected for displacement analysis will be those that are susceptible to displacement impacts (per Furness *et al*., 2013) and those identified as being priority species for displacement of displacement effects (NatureScot, 2023). Species selection will be based on their abundance within the project area and 2 km displacement buffer, as estimated from DAS. Site abundance will be calculated from the total number of birds recorded (i.e., those on the sea surface and in flight, combined) within the array area and the 2 km displacement buffer. These values will be interpolated to account for the portions of the array area which were not explicitly covered by the DAS transects.

10.10.27 The matrix approach to displacement analysis will be used for all species, per NatureScot (2023) guidance. This analytical approach uses the mean seasonal peak estimate, along with estimates on the proportion of seabirds displaced and the proportion of seabirds which die due to displacement.

10.10.28 Displacement and mortality rates for kittiwake, gannet, guillemot, razorbill and puffin are presented in Table 10-7. Rates are provided from recent NatureScot (2023) guidance.

Table 10-7: Proposed displacement and mortality rates for use in displacement analysis.

Species	% of birds displaced	% mortality
Kittiwake	30% (all year)	1% and 3% (breeding and non-breeding)
Gannet	70% (all year)	1% and 3% (breeding and non-breeding)
Guillemot	60% (all year)	3% and 5% (breeding)
		1% and 3% (non-breeding)
Razorbill	60% (all year)	3% and 5% (breeding)
		1% and 3% (non-breeding)
Puffin	60% (all year)	3% and 5% (breeding)
		1% and 3% (non-breeding)

10.10.29 The SeabORD model (Searle *et al.*, 2019) will also be used for kittiwake, guillemot, razorbill and puffin, for which the model has been developed, if this continues to be recommended by NatureScot and/or Marine Scotland Science. If SeabORD is to be used, it is expected that the decay function will be utilised to model displacement.

10.10.30 Data collected from the regional DAS will be reviewed to put site distributions into context within the wider area.

Population Viability Analysis

10.10.31 PVA is used to determine likely impacts at the population-level. The Natural England PVA tool (Searle *et al.*, 2019) will be utilised, which is the standard approach to impact assessment used by other offshore wind farm projects within the UK and is recommended by NatureScot (2023). It is proposed that PVA will be undertaken whenever baseline mortalities will increase be 0.02% to regional or specific designated site population, as per NatureScot (2023) Guidance Note 11.

10.10.32 A meta-population model for the Orkney and east coast population of kittiwake is currently under development by Marine Scotland, as highlighted in the SMP roadmap (Scottish Government, 2022), and this will be reviewed if published before the Scoping Opinion is issued.

10.10.33 The demographic rates to be used as input parameters will be derived from Horswill & Robinson (2015). If adjustments to demographic rates would be needed so that the models reflect contemporary population parameters, based on the latest SMP datasets, this will be discussed with NatureScot. As is standard for PVAs, relative harvest models will be used; these models do not take density dependence or sabbatical rates into account. The PVA model will be run for several years before impact to simulate change in population size over the years preceding the onset of impact and to allow the modelled population structure to stabilise. Modelling of impacts will be undertaken for 25 years (and the intended lease period if this is different) and 50 years.

10.10.34 The outputs of PVAs to be provided will be the Counterfactual of Growth Rate (CGR) and the Counterfactual of Population Size (CPS).

10.11 Scoping Questions

10.11.1 The following scoping questions refer to the Offshore and Intertidal Ornithology chapter and are designed to focus the scoping exercise and inform the scoping opinion.

- Do you agree with the study area(s) defined for offshore and intertidal ornithology?
- Do you agree with the use of those data listed in Section 10.3, and any additional anticipated data listed in Section 10.10, being used to inform the Offshore EIA? Are there any additional data sources or guidance documents that should be considered?
- Do you agree that all receptors related to offshore and intertidal ornithology have been identified, and that the preliminary list of IOFs is appropriate?
- Do you agree with the scoping in and out of impact pathways in relation to offshore and intertidal ornithology?
- Do you agree with the proposed assessment methodology for offshore and intertidal ornithology?
- Do you agree with the assessment of the potential for transboundary effects in relation to offshore and intertidal ornithology?

- Do you agree with the assessment of the proposed approach to cumulative effects in relation to offshore and intertidal ornithology?
- Do you agree that the embedded mitigation outlined is suitably relevant to offshore and intertidal ornithology?
- Do you agree with the proposed threshold number of 100 records for using MRSea to generate density surfaces (this differs to that of NatureScot (2023) guidance)?
- Do you agree with the proposal that CRM is run stochastically solely using option 2? This differs from what we infer from NatureScot (2023) guidance which suggest that option 3 and models run deterministically are also required?
- If option 3 models are to be required, NatureScot (2023) guidance advises that site-specific avoidance rates are calculated. Could further information be provided how these should be calculated please? Also, could confirmation be provided on other input parameters to use since these are not provided in the NatureScot (2023) Guidance Note 7 for option 3 models.
- Could confirmation be provided as to the definition of the 'most likely scenario' (MLS), in light of NatureScot (2023) guidance specifying that CRMs should be run for the 'worst case scenario' (WCS) as well as the MLS?
- Would you be able to provide guidance on how macro-avoidance should be incorporated into gannet and kittiwake collision risk modelling, as birds that are displaced would not be available for collision impacts?
- Do you agree with the use of a qualitative approach to assessing impacts on migratory bird species, based on Bradbury et al. (2014) and the upcoming update to this by the BTO commissioned by Marine Scotland?
- Could you provide clarity on how to use the data from Furness (2015) to derive population estimates for the non-breeding seasons as described by NatureScot (2020), ideally with a worked example for razorbill or gannet, i.e., for species where multiple BDMS correspond with a single non-breeding season as defined by NatureScot (2020)?
- Could you provide guidance on when documents on how to use Conservation and Management Advice to inform PVAs will become available, given NatureScot (2023) guidance that any counterfactuals used must be compatible with Conservation Management Advice?
- Could you provide an update as to when anticipated NatureScot guidance on how to consider highly pathogenic avian influenza (HPAI) in assessments is expected and/or provide guidance on accounting for HPAI in assessments?

11 Marine Mammals

11.1 Introduction

11.1.1 This chapter of the Offshore Scoping Report identifies the marine mammal receptors of relevance to the proposed development. It identifies the potential impacts from the construction, O&M, and decommissioning of the proposed development on these marine mammal receptors and sets out the proposed scope of the EIA. The proposed methods of assessment for the EIA are also presented, along with embedded mitigation measures.

11.1.2 Based on the results of 17 months of site-specific surveys and a literature review of the existing data, the key marine mammal species considered in this chapter are minke whale (*Balaenoptera acutorostrata*), harbour porpoise (*Phocoena phocoena*), bottlenose dolphin (*Tursiops truncatus*), white-beaked dolphin (*Lagenorhynchus albirostris*), Risso's dolphin (*Grampus griseus),* harbour seals (*Phoca vitulina*) and grey seals (*Halichoerus grypus*). Consideration is also given to the less commonly sighted species of humpback whale (*Megaptera novaeangliae*), killer whales (*Orcinus orca*) and Atlantic white-sided dolphin (*Lagenorhynchus acutus*), as identified within the literature. Each of the species listed, and the reasoning for their inclusion or exclusion from any EIA, are discussed further in Section 11.4 and will be fully detailed in the marine mammal baseline characterization technical report.

11.1.3 This chapter should be read alongside the following chapters:

- Chapter 6: Marine and Coastal Processes;
- Chapter 7: Marine Water and Sediment Quality; and
- Chapter 9: Fish and Shellfish Ecology.

11.1.4 This chapter of the Offshore Scoping Report has been prepared by SMRU Consulting (trading name of SMRU Ltd.), St. Andrews.

11.2 Study Area

11.2.1 The study area for the marine mammals scoping assessment varies depending on the species as each species requires individual consideration based on differing ecology and behaviour. The marine mammal study area has therefore been defined at two spatial scales; a regional scale study area and the local scale study area.

11.2.2 The regional scale study area encompasses a wider geographic context in terms of species presence and their estimated densities and abundance. This scale defines the appropriate reference populations for the assessment. The regional study area for each species is as follows:

- Minke whale: Celtic and Greater North Seas Management Unit (CGNS MU);
- Harbour porpoise: North Sea (NS) MU;
- Bottlenose dolphin: Coastal East Scotland (CES) and Greater North Sea (GNS) MUs;
- White-beaked dolphin: CGNS MU;
- Risso's dolphin: CGNS MU;
- Harbour seal: the East Scotland and Moray Firth Seal MUs (SMUs); and
- Grey seal: the East Scotland and Moray Firth SMUs.

11.2.3 The local scale study area is the survey area for the Muir Mhòr site-specific surveys. Surveys to inform the local scale study area are being carried out between April 2021 and March 2023 by HiDef Aerial Surveying Limited. However, only data from April 2021 – September 2022 was available to inform this scoping report. The local scale study area is informed by monthly digital aerial surveys comprising of 2.5 km spaced survey transects within the array area, plus a 4 km buffer, to provide an indication of the local densities of each species. The monthly digital aerial survey area is shown in Figure 11-1. In addition, a regional digital aerial survey was being undertaken to include the wider E1 and E2 PO areas, as per the recommendation in the SMP. These surveys took place between March 2022 and February 2023, and are intended to put the site-specific surveys into wider context. This information will be incorporated into any marine mammal baseline characterisation report and has not been used for the purpose of this scoping report. The extent of the regional digital aerial surveys and the marine mammal MUs are included in Figure 11-2.

600000

700000

6400000

6400000

Legend

- Array Area
- Offshore Export Cable Corridor
- Array Area 4km Buffer
- Survey Transect Lines

N

Esri, Garmin, GEBCO, NOAA NGDC, and other contributors

600000

700000

Muir Mhòr Offshore Wind Farm Ltd, The Tun Building
4 Jackson's Entry, Holyrood Road, No 4 EH8 8PJ Edinburgh
United Kingdom

A	15/05/23	Drawn By JC	Checked By RRS	For issue	

Datum	ETRS 1989
Projection	ETRS 1989 UTM Zone 30N
Plot	A3
Scale	1:500,000

0 3 6 9 12 15 km

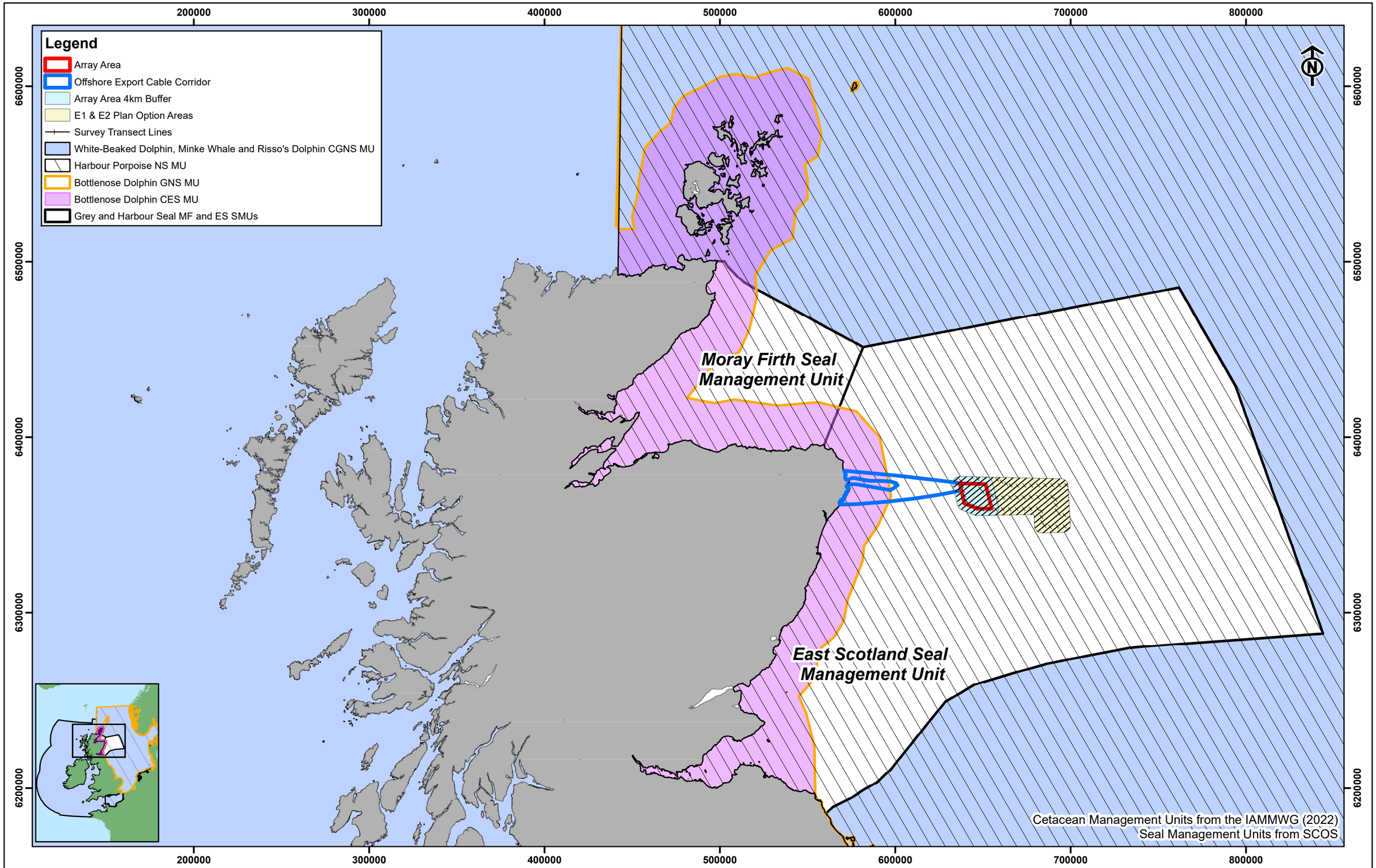
MUIR MHÒR WIND FARM

2.5km spaced survey transects flown over the Mhuir Mhor Array area - this includes a 4km around the site

Confidentiality Class	C1
Drg No	SMRUC-0001
Rev	A
Layout	NA

Figure 11.1

Ref files: MuirMhor_arrayarea



This drawing/map has been produced to the latest known information at the time of issue. Please consult with the Vattenfall GIS team to ensure the content is still current before using the information contained on this map.

Muir Mhòr Offshore Wind Farm Ltd, The Tun Building 4 Jackson's Entry, Holyrood Road, No 4 EH8 8PJ Edinburgh United Kingdom

A	15/05/23	Drawn By JC	Checked By RRS	For issue	

Datum	ETRS 1989
Projection	ETRS 1989 UTM Zone 30N
Plot	A3
Scale	1:2,000,000

0 10 20 30 40 50 km

MUIR MHÒR WIND FARM

2.5km spaced survey transects flown over the Muir Mhòr Array area relative to marine mammal Management Units (MUs)

Confidentiality Class	C1
Drg No	SMRUC-0002
Rev	A
Layout	NA

Figure 11.2

Ref files: MuirMhor_marineMammal_MUs

11.3 Baseline Environment

Data Sources

11.3.1 The key existing data sets and literature which shall be used to supplement the site-specific survey data are outlined in Table 11-1. Each source of information has relevant coverage of the study areas and is key in informing the baseline characterisation and assessments for the EIA.

11.3.2 It should be noted that any data sources not currently available in the public domain may also be used to inform the EIA. For example, the SCANS-IV surveys undertaken to provide updated estimates of cetacean abundance in European Atlantic waters were completed in summer 2022, but the results are anticipated to be released later in 2023.

Table 11-1: Key sources of marine mammal baseline data.

Source, Author, and Year	Summary	Coverage of Muir Mhòr array area and ECC
Site-specific aerial surveys for the proposed development	Site-specific baseline characterisation digital video aerial surveys (24 surveys between April 2021 – March 2023). Only a certain proportion of the data (April 2021 – September 2022) was made available to inform this scoping report.	The survey area consists of the Muir Mhòr array area plus a 4 km buffer.
Regional Baselines for Marine Mammal Knowledge Across the North Sea and Atlantic Areas of Scottish Waters (Hague *et al.*, 2020)	This report collates and provides up-to-date information on the abundance and distribution of marine mammal species in the Scottish Northern North Sea region and Scottish Atlantic waters, with a focus on Draft Plan Option (DPO) sites identified in the Draft Sectoral Marine Plan for Offshore Wind Energy for Scotland.	Report covers the entirety of Scotland and thus, includes the proposed development area.
Revised Phase III Data Analysis of Joint Cetacean Protocol Data Resources (Paxton *et al.*, 2016)	The Joint Cetacean Protocol (JCP) has been set up with the aim of delivering information on the distribution, abundance and population trends of cetacean species occurring in the North Sea and adjacent sea regions. Effort-linked sightings data contained within the JCP data resource have been used to estimate spatio-temporal patterns of abundance for seven species of cetacean over a 17-year period from 1994–2010 over a 1.09 million km^2 prediction region from 48° N to c. 64° N and from the continental shelf edge west of Ireland to the Kattegat in the east.	Covers cetacean trends in the North Sea and includes the proposed development area.
Statistical approaches to aid the identification of(MPA for minke whale, Risso's dolphin, white-beaked dolphin and basking shark (Paxton *et al.*, 2014)	Effort-linked sightings data contained within the JCP plus additional data sourced by Scottish Natural Heritage were used to generate estimated densities per area surveyed (corrected for detection/availability) for minke whale (2000 – 2012), Risso's dolphin (1994 – 2012) and white-beaked dolphin (1994 – 2012). A further relative density per area surveyed index was obtained for basking shark (2000 – 2012). There were up to 23 distinct data sources used for each analysis (25 used in total) with data from at least 172 distinct survey platforms (ships and aircraft) representing up to 180,300 km of effort depending on the species considered.	Generated estimated densities per area surveyed which includes the North Sea and includes the proposed development area.
Existing OWF data (Multiple Sources, Multiple Years)	Strategic Marine Mammal Monitoring Programme (completed on behalf of Moray East OWF and Beatrice OWF) (Graham *et al.*, 2015, Graham *et al.*, 2016, Graham *et al.*, 2020, Graham *et al.*, 2021); Various North Sea OWF project EIAs and supplementary data (BOWL, 2012, Bailey, 2017, Moray Offshore Windfarm (West) Limited, 2018, Seagreen, 2018a, b).	Although these data sources cover specific North Sea areas, they are relevant to the proposed development area.

Source, Author, and Year	Summary	Coverage of Muir Mhòr array area and ECC
SCANS III density surfaces (Lacey *et al.*, 2022)	Modelled density surfaces of cetaceans in European Atlantic waters in summer 2016 using the SCANS III data.	Modelled density surfaces cover the entire SCANS III survey area The SCANS III survey area was separated out into 'Blocks', in which the proposed development area is located with SCANS III Block R.
SCANS III (Hammond *et al.*, 2021)	Estimates of cetacean abundance in European Atlantic waters in summer 2016 from the SCANS-III aerial and shipboard surveys.	SCANS III surveys covered the majority of European Atlantic waters (not including south, west and north Ireland). The proposed development area is located within SCANS III Block R.
Special Committee on Seals (SCOS) Scientific Advice on Matters Related to the Management of Seal Populations (SCOS, 2022)	Under section 13 of the Conservation of Seals Act 1970 and article 5 of the Marine (Scotland) Act 2010 (Consequential Provisions) Order 2010, the Natural Environment Research Council (NERC) has a duty to provide scientific advice to government on matters related to the management of UK seal populations. NERC has appointed a SCOS to formulate this advice. This document outlines the current status of both harbour and grey seal populations in the UK. Populations of seals are characterised within management units.	The SMUs relevant to the proposed development area are the East Scotland, North Coast & Orkney, and Moray Firth SMUs.
Seal telemetry database (SMRU, 2019)	Data collated by multiple authors and gathered through a consortium of funders. Used to assess connectivity and habitat associations of seal species with at-sea and on-land locations,	Data encompasses the entirety of Scotland and thus, includes the proposed development area.
Updated abundance estimates for cetacean Management Units in UK waters (Inter- Agency Marine Mammal Working Group (IAMMWG, 2022)	The IAMMWG defined MUs for the seven most common cetacean species found in UK waters. Abundance estimates were calculated for each species within their respective MUs.	The regional study areas for the key marine mammal species are as follows – harbour porpoise: NS MU; bottlenose dolphin: CES and GNS MUs; short-beaked common dolphin: CGNS MU; white-beaked dolphin: CGNS MU; and minke whale: CGNS MU. Each MU has connectivity with the proposed development area.
Designated haul-out sites for grey and harbour seals (Protection of Seals Orders) (Marine Scotland, 2017)	Seal haul-out sites are designated under section 117 of Marine (Scotland) Act 2010. Seal haul-outs are locations on land where seals come ashore to rest, moult or breed. There are a total of 194 seal haul-out sites across Scotland which have been mapped on the NMPi system.	The closest seal haul-out site to the proposed development area is the Ythan River Mouth, located approximately 60 km west-south-west of the array area and approximately 15 km south of the ECC at its closest point.

Source, Author, and Year	Summary	Coverage of Muir Mhòr array area and ECC
Seal habitat preference maps (Carter *et al.*, 2020)	Habitat modelling was used, matching seal telemetry data to habitat variables, to understand the species-environment relationships that drive seal distribution. Haul-out count data were then used to generate predictions of seal distribution at sea from all known haul-out sites. This resulted in predicted distribution maps on a 5x5 km grid. The estimated density surface gives the percentage of the British Isles at sea population (excluding hauled-out animals) estimated to be present in each grid cell at any one time during the main foraging season.	Report covers the entirety of Scotland and thus, includes the proposed development area.
East Coast Scotland Marine Mammal Acoustic Array (ECOMMAS) (Palmer *et al.*, 2019)	The ECOMMAS project uses acoustic recorders, known as C-PODs, at 30 locations off the east coast of Scotland, to detect echolocation clicks. At 10 of these locations, a broadband acoustic recorder has also been deployed, to record ambient noise levels, as well as other animal vocalisations.	Data for porpoise and dolphin detection-positive-days (DPD) can be accessed for the east coast of Scotland. This includes locations situated within the CES and GNS MUs for bottlenose dolphins and the NS MU for harbour porpoise which have connectivity with the proposed development area.
The Identification of Discrete and Persistent Areas of Relatively High Harbour Porpoise Density in the Wider UK Marine Area (Heinänen and Skov, 2015)	This report provides the results of detailed analyses of 18 years of survey data in the JCP undertaken to inform the identification of discrete and persistent areas of relatively high harbour porpoise density in the UK marine area within the UK EEZ.	UK harbour porpoise MUs were used for presentation of results, thus, any data used from this report shall be representative of that for the harbour porpoise NS MU. The proposed development area is located within this MU.
Distribution Maps of Cetacean and Seabird Populations in the North-East Atlantic (Waggitt *et al.*, 2020)	This study provides the largest ever collation and standardisation of diverse survey data for cetaceans and seabirds, and the most comprehensive distribution maps of these taxa in the North-East Atlantic. Aerial and vessel survey data were collated between 1980 and 2018. Distributional maps for 12 cetacean species were produced at 10 km resolution.	Modelled density surfaces include the entirety of Scotland and thus, includes the proposed development area.
Integrating multiple data sources to assess the distribution and abundance of bottlenose dolphins in Scottish waters (Cheney *et al.*, 2013)	Provides the first comprehensive assessment of the abundance of bottlenose dolphins in the inshore waters of Scotland through a combination of dedicated photo-identification studies and opportunistic sightings.	Covers the Coastal East Scotland Management Unit (CES MU) for bottlenose dolphins, and the Moray Firth SAC.

Source, Author, and Year	Summary	Coverage of Muir Mhòr array area and ECC
Special Committee on Seals (SCOS)	Harbour and grey seal haul-out counts and grey seal pup production estimates for the relevant SMUs	Covers the relevant SMUs.

11.4 Description of Baseline Environment

11.4.1 The marine mammal species most likely to be present in the Muir Mhòr array area and ECC are informed by site specific survey data, historical records, and a comprehensive literature review. The species include minke whale, bottlenose dolphin, white-beaked dolphin, harbour porpoise, grey seal and harbour seal. Further information on the occurrence of each of these species is indicated below.

11.4.2 Other marine mammals that have been sighted along the east coast of Scotland and in the wider North Sea area include humpback whale, killer whales and Atlantic white-sided dolphin, although they are rarely sighted. None of these species were present within the aerial site-specific surveys for the period of April 2021 – September 2022. While the evidence base for their occurrence will be comprehensively assessed in the baseline characterisation report, it is not anticipated that they will be subject to quantitative assessment, as density and abundance estimates for these species are lacking. Furthermore, any mitigation proposed as part of the proposed development, will also apply to these species, irrespective as to whether they have been quantitatively or qualitatively assessed. The final list of species for quantitative assessment will be refined in the baseline characterisation report.

Cetaceans

Minke whale

11.4.3 The population estimate for the CGNS MU based on SCANS-III data is 20,118 minke whales (95% CI: 14,061 – 28,786, CV: 018). The UK portion of this MU has an estimated abundance of 10,288 (95% CI: 6,210 – 17,042, CV: 0.26) (IAMMWG, 2022). In the UK, minke whales have been assessed as having an 'Unknown' Overall Conservation Status.

11.4.4 Minke whales were sighted during eight of the 17 months surveyed throughout the two site-specific aerial survey years and a total of 12 sightings were made between April – August 2021 and April – September 2022. If sufficient sightings data is available to generate monthly density estimates and spatial distribution patterns for minke whales from the site-specific aerial surveys, this will be provided within any baseline characterisation report submitted in support of an EIA (see Section 12.10). However, should this not be possible, density estimates shall be derived from pre-existing data sources such as the SCANS-III or IV data.

11.4.5 The Muir Mhòr array area and ECC are in SCANS-III Block R where there was an estimated density of 0.0387 minke whales/km^2 in July 2016 (Hammond *et al.*, 2021). The abundance estimate for this block was 2,498 (95% CI: 604 – 6791, CV: 0.614).

11.4.6 The closest designated site for minke whales to the Muir Mhòr array area and ECC is the Southern Trench NC MPA. The NC MPA is located approximately 30 km west of the array area, whilst the ECC will overlap the NC MPA.

11.4.7 Figure 11-3 provides a visual representation of the density estimates of minke whale for the UK based on the SCANS-III data (Lacey *et al.*, 2022), the Paxton *et al.* (2016) Revised Phase III Data report, and the Waggitt *et al.* (2020) paper.

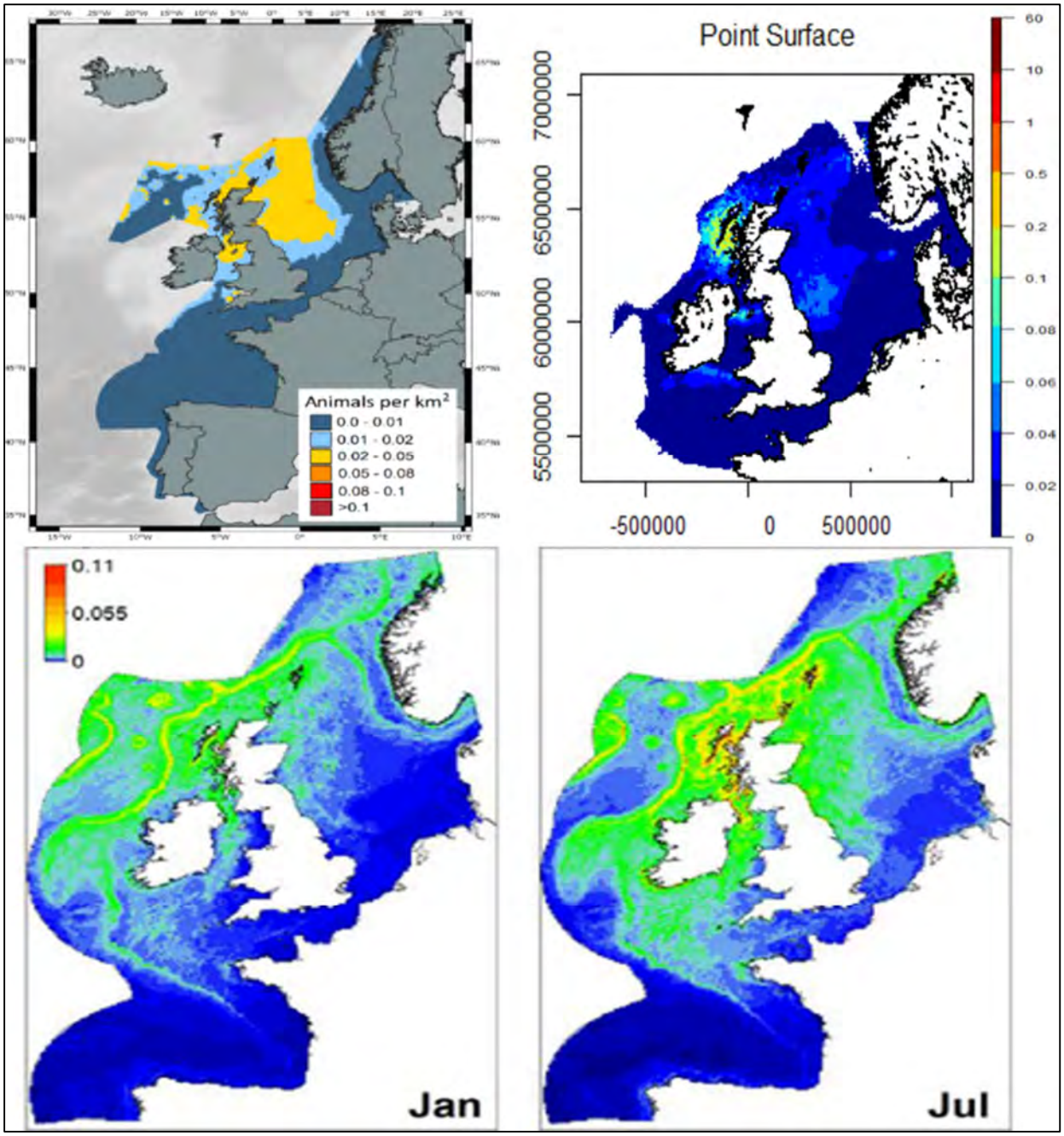


Figure 11-3: Top left: predicted surface for minke whales in SCANS-III (2016) (Lacey *et al.*, 2022), top right: predicted minke whale densities (animals/km^2) for all summers (1994 – 2010) as point estimates of cell densities (Paxton *et al.*, 2016); bottom: predicted densities of minke whales (animals per km^2) in January (left) and July (right) in the North-East Atlantic (Waggitt *et al.*, 2020).

Bottlenose dolphin

11.4.8 The population estimate for the CES MU is 224 bottlenose dolphins (95% CI: 214-234) (Arso Civil *et al.*, 2021, IAMMWG, 2022).This MU is located entirely within the UK EEZ. In the UK, bottlenose dolphins have been assessed as having an 'Unknown' Overall Conservation Status (JNCC, 2019a), although the CES MU population is thought to be increasing (Arso Civil *et al.*, 2021).

11.4.9 Individuals associated with the Moray Firth SAC are primarily observed within shallow (<20 m deep), nearshore waters of eastern Scotland (within 2 km), in particular the waters of the inner and southern coast of the Moray Firth, Aberdeenshire coast and Tay Estuary (Quick *et al.*, 2014). Recent reports however have indicated an increase in sightings of bottlenose dolphins from this population in the Firth of Forth and as far south as the coast of northern England (Arso Civil *et al.*, 2022).

11.4.10 Bottlenose dolphins were not definitively sighted during the site-specific aerial surveys, although a total of 89 sightings of unidentified seal and/or cetacean species were made, some of which may have been bottlenose dolphins. Despite this, sightings of bottlenose dolphins offshore in the North Sea have been recorded in the region of the proposed development (Reid *et al.*, 2003). These sightings, however, are infrequent, and it is likely that these individuals are attributed to the GNS MU (Cheney *et al.*, 2013, IAMMWG, 2022) rather than the CES MU.

11.4.11 The proposed development area is located in SCANS-III Block R where there was an estimated density of 0.0298 offshore bottlenose dolphin/km^2 in July 2016 (Hammond *et al.*, 2021). The abundance estimate for this block was 1,924 (95% CI: 0 – 5,048, CV: 0.861). It is noted that the SCANS-III density estimates are not the most appropriate available for the CES bottlenose dolphin population, whose distribution is largely restricted to nearshore waters of ≤ 20 m water depth and within 2 km of the coast (Quick *et al.*, 2014). Therefore, the quantitative assessment for bottlenose dolphins will consider potential impacts to both the offshore population and the coastal population separately.

11.4.12 Figure 11-4 provides a summary of the locations in which bottlenose dolphins were encountered during boat surveys undertaken between 1990 and 2019 (Arso Civil *et al.*, 2021).

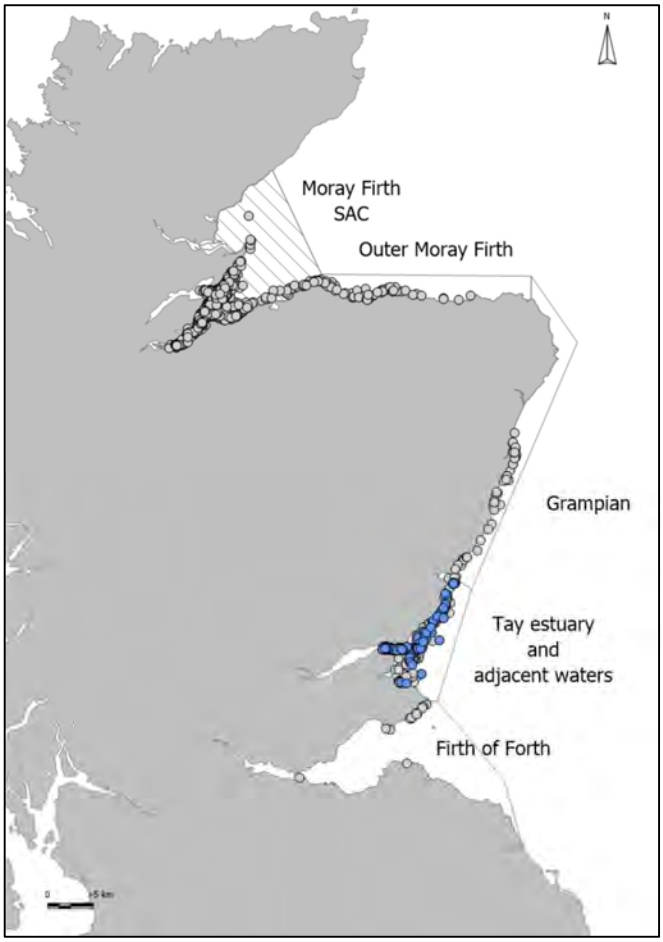


Figure 11-4: Main survey areas along the east coast of Scotland, from the Moray Firth SAC (hatched area) to the Firth of Forth. Locations of bottlenose dolphin encounters between 1990 and 2019 collected by University of Aberdeen and SMRU are shown in grey, and those collected by SMRU between 2017 and 2019 shown in blue (Arso Civil *et al.*, 2021).

Harbour porpoise

11.4.13 The population estimate for the North Sea Management Unit (NS MU) based on SCANS III data is 346,601 harbour porpoise (95% CI: 289,498 – 419,967, CV: 0.09) (IAMMWG, 2022). The UK portion of this MU has an estimated abundance of 159,632 porpoise (95% CI: 127,442 – 199,954, CV: 0.12) (IAMMWG, 2022). The conservation status of harbour porpoise in UK waters has been updated by the JNCC (2019b) which concludes a favourable assessment of future prospects and range, but an unknown conclusion for population size and habitat. This resulted in an overall assessment of conservation status of "Unknown" and an overall trend in Conservation status of "Unknown". A trend analysis indicates that the harbour porpoise abundance in the North Sea is stable and has not changed since 1994, although the associated confidence intervals are quite wide (JNCC, 2019b, Hammond *et al.*, 2021).

11.4.14 Harbour porpoise were the most abundant marine mammal sighted in the site-specific aerial surveys. They were sighted in 15 of the surveyed throughout the two survey years (no sightings in February and March 2022), resulting in a total of 493 sightings. Monthly density

estimates and spatial distribution patterns for harbour porpoise will be derived from the site-specific aerial surveys and provided within the baseline characterisation report submitted in support of an EIA (see Section 12.10).

11.4.15 The proposed development is located in SCANS-III Block R where there was an estimated density of 0.599 harbour porpoise/km^2 in July 2016 (Hammond *et al.*, 2021). The abundance estimate for this block was 38,464 (95% CI: 20,584 – 66,524, CV: 0.287). The SCANS surveys of the whole of the North Sea show southwards shift in distribution of the North Sea harbour porpoise population between the survey years of 1994 and 2005; this pattern of higher densities in the southern North Sea persisted in the most recent 2016 surveys (Hammond *et al.*, 2021).

11.4.16 Figure 11-5 provides a visual representation of the density estimates of harbour porpoise for the UK based on the SCANS-III data (Lacey *et al.*, 2022), the Paxton *et al.* (2016) Revised Phase III Data report, and the Waggitt *et al.* (2020) paper.

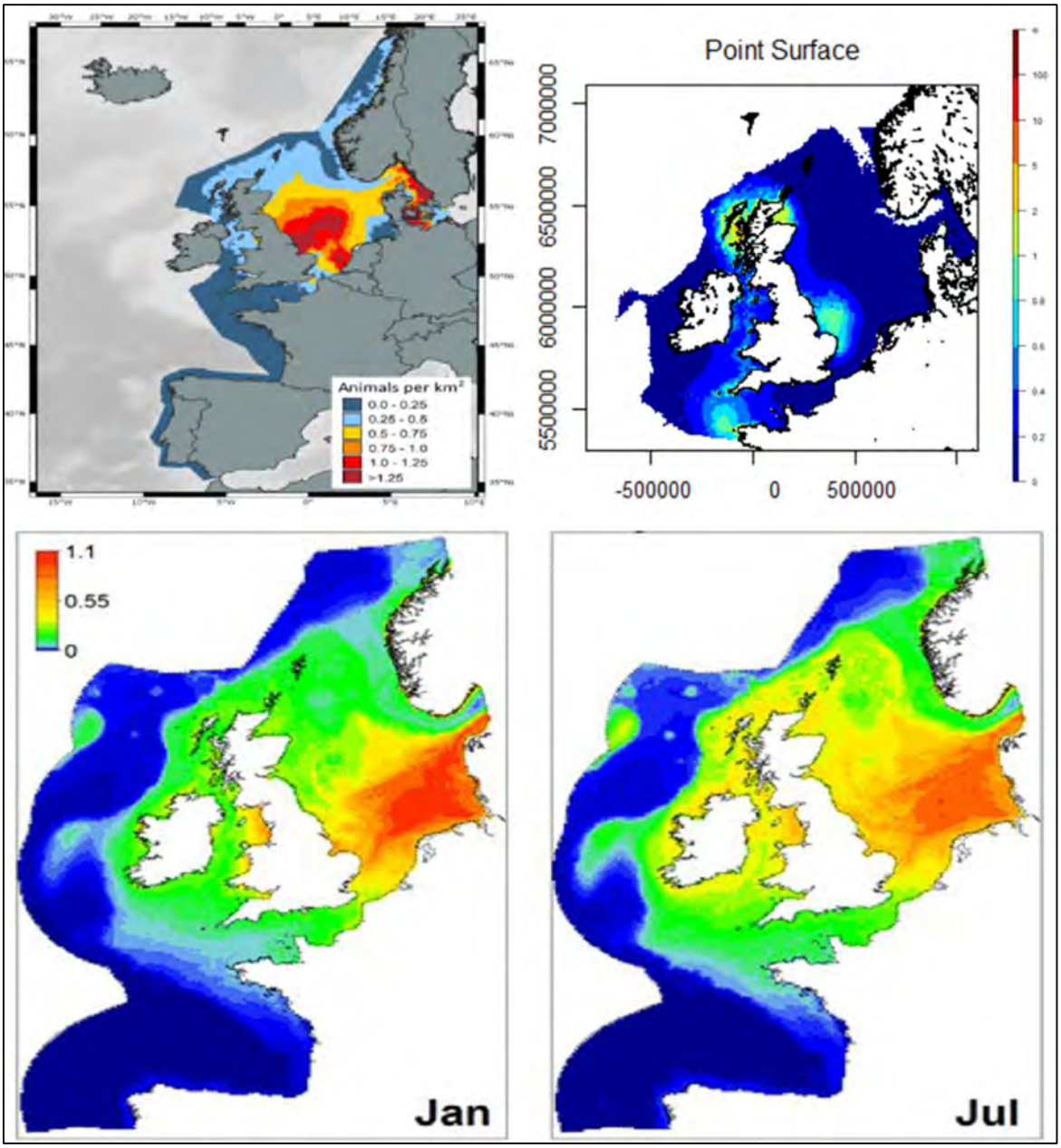


Figure 11-5: Top left: predicted surface for harbour porpoise in SCANS-III (2016) (Lacey *et al.*, 2022); top right: predicted harbour porpoise densities (animals/km^2) for summer 2008 – 2010 as point estimates of cell densities (Paxton *et al.*, 2016); bottom row: spatial variation in predicted densities of harbour porpoise (animals per km^2) in January (left) and July (right) in the North-East Atlantic (Waggitt *et al.*, 2020).

White-beaked dolphin

11.4.17 White-beaked dolphins are one of the most common cetacean species within the waters of the North Sea and are found within the waters off the coast of Scotland throughout the year, with the highest densities recorded in the summer months (Reid *et al.*, 2003, Hague *et al.*, 2020). In the UK, white-beaked dolphins have been assessed as having an Unknown Overall

Conservation Status (JNCC, 2019d). The population estimate for the CGNS MU based on SCANS III and Observe data is 43,951 individuals (95% CI: 28,439 – 67,924, CV: 0.22). The UK portion of this MU has an estimated abundance of 10,288 (95% CI: 6210 – 17,042, CV: 0.26) (IAMMWG, 2022).

11.4.18 White-beaked dolphin were sighted during six of the 17 months surveyed throughout the two site-specific aerial survey years, resulting in a total of 37 sightings. If sufficient sightings data are available to generate monthly density estimates and spatial distribution patterns for white-beaked dolphin from the site-specific aerial surveys, this will be provided within the baseline characterisation report submitted in support of an EIA (see Section 12.10). However, should this not be possible, density estimates shall be derived from pre-existing data sources such as the SCANS-III or IV data. The proposed development is in SCANS-III Block R where there was an estimated density of 0.243 white-beaked dolphin/km^2 in July 2016 (Hammond *et al.*, 2021).The abundance estimate for this block was 15,694 (95% CI: 3,022 – 33,340, CV: 0.484).

11.4.19 Figure 11-6 provides a visual representation of the density estimates of white-beaked dolphin for the UK based on the SCANS-III data (Lacey *et al.*, 2022), the Paxton *et al.* (2016) Revised Phase III Data report, and the Waggitt *et al.* (2020) paper.

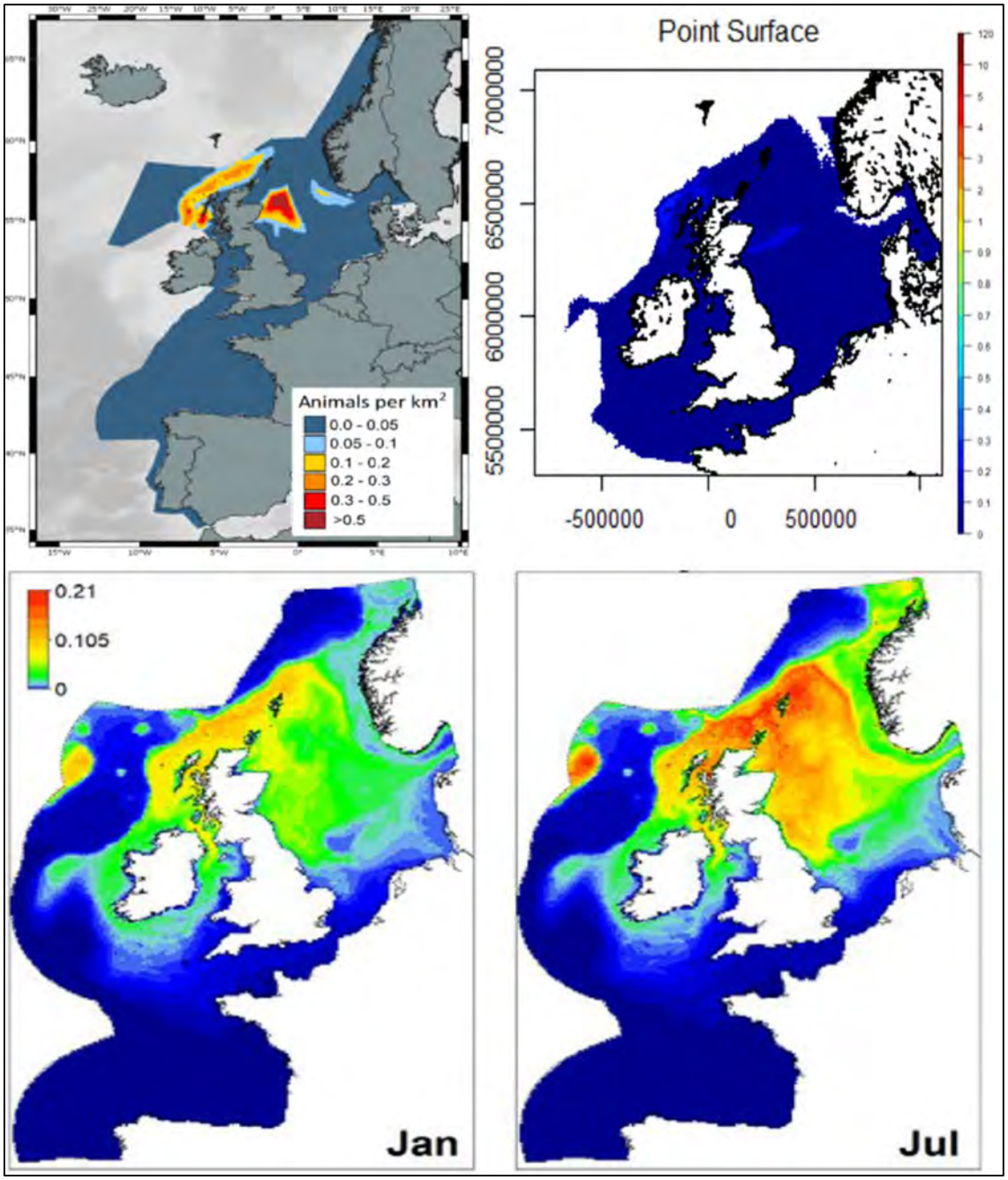


Figure 11-6: Top left: predicted surface white-beaked dolphins in SCANS-III (2016) (Lacey *et al.*, 2022); top right: predicted white-beaked dolphin densities (animals/km^2) for all summers (1994 – 2010) as point estimates of cell densities (Paxton *et al.*, 2016); bottom row: spatial variation in predicted densities of white-beaked dolphin (animals per km^2) in January (left) and July (right) in the North-East Atlantic (Waggitt *et al.*, 2020).

Risso's dolphin

11.4.20 The overall assessment of conservation status of Risso's dolphin in UK waters has been assessed as 'Unknown' Overall Conservation Status (JNCC, 2019c). The population estimate for the CGNS MU based on SCANS III and Observe data is 12,262 individuals (95% CI: 5,227 – 28,764, CV: 0.46). The UK portion of this MU has an estimated abundance of 8,687 (95% CI: 2,810 – 26,852, CV: 0.63) (IAMMWG, 2022).

11.4.21 Although this species is only occasionally or rarely present in wider North Sea, Risso's dolphins were identified four times during the two years of site-specific aerial surveys. It is unlikely that sufficient sightings data are available to generate monthly density estimates and spatial distribution patterns for Risso's dolphin from the site-specific aerial surveys. However, density estimates shall be derived from pre-existing data sources such as the Paxton *et al.* (2016) report or the upcoming SCANS-IV report, if possible. The proposed development is in SCANS-III Block R. No density estimate based on the SCANS-III data could be provided for Risso's dolphin within this block.

11.4.22 Figure 11-7 provides a visual representation of the density estimates of Risso's dolphin for the UK based on the Paxton *et al.* (2016) Revised Phase III Data report, and the Waggitt *et al.* (2020) paper. Risso's dolphin density estimates were not modelled from the SCANS-III data.

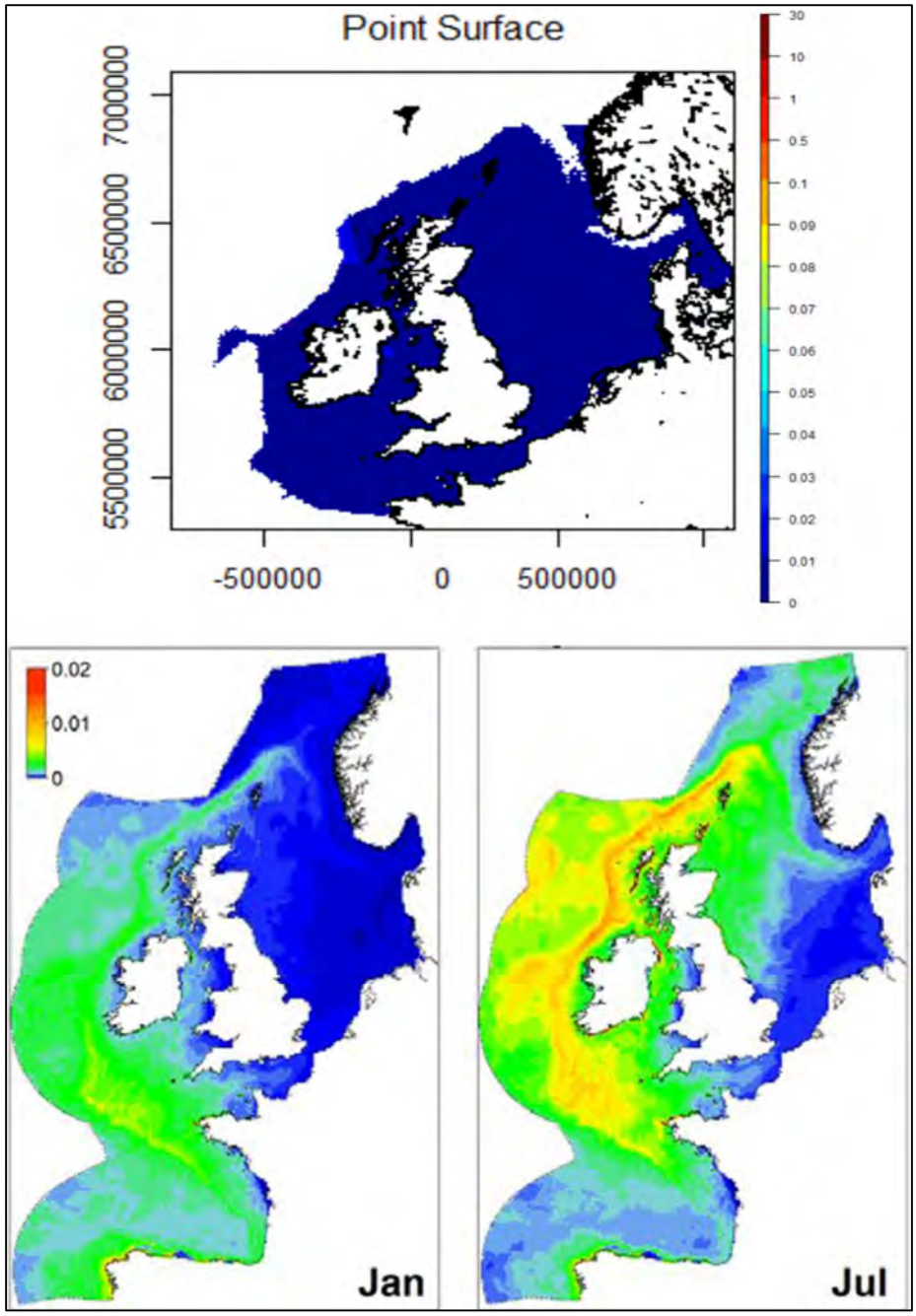


Figure 11-7: Top: predicted Risso's dolphin densities (animals/km^2) for all summers (1994 – 2010) as point estimates of cell densities (Paxton *et al.*, 2016); bottom row: spatial variation in predicted densities of Risso's dolphin (animals per km^2) in January (left) and July (right) in the North-East Atlantic (Waggitt *et al.*, 2020).

Pinnipeds

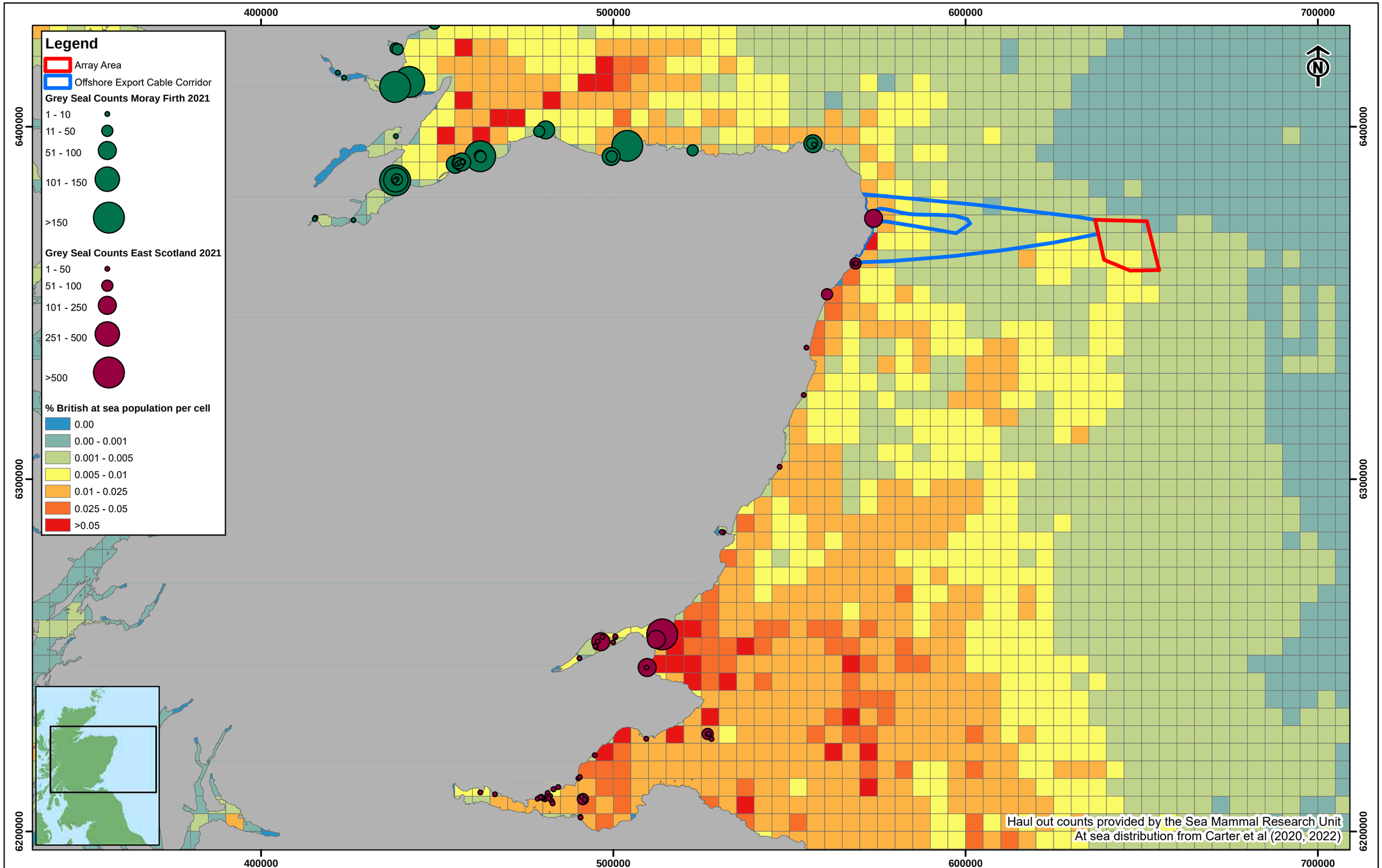
Grey seal

11.4.23 The overall assessment of conservation status of grey seals in UK waters has been assessed as 'Favourable' with an overall improving trend in conservation status and population modelling for regularly monitored grey seal breeding colonies across the UK show an increasing trend of 2% per annum (SCOS, 2022).

11.4.24 For grey seals in Scotland, many breeding sites which are monitored for pup production, are designated as SACs. The closest of these SACs to the proposed development area and designated for grey seals are the Isle of May SAC which is approximately 172 km away (SW of the array area, within the East Coast SMU), and the Berwickshire and North Northumberland Coast SAC, approximately 190 km away (SSW of the array area, within the East Scotland SMU). The Isle of May SAC had the largest east coast breeding colony of grey seals in Scotland and the fourth-largest breeding colony in the UK, contributing approximately 4.5% of annual UK pup production at the time of site selection (JNCC (2020b); (SAC designated circa 2005)). As of 2021, SCOS reported that pup production within the SAC appeared to be 'potentially declining' (SCOS, 2022). The Berwickshire and North Northumberland Coast SAC contains two large, discrete grey seal breeding populations with different histories and different recent dynamics, one located at the Farne Islands, the other at Fast Castle (SCOS, 2022). Overall pup production in the Berwickshire & North Northumberland Coast SAC is continuing to increase and between 2014 and 2019, pup production at the Berwickshire and North Northumberland Coast SAC had a mean estimated increase of 53% (SCOS, 2022).

11.4.25 As grey seals forage in the open sea and return regularly to haul out on land where they rest, moult and breed, they may range widely to forage. Tracking of individual grey seals has shown that most foraging probably occurs within 100 km of a haul out site although they can feed up to several hundred km offshore (SCOS, 2022). Carter *et al.* (2020) gives a maximum recorded distance from a haul-out as 448 km). Movements of grey seals between haul out sites in the North Sea and haul out sites in the Outer Hebrides have been recorded as well as movements from sites in Wales and NW France, to the Inner Hebrides (SCOS, 2022).The closest grey seal haul out site to the Muir Mhòr array area and ECC is the Ythan River Mouth, located approximately 60 km WSW of the array area and approximately 15 km south of the ECC at its closest point.

11.4.26 Grey seals were the most abundant pinniped sighted in the site-specific aerial surveys. They were sighted in 13 of the 17 months surveyed throughout the two survey years (resulting in a total of 44 sightings). As the most robust density estimates available for grey seals are presented in Carter *et al.* (2020), (2022), habitat-based predictions of at-sea distribution for grey seals based on these papers shall be provided within the baseline characterisation report. Figure 11-8 provides a visual representation of the average density estimates of grey seals (derived from Carter *et al.* (2020)) and SMRU grey seal counts on land for 2021. Each source of data covers the Moray Firth and East Scotland MUs.



This drawing/map has been produced to the latest known information at the time of issue. Please consult with the Vattenfall GIS team to ensure the content is still current before using the information contained on this map.

Muir Mhòr Offshore Wind Farm Ltd, The Tun Building 4 Jackson's Entry, Holyrood Road, No 4 EH8 8PJ Edinburgh United Kingdom

A	15/05/23	Drawn By JC	Checked By RRS	For issue

Datum	ETRS 1989
Projection	ETRS 1989 UTM Zone 30N
Plot	A3
Scale	1:1,000,000

0 6 12 18 24 30 km

MUIR MHÒR WIND FARM

Grey Seal Counts and % British at sea population per cell for the Moray Firth and East Scotland

Confidentiality Class	C1
Drg No	SMRUC-0004
Rev	A
Layout	NA

Figure 11.8

Ref files: ScopingGreySeals

Harbour seal

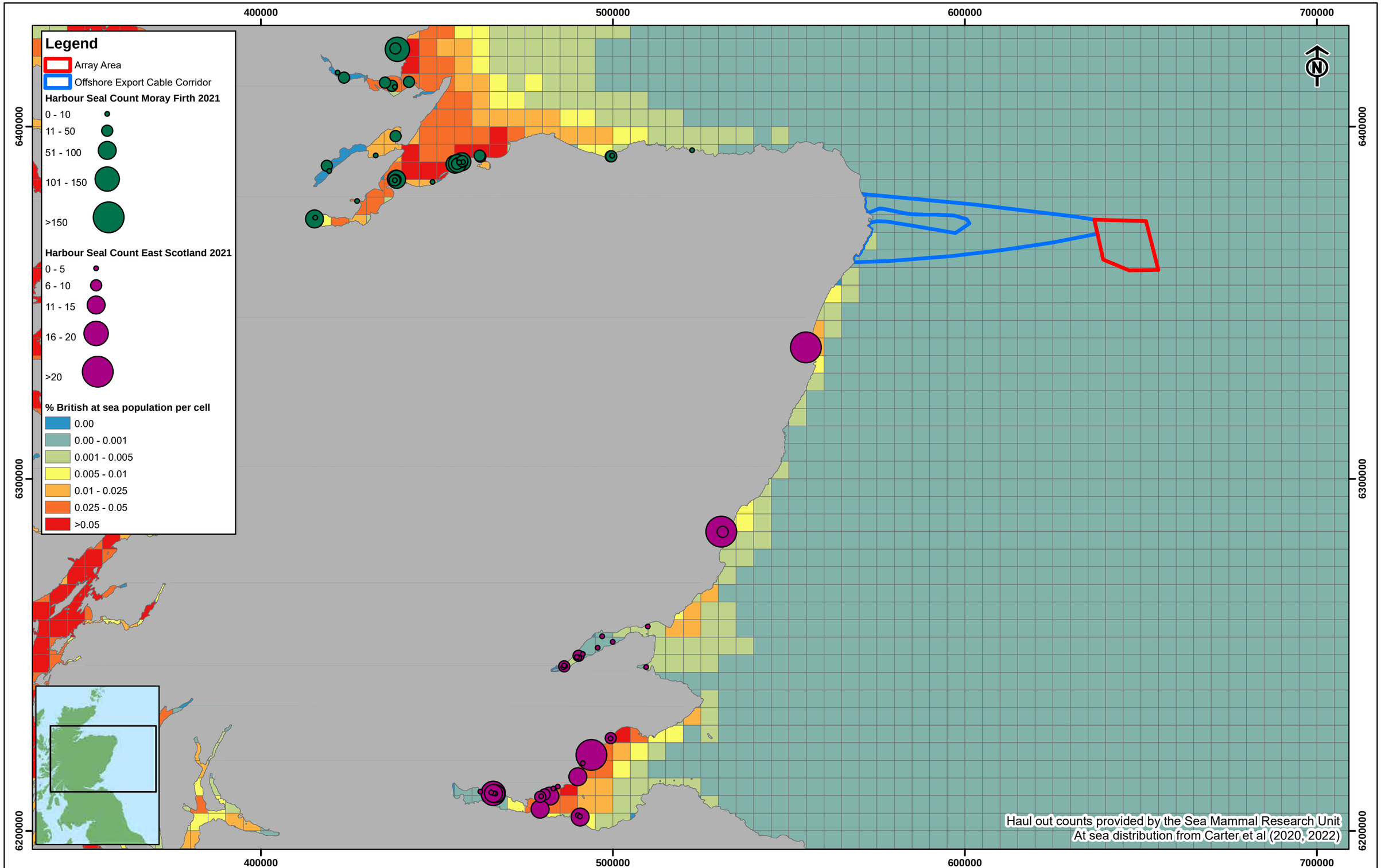
11.4.27 The overall Conservation Status of harbour seals in UK waters has been assessed as 'Unfavourable – Inadequate' with an unknown overall trend in Conservation Status (JNCC, 2013). For Scotland, harbour seal populations in the Moray Firth SMU are thought to be stabilising and/or beginning to see increases in numbers, after an initial decline in the early 2000's, whilst the East Scotland SMU could be seeing population decline (SCOS, 2022).

11.4.28 For harbour seals, many breeding sites, which are monitored for pup production, are designated as SACs. The closest of these SACs to the array area and ECC and designated for harbour seals are the Firth of Tay and Eden Estuary SAC, approximately 155 km away (SW, East Coast SMU), and the Dornoch Firth and Morrich More SAC, approximately 195 km away (WNW, Moray Firth SMU). The latest harbour seal counts for each of these SACs signifies a declining population within each SAC, although comparisons of the time series of harbour seals counted within SACs compared with numbers found within a 50 km range show that SACs are not reliable indicators of trends in the wider population (better represented by MU trends).

11.4.29 Seal tracking studies have indicated that harbour seal typically forage within 30-50 km from the coastline (Jones *et al.*, 2015), although longer travel distances do occur (e.g. Carter *et al.* (2020) gives a maximum recorded distance from a haul-out as 273 km).

11.4.30 Harbour seals were sighted far less frequently than grey seals in the site-specific aerial surveys. They were sighted in only four of the 17 months surveyed throughout the two survey years, totalling four sightings. As the most robust density estimates available for grey seals are presented in Carter *et al.* (2020), (2022), habitat-based predictions of at-sea distribution for harbour seals based on these papers shall be provided within any baseline characterisation report.

11.4.31 Figure 11-9 provides a visual representation of the average density estimates of harbour seals (derived from Carter *et al.* (2020)) and SMRU harbour seal counts on land for 2021. Each source of data covers the Moray Firth and East Scotland MU.



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Muir Mhòr Offshore Wind Farm Ltd, The Tun Building 4 Jackson's Entry, Holyrood Road, No 4 EH8 8PJ Edinburgh United Kingdom

A	15/05/23	Drawn By JC	Checked By RRS	For issue

Datum	ETRS 1989
Projection	ETRS 1989 UTM Zone 30N
Plot	A3
Scale	1:1,000,000

0 6 12 18 24 30 km

MUIR MHÒR WIND FARM

Harbour Seal Counts and % British at sea population per cell for the Moray Firth and East Scotland

Confidentiality Class	C1
Drg No	SMRUC-0004
Rev	A
Layout	NA

Figure 11.9

Ref files: ScopingHarbourSeals

Designated Sites

11.4.32 A HRA screening report shall be completed for the Muir Mhòr array area and ECC and shall include details of the sites (specifically SACs) designated for the protection of marine mammal receptors. The HRA shall identify which designated sites shall be screened into the proposed HRA for marine mammal species. However, as the HRA only considers Special Protected Areas (SPAs) and SACs, other marine mammal designations such as MPAs won't be given due consideration. As such, this section outlines all marine mammal designations within the assessment MUs for each marine mammal species. These are listed in Table 11-2.

Table 11-2: List of designated sites with relevance to the marine mammal MUs included in this scoping document chapter and the Muir Mhòr array area and ECC.

Species	Designated Site	Site Description and Summary
Harbour porpoise	Southern North Sea SAC	Approximately 221 km south of the Muir Mhòr array area and 243 km from the offshore ECC (by sea). The SAC lies along the east coast of England, predominantly in the offshore waters of the central and southern North Sea, from north of Dogger Bank to the Straits of Dover in the south. It covers an area of 36,951 km^2, designated for the protection of harbour porpoise
Minke whale	Southern Trench MPA	Approximately 30 km west of the Muir Mhòr array area (by sea). The ECC will overlap with the site.
Bottlenose dolphin	Moray Firth SAC	Approximately 158.5 km west of the Muir Mhòr array area and 102 km from the ECC (by sea). Site supports the only known resident bottlenose dolphin population in the North Sea, estimated at approximately 224 individuals.
Grey seal	Berwickshire and North Northumberland Coast SAC	Approximately 183 km SSW of the Muir Mhòr array area and 162 km from the ECC (by sea). It is the most south-easterly site selected for this species in Scotland and supports around 2.5% of annual UK pup production.
	Isle of May SAC	Approximately 175 km SW of the Muir Mhòr array area and 139.5 km from the ECC (by sea). The site is the largest east coast breeding colony of grey seals in Scotland and the fourth-largest breeding colony in the UK, contributing approximately 4.5% of annual UK pup production.
Harbour seal	Firth of Tay and Eden Estuary SAC	Approximately 157.5 km SW of the Muir Mhòr array area and 117 km from the ECC (by sea). Site initially designated as around 600 adults were identified to haul-out at the site to rest, pup and moult, representing around 2% of the UK population of this species – counts now in decline but could be attributed to redistribution of individuals.
	Dornoch Firth and Morrich More SAC	Approximately 203 km WNW of Muir Mhòr array area and 143 km from the ECC (by sea). Site initially designated for species as numbers represented almost 2% of the UK population – counts now in decline but could be attributed to redistribution of individuals.

11.5 Summary of Scoped-In Receptors

11.5.1 The key marine mammal receptors within the marine mammal study area are identified as follows:

- Minke whale (including the Southern Trench MPA);
- Bottlenose dolphin (including the Moray Firth SAC);
- Harbour porpoise (Southern North Sea SAC);
- White-beaked dolphin;
- Grey seal (including the Berwickshire and North Northumberland Coast and Isle of May SACs); and
- Harbour seal (including the Firth of Tay and Eden Estuary, and Dornoch Firth and Morrich More SACs).

11.6 Embedded Commitments

11.6.1 As part of the Project design process, a number of designed-in measures have been proposed to reduce the potential for impacts on marine mammal receptors. These are presented in Table 11-3 and in the Commitments Register (Appendix A) and will likely evolve over the development process as the EIA progresses and in response to stakeholder consultation.

Table 11-3: Embedded commitment measures of relevance to marine mammals.

Code	Commitment	Type (Primary, Secondary or Tertiary)	How Commitment Secured
C-02	Development of and adherence to a Cable Plan (CaP). The CaP will confirm planned cable routing, installation methods, cable specifications and any additional protection and requirement for any post-installation monitoring.	Tertiary	CaP
C-08	Development of and adherence to an EMP. This will set out mitigation measures and procedures relevant to environmental management, including but not limited to chemical usage, invasive and non-native species, pollution prevention and waste management.	Tertiary	EMP
C-10	Development of and adherence to a VMP. The VMP will confirm the anticipated types and numbers of vessels that will be engaged on the proposed development and consider vessel coordination including indicative transit route planning.	Tertiary	VMP
C-14	Development of and adherence to a PS (applicable where piling is undertaken). The PS will detail the method of pile installation and associated noise levels. It will describe any mitigation measures to be put in place (e.g., soft starts and ramp ups, use of Acoustic Deterrent Devices) during piling to manage the effects of underwater noise on sensitive receptors.	Tertiary	PS
C-15	Development of and adherence to MMMP. This will identify appropriate mitigation measures during offshore activities that are likely to produce underwater noise and vibration levels capable of potentially causing injury or disturbance to marine	Tertiary	MMMP

Code	Commitment	Type (Primary, Secondary or Tertiary)	How Commitment Secured
	mammals. This will be developed alongside the PS and referred to in EPS licence applications.		
C-29	Where practicable, cable burial will be the preferred means of cable protection. Cable burial will be informed by the CBRA and detailed within the CaP. In areas where CBRA deems burial not feasible, suitable implementation and monitoring of cable protection will be employed.	Primary	CaP
C-31	UXO hazards will be avoided where practicable and appropriate. If avoidance is not possible, decision making will relate to removal, with detonation considered if avoidance or removal is not possible. If detonation is required, and where practicable and appropriate, low-order deflagration will be the preferred method. Licencing of UXO clearance works will be subject to a standalone Marine Licence (and EPS licence) application. These applications will provide details of measures to minimising impacts on marine mammals where appropriate.	Tertiary	-
C-37	Development of and adherence to an Entanglement Management Plan to reduce the potential entanglement risk to marine life.	Tertiary	Entanglement Management Plan
C-40	Development of and adherence to a Wet Storage Plan (WSP) to provide details on requirements (if applicable) for assembled WTGs and cabling. WTGs to be held at a nearshore wet storage location before being transported to site.	Tertiary	WSP

11.6.2 As a result of the commitment to implement these measures, and to align the proposed development with various standard sectoral practices and procedures, the embedded mitigations are considered inherently part of the design of the proposed development and have therefore been included in the assessment presented in Section 11.7.

11.6.3 The requirement and feasibility of any additional mitigation measures will be dependent on the significance of the effects upon marine mammals and will be consulted upon with statutory consultees throughout the EIA process.

11.7 Scoping of Impacts

11.7.1 Table 11-4 sets out an initial assessment of the likelihood of effects on marine mammals due to Project activities for the scoping stage of the EIA process. The assessment is based on a combination of the following: the definition of the proposed development at the scoping stage; embedded commitments (as set out in Section 11.6, together with the means by which it will be secured); the level of understanding of the baseline at the scoping stage; the existing evidence base for marine mammal effects due to proposed development activities; relevant policy; and the professional judgement of qualified marine mammal specialists.

Table 11-4: Scoping assessment for marine mammals.

Impact Pathway	Embedded Commitments	Scoped In or Scoped Out	Justification
Construction & Decommissioning			
Noise related impacts associated with construction activities resulting in auditory injury (i.e., (PTS)), behavioural disturbance, and/or displacement of animals.	C-14, C-15, C31	Scoped In	Underwater noise associated with piling, UXO clearance, pre-construction geophysical surveys and other construction related activities (cable laying, dredging, trenching etc) all have the potential to have an impact on the behaviour, habitat use and distribution of marine mammals either at individual or population level. The impacts of underwater noise on marine mammals therefore require further consideration. This will also allow the embedded commitments, specifically the MMMP, to be appropriately informed and developed proportionate to the risks of underwater noise to marine mammal as a result of the construction of the proposed development. Within the ECC, specific consideration will be given to impacts on coastal species such as bottlenose dolphin, and to the Southern Trench NC MPA designated for minke whale.
Indirect impacts associated with construction resulting in marine mammal prey item disturbance and/or displacement.	Listed in Chapter 9: Fish and Shellfish Ecology.	Scoped In	Changes in prey abundance and distribution resulting from construction activities may impact on the ability of marine mammals to forage in the area. These impacts can arise from underwater noise emissions (i.e., during pile driving, UXO clearance, geophysical surveys etc) which cause disturbance to fish populations (as prey species of marine mammals). The scale of these impacts may depend on the number and size of piles required during construction, the number of UXO clearances required and/or the duration of geophysical survey activities.
Collision risk related impacts associated with increased vessel traffic in the proposed development area during construction.	C-10	Scoped Out	It is not expected that increased localised vessel traffic associated with the proposed development will increase the risk of collision to marine mammals. Vessel movements will be managed in a way that will mitigate the potential for collision risk to marine mammals, including: • Vessel activities will fall under standard transit speeds as outlined within the VMP; • Vessels will follow prescribed routes (non-random movement) as outlined within the VMP; and • Vessels shall also act in accordance with the guidelines set out within The Scottish Marine Wildlife Watching Code (SNH, 2017), to minimise collision risks with marine mammals.
Disturbance related impacts associated with increased vessel	C-10	Scoped In	Relatively high levels of vessel traffic (passenger, cargo, and other vessel activities) within the area form part of the existing baseline. Increased vessel traffic during construction may increase the risk of disturbance to marine mammals. Within the ECC, specific consideration will be given to impacts on

Impact Pathway	Embedded Commitments	Scoped In or Scoped Out	Justification
traffic in the array area and ECC during construction.			coastal species such as bottlenose dolphin, the Southern Trench NC MPA designated for minke whale, and seal haul-out sites.
Changes in water quality relating to various construction activities such as vessel movements and cable laying/trenching.	C-02, C-08, C-29 Other embedded commitments are listed in Chapter 7: Marine Water and Sediment Quality.	Scoped Out	Activities relating to the construction development may influence water quality as a result of sediment disturbance and the accidental release of fuels, oils and/or hydraulic fluids. These impacts are expected to be localised and short-lived. With regards to the accidental release of fuels, oils and/or hydraulic fluids, the impact of pollution is associated with the construction of infrastructure and use of supply/service vessels may lead to direct mortality of marine mammals or a reduction in prey availability either of which may affect species' survival rates. However, with implementation of an appropriate PEMP and a Marine Pollution Contingency Plan (MPCP), a major incident that may impact any species at a population level is considered very unlikely. When considering sediment disturbance, marine mammals often migrate through waters where conditions are turbid for extended periods without significant impacts to species biology or behaviour. Evidence that turbidity affects cetaceans directly is not evident in the literature (Todd *et al.*, 2015) and pinnipeds often live in dark and turbid waters, where their mystacial vibrissae, or whiskers, play an important role in orientation, discriminating objects by direct touch, or to analyse water movements (Hanke *et al.*, 2010). Any impact is of sediment suspension is therefore predicted to be of local spatial extent, short-term duration, intermittent frequency and reversible, within the context of regional and localised marine mammal populations and therefore not significant in terms of the EIA.
Disturbance and/or displacement from wet storage activities	C-40	Scoped In	There is the potential for marine mammals to be disturbed and displaced by anthropogenic activities and the presence of anthropogenic objects associated with wet storage.
Operation & Maintenance			
Noise related impacts associated with the O&M of floating WTGs.	-	Scoped In	Existing evidence suggests that operational noise associated with the development is likely to be considerably less than construction noise and will be detectable by marine mammals. Based on the location of the array area and the ambient noise generated from local fishing and shipping activities, the O&M of the proposed development is not likely to surpass existing ambient noise. However, due to the early stage of floating offshore wind technology and limited existing monitoring data of noise from operational floating wind farms, this impact has been scoped in.

Impact Pathway	Embedded Commitments	Scoped In or Scoped Out	Justification
Indirect impacts associated with the O&M of floating WTGs resulting in marine mammal prey item disturbance and/or displacement.	-	Scoped In	The effects of operational noise of floating WTGs are not likely to generate significant levels of noise that would result in disturbance of migratory or sensitive fish species (as prey species of marine mammals). Based on the location of the array area and the ambient noise generated from local fishing and shipping activities, the O&M of the proposed development is not likely to surpass existing ambient noise. However, due to the early stage of floating offshore wind technology and limited existing monitoring data of noise from operational floating wind farms, this impact has been scoped in.
Risk of injury resulting from entanglement of marine mammals within mooring lines or cables of WTGs, and the secondary interactions with derelict fishing gears wrapped around WTG mooring lines.	C-37	Scoped In	The effects of marine renewable energy mooring devices on marine mammals are poorly understood. It is predicted that the introduction of dynamic lines or cables introduces a potential entanglement risk and could increase the risk of derelict fishing gear items from being entangled within mooring systems. Further consideration needs to be given to the risk of injury resulting from entanglement of marine mammals with mooring lines, cables and attached derelict gear.
Risk of injury resulting from collision of marine mammals with WTG structures.	-	Scoped In	Although a semi-submersible or tension leg platform WTG structures are being proposed, the floating substructure is still to be defined. Designs with the greatest total submerged volumes (such as semi-submersible) are more likely to generate a collision risk with marine mammals. Collision risk with floating structures is poorly understood and further consideration of the potential risks is recommended.
Disturbance related impacts associated with increased vessel traffic in the array area and ECC during O&M.	C-10	Scoped Out	The small number of vessels required for O&M activities is unlikely to generate an increase in disturbance against the existing baseline of shipping activity. The development and implementation of a VMP shall help minimise impacts of disturbance to negligible levels.
Collision risk related impacts associated with increased vessel traffic in the array area and ECC during O&M.	C-10	Scoped Out	The small number of vessels required for O&M activities is unlikely to generate an increase in collision risk against the existing baseline of shipping activity. The development and implementation of a VMP shall help minimise risks of marine mammal-vessel collisions to negligible levels.
Changes in water quality relating to accidental release of pollutants.	C-08	Scoped Out	The accidental release of pollutants is limited to oils and fluids contained within the WTGs and vessels. The potential for full inventory release from a turbine is considered extremely remote and would occur as a slow release, which would be almost undetectable and immediately dispersed, limiting the

Impact Pathway	Embedded Commitments	Scoped In or Scoped Out	Justification
			potential interactions between pollutants and marine mammals. For these reasons, localised, temporary changes to water quality will not have a significant impact on marine mammals.
Impacts on marine mammals from electromagnetic fields (EMF) due to presence of subsea cabling.	-	Scoped Out	EMFs are emitted along the lengths of subsea cables and can have behavioural and psychological effects on sensitive marine mammals and megafauna species. Existing evidence suggests that the levels of EMFs emitted by offshore renewable energy export cables are at a level low enough that there is no potential for direct significant impacts on marine mammals (Copping and Hemery, 2020).
Impacts on marine mammal prey items from EMF due to presence of subsea cabling.	-	Scoped In	Potential EMF impacts on prey species may impact foraging success for marine mammals. EMF impacts on the potential prey items of marine mammals shall also be covered in the Fish and Shellfish Ecology, and Benthic Ecology chapters of any EIA.
Long term habitat changes, displacement and/or barrier effects due to presence of WTGs within the array area. This includes the potential for changes in future foraging opportunities.	-	Scoped In	The introduction of new infrastructure into the marine environment can potentially result in displacement or exclusion from habitats. This impact will require further consideration as this impact pathway is poorly understood for offshore floating renewable energy developments. In addition, changes in prey abundance and distribution may occur due to offshore windfarm infrastructure.

11.8 Potential Cumulative Impacts

11.8.1 Chapter 4 (EIA Methodology) details how potential cumulative impacts will be assessed through a CIA and gives examples of the projects which are likely to be included in that assessment. For marine mammals, cumulative interactions may occur with other planned OWFs, as well as other activities in the study area.

11.8.2 The most significant cumulative impact on marine mammal species is likely to be underwater noise associated with construction activities. For marine mammals the approach to CIA will be holistic and combine all potential sources of underwater noise including UXO clearance and pile driving at other OWFs together with disturbance from vessels, seismic surveys and any other offshore construction developments that are planned within the relevant MUs for each species.

11.8.3 For each relevant project, the cumulative assessment will present the number of animals which may be impacted on any one day, based on reported levels of impacts in published EIAs where available or on various assumptions relating to impact footprints and animal densities. For each year where the construction of offshore projects are planned, the maximum number animals impacted on any one day (assuming concurrent activity) will be presented as a proportion of the relevant MU.

11.8.4 The CIA for marine mammals will consider the maximum adverse design scenario for each of the projects, plans and activities in line with the methodology outlined in Chapter 4 (EIA Methodology). The impacts of fishing and shipping will not be considered in the CIA since these activities occurred throughout the baseline and are therefore already accounted for in the existing marine mammal baseline characterisation abundance and density estimates.

11.9 Potential Transboundary Effects

11.9.1 Potential marine mammal transboundary impacts will be assessed considering the populations and species that are likely to be impacted and their potential linkage to designated sites and protected areas.

11.9.2 Direct impacts may occur due to underwater noise generated during construction and decommissioning, particularly piling during the installation of foundations. Indirect impacts may cause disturbance to prey (fish) species from loss of fish spawning and nursery habitat and suspended sediments and deposition. The O&M phase is considered less likely to result in significant transboundary impacts.

11.9.3 The probability of transboundary impacts to marine mammals occurring during construction, particularly due to underwater noise from piling is potentially high. However, with the recent rise in floating wind technologies, the extent cannot be determined at this stage and will be subject to assessment in the EIA.

11.9.4 In producing a standalone HRA report, the risk of transboundary impacts with the potential to affect the integrity of transboundary European designated sites will be assessed and presented.

11.10 Proposed Approach to EIA

Guidance

11.10.1 In addition to the general approach and guidance outlined in Chapter 4 (EIA Methodology), the assessment of marine mammal receptors will also comply with the following guidance documents where they are specific to this topic:

- IEEM guidelines for marine and coastal ecological impact assessment in Britain and Ireland (IEEM, 2010, CIEEM, 2019);
- European Union Guidance on wind energy developments and Natura 2000 legislation (European Commission, 2021)
- OSPAR Guidance on Environmental Considerations for Offshore Wind Farm Development (OSPAR, 2008);
- The marine mammal PTS-onset noise exposure criteria recommended in Southall *et al.* (2019);
- Position statement from the Joint Statutory Nature Conservation Bodies in relation to the use of Acoustic Deterrent Devices (ADDs) for marine mammal mitigation during offshore wind farm construction (JNCC, 2016);
- Guidance on mitigation protocols to minimise the risk of injury to marine mammals from piling noise (JNCC, 2010b)
- Scottish Marine Wildlife Watching Code (SNH, 2017);
- JNCC guidelines for minimising the risk of injury to marine mammals from geophysical surveys (seismic survey guidelines) (JNCC, 2017);
- JNCC guidelines for minimising the risk of disturbance and injury to marine mammals whilst using explosives (JNCC, 2010a); and
- Guidance on the Offence of Harassment at Seal Haul-Out Sites (Marine Scotland, 2014).

Additional data sources

11.10.2 A detailed literature review will be developed for the baseline characterisation in support of the EIA, building upon the data sources listed in Table 11-1 and Section 11.3. Project-specific survey outputs will be used to enhance the understanding of the baseline conditions. Additional data sources include the following:

- The latest available results from the site-specific digital aerial surveys will be fully processed to obtain absolute density estimates (where sightings data allow) and summary information on effort and environmental conditions encountered during the surveys, monthly sighting rates and (where possible) design-based abundance estimates of marine mammals will be provided. Where appropriate, abundance and density estimates will be apportioned to account for any species identified to group level, and, where possible, corrected to account for availability bias. Spatial distribution patterns within the array area will also be provided where sightings data allow; and
- An assessment of the most up-to-date and appropriate density estimates to be carried forward to quantitative impact assessment (i.e., SCANS-IV Report, the SCOS Annual Report (both anticipated to be published in 2023) and Paxton *et al.* (in-preparation) 'Analyses relating to the abundance and distribution of selected marine mobile species in Scottish territorial waters', (when these reports are available in the public domain).

Assessment Methodology

Underwater Noise Modelling

11.10.3 Modelling of underwater noise across the proposed development area will be undertaken for all potential noise sources. This will be used to determine the potential risk of physical injury, disturbance/ displacement effects caused by underwater noise.

11.10.4 Noise modelling will be undertaken to quantitatively assess the risk of PTS to marine mammals and disturbance effects using Temporary Threshold Shift (TTS-onset) as a proxy.

11.10.5 For the assessment of pile-driving noise (i.e., pile driven anchors), the INSPIRE underwater noise model will be used. INSPIRE is a range dependent, semi-empirical broadband noise propagation model developed by Subacoustech Environmental Limited, which has been updated and refined over ten years using empirical data from hundreds of datasets from field studies. The model considers a wide array of input parameters and has the capability to simultaneously model piling from multiple piling events to enable the assessment of events in combination. Two underwater noise modelling locations will be selected to be precautionary in terms of the maximum potential impacts to key sensitivities. These methods will be fully described in the underwater noise technical report as part of the EIA, supported by the underwater noise modelling and analysis.

11.10.6 The impact assessment of the risk of auditory injury (PTS-onset) to all species scoped in as a result of UXO clearance operations will include an assessment for both high-order detonations and low-order detonations, whilst aligning with recent recommendations and position statements on UXO clearance for similar OWF developments in the area.

11.10.7 For the assessment of non-impulsive, continuous noise sources such as vessel noise, dredging, trenching, rock placement etc, the SPEAR model will be used. SPEAR is a simple geometric spreading model that uses measured source level data to predict impact ranges.

11.10.8 Outputs from the noise modelling will be combined with marine mammal density information to quantify the number of marine mammals that are likely to be impacted by the proposed development. The numbers of animals impacted will be presented as proportions of the relevant MUs (entire MU and UK portion).

Assessment of PTS using Southall *et al.* 2019 Criteria

11.10.9 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 PTS. The risk of injury will be based on dual criteria: cumulative sound exposure level (SEL_{cum}) and peak sound pressure level (SPL_{peak}). To assess the SEL_{cum} criterion, the predictions of received sound level over 24 hours are frequency weighted, to reflect the hearing sensitivity of each functional hearing group. The SEL_{cum} from multiple pulses will be assessed using a fleeing animal model using indicative swim speeds. The SPL_{peak} criterion is for unweighted received sound level. If required, population level modelling will be conducted using the Interim Population Consequences of Disturbance (iPCoD) Model (King *et al.*, 2015).

Assessment of Disturbance – UXO

11.10.10 If required, UXO clearance will be undertaken as part of a separate Marine Licence (and EPS licence) application. At both the scoping and EIAR stage, the number and size of any UXO that may require clearance is unknown. The EIAR will present an indicative worst-case scenario for number of UXO and charge size, based on knowledge gained from previous UXO surveys for other developments in the North Sea region.

11.10.11 The current guidance (JNCC, 2020a) is to assume a 26 km Effective Deterrence Range (EDR) from high-order UXO clearance for harbour porpoise when assessing potential disturbance in harbour porpoise SACs. However, this EDR is not based on any empirical evidence of disturbance responses to UXO clearance (instead, extrapolated from evidence for pie-driving) and no EDRs have been proposed for other species of marine mammal (and other megafauna); as such, the modelled extent of TTS-onset threshold noise levels outlined by Southall *et al.* (2019) will be used as a proxy for disturbance. Disturbance from low-order UXO clearance will also be assessed using TTS-onset thresholds for worst-case low-order deflagration donor charge sizes, and also an EDR of 5 km (as used in recent consent applications for offshore wind projects in the Southern North Sea).

Assessment of Disturbance - Piling

11.10.12 The assessment of piling disturbance will be based on the best practice methodology at the time of assessment, making use of the best available scientific evidence. It is likely, based on current practice, that the methodology will incorporate the application of a species-specific dose response approach rather than a fixed behavioural threshold approach. The current piling dose-response functions available are: Graham *et al.* (2017) for harbour porpoise at the Beatrice OWF, and Whyte *et al.* (2020) for harbour seals at the Lincs OWF. Where species specific dose-response functions are not available, the existing ones will be used as a proxy. These functions provide estimates of the proportion of individuals disturbed when exposed to different levels of noise (unweighted SEL for single strikes, in 5 dB increments). Noise contours at appropriate intervals will be generated by noise modelling and overlain on species density surfaces to predict the number of animals potentially disturbed. This will allow the quantification of the number of animals that potentially respond. If required (for example, if the assessment concludes a potentially significant impact), population level modelling will be conducted using the iPCoD model to determine if the impact is sufficient to result in changes at the population level.

Assessment of Vessel Collision and Disturbance

11.10.13 Assessments made on the impacts of vessel collisions with marine mammals and vessel disturbance will be based on the most up-to-date scientific evidence on the effect of construction, O&M and decommissioning vessels on marine mammals. For example, an assessment of vessel disturbance on marine mammals will be made drawing on the results of studies of harbour porpoise responses to construction vessel traffic by Benhemma-Le Gall *et al.* (2021), whilst the sensitivity of each species to vessel collision may be drawn from reports published by the UK Cetaceans Strandings Investigation Programme or the Scottish Marine Animal Stranding Scheme.

Assessment of Disturbance from Other Construction Activities and Operations

11.10.14 For other construction and pre-construction activities, an assessment of the risk of disturbance will be based on the best available information on noise levels for each activity, alongside any available evidence of disturbance impacts provided in the literature.

11.10.15 For operational noise, an assessment of the risk of disturbance will be based on the best available information on noise levels from floating wind turbines (e.g., Hywind Scotland, Kincardine). Consideration will be given to assessing the acoustic footprint of multiple WTGs within the array.

11.10.16 In the assessment of disturbance from other construction activities and operations, detailed consideration shall be given to areas of uncertainty, the degrees of conservatism in the assessment of noise impacts to marine mammals, and their implications for the assessment.

Other Impacts

11.10.17 The assessment of potential impacts other than underwater noise (e.g., entanglement, long-term habitats change) will be qualitative and based on the best available evidence of these impact pathways considered alongside the proposed development's design envelope, location and species scoped in. Assessments will be made based on the literature available at the time, such as Benjamins *et al.* (2014).

11.10.18 European sites designated for the conservation of marine mammal features (SACs) will be considered within the HRA or 'Report to Inform Appropriate Assessment (RIAA)' which will be completed alongside the EIAR. As the HRA/RIAA will only include SACs and SPAs, the EIAR chapter will provide an assessment of the potential impacts of the development on the minke whale feature of the Southern Trench MPA.

11.11 Scoping Questions

11.11.1 The following questions are designed to focus the marine mammals scoping exercise and inform the Scoping Opinion:

- Do you agree with the study area(s) defined in Section 11.3 for the analysis of predicted impacts on marine mammals?
- Do you agree with the use of those data listed Table 11-1 and any additional anticipated data listed in Section 11.10 being used to inform the Offshore EIA?
- Are there any additional data sources or guidance documents that should be considered?
- Do you agree that all receptors related to marine mammals have been identified?
- Do you agree with the suggested embedded commitments considered and the approach to mitigation identified in relation to marine mammals?
- Do you agree with the scoping in and out of impact pathways in relation to marine mammals?
- Do you agree with the assessment of the potential for transboundary effects in relation to marine mammals?
- Do you agree with the assessment of the proposed approach to cumulative effects in relation to marine mammals?
- Do you agree with the proposed impact assessment methodology, in particular, the underwater noise impact assessment, for marine mammals?

12 Commercial Fisheries

12.1 Introduction

12.1.1 This chapter of the Offshore Scoping Report identifies the commercial fisheries receptors of relevance to the proposed development and considers the potential impacts from the construction, O&M and decommissioning of the proposed development on commercial fisheries.

12.1.2 For this report, 'commercial fishing' is defined as any form of fishing activity legally undertaken where the catch is sold for taxable profit.

12.1.3 This chapter should be read alongside the following other chapters:

- Chapter 9: Fish and Shellfish Ecology, which includes consideration of potential impacts on species of commercial importance;
- Chapter 13: Shipping and Navigation, which includes consideration of potential impacts on vessel routing and navigational safety; and
- Chapter17: Socio-Economics, Tourism and Recreation, which includes consideration of potential impacts on recreational sea angling.

12.1.4 This chapter of the Offshore Scoping Report has been prepared by Poseidon Aquatic Resource Management Ltd.

12.2 Study Area

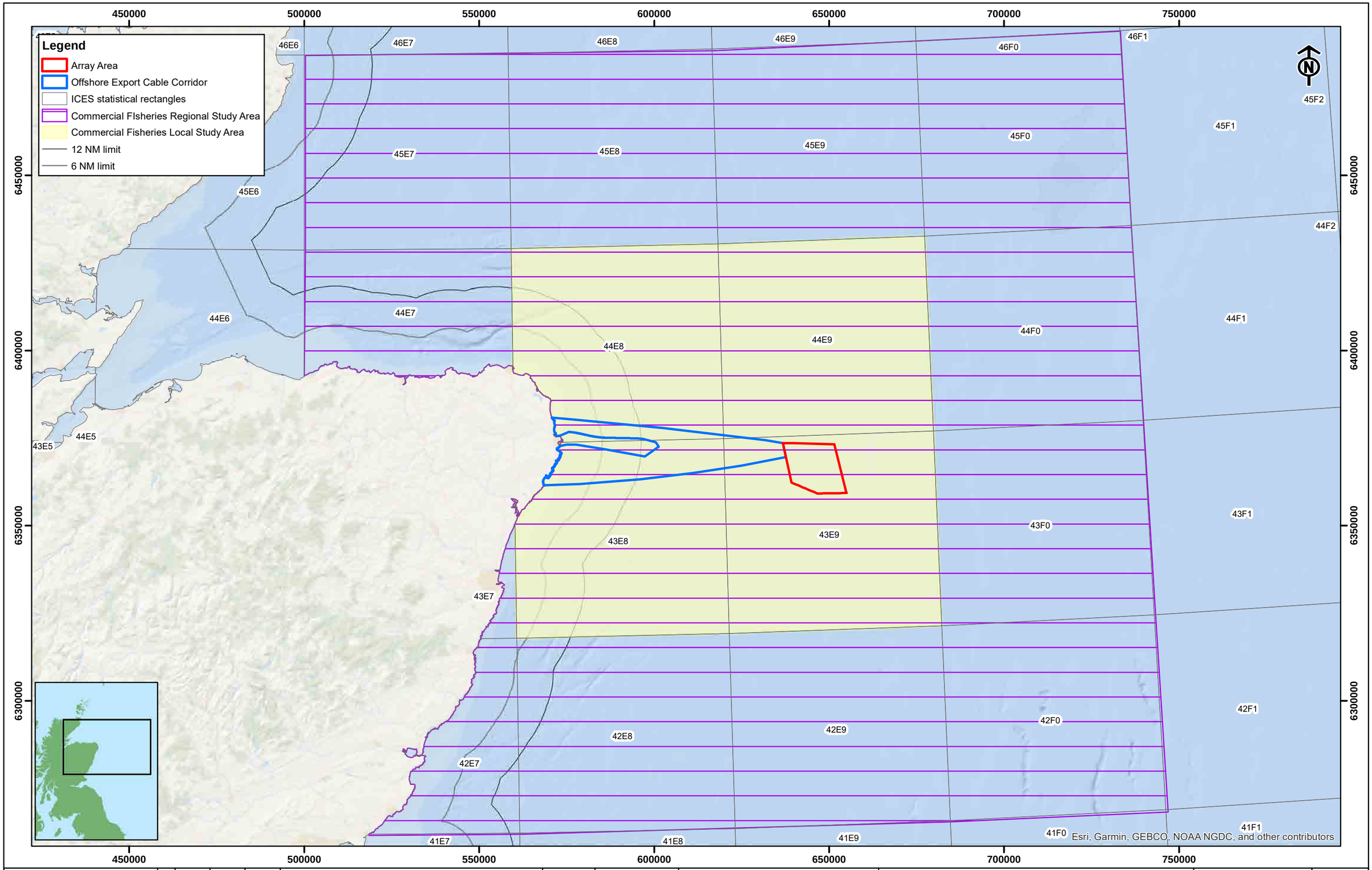
12.2.1 The proposed development is located within the southern portion of the ICES Division 4a (northern North Sea) and northern portion of ICES Division 4b (central North Sea) statistical areas; within UK EEZ waters. For the purpose of recording commercial fisheries landings, ICES Divisions 4a and 4b are divided into statistical rectangles, of which the proposed development overlaps with 43E8, 43E9, 44E8 and 44E9. For the purposes of this Offshore Scoping Report, the local commercial fisheries study area comprises these four ICES rectangles.

12.2.2 While the local study area illustrated in Figure 12-1 focuses on the proposed development overlap with ICES rectangles, a wider regional area will be considered for potential fisheries displacement impacts within the EIAR. It is proposed that the regional study area will also include those twelve ICES rectangles immediately adjacent to the commercial fisheries study area as shown in Figure 12-1.

12.3 Baseline Environment

Data Sources

12.3.1 The data sources that have been used to inform the commercial fisheries chapter of the Offshore Scoping Report are presented within Table 12-1. These data sources will be taken forward and used to inform the EIA.



This drawing/map has been produced to the latest known information at the time of issue. Please consult with the Vattenfall GIS team to ensure the content is still current before using the information contained on this map.

MUIR MHÒR OFFSHORE WIND FARM

A joint venture between Fred.Olsen Seawind & Vattenfall

Muir Mhòr Offshore Wind Farm Ltd, The Tun Building 4 Jackson's Entry, Holyrood Road, No 4 EH8 8PJ Edinburgh United Kingdom

Rev	Date	Drawn By	Checked By	Comment
A	09/05/23	FN	LK	First Issue

Datum	ETRS 1989
Projection	ETRS 1989 UTM Zone 30N
Plot	A3
Scale	1:1,000,000

0 6 12 18 24 30 km

MUIR MHÒR WIND FARM

Commercial Fisheries Local and Regional Study Areas

Confidentiality Class	C1
Drg No	POSE-0001
Rev	A
Layout	NA

Figure 12.1

Ref files: MMH_A3_CF_StudyArea_12.1

Table 12-1: Key sources of commercial fisheries data.

Source, Author and Year	Summary	Coverage of Muir Mhòr array area and ECC
UK annual fisheries landings statistics Marine Management Organisation (MMO), 2017 to 2021 (MMO, 2023a)	Fisheries landings data for registered fishing vessels landing to their home nation ports.	UK national dataset providing full coverage of the commercial fisheries study areas.
UK Vessel Monitoring System (VMS) data MMO, 2020 (MMO, 2023b)	VMS data for UK fishing vessels greater than 15 m in length, including vessels registered in Scotland, England, Northern Ireland, Wales and Isle of Man. Note that UK vessels ≥12 m in length have VMS on board, however, to date, the MMO provide amalgamated VMS datasets for ≥15 m vessels only. VMS data sourced from MMO displays the first sales value (£) of catches. Note that the most recent data has been presented in this Offshore Scoping Report, but that longer term datasets will be analysed within the EIAR.	UK national dataset providing full coverage of the commercial fisheries study areas.
EU annual fisheries landings statistics Scientific, Technical and Economic Committee for Fisheries (STECF), 2004 to 2016 (EU DCF, 2020)	Fisheries landings data for registered fishing vessels landing to their home nation ports.	European-wide dataset providing full coverage of the commercial fisheries study areas.
EU VMS data ICES, 2016 to 2020 (ICES, 2022)	VMS data for fishing vessels greater than 12 m in length. VMS data sourced from ICES displays the surface Swept Area Ratio of catches by different gear types and covers EU (including UK) registered vessels 12 m and over in length. Surface Swept Area Ratio indicates the number of times in an annual period that a demersal fishing gear makes contact with (or sweeps) the seabed surface. Surface Swept Area Ratio provides a proxy for fishing intensity.	European-wide dataset providing full coverage of the commercial fisheries study areas.
Fisheries datasets	Fisheries datasets available from the Marine Scotland MAPS NMPi, including ScotMap data.	Varying spatial coverage, in most cases providing full coverage of the commercial fisheries study areas.

Source, Author and Year	Summary	Coverage of Muir Mhòr array area and ECC
NMPi), various publication dates (Marine Scotland MAPS NMPI, 2023)		
Fishing vessel route density data European Maritime Safety Agency (EMSA, 2023)	Fishing vessel route density, based on vessel Automatic Information System (AIS) positional data. AIS is required to be fitted on fishing vessels ≥15 m length. Note that the most recent data has been presented in this Scoping Report, but that longer term datasets will be analysed within the EIAR.	European-wide dataset providing full coverage of the commercial fisheries study areas.
Key species stock assessments ICES and Marine Scotland, various publication dates	Assessments of the status of commercially targeted fish and shellfish stocks.	Varying spatial coverage, in most cases providing full coverage of the commercial fisheries study areas.
Sectoral Marine Plan (Scottish Government, 2020)	Description of regional commercial fisheries activity.	Covering Plan Option Area E2 and therefore providing full coverage of the commercial fisheries study areas.
Fisheries activity mapping in the North and East Coast Regional Inshore Fisheries Group (RIFG) area (North Atlantic Fisheries College (NAFC) Marine Centre University of Highlands and Islands (UHI), 2021)	Mapping of fishing activity and critical habitats of key species within 12 nautical miles (nm) of the coast in the North and East Coast RIFG area.	Covers the North and East Coast RIFG area, inclusive of part of the commercial fisheries local study area (ICES rectangles 43E8 and 44E8).

12.3.2 It should be noted that the quantitative datasets identified in Table 12-1 may not capture all commercial fisheries activity in the commercial fisheries study areas. For instance, the VMS datasets only covers vessels ≥12 m (ICES data) or ≥15 m (MMO data) in length. Note that UK vessels ≥12 m in length have VMS on board, however, to date, the MMO provide amalgamated VMS datasets for ≥15 m vessels only.

12.3.3 However, in addition to VMS data, other published data does provide a useful insight into commercial fisheries activity undertaken in inshore areas (e.g., ScotMap inshore fisheries mapping) and consultation with fisheries stakeholders and industry is expected to further inform assessment in the EIAR.

12.3.4 Consultation with representatives of fishermen's associations and organisations will be undertaken to seek to corroborate the findings of desk-based baseline data analysis and to provide insight into specific fishing grounds and activity of any vessels active in the area. Consultation will also be important to inform gear specifications for vessels active in the area, which will allow a full understanding of how different vessels and different gear configurations may be affected.

12.3.5 Variations and trends in commercial fisheries activity are an important aspect of the baseline assessment and is the principal reason for considering up to five years of key baseline data. Given the time periods considered in this scoping exercise (i.e., 2017 to 2021), existing baseline data may to some extent capture potential changes in commercial fisheries activity resulting from the COVID-19 pandemic, which is understood to have temporarily affected market demand and supply chains. However, changes in fishing patterns resulting from the withdrawal of the UK from the EU would be expected in future data sets, which include data for 2021 onwards. Long term environmental and climatic changes may be expected to be detectable within the five-year time series but may benefit from longer-term analysis dependant on the target species (for example, where king scallop (*Pecten maximus*) are a relevant target species, analysis of landings across a seven to ten-year period is proposed to capture the cyclical nature of their productivity and associated fishery). Inclusion of such longer-term analysis will be informed by stakeholder consultation.

12.4 Description of Baseline Environment

12.4.1 Landings by UK-registered vessels from the commercial fisheries local study area (ICES rectangles 43E8, 43E9, 44E8 and 44E9) had an annual average landings value of approximately £13.4 million across the years 2017 to 2021 (MMO, 2023a, with landings values peaking in 2017 at £15.8 million and being at their lowest in 2020 at £11 million (likely due to a combination of COVID-19 restrictions and the UK EU-exit). Landings from ICES rectangles 44E8 and 44E9, north of the Muir Mhòr array area, accounted for approximately 38% and 37% of the total value of landings from the local study area respectively. Over the same time period, the annual average weight of landings from the study area was approximately 8,400 tonnes, peaking at approximately 10,000 tonnes in 2017.

12.4.2 Landings of shellfish dominated, accounting for 53% of the total landings value (based on data from MMO, 2023a. Landings of demersal fish species accounted for 33% of the total landings value, and pelagic fish species for 14%. Scottish vessels were responsible for the majority (84%) of landings, with landings also being made by vessels registered in England and to a much lesser extent vessels registered in Northern Ireland. The main landing ports local to the proposed development include (but are not limited to) Peterhead, Fraserburgh, and Lerwick.

12.4.3 Figure 12-2 and Figure 12-3 show the top 12 species landed from the Commercial Fisheries local study area by value and weight respectively, from 2017 to 2021 (MMO, 2023a. Figure

12-4 shows the landed value over the same period from the commercial fisheries local study area by ICES rectangle and gear type. The key species landed are Nephrops (*N.norvegicus*), haddock (*M.aeglefinus*), herring (*C.harengus*), king scallop (also referred to as scallop) and brown crabs (*Cancer pagurus*). First sales value and weight of Nephrops landings have fluctuated over the 2017 to 2021 period, with an annual landed value of £1.7 million in 2020 and of £5.4 million in 2019. Landed values and weights of herring and scallops have also been variable across the time period, with five-year averages of £1.4 million of both herring and of scallop landed annually from the local study area. The significant annual variation in landings of herring represent patterns typical for pelagic species that swim in fast moving shoals and may not be specifically linked to areas or habitats when caught in the water column. Landings of haddock from the local study area have remained relatively stable over the time series, peaking in annual landed value in 2021 at £2.9 million. Landings of brown crab from the local study area have shown some variation across the time series, with an annual landed value of £1.3 million.

12.4.4 Landing statistics indicate that landings by under 10 m length vessels and over 10 m vessels are made across the commercial fisheries local study area, with the majority of landings by value being made by vessels over 10 m length. Notably, the majority (92% by value) of the landings by potting vessels and all landings by vessels using handlines are made by vessels ≤10 m in length, indicating the importance of the inshore fleet across the inshore portion of the commercial fisheries local study area. Almost all of the landings by demersal and pelagic trawl, dredge and demersal seine are by vessels >10 m in length.

12.4.5 Landings of the species detailed above vary seasonally. Landings of haddock targeted by demersal trawlers show peaks in January and June with less landings through the intermediate spring, whilst landings of Nephrops exhibit a summer peak during June and July. Landings of herring taken in demersal and pelagic trawls are principally in late summer, in the month of August. Landings of scallops by dredgers peak in late spring and early summer. Inshore vessels are often equipped to move from species to species throughout the seasons. Landing trends per month will be analysed within the EIAR for individual species at both an ICES rectangle level, and by port of landing to identify which fleet and fishery operate at specific times of the year.

12.4.6 Figure 12-5 and Figure 12-6 show the top 12 species landed from the commercial fisheries regional study area by value and weight respectively, from 2017 to 2021 (MMO, 2023a). Figure 12-7 shows the landed value over the same period from the commercial fisheries regional study area by ICES rectangle and gear type. Key target species and active gear types are broadly aligned with those in the local study area, with pots and traps used to target shellfish including brown crab and European lobster (*H.gammarus*), demersal trawls used to target *Nephrops*, haddock and mixed demersal fish species, and dredges used to target scallop. Within the wider regional study area, landings data additionally indicates the presence of vessels deploying pelagic seine gear to target mackerel (*S.scombrus*).

12.4.7 EU landings data indicates the potential for fishing activity by Danish, French and Dutch fishing vessels in the local and regional study areas. Activity by Norwegian pelagic trawlers may also occur.

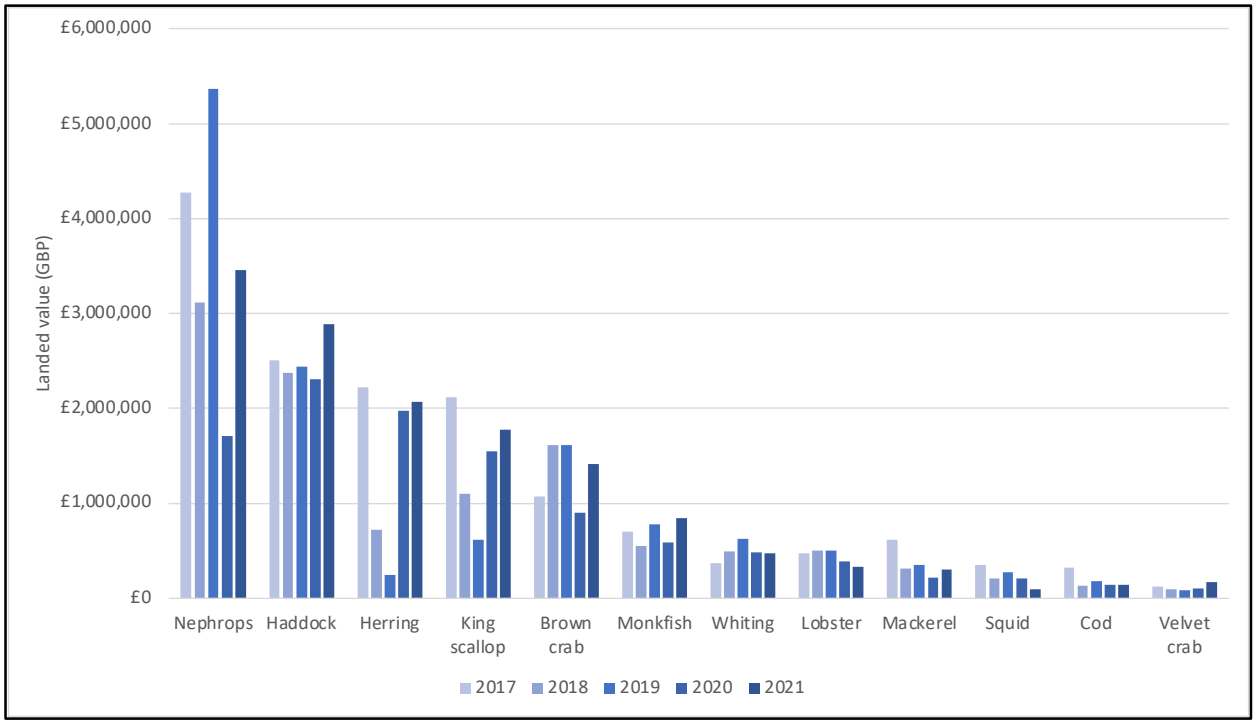


Figure 12-2: Top twelve species by value Great British Pound (GBP) from 2017 to 2021 landed from the commercial fisheries local study area (data source: MMO, 2021; MMO, 2023a).

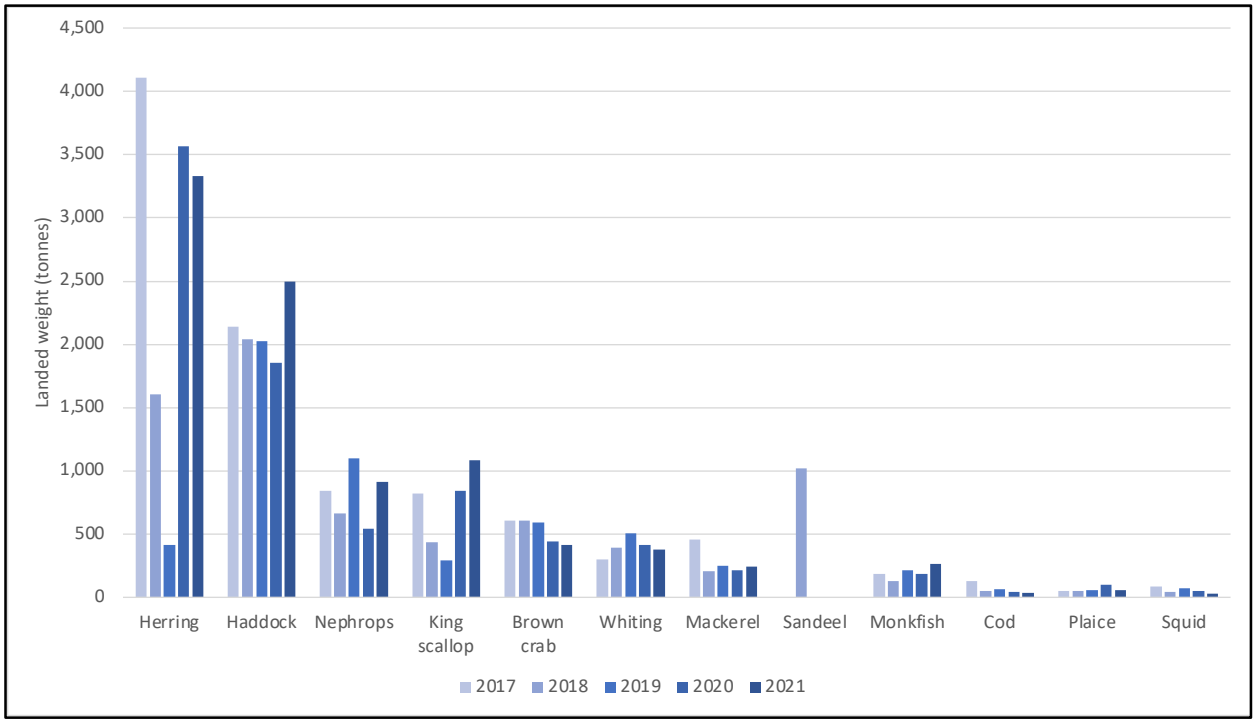


Figure 12-3: Top twelve species by weight (tonnes) from 2017 to 2021 landed from the commercial fisheries local study area (Source: MMO, 2021; MMO, 2023a).

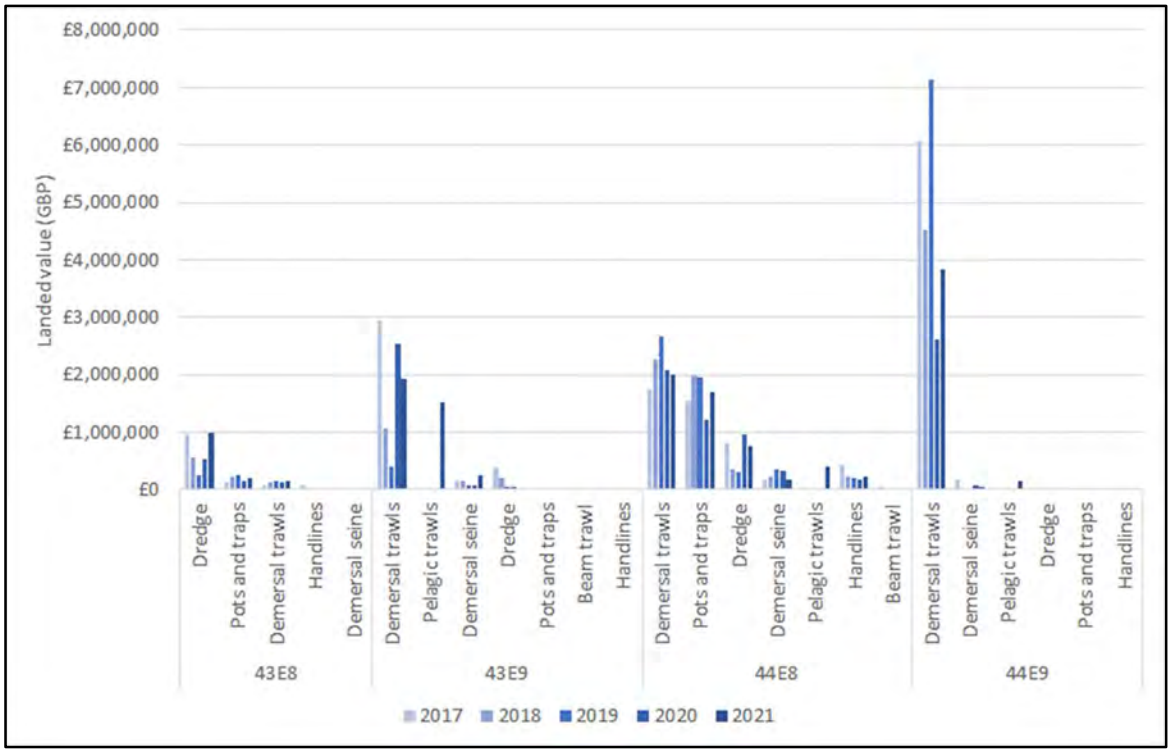


Figure 12-4: Landed value from 2017 to 2021 from the commercial fisheries local study area by ICES rectangle and gear type (Source: MMO, 2021; MMO, 2022).

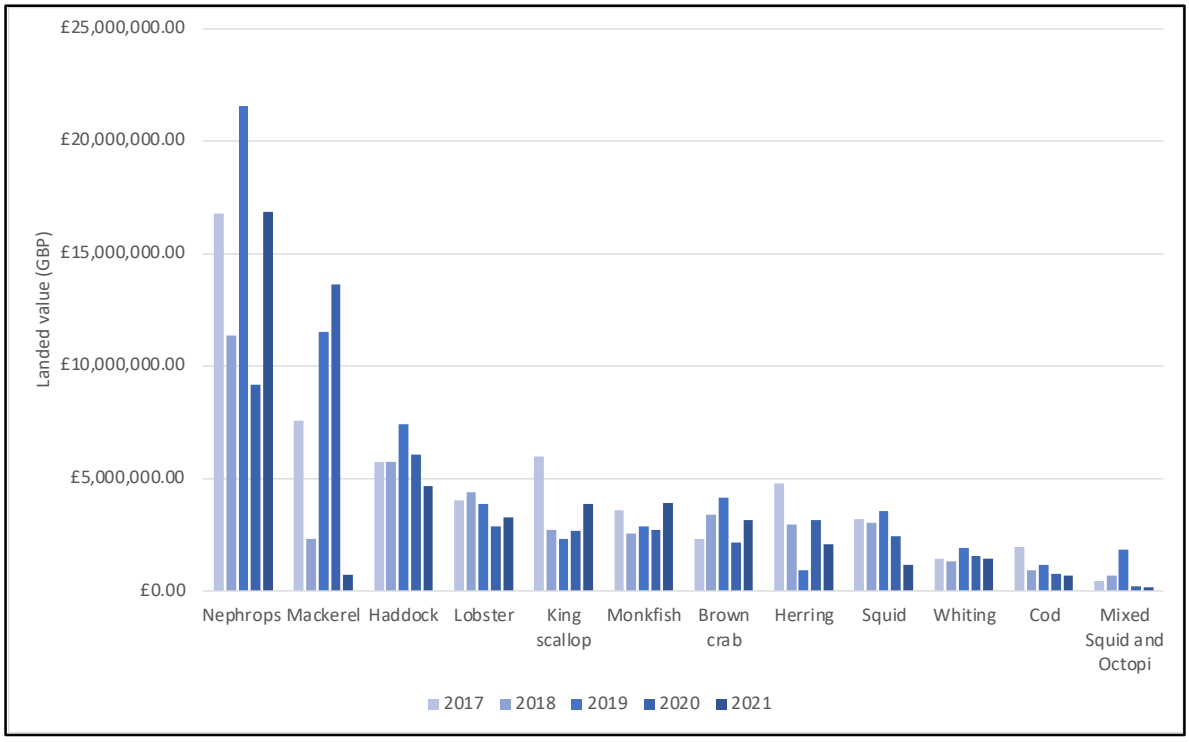


Figure 12-5: Top twelve species by value (GBP) from 2017 to 2021 landed from the commercial fisheries regional study area (data source: MMO, 2021; MMO, 2023a).

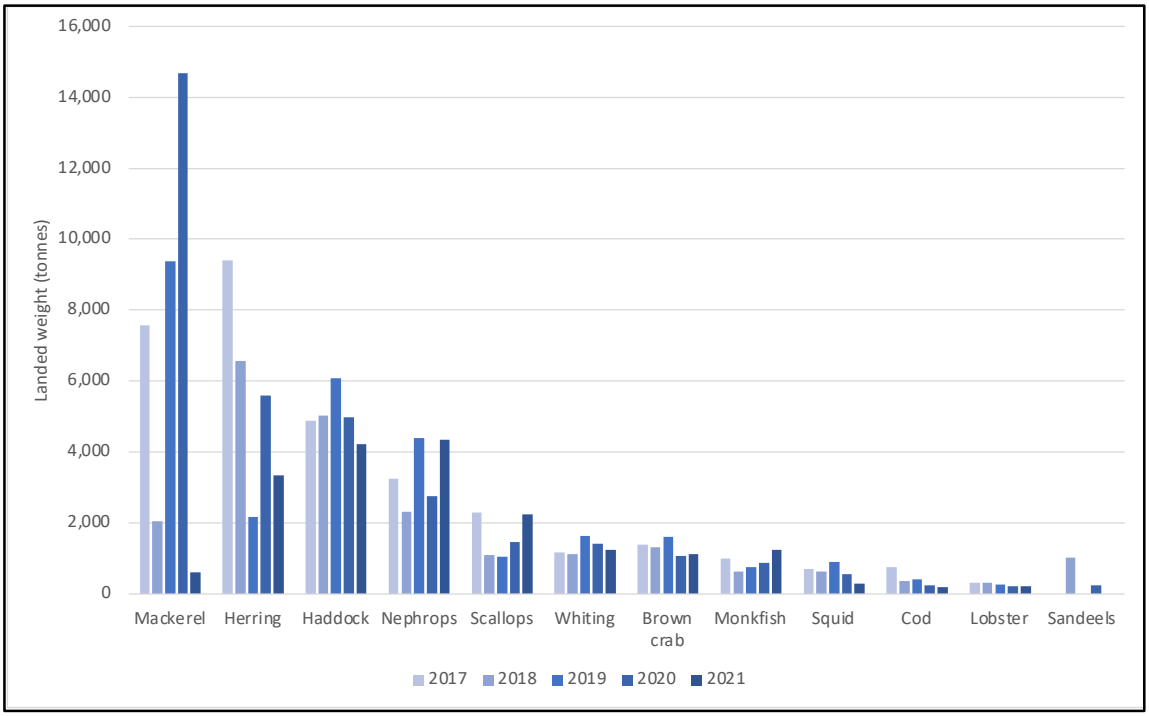


Figure 12-6: Top twelve species by weight (tonnes) from 2017 to 2021 landed from the commercial fisheries regional study area (Source: MMO, 2021; MMO, 2023a).

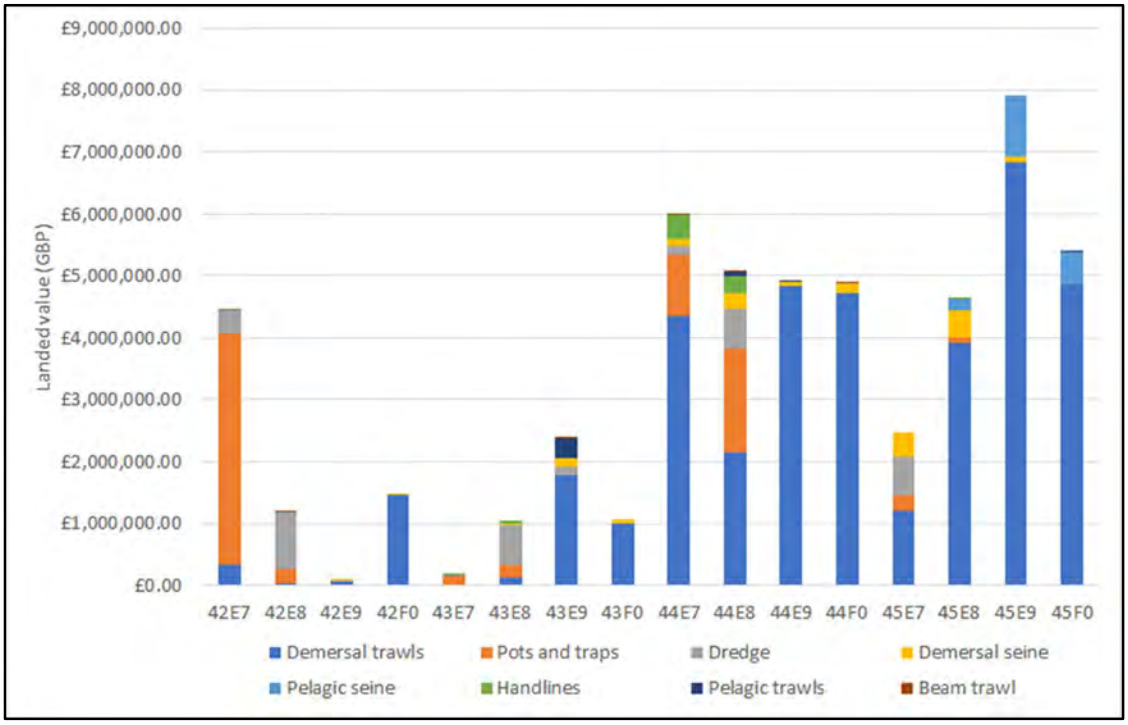


Figure 12-7: Average annual landed value (GBP) from 2017 to 2021 from the commercial fisheries regional study area by ICES rectangle and gear type (Source: MMO, 2021; MMO, 2023a).

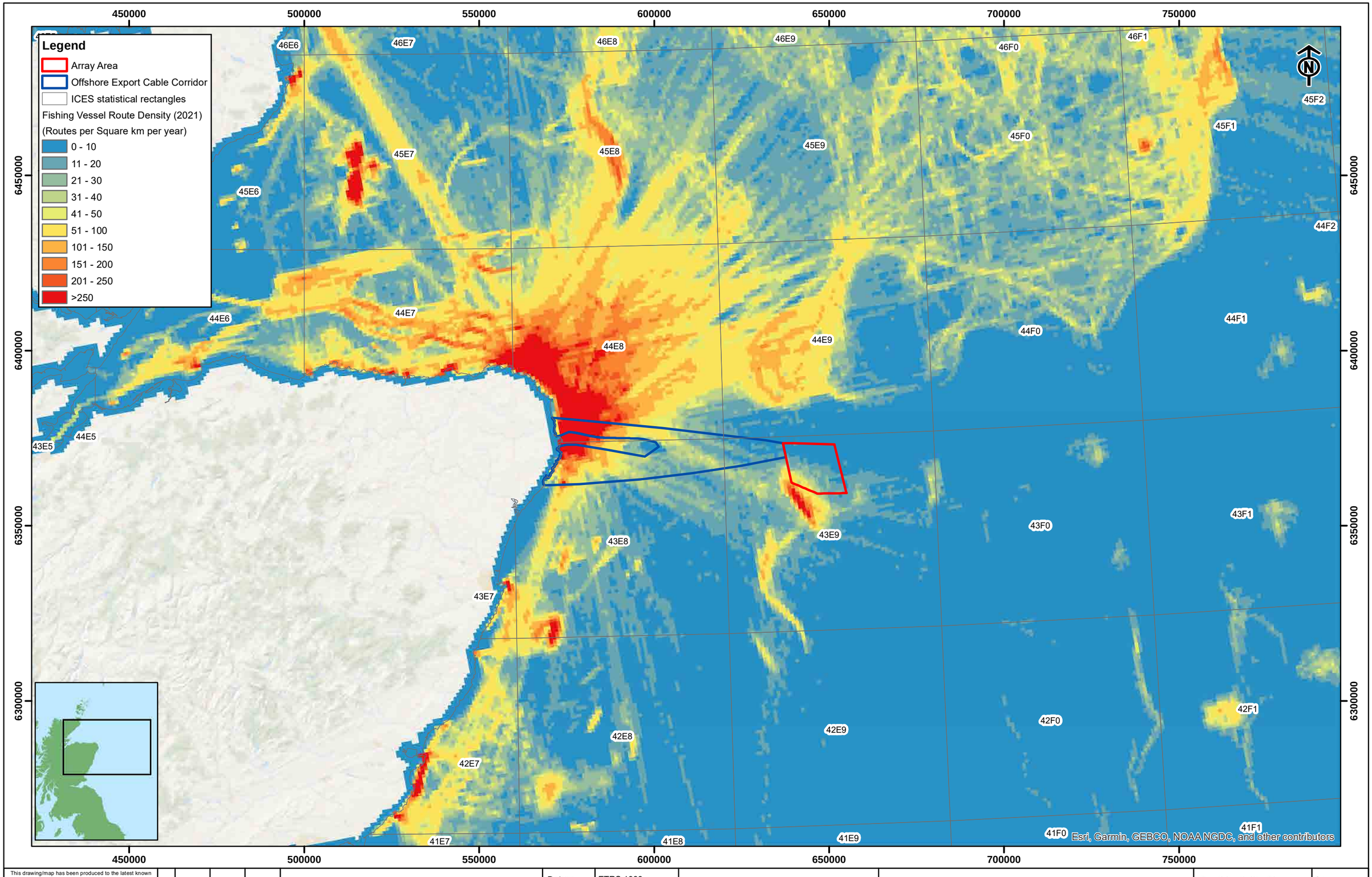
12.4.8 In addition to landings data, spatial data describing fishing activity is available, including AIS fishing vessel route density data. AIS is required to be fitted on fishing vessels ≥15 m length. The data presented in Figure 12-8 is specific to fishing vessels and indicates the route density per square km per year. This data does not distinguish between transiting vessels and active fishing but does provide a useful source to corroborate fishing grounds. Data indicates fishing vessel presence within the proposed development, with sustained fishing vessel presence across the southern portion of the Muir Mhòr array area and nearshore sections of the offshore ECC, but with significant fishing grounds present throughout the region and particularly to the north.

12.4.9 VMS and spatial data to map fishing activity is available for UK and EU fleets. VMS data sourced from ICES displays the surface Swept Area Ratio of catches by different gear types and covers EU (including UK) registered vessels 12 m and over in length. Surface Swept Area Ratio indicates the number of times in an annual period that a demersal fishing gear makes contact with (or sweeps) the seabed surface. Surface Swept Area Ratio provides a proxy for fishing intensity and has been analysed to determine an average annual Swept Area Ratio based on data from 2016-2020. VMS data sourced from MMO displays the first sales value (GBP) of catches and covers UK registered vessels 15 m and over in length from 2016 to 2019. Scotmap inshore fisheries mapping data relating to the period 2007 to 2011 are also available and have been mapped.

12.4.10 Mapped data is provided for the following gear types:

- Figure 12-9 and Figure 12-10: Demersal otter trawl, indicating some activity within the Muir Mhòr array area and offshore portion of the offshore ECC but relatively higher levels of activity to the immediate north of the Muir Mhòr array area;
- Figure 12-11 and Figure 12-12: Dredge, indicating activity in the nearshore portion of the offshore ECC and low levels of activity in the offshore portion of the offshore ECC and Muir Mhòr array area, with relatively higher levels of activity to the north and south of the proposed development;
- Figure 12-13 and Figure 12-14: Demersal seine, indicating low levels of activity within the offshore ECC and northern portion of the Muir Mhòr array area, with relatively higher levels of activity to the north and east of the proposed development;
- Figure 12-15: Pelagic trawl, indicating low levels of pelagic trawl activity by UK vessels in the study areas; and
- Figure 12-16 and Figure 12-17: Pots and traps, indicating low levels of potting activity by UK vessels over 15 m length in the local study area and notable levels of potting activity by UK inshore vessels in the nearshore portion of the offshore ECC.

12.4.11 The mapped spatial data presented below is aligned with that presented in the UHI study, which mapped fisheries and habitats in the North and East Coast RIFG area (Shelmerdine and Mouat, 2021).



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A joint venture between Fred. Olsen Seawind & Vattenfall

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United Kingdom

Rev	Date	Drawn By	Checked By	Comment
A	09/05/23	FN	LK	First Issue

Datum	ETRS 1989
Projection	ETRS 1989 UTM Zone 30N
Plot	A3
Scale	1:1,000,000

0 6 12 18 24 30 km

MUIR MHÒR WIND FARM

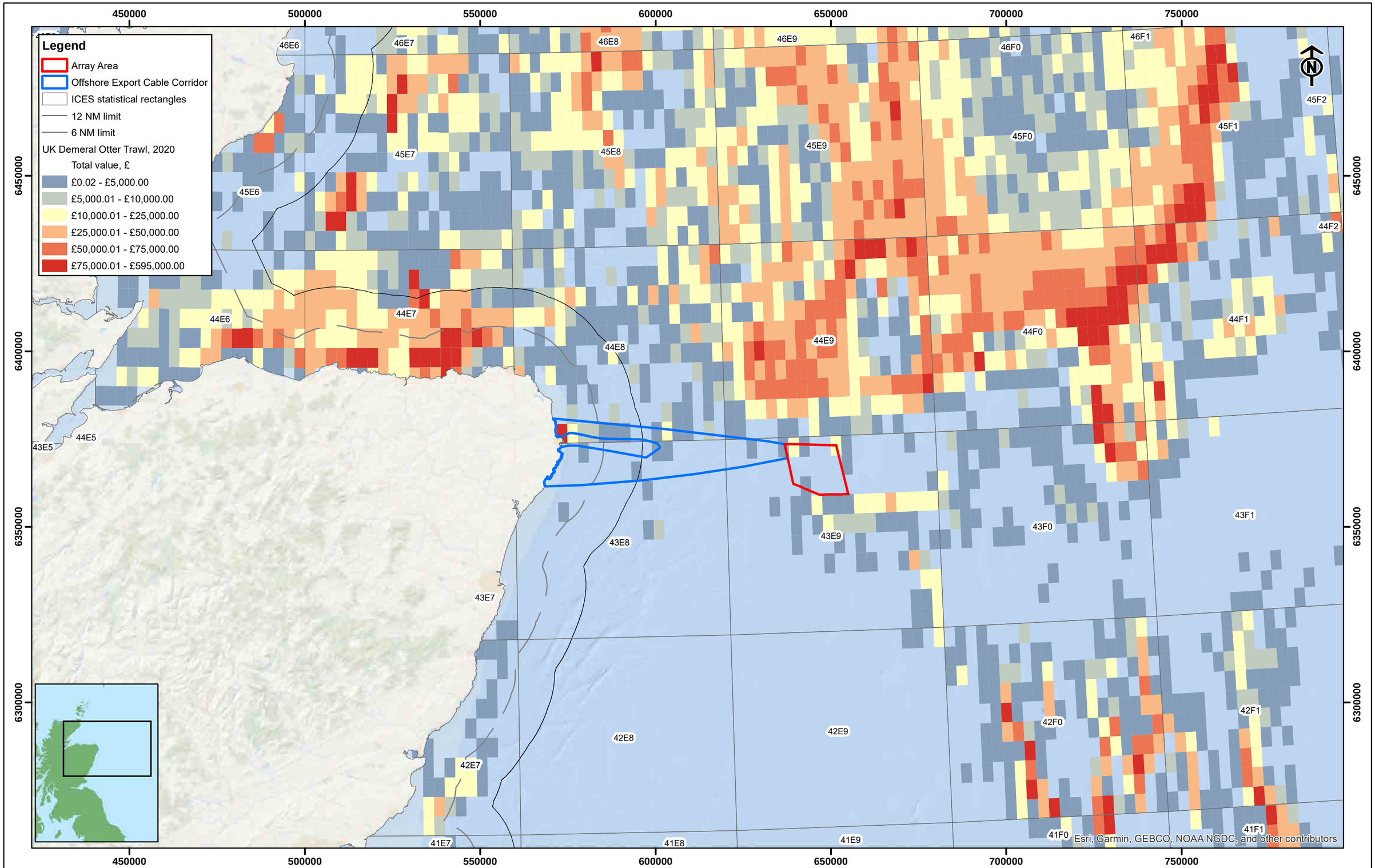
Fishing Vessel Route Density Data (2021)

Source: EMSA, 2022

Confidentiality Class	C1
Drg No	POSE-0002
Rev	A
Layout	NA

Figure 12.8

Ref files: MMH_A3_CF_FishingRouteDensity_12.8



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0 6 12 18 24 30 km

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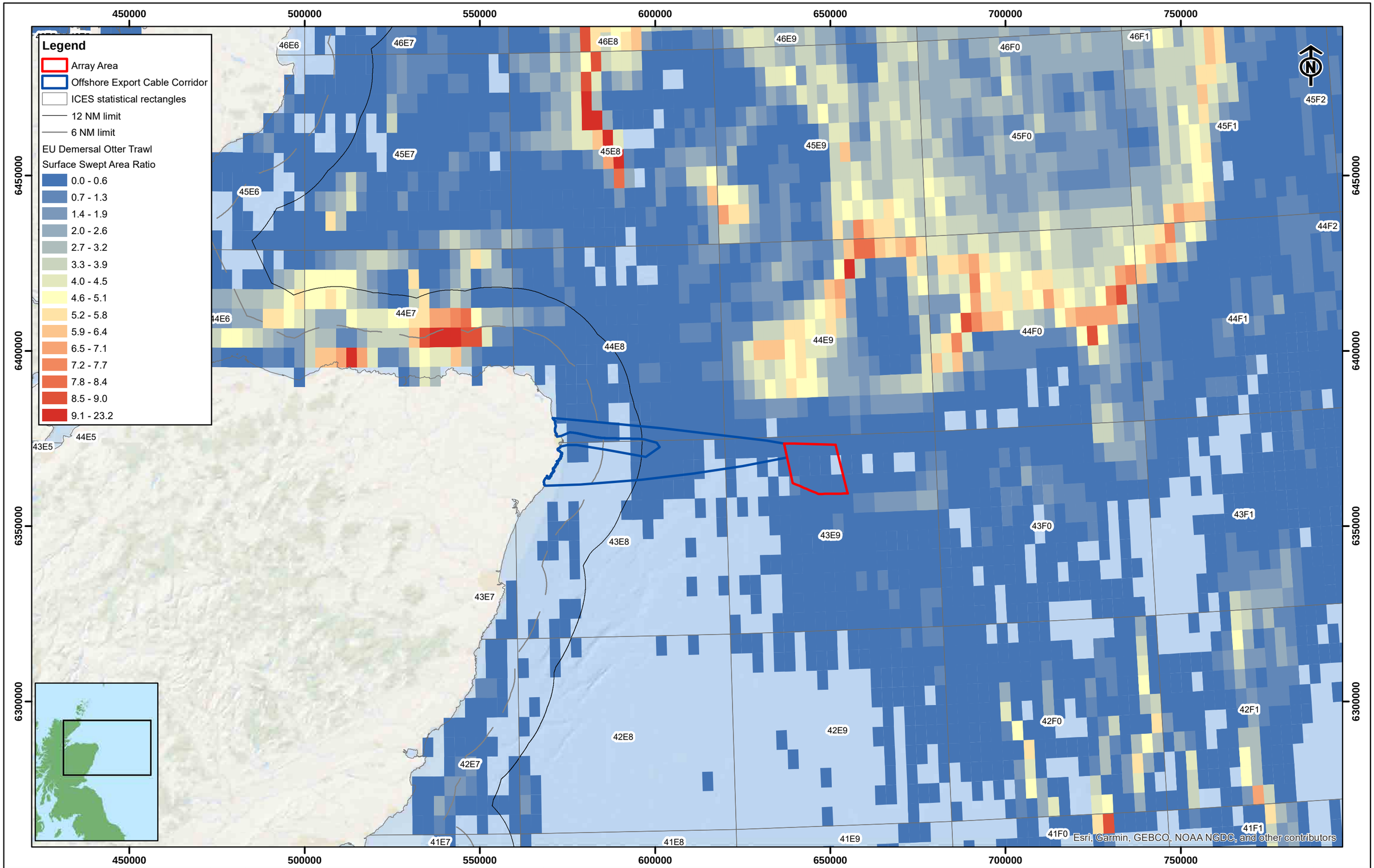
Demersal Otter Trawl VMS Data, 2020
UK Fishing Vessels 15m and Over

Source: MMO, 2023b

Confidentiality Class	C1
Drg No	POSE-0003
Rev	A
Layout	NA

Figure 12.9

Ref files: MMH_A3_CF_UKDemersalTrawl_12.9



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Plot	A3
Scale	1:1,000,000

0 6 12 18 24 30 km

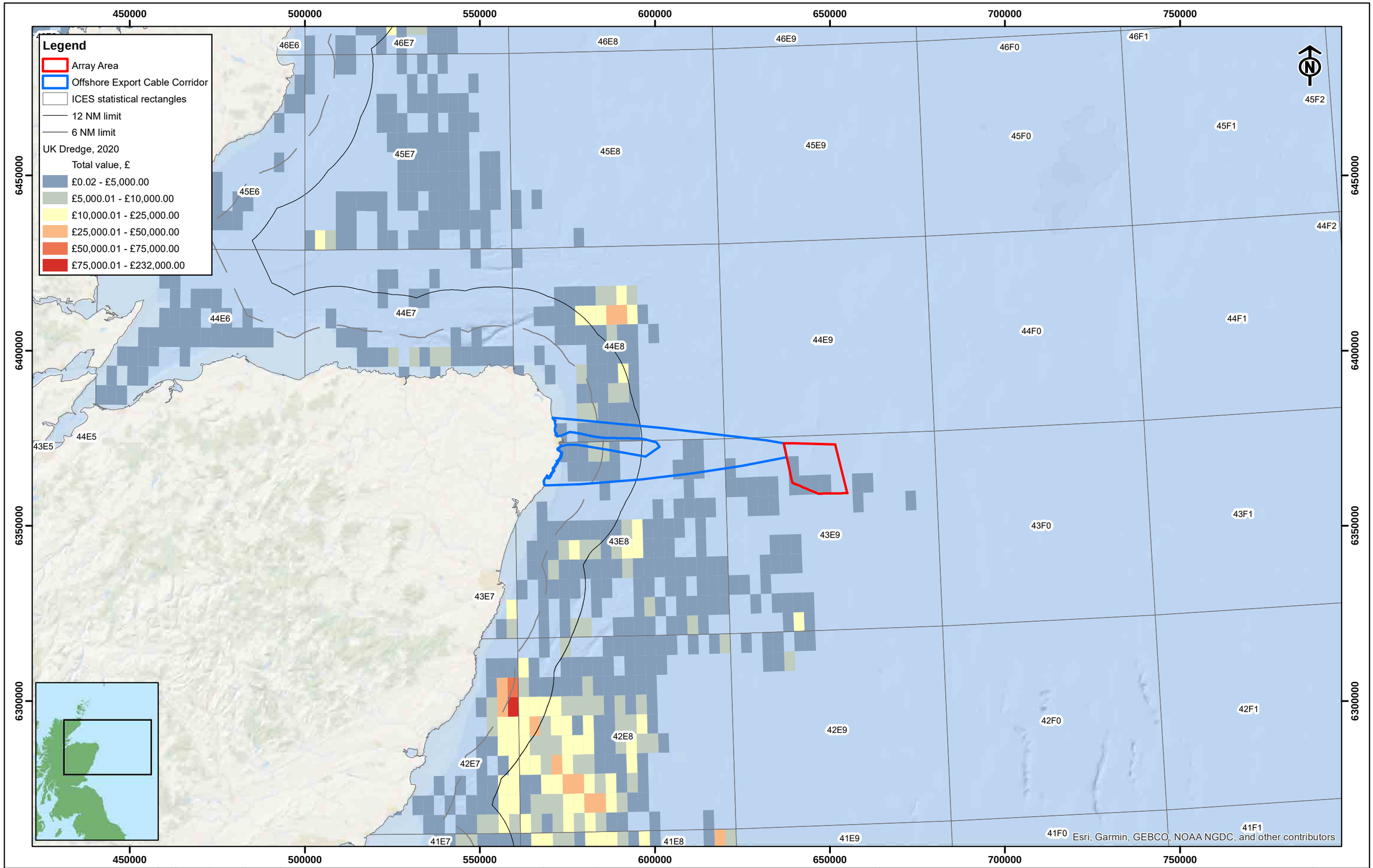
MUIR MHÒR WIND FARM

Demersal Otter Trawl Surface Swept Area Ratio
EU (includingUK) Fishing Vessels 12m and Over
5-Year Average (2016-2020)
Source: ICES, 2021

Confidentiality Class	C1
Drg No	POSE-0004
Rev	A
Layout	NA

Figure 12.10

Ref files: MMH_A3_CF_EUDemersalTrawl_12.10



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Plot	A3
Scale	1:1,000,000

0 6 12 18 24 30 km

MUIR MHÒR WIND FARM

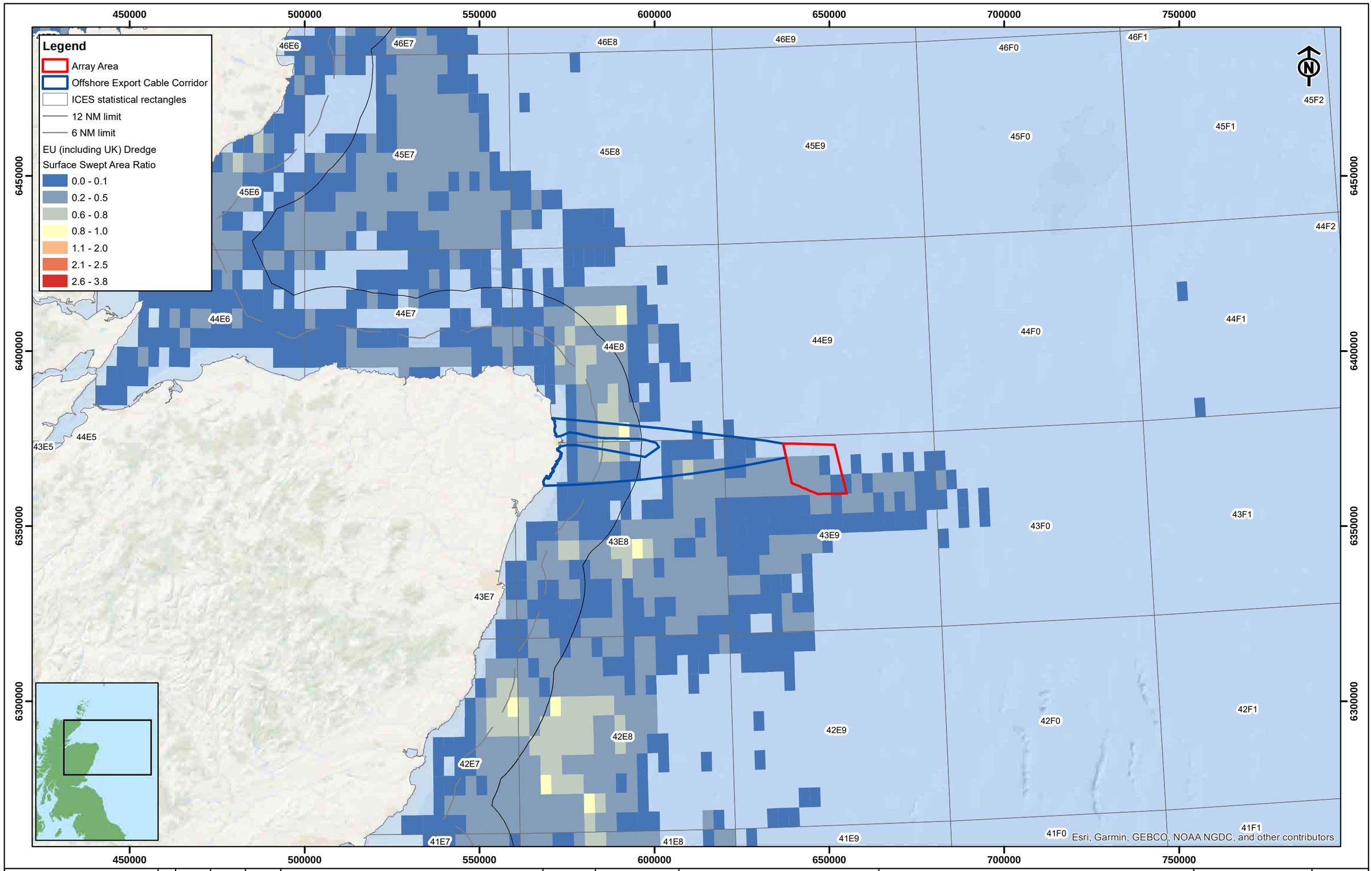
Dredge VMS Data
UK Fishing Vessels 15m and Over

Source: MMO, 2023b

Confidentiality Class	C1
Drg No	POSE-0005
Rev	A
Layout	NA

Figure 12.11

Ref files: MMH_A3_CF_UKDredge_12.11



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0 6 12 18 24 30 km

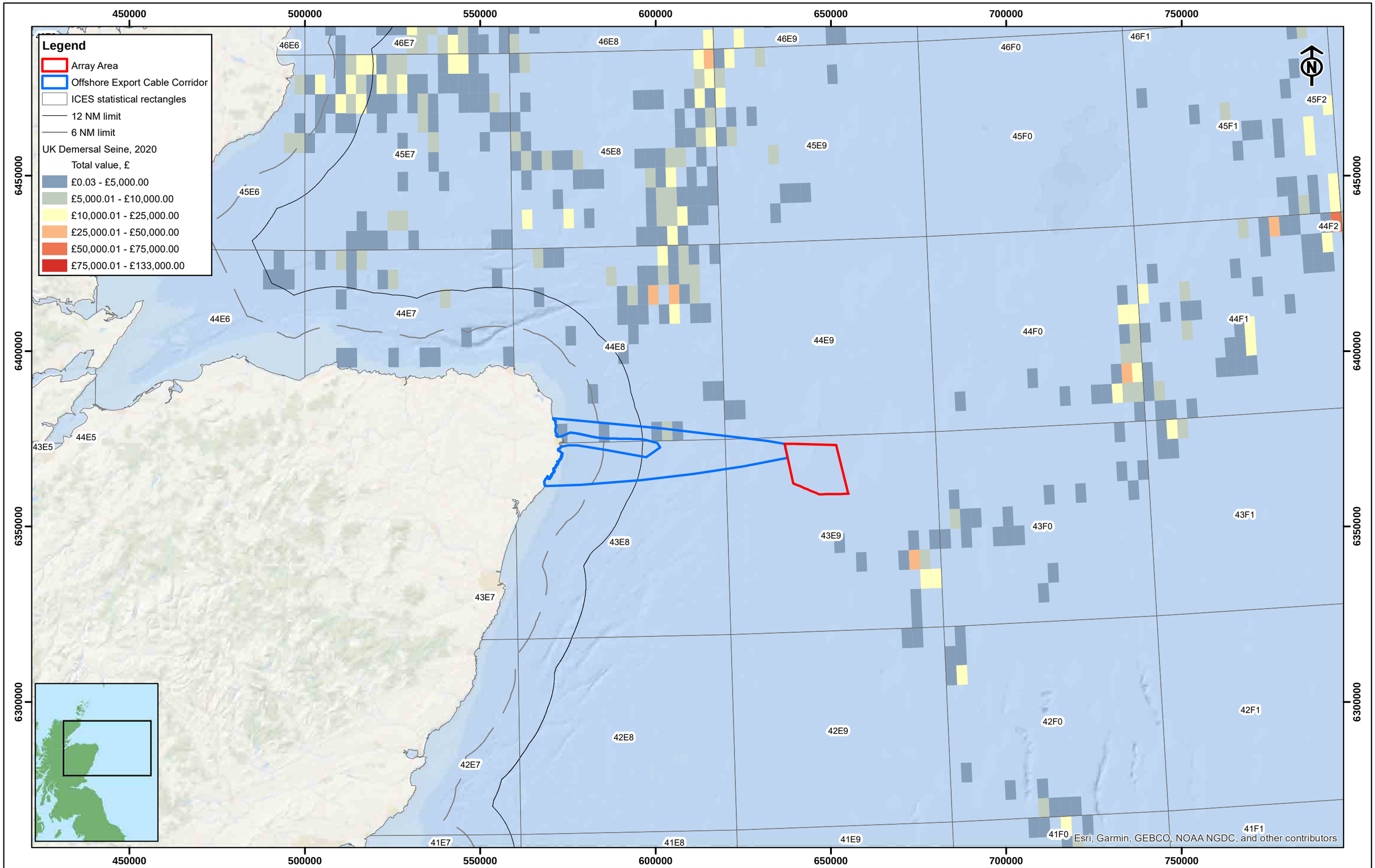
MUIR MHÒR WIND FARM

Dredge Surface Swept Area Ratio
EU (includingUK) Fishing Vessels 12m and Over
5-Year Average (2016-2020)
Source: ICES, 2021

Confidentiality Class	C1
Drg No	POSE-0006
Rev	A
Layout	NA

Figure 12.12

Ref files: MMH_A3_CF_EUDredge_12.12



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0 6 12 18 24 30 km

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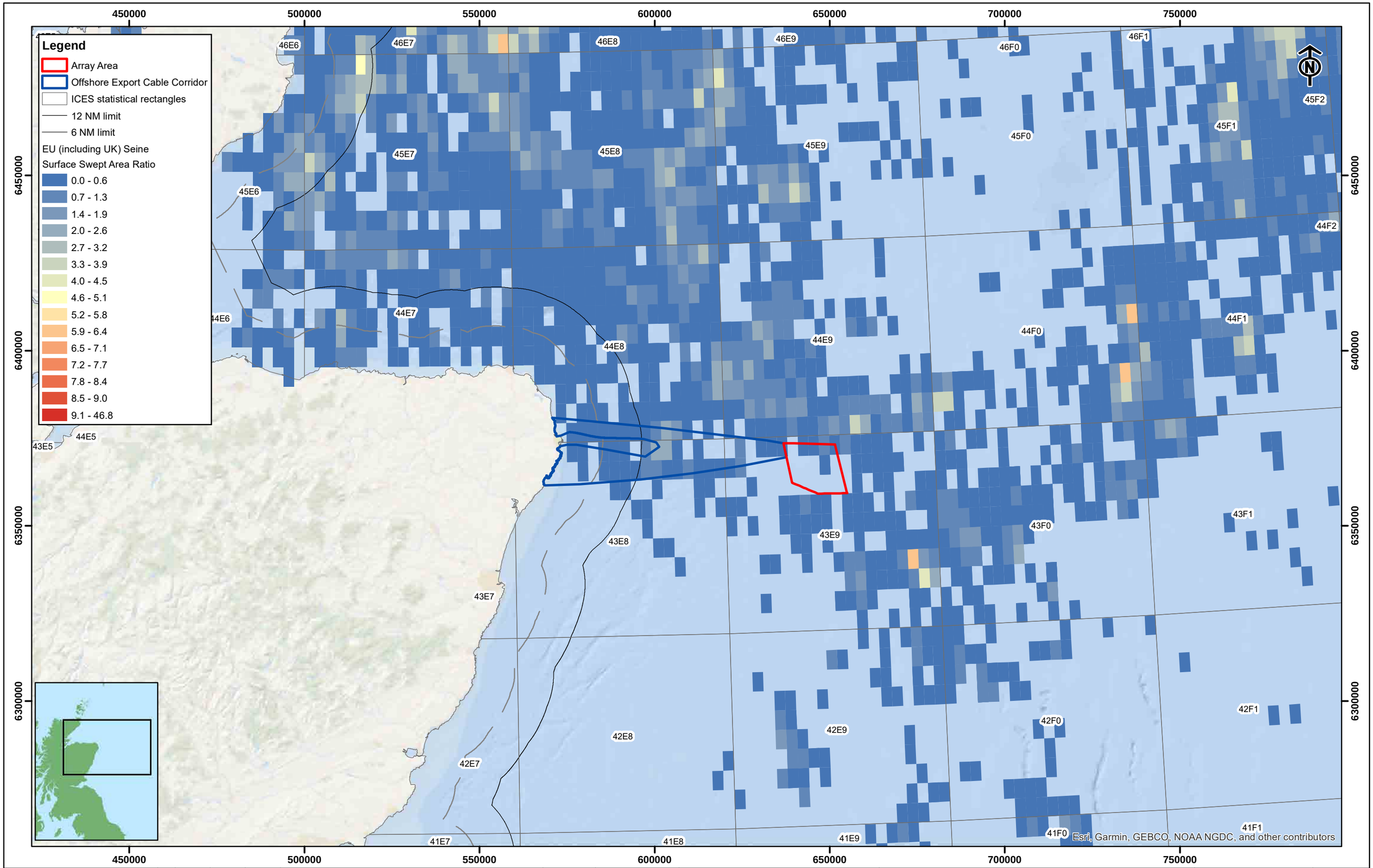
Demersal Seine VMS Data
UK Fishing Vessels 15m and Over

Source: MMO, 2023b

Confidentiality Class	C1
Drg No	POSE-0007
Rev	A
Layout	NA

Figure 12.13

Ref files: MMH_A3_CF_UKSeine_12.13



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Plot	A3
Scale	1:1,000,000

0 6 12 18 24 30 km

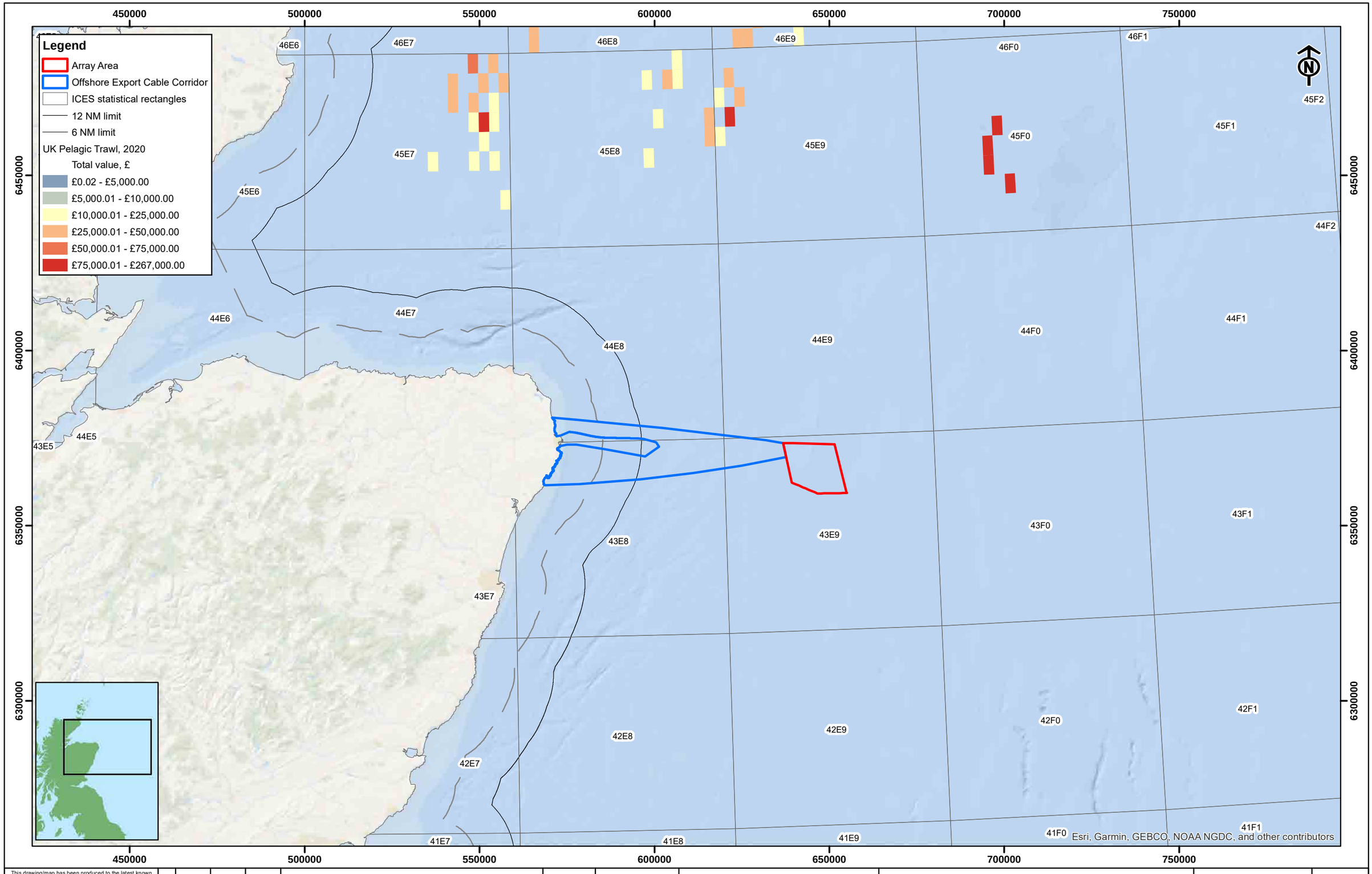
MUIR MHÒR WIND FARM

Demersal Seine Surface Swept Area Ratio
EU (includingUK) Fishing Vessels 12m and Over
5-Year Average (2016-2020)
Source: ICES, 2021

Confidentiality Class	C1
Drg No	POSE-0008
Rev	A
Layout	NA

Figure 12.14

Ref files: MMH_A3_CF_EUSeine_12.14



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Projection	ETRS 1989 UTM Zone 30N
Plot	A3
Scale	1:1,000,000

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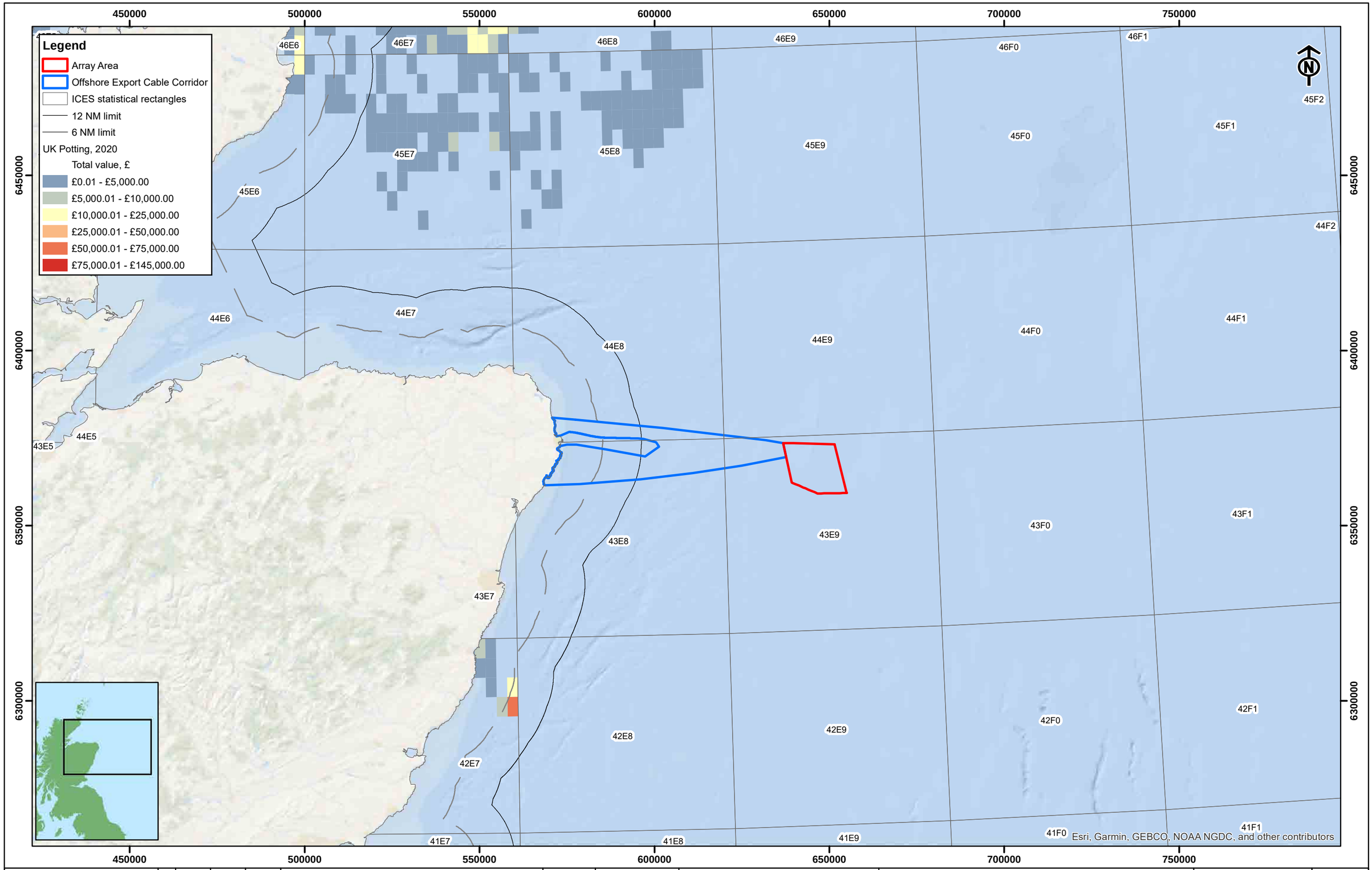
Pelagic Otter Trawl VMS Data
UK Fishing Vessels 15m and Over

Source: MMO, 2023b

Confidentiality Class	C1
Drg No	POSE-0009
Rev	A
Layout	NA

Figure 12.15

Ref files: MMH_A3_CF_UKPelagicTrawl_12.15



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Datum	ETRS 1989
Projection	ETRS 1989 UTM Zone 30N
Plot	A3
Scale	1:1,000,000

0 6 12 18 24 30 km

MUIR MHÒR WIND FARM

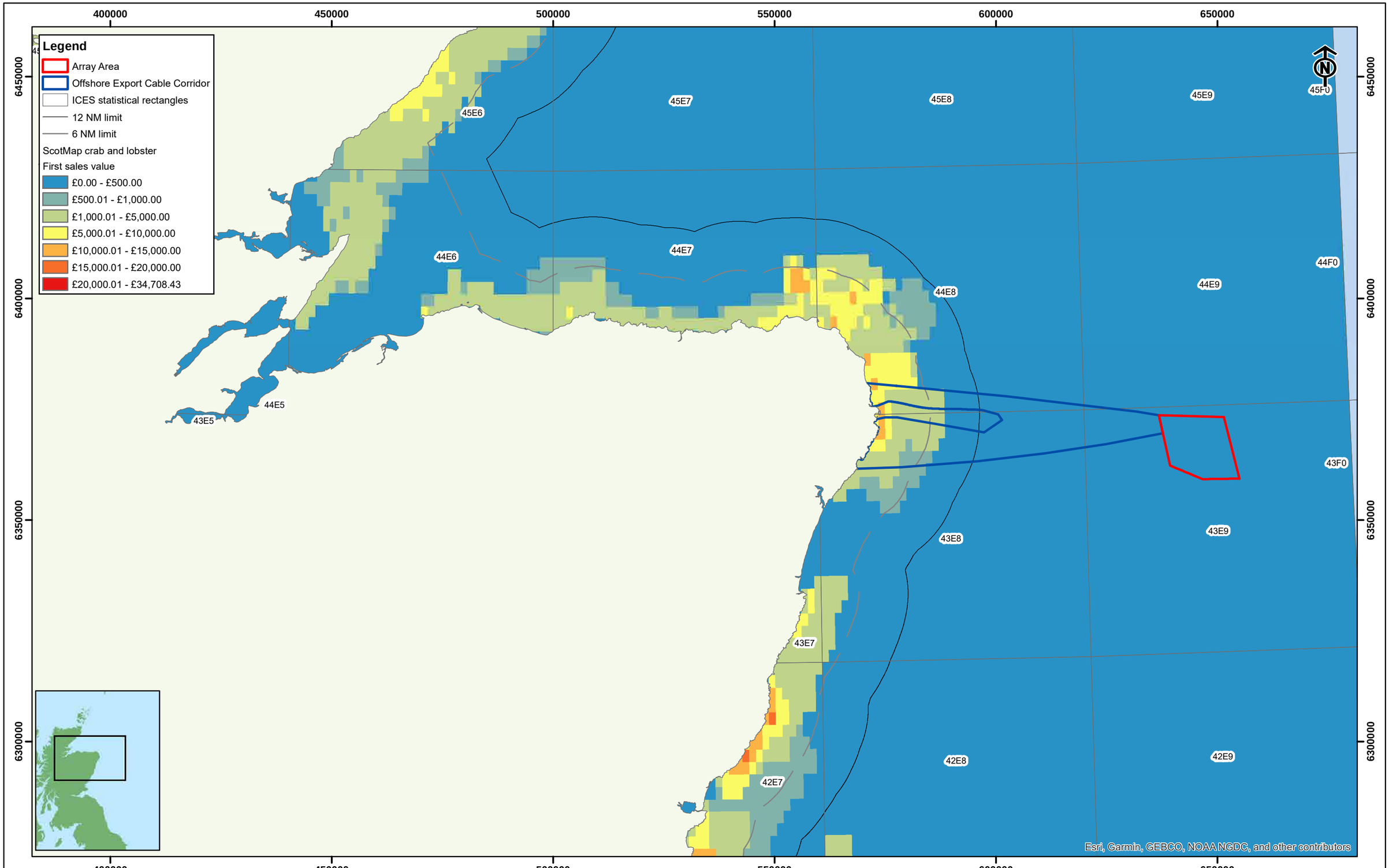
Potting and Trap VMS Data
UK Fishing Vessels 15m and Over

Source: MMO, 2023b

Confidentiality Class	C1
Drg No	POSE-0010
Rev	A
Layout	NA

Figure 12.16

Ref files: MMH_A3_CF_UKPotting_12.16



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Datum	ETRS 1989
Projection	ETRS 1989 UTM Zone 30N
Plot	A3
Scale	1:800,000

0 4.5 9 13.5 18 22.5 km

MUIR MHÒR WIND FARM

ScotMap Crab and Lobster First Sales Value

Source: Marine Scotland ScotMap

Confidentiality Class	C1
Drg No	POSE-0011
Rev	A
Layout	NA

Figure 12.17

Ref files: MMH_A3_CF_ScotMapPots_12.17

12.5 Summary and Key Issues

12.5.1 The key commercial fisheries receptors within the commercial fisheries study areas are identified as follows:

- Local creel fleet targeting brown crab and lobster (vessels typically 15 m and under in length) across the offshore ECC;
- Local jigging fleet targeting mackerel across the offshore ECC;
- Demersal trawl fleet targeting *Nephrops*, herring, haddock and other whitefish across both offshore ECC and Muir Mhòr array area;
- Scallop dredging fleet targeting scallops, predominately across the offshore ECC;
- Scottish seine fleet targeting haddock and other whitefish across both offshore ECC and Muir Mhòr array area; and
- Pelagic trawlers from Norway, Denmark, France and the Netherlands operating across the wider regional study area.

12.5.2 Salmon fishing and sea trout fishing rights in Scotland include coastal fixed engine and net and coble fisheries. It is understood that there are several fixed engine sites for wild salmon and sea trout and several net and coble sites around Fraserburgh (Scottish Government, 2021). These sites have been reported to be active at some point during the period between 2011 to 2018. The EIA will explore if these sites remain active.

12.5.3 There are no aquaculture facilities within the commercial fisheries study area and it is considered unlikely that there would be any aquaculture development offshore in the vicinity of the proposed development unless there is beneficial co-location with offshore wind development.

12.6 Embedded Commitments

12.6.1 As part of the Project design process, several designed-in measures have been proposed to reduce the potential for impacts on environmental and socio-economic receptors. These are presented in Table 12-2 and in the Commitments Register (Appendix A) and will likely evolve over the development process as the EIA progresses and in response to stakeholder consultation.

Table 12-2: Embedded commitment measures of relevance to commercial fisheries.

Code	Commitment	Type (Primary, Secondary or Tertiary)	How Commitment Secured
C-02	Development of and adherence to aCaP. The CaP will confirm planned cable routing, installation methods, cable specifications and any additional protection and requirement for any post-installation monitoring.	Tertiary	CaP
C-03	Development of and adherence to a DSLP. The DSLP will confirm layout and relevant design parameters.	Tertiary	DSLP
C-07	All dropped objects will be reported. Where recovery is possible and the dropped object may cause a hazard, object will be retrieved.	Tertiary	EMP

Code	Commitment	Type (Primary, Secondary or Tertiary)	How Commitment Secured
C-08	Development of and adherence to an EMP. This will set out mitigation measures and procedures relevant to environmental management, including but not limited to chemical usage, invasive and non-native species, pollution prevention and waste management.	Tertiary	EMP
C-09	Development of and adherence to a DP. The DP will outline measures for the decommissioning of the Proposed Development.	Tertiary	DP
C-10	Development of and adherence to a VMP. The VMP will confirm the anticipated types and numbers of vessels that will be engaged on the proposed development and consider vessel coordination including indicative transit route planning.	Tertiary	VMP
C-11	Development of and adherence to a Fisheries Management and Mitigation Strategy (FMMS). The FMMS will set out the means of ongoing fisheries liaison through construction and operation and O&M phases of the proposed development and detail any mitigation measures of relevance to commercial fisheries to be put in place.	Tertiary	FMMS
C-12	Ongoing liaison with fishing fleets will be maintained during construction, maintenance and decommissioning operations via an appointed Fisheries Liaison Officer and Fishing Industry Representative.	Tertiary	FMMS
C-13	Adherence to best practice guidance with regards to fisheries liaison and procedures in the event of interactions between the proposed development and fishing activities (e.g., FLOWW, 2014; 2015).	Tertiary	FMMS
C-14	Development of and adherence to a PS (applicable where piling is undertaken). The PS will detail the method of pile installation and associated noise levels. It will describe any mitigation measures to be put in place (e.g., soft starts and ramp ups, use of Acoustic Deterrent Devices) during piling to manage the effects of underwater noise on sensitive receptors.	Tertiary	PS
C-15	Development of and adherence to MMMP. This will identify appropriate mitigation measures during offshore activities that are likely to produce underwater noise and vibration levels capable of potentially causing injury or disturbance to marine mammals. This will be developed alongside the Piling Strategy and referred to in EPS licence applications.	Tertiary	MMMP
C-16	Development of and adherence to a Navigational Safety Plan (NSP). The NSP will describe measures put in place by the proposed development related to navigational safety, including information on Safety Zones, charting, construction buoyage, temporary lighting and marking, and means of notification of proposed development activity to other sea users (e.g., via Notice to Mariners).	Tertiary	NSP

Code	Commitment	Type (Primary, Secondary or Tertiary)	How Commitment Secured
C-17	Applications to be made, where appropriate, for Safety Zones (500m) for construction and major maintenance works, and for pre commissioning works (50m).	Secondary	NSP
C-18	Use of guard vessels where deemed appropriate to ensure adherence with Safety Zones or advisory passing distances, as defined by risk assessment, to mitigate any impact which poses a risk to surface navigation during construction, maintenance and decommissioning phases. Such impacts may include partially installed structures or cables, extinguished navigation lights or other unmarked hazards.	Secondary	NSP
C-19	Advance warning and accurate location details of construction, maintenance and decommissioning operations, associated Safety Zones and advisory passing distances will be given via Notices to Mariners and Kingfisher Bulletins.	Tertiary	NSP
C-20	Participation in any fisheries working group to assist with liaison between the proposed development and the fishing community.	Tertiary	FMMS
C-21	Compliance with MCA Marine Guidance Note (MGN) 654 (MCA, 2021) and its annexes where applicable (including consideration of a Search and Rescue (SAR) checklist, an Emergency Response and Cooperation Plan (ERCoP) and Under Keel Clearance. Consideration will also be given to MGN 543 SAR Annex 5 (MCA, 2018).	Tertiary	CaP CMS DSLP
C-22	Compliance of all project vessels with international marine regulations as adopted by the Flag State, notably the International Regulations for Preventing Collisions at Sea (COLREGs) (IMO, 1974) and the International Convention for the Safety of Life at Sea (SOLAS) (IMO, 1974).	Tertiary	NSP
C-23	Notification of damage or decay to cables to the Maritime and Coastguard Agency (MCA), NLBKingfisher and UKHO within 24 hours of discovery.	Tertiary	CaP NSP
C-24	Aids to navigation (marking and lighting) will be deployed in accordance with the latest relevant available standard industry guidance and as advised by NLB, MCA and CAA and MOD as appropriate. This will include a buoyed construction area around the array area in consultation with NLB.	Tertiary	NSP LMP
C-25	Appropriate marking of the proposed development on Admiralty and aeronautical charts. This will include provision of the positions and heights of structures to the UKHO, CAA, MOD and Defence Geographic Centre (DGC).	Tertiary	NSP LMP
C-26	Compliance with regulatory expectations on moorings for floating wind and marine devices published by MCA and the HSE.	Tertiary	CMS
C-29	Where practicable, cable burial will be the preferred means of cable protection. Cable burial will be informed by the CBRA and detailed within the CaP. In areas where CBRA deems burial not	Primary	CaP

Code	Commitment	Type (Primary, Secondary or Tertiary)	How Commitment Secured
	feasible, suitable implementation and monitoring of cable protection will be employed.		
C-32	Over trawl surveys of offshore export cables will be undertaken through the operational life of the project where mechanical protection of cables laid on the sea bed has been deployed.	Tertiary	CaP
C-36	Development of and adherence to a Lighting and Marking Plan (LMP). The LMP will confirm appropriate lighting and marking mitigation whilst ensuring compliance with legal requirements with regards to shipping, navigation and aviation marking and lighting.	Tertiary	LMP
C-38	Development of and adherence to a PEMP, which will set out commitments to environmental monitoring in pre-, during and post-construction phases.	Tertiary	PEMP
C-42	Lighting and marking failures appropriately reported/rectified as soon as possible and interim hazard warnings put in place as required.	Tertiary	LMP

12.6.2 As a result of the commitment to implement these measures, and to align the proposed development with various standard sectoral practices and procedures, the embedded commitments are considered inherently part of the design of the proposed development and have, therefore, been included in the assessment presented in Section 12.7.

12.6.3 The requirement and feasibility of any additional mitigation measures will be dependent on the significance of the effects upon commercial fisheries and will be consulted upon with statutory consultees throughout the EIA process.

12.7 Scoping of Impacts

12.7.1 Table 12-3 sets out an initial assessment of the likelihood of effects on commercial fisheries due to Project activities for the scoping stage of the EIA process. The assessment is based on a combination of the following: the definition of the proposed development at the scoping stage; embedded commitments (as set out in Section 12.6, together with the means by which it will be secured); the level of understanding of the baseline at the scoping stage; the existing evidence base for commercial fisheries effects due to proposed development activities; relevant policy; and the professional judgement of qualified commercial fisheries specialists.

Table 12-3: Scoping assessment for commercial fisheries.

Impact Pathway	Embedded Mitigation	Scoped In or Scoped Out	Justification
Construction (and Decommissioning)			
Reduction in access to, or exclusion from established fishing grounds	C-02, C-09, C-10, C-11, C-12, C-13, C-16, C17, C-18, C-19, C-20, C-21, C-22, C-24, C-26, C-29, C-36, C-38, C-42	Scoped In	Installation and decommissioning activities have potential to create loss of fishing opportunities. This effect is expected to be localised and short term; furthermore, the operational range of relevant fleets will not typically be limited to the proposed development. Further assessment required to conclude impact significance.
Displacement leading to gear conflict and increased fishing pressure on adjacent grounds	C-09, C-10, C-11, C-12, C-13, C-16, C17, C-18, C-19, C-20, C-21, C-22, C-24, C-26, C-36, C-38, C-42	Scoped In	Any reduced access to fishing grounds creates the potential for displacement of fishing activity. This effect is expected to be short-term and localised, and the operational range of relevant fleets will not typically be limited to the proposed development. Further assessment required to conclude impact significance.
Disturbance of commercially important fish and shellfish resources leading to displacement or disruption of fishing activity	C-08, C-09, C-14, C-15, C-38,	Scoped In	Installation and decommissioning activities may lead to disturbance of commercially important fish and shellfish resources and therefore displace or disrupt a range of fishing activity. Further assessment required to conclude impact significance; assessment will be informed by the outcomes of the fish and shellfish ecology impact assessment (Chapter 9) and it will be assumed that commercial fisheries will be affected as a result of any loss of resources.
Increased vessel traffic associated with the proposed development within fishing grounds leading to interference with fishing activity	C-09, C-10, C-11, C-12, C-13, C-16, C-17, C-18, C-19, C-20, C-21, C-22, C-24, C-26, C-36, C-42	Scoped In	Movement of vessels associated with the proposed development adding to the existing volume of marine traffic in the area, may lead to interference of fishing activity. Further assessment is required to conclude impact significance. Assessment will be informed by the outcomes of the shipping and navigation impact assessment (Chapter 13) and NRA.
Additional steaming to alternative fishing grounds for vessels that would otherwise fish within the Proposed development	C-09, C-10, C-11, C-12, C-13, C-16, C-17, C-18, C-19, C-20, C-	Scoped Out	This effect will be localised to Safety Zones and therefore limited deviations to steaming routes are expected. Given adequate notification, it is expected that vessels, which typically have an operational range beyond that of the proposed development (as indicated by VMS data presented above), will be in a position to

Impact Pathway	Embedded Mitigation	Scoped In or Scoped Out	Justification
	21, C-22, C-24, C-26, C-36, C-42		avoid temporary construction/decommissioning areas with no or minimal impact on their steaming times. As such the impact has been scoped out of the EIA.
		Operation and Maintenance	
Reduction in access to, or exclusion from established fishing grounds	C-02, C-10, C-11, C-12, C-13, C-16, C-17, C-18, C-19, C-20, C-21, C-22, C-23, C-24, C-25, C-26. C-29, C-32, C-36, C-38, C-42	Scoped In	Accessibility within the array area will be dependent on turbine spacing, turbine layout and foundation type. In particular, mooring systems of floating foundations may affect the ability of commercial fishing fleets in deploying certain gears. Further assessment required to conclude impact significance.
Displacement leading to gear conflict and increased fishing pressure on adjacent grounds	C-10, C-11, C-12, C-13, C-16, C-17, C-18, C-19, C-20, C-21, C-22, C-23, C-24, C-25, C-26, C-32, C-36, C-38, C-42	Scoped In	Any reduced access to fishing grounds creates the potential for displacement of fishing activity. This effect is expected to be localised and the operational range of relevant fleets will not typically be limited to the proposed development. Further assessment required to conclude impact significance.
Disturbance of commercially important fish and shellfish resources leading to displacement or disruption of fishing activity	C-08, C-38	Scoped In	O&M of the proposed development may lead to disturbance of commercially important fish and shellfish resources, including electromagnetic fields from subsea cables, and changes to habitat, and therefore displace or disrupt a range of fishing activity. Further assessment required to conclude impact significance; assessment will be informed by the outcomes of the fish and shellfish ecology impact assessment (Chapter 9), and it will be assumed that commercial fisheries will be affected as a result of any loss of resources.
Increased vessel traffic associated with the proposed development within fishing grounds leading to interference with fishing activity	C-10, C-11, C-12, C-13, C-16, C-17, C-18, C-19, C-20, C-21, C-22, C-23, C-24, C-25, C-26, C-32, C-36, C-42	Scoped In	Movement of vessels associated with O&M of the proposed development adding to the existing volume of marine traffic in the area, may lead to interference of fishing activity. Further assessment required to conclude impact significance; assessment will be informed by the outcomes of the shipping and navigation impact assessment (Chapter 13) and NRA.

Impact Pathway	Embedded Mitigation	Scoped In or Scoped Out	Justification
Additional steaming to alternative fishing grounds for vessels that would otherwise fish within the proposed development	C-10, C-11, C-12, C-13, C-16, C-17, C-18, C-19, C-20, C-21, C-22, C-23, C-24, C-25, C-26, C-32, C-36, C-42	Scoped Out	This effect will be localised to safety zones associated with temporary maintenance works on installed structures and therefore limited deviations to steaming routes are expected. Given adequate notification, it is expected that vessels, which typically have an operational range beyond that of the proposed development (as indicated by VMS and ScotMap data presented above), will be in a position to avoid temporary maintenance areas around installed infrastructure with no or minimal impact on their steaming times. As such the impact has been scoped out of the EIA.
Physical presence of infrastructure and potential exposure of that infrastructure leading to gear snagging	C-03, C-07, C-10, C-11, C-12, C-13, C-16, C-17, C-18, C-19, C-20, C-21, C-22, C-23, C-24, C-25, C-26, C-32, C-36, C-42	Scoped In	Standard industry practice and protocol (e.g., seabed infrastructure will be buried and/or marked on nautical charts) will minimise the risk of gear snagging, but it remains likely to be an area of industry concern. Further assessment required to conclude impact significance. Safety aspects associated with this impact, including damage to property and vessel stability, will be considered within the shipping and navigation impact assessment (Chapter 13).

12.8 Potential Cumulative Impacts

12.8.1 Chapter 4 (EIA Methodology) details how potential cumulative impacts will be assessed through a CIA and gives examples of the projects which are likely to be included in that assessment.

12.8.2 Offshore wind projects and other activities, such as subsea cables and pipelines, relevant to the assessment of cumulative impacts on commercial fisheries will be identified through a screening exercise. The potential impacts considered in the cumulative assessment as part of EIA will be in line with those described for the project-alone assessment, though it is possible that some will be screened out on the basis that the impacts are highly localised (i.e., they occur only within proposed development boundaries) or where management measures in place for the proposed development and other projects will reduce the risk of impacts occurring. Key potential cumulative impacts are expected to result from a loss or restricted access to established fishing grounds and displacement of fishing activity.

12.8.3 The CIA for commercial fisheries will consider the maximum adverse design scenario for each of the projects, plans and activities in line with the methodology outlined in Chapter 4(EIA Methodology). A study area of the North Sea (ICES divisions 4 a,b,c) is proposed for the commercial fisheries CIA. The EIA will further consider the geographic scope of the cumulative impact assessment for certain fleets that may have a wider operational range, such as the scallop dredge and pelagic trawl fisheries.

12.9 Potential Transboundary Effects

12.9.1 Transboundary impacts will be considered based on any potential displacement of fishing activity into the Norwegian EEZ, which is expected to be unlikely based on data reviewed within this Offshore Scoping Report.

12.10 Proposed Approach to EIA

Guidance

12.10.1 In addition to the general approach and guidance outlined in Chapter 4(EIA Methodology), the assessment of potential impacts on commercial fisheries receptors will also comply with the following guidance documents where they are specific to this topic:

- Good Practice Guidance for assessing fisheries displacement by other licensed marine activities (Xodus, 2022);
- Best Practice Guidance for Fishing Industry Financial and Economic Impact Assessments (United Kingdom Fisheries Economic Network and Seafish, 2012);
- Fisheries Liaison with Offshore Wind and Wet Renewables group (FLOWW) Recommendations for Fisheries Liaison: Best Practice guidance for offshore renewable developers (FLOWW, 2014 and noted to be currently in the process of being updated; BERR, 2008);
- FLOWW Best Practice Guidance for Offshore Renewables Developments: Recommendations for Fisheries Disruption Settlements and Community Funds (FLOWW, 2015);
- Options and opportunities for marine fisheries mitigation associated with wind farms (Blyth-Skyrme, 2010a);
- Developing guidance on fisheries Cumulative Impact Assessment for wind farm developers (Blyth-Skyrme, 2010b);

- Cumulative impact assessment guidelines, guiding principles for cumulative impacts assessments in offshore wind farms (Renewable UK, 2013);
- Guidelines for data acquisition to support marine environmental assessments of offshore renewable energy projects. Contract report: ME5403 (Cefas, 2012);
- Fisheries Liaison Guidelines - Issue 6 (UK Oil and Gas, 2015);
- Fishing and Submarine Cables - Working Together (International Cable Protection Committee, 2009); and
- Offshore Wind Farms - Guidance note for Environmental Impact Assessment in respect of Food and Environmental Protection Act (FEPA) and Coast Protection Act (CPA) requirements (Cefas), Marine Consents and Environment Unit (MCEU), DEFRA and Department of Trade and Industry (DTI), 2004).

Additional data sources

12.10.2 Detailed analysis of baseline datasets will be undertaken within the offshore EIA to characterise long-term (i.e., over several years) patterns in commercial fisheries activity across the study area and predict potential impacts upon future commercial fishing activities. Data sources include those set out within Table 12-1 and will additionally be expected to include marine traffic survey (AIS and radar) data gathered for the proposed development, the results of any fisheries scouting surveys (fishing gear and vessel observations), and data held by the Company FLO.

12.10.3 Consultation with the commercial fishing industry will be undertaken in order to ground-truth available baseline data and gain further understanding of commercial fisheries activity by smaller vessels across the inshore portion of the study area. Consultation will be undertaken with a number of relevant stakeholders, including the following:

- SFF;
- SWFPA;
- North and East Coast Regional Inshore Fisheries Group;
- Other local fishermen's associations and existing commercial fisheries working groups;
- Individual fishermen as identified by the Company FLO/other means; and
- Any Norwegian and EU Member State representative organisations as identified during baseline data analysis.

12.10.4 Analysis of data and the results of consultation will provide an extended baseline characterisation of the study area, which will underpin and inform the impact assessment.

12.10.5 No site-specific surveys are proposed to inform the commercial fisheries EIAR chapter.

Assessment Methodology

12.10.6 The EIA will follow the general approach outlined in Chapter 4 (EIA Methodology) of this Offshore Scoping Report. Definitions specific to commercial fisheries in relation to assessing the sensitivity of the receptor and magnitude of an impact will be provided to frame the assessment.

12.10.7 Where relevant, impact assessment will be informed by the outcomes of the fish and shellfish ecology and shipping and navigation assessments.

12.10.8 Impacts will be assessed for each relevant fleet/fishery scoped into EIA, and where relevant, impacts associated with the array area and the offshore ECC will be separately assessed.

12.10.9 To explore trends in fishing patterns, the EIA will typically analyse five years of data based on the most up to date data available for each particular data source at the time of analysis. Where appropriate, a longer timeline of data will be assessed; specifically, it is proposed to assess 10 years of data for the following fisheries:

- Haddock: to take account of stakeholder insight and knowledge that the demersal otter trawl fleet targeted haddock of a smaller size approximately 5-10 years ago owing to processor capability and market demand at that time.
- King scallop: to take account of the cyclical nature of scallop grounds that typically produce higher yields every 5-7 years.

12.11 Scoping Questions

12.11.1 The following Scoping questions refer to the commercial fisheries chapter and are designed to focus the scoping exercise and inform the scoping opinion:

- Do you agree with the study areas defined for commercial fisheries?
- Do you agree with the use of those data listed in Section 12.3, and any additional anticipated data listed in Section 12.10, being used to inform the Offshore EIA?
- Are there any additional data sources or guidance documents that should be considered?
- Do you agree that the embedded commitment measures described provide a suitable means for managing and mitigating the potential effects of the proposed development on commercial fisheries receptors?
- Do you agree with the scoping in and out of impact pathways in relation to commercial fisheries?
- Do you agree with the proposed assessment methodology for commercial fisheries?
- Do you agree with the assessment of the potential for transboundary effects in relation to commercial fisheries?
- Do you agree with the assessment of the proposed approach to cumulative effects in relation to commercial fisheries?

13 Shipping and Navigation

13.1 Introduction

13.1.1 This chapter of the Offshore Scoping Report identifies the shipping and navigation receptors of relevance to the proposed development and considers the potential impacts from the construction, O&M and decommissioning of the offshore components of the proposed development on shipping and navigation up to MHWS. The planned approach to assessing the impacts / risks from the proposed development within a NRA is also outlined.

13.1.2 This chapter should be read alongside the following other chapters:

- Chapter 12: Commercial Fisheries;
- Chapter 15: Military and Civil Aviation; and
- Chapter 19: Infrastructure and Other Users.

13.1.3 This chapter of the Offshore Scoping Report has been prepared by Anatec Limited.

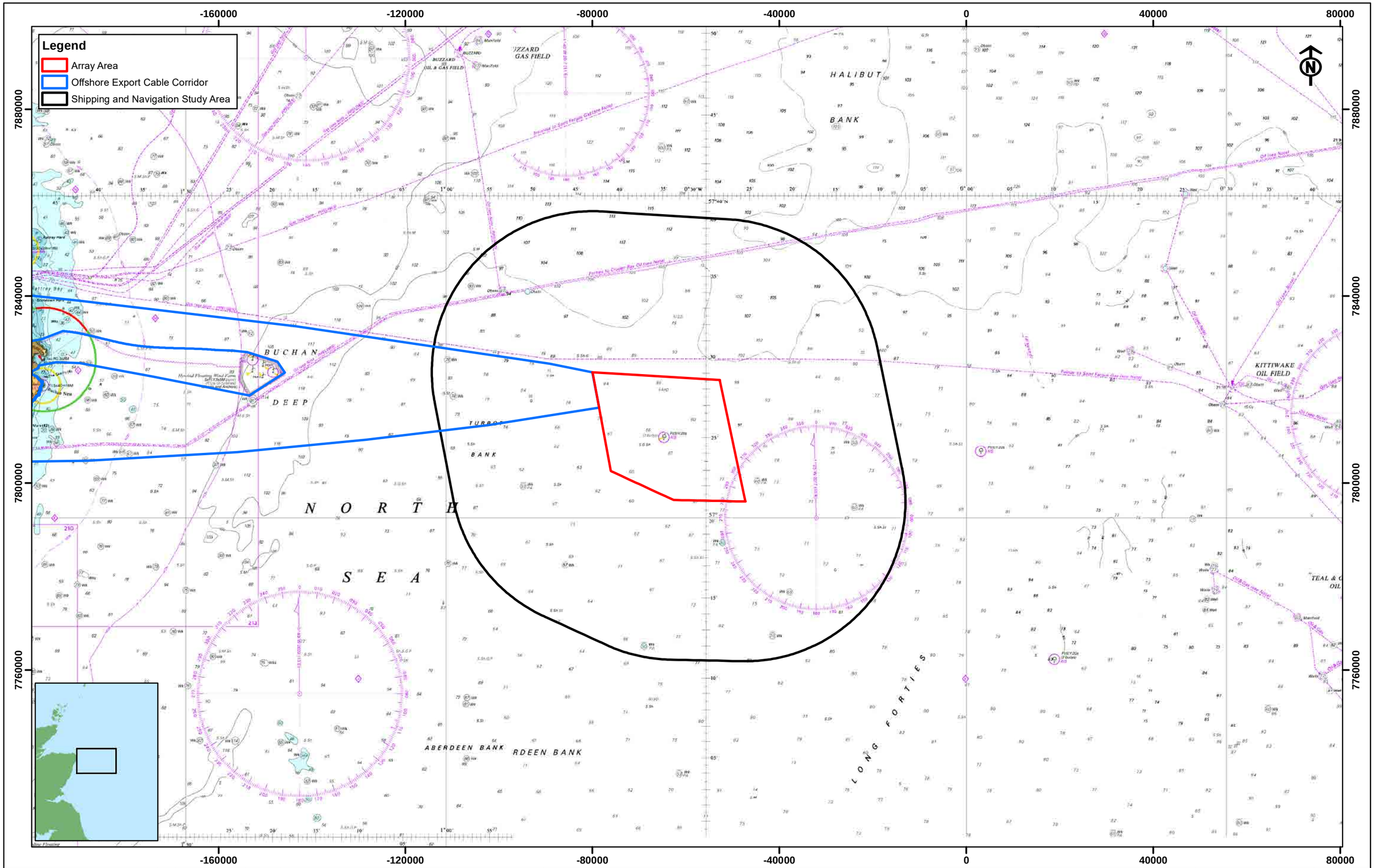
13.2 Study Area

13.2.1 The shipping and navigation study area is defined by a 10 nautical mile (nm) buffer around the Muir Mhòr array area. The 10 nm buffer is standard for shipping and navigation assessments as it is large enough to encompass any vessel routeing which may be impacted, while remaining site specific to the area being studied. A separate study area for the offshore ECC will be assessed in the NRA as a part of the EIA, likely consisting of a 2 nm buffer. An overview of the shipping and navigation study area is presented in Figure 13-1, along with the array area and offshore ECC.

13.3 Baseline Environment

Data Sources

13.3.1 The data sources that have been used to inform the Shipping and Navigation chapter of the Offshore Scoping Report are presented within Table 13-1. These data sources will be taken forward and used to inform the EIA, alongside any additional site-specific data that will be collected for the proposed development



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Muir Mhòr Offshore Wind Farm Ltd, The Tun Building 4 Jackson's Entry, Holyrood Road, No 4 EH8 8PJ Edinburgh United Kingdom

Rev	Date	Drawn By	Checked By	Comment
A	11/05/23	DS	JM	First Issue

Datum	WGS 1984
Projection	WGS 1984 World Mercator
Plot	A3
Scale	1:750,000

0 4.5 9 13.5 18 22.5 km

MUIR MHÒR WIND FARM

Overview of Shipping and Navigation Study Area

Confidentiality Class	C1
Drg No	ANA-SCO-S&N-0131
Rev	A
Layout	NA

Figure 13.1

Ref files: Overview of shipping and navigation study area

Table 13-1: Key sources of shipping and navigation data.

Source, Author and Year	Summary	Coverage of Muir Mhòr array area and ECC
Automatic Identification System (AIS) satellite and terrestrial data – summer 14 days, Anatec 2022.	Fourteen days of desk based AIS data from 29-30 July 2022 and 18-29 August 2022 collected via satellite and terrestrial receivers. Provides movements of vessels broadcasting on AIS within the shipping and navigation study area. Vessels which are not required to carry AIS mandatorily may be underrepresented. In particular, vessels under 300 gross tonnage (GT), commercial fishing vessels under 15 metres (m) length and recreational vessels are not required to, and so may not broadcast information on AIS, unless carrying AIS voluntarily.	Fourteen days covering the shipping and navigation study area.
AIS, Radio Detection and Ranging (Radar), and visual observation survey data – winter 14 days, Anatec 2023.	A vessel traffic survey of the shipping and navigation study area was undertaken to collect 14 full days of seasonal vessel traffic data during 10-26 February 2023 with survey downtime due to adverse conditions between the 16-17 February 2023. Survey carried out by survey vessel *Karima* which was situated within the array area during the entity of the study period. Data collected includes AIS, radar, and visual observations of vessel traffic.	Fourteen days covering the shipping and navigation study area.
Incident data provided by the Marine Accident Investigation Branch (MAIB), MAIB 2012-2021	Provides details and locations of incidents reported by the MAIB over a 10-year period.	Ten years within the shipping and navigation study area.
Incident data provided by the RNLI, RNLI 2012-2021	Provides details and locations of incidents reported by the RNLI over a 10-year period.	Ten years within the shipping and navigation study area.
UKHOAdmiralty Charts 273-0, 278-0, and 1409-0, UKHO 2022	Provides an overview of navigational features located in proximity to the proposed development.	International dataset providing coverage throughout the North Sea.
UKHO Admiralty Sailing Directions North Sea (West) Pilot – NP54	Pilot book providing essential information to support port entry and coastal navigation for vessels including navigational hazards, buoyage, pilotage, regulations, general notes on countries, port facilities, seasonal currents, ice, and climatic conditions.	International dataset providing coverage throughout the North Sea.

13.4 Description of Baseline Environment

Navigational Features

13.4.1 An overview of relevant navigational features in proximity to the proposed development is presented in Figure 13-2. It is noted there are no charted navigational features within the array area.

13.4.2 The proposed development is located approximately 34 nm east of the Scottish coast at Peterhead, with Peterhead Port being the closest port/harbour to the proposed development. The proposed development is situated in UK waters with charted water depths ranging between 60-84 m within the array area and depths reaching 118 m within the offshore ECC.

13.4.3 Peterhead port is situated between the two offshore ECC landfall options and is the largest fishing port in Europe as well as being an important base for serving a range of commercial vessels (Peterhead Port Authority, 2023). Pilotage at the port is compulsory for:

- All vessels exceeding 3500 GT;
- All tankers carrying oil in bulk as cargo;
- Vessels carrying hazardous cargoes or dangerous good in bulk in quantities of 100 tonnes or more;
- Vessels carrying more than one tonne of IMO) Class 1 explosives;
- All vessel which, in the opinion of the Harbour Master or his appointed deputies, are defective, damaged or handicapped to such an extent that pilotage is required;
- Or when a pilot is required due to an obstruction in Peterhead Bay Harbour; and
- Vessels carrying more than 12 passengers.

13.4.4 Anchoring within Peterhead Bay is prohibited unless in an emergency or authorised by the Harbour Master or his deputies. No other charted anchorages are located in proximity to the proposed development.

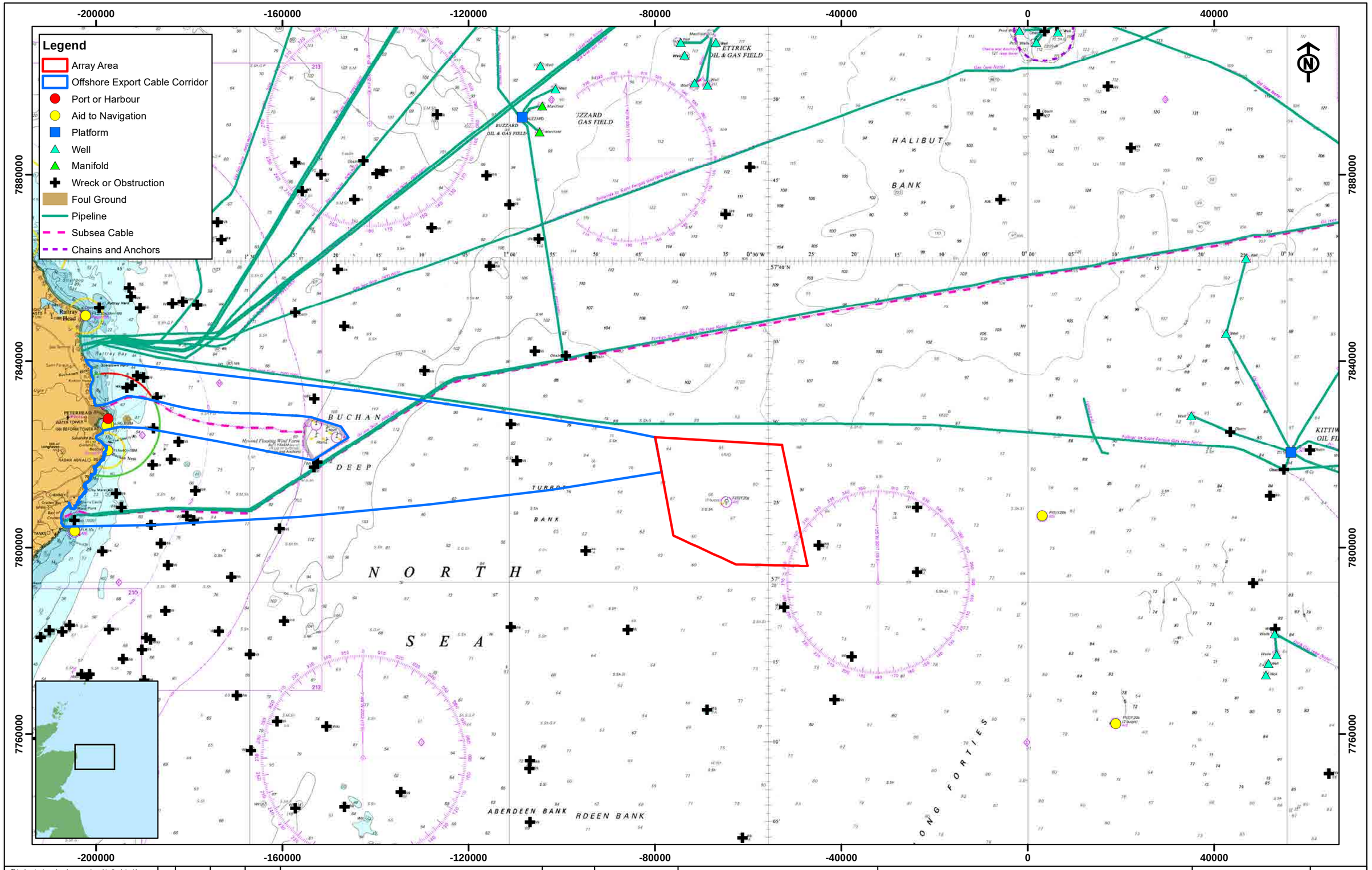
13.4.5 Also situated between the offshore ECC options, bordering the fork in the offshore ECC, is the Hywind Scotland floating OWF. This OWF is situated approximately 19 nm directly west of the Muir Mhòr array area and has been operational since 2019.

13.4.6 Situated less than 1 nm from Peterhead Port and neighbouring the south offshore ECC option is an area of foul ground of 0.2 nautical mile squared (nm^2).

13.4.7 The closest aid to navigation (AtN) to the array area is a spherical light buoy located 15 nm to the east. There is one AtN within the offshore ECC, the Buchan Ness Lighthouse situated on the coast within the southern offshore ECC option. There is a red-light buoy on the south boundary of the southern offshore ECC option, south of Cruden Bay, highlighting the shallow, rocky reef of The Skares to the west.

13.4.8 There are two subsea cables and two pipelines which intersect the offshore ECC. The Hywind Scotland OWF export cable intersects the northern offshore ECC option approximately 2 nm from the coast. The other subsea cable and both oil pipelines, all which make landfall in Cruden Bay from the Buzzard and Forties fields, intersect the southern offshore ECC option from their landfall to approximately 20 nm offshore. The Buzzard field is the closest oil and gas related infrastructure, located approximately 20 nm north of the array area.

13.4.9 There are 20 charted wrecks or obstructions within the offshore ECC and the closest to the array area being a wreck 1 nm to the east at a depth of 60 m.



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MUIR MHÒR OFFSHORE WIND FARM

anatec

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Rev	Date	Drawn By	Checked By	Comment
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Datum	WGS 1984
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Plot	A3
Scale	1:750,000

0 4.5 9 13.5 18 22.5 km

MUIR MHÒR WIND FARM
Navigational Features

Confidentiality Class	C1
Drg No	ANA-SCO-S&N-0132
Rev	A
Layout	NA

Figure 13.2

Ref files: Navigational features

Vessel Traffic Data

13.4.10 The vessel traffic derived from two 14 day seasonal data periods in the summer of 2022 and winter of 2023 (Table 13-1) are presented in Figure 13-3 and Figure 13-4, respectively. It is noted that the summer 2022 dataset is desk based (satellite and terrestrial receivers) while the winter 2023 dataset is from a dedicated on-site survey.

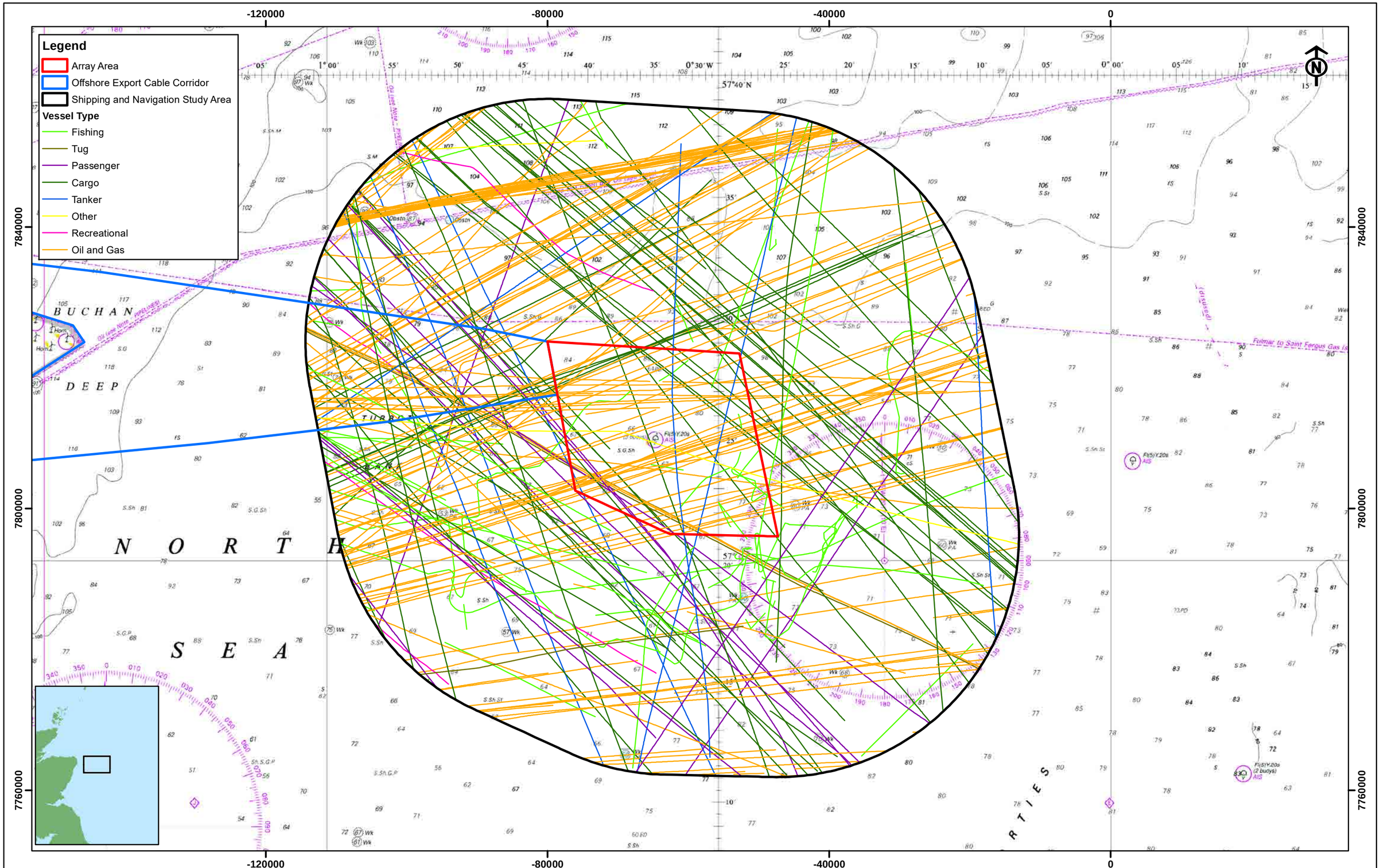
13.4.11 Vessels deemed to be representing temporary traffic (i.e., non-routine), have been removed from the analysis to ensure that the focus of the assessment is on permanent traffic within the surrounding area. Decisions to remove vessels were based on information broadcast via AIS and track behaviour. During the summer data period, temporary traffic removed from the dataset included vessels undertaking geophysical surveys, research vessels, vessels attending temporary jack-up rigs, and an offshore construction vessel that was attending Seagreen OWF (located approximately 52 nm south-west of the Muir Mhòr array area). Seagreen OWF was under construction during the survey period and so any vessels involved in the construction works are not classed as routine. During the winter data period, vessels removed from the dataset included the survey vessel *Karima* (which was the vessel undertaking the survey) and one offshore construction vessel associated with Seagreen.

13.4.12 During the summer data period, there was an average of 16 unique vessels recorded per day within the shipping and navigation study area. An average of five unique vessels intersected the array area per day, or 31% of all vessel tracks recorded during the summer data period. The main vessel types recorded during the summer data period were oil and gas (58%), cargo (20%), fishing (10%), and passenger (5%). No other vessel types equated to more than 5% of all vessel types recorded.

13.4.13 The average length of vessels recorded during the summer data period was 113 m. Vessel length ranged from 10 m for a recreational vessel to 316 m for a cruise liner.

13.4.14 During the winter survey period, there was an average of 12 unique vessels recorded per day within the shipping and navigation study area. An average of three unique vessels intersected the array area per day, or 25% of all vessel tracks recorded during the winter survey period. The main vessel types recorded during the winter survey period were oil and gas (72%), cargo (13%), fishing (10%), and tanker (5%). No other vessel types equated to more than 5% of all vessel types recorded. No recreational vessels were recorded within the shipping and navigation study area during the winter survey period which may be expected given the time of year and distance offshore.

13.4.15 The average length of vessels recorded during the winter survey period was 91 m. Vessel length ranged from 20 m for a fishing vessel to 276 m for a crude oil tanker.



Muir Mhòr Offshore Wind Farm Ltd, The Tun Building
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United Kingdom

Rev	Date	Drawn By	Checked By	Comment
A	11/05/23	DS	JM	First Issue

Datum	WGS 1984
Projection	WGS 1984 World Mercator
Plot	A3
Scale	1:500,000

0 3 6 9 12 15 km

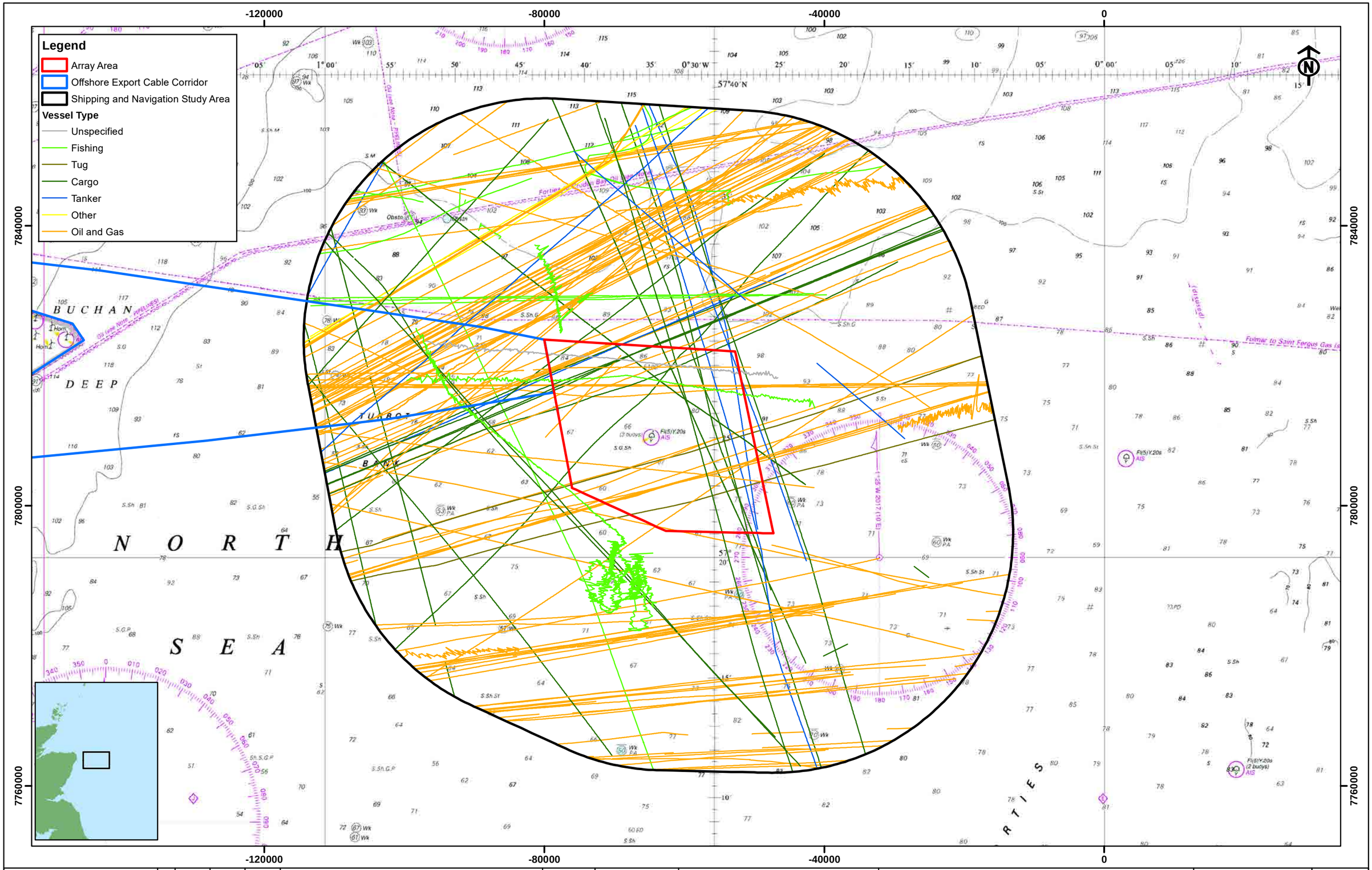
MUIR MHÒR WIND FARM

14-Day Vessel Traffic Data by Vessel Type (Summer 2022)

Confidentiality Class	C1
Drg No	ANA-SCO-S&N-0133
Rev	A
Layout	NA

Figure 13.3

Ref files: 14 days AIS summer



This drawing/map has been produced to the latest known information at the time of issue. Please consult with the Vattenfall GIS team to ensure the content is still current before using the information contained on this map.

MUIR MHÒR OFFSHORE WIND FARM

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Rev	Date	Drawn By	Checked By	Comment
A	11/05/23	DS	JM	First Issue

Datum	WGS 1984
Projection	WGS 1984 World Mercator
Plot	A3
Scale	1:500,000

0 3 6 9 12 15 km

MUIR MHÒR WIND FARM

14-Day Vessel Traffic Data by Vessel Type (Winter 2023)

Confidentiality Class	C1
Drg No	ANA-SCO-S&N-0134
Rev	A
Layout	NA

Figure 13.4

Ref files: 14 days AIS winter

13.4.16 Oil and gas vessels were the dominant vessel type recorded across both data periods. Over the combined 28 days of vessel traffic, all oil and gas vessels were on transit as opposed to being engaged in on-site oil and gas activities. This is expected as there is no oil and gas infrastructure present within the shipping and navigation study area. Most transits were recorded east-west across the study area with several vessels on a northwest-southeast route. There were several defined oil and gas routes recorded within the study area across both data periods, these included:

- North of the array area routeing between Peterhead Port (UK) and the Forties field;
- North of the array area routeing between the Port of Aberdeen (UK) and oil and gas fields;
- North of the array area routeing between Peterhead Port and the Kittiwake field;
- South of the array area routeing between the Port of Aberdeen and the Everest field; and
- Three routes at the southern extent of the shipping and navigation study area with vessels routeing between the Port of Aberdeen and various oil and gas locations including the Montrose field and the Gannet Area.

13.4.17 During the summer data period, oil and gas vessels were also recorded on a route to the northwest extent of the shipping and navigation study area routeing between Aberdeen (UK) and Tiffany Field (North Sea).

13.4.18 There was only one defined cargo vessel route identified across the 28 days of vessel traffic data. This east-west route intersected the northern extent of the array area and was utilised by the Sea-Cargo Roll-on/Roll-off cargo (Ro-Ro) vessel *Sea Cargo Express* which routes between Aberdeen (UK) and Tanager (Norway) each way, once per week.

13.4.19 During the summer data period, cargo vessels were also observed routeing north-west south-east on two low density routes positioned north-east and south-west of the array area, respectively. Vessels on these routes were primarily bulk carriers and container vessels. Vessels on these routes heading north-west were noted routeing to ports in Canada, Mexico, and to the west of the UK. Those vessels routeing south were primarily heading for Hamburg (Germany) and Bremerhaven (Denmark).

13.4.20 During the winter data period, a north-south cargo vessel route was noted intersecting the eastern extent of the Muir Mhòr array area with vessels routeing between Rotterdam (the Netherlands) and ports in Iceland and the Faroe Islands. As well as cargo vessels, several tankers were also utilising this route.

13.4.21 Passenger vessels were only recorded within the summer data period and were mainly on a north-west south-east route to the south-west of the array area. All vessels on this route were cruise liners headed between Invergordon (UK) and Bremerhaven (Denmark).

13.4.22 Fishing vessels were recorded mainly in transit to the south of the shipping and navigation study area during the summer data period and mainly in the north during the winter data period. Fishing vessels across the 28 days that were likely engaged in active fishing were observed to the immediate south of the array area across both data periods (pelagic trawlers in summer; seiners in winter). The most common port destination broadcast by fishing vessels was Fraserburgh Harbour (UK). Fishing vessels less than 15 m in length are not obliged to broadcast via AIS and as such the vessel traffic data presented during the summer data period likely does not represent the total fishing vessel activity. Those fishing vessels

not broadcasting on AIS were identified via Radar and visual observations during the winter data period (AIS 64% and Radar 36%).

13.4.23 Four unique recreational vessels were recorded during the summer data period, all which were on transits north-west south-east to the west of the array area. As with fishing vessels, recreational vessel activity may be underrepresented given AIS carriage requirements are not compulsory for recreational vessels, however, due to distance offshore there is not anticipated to be significant activity within the area.

Maritime Incident Data

Marine Accident Investigation Branch

13.4.24 Marine Accident Investigation Branch (MAIB) data was reviewed for a ten-year period between 2012-2021. Four incidents were recorded within the shipping and navigation study area, including one within the array area and one within the offshore ECC. The incident recorded within the Muir Mhòr array area was an allision incident involving a general cargo vessel in 2016. Given there are no infrastructure or surface obstructions within the array area, it is likely that this incident was misreported by the MAIB. The other three incidents within the shipping and navigation study area include two 'accidents to person' involving fishing trawlers, one of these occurring within the offshore ECC and the other to the north of the array area. The fourth incident was the flooding/foundering of a fishing vessel to the south of the array area.

13.4.25 Additional MAIB data covering the previous ten-year period (2002-2011) will be considered in the NRA to identify any trends.

Royal National Lifeboat Institution

13.4.26 RNLI data was reviewed for a ten-year period between 2012-2021. Five incidents were recorded within the shipping and navigation study area. All incidents were to the north of the Muir Mhòr array area and consisted of one unspecified incident, one grounding, one machinery failure, and two instances of 'person in danger'. The casualty types of these five incidents included two 'person in danger', one fishing vessel, one recreational vessel, and one unspecified. Kessock RNLI station responded to three of these incidents, while Fraserburgh and Invergordon RNLI stations each responded to one incident.

13.5 Summary and Key Issues

13.5.1 The key shipping and navigation receptors within the shipping and navigation study area are identified as follows:

- Commercial vessels (cargo vessels, tankers, passenger vessels, marine aggregate dredgers, tugs and other offshore support vessels undertaking commercial operations, particularly oil and gas vessels);
- Military vessels;
- Commercial fishing vessels in transit;
- Recreational vessels (2.4-24 m length);
- Ports/harbours and related services; and
- UK emergency responders.

13.6 Embedded Commitments

13.6.1 As part of the proposed development design process, a number of designed-in measures have been proposed to reduce the potential for impacts on environmental and socio-economic receptors. These are presented in Table 13-2 and in the Commitments Register (Appendix A) and will likely evolve over the development process as the EIA progresses and in response to stakeholder consultation.

Table 13-2: Embedded commitment measures of relevance to shipping and navigation.

Code	Commitment	Type (Primary, Secondary or Tertiary)	How Commitment Secured
C-02	Development of and adherence to a Cable Plan (CaP). The CaP will confirm planned cable routing, installation methods, cable specifications and any additional protection and requirement for any post-installation monitoring.	Tertiary	CaP
C-03	Development of and adherence to a DSLP. The DSLP will confirm layout and relevant design parameters.	Tertiary	DSLP
C-08	Development of and adherence to an EMP. This will set out mitigation measures and procedures relevant to environmental management, including but not limited to chemical usage, invasive and non-native species, pollution prevention and waste management.	Tertiary	EMP
C-09	Development of and adherence to a Decommissioning Programme. The DP will outline measures for the decommissioning of the Proposed Development.	Tertiary	DP
C-10	Development of and adherence to a VMP. The VMP will confirm the anticipated types and numbers of vessels that will be engaged on the proposed development and consider vessel coordination including indicative transit route planning.	Tertiary	VMP
C-13	Adherence to best practice guidance with regards to fisheries liaison and procedures in the event of interactions between the proposed development and fishing activities (e.g., FLOWW, 2014; 2015).	Tertiary	FMMS
C-16	Development of and adherence to a NSP). The NSP will describe measures put in place by the proposed development related to navigational safety, including information on Safety Zones, charting, construction buoyage, temporary lighting and marking, and means of notification of proposed development activity to other sea users (e.g., via Notice to Mariners).	Tertiary	NSP
C-17	Applications to be made, where appropriate, for Safety Zones (500 m) for construction and major maintenance works, and for pre commissioning works (50 m).	Secondary	NSP
C-18	Use of guard vessels where deemed appropriate to ensure adherence with safety zones or advisory	Secondary	NSP

Code	Commitment	Type (Primary, Secondary or Tertiary)	How Commitment Secured
	passing distances, as defined by risk assessment, to mitigate any impact which poses a risk to surface navigation during construction, maintenance and decommissioning phases. Such impacts may include partially installed structures or cables, extinguished navigation lights or other unmarked hazards.		
C-19	Advance warning and accurate location details of construction, maintenance and decommissioning operations, associated Safety Zones and advisory passing distances will be given via Notices to Mariners and Kingfisher Bulletins.	Tertiary	NSP
C-21	Compliance with Maritime and Coastguard Agency (MCA) Marine Guidance Note (MGN) 654 (MCA, 2021) and its annexes where applicable (including consideration of a SAR checklist, an ERCoP and Under Keel Clearance.	Tertiary	CaP CMS DSLP
C-22	Compliance of all project vessels with international marine regulations as adopted by the Flag State, notably COLREGs (IMO, 1972/77) and the International Convention for the Safety of Life at Sea (SOLAS) (IMO, 1974).	Tertiary	NSP
C-23	Notification of damage or decay to cables to the MCA, NLB Kingfisher and UKHO within 24 hours of discovery.	Tertiary	CaP NSP
C-24	Aids to navigation (marking and lighting) will be deployed in accordance with the latest relevant available standard industry guidance and as advised by NLB, MCA and CAA and MOD as appropriate. This will include a buoyed construction area around the array area in consultation with NLB.	Tertiary	NSP LMP
C-25	Appropriate marking of the proposed development on Admiralty and aeronautical charts. This will include provision of the positions and heights of structures to the UKHO, CAA, MOD and Defence Geographic Centre (DGC).	Tertiary	NSP LMP
C-26	Compliance with regulatory expectations on moorings for floating wind and marine devices published by MCA and the HSE.	Tertiary	CMS
C-29	Where practicable, cable burial will be the preferred means of cable protection. Cable burial will be informed by the CBRA and detailed within the CaP. In areas where CBRA deems burial not feasible, suitable implementation and monitoring of cable protection will be employed.	Primary	CaP
C-33	Minimum blade clearance of 30 m above MSL.	Primary	DSLP

Code	Commitment	Type (Primary, Secondary or Tertiary)	How Commitment Secured
			CMS
C-36	Development of and adherence to a Lighting and Marking Plan (LMP). The LMP will confirm appropriate lighting and marking mitigation whilst ensuring compliance with legal requirements with regards to shipping, navigation and aviation marking and lighting.	Tertiary	LMP
C-40	Development of and adherence to a WSP to provide details on requirements (if applicable) for assembled WTGs and cabling. WTGs to be held at a nearshore wet storage location before being transported to site.	Tertiary	WSP
C-42	Lighting and marking failures appropriately reported/rectified as soon as possible and interim hazard warnings put in place as required.	Tertiary	LMP

13.6.2 As a result of the commitment to implement these measures, and to align the proposed development with various standard sectoral practices and procedures, the embedded commitments are considered inherently part of the design of the proposed development and have, therefore, been included in the assessment presented in Section 13.7.

13.6.3 The requirement and feasibility of any additional mitigation measures will be dependent on the significance of the effects upon shipping and navigation and will be consulted upon with statutory consultees throughout the EIA process.

13.7 Scoping of Impacts

13.7.1 Table 13-3 sets out an initial assessment of the likelihood of effects on shipping and navigation due to proposed development activities for the scoping stage of the EIA process. The assessment is based on a combination of the following: the definition of the proposed development at the scoping stage; embedded commitments (as set out in Section 13.6, together with the means by which it will be secured); the level of understanding of the baseline at the scoping stage; the existing evidence base for shipping and navigation effects due to proposed development activities; relevant policy; and the professional judgement of qualified shipping and navigation specialists.

Table 13-3: Scoping assessment for shipping and navigation.

Impact Pathway	Embedded Commitments	Scoped In or Scoped Out	Justification
Construction and Decommissioning			
Vessel displacement due to construction activities resulting in increased vessel to vessel collision risk between third party vessels.	C-03, C-08, C-12, C-13, C-16, C-17, C-18, C-19, C-21, C-24, C-25, C-36, C-42,	Scoped In	Third-party vessels may be displaced from their existing routes due to construction/decommissioning activities associated with the proposed development with the reduction in available sea room and subsequent increased traffic density resulting in increased encounter and collision risk. Vessel traffic data shows several commercial routes currently passing through the proposed development.
Vessel to vessel collision risk between a third-party vessel and a project vessel.	C-03, C-08, C-10, C-12, C-13, C-16, C-17, C-18, C-19, C-22, C-24, C-36, C-42	Scoped In	The presence of project vessels during construction/decommissioning may increase the likelihood of vessel-to-vessel encounters and subsequently increase the collision risk between third-party and project vessels.
Reduced access to local ports due to construction/ decommissioning activities associated with the proposed development.	C-03, C-08, C-10, C-12, C-13, C-19, C-22	Scoped In	Access to local ports may be impacted due to construction/decommissioning activities associated with the proposed development. The extent of the impact will depend on the final landfall location chosen for the offshore ECC.
Operation and Maintenance			
Vessel displacement due to the presence of the proposed development resulting in increased vessel to vessel collision risk between third party vessels.	C-08, C-12, C-13, C-16, C-17, C-18, C-19, C-21, C-24, C-25, C-36, C-42,	Scoped In	Third-party vessels may be displaced from their existing routes due to the physical presence of the proposed development with the reduction in available sea room and subsequent increased traffic density resulting in increased encounter and collision risk. Vessel traffic data shows a number of commercial routes currently passing through the proposed development.
Vessel to vessel collision risk between a third party vessel and a project vessel.	C-08, C-10, C-12, C-13, C-16, C-17, C-18, C-19, C-22, C-24, C-36, C-42	Scoped In	The presence of project vessels during maintenance activities may increase the likelihood of vessel-to-vessel encounters and subsequently increase the collision risk between third-party and project vessels.

Impact Pathway	Embedded Commitments	Scoped In or Scoped Out	Justification
Creation of vessel to structure allision risk.	C-03, C-08, C-10, C-12, C-13, C-17, C-19, C-21, C-22, C-24, C-25, C-33, C-36, C-40, C-42	Scoped In	Surface piercing structures will pose a potential allision risk (powered or drifting) to third-party vessels.
Reduced access to local ports due to maintenance activities associated with the proposed development.	C-08, C-10, C-12, C-13, C-19, C-22	Scoped In	Access to local ports may be impacted due to maintenance activities associated with the proposed development. The extent of the impact will depend on the final landfall location chosen for the offshore ECC.
Reduction in under keel clearance due to the presence of cable protection.	C-02, C-21, C-23, C-25, C-29	Scoped In	The implementation of cable protection may reduce existing water depths and the subsequent available under keel clearance available to third-party vessels.
Vessel interaction with subsea cables and mooring lines associated with the proposed development.	C-02, C-16, C-18, C-19, C-23, C-25, C-26	Scoped In	The presence of subsea cables and mooring lines (for floating structures) associated with the proposed development may increase the likelihood of anchor or fishing gear interaction for third-party vessels. This impact will be considered in the NRA in relation to navigational safety only, i.e., effects on active fishing activity will be considered as part of the commercial fisheries assessment.
Loss of station.	C-08, C-12, C-13, C-16, C-18, C-19, C-24, C-26, C-33, C-36, C-42	Scoped In	A mooring system failure could cause a floating structure to lose station and create a hazard to safe navigation away from the array area.
Interference with marine navigation, communication and position fixing equipment.	C-21, C-24, C-25, C-29, C-36, C-42	Scoped In	Marine navigation, communication and position fixing equipment on board third-party vessels may be affected by the presence of structures within the array area or offshore ECC, including in relation to Radar and electromagnetic interference.
Reduction of emergency response capability including access for SAR responders	C-03, C-08, C-10, C-21, C-22, C-24, C-36, C-42	Scoped In	The presence of the proposed development may result in an increased number of incidents requiring emergency response associated with project vessels or third-party vessels. Also, the presence of surface piercing structures may reduce access capability for SAR responders including helicopters.

13.8 Potential Cumulative Impacts

13.8.1 Chapter 4 (EIA Methodology) details how potential cumulative impacts will be assessed through a CIA and gives examples of the projects which are likely to be included in that assessment. For shipping and navigation, cumulative interactions may occur with (but not limited to) other OWF developments, oil and gas infrastructure, subsea cables/pipelines, and marine aggregate dredging areas. A screening of projects will be undertaken with consideration of the following criteria:

- Project status (projects operational or under construction may be screened out on the basis that vessel traffic movements in the baseline environment will already be representative);
- Distance to the array area and offshore ECC;
- Level of interaction with baseline traffic relevant to the proposed development;
- Level of concern raised during consultation; and
- Data confidence.

13.8.2 Screened in projects will be taken forward for consideration in the CIA and a tiering system used to ensure all realistic cumulative scenarios are adequately assessed.

13.8.3 The CIA for shipping and navigation will consider all of the impacts considered for the proposed development in isolation.

13.9 Potential Transboundary Effects

13.9.1 There is the potential for transboundary impacts upon shipping and navigation receptors during all phases of the proposed development given the international nature of vessel traffic movements. Given the international use of AIS to broadcast vessel information, the baseline environment will allow the transboundary effects to be considered alongside the impact assessment of the proposed development in isolation and any affected transboundary states will be identified.

13.10 Proposed Approach to EIA

Guidance

13.10.1 In addition to the general approach and guidance outlined in Chapter 4 (EIA Methodology), the assessment of shipping and navigation receptors will also comply with the following guidance documents where they are specific to this topic:

- MGN 654 (Merchant and Fishing) Safety of Navigation: Offshore Renewable Energy Installations (OREIs) – Guidance on UK Navigational Practice, Safety and Emergency Response and its annexes (MCA, 2021);
- Revised Guidelines for Formal Safety Assessment (FSA) for Use in the IMO Rule-Making Process (IMO, 2018);
- International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA) Guideline G1162 Guidance on the Marking of Offshore Man-Made Structures (IALA, 2021 (a));
- IALA Recommendations O-139 on The Marking of Man-Made Offshore Structures (IALA, 2021 (b));

- The RYA Position on Offshore Renewable Energy Developments: Paper 1 (of 4) – Wind Energy (RYA, 2019);
- COLREGs as amended (IMO, 1972/77);
- SOLAS as amended (IMO, 1974); and
- United Nations Convention on the Law of the Sea (UNCLOS) (United Nations (UN), 1982).

Additional data sources

13.10.2 This will include a further vessel traffic survey for the shipping and navigation study area in compliance with the requirements of MGN 654 (MCA, 2021). In particular, this will consist of 14 days of AIS, Radar and visual observations data collected from a dedicated survey vessel on-site between June and August 2023.

13.10.3 This aligns with the 14 days of similar data already collected for winter 2023 (which is considered in the description of the baseline environment in Section 13.4). Together, these datasets will ensure that non-AIS vessels are suitably characterised when establishing the baseline environment in the EIA and allow seasonal variations to be identified.

13.10.4 Additionally, AIS data from desktop sources covering two seasonal 14-day periods will be used to characterise vessel movements within and in proximity to the offshore ECC. As noted in Section 13.2, the study area for this dataset is likely to be a 2 nm buffer of the offshore ECC.

13.10.5 Furthermore, long-term vessel traffic data recorded on AIS over a 12-month period (2022) within the shipping and navigation study area will be used to validate the findings of the vessel traffic surveys and further investigate any seasonal variation not immediately clear from the vessel traffic survey data.

13.10.6 Consultation with relevant stakeholders will also be used to further inform the baseline environment and impact assessment. Initial discussions have already taken place between the Muir Mhòr Project, the MCA and the NLB. Between June 2022 and January 2023, the Project consulted with the following ports: Nigg Energy Park, Ardersier, Orkney, Cromarty, Aberdeen, Dundee, Leith, Kishorn, Methil, Fraserburgh, Peterhead, Montrose, Inverness, and Hunterston PARC. An introductory meeting took place with the UK Chamber of Shipping on May 19th, 2023.

13.10.7 Further detailed consultation will be undertaken during the NRA / EIA process with key stakeholders relevant to shipping and navigation, including:

- RYA Scotland;
- RNLI;
- Cruising Association;
- Local ports and harbours, e.g., Peterhead Port, Port of Aberdeen;
- Regular vessel operators identified from the vessel traffic data; and
- Local marinas and yacht clubs.

Assessment Methodology

13.10.8 The EIA / NRA will follow the general approach outlined in Chapter 4 (EIA Methodology) of this Offshore Scoping Report. The assessment methodology for shipping and navigation will deviate from the methodology set out in Chapter 4 to ensure compliance with the IMO FSA approach (IMO, 2018), as required by Annex 1 to MGN 654 (MCA, 2021b).

13.10.9 The methodology centres on risk control and will assess each impact in terms of both frequency of occurrence and severity of consequence to determine whether the significance is 'broadly acceptable', 'tolerable', or 'unacceptable'. Impacts assessed as 'unacceptable' will require additional mitigation measures beyond the embedded commitments discussed in Section 12.6, in order to bring the impact within the 'tolerable' or 'broadly acceptable' parameters. This is an application of the As Low as Reasonably Practicable (ALARP) approach.

13.10.10 The risk-ranking matrix used to determine the significance from frequency and consequence is presented in Table 13-4.

Table 13-4: Risk-Ranking Matrix

		Frequency				
		Negligible	Extremely Unlikely	Remote	Reasonably Probable	Frequent
Consequence	Major	Tolerable	Tolerable	Unacceptable	Unacceptable	Unacceptable
	Serious	Broadly Acceptable	Tolerable	Tolerable	Unacceptable	Unacceptable
	Moderate	Broadly Acceptable	Broadly Acceptable	Tolerable	Tolerable	Unacceptable
	Minor	Broadly Acceptable	Broadly Acceptable	Broadly Acceptable	Tolerable	Tolerable
	Negligible	Broadly Acceptable	Broadly Acceptable	Broadly Acceptable	Broadly Acceptable	Tolerable

13.10.11 The frequency and consequence rankings per impact will be determined using a number of inputs, including:

- Quantitative modelling undertaken in the NRA (using Anatec's COLLRISK software);
- Hazard Workshop feedback from a cross-section of shipping and navigation receptors;
- Other stakeholder consultation feedback;
- Outputs of the baseline characterisation, including the vessel traffic surveys;
- Consideration of embedded commitment measures;
- Lessons learnt from other offshore developments; and
- Expert opinion.

13.10.12 Additional mitigation measures (beyond those already embedded and listed in Section 12.6) will be recommended where necessary to reduce the residual risks to shipping and navigation receptors.

13.11 Scoping Questions

13.11.1 The following Scoping questions refer to the shipping and navigation chapter and are designed to focus the Scoping exercise and inform the Scoping Opinion:

- Do you agree with the study area(s) defined in Section 13.2 for shipping and navigation?

- Do you agree with the use of those data listed in Section 13.3 and the additional anticipated data listed in Section 13.10, for informing the EIA / NRA?
- Are there any additional data sources or guidance documents that should be considered?
- Do you agree that all receptors related to shipping and navigation have been identified?
- Do you agree with the impacts scoped in for shipping and navigation and in particular those relating to the use of floating technology?
- Do you agree the embedded commitments are appropriate, or are there other measures that should be included?
- Do you agree with the assessment of the potential for transboundary effects in relation to shipping and navigation?
- Do you agree with the assessment of the proposed approach to cumulative effects in relation to shipping and navigation?
- Do you agree with the proposed assessment methodology for shipping and navigation?
- Are there any additional shipping and navigation organisations that you would recommend be consulted?

14 Marine Archaeology and Cultural Heritage

14.1 Introduction

14.1.1 This chapter of the Offshore Scoping Report identifies the marine archaeology and cultural heritage receptors of relevance to the proposed development and considers the potential impacts from the construction, O&M and decommissioning of the proposed project on marine archaeology and cultural heritage up to Mean High Water Springs (MHWS). Cultural heritage and archaeology in the intertidal zone, between Mean Low Water Springs (MLWS) and MHWS, will also be considered within the Archaeology and Cultural Heritage chapter of the Onshore Scoping Report.

14.1.2 This chapter should be read alongside the following other chapters:

- Chapter 6: Marine and Coastal Processes; and
- Chapter 16: Seascape, Landscape and Visual Resources.

14.1.3 This chapter of the Offshore Scoping Report has been prepared by Wessex Archaeology.

14.2 Study Area

14.2.1 The marine archaeology and cultural heritage study area is defined by the proposed development footprint, comprising the Muir Mhòr array area and the offshore ECC, offshore from MLWS. A 1 km buffer has been added that will be used to capture relevant data on proximate designated and non-designated marine archaeological assets, and to provide the necessary context for understanding archaeological potential and heritage significance of receptors that may be affected by the proposed development. (Figure 14-1).

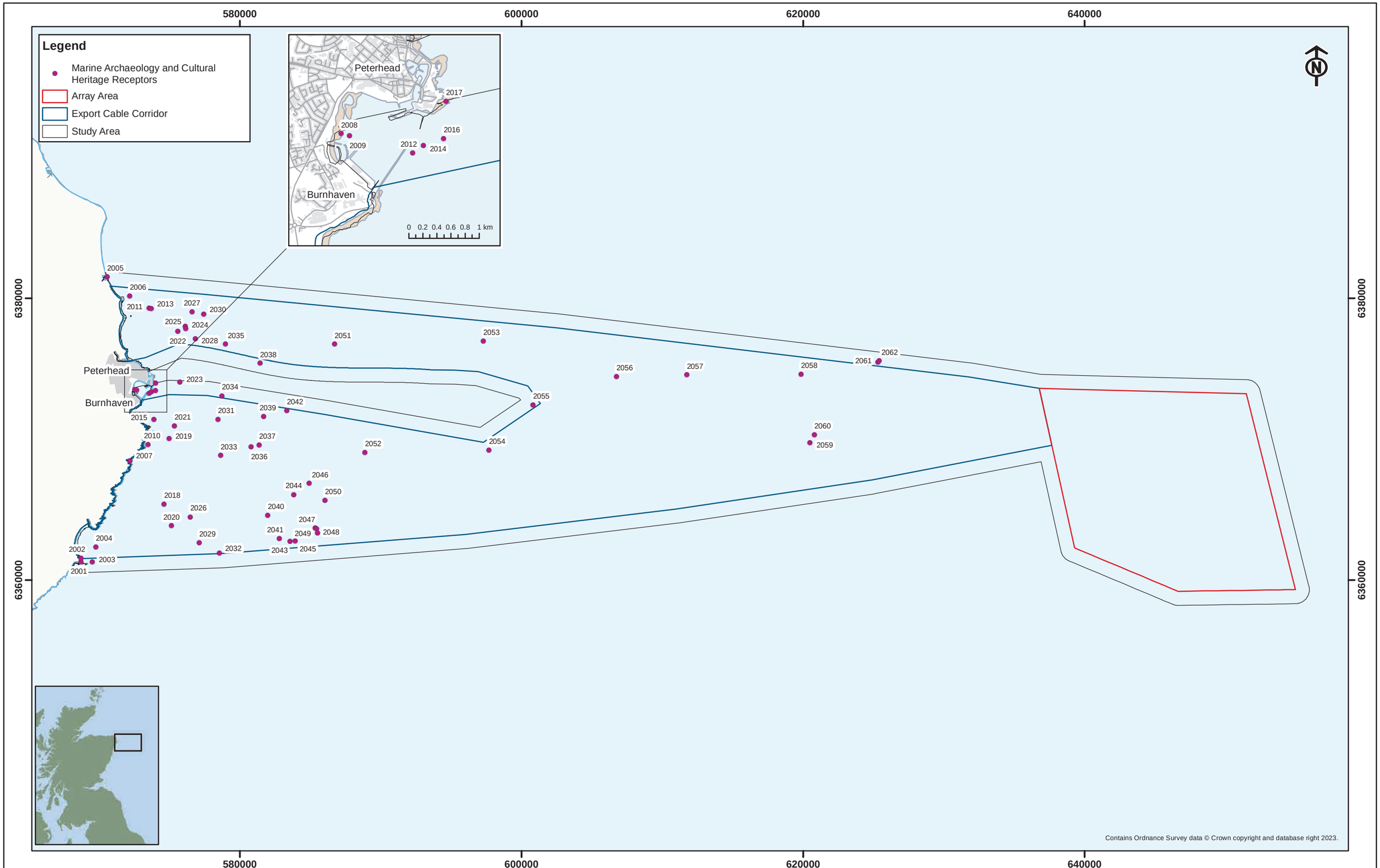
14.3 Baseline Environment

Data Sources

14.3.1 The data sources that have been used to inform this chapter are presented within Table 14-1. These data sources will be taken forward and used to inform the EIA, alongside any additional site-specific data that will be collected for the Project.

14.3.2 For this Offshore Scoping Report, the primary resource are wreck sites with positions verified by the United Kingdom Hydrographic Office (UKHO), as well as the maritime dataset from Canmore. The marine coverage of the Aberdeenshire Historic Environment Record (HER) have been acquired but not used for the purposes of scoping.

14.3.3 The potential for submerged archaeological assets such as palaeolandscapes and prehistoric remains was assessed using relevant available public literature and baseline knowledge.



This drawing/map has been produced to the latest known information at the time of issue. Please consult with the Vattenfall GIS team to ensure the content is still current before using the information contained on this map.

MUIR MHÒR OFFSHORE WIND FARM

A joint venture between Fred Olsen Seawind & Vattenfall

Muir Mhòr Offshore Wind Farm Ltd, The Tun Building
4 Jackson's Entry, Holyrood Road, No 4 EH8 8PJ Edinburgh
United Kingdom

Rev	Date	Drawn By	Checked By	Comment
A	13/04/23	AW	KJF	First Issue

Datum	ETRS 1989
Projection	ETRS 1989 UTM Zone 30N
Plot	A3
Scale	1:250,000

MUIR MHÒR WIND FARM

Marine Archaeology and Cultural Heritage Receptors

Confidentiality Class	C1
Drg No	263000-14.1
Rev	A
Layout	NA

Figure 14.1

Ref files: MMH_Fig14.1_Scoping_RevA

Table 14-1: Key marine archaeology and cultural heritage datasets.

Source, Author and Year	Summary	Coverage of Muir Mhòr array area and ECC
Wreck Database, UKHO, 2023	A record containing charted and uncharted wrecks, and obstructions.	Full coverage of Muir Mhòr array area and ECC.
Canmore, HES, 2023	The National Record of the Historic Environment of Scotland. Compiled and managed by HES. Contains entries for archaeological sites, findspots and archaeological events, including buildings, industry, and maritime heritage.	Full coverage of Muir Mhòr array area and ECC. Available in two datasets, maritime and terrestrial.
Aberdeenshire HER, Aberdeenshire Council Archaeology Service, 2023	Records of sites of archaeological and historical interest.	Full coverage of Muir Mhòr array area and ECC
BGS GeoIndex Offshore, BGS, 2023	Marine Environmental Data and Information Network (MEDIN) data archive centre for geology, geophysics and backscatter.	Full coverage of Muir Mhòr array area and ECC

14.4 Description of Baseline Environment

Overview of Baseline Environment

14.4.1 Marine historic assets are defined in the Marine (Scotland) Act 2010, Section 73 (5) as a vessel, vehicle, aircraft, parts or remains of such, objects contained or formerly contained in such, a building or other structure or parts of such, a cave or excavation, a deposit or, artefact or any other thing or groups of things that evidence previous human activity.

14.4.2 Marine archaeological and cultural heritage receptors located within the study area can be characterised as comprising three fundamental categories:

- Seabed prehistory;
- Maritime archaeology; and
- Aviation archaeology.

14.4.3 The known marine archaeological and cultural heritage receptors located within the study area are listed in Table 14-2, and shown in Figure 14-1.

Designated Assets

14.4.4 There are no sites located within the study area that have statutory designations under the Protection of Military Remains Act 1986 (PMRA 1986), Marine (Scotland) Act 2010 or the Ancient Monuments and Archaeological Areas (AMAA) Act 1979. If there were any aircraft material from crashed military aircraft within the study area, it would automatically be legally protected under the PMRA 1986.

Seabed Prehistory

14.4.5 There are currently no known submerged prehistoric assets within the study area, in large part due to significant data gaps in shallow coastal waters, with potential constrained by increased water depths in the northern North Sea (Bicket and Tizzard, 2015; Dawson *et al*., 2017).

14.4.6 Hominids and humans have occupied the British Isles at various times, with the earliest occupation extending back to around one million years (Parfitt *et al*., 2010), with coastal areas clearly attracting human populations, including landscapes that are now submerged (Bailey *et al.,* 2020).

14.4.7 The earliest archaeological evidence for Scotland comprises around the last 15,000 years and reflects Later Upper Palaeolithic and Early Mesolithic human activity at various locations across Scotland (Saville *et. al.,* 2012) in periods when (now-inundated) coastal land was more extensive than today, due to lower global sea-levels following the end of the last ice age (Gaffney and Fitch, 2022).

14.4.8 Nearshore areas around Scotland's coasts retain higher potential for encountering Late Pleistocene and Early Holocene submerged palaeolandscapes. For example, within the ECC and landfall areas there is potential for the presence of as yet undiscovered *in situ* palaeolandscape deposits (e.g., peats, estuarine and low-energy coastal sediments of archaeological interest), and prehistoric sites and finds located within the inundated nearshore palaeogeography. Any prehistoric discoveries will be regarded of national importance, above or below sea level.

Maritime archaeology

14.4.9 Maritime archaeological sites can be considered to comprise two broad categories; the remains of vessels that have been lost as a result of stranding, foundering, collision, enemy

action and other causes (e.g., shipwrecks), and those sites that consist of vessel-related material including jetsam, flotsam, lagan and derelict.

14.4.10 Vessel-related material includes (but is not limited to) equipment lost overboard or deliberately jettisoned, such as fishing gear, ammunition and anchors, or the only surviving remains of a vessel such as its cargo or a ballast mound.

14.4.11 Shipwrecks on the seabed provide an insight into the types of vessels used in the past, the nature of shipping activity in the wider area and the changing usage of the marine environment through different periods. Such remains are considered more likely in sediments which promote the preservation of wreck sites (e.g., finer grained sediments that are not subject to high levels of mobility), particularly where such sediments have seen limited, recent disturbance.

14.4.12 There are 62 records listed by the UKHO and Canmore located in the study area (Table 14-2). These comprise of:

- 39 wreck sites;
- 10 wreck sites that are now listed as dead (i.e., they have not been located by repeated surveys, however there may still be wreck material at these locations);
- Three wrecks that has been lifted (i.e., almost wholly salvaged, although there may still be wreck material at this location);
- Four obstructions or foul ground; and
- Six obstructions or foul ground that are now listed as dead.

14.4.13 Most of the known wreck sites date to the 20th century, in particular relating to the First and Second World Wars, however there are also numerous records for vessels that sank post-1945.

14.4.14 Shipwreck inventories and documentary sources are usually biased towards the 18th century and later when more systematic reporting began. Therefore, there are few known historical records of wrecks from medieval or earlier periods. There is high potential for both unknown, unrecorded vessels and reported but unlocated losses to have sunk in the array area and the ECC over many centuries.

Table 14-2: Maritime archaeology records within the study area.

WA ID	UKHO ID	Canmore ID	Type	Description	Easting (ETRS 1989 UTM30N)	Northing (ETRS 1989 UTM30N)
2001	2387	321974	Wreck	The fishing vessel DAISY that sank in 1993. Now listed as dead.	568708	6361290
2002	2254	125162	Wreck	The Dutch carrier MARIA W, built in 1932, sank in 1966 after running aground, carrying fertiliser.	568721	6361539
2003	2369	101867	Wreck	The Danish steam ship XENIA, built in 1895, sunk after running aground in 1903, en route from the Tyne to Boston with a cargo of coal.	569527	6361275

WA ID	UKHO ID	Canmore ID	Type	Description	Easting (ETRS 1989 UTM30N)	Northing (ETRS 1989 UTM30N)
2004	N/A	324617	Obstruction	Listed in Canmore data as relating to UKHO 79081 but does not appear in UKHO data.	569771	6362323
2005	2363	321961	Wreck	The fishing vessel JACQUELINE sunk in 1982 after grounding.	570579	6381517
2006	2365	321962	Wreck	The fishing vessel OCEAN HERALD II that ran aground at Scotstown Head in 1984.	572197	6380154
2007	2267	101744	Wreck	Wreck of the steam ship ZITELLA, built in 1929, stranded in 1940, en route from Narvik to Middlesbrough with a cargo of iron ore.	572205	6368464
2008	2378	101873	Wreck	Burnt out hulk. Listed as lifted.	572548	6373512
2009	65023	324038	Wreck	The Dutch tug SMIT-LLOYD 47, lost in 1979 after dragging anchor. Refloated in 1979 and listed as lifted.	572666	6373483
2010	2266	101835	Wreck	Wreck of the steam ship CAIRNAVON, built in 1920, sunk in 1925 on passage from Leith to Montreal.	573485	6369600
2011	N/A	202100	Wreck	A wreck listed in Ridley (1992) Dive Scotland.	573562	6379278
2012	2273	321924	Wreck	The wreck of the fishing vessel BEN TARBET sank in 1975 after collision with Venturer. Wreck measures 40 m x 30 m x 1.37 m. Wreck has been demolished and is now listed as foul ground.	573566	6373239
2013	2285	101843	Wreck	The steam ship MURIEL was torpedoed in 1918 whilst en route from the Tyne to Scapa Flow with a cargo of coal. Now listed as dead.	573710	6379255
2014	N/A	202086	Wreck	A wreck listed in Ridley (1992) Dive Scotland.	573719	6373342
2015	2379	292343	Wreck	The fishing vessel CONSTANT STAR ran aground in 1987.	573904	6371386
2016	73699	324450	Wreck	The tug IJSSELSTROOM sank in 2009 whilst assisting with a tow of a stone barge into Peterhead. It is now assumed to be lifted and listed as dead.	574007	6373440
2017	2385	208634	Wreck	SEA REEFER, a carrier registered in Antigua and Barbuda, built 1970, broke	574039	6373971

WA ID	UKHO ID	Canmore ID	Type	Description	Easting (ETRS 1989 UTM30N)	Northing (ETRS 1989 UTM30N)
				off anchor in 1992 and was wrecked. Demolished where it lay, so listed as lifted.		
2018	2262	101743	Wreck	Unknown wreck measuring 36 m x 8 m x 6.7 m. Intact.	574615	6365378
2019	N/A	292398, 292399	Wreck	Two wrecks appearing on an 1869 chart.	574979	6370025
2020	2256	321920	Wreck	The fishing vessel INTEGRITY sank in 1976 after a collision with the trawler Rowanlea. Wreck measures 38 m x 9 m x 4 m. Wreck is upright with the decks collapsed.	575158	6363844
2021	79296	N/A	Wreck	Wreck shown on 6th edition of chart BA 1438. Listed as dead.	575363	6370922
2022	2282	N/A	Wreck	The steam ship MURIEL sank in 1918 with a cargo of coal. Wreck measures 85-90 m x 12 m x 5 m. Wreck in one piece but bows are flattened.	575598	6377649
2023	78420	101841	Foul ground	Thought to be dumped hawsers.	575754	6374048
2024	2286	101844	Wreck	Wreck of steam ship SAINT MAGNUS, built 1912, sunk in 1918 after being torpedoed whilst en route from Methil to New York with general cargo and mail. Wreck is intact and upright and measures 69 m x 22 m x 6.5 m.	576136	6377980
2025	N/A	202099	Wreck	A wreck listed in Ridley (1992) Dive Scotland.	576173	6377841
2026	2261	N/A	Foul ground	Listed as dead.	576482	6364461
2027	2283	101842	Wreck	The screw steam trawler BEL LILY, built 1899, sunk in 1917 after striking contact mine whilst on passage to Grimsby. Wreck measures 37 m x 11 m x 4.7 m, highly degraded.	576623	6379034
2028	N/A	101840	Obstruction	A sonar contact, that may be associated with CRANSDALE lost in 1931.	576845	6377112
2029	N/A	202071	Wreck	A wreck listed in Ridley (1992) Dive Scotland.	577119	6362641
2030	2284	202103	Wreck	An unknown wreck measuring 37 m x 22 m x 5 m.	577440	6378860

WA ID	UKHO ID	Canmore ID	Type	Description	Easting (ETRS 1989 UTM30N)	Northing (ETRS 1989 UTM30N)
2031	N/A	202068	Wreck	A wreck listed in Ridley (1992) Dive Scotland.	578453	6371389
2032	2255	101747	Wreck	Unknown wreck measuring 139 m x 31 m x 11.5 m with several depressions nearby that could be depth charge craters. Canmore suggests HMS ORMONDE.	578553	6361900
2033	2269	101837	Wreck	Possibly the wreck of the steam trawler WINDWARD HO, built 1902, sank in 1917 after hitting a mine. Wreck measures 50 m x 12 m x 5.3 m. Wreck is upright and intact.	578642	6368837
2034	2272	321923	Wreck	Largely intact unknown wreck measuring 36 m x 10 m x 4.9 m.	578722	6373059
2035	2281	321927	Wreck	Unknown wreck measuring 41 m x 8 m x 5.6 m. Upright and intact.	578990	6376746
2036	2268	101836	Wreck	Possibly the wreck of HMS FLOTTA, a trawler built in 1941 and foundered after grounding in 1941. Wreck measures 15 m x 13 m x 2.8 m and is highly degraded.	580802	6369447
2037	59197	323827	Obstruction	A container lost by MV Sardinia in 2001. Now listed as dead.	581386	6369565
2038	2278	N/A	Wreck	An unknown wreck now listed as dead. Canmore suggests the SKOMER.	581435	6375380
2039	2276	101838	Wreck	The Swedish steam ship ATLAND, built in 1910 and lost after collision with SS Carso in 1943 whilst on passage from Pepel to London. Wreck measures 119 m x 24 m x 10.2 m. Lies upright and is largely intact.	581704	6371596
2040	2260	101834	Wreck	Wreck of the steam ship ST GLEN, built in 1907 and sunk in 1940 after being bombed by aircraft. En route from Rosario and Buenos Aires to Hull. Now listed as dead.	581986	6364568
2041	2257	101832	Wreck	Unknown upright wreck measuring 34 m x 6 m x 3.5 m. Canmore suggests it could be the HMS ORMONE or FRIEDRICH BOLTE.	582805	6362932
2042	2270	N/A	Obstruction	Listed as dead.	583336	6372017
2043	2259	321921	Wreck	A wreck, probably the Finnish steam ship MERCATOR which was torpedoed in 1939, whilst en route from	583587	6362739

WA ID	UKHO ID	Canmore ID	Type	Description	Easting (ETRS 1989 UTM30N)	Northing (ETRS 1989 UTM30N)
				Buenos Aires to Helsinki via Leith. Wreck measures 113 m x 14 m x 9 m. Broken, with a strong magnetic anomaly.		
2044	74769	324508	Wreck	Unknown wreck lying in two parts, measuring 71 m x 40 m x 9.6 m.	583825	6366049
2045	N/A	202073	Wreck	A wreck listed in Ridley (1992) Dive Scotland.	583929	6362775
2046	2263	N/A	Obstruction	Listed as dead.	584942	6366855
2047	N/A	292512	Wreck	Possibly ARCTURUS	585363	6363677
2048	N/A	202075	Wreck	A wreck listed in Ridley (1992) Dive Scotland.	585453	6363642
2049	2258	101742, 101833	Wreck	Another possible position for the Finnish steam ship MERCATOR, torpedoed in 1939. Now listed as dead.	585517	6363341
2050	N/A	196053	Wreck	A wreck listed in Ridley (1992) Dive Scotland. The listed World Geodetic System (WGS) coordinates (N 57 45.17, W 1 33.67) appear outside the study area. The listed National Grid Reference (NGR) (NK 261 373) are within it. The NGR point has been used in this instance as unable to tell which is correct.	586049	6365636
2051	2280	N/A	Obstruction	Listed as dead.	586733	6376728
2052	2265	N/A	Obstruction	Listed as dead.	588898	6369042
2053	2392	321979	Wreck	Possibly the fishing vessel STELLA MARIE which sank in 1987. Wreck measures 30 m x 8 m x 4 m. Lies upright but is degraded.	597294	6376957
2054	2264	321922	Wreck	The motor vessel ANNEMIEKE, registered in Panama, built in 1968 and lost in 1978. Wreck measures 67 m x 23 m x 14.2 m. Wreck is highly degraded and in two parts.	597704	6369207
2055	2377	321968	Wreck	Wreck of the fishing vessel STELLA MARIE, sunk in 1987. Now listed as dead.	600819	6372414
2056	2275	321926, 292194	Wreck	The fishing vessel CALEDONIA (PD 234), sank in 1979 in rough seas. Now listed as dead.	606764	6374422

WA ID	UKHO ID	Canmore ID	Type	Description	Easting (ETRS 1989 UTM30N)	Northing (ETRS 1989 UTM30N)
2057	2274	321925	Wreck	The fishing vessel FAMILY'S PRIDE, sunk by submarine in 1917. Listed as dead.	611756	6374556
2058	69129	324214	Wreck	Wreck of the fishing vessel EVENING STAR, sunk in 2007. Built in 1983. Wreck is intact and measures 21 m x 8 m x 6.2 m.	619869	6374607
2059	N/A	292417	Wreck	Listed in Whittaker (1998) Off Scotland	620502	6369724
2060	2417	322001	Wreck	Wreck of the wooden fishing vessel SHARRINGDALE, sunk in 1995 after a collision. Wreck measures 18 m x 8 m x 6.7 m.	620803	6370310
2061	N/A	291576	Wreck	Listed in Whittaker (1998) Off Scotland	625329	6375440
2062	2413	321997	Foul ground	No information available.	625395	6375562

Aviation archaeology

14.4.15 Marine aviation archaeology receptors comprise the remains or associated remains of military and civilian aircraft that have been lost at sea (Wessex Archaeology, 2008). Evidence is divided into three primary time periods based on major technological advances in aircraft design: Pre-1939; 1939-1945; and post-1945. There are reported sites of aircraft crash sites in the study area and there is particularly high potential for the discovery aircraft from 1939-1945.

14.4.16 There were several airfields in the vicinity of the proposed development during the Second World War, including Royal Air Force (RAF) Peterhead. From 1941 to 1945, a number of aviation bases were maintained in Northeast Scotland supporting various roles including maritime patrol and defence; and, for example, Luftwaffe missions based from Norway to Scotland also suggest potential for historic aviation activity in the region.

14.4.17 Maritime aircraft crash sites can retain a significant amount of material, whilst being an ephemeral target to identify in survey datasets, with the potential for *in situ* human remains.

14.4.18 The remains of crashed military aircraft are protected under the PMRA 1986 and cannot be disturbed without a licence.

14.4.19 There are four records of aviation sites recorded in Canmore located in the study area (Table 14-3). However, these are recorded losses, as their positional location is approximate or arbitrary and no wreck material has been confirmed at the listed location.

Table 14-3: Aviation records within the study area

Canmore ID	Aircraft Type	Location of Loss	Year of Loss
292419	Avro Anson I	Three miles off [East of] Collieston.	1941
292544	Vickers Wellington IC	Ditched 1 mile SE of Cruden Bay.	1942
292173	Armstrong Whitworth Whitley	Crashed near [the] shore near Peterhead.	1943
292172	Unknown	Near Peterhead	1946

14.5 Summary and Key Issues

14.5.1 The key marine archaeology and cultural heritage receptors within the study area are identified as follows:

- Potential seabed prehistory receptors;
- Known and potential maritime archaeology receptors; and
- Potential aviation archaeology receptors.

14.6 Embedded Commitments

14.6.1 As part of the project design process, a number of designed-in measures have been proposed to reduce the potential for impacts on environmental and socio-economic receptors. These are presented in Table 14-4 and in the Commitments Register (Appendix A) and will likely evolve over the development process as the EIA progresses and in response to stakeholder consultation.

Table 14-4: Embedded commitment measures of relevance to marine archaeology and cultural heritage.

Code	Commitment	Type (Primary, Secondary or Tertiary)	How Commitment Secured
C-01	Scour protection or other appropriate mitigation to be employed around seabed infrastructure where there is the potential risk for significant scour to develop.	Tertiary	CaP CMS
C-02	Development of and adherence to a CaP. The CaP will confirm planned cable routing, installation methods, cable specifications and any additional protection and requirement for any post-installation monitoring.	Tertiary	CaP
C-03	Development of and adherence to a DSLP. The DSLP will confirm layout and relevant design parameters.	Tertiary	DSLP
C-09	Development of and adherence to a DP. The DP will outline measures for the decommissioning of the Proposed Development.	Tertiary	DP
C-28	The archaeological assessment of marine geophysical and geotechnical survey datasets would facilitate the implementation of archaeological exclusion zones (AEZs), micrositing of infrastructure, and the	Primary	WSI

Code	Commitment	Type (Primary, Secondary or Tertiary)	How Commitment Secured
	implementation of a Protocol for Archaeological Discoveries (PAD), as detailed in the Marine Written Scheme of Investigation (WSI).		

14.6.2 As a result of the commitment to implement these measures, and to align the proposed development with various standard sectoral practices and procedures, the embedded commitments are considered inherently part of the design of the proposed development and have, therefore, been included in the assessment presented in Section 14.7.

14.6.3 The requirement and feasibility of any additional mitigation measures will be dependent on the significance of the effects upon marine archaeology and cultural heritage and will be consulted upon with statutory consultees throughout the EIA process.

14.7 Scoping of Impacts

14.7.1 Table 14-5 sets out an initial assessment of the likelihood of effects on marine archaeology and cultural heritage due to proposed development activities for the scoping stage of the EIA process. The assessment is based on a combination of the following: the definition of the proposed development at the scoping stage; embedded commitments (as set out in Section 14.6, together with the means by which it will be secured); the level of understanding of the baseline at the scoping stage; the existing evidence base for marine archaeology and cultural heritage effects due to proposed development activities; relevant policy; and the professional judgement of qualified archaeological specialists.

14.7.2 Potential impacts on marine archaeology and cultural heritage have been identified which may occur during the construction, O&M, and decommissioning phases of the proposed development.

14.7.3 The potential activities during proposed development construction and decommissioning phases are:

- Direct physical impacts:
  - Intrusive seabed surveys such as geotechnical campaigns;
  - Installation of infrastructure (e.g., WTG foundations, OEP foundations, and transmission cables) on/into the seabed, and in the water column or above the surface;
  - Use of vessels (from anchors and jack-up legs) during installation, deployment, operations / maintenance and decommissioning (e.g., jack-up barge; multi cat; workboat; dive-support vessel; crane-barge; tug; specialist cable-laying vessel);
  - Removal of device(s), offshore export cable(s) and other infrastructure from the seabed; and
- Indirect physical impacts:
  - Scour associated with the disturbance from construction activities.

14.7.4 The potential activities during proposed development O&M are:

- Direct effects such as:

- Use of vessels (from anchors and jack-up legs) (e.g., jack-up barge; multi cat; workboat; dive-support vessel; crane-barge; tug);
- Other maintenance activities (e.g., biofouling removal; ROV/diver inspection or repairs); and
- Use of equipment to monitor devices *in situ* or other environmental parameters (e.g., ROV, cameras or acoustic devices).

- Indirect effects such as changes in local scouring and sedimentation patterns from installed seabed infrastructure.

Table 14-5: Scoping assessment for Marine Archaeology and Cultural Heritage.

Impact Pathway	Embedded Commitments	Scoped In or Scoped Out	Justification
Construction and Decommissioning			
Loss of or damage to known and unknown marine historic environment assets from direct impacts.	C-02, C-03, C-09, C-28	Scoped In	Any infrastructure comprised within the proposed development, including the device designs, the offshore export cable and other infrastructure that impacts on the seabed has the potential to result in the damage/loss of known archaeological features and unknown archaeological features, which may lie undiscovered on or below the surface of the seabed, if any are present. Similar effects may be expected from vessel jack-up or anchoring systems that impact the seabed, or the removal of devices and other infrastructure in ways that disturb the seabed during decommissioning activities. Effects are considered to be permanent.
Loss of or damage to submerged prehistoric landscapes from physical impacts	C-02, C-03, C-09, C-28	Scoped In	Any infrastructure comprised within the proposed development, including the device designs, the offshore export cable and other infrastructure that impacts on the seabed has the potential to result in the damage/loss of submerged prehistoric landscape deposits or features, if any are present. Similar effects may be expected from vessel jack-up or anchoring systems that impact the seabed, or the removal of devices and other infrastructure in ways that disturb the seabed during decommissioning activities. Effects are considered to be permanent.
Indirect disturbance to marine historic environment assets caused by cable burial methods and /or cable protection	C-02, C-03, C-09, C-28	Scoped In	Indirect impacts to known and potential seabed prehistory, maritime and aviation assets caused by changes to the hydrodynamic and sedimentary regimes due to sediment redistribution.
Operation and Maintenance			
Loss of or damage to known and unknown marine historic environment assets from direct impacts	C-01, C-02, C-03, C-09, C-28	Scoped In	Any infrastructure comprised within the proposed development, including the device designs, cables and other infrastructure on the seabed or in the water column above that result in localised scouring have the potential to result in the damage/loss of known and unknown archaeological features lying on the seabed, if such assets are shown to be present. Maintenance vessel jack-up or anchoring systems that impact the seabed, or the repeated removal and replacement of devices and other infrastructure in ways that disturb the seabed also have the potential to result in the damage/loss of any archaeological features lying on the seabed. Effects are considered to be permanent.

Impact Pathway	Embedded Commitments	Scoped In or Scoped Out	Justification
Loss of or damage to submerged prehistoric landscapes from direct impacts	C-01, C-02, C-03, C-28	Scoped In	Any infrastructure comprised within the proposed development, including the device designs, cables and other infrastructure on the seabed or in the water column above that result in localised scouring have the potential to result in the damage/loss of submerged prehistoric landscape deposits or features, if any are present. Maintenance vessel jack-up or anchoring systems that impact the seabed, or the repeated removal and replacement of devices and other infrastructure in ways that disturb the seabed also have the potential to result in the damage/loss of any such features. Although the likelihood of impact is low, effects are considered to be permanent.
Indirect disturbance to marine historic environment assets caused by additional cable protection used during repair and maintenance	C-02, C-03, C-28	Scoped In	Indirect changes to known and potential seabed prehistory, maritime and aviation assets caused by changes to hydrodynamic and sedimentary regimes may expose receptors leading to increased rates of deterioration through biological, chemical and physical processes.

Ministry of Defence

14.7.5 It is necessary to consider the aviation, air defence and other activities of the MOD. This includes:

- MOD airfields, both radar and non-radar equipped;
- MOD AD radars; and
- MOD Practice and Exercise Areas (PEXAs) for both aviation and non-aviation activities.

14.8 Potential Cumulative Impacts

14.8.1 Chapter 4 (EIA Methodology) details how potential cumulative impacts will be assessed through a CIA and gives examples of the projects which are likely to be included in that assessment. For marine archaeology and cultural heritage, cumulative interactions may occur with other seabed development such as offshore wind farms, oil and gas infrastructure, undersea cables and pipelines.

14.8.2 Impacts that are scoped into the assessment for the project alone are generally spatially restricted to being within close proximity to the Muir Mhòr array area and ECC.

14.8.3 The CIA for marine archaeology and cultural heritage will consider the maximum adverse design scenario for each of the projects, plans and activities in line with the methodology outlined in Chapter 4 (EIA Methodology).

14.9 Potential Transboundary Effects

14.9.1 The proposed development has no archaeology and cultural heritage receptors that are anticipated to occur as a result of proposed development activities during construction, O&M or decommissioning. Any predicted impacts on these pathways will largely be localised to within the study area and will not give rise to effects on the marine environment beyond UK waters.

14.9.2 The proposed development is a significant distance from the nearest adjacent exclusive economic zone (EEZ) of another state and, therefore, it is considered that transboundary impacts will not occur and will therefore be scoped out from further consideration within the EIA.

14.9.3 In addition to the general approach and guidance outlined in Chapter 4 (EIA Methodology), the assessment of marine archaeology and cultural heritage receptors will also comply with the following guidance documents where they are specific to this topic:

- Code of Practice for Seabed Developers (The Joint Nautical Archaeology Policy Committee and Crown Estate, 2006);
- Historic Environment Guidance for the Offshore Renewable Energy Sector (Wessex Archaeology, 2007);
- Guidance for Assessment of Cumulative Impacts on the Historic Environment from Offshore Renewable Energy (Oxford Archaeology & George Lambrick Archaeology and Heritage, 2008);
- Offshore Geotechnical Investigations and Historic Environment Analysis: Guidance for the Renewable Energy Sector (Gribble and Leather, 2011);
- Marine Geophysics Data Acquisition, Processing and Interpretation: Guidance Notes (Plets, Dix and Bates, 2013);

- Archaeological Written Schemes of Investigation for Offshore Wind Farm Projects (The Crown Estate, 2021);
- Protocol for Archaeological Discoveries: Offshore Renewables Projects (The Crown Estate, 2014);
- Standards and guidance for historic environment desk-based assessment (Chartered Institute for Archaeologists (CIfA), 2014); and
- Environmental Impact Assessment Handbook: Guidance for competent authorities, consultation bodies, and others involved in the Environmental Impact Assessment process in Scotland (Historic Environment Scotland and Scottish Natural Heritage, 2018).

14.9.4 As the proposed development is located within Scottish territorial waters and the UK EEZ, there is policy to consider in relation to the marine historic environment. These are outlined below and will also be considered in relation to the marine archaeology and cultural heritage Offshore EIA:

- UK MPS was jointly published by all UK Administrations in March 2011 as part of a new system of marine planning being introduced across UK seas. The MPS sets out the framework for preparing Marine Plans and making decisions affecting the marine environment. The MPS also states that Marine Plans must ensure a sustainable marine environment that will protect heritage assets (page 3).
- Scotland's National Marine Plan: A Single Framework for Managing Our Seas (March 2015) covers both Scottish inshore waters (out to 12 nm) and offshore waters (12 to 200 nm). It contains policies and advice concerning the marine historic environment, including that development and use of the marine environment should protect and, where appropriate, enhance heritage assets in a manner proportionate to their significance and that, as well as designated marine heritage assets, there are likely to be a number of undesignated sites of demonstrably equivalent significance, which are yet to be fully recorded or await discovery (pages 1, 19, 21);
- Scotland's National Marine Plan also recommends that Marine Planning Partnerships and licensing authorities should seek to identify significant historic environment resources at the earliest stages of planning or development process and preserve them *in situ* wherever feasible. Adverse impacts should be avoided, or, if not possible, minimised and mitigated. Where this is not possible licensing authorities should require developers to record and advance understanding of the significance of the heritage asset before it is lost, in a manner proportionate to that significance (page 21);
- The Historic Environment Policy for Scotland (HEPS) 2019 includes policies that decisions affecting any part of the historic environment require an inclusive understanding of its breadth and cultural significance and consideration of avoiding or minimising detrimental impacts (page 9); and
- Designation Policy and Selection Guidance (HES, 2019) stands alongside HEPS 2019 and outlines the principles and criteria that underpin the designation of Historic Marine Protected Areas (HMPAs) (page 4).

Additional data sources

14.9.5 A more detailed literature review will be developed for the EIA, building upon the high-level outline provided within this Offshore Scoping Report. Project-specific survey outputs will be used to enhance the understanding of the baseline conditions. These may include the

following geophysical surveys (side scan sonar, sub-bottom profiler, multi-beam echosounder, magnetometry) across the Muir Mhòr array area and offshore ECC.

Assessment Methodology

14.9.6 The EIA will follow the general approach outlined in Chapter 4 (EIA Methodology) of this Offshore Scoping Report.

14.9.7 An assessment will be conducted to identify any possible (as well as known) submerged cultural heritage within the Muir Mhòr array area and ECC. It would capture marine historic assets that have the potential to be present due to an unknown location of loss, since there could be assets of moderate and high heritage value present. The desk-based assessment would be conducted to appropriate professional standards (CIfA, 2014). The importance of marine historic environment assets would be evaluated to inform the assessment. The level of importance assigned depends on a number of factors, including intrinsic, contextual and associative characteristics. This will be based on:

- Designation Policy and Selection Guidance (HES, 2019);
- Ships and Boats: Prehistory to Present. Designation Selection Guide (English Heritage, 2012); and
- Assessing Boats and Ships 1860-1913, 1914-1938 and 1939-1950 (Wessex Archaeology, 2011).

14.9.8 The assessment would address the identification of any marine historic assets on the seabed, so that avoidance of impact can be embedded in the project design, and if avoidance is not possible, then an evidence-based approach will be used to design suitable mitigation strategies in consultation with MS-LOT and HES.

14.9.9 For any marine archaeology impacts scoped in, the assessment will be based on analysis of desk-based sources (including Geographical Information System (GIS) based gazetteer) and geophysical and geotechnical data collected specifically for the proposed development. The assessment of the magnitude of impact and the significance of effect on marine historic environment assets will be based on Historic Environment Scotland and Scottish Natural Heritage's Environmental Impact Assessment Handbook (2018). Specific detailed methodology for the historic environment will be agreed in consultation with statutory stakeholders and curators.

14.10 Scoping Questions

14.10.1 The following Scoping questions refer to the Marine Archaeology and Cultural Heritage chapter and are designed to focus the Scoping exercise and inform the Scoping Opinion:

- Do you agree with the study area(s) defined for Marine Archaeology and Cultural Heritage?
- Do you agree with the use of those data listed in Section 14.3, and any additional anticipated data listed in Section 14.9, being used to inform the Offshore EIA?
- Are there any additional data sources or guidance documents that should be considered?
- Do you agree with the recommendation for reviewing any available marine geophysical and geotechnical surveys to enhance the baseline historic marine environment?
- Have all potential impacts on marine archaeology and cultural heritage resulting from the proposed development been identified within this Scoping Report?

- Do you agree that the embedded commitments proposed for the proposed development will provide suitable means by which to manage and mitigate the potential effects of the proposed development on the marine historic environment?
- Do you agree with the assessment of the potential for transboundary effects in relation to marine archaeology and cultural heritage?
- Do you agree with the assessment of the proposed approach to cumulative effects in relation to marine archaeology and cultural heritage?
- Do you agree with the scoping in of impact pathways in relation to marine archaeology and cultural heritage?
- do you agree with the proposed assessment methodology for marine archaeology and cultural heritage?

15 Military and Civil Aviation

15.1 Introduction

15.1.1 This chapter of the Offshore Scoping Report identifies the military and civil aviation receptors of relevance to the proposed development and considers the potential impacts from the construction, O&M, and decommissioning of the offshore components of the proposed development on military and civil aviation.

15.1.2 WTGs have the potential to cause a variety of adverse effects on military and civil aviation receptors. WTGs can impact the radars used by civilian and military air traffic controllers because the characteristics of moving turbine blades are similar to those of aircraft, leading to spurious returns, or clutter, on radar displays. This can affect the safe provision of air traffic services or interfere with tracking of aircraft by the military. WTGs can also have the potential to present a physical obstruction for aviation activities such as military low flying or helicopter SAR operations.

15.1.3 Aviation stakeholders potentially affected include the CAA, NERL, NATS, the MOD, Aberdeen Airport, and offshore helicopter operators such as Bristow Group, who currently deliver the UK SAR contract on behalf of His Majesty's Coastguard.

15.1.4 This chapter should be read alongside the following other chapters:

- Chapter 13: Shipping and Navigation;
- Chapter 16: Seascape, Landscape and Visual Resources; and
- Chapter 19: Other Human Users.

15.1.5 This chapter of the Offshore Scoping Report has been prepared by Cyrrus Limited.

15.2 Study Area

15.2.1 In considering the spatial extent of the military and civil aviation study area, the overriding factor is the potential for WTGs within the Muir Mhòr array area to have an impact on civil and military aviation radars, taking into account required aviation radar operational ranges. In general, Primary Surveillance Radars (PSRs) installed on civil and military airfields have an operational range of between 40 and 60 nautical miles (nm). All radar-equipped airfields within 60 nm of the Muir Mhòr array area are therefore included in the study area. En-route radars operated by NATS (En-Route) plc (NERL) and military Air Defence (AD) radars are required to provide coverage at ranges in excess of 60 nm and so all such radars with potential Radar Line of Sight (RLoS) of WTGs in the array area are also included in the study area.

15.2.2 The military and civil aviation study area is defined by the proposed development footprint plus an appropriate buffer. This includes the airspace between the Muir Mhòr array area and the UK mainland, extending from the NERL radar facility at Allanshill to the west, to Aberdeen Airport to the south. Airports and radars within the study area that are under consideration as part of this Offshore Scoping Report are shown in Figure 15-1.

15.2.3 The following criteria have been used to identify receptors within the study area (and discussed further in the sections below:

- Civil aerodromes;
- MOD;
- NERL facilities;

- Other aviation activities; and
- Meteorological radio facilities.

Civil aerodromes

15.2.4 Civil Aviation Publication (CAP) 764 Policy and Guidelines on Wind Turbines (CAA, 2016) states the distances from various types of aerodromes where consultation should take place. These distances include:

- Aerodromes with a surveillance radar – 30 km;
- Non-radar equipped licensed aerodromes with a runway of more than 1,100 m – 17 km;
- Licensed aerodromes where the WTGs will lie within airspace coincidental with any published Instrument Flight Procedure (IFP);
- Unlicensed aerodromes with runways of more than 800 m – 4 km;
- Unlicensed aerodromes with runways of less than 800 m – 3 km;
- Gliding sites – 10 km; and
- Other aviation activities such as parachute sites and microlight sites within 3 km.

15.2.5 CAP 764 goes on to state that these distances are for guidance purposes only and do not represent ranges beyond which all WTG developments will be approved or within which they will always be objected to. For example, aerodromes may utilise their radars at ranges considerably in excess of 30 km.

15.2.6 As well as examining the technical impact of WTGs on Air Traffic Control (ATC) facilities, it is also necessary to consider the physical safeguarding of ATC operations using the criteria laid down in CAP 168 Licensing of Aerodromes (CAA, 2019) to determine whether the proposed development will breach obstacle clearance criteria.

NERL facilities

15.2.7 It is necessary to consider the possible effects of WTGs upon NERL radar systems; a nationwide network of primary and secondary radar facilities.

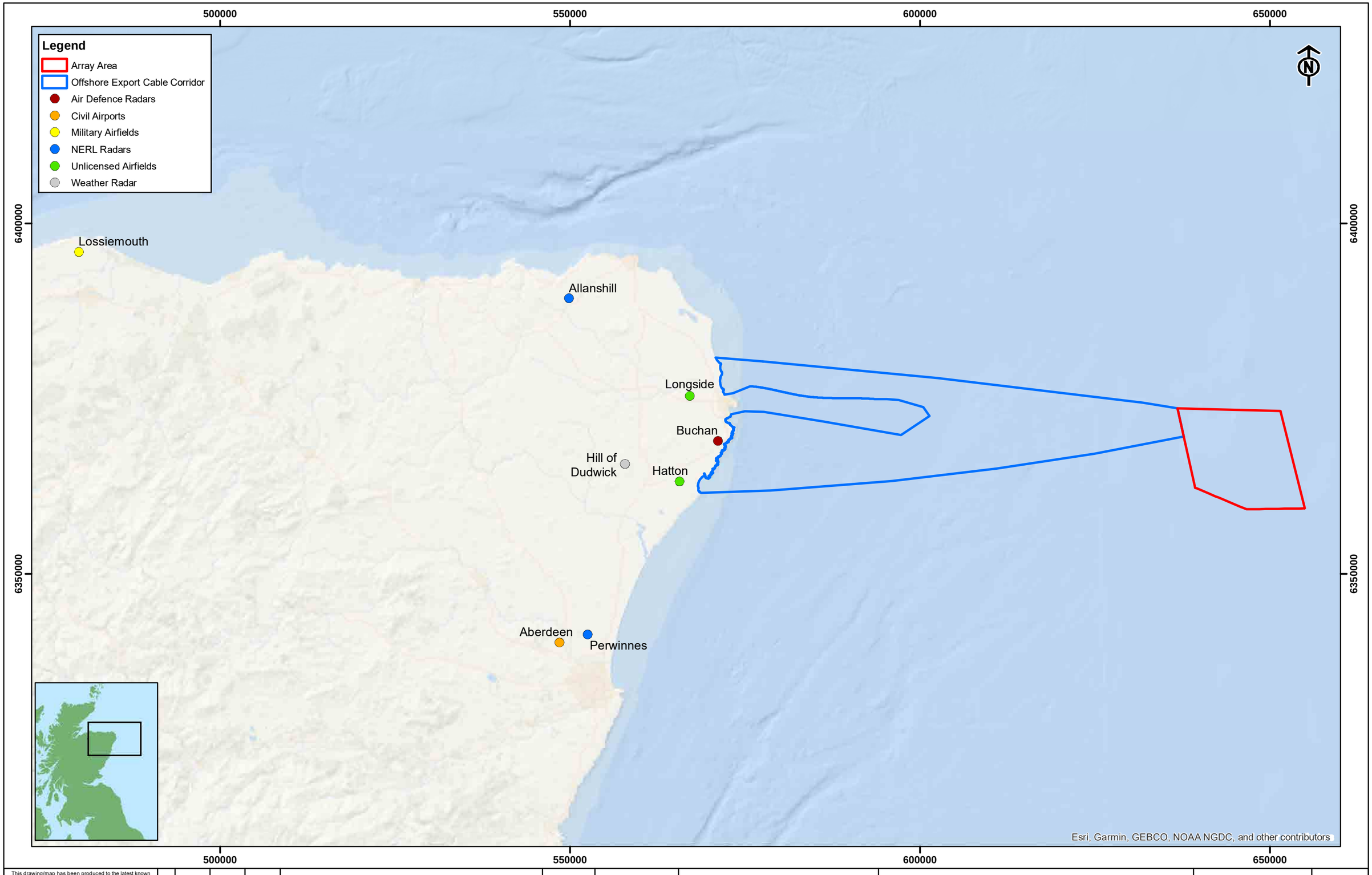
Other aviation activities

15.2.8 Other aviation activities of relevance could include:

- General military low flying training operations; and
- Military and civilian ‘off-route’ fixed-wing and helicopter operations, including SAR missions and offshore helicopter operations in support of offshore wind and oil and gas industries.

Meteorological radio facilities

15.2.9 WTGs have the potential to adversely impact meteorological radio facilities such as weather radars. The Met Office must be consulted by developers on WTG proposals within a 20 km radius zone of any of their UK weather radar sites.



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Datum	ETRS 1989
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0 4 8 12 16 20 km

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Airports and Radars Within the Military and Civil Aviation Study Area

Confidentiality Class	C1
Drg No	GoBe-0032
Rev	A
Layout	NA

Figure 15.1

Ref files: MMH_AVI_Fig15.1_StudyAreaRadarAirports_RevA

15.3 Baseline Environment

Data Sources

15.3.1 The data sources that have been used to inform the Military and Civil Aviation chapter of the Offshore Scoping Report are presented within Table 15-1. The primary sources of aviation related data are the UK civil and military Aeronautical Information Publications (AIPs). The AIPs contain details on airspace and en-route procedures as well as charts and other air navigation information. These data sources will be taken forward and used to inform the EIA.

Table 15-1: Key sources of military and civil aviation data.

Source, Author and Year	Summary	Coverage of Muir Mhòr array area and ECC
CAP 032 UK AIP, CAA 2023	Contains information on facilities, services, rules, regulations, and restrictions in UK airspace.	Full coverage
UK Military AIP, MOD 2023	The main resource for information on flight procedures at all military aerodromes.	Full coverage
Wind farm self-assessment maps, NATS 2012	Maps provided by NATS to ascertain potential impact of WTGs on their en-route electronic infrastructure.	Full coverage
Offshore infrastructure data, North Sea Transition Authority (NSTA) 2023	Regularly updated NSTA offshore shapefiles.	Full coverage

15.4 Description of Baseline Environment

15.4.1 Figure 15-2 presents an overview of the existing military and civil airspace environment. The following sections provide further details.

Civil aviation

15.4.2 The airspace above and adjacent to the Muir Mhòr array area is used by civil and military aircraft and lies within the Scottish Flight Information Region (FIR) for air traffic control. This airspace is regulated by the UK CAA. The Scottish FIR is adjacent to the Polaris FIR, whose boundary is approximately 213 km to the north-east of the array area at kits closest point and is regulated by CAA Norway.

15.4.3 Airspace is classified as either controlled or uncontrolled and is divided into a number of classes depending on what kind of Air Traffic Service (ATS) is provided and under what conditions. In the UK, there are five classes of airspace; specifically A, C, D, E and G. The first four are controlled airspace classes while Class G is uncontrolled. Within controlled airspace, aircraft are monitored and instructed by ATC, whereas in uncontrolled airspace aircraft are not subject to ATC instruction but rather operate according to a simple set of regulations. ATC may still provide information, if requested, to ensure flight safety.

15.4.4 Aircraft operate under one of two flight rules: Visual Flight Rules (VFR) or Instrument Flight Rules (IFR). VFR flight is conducted with visual reference to the natural horizon while IFR flight requires reference solely to aircraft instrumentation.

15.4.5 From sea level to Flight Level (FL) 195, approximately 19,500 feet (ft) or 5,950 m Above Mean Sea Level (AMSL), the airspace in the vicinity of the Muir Mhòr array area is Class G

uncontrolled airspace. This airspace is used predominantly by low level flight operations and generally by aircraft flying under VFR. Under VFR flight the pilot is responsible for maintaining a safe distance from terrain, obstacles, and other aircraft.

15.4.6 Above FL 195 is Class C controlled airspace in the form of a Temporary Reserved Area (TRA). This airspace, TRA 007B, has an upper vertical limit of FL 245, approximately 24,500 ft AMSL, and is available for use by both military and civil aircraft, though its main use is to accommodate VFR military flying activity. Above TRA 007B the upper limit of Class C airspace is FL 660, approximately 66,000 ft AMSL. Laterally, the closest controlled airspace to the array area is the Moray Control Area (CTA), which is divided into CTAs 1 to 17. Of these elements, the closest to the Muir Mhòr array area is CTA 2, approximately 9.5 km to the north-west. Moray CTA 2 is Class E controlled airspace with a lower limit of FL 105, approximately 10,500 ft AMSL, and an upper limit of FL 195. Above CTA 2 is Moray CTA 15, Class C airspace with an upper limit of FL 245. The Moray CTA is depicted in Figure 15-2.

15.4.7 The nearest major UK civil airport to the Muir Mhòr array area is Aberdeen Airport, which is approximately 93.5 km to the west-south-west (Figure 15-1). Aberdeen Airport is Scotland's third airport, the 16th busiest in the UK and the main heliport for offshore helicopter operations in the northern North Sea.

15.4.8 Longside Airfield is an unlicensed tar airstrip approximately 70 km west of the Muir Mhòr array area (Figure 15-1) and home to the Buchan Aero Club. Hatton Airstrip is a private grass strip approximately 72 km west of the Muir Mhòr array area (Figure 15-1).

15.4.9 NERL provides en-route civil air traffic services within the Scottish FIR and operates a network of radar facilities providing en-route information for ATC on both civil and military aircraft. The closest NERL radars to the Muir Mhòr array area are based at Allanshill, 88 km to the west-north-west, and Perwinnes, 89 km to the west-south-west (Figure 15-1).

15.4.10 Preliminary RLoS analysis for WTGs with a maximum tip height of 340 m AMSL indicates that all WTGs within the Muir Mhòr array area will be visible to both Allanshill and Perwinnes radars, as depicted in Figure 15-3. NERL radar facilities are combined PSR and Secondary Surveillance Radar (SSR) systems. NATS do not consider the impact of WTGs on SSR to be material or relevant for turbines that are beyond 15 nm (approximately 28 km) from their SSR facilities. Furthermore, CAP 764 states that WTG effects on SSR *"…are typically only a consideration when the turbines are located very close to the SSR i.e., less than 10 km".* The nearest SSR facility, at Allanshill, is 88 km from the Muir Mhòr array area.

15.4.11 During an introductory meeting with NATS they stated that they are going to procure replacement PSRs and that in the future, instead of radars at both Perwinnes and Allanshill, there may only be a single radar at an as yet undefined location. Any impacts on the current facilities will likely therefore change before Muir Mhòr consent/construction.

Military aviation

15.4.12 The Muir Mhòr array area lies beneath the Central Managed Danger Area (MDA), one of four MDA complexes in UK airspace that, when activated, provide segregated airspace for military flying training (Figure 15-2). Specifically, the array area is beneath danger area EG D613A which has vertical limits from FL 100, approximately 10,000 ft AMSL, to FL 660. Ordnance, munitions and explosives and high energy manoeuvre activities take place within this danger area.

15.4.13 Approximately 28 km north-north-east of the array area is Air to Air Refuelling Area (AARA) Area 04. AARA Area 04 is permanently available to military traffic and has vertical limits from FL 70 (approximately 7,000 ft AMSL) to FL 240 (approximately 24,000 ft AMSL).

15.4.14 EG D613A and AARA Area 04 are depicted in Figure 15-2. There are no known further PEXAs, including PEXAs for non-aviation activities, within the study area.

15.4.15 There are no PSR-equipped military airfields within the study area. The closest such airfield is Royal Air Force Lossiemouth, 159 km west-north-west of the array area.

15.4.16 The nearest MOD AD radar to the Muir Mhòr array area is based at Remote Radar Head Buchan, 66 km to the west. Preliminary RLoS modelling indicates that all WTGs within the array area will be visible to Buchan AD PSR. RLoS coverage at 340 m AMSL for Buchan AD PSR is illustrated in Figure 15-4.

Helicopter Main Routing Indicators

15.4.17 The Muir Mhòr array area is within the Aberdeen Offshore Safety Area (OSA), airspace extending from the surface to FL 100. The OSA is the busiest airspace in the vicinity in terms of offshore helicopter traffic and contains a network of offshore routes over the North Sea that are flown by helicopters in support of oil and gas installations. These routes are published on charts as Helicopter Main Routing Indicators (HMRIs) and, together with the OSA, alert other airspace users of the potential for frequent low-level helicopter traffic. The routes have no lateral dimensions, however there should be no obstacles within 2 nm of the route centreline.

15.4.18 The Muir Mhòr array area is within 2 nm of the centrelines of HMRIs 080, 083, 086, 089 and 092. All HMRIs in the vicinity of the array area are depicted in Figure 15-5.

Offshore helidecks

15.4.19 To help achieve a safe operating environment, a 9 nm consultation zone for planned obstacles exists around offshore helicopter destinations. Within 9 nm, obstacles such as WTGs can potentially impact upon the feasibility of helicopters to safely fly low visibility or missed approach procedures at the associated helideck site. There are no offshore platforms within 9 nm of the Muir Mhòr array area.

15.4.20 Consideration has also been given to helicopter winching operations at existing offshore wind farms. The closest such development with Helicopter Certification Agency (HCA) Wind Turbine Winching Platform approval is Aberdeen Offshore Wind Farm, 77 km west-south-west of the Muir Mhòr array area. Infrastructure within the array area will not impinge on helicopter access at Aberdeen Offshore Wind Farm.

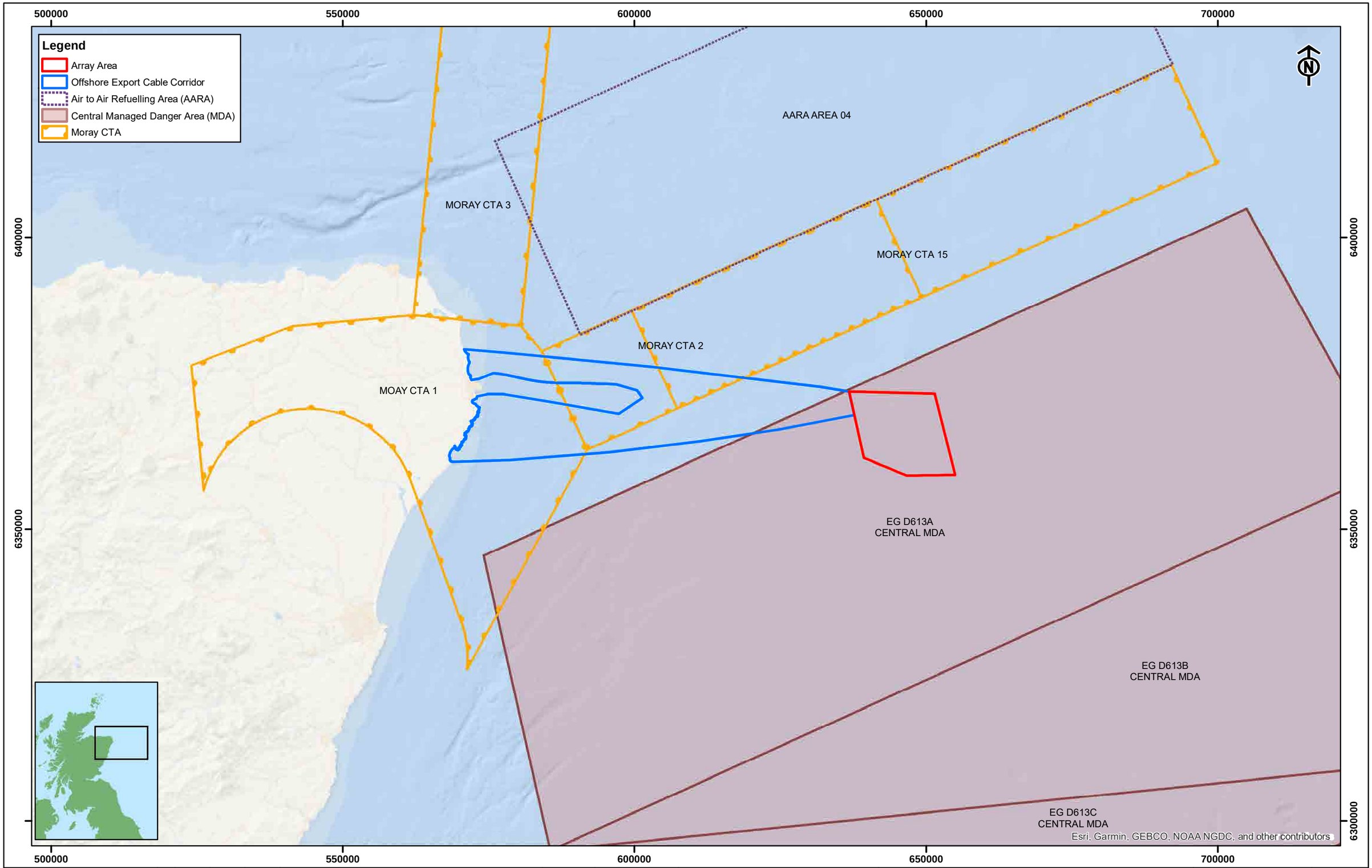
15.4.21 Oil and gas surface infrastructure in the vicinity of the array area are depicted in Figure 15-5.

Search and Rescue

15.4.22 There are ten helicopter SAR bases around the UK with Bristow Helicopters providing helicopters and aircrew. The nearest SAR base is at Inverness Airport, 200 km west of the array area. The obstacle environment created by WTGs within the array area has the potential to impact on SAR operations.

Met Office Weather Radars

15.4.23 The closest Met Office weather radar to the array area is located at Hill of Dudwick in Aberdeenshire, 79 km west of the array area.



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Plot	A3
Scale	1:600,000

0 5 10 15 20 25 km

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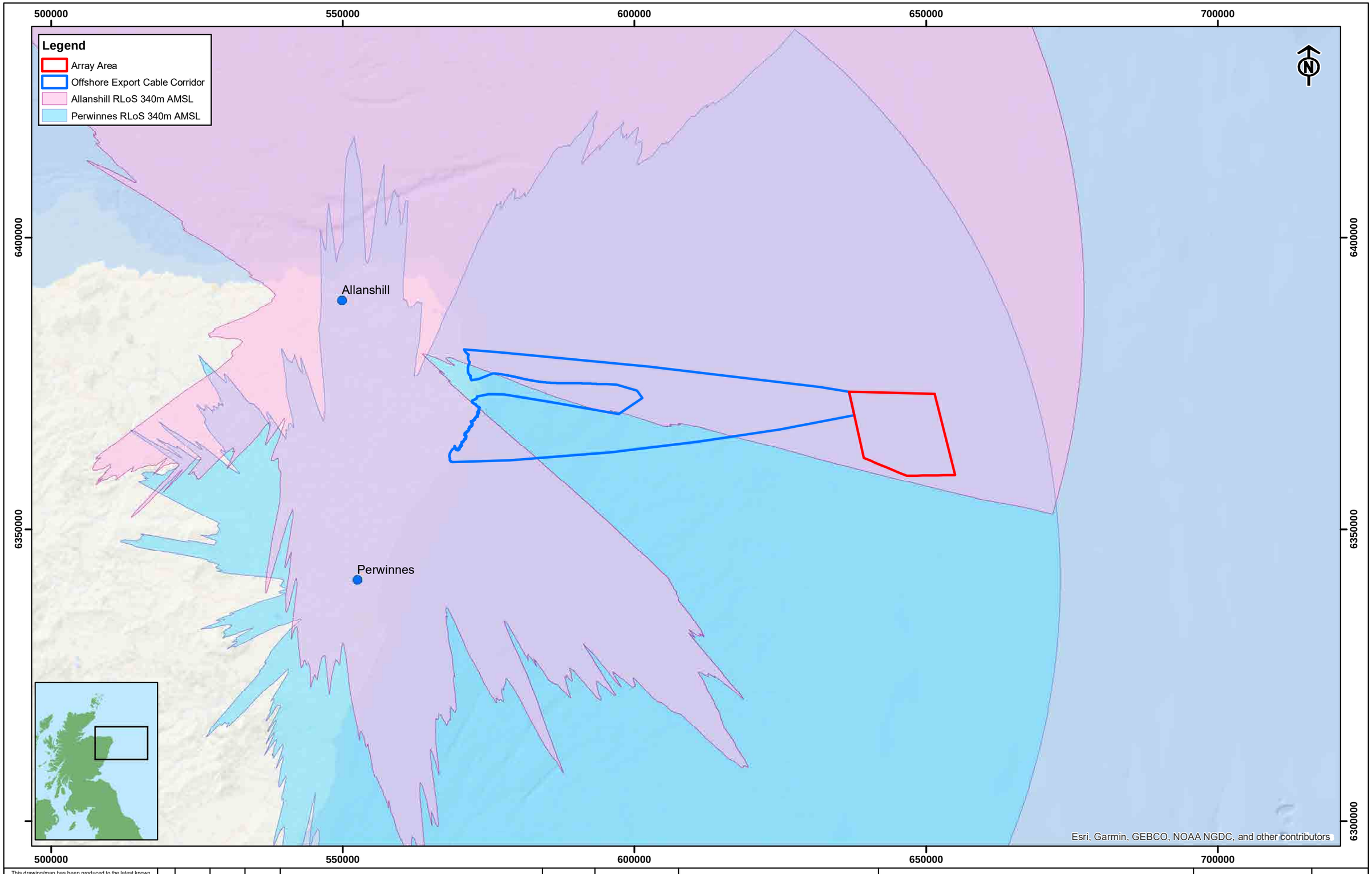
Existing Military and Civil Airspace Environment

Confidentiality Class	C1
Drg No	GoBe-0033
Rev	A
Layout	NA

Figure 15.2

Ref files: MMH_AVI_Fig15.2_MilitaryAndCivilAirspace_RevA



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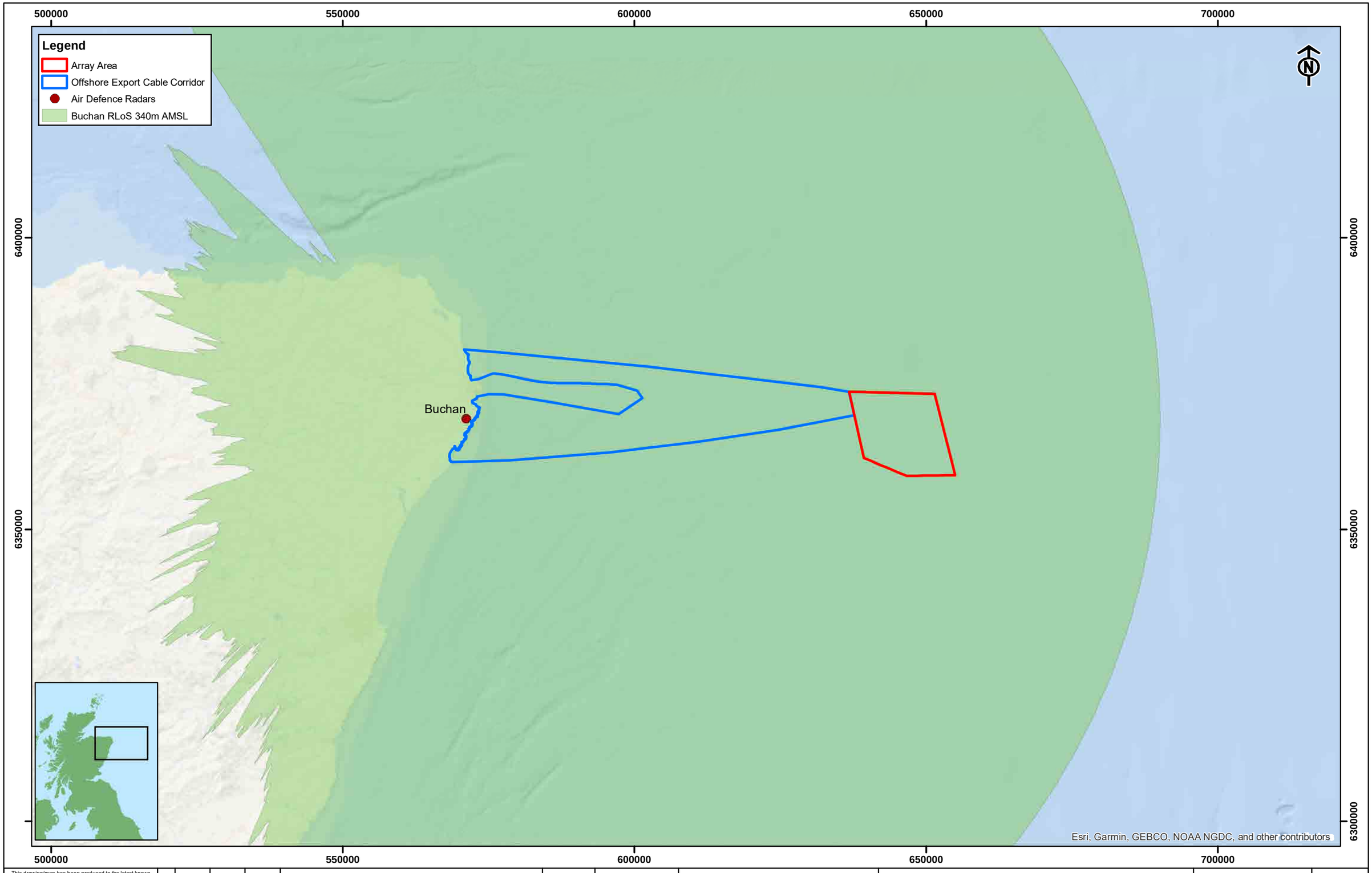
RLoS Coverage at 340m AMSL for Allanshill and Perwinnes PSRs

Confidentiality Class	C1
Drg No	GoBe-0034
Rev	A
Layout	NA

Figure 15.3

Ref files: MMH_AVI_Fig15.2_MilitaryAndCivilAirspace_RevA



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0 5 10 15 20 25 km

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RLoS Coverage at 340m AMSL for Buchan AD PSR

Confidentiality Class	C1
Drg No	GoBe-0035
Rev	A
Layout	NA

Figure 15.4

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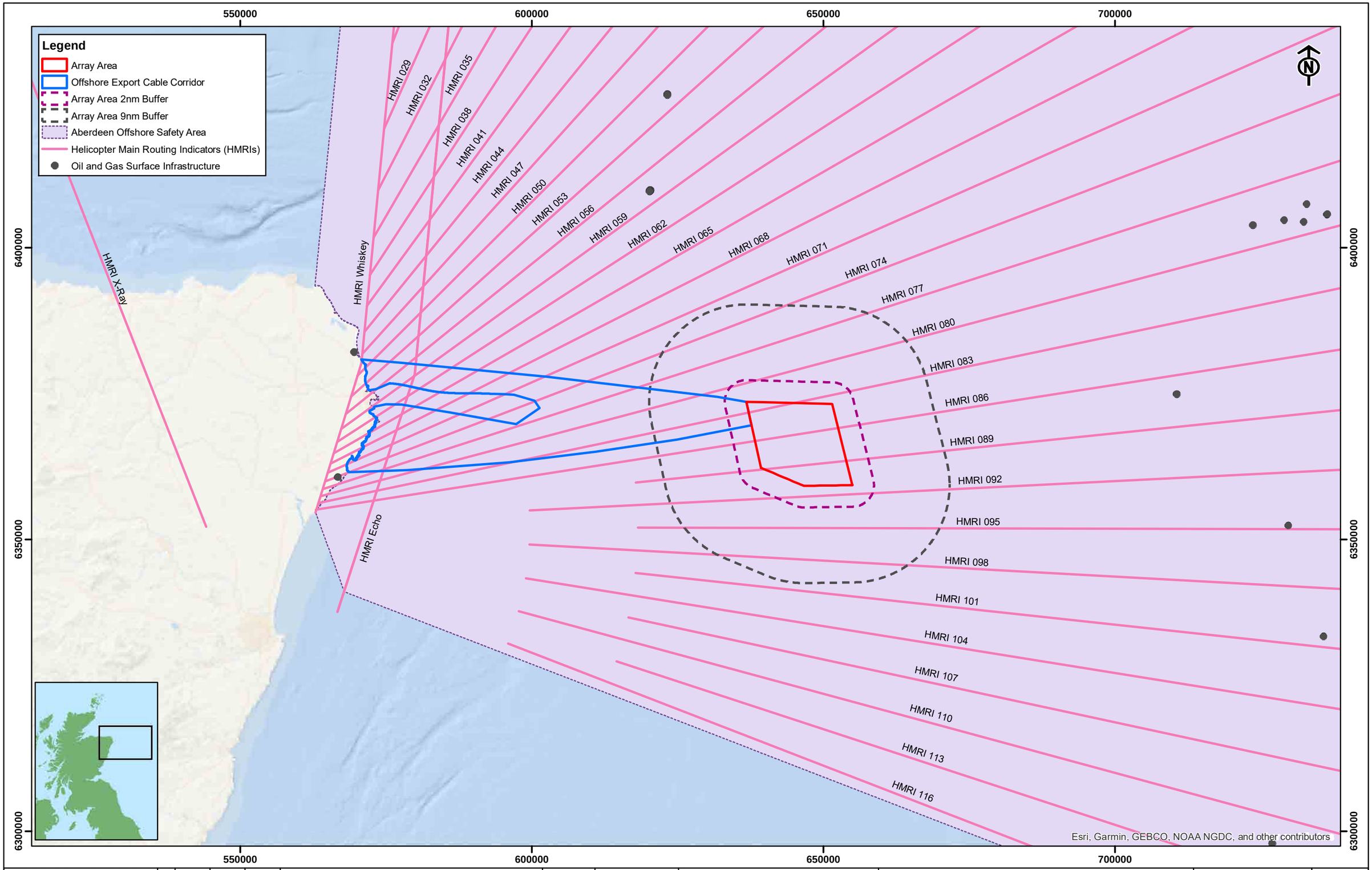

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0 5 10 15 20 25 km

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HMRIs and Oil and Gas Infrastructure in the Vicinity of the Array Area

Confidentiality Class	C1
Drg No	GoBe-0036
Rev	A
Layout	NA

Figure 15.5

Ref files: MMH_AVI_Fig15.4_RLoSBuchanPSR_RevA

15.5 Summary and Key Issues

15.5.1 The key military and civil aviation receptors within the military and civil aviation study area are identified as follows:

- Allanshill PSR;
- Perwinnes PSR;
- Buchan AD PSR;
- Military low flying aircraft;
- Helicopter traffic supporting offshore oil and gas; and
- Helicopters engaged in SAR operations.

15.6 Embedded Commitments

15.6.1 As part of the project design process, several designed-in measures have been proposed to reduce the potential for impacts on environmental and socio-economic receptors. These are presented in Table 15-2 and in the Commitments Register (Appendix A) and will likely evolve over the development process as the EIA progresses and in response to stakeholder consultation.

Table 15-2: Embedded commitment measures of relevance to military and civil aviation.

Code	Commitment	Type (Primary, Secondary or Tertiary)	How Commitment Secured
C-03	Development of and adherence to a DSLP. The DSLP will confirm layout and relevant design parameters.	Tertiary	DSLP
C-09	Development of and adherence to a DP. The DP will outline measures for the decommissioning of the Proposed Development.	Tertiary	DP
C-21	Compliance with Maritime and Coastguard Agency (MCA) (MGN) 654 (MCA, 2021) and its annexes where applicable (including consideration of a SAR checklist, an ERCoP and Under Keel Clearance. Consideration will also be given to MGN 543 SAR Annex 5 (MCA, 2018).	Tertiary	CaP CMS DSLP
C-24	Aids to navigation (marking and lighting) will be deployed in accordance with the latest relevant available standard industry guidance and as advised by NLB, MCA and CAA and MOD as appropriate. This will include a buoyed construction area around the array area in consultation with NLB.	Tertiary	NSP LMP
C-25	Appropriate marking of the proposed development on Admiralty and aeronautical charts. This will include provision of the positions and heights of structures to the UKHO, CAA, MOD and Defence Geographic Centre (DGC).	Tertiary	NSP LMP
C-36	Development of and adherence to a Lighting and Marking Plan (LMP). The LMP will confirm appropriate lighting and marking mitigation whilst ensuring compliance with legal requirements with regards to shipping, navigation and aviation marking and lighting.	Tertiary	LMP

Code	Commitment	Type (Primary, Secondary or Tertiary)	How Commitment Secured
C-40	Development of and adherence to a WSP to provide details on requirements (if applicable) for assembled WTGs and cabling. WTGs to be held at a nearshore wet storage location before being transported to site.	Tertiary	WSP
C-42	Lighting and marking failures appropriately reported/rectified as soon as possible and interim hazard warnings put in place as required.	Tertiary	LMP

15.6.2 As a result of the commitment to implement these measures, and to align the proposed development with various standard sectoral practices and procedures, the embedded commitments are considered inherently part of the design of the proposed development and have, therefore, been included in the assessment presented in Section 15.7.

15.6.3 The requirement and feasibility of any additional mitigation measures will be dependent on the significance of the effects upon military and civil aviation and will be consulted upon with statutory consultees throughout the EIA process.

15.7 Scoping of Impacts

15.7.1 Table 15-3 sets out an initial assessment of the likelihood of effects on military and civil aviation due to the proposed development activities for the scoping stage of the EIA process. The assessment is based on a combination of the following: the definition of the proposed development at the scoping stage; embedded commitments (as set out in Section 15.6, together with the means by which it will be secured); the level of understanding of the baseline at the scoping stage; the existing evidence base for military and civil aviation effects due to proposed development activities; relevant policy; and the professional judgement of qualified military and civil aviation specialists.

Table 15-3: Scoping assessment for military and civil aviation.

Impact Pathway	Embedded Commitments	Scoped In or Scoped Out	Justification
Construction			
Creation of an aviation obstacle environment	C-03, C-21, C-24, C-25, C-36, C-40, C-42	Scoped In	Construction of the wind farm will involve tall crane vessels and the installation of infrastructure above sea level which may pose a physical obstruction to low flying aircraft, increasing the risk of collision or requiring aircraft to fly extended routes to avoid obstacles. Specifically, tall crane vessels and above sea level infrastructure will have a potential impact on military low flying aircraft, helicopter traffic in support of offshore oil and gas and SAR operations.
Increased air traffic in the area related to wind farm activities	C-03, C-21, C-24, C-25, C-36, C-40, C-42	Scoped In	Helicopter traffic associated with the construction phase may impact on existing traffic in the area, increasing the risk of aircraft collision. Existing traffic may include helicopter traffic in support of oil and gas and aircraft associated with SAR operations.
Impact on civil and military PSR systems	-	Scoped Out	To discriminate wanted aircraft targets from unwanted clutter, PSRs ignore static objects and only display moving targets. PSRs that can see the rotating blades of WTGs can mistake them for aircraft and so present them on the radar display as clutter. Until WTG blades in RLoS are allowed to rotate at operational speeds, they will not generate PSR clutter. Similarly, tall construction vessels and cranes that are in RLoS will not be moving fast enough to generate PSR clutter.
Impacts on civil and military SSR systems	-	Scoped Out	NATS do not consider the impact of WTGs on SSR to be material or relevant for WTGs that are beyond approximately 28 km from their SSR facilities. Furthermore, CAP 764 states that WTG effects on SSR *"…are typically only a consideration when the turbines are located very close to the SSR i.e., less than 10 km"*. The nearest SSR facility, at Allanshill, is 88 km from the array area.
Impact on weather radars	-	Scoped Out	The closest Met Office Weather radar is at Hill of Dudwick, 79 km west of the array area. WTGs will be significantly beyond the 20 km safeguarded zone established around weather radars and therefore unlikely to have a significant impact.
Impacts from the Offshore ECC	-	Scoped Out	The offshore cable will be below sea level and will have no impact on aviation activities. Surface vessels will not generate any PSR clutter.
Operations and Maintenance			

Impact Pathway	Embedded Commitments	Scoped In or Scoped Out	Justification
Creation of an aviation obstacle environment	C-03, C-21, C-24, C-25, C-36, C-40, C-42	Scoped In	The presence of completed WTGs may pose a physical obstruction to low flying aircraft, increasing the risk of collision or requiring aircraft to fly extended routes to avoid obstructions. Specifically, WTGs will have a potential impact on military low flying aircraft, helicopter traffic in support of offshore oil and gas and SAR operations.
Increased air traffic in the area related to wind farm activities	C-03, C-21, C-24, C-25, C-36, C-40, C-42	Scoped In	Helicopter traffic associated with maintenance activities may impact on existing traffic in the area, increasing the risk of aircraft collision. Existing traffic may include helicopter traffic in support of oil and gas and aircraft associated with SAR operations.
Impact on NERL Allanshill PSR, NERL Perwinnes PSR and Buchan AD PSR	-	Scoped In	To discriminate wanted aircraft targets from unwanted clutter, PSRs ignore static objects and only display moving targets. PSRs that can see the rotating blades of WTGs can mistake them for aircraft and so present them on ATC radar displays as clutter. Controllers may not be able to distinguish aircraft from the clutter.
Impacts on civil and military SSR systems	-	Scoped Out	NATS do not consider the impact of WTGs on SSR to be material or relevant for WTGs that are beyond approximately 28 km from their SSR facilities. Furthermore, CAP 764 states that WTG effects on SSR *"…are typically only a consideration when the turbines are located very close to the SSR i.e., less than 10 km*". The nearest SSR facility, at Allanshill, is 88 km from the array area.
Impact on weather radars	-	Scoped Out	The closest Met Office Weather radar is at Hill of Dudwick, 79 km west of the array area. WTGs will be significantly beyond the 20 km safeguarded zone established around weather radars and therefore unlikely to have a significant impact.
Impacts from the Offshore ECC	-	Scoped Out	The offshore cable will be below sea level and will have no impact on aviation activities.
Decommissioning			
Creation of an aviation obstacle environment.	C-03, C-09, C-21, C-24, C-25, C-36, C-40, C-42	Scoped Out	During the decommissioning phase the existing WTGs will be gradually dismantled and therefore the aviation obstacle environment will be removed. No specific decommissioning impacts are foreseen above those present in the construction and operations and maintenance phases.

Impact Pathway	Embedded Commitments	Scoped In or Scoped Out	Justification
Increased air traffic in the area related to wind farm activities	C-03, C-09, C-21, C-24, C-25, C-36, C-40, C-42	Scoped In	Helicopter traffic associated with the decommissioning phase may impact on existing traffic in the area, increasing the risk of aircraft collision. Existing traffic may include helicopter traffic in support of oil and gas and aircraft associated with SAR operations.
Impact on NERL Allanshill PSR, NERL Perwinnes PSR and Buchan AD PSR	-	Scoped Out	During the decommissioning phase the blades of WTGs will cease rotating, therefore the impact on PSRs will gradually reduce until the last WTG ceases operation. Any mitigations will remain in place until the blades of the last WTG stop rotating. There will be no other specific impacts on PSRs during decommissioning.
Impacts on civil and military SSR systems	-	Scoped Out	NATS do not consider the impact of WTGs on SSR to be material or relevant for WTGs that are beyond approximately 28 km from their SSR facilities. Furthermore, CAP 764 states that WTG effects on SSR *"…are typically only a consideration when the turbines are located very close to the SSR i.e., less than 10 km*". The nearest SSR facility, at Allanshill, is 88 km from the array area.
Impact on weather radars	-	Scoped Out	The closest Met Office Weather radar is at Hill of Dudwick, 79 km west of the array area. WTGs will be significantly beyond the 20 km safeguarded zone established around weather radars and therefore unlikely to have a significant impact.
Impacts from the Offshore ECC	-	Scoped Out	The offshore cable will be below sea level and will have no impact on aviation activities.

15.8 Potential Cumulative Impacts

15.8.1 Chapter 4 (EIA Methodology) details how potential cumulative impacts will be assessed through a CIA and gives examples of the projects which are likely to be included in that assessment. For military and civil aviation, cumulative interactions may occur with other existing and future offshore wind farms and associated aviation activities.

15.8.2 Potential cumulative impacts include increased collision risk and cumulative impacts on radar.

15.8.3 The CIA for military and civil aviation will consider the maximum adverse design scenario for each of the projects, plans and activities in line with the methodology outlined in Chapter 4 (EIA Methodology).

15.9 Potential Transboundary Effects

15.9.1 The potential impacts of WTGs on aviation are localised and the Muir Mhòr array area is completely within UK airspace, with the nearest Norwegian operated airspace 213 km to the north-east. Furthermore, the array area is significantly beyond the expected radar coverage from the nearest non-UK airport.

15.9.2 The proposed development is a significant distance from the nearest adjacent exclusive economic zone (EEZ) of another state and, therefore, it is considered that transboundary impacts will not occur and will therefore be scoped out from further consideration within the EIA.

15.10 Proposed Approach to EIA

Guidance

15.10.1 In addition to the general approach and guidance outlined in Chapter 4 (EIA Methodology), the assessment of military and civil aviation receptors will also comply with the following guidance documents where they are specific to this topic:

- CAP 032 UK AIP (CAA, 2023);
- CAP 168 Licensing of Aerodromes (CAA, 2022);
- CAP 437 Standards for Offshore Helicopter Landing Areas (CAA, 2023);
- CAP 670 Air Traffic Services Safety Requirements (CAA, 2019);
- CAP 764 Policy and Guidelines on Wind Turbines (CAA, 2016);
- CAP 1616 Airspace Change (CAA, 2021);
- Air Navigation Order 2016/765 (CAA, 2022);
- UK Military AIP (MOD, 2023);
- MOD Obstruction Lighting Guidance (MOD, 2020);
- MCA Marine Guidance Note (MGN) 654 Safety of Navigation: OREIs – Guidance on UK Navigational Practice, Safety and Emergency Response (MCA, 2021);
- MCA document Offshore Renewable Energy Installations: Requirements, Guidance and Operational Considerations for SAR and Emergency Response (MCA, 2021); and
- International Civil Aviation Organisation (ICAO) Annex 14 Aerodrome Design and Operations (ICAO, 2022).

Additional data sources

15.10.2 A more detailed literature review will be developed for the EIA, building upon the high-level outline provided within this Offshore Scoping Report.

Assessment Methodology

15.10.3 The EIA will follow the general approach outlined in Chapter 4 (EIA Methodology) of this Offshore Scoping Report.

15.10.4 The EIA process will be supported by further desk-based studies, including RLoS modelling, that will identify and examine in greater detail sensitive aviation and radar receptors. RLoS is determined using radar propagation modelling software and 3D terrain data. Studies will be undertaken in parallel with consultation with relevant stakeholders to provide a detailed understanding of potential impacts. It is expected that consultation will be an iterative process, allowing for any concerns that are raised to be considered throughout the pre-application phase and in finalising the consent application. The military and civil aviation assessment will also comply with the guidance documents listed in Section 15.10.1.

15.10.5 In respect of impacts on Buchan AD PSR, an Air Defence and Offshore Wind (AD&OW) Windfarm Mitigation Task Force (the Task Force) has been established as a collaborative initiative between MOD, the Department for Energy Security and Net Zero, the Offshore Wind Industry Council and The Crown Estate. The aim of the Task Force is to enable the co-existence of UK AD&OW, allowing offshore wind to contribute towards meeting the UK Government's Net Zero target without degrading the nation's AD surveillance capability.

15.10.6 The corresponding AD&OW Strategy and Implementation Plan sets the direction for this collaboration through identifying, assessing, and deploying solutions that will enable the co-existence of AD&OW operations such that neither is unduly nor excessively compromised. This plan indicates that there may be positive changes to current AD PSR characteristics and capabilities that in turn may affect a reduction in the potential impact that the proposed development may have.

15.11 Scoping Questions

15.11.1 The following Scoping questions refer to the Military and Civil Aviation chapter and are designed to focus the Scoping exercise and inform the Scoping Opinion:

- Do you agree with the study area(s) defined in Section 15.2 for military and civil aviation?
- Do you agree with the use of those data listed in Section 15.3 being used to inform the Offshore EIA?
- Are there any additional data sources or guidance documents that should be considered?
- Do you agree that all receptors related to military and civil aviation have been identified?
- Do you agree with the scoping in and out of impact pathways in relation to military and civil aviation?
- Do you agree with the assessment of the potential for transboundary effects in relation to military and civil aviation?
- Do you agree with the assessment of the proposed approach to cumulative effects in relation to military and civil aviation?
- Do you agree with the proposed assessment methodology for military and civil aviation?

16 Seascape, Landscape and Visual Resources

16.1 Introduction

16.1.1 This chapter of the Offshore Scoping Report identifies the Seascape, Landscape and Visual Resources (SLVR) of relevance to the proposed development and considers the potential impacts from the construction, O&M and decommissioning of the proposed development on seascape, landscape and visual receptors up to MHWS (Mean High Water Springs).

16.1.2 This chapter should be read alongside Chapter 14: Marine Archaeology and Cultural Heritage - for potential effect to features of historical importance.

16.1.3 This chapter of the Offshore Scoping Report has been prepared by OPEN (Optimised Environments).

16.2 Study Area

16.2.1 The area in which the generation infrastructure will be located (the Muir Mhòr array area), including WTGs, inter-array cables and OEPs is located approximately 63 km from the closest part of the coast (at South Head, Peterhead) (Figure 16-1). A precautionary approach is proposed in defining a 70 km radius Seascape, Landscape and Visual Resources study area (Figure 16-1) for the proposed development for the purpose of scoping, due to the large WTGs of up to 340 m to blade tip height (above MSL) and to test the potential for effects at such range. The SLVR study area is defined as the outer limit of the area where significant effects could occur, using professional judgement; and broadly comprises a large area of the North Sea and a small section of the adjoining north-eastern coast of Aberdeenshire between Rattray Head and Cruden Bay. Published guidance suggests a study area of 45 km radius for turbines over 150 m in overall height (SNH, 2017), and 50 km has been accepted for other offshore developments with substantially larger turbines. In the Berwick Bank Scoping Opinion, Scottish Ministers requested that the study area must extend beyond 50 km for turbines of up to 310 m to blade tip (Marine Scotland, 2021).

16.2.2 The SLVR study area is based on the extent of the likely impacts modelled in the blade tip Zone of Theoretical Visibility (ZTV) (Figure 16-2 and Figure 16-3), focusing on locations where it may be possible to see the proposed development. The blade tip ZTV (Figure 16-2 and Figure 16-3) indicates that areas of higher theoretical visibility primarily occur within 60 km of the array area. Beyond this distance, the number of visible WTGs is lower and the geographic extent with visibility of the proposed development is restricted. At this range, it is likely that the WTGs will appear very small in height, and the lateral (or horizontal) spread of the array area will occupy a small portion of available views. At such long distances, the influence of earth curvature begins to limit the apparent height and visual influence of the WTGs, as their lower parts are hidden behind the horizon, leaving only the upper parts visible above the skyline. Therefore, significant visual effects are unlikely to arise at distances greater than 70 km, even if the proposed development's WTGs are theoretically visible.

16.3 Visibility

16.3.1 The Met Office defines visibility as 'the greatest distance at which an object can be seen and recognised in daylight, or at night could be seen if the general illumination were raised to a daylight level' (Met Office, 2000).

16.3.2 A quantitative description of the existing visibility is provided using METAR visibility data from the closest Met Office weather station at Peterhead, to highlight potential trends in the visibility conditions of the SLVR study area. This 'visibility data', presented in Table 16-1 shows a 10-year average of the frequency of observations at measured distances from the

station between January 2013 to December 2022. The visibility range is shown in bands relating to the Met Office definitions of visibility (very poor to excellent) to show the likely frequency of visibility at different distance ranges. The Met Office visibility data has no records of visibility experienced beyond 60 km in range.

Table 16-1: Frequency of visibility at different ranges as a percentage (Inverbervie weather station)

Visibility (km)	Yearly average visibility frequency (%)	Visibility range and definition	% visibility frequency (over 10 years)	Days per year visibility frequency (10-year average)
0.00 => 0.99	6.23	<1 km Very poor	6.23	22.74
1.00 => 1.99	1.02	1-4 km Poor	3.41	12.44
2.00 => 2.99	1.12			
3.00 => 3.99	1.27			
4.00 => 4.99	1.31	4-10 km Moderate	10.45	38.14
5.00 => 5.99	1.59			
6.00 => 6.99	1.74			
7.00 => 7.99	1.89			
8.00 => 8.99	1.88			
9.00 => 9.99	2.04			
10.00 => 10.99	2.06	10-20 km Good	19.27	70.33
11.00 => 11.99	2.15			
12.00 => 12.99	2.06			
13.00 => 13.99	1.93			
14.00 => 14.99	1.97			
15.00 => 15.99	1.89			
16.00 => 16.99	1.86			
17.00 => 17.99	1.86			
18.00 => 18.99	1.83			
19.00 => 19.99	1.67			
20.00 => 20.99	1.67	20-40 km Very Good	32.08	117.09
21.00 => 21.99	1.68			

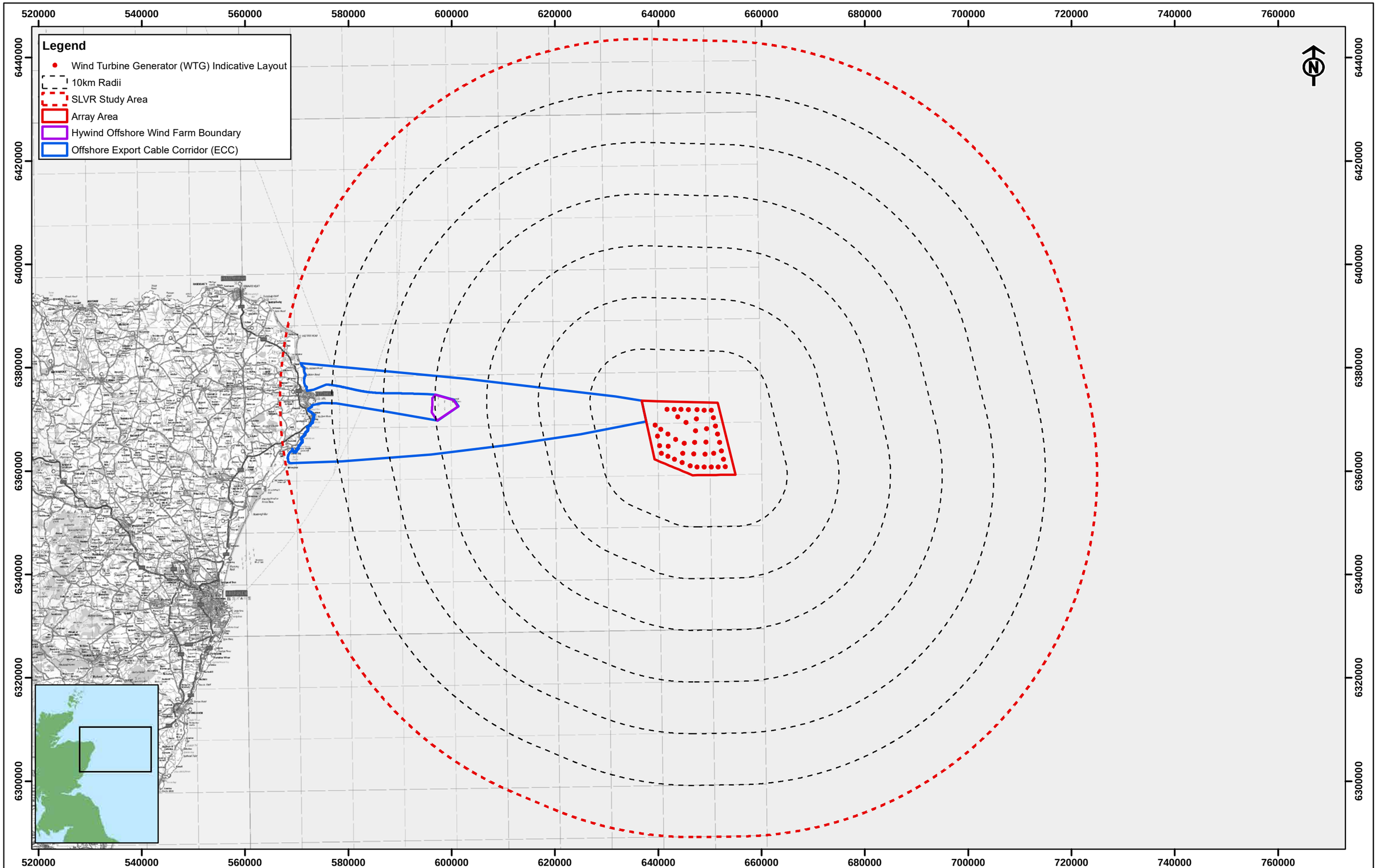
Visibility (km)	Yearly average visibility frequency (%)	Visibility range and definition	% visibility frequency (over 10 years)	Days per year visibility frequency (10-year average)
22.00 => 22.99	1.65			
23.00 => 23.99	1.60			
24.00 => 24.99	1.61			
25.00 => 25.99	1.62			
26.00 => 26.99	1.54			
27.00 => 27.99	1.59			
28.00 => 28.99	1.62			
29.00 => 29.99	1.59			
30.00 => 34.99	7.80			
35.00 => 39.99	8.11			
40.00 => 44.99	8.32	40 – 50km Excellent	17.86	65.18
45.00 => 49.99	9.54			
50.00 => 59.99	10.69	50 – 60 km Excellent	10.69	39.01
60.00 => 69.99	0.00			
>= 70.00	0.00	> 60km Excellent	0	0

16.4 Baseline Environment

Data Sources

16.4.1 The data sources that have been used to inform the SLVR chapter of the Offshore Scoping Report are presented within Table 16-2.

16.4.2 The baseline environment for this Offshore Scoping Report has been established following a desk-based analysis of the data and information sources listed in Table 16-2.



This drawing/map has been produced to the latest known information at the time of issue. Please consult with the Vattenfall GIS team to ensure the content is still current before using the information contained on this map.

MUIR MHÒR OFFSHORE WIND FARM

A joint venture between Fred. Olsen Seawind & Vattenfall

Muir Mhòr Offshore Wind Farm Ltd, The Tun Building
4 Jackson's Entry, Holyrood Road, No 4 EH8 8PJ Edinburgh
United Kingdom

Rev	Date	Drawn By	Checked By	Comment
A	05/04/23	BPHB	LK	First Issue

Datum	ETRS 1989
Projection	ETRS 1989 UTM Zone 30N
Plot	A3
Scale	1:680,000

0 4 8 12 16 20 km

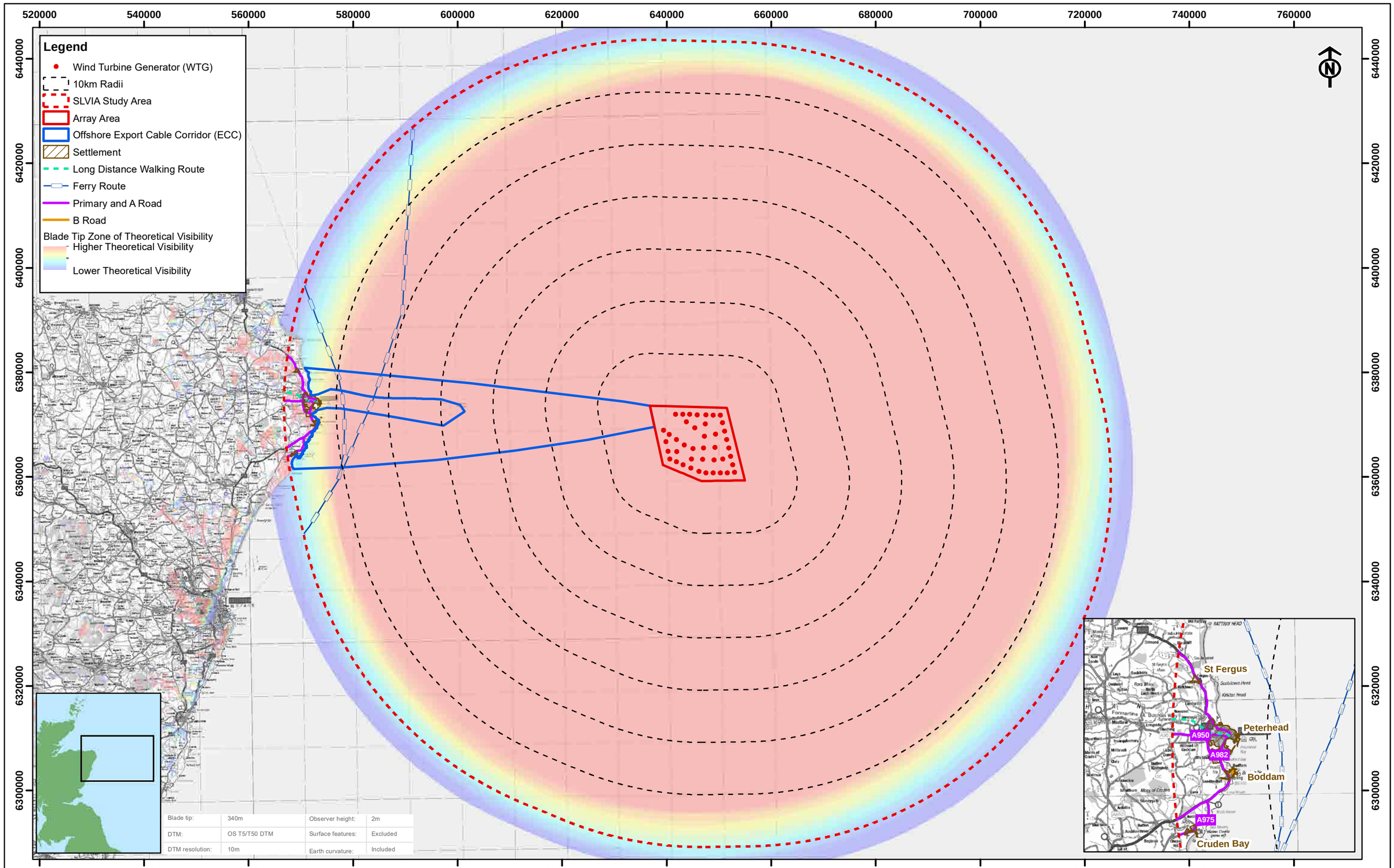
MUIR MHÒR WIND FARM

SLVR Study Area

Confidentiality Class	C1
Drg No	GoBe-0001
Rev	A
Layout	NA

Figure 16.1

Ref files: MMH_A3_SCOP_16.1_Study_Area_v01



This drawing/map has been produced to the latest known information at the time of issue. Please consult with the Vattenfall GIS team to ensure the content is still current before using the information contained on this map.

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A	31/03/23	BPHB	LK	First Issue

Datum	ETRS 1989
Projection	ETRS 1989 UTM Zone 30N
Plot	A3
Scale	1:680,000

0 4 8 12 16 20 km

MUIR MHÒR WIND FARM

Blade tip ZTV with Key Visual Receptors

Confidentiality Class	C1
Drg No	GoBe-0001
Rev	A
Layout	NA

Figure 16.2

Ref files: MMH_A3_SCOP_16.2_ZTV_VR_v01

560000 580000 600000

6380000

Legend

- 10km Radii
- SLVIA Study Area
- Offshore Export Cable Corridor (ECC)

Blade Tip Zone of Theoretical Visibility
- Higher Theoretical Visibility
- Lower Theoretical Visibility

Viewpoints
1. Rattray Head
2. Scotstown Head
3. Gadle Braes, Peterhead
4. Reform Tower
5. Boddam
6. Stirling Hill
7. Bullers O' Buchan

PETERHEAD

Blade tip:	340m	Observer height:	2m
DTM:	OS T5/T50 DTM	Surface features:	Excluded
DTM resolution:	10m	Earth curvature:	Included

560000 580000 600000

This drawing/map has been produced to the latest known information at the time of issue. Please consult with the Vattenfall GIS team to ensure the content is still current before using the information contained on this map.

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Rev	Date	Drawn By	Checked By	Comment
A	31/03/23	BPHB	LK	First Issue

Datum	ETRS 1989
Projection	ETRS 1989 UTM Zone 30N
Plot	A3
Scale	1:115,000

0 0.7 1.4 2.1 2.8 3.5 km

MUIR MHÒR WIND FARM

Blade tip ZTV with Viewpoints

Confidentiality Class	C1
Drg No	GoBe-0001
Rev	A
Layout	NA

Figure 16.3

Ref files: MMH_A3_SCOP_16.3_ZTV_VP_v01

Table 16-2: Key sources of SLVR Data.

Source, Author and Year	Summary	Coverage of Muir Mhòr array area and ECC
Visibility Data, Met Office, (2013-2022)	Visibility Data. Visibility bands every 1 km up to 30 km, then every 5 km up to 50 km, then every 10 km up to 70 km, and >70 km.	Weather stations at Peterhead.
National Landscape Character Assessment, NatureScot, 2019.	Identifies, describes and maps variation in landscape character within Scotland.	Full coverage of land within the SLVR study area.
Coastal Character Assessment, NatureScot, 2005.	Identifies, describes and maps variation in the character of Scotland's coasts at the national level.	Full coverage of coastline within the SLVR study area.
Hywind Scotland Pilot Park Environmental Statement, Statoil, 2015.	Identifies, describes and maps variations in the character of Scotland's coasts at a more detailed level.	Full coverage of coastline within the SLVR study area.
Aberdeenshire Local Development Plan Appendix 13: Special Landscape Areas, Aberdeenshire Council, 2023.	Identifies, describes and maps areas of the landscape that exhibit particular qualities and characteristics that are valued locally.	Full coverage of land within the SLVR study area.
Aberdeenshire Core Path Plan, Aberdeenshire Council, 2023.	Identifies and maps core paths within Aberdeenshire.	Full coverage of land within the SLVR study area.
Visual receptor mapping, Ordnance Survey/Sustrans, Various.	Mapping of settlements, long distance recreational routes.	Full coverage of land within the SLVR study area.
Oceanwise.	Marine and coastal mapping data, ferry routes.	Full coverage of SLVR study area.
Digital Terrain Model, Ordnance Survey, 2022.	Digital terrain model datasets.	Full coverage of land within the SLVR study area.
Ordnance Survey mapping at a range of scales, Ordnance Survey, 2022.	Topographical maps.	Full coverage of land within the SLVR study area.
Aerial and street-level photography, Google/Bing, 2022.	Aerial and street-level photography available online.	Full coverage of land within the SLVR study area.
Cumulative Wind Farms, LUC, Various.	Mapping of onshore and offshore wind farms within the SLVR study area.	Full coverage of the SLVR study area.

16.5 Description of Baseline Environment

Visual Baseline

Introduction

16.5.1 An initial understanding of the baseline visual resource is provided in 'An assessment of the sensitivity and capacity of the Scottish seascape in relation to windfarms' (Scott, *et al* 2005), which notes the '*simple horizontal visual composition of sky, sea and land*' that is visible from '*Low-lying coastal sections comprising long, sweeping curved sandy beaches*' and the '*flat, mixed or arable farmland*' extending inland. This remains along the '*more resistant coastline of promontories, low cliffs and rocky shoreline*' where views of '*the simple sea backdrop*' are '*generally expansive and open*'. Shipping is noted as a common feature within the North Sea with occasional industry and settlement along the coast.

16.5.2 The Muir Mhòr array area is located to the east of the operational Hywind Scotland Pilot Park OWF and may appear behind it in views offshore from the coastline around Peterhead. The Muir Mhòr array area lies much further offshore than the European Offshore Wind Deployment Centre (Aberdeen Bay) and Kincardine OWF which lie towards the south, near Aberdeen. The Muir Mhòr array area may appear behind the former, just north of Aberdeen, and behind the latter, further south of Aberdeen.

Zone of Theoretical Visibility (ZTV)

16.5.3 The visual baseline is largely defined by the ZTV shown in Figure 16-2 and at a more detailed scale, in Figure 16-3. The ZTV shows the main area in which the WTGs within the Muir Mhòr array area would theoretically be visible, highlighting the different groups of people who may experience views of WTGs located within the Muir Mhòr array area and assisting in the identification of viewpoints where they may be affected.

16.5.4 The ZTV is based on WTGs of 340 m to blade tip and represents the Maximum Design Scenario (MDS) considered in the scoping assessment. The ZTV also illustrates where there would be no visibility of these WTGs, as well as areas where there will be lower or higher numbers of WTGs theoretically visible.

16.5.5 The ZTV illustrates the 'bare ground' situation based on an Ordnance Survey (OS) terrain model and does not take into account the screening effects of vegetation, buildings, or other local features that may prevent or reduce visibility. By using a bare ground elevation model, the results will be an over-representation of maximum visibility, as many areas could, in reality, be blocked by surface features not included in the model. A further limitation of the ZTV is that it indicates 'higher' or 'lower' theoretical visibility based on the number of WTGs visible, not on the amount of WTG visible. Therefore, areas indicated with higher visibility (in terms of the number of visible WTGs) may have views of very small amounts of these WTGs at long range.

16.5.6 The ZTV shows that the main areas with higher theoretical visibility of the proposed development are offshore areas of the North Sea, as the SLVR study area coastline is located over 60 km from the array area. Beyond 60 km, the number of visible WTGs reduces, the amount of the WTGs visible over the horizon will be less and the apparent height of WTGs will be smaller, and will only be viewed in excellent visibility conditions, which is rare.

16.5.7 The ZTV also shows that there is theoretical visibility of the proposed development from the coastline within the SLVR study area between Rattray Head and Cruden Bay, with both locations lying over 67 km away from the array area. This section of coastline is the closest area of land with theoretical visibility of the proposed development, which may afford views of it in very infrequent periods of excellent visibility.

16.5.8 The ZTV includes much of Peterhead, the higher surrounding land within 5 km of the town and narrow strips along the coastline immediately adjoining the sea. To the north, the ZTV is more intermittent and thinner along the coast. To the south, the ZTV encompasses a broader, more consistent coastal strip. The ZTV north of Peterhead is more intermittent than that to the south. Inland of these strips, to the north-west and south-west of Peterhead, larger areas of the ZTV are more fragmented as it encompasses areas of undulating farmland. ZTV coverage of recreational and transport routes is intermittent and limited, with only the A90 within approximately 4 km of Peterhead having consistent ZTV coverage. Higher visibility of the WTGs within the array area is indicated in the ZTV with relatively small areas of lower visibility to peripheral areas.

16.5.9 Actual visibility of the WTGs within the Muir Mhòr array area from much of the hinterland and inland areas becomes increasingly screened by vegetation, such as woodland and hedgerows, and/or built development and settlement. Visibility from streets, open spaces and low storey buildings within Peterhead and Boddam will typically be contained within the urban environment by surrounding built form, with most visibility of the Muir Mhòr array area likely at the coastal edge and seafront.

Visual Receptors

16.5.10 Visual receptors are the people who will experience views of the proposed development from their homes and communities, their places of work, or the places they visit for recreation. Visual receptors at locations within the ZTV have been considered, focusing on locations within the 70 km SLVR study area. The types and general locations of key receptors within the SLVR study area include (Figure 16-2):

- Residents of coastal settlements including the town of Peterhead and the smaller Boddam;
- Visitors to tourist attractions including Reform Tower and Bullers O' Buchan;
- People visiting or engaged in water activities at beaches (Rattray, Scotstown and Peterhead Lido);
- People using the public rights of way network including the Formartine & Buchan Way (one of Scotland’s Great Trails) and at the high point of Stirling Hill;
- Road users on the A90 between Crimond and Hatton, including scenic driving routes along the road (the Northeast 250 and Aberdeenshire Coastal Trail); A950, A975 and other minor roads;
- People travelling on ferries between Aberdeen, Orkney and the Shetland Islands; on recreational boats along the Aberdeenshire coast; and people working in fisheries, oil and gas, or other offshore commercial activities.

16.5.11 Significant effects on views experienced by onshore visual receptors within the SLVR study area coast are however, considered unlikely to arise at such long distances, considering the ZTV (Figure 16-3) and the limited amount of the WTGs visible, as illustrated by representative viewpoints from these receptors in the wirelines in this Offshore Scoping Report (Appendix B).

Viewpoints

16.5.12 Representative viewpoints considered in the scoping assessment are identified in Table 16-3 and mapped in Figure 16-3. These are based on the relevant landscape and visual receptors identified above using the ZTV and benchmarking of representative viewpoints selected for other OWFs, such as Hywind Scotland Pilot Park OWF, that provide precedents for this

scoping assessment. These viewpoints have been selected to review the likely impacts of the proposed development as part of the scoping assessment.

16.5.13 Wireline visualisations showing the WTGs from each of the representative viewpoints are presented in Appendix B, to aid understanding of the potential visual effects of the proposed development. These are considered in Section 16.8, with justification for scoping in or scoping out the related impacts on SLVR of the EIA presented in Table 16-5.

16.5.14 Atmospheric visibility by night and day varies with weather conditions, and more distant viewpoints are likely to have less frequent views of the proposed development due to fog, rain, and so on. Data on atmospheric visibility is considered further in Section 16.3.

Table 16-3: Viewpoints considered in scoping assessment illustrated in Figure 16-3.

No.	Viewpoint	Grid Reference	Distance (km)[23]	Reason for Selection
1	Rattray Head	410813, 857762	67.4	Represents views experienced by recreational receptors at the beach at Rattray Head and users of coastal core path (7LD.01.18).
2	Scotstown Head	411851, 851873	65.4	Represents views experienced by recreational receptors at Scotstown Beach and users of coastal core path (7LD.01.18).
3	Gadle Braes, Peterhead	412963, 847099	64	Represents views experienced by recreational receptors, users of a core path (7LD.01.18) and residential receptors.
4	Reform Tower	412167, 844655	64.7	Represents views experienced by recreational receptors in Peterhead: at Reform Tower, at Peterhead Lido Beach and using core path (7LD.01.23); and residential receptors within Peterhead (South Road).
5	Boddam	413469, 842640	63.5	Represents views experienced by recreational receptors at Boddam Harbour, users of core path (7LD.01.24) and residential receptors within Boddam (Harbour Street).
6	Stirling Hill	411655, 841107	65.3	Represents views from an accessible high point to the south-west of Boddam, on core path (202.01).
7	Bullers O' Buchan	411020 838106	66.2	Represents views experienced by recreational receptors visiting Bullers O' Buchan and users of core path (202.01).

16.5.15 Significant effects on views experienced by onshore visual receptors at these representative viewpoints within the SLVR study area coast are considered unlikely to arise at such long distances, considering the ZTV (Figure 16-3) and the limited amount of the WTGs visible, as illustrated by representative viewpoints from these receptors in the wirelines in this Offshore Scoping Report (Appendix B).

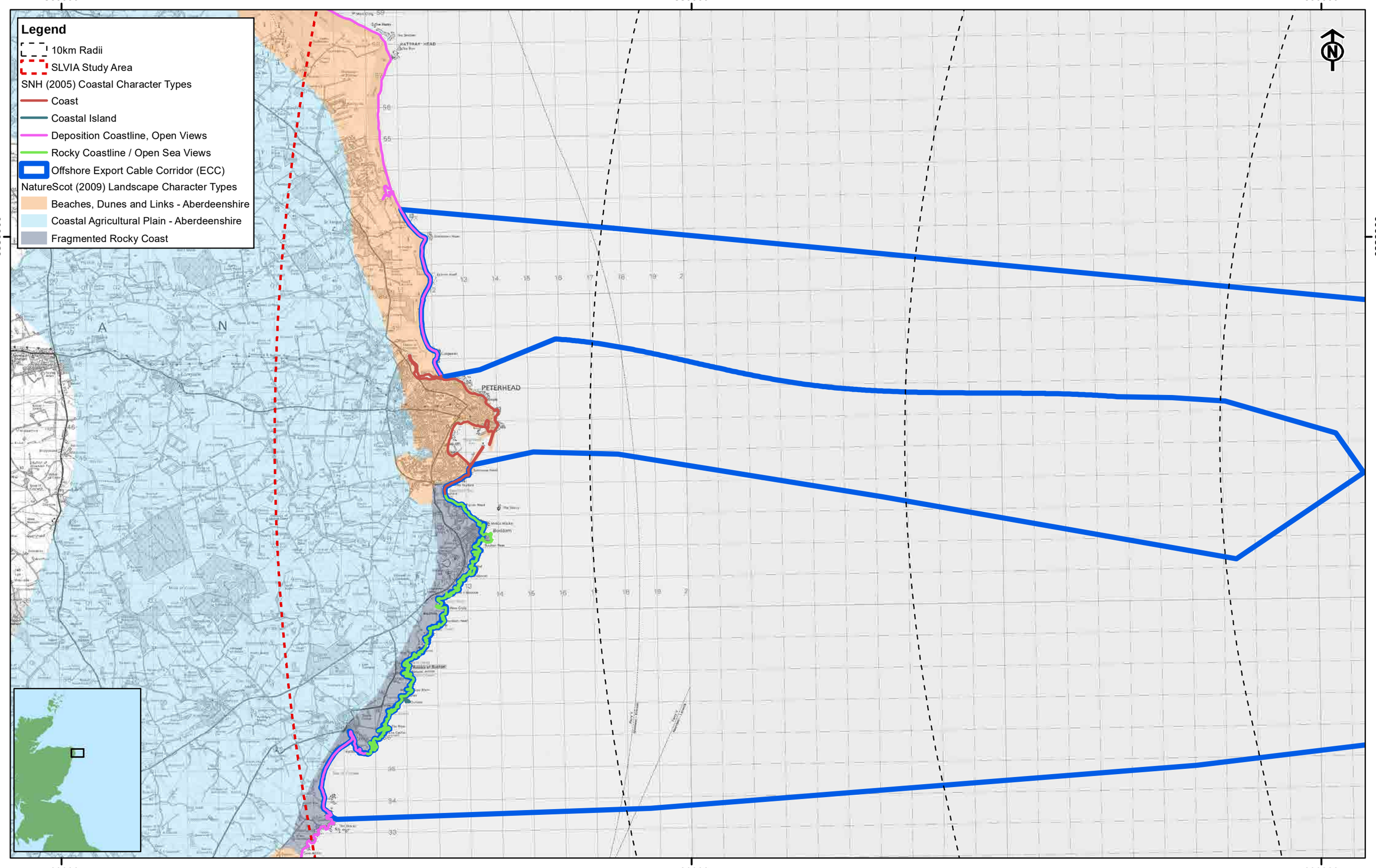
[23] Distance from the Muir Mhòr array area boundary

560000

580000

600000

6380000



MUIR MHÒR OFFSHORE WIND FARM
A joint venture between Fred. Olsen Seawind & Vattenfall
Muir Mhòr Offshore Wind Farm Ltd, The Tun Building
4 Jackson's Entry, Holyrood Road, No 4 EH8 8PJ Edinburgh
United Kingdom

Rev	Date	Drawn By	Checked By	Comment
A	31/03/23	BPHB	LK	First Issue

Datum	ETRS 1989
Projection	ETRS 1989 UTM Zone 30N
Plot	A3
Scale	1:115,000

0 0.7 1.4 2.1 2.8 3.5 km

MUIR MHÒR WIND FARM

Coastal Character and Landscape Character

Confidentiality Class	C1
Drg No	GoBe-0001
Rev	A
Layout	NA

Figure 16.4

Ref files: MMH_A3_SCOP_16.4_LCA_CC_v01

560000 580000 600000

6380000

Legend

- Wind Turbine Generator (WTG)
- Offshore Electrical Platform (OEP)
- 10km Radii
- SLVIA Study Area
- Array Area
- Offshore Export Cable Corridor (ECC)
- Special Landscape Area

Blade Tip Zone of Theoretical Visibility
- Higher Theoretical Visibility
- Lower Theoretical Visibility

North East Aberdeenshire Coast

North Aberdeenshire Coast

PETERHEAD

N

Blade tip:	340m
DTM:	OS T5/T50 DTM
DTM resolution:	10m
Observer height:	2m
Surface features:	Excluded
Earth curvature:	Included

560000 580000 600000

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Scale	1:115,000

0 0.7 1.4 2.1 2.8 3.5 km

MUIR MHÒR WIND FARM

Blade tip ZTV with Landscape Planning Designations

Confidentiality Class	C1
Drg No	GoBe-0001
Rev	A
Layout	NA

Figure 16.5

Ref files: MMH_A3_SCOP_16.5_ZTV_LD_v01

Night-time visual impacts

16.5.16 Artificial lighting is already present in the SLVR study area, from the large settlement of Peterhead, the St Fergus Gas Terminal, passing vessels in the sea, and the operational Hywind Scotland Pilot Park OWF. Visual receptors, who may experience views of aviation lighting fitted to the WTGs, include residents and visitors, however, these receptors will mainly be located in settled or accessible locations with baseline lighting at sunset or during the hours of darkness. Given the baseline context and the distance of the aviation lighting on the proposed development's WTGs at distances over 63 km, the potential impacts of WTG lighting on views and landscape/coastal character is scoped out of the assessment, as there is no potential for it to result in significant effects at night at such range.

Seascape and Landscape Character

SLVR Study Area and Seascape Character

16.5.17 There is no characterisation of offshore seascape character in Scotland, and NatureScot (formerly SNH) have not adopted this approach, which is used in England. As such, there is no classification of the seascape character of the SLVR study area. The offshore part of the SLVR study area can generally be described as an open area of sea, with offshore oil and gas platforms to the north and north-west; and the operational Hywind Scotland Pilot Park OWF to the north-west. A range of vessels move through the area. Within the SLVR study area, the seascape is part of the North Sea and land is only found to the west, within Aberdeenshire.

Coastal Character

16.5.18 NatureScot promotes the coastal character approach, which focuses on the coastal edge as a means of characterising marine landscapes (NatureScot, 2018). Thirteen National Coastal Character Types (NCCTs) have been identified (Scott *et al.,* 2005) at a broad scale, of which two occur within the SLVR study area (as shown on Figure 16-4):

- Deposition Coastline (3); and
- Mainland Rocky Coastline (2).

16.5.19 Orkney and north Caithness are the only stretches of coast in Scotland to be characterised at a more detailed scale (NatureScot, 2016). Some detailed regional and local coastal character assessments have been undertaken as part of EIAs for marine development projects for parts of the Scottish coastline. The Hywind Scotland Environmental Statement (ES) (Statoil, 2015), for example, includes a Coastal Character Assessment comprising three Coastal Character Areas (CCAs) subdivided into nine Local Coastal Character Areas (LCCAs) along the north-eastern coast of Aberdeenshire. The relevant coastal areas with the SLVR study area are:

- CCAs:
- Collieston to Boddam;
- Peterhead; and
- Peterhead to Fraserburgh.
- LCCAs:
- Eastern Port – Peterhead (6);
- East facing enclosed sandy bay (8);
- Indented rocky coast (7); and

- Long beaches, links and dunes (9).

16.5.20 Significant effects on coastal character have been identified up to 30 km from OWFs (Marine Scotland, 2021). As the Muir Mhòr array area will feature large WTGs (up to 340 m to blade tip), the coastal character of the Aberdeenshire coastline within 70 km of the Muir Mhòr array area has been considered in this scoping assessment, to capture those areas where potential effects could occur. Significant effects on the perceived coastal character of the SLVR study area coast are however, considered unlikely to arise at such long distances, considering the ZTV (Figure 16-3) and the limited amount of the WTGs visible, as illustrated by representative viewpoints in these CCAs in the wirelines in this Offshore Scoping Report (Appendix B).

Landscape character

16.5.21 Landscape character is described in the National Landscape Character Assessment of Scotland. A number of different Landscape Character Types (LCT) occur within the mainland section of the SLVR study area as shown in Figure 16-4.

16.5.22 The LCTs within the onshore part of the study area tends to reflect the agricultural and coastal nature of the area, and include:

- Beaches, Dunes and Links – Aberdeenshire (12), comprising a low-lying even coastline with subtle points at Rattray Head, Scotstown Head and Forvie Ness and characterised by long, unbroken stretches of broad sandy beach backed by extensive rolling dunes with largely uninterrupted sea views from adjoining farmed coastal plains.
- Coastal Agricultural Plain – Aberdeenshire (17), comprising a relatively large scale, low-lying landscape of exposed farmland strongly influenced by the sea and characterised by a gently undulating landform influenced by development including transmission masts, electricity transmission lines, the A90 and A953, and the gas terminal at St Fergus.
- Fragmented Rocky Coast - Fragmented Rocky Coast (11), comprising a rocky coastline of fractured angular cliffs between 20-60 metres high, narrow inlets and jagged reefs between the headland of Peterhead and the village of Collieston and containing the large natural harbour of Peterhead Bay, with a narrow band of rough grassland and heath at the clifftops that gently merges into the broad and low-lying agricultural plain of the hinterland.

16.5.23 ZTV mapping (Figure 16-5) has been used to consider these LCTs as part of the scoping assessment, where LCTs have coastal or marine influence. Significant effects on the perceived character of LCTs within the SLVR study area coast are however, considered unlikely to arise at such long distances, considering the ZTV (Figure 16-5) and the limited amount of the WTGs visible, as illustrated by representative viewpoints within these LCTs in the wirelines in this Offshore Scoping Report (Appendix B).

Designated Landscapes

16.5.24 There are no nationally protected landscapes (e.g. National Scenic Areas (NSAs) or Wild Land Areas (WLAs) within the 70 km SLVR study area. However, the value of the Aberdeenshire coastline is recognised by almost continuous regional level designation of the rural sections of the coastline as Special Landscape Areas (SLAs) (Aberdeenshire Council, 2023). Designated landscapes within the SLVR study area are shown on Figure 16-5 together with the ZTV of the proposed development. The SLVR study area encompasses one SLA, the North-east Aberdeenshire Coast SLA, which lies approximately 63 km from the Muir Mhòr array area at its closest point at Boddam and extends to beyond 70 km from the Muir Mhòr array area to the north and south of the SLVR study area.

North-East Aberdeenshire Coast SLA

16.5.25 The Northeast Aberdeenshire Coast SLA encompasses two separate sections of coastal farmland extending between Fraserburgh and Peterhead and Buchan Ness and Blackdog (Aberdeenshire Council, 2023). These areas comprise wide sandy beaches backed by rolling dunes, with outcrops of rugged cliffs and unified by the east-facing orientation of the landscape towards the open North Sea. Designation of this area distinguishes its strong sense of place, scenic qualities and uninterrupted views out to the North Sea.

16.5.26 The aspects and features for which this landscape is designated which could be potentially affected by the Muir Mhòr array area and ECC include:

- "Expansive beaches backed by rolling dunes, with long views out to sea.
- A popular coast for visitors, with coastal paths, accessible dunes, golf courses and popular beaches.
- Ancient coastal forts occupy headlands, with later castles and houses like Slains also prominently sited.
- Panoramic views out to sea from cliff tops and open beaches."

16.5.27 Offshore renewable energy technologies are identified as a key force for change for both of the SLAs in the SLVR study area. The ZTV (Figure 16-5) indicates theoretical visibility of the Muir Mhòr WTGs from coastal areas of the North Aberdeenshire Coast SLA, at distances of over 63 km. Significant effects on the perceived character and qualities of the SLA are however, considered unlikely to arise at such long distances, considering the ZTV (Figure 16-5) and the limited amount of the WTGs visible, as illustrated by representative viewpoints within the SLA in the wirelines in this Offshore Scoping Report (Appendix B).

16.6 Summary and Key Issues

16.6.1 The key SLVR receptors within the SLVR study area are identified as follows:

- Residents of Peterhead and Boddam;
- People visiting or engaged in water-based activities at the coast, including for example at Cruden Bay, Bullers of Buchan, St Fergus Links and Rattray Head;
- Users of the Formartine & Buchan Way and core paths;
- Hill walkers at Stirling Hill and other viewpoints;
- Road users on the A90;
- NCCTs (2: Mainland Rocky Coastline and 3: Deposition Coastline);
- LCCAs (6. Eastern Port – Peterhead; 7. Indented rocky coast; 8. East facing enclosed sandy bay; and 9. Long beaches, links and dunes); and
- LCTs (11: Fragmented Rocky Coast, 12: Beaches, Dunes and Links – Aberdeenshire and 17: Coastal Agricultural Plain).

16.7 Embedded Commitments

16.7.1 As part of the project design process, several designed-in measures have been proposed to reduce the potential for impacts on environmental and socio-economic receptors. These are presented in Table 16-4 and in the Commitments Register (Appendix A) and will likely evolve over the development process as the EIA progresses and in response to stakeholder consultation.

Table 16-4: Embedded commitment measures of relevance to seascape, landscape, and visual resources.

Code	Commitment	Type (Primary, Secondary or Tertiary)	How Commitment Secured
C-03	Development of and adherence to a DSLP. The DSLP will confirm layout and relevant design parameters.	Tertiary	DSLP
C-04	The layout of WTGs and substation(s) will be designed in such a way as to minimise the impacts on Seascape, Landscape, Visual Impacts Assessment (SLVIA) where practicable.	Primary	Design Statement (DS)
C-09	Development of and adherence to a DP. The DP will outline measures for the decommissioning of the Proposed Development.	Tertiary	DP
C-40	Development of and adherence to a WSP to provide details on requirements (if applicable) for assembled WTGs and cabling. WTGs to be held at a nearshore wet storage location before being transported to site.	Tertiary	WSP

16.7.2 As a result of the commitment to implement these measures, and to align the proposed development with various standard sectoral practices and procedures, the embedded commitments are considered inherently as part of the design of the proposed development and have, therefore, been included in the assessment presented in Section 16.8.

16.7.3 Additional mitigation measures are not considered necessary due to the distance of the project offshore and the lack of significant effects predicted on SLVR.

16.8 Scoping of Impacts

16.8.1 Table 16-5 sets out an initial assessment of the likelihood of effects on SLVR due to the proposed development for the scoping stage of the EIA process. The assessment is based on a combination of the following: the definition of the proposed development at the scoping stage; embedded commitments (as set out in Section 16.7); the level of understanding of the baseline at the scoping stage; the existing evidence base for effects on SLVR due to proposed development activities; ZTV modelling (Figure 16-2 and Figure 16-3) and wireline visualisations (Appendix B); together with the professional judgement of qualified SLVR specialists.

16.8.2 The wireline visualisations in Appendix B indicate that the Muir Mhòr array area's distance offshore (over 63 km) and the curvature of the earth, will restrict visibility of the proposed development's WTGs from the coast of the SLVR study area. From much of the coast, only the blade tips of the WTGs will be visible with turbine nacelles only becoming visible from elevated locations (such as Stirling Hill). In theory, a relatively high number of the WTGs and their lateral extent may be perceptible; however, these will appear low to the distant horizon and small in vertical scale as they will be located at long range from the coast. The presence of the operational Hywind Scotland Pilot Park OWF in the existing seascape context will also reduce the proposed development's WTGs potential visual influence, as the addition of WTGs in the backdrop will not appear as an uncharacteristic introduction to the seascape. The WTGs of the Hywind Scotland Pilot Park OWF will appear notably larger and distinct in views, compared to those of the proposed development. This will be observable from a greater section of the coastline due to the location of Hywind Scotland Pilot Park OWF, at closer proximity to the coast. Notable shipping activity within the expansive seascape context will also limit the visual impact of the proposed development.

16.8.3 The wireline visualisations (Figure 16-2 and Figure 16-3) indicate that construction and O&M of the proposed development is unlikely to have significant effects on SLVR, due to its very long distance offshore, the limited amount of the turbine blade tips that are theoretically visible and the presence of an operational OWF in the seascape hosting the proposed development. On this basis, it is proposed to scope out seascape, landscape and visual effects of the construction, O&M and decommissioning resulting from the array area of the proposed development from the EIA.

Table 16-5: Scoping assessment for Seascape, Landscape and Visual Resources.

Impact Pathway	Embedded Commitments	Scoped In or Scoped Out	Justification
Construction and Decommissioning			
Physical impacts on landscape as a result of the construction and decommissioning of the proposed development	C-09	Scoped Out	No potential for significant effects on landscape receptors due to the proposed development's offshore location. Due to the offshore location of the Muir Mhòr array area and the offshore ECC, the proposed development will only affect the perceived character and qualities of the landscape, which is considered as an indirect effect. No physical attributes that define landscape character or special qualities of designated landscapes will be changed. Landfall impacts will be assessed as part of the onshore Landscape and Visual Impact Assessment (LVIA).
Impacts on SLVR outwith the ZTV and/or on landscape character inland from the coast as a result of the construction and decommissioning of the proposed development.	C-09	Scoped Out	No potential for significant effects on SLVR due to lack of visibility of the proposed development. The proposed development will not be visible from SLVRs that are entirely outwith the ZTV. SLVRs inland from the coast particularly LCTs, are unlikely to have a strong relationship with the sea or intervisibility with the proposed development, due to intervening landscape elements. Construction/decommissioning activity within the wider context of these landscapes is unlikely to alter their perceived landscape character and they are unlikely to be significantly affected.
Impacts on coastal character as a result of the presence and activity of construction and decommissioning works within the array area of the proposed development	C-09	Scoped Out	Effects on coastal character and landscape character are unlikely to be significant due to the very long distance offshore of works related to the proposed development and their distant visibility within an expansive seascape context. Any such effects would be short-term and temporary. The Muir Mhòr array area will lie very far offshore at 63 km from the coastline and will appear very limited in extent within the wider seascape of the North Sea. Long range visibility of construction/decommissioning activity is likely to result in low or negligible levels of change to the baseline coastal character.

Impact Pathway	Embedded Commitments	Scoped In or Scoped Out	Justification
Visual impacts on views experienced by onshore visual receptors as a result of the presence and activity of construction and decommissioning works within the array area of the proposed development.	C-09	Scoped Out	Effects on views experienced by onshore visual receptors are unlikely to be significant due to the very long distance offshore of works related to the Muir Mhòr array area and their distant visibility within an expansive seascape context. Any such effects would be short-term and temporary. The Muir Mhòr array area will lie very far offshore at 63 km from the closest views from coastline and will appear very small in scale and limited extent within the wider seascape of the North Sea. Long range visibility of construction/decommissioning activity is likely to result in low or negligible levels of change to the baseline views. Significant effects on views experienced by onshore visual receptors at these representative viewpoints within the SLVR study area coast are considered unlikely to arise at such long distances, considering the ZTV (Figure 16-3) and the limited amount of the WTGs visible, as illustrated by representative viewpoints from these receptors in the wirelines in this Offshore Scoping Report (Appendix B).
Impacts on coastal character, landscape character and views as a result of the presence and activity of works related to the offshore ECC	C-09	Scoped Out	Effects on SLVR are unlikely to be significant, due to the nature of the offshore ECC; and the distant visibility of related activity offshore within an expansive seascape context. The sporadic nature of related above-sea construction activity means its effects will be short-term and temporary. Related above-sea construction activity is mainly related to the movement of sea vessels, which are an established component of the baseline seascape and views of it. Long-range visibility of this activity further reduces its impact.
Assembly and pre-commissioning of WTGs; wet storage; and related activity including tow out from the port facility	C-40	Scoped In	Significant visual effects may arise within the vicinity of the harbour used for wet storage, due to the higher sensitivity of receptors within this area and the close-range visibility of the WTGs they may experience. These intermittent and periodic effects will be short-term and temporary. Assembly and pre-commissioning of complete structures and turbines, and wet storage, will take place alongside other port operations and their typically industrialised setting. Within this context, assembly of the WTGs and related activities will not introduce uncharacteristic elements or processes. While a perceptible change to the character of the port and its visual qualities is unlikely, close-range visibility of the WTGs coupled with their relatively large scale within the context of the harbour has potential to be significant for higher sensitivity receptors.

Impact Pathway	Embedded Commitments	Scoped In or Scoped Out	Justification
			Other effects on SLVR are unlikely to be significant, due to the nature of the WTGs and related pre-commissioning processes.
Visual presence of navigation/aviation lighting at night within views experienced by visual receptors onshore	C-09	Scoped Out	Effects on SLVR are unlikely to be significant, due to the long rang visibility of lighting related to the proposed development, which will lie a long distance offshore. The effects of this lighting will be short-term and temporary during construction and decommissioning. The proposed development may include navigational lights associated with construction buoyage and construction vessels; and aviation marking lights on top of cranes associated with heavy lift vessels or jack up vessels. These will not affect perceptions of landscape character during the day but will have visual effects at night. Lighting related to the proposed development's construction/decommissioning works will be visible within the context of other OWFs and at long range offshore. These factors will limit their effects on visual receptors, who are likely to observe a slight change to their night-time views.
Visual impacts on views experienced by offshore visual receptors as a result of the presence and activity of construction and decommissioning works	C-09	Scoped Out	Effects on SLVR are unlikely to be significant due to the very distant visibility of proposed development works; the relatively small proportion of the seascape they will occupy; and the incidental nature of their visibility. Any such effects would be short-term and temporary. The Muir Mhòr array area will lie approximately 53 km east from the nearest ferry route, which is loosely aligned with the coastline. The proposed development will appear peripheral to the direction of travel to those on ferries along the relevant ferry routes and will form a comparatively small, distant feature against a panoramic horizon of open sea. Other offshore receptors who may have closer range views of the proposed development, are unlikely to be particularly sensitive its effects due to the nature of the activities they may be engaged in. Long range visibility of construction/decommissioning activity is likely to result in low or negligible levels of change to the baseline environment.
Operation and Maintenance			
Impacts on coastal character as a result of the operation and maintenance of the array area of the proposed development	C-03, C-04	Scoped Out	Significant effects on SLVR due to the proposed development are unlikely, due to the diminishing effects of distance, which will limit its horizontal and vertical extent; earth curvature, which will limit the visibility of its WTGs; and the presence of the operational Hywind Scotland Pilot Park OWF in the wider seascape. The effects of the proposed development will be long-term and reversible.

Impact Pathway	Embedded Commitments	Scoped In or Scoped Out	Justification
Impacts on coastal character, landscape character and views as a result of the O&M of the offshore ECC	C-03, C-04	Scoped Out	No potential for significant effects on SLVR arising from the offshore ECC, due to its location below the sea surface and its lack of visibility.
Impacts on SLVR outwith the ZTV and/or on landscape character inland from the coast as a result of the O&M of the proposed development.	C-03, C-04	Scoped Out	No potential for significant effects on SLVR due to lack of visibility of the proposed development. The proposed development will not be visible from SLVRs that are entirely outwith the ZTV. SLVRs inland from the coast particularly LCTs, are unlikely to have a strong relationship with the sea or intervisibility with the proposed development, due to intervening landscape elements. The operation and maintenance of the proposed development within the wider context of these landscapes is unlikely to alter their perceived landscape character and they are unlikely to be significantly affected.
Presence and/or activity of maintenance vessels	-	Scoped Out	Operational effects on SLVR will be limited to those arising from repairs and the presence/activity of maintenance vessels. Long-range visibility of these within a wider seascape that already contains OWFs and the related activity of sea vessels, means their introduction is unlikely to significantly affect SLVR.
Visual presence of navigation/aviation lighting at night within views experienced by visual receptors onshore	C-03, C-04.	Scoped Out	Effects on SLVR arising from the proposed development are unlikely to be significant, due to the array area's long distance offshore; the resulting distant and limited visibility of related lighting; and the presence of similar lighting associated with Hywind Scotland Pilot Park OWF within the existing seascape. Any such effects would be long-term but reversible.
Visual impacts on views experienced by onshore visual receptors as a result of the O&M of the array area of the proposed development.	C-03, C-04	Scoped Out	Effects on views experienced by onshore visual receptors are unlikely to be significant due to the very long distance offshore of proposed development's WTGs and their distant visibility within an expansive seascape context. The Muir Mhòr array area will lie very far offshore at 63 km from the closest views from coastline and will appear very small in scale and limited extent within the wider seascape of the North Sea. Long range visibility of the operational WTGs is likely to result in low or negligible levels of change to the baseline views. Significant effects on views experienced by onshore visual receptors at representative viewpoints within the SLVR study area coast are considered unlikely to arise at such long distances, considering the ZTV (Figure 16-3) and the limited amount of the WTGs visible, as

Impact Pathway	Embedded Commitments	Scoped In or Scoped Out	Justification
			illustrated by representative viewpoints from these receptors in the wirelines in this Scoping Report (Appendix B).
Visual impacts on views experienced by offshore visual receptors as a result of the O&M of the array area of the proposed development.	C-03, C-04.	Scoped Out	Significant visual effects experienced by offshore visual receptors are unlikely, due to the presence of OWFs and related vessel activity within the wider seascape; the incidental nature of the proposed development's visibility and, for ferry passengers, the intervening distance. Although the proposed development may increase the level of OWF development, and the density and spread of WTGs within this area and in views from vessels, offshore visual receptors such as people working in fisheries, oil and gas, or other commercial activities, are not of high sensitivity and are unlikely to experience significant effects. The Muir Mhòr array area will lie approximately 53 km east from the nearest ferry route, which is loosely aligned with the coastline. The proposed development will appear peripheral to the direction of travel to those on ferries along the relevant ferry routes and will form a comparatively small, distant feature against a panoramic horizon of open sea. Other offshore receptors who may have closer range views of the proposed development, are unlikely to be particularly sensitive its effects due to the nature of the activities they may be engaged in. Long range visibility of the proposed development is likely to result in low or negligible levels of change to the baseline environment.

16.9 Potential Cumulative Impacts

16.9.1 Chapter 4 (EIA Methodology) details how potential cumulative impacts will be assessed through a CIA and gives examples of the projects which are likely to be included in that assessment.

16.9.2 Operational schemes are considered as part of the baseline for the SLVR and are shown on Figure 16-1. There is one operational OWF within the SLVR study area: Hywind Scotland Pilot Park, which is located approximately 35 km to the west of the Muir Mhòr array area and comprises five turbines at 176 m to blade tip. Two further operational OWFs lie just beyond the SLVR study area: European Offshore Wind Deployment Centre (Aberdeen Bay), approximately 78 km to the west south-west and comprising 11 WTGs at 191 m to blade tip; and Kincardine, approximately 78 km to the south-west and comprising five WTGs at 176 m to blade tip.

16.9.3 For SLVR, cumulative interactions may occur with similar OWFs that are under construction, consented or at application stage. Scoping Reports have been submitted for Green Volt OWF (November 2021), which would be located around 39 km to the north; MarramWind OWF (January 2023), approximately 60 km, also to the north; and Salamander OWF (March 2023), approximately 28 km to the north-west of the array area.

16.9.4 Several of the ScotWind sites which were allocated in February 2022 fall within the SLVR study area. Development within these sites is less certain and their development will be over a long timeframe. The SLVR study area includes the western extents of the site allocated to Shell New Energies (CampionWind), approximately 12 km to the east of the array area; and the north-eastern extents of the site allocated to DEME (Cluaran Deas Ear), approximately 52 km to the south.

Table 16-6: Scoping assessment for cumulative effects on SLVR.

Impact Pathway	Scoped In or Scoped Out	Justification
Construction and Decommissioning		
Cumulative effects of the proposed development on SLVR, as identified in Table 16-5.	Scoped Out	Limited potential for significant cumulative effects on SLVR, due to the distant and limited potential visibility of the proposed development cumulatively with other projects located within the SLVR study area, notably pre-application stage MarramWind, Green Volt and CampionWind OWFs. The proposed development will lie a very long distance offshore (over 63 km) and earth curvature will restrict its visibility such that it has limited potential for cumulative interaction with other projects. Cumulative effects on SLVR are unlikely to be significant and will be short-term and temporary.
Operation and Maintenance		
Cumulative effects of the proposed development on SLVR, as identified in Table 16-5.	Scoped Out	Limited potential for significant cumulative effects on SLVR, due to the distant and limited potential visibility of the proposed development cumulatively with other projects located within the SLVR study area. Any such effects are likely to be long-term and reversible. The operational Hywind Project Park, European Offshore Wind Deployment Centre (Aberdeen Bay) and Kincardine OWFs are considered as part of the baseline. The proposed development will lie a long distance offshore (over 63 km) and the screening effects of earth curvature at this distance, will restrict

Impact Pathway	Scoped In or Scoped Out	Justification
		its visibility; and that of the equally distant pre-application stage MarramWind, Green Volt and CampionWind OWFs. Cumulative effects may arise with the pre-application Salamander OWF, which is approximately 33 km offshore, but the very limited potential visibility of the proposed development at distances over 63 km from the coast is such that cumulative effects are unlikely to be significant.

16.10 Potential Transboundary Effects

16.10.1 The SLVR study area lies within UK waters. The boundary with EU territorial waters lies over 150 km to the east of the array area, while the nearest coastline outside the UK, within Norway, lies over 350 km away. The proposed development is a significant distance from the nearest adjacent exclusive economic zone (EEZ) of another state and, therefore, it is considered that transboundary impacts will not occur and will therefore be scoped out from further consideration within the EIA.

16.11 Proposed Approach to EIA

Approach to Assessment of Effects on SLVR

16.11.1 The EIA will follow the general approach outlined in Chapter 4 (EIA Methodology) of this Offshore Scoping Report. The approach to the assessment of SLVR in the EIA Report will be based on the outcome of the scoping assessment undertaken in Section 16.8. The construction, O&M, and decommissioning of the Muir Mhòr array area and offshore ECC are considered unlikely to result in significant effects on the perceived coastal character and views within the SLVR study area coast and are scoped out of further assessment in the EIA Report. The Muir Mhòr array area is unlikely to give arise to significant effects at such long distances over 63 km from the nearest coastline, considering the ZTV (Figure 16-5) and the limited amount of the WTGs visible, as illustrated by wirelines from representative viewpoints in this Offshore Scoping Report (Appendix B).

16.11.2 The EIA Report will only consider the effects on SLVR arising as a result of the assembly and pre-commissioning of WTGs; wet storage; and related activity including tow out from the port facility. Significant visual effects may arise within the vicinity of the harbour used for wet storage, due to the higher sensitivity of receptors within this area and the close-range visibility of the WTGs they may experience. These intermittent and periodic effects will be short-term and temporary. Assembly and pre-commissioning of complete structures and turbines, and wet storage, will also take place alongside other port operations and their typically industrialised setting. Within this context, assembly of the WTGs and related activities will not introduce uncharacteristic elements or processes. While a perceptible change to the character of the port and its visual qualities is unlikely, close-range visibility of the WTGs coupled with their relatively large scale within the context of the harbour has potential to be significant and will be assessed in the EIA Report.

16.12 Scoping Questions

16.12.1 The following Scoping questions refer to the SLVR chapter and are designed to focus the Scoping exercise and inform the Scoping Opinion:

- Do you agree with the study area defined for SLVR?
- Do you agree with the use of those data listed in Section 16.4 being used to inform the Offshore EIA?

- Are there any additional data sources or guidance documents that should be considered?
- Do you agree that all receptors related to SLVR have been identified?
- Do you agree with the scoping in and out of impacts in relation to SLVR?
- Do you agree with the assessment of the potential for transboundary effects in relation to SLVR?
- Do you agree with the assessment of the proposed approach to cumulative effects in relation to SLVR?
- Do you agree with the proposed assessment methodology for SLVR?

17 Socio-economic, Tourism and Recreation

17.1 Introduction

17.1.1 This chapter of the Offshore Scoping Report identifies the socio-economic, tourism and recreation receptors of relevance to the proposed development and considers the potential impacts from the construction, O&M and decommissioning of the proposed development. The impacts associated with onshore elements, such as the onshore substation, will be considered as part of the Onshore Scoping Report and assessed separately as part of the EIAR.

17.1.2 This chapter should be read alongside the following other chapters:

- Chapter 12: Commercial Fisheries;
- Chapter 13: Shipping and Navigation;
- Chapter 16: Seascape, Landscape and Visual Resources; and
- Chapter 19: Infrastructure and Other Users.

17.1.3 This chapter of the Offshore Scoping Report has been prepared by BiGGAR Economics Ltd.

17.2 Study Area

17.2.1 Whilst the Muir Mhòr array area is located offshore, for most of the socio-economic effects, the relevant study areas are onshore.

17.2.2 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 Marine Scotland (Marine Scotland, 2022). 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 to be considered for assessments should be identified before defining the local areas;
- Principle 3 (Epicentres): The local areas should include all the epicentres of the appropriate impacts;
- Principle 4 (Accountability): The local areas used in the assessment should comprise of pre-existing economic or political geographies (community councils, local authorities, development agencies) to enhance accountability;
- Principle 5 (Understandable): The local areas should be defined in such a way that they are understandable to the communities they describe; and
- 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.

17.2.3 The local socio-economic study area(s) will be defined within the EIAR if more information on the ports that will be used during the construction and operation is known. Based on the principles set out above, it is expected that the local study area(s) could be defined as the local authority area(s) in which the construction and operational ports are located. If the port(s) are close to the local authority boundary with the neighbouring local authority, it is

possible that the local study area(s) will be defined as including more than one local authority area. If the construction port(s) and operational port(s) are in different local authority areas, different local study area(s) will be defined for construction and operational effects.

17.2.4 The socio-economic effects will be also assessed at the level of Scottish and UK economies.

17.2.5 For tourism and recreation, the focus will also be onshore activity that is impacted by the development, construction, operation and decommissioning of the offshore assets. Given the distance of the Muir Mhòr array area from shore (63 km), it is anticipated that there will be limited effects associated with visibility and therefore any potential changes to behaviour would be expected to arise due to increased activity at ports and harbours.

17.2.6 In addition, there will also be the potential for marine recreation to be impacted by the construction and decommissioning of the offshore cable route, near the potential landfall location near Peterhead. These could occur if the vessels used during the construction impede on the ability of marine recreation users to pursue these activities, including recreational sailing or sea angling.

17.2.7 More local study areas, which are expected to include the electoral wards around the chosen port(s) will be defined when more information is known about the proposed development.

17.3 Baseline Environment

Data Sources

17.3.1 The data sources that have been used to inform the Socioeconomics, Tourism and Recreation chapter of the Offshore Scoping Report are presented within Table 17-1. These data sources will be taken forward and used to inform the EIA.

Table 17-1: Key sources of Socio-Economic, Tourism and Recreation data.

Source, Author and Year	Summary	Coverage of study areas
Socio-economics		
National Records of Scotland (2022), Mid-2021 Population Estimates Scotland	Population estimates, broken down by age.	Covers Scotland and each of its 32 local authorities.
National Records of Scotland (2020), 2018-based Principal Population Projections	Population projections for Scotland and each of its 32 local authorities, broken down by age.	Covers Scotland and each of its 32 local authorities.
Office for National Statistics (ONS) (2020b), Principal Populations 2018-Based	Population projections for the UK as a whole, broken down by age.	Covers the UK as a whole.
ONS (2022a) Annual Survey of Hours and Earnings 2022	Provides average and median residential and workplace earning.	Covers the UK, Scotland and local authorities.
ONS (2022b), Business Register and Employment Survey 2021	Provides a breakdown of employment by sector.	Covers the UK, Scotland, local authorities and the electoral wards.
ONS (2023), Annual Population Survey 2022	Provides statistics on characteristics of populations, including economic activity rate and unemployment rate	Covers the UK, Scotland and local authorities.
Offshore Wind Industry Council (2021), People Skills Survey 2021-2026	Provides information on the existing offshore wind labour force across the UK as well as the skills that are expected to be needed up to 2026.	Covers the UK and individual regions across Scotland.
ORE-C (2020), The Offshore Wind O&M Opportunity	Discusses the potential opportunities in offshore wind by 2030, with a detailed breakdown of annual spending and associated opportunities in the UK.	Considers opportunities in the UK.
UK Government (2020), The Offshore Wind Sector Deal	Sets out the economic opportunities associated with offshore wind, including UK Government targets on the share of UK content.	Applies to the UK.

Source, Author and Year	Summary	Coverage of study areas
Scottish Government (2018), National Performance Framework	Sets out a framework for what a successful country would look like, providing a range of measures to assess a proposed project against.	Applies to Scotland.
Scottish Government (2022b), National Strategy for Economic Transformation	Sets out the priorities for the Scottish economy, as well as how to achieve a wellbeing economy.	Applies to Scotland.
Scottish Government (2020), Offshore Wind Policy Statement	Sets out the Scottish Government's ambitions for the future of offshore wind in Scotland.	Applies to Scotland.
Tourism and Recreation		
Kantar Taylor Nelson Sofres (TNS) (2020a), GB Day Visitor 2019	Annual publication of domestic day visits by number and value, with 2019 as the latest year not affected by Covid-19. May be updated prior to drafting the EIA.	Covers UK, Scotland and local authorities.
Kantar TNS (2020b), GB Tourism Survey 2019	Annual publication of domestic overnight tourism visits and nights by number, value and purpose, with 2019 as the latest year not affected by Covid-19. May be updated prior to drafting the EIA.	Covers UK, Scotland and local authorities.
ONS (2020a), International Passenger Survey	Annual publication of international overnight tourism visits and nights by number, value and purpose, with 2019 as the latest year not affected by Covid-19. May be updated prior to drafting the EIA.	Covers UK, Scotland and selected regions, such as Grampian.
Scottish Government (2022a), Annual Growth Sector Statistics	Provides economic statistics, such as employment and Gross Value Added (GVA), on growth sectors identified by the Scottish Government, including sustainable tourism	Covers Scotland and its local authorities.

17.4 Description of Baseline Environment

Socio-economics overview

17.4.1 The Scottish population is projected to decrease over time, particularly the working age population, and so the Scottish economy requires new drivers of growth. The offshore renewables sector represents an opportunity of substantial scale for the Scottish economy, and the wider UK economy.

17.4.2 Baseline characterisation of the local socio-economic study area(s) will be undertaken when the ports that will be used during the construction and operation are known.

Tourism and Recreation overview

17.4.3 Sustainable tourism is identified as one of Scotland's growth sectors, accounting for 209,000 jobs in 2022. In 2019, the most recent year for which data is available, total visitor spending was £10.7 billion.

17.4.4 The focus of marine recreation in Peterhead is Peterhead Bay Marina, which contains 150 pontoon berths and 20 visitor berths, and it is the home of Peterhead Sailing Club (Peterhead Port Authority, 2021). The marina is owned and managed by Peterhead Port Authority. Peterhead Port is the busiest fishing port in Europe and is also home to oil and gas, cruise and bulk haulage activities. The marina is located in the southern half of the port.

17.4.5 The tourism baseline will be augmented with local visitor attractions and other data when more information is known about the construction and operation port(s).

Strategic overview

National Performance Framework

17.4.6 Scotland's National Performance Framework (NPF) (Scottish Government, 2018), first published in 2018, sets out the ambitions of the Scottish Government across a range of economic, social, and environmental factors. The framework includes 'increased wellbeing' as part of its purpose and combined measurement of how well Scotland is doing in economic terms with a broader range of wellbeing measures. The NPF is designed to give a more rounded view of economic performance and progress towards achieving sustainable and inclusive economic growth and wellbeing across Scotland.

17.4.7 The aims for Scotland set out in the NPF are:

- create a more successful country;
- give opportunities to all people living in Scotland;
- increase the wellbeing of people living in Scotland;
- create sustainable and inclusive growth; and
- reduce inequalities and give equal importance to economic, environmental and social progress.

National Planning Framework

17.4.8 In 2023, the Scottish Government published the National Planning Framework 4 (Scottish Government, 2023), which set out Scotland's spatial strategy to 2045. It affirms the importance of Scotland's transition to a net zero economy through green investment and green jobs, with wind energy highlighted as playing a significant role in the coming years. It states that renewable energy developments will only be supported where they maximise net

economic impact, including local and community socio-economic benefits, such as employment, associated business and supply chain opportunities.

National Strategy for Economic Transformation

17.4.9 In March 2022, the Scottish Government released the National Strategy for Economic Transformation (Scottish Government, 2022b), which set out its ambition for Scotland's economy over the next 10 years. The Scottish Government's vision is to create a wellbeing economy where society thrives across economic, social and environment dimensions, which delivers prosperity for all Scotland's people and places. Of particular importance is the ambition to be greener, with a just transition to net zero, a nature-positive economy and a rebuilding of natural capital.

17.4.10 A key longer-term challenge identified in the strategy is to address deep-seated regional inequality, which includes in rural and island areas that face problems such as a falling labour supply, poorer access to infrastructure and housing. The transition to net zero presents a further challenge of delivering positive employment, revenue and community benefits.

17.4.11 To deliver its vision and address the economy's challenges, five programmes of action have been identified (with a sixth priority of creating a culture of delivery), including:

- establishing Scotland as a world-class entrepreneurial nation;
- strengthening Scotland's position in new markets and industries, generating new, well-paid jobs from a just transition to net zero;
- making Scotland's businesses, industries, regions, communities and public services more productive and innovative;
- ensuring that people have the skills they need to meet the demands of the economy, and that employers invest in their skilled employees; and
- reorienting the economy towards wellbeing and fair work.

17.4.12 The strategy notes that Scotland has substantial energy potential, with a quarter of Europe's wind potential, and that it has developed a growing green industrial base. This provides a strong foundation for securing new market opportunities arising from the transition to net zero, for example in the hydrogen economy and in the decarbonisation of heating systems, where Scotland may be able to secure first-mover advantage and will need continuing investment and support. Renewable energy also has a role to play in supporting productive businesses and regions across Scotland.

Offshore Wind Policy Statement

17.4.13 The Scottish Government's 2020 Offshore Wind Policy Statement (Scottish Government, 2020) highlights the substantial potential of Scotland's waters for offshore wind and the importance of the sector in the transition to net zero.

17.4.14 When the policy statement was published in October 2020 the ScotWind leasing round was expected to lead to an additional 11GW of offshore wind capacity by 2030, generating substantial economic impacts in Scotland's offshore wind supply chain. In contrast, the ScotWind leasing round is now expected to lead to an additional 25GW of offshore wind capacity (CES, 2022), with particular economic opportunities related to floating offshore.

UK Government Offshore Wind Sector Deal

17.4.15 The UK Government's Offshore Wind Sector Deal (UK Government, 2020) aims to ensure that UK companies can benefit from the opportunities presented by the expansion of the offshore wind sector, enhancing the competitiveness of UK firms internationally and sustaining the UK's role as a global leader in offshore wind generation, as outlined in the

offshore wind sector deal. Offshore wind is also expected to play a significant role in the transition to net zero, creating green jobs as part of the net zero, build back greener agenda.

17.4.16 The strategic baseline will be augmented with local strategies when the local socio-economic area(s) are identified.

17.5 Summary and Key Issues

17.5.1 It is anticipated that the key socio-economic receptors identified will be the local study area(s), once construction and operation ports are known, as well as Scotland and the UK.

17.5.2 Tourism and recreation receptors within the tourism and recreation study area are expected to include visitor attractions, recreational assets and construction and operation ports, once known.

17.6 Embedded Commitments

17.6.1 As part of the proposed development design process, a number of designed-in measures have been proposed to reduce the potential for impacts on socio-economic receptors. These are presented in Table 17-2 and in the Commitments Register (Appendix A) and will likely evolve over the development process as the EIA progresses and in response to stakeholder consultation.

Table 17-2: Embedded commitments measures of relevance to socio-economics, tourism and recreation.

Code	Commitment	Type (Primary, Secondary or Tertiary)	How Commitment Secured
C-09	Development of and adherence to a DP. The DP will outline measures for the decommissioning of the Proposed Development.	Tertiary	DP
C-10	Development of and adherence to a VMP. The VMP will confirm the anticipated types and numbers of vessels that will be engaged on the proposed development and consider vessel coordination including indicative transit route planning.	Tertiary	VMP
C-11	Development of and adherence to an FMMS. The FMMS will set out the means of ongoing fisheries liaison through construction and operation and O&M phases of the proposed development and detail any mitigation measures of relevance to commercial fisheries to be put in place.	Tertiary	FMMS
C-12	Ongoing liaison with fishing fleets will be maintained during construction, maintenance and decommissioning operations via an appointed Fisheries Liaison Officer and Fishing Industry Representative.	Tertiary	FMMS
C-13	Adherence to best practice guidance with regards to fisheries liaison and procedures in the event of interactions between the proposed development and fishing activities (e.g., FLOWW, 2014; 2015).	Tertiary	FMMS
C-16	Development of and adherence to a NSP. The NSP will describe measures put in place by the proposed development related to navigational safety, including information on Safety Zones, charting, construction buoyage, temporary lighting and marking,	Tertiary	NSP

Code	Commitment	Type (Primary, Secondary or Tertiary)	How Commitment Secured
	and means of notification of proposed development activity to other sea users (e.g., via Notice to Mariners).		
C-19	Advance warning and accurate location details of construction, maintenance and decommissioning operations, associated Safety Zones and advisory passing distances will be given via Notices to Mariners and Kingfisher Bulletins.	Tertiary	NSP
C-20	Participation in any fisheries working group to assist with liaison between the proposed development and the fishing community.	Tertiary	FMMS
C-26	Compliance with regulatory expectations on moorings for floating wind and marine devices published by Maritime and Coastguard Agency (MCA) and the HSE.	Tertiary	CMS
C-30	Adherence to the Supply Chain Development Statement in relation to local manufacturers and contractors.	Tertiary	Supply Chain Development Statement
C-33	Minimum blade clearance of 30 m above MSL.	Primary	DSLP CMS

17.6.2 As part of the ScotWind bidding process, the Developer provided a Supply Chain Development Statement (SCDS), which outlines a commitment scenario and an ambition scenario for the share of supply chain content that will be sourced from Scotland in the development and construction phase, as well as in the first six years of operation. This will be refined over time as the proposed development develops.

17.6.3 The measures committed to as part of the SCDS, including engaging with supply chain, hosting meet the buyer events and including local content as part of the procurement process, are likely to increase the positive socio-economic impacts associated with the proposed development.

17.6.4 As a result of the commitment to implement these measures, and to align the proposed development with various standard sectoral practices and procedures, the embedded commitments are considered inherently part of the design of the proposed development and have therefore been included in the assessment presented in Section 17.7.

17.6.5 The requirement and feasibility of any additional mitigation measures will be dependent on the significance of the effects upon socio-economics, recreation and tourism and will be consulted upon with statutory consultees throughout the EIA process.

17.7 Scoping of Impacts

17.7.1 Table 17-3 sets out an initial assessment of the likelihood of effects on socio-economics, recreation, and tourism due to proposed development activities for the scoping stage of the EIA process. The assessment is based on a combination of the following: the definition of the proposed development at the scoping stage; embedded commitments (as set out in Section 17.6, together with the means by which it will be secured); the level of understanding of the baseline at the scoping stage; the existing evidence base for socio-economics, recreation

and tourism effects due to proposed development activities; relevant policy; and the professional judgement of qualified socio-economics, recreation and tourism specialists.

17.7.2 The development, construction, operation and decommissioning of the proposed development has the potential to have a wide range of socio-economic, tourism and recreation impacts on multiple different communities. This is highlighted by Marine Scotland in its General Advice for Socio-economic Impact Assessment (Marine Analytical Unit, Marine Scotland, 2022). The General Advice highlights some commonly identified socio-economic impacts which could occur as a result of the development of an offshore wind farm, which are presented in Table 17-3.

17.7.3 The location of where activities occur can be crucial in determining the significance of any effect. An impact of a given scale can have a different effect in different communities. For example, the creation of 10 jobs may not be significant in a large urban area, however it could be significant in a rural area. Therefore, impacts are assessed relative to the socio-economic baseline in each area.

17.7.4 At the time of completing the EIA, it is unlikely that the key epicentres, such as ports, will have been selected. This has an implication on how definitive the assessment of some impacts can be. For example, the potential arrival of new people into the area to support the construction of the proposed development may have impacts on the size and structure of the population or lead to different settlement patterns. The magnitude of any impact and the sensitivity of the communities to this impact is likely to be dependent on the communities in which these impacts occur. These impacts will be based around the key epicentres of economic impact that will generate employment opportunities. For the offshore elements of the proposed development the key epicentres will be the ports used for construction, operations, and decommissioning. It is assumed that at the time of the assessment, it will not be known which port locations will be used, and therefore which communities will be impacted. It will however be possible to consider the potential scale of these impacts and their potential to be significant in different location types, using publicly available data.

17.7.5 This approach is not possible for some impacts, particularly those that are highly dependent on the communities in which they occur and will require primary stakeholder engagement with the communities to inform any assessment. These impacts have been scoped out of the assessment at the EIA stage.

17.7.6 The Developer acknowledges that these impacts will be important to the communities that they occur in. Therefore, to allow for a meaningful consideration of these impacts, it will commit to exploring these issues in more detail post-consent as details of the proposed development are decided. . This will form part of their Stakeholder Engagement Plan and will include a stakeholder mapping and engagement exercise once initial potential impacts have been identified. The Developer will also monitor and evaluate the properties of the employment supported specifically by the proposed development, in conjunction with the reporting requirements for the Contract Position Statement as part of the ScotWind leasing arrangement.

17.7.7 The General Advice from Marine Scotland also requests that the onshore and offshore elements of an offshore wind farm are considered together. The Developer is proposing a separate Town and Country Planning Application for the onshore elements of the Project and therefore it is proposed that a supplementary stand-alone economic impact report will be produced and submitted alongside the EIA, which covers both the onshore and offshore elements of the Project.

Table 17-3: Scoping assessment for Socio-Economics, Tourism and Recreation.

Impact Pathway	Embedded Commitments	Scoped In or Scoped Out	Justification
Construction			
Increase in employment and GVA.	C-30	Scoped In	The construction of the proposed development will require expenditure with companies in each of the study areas. This will support employment and generate GVA, including impacts associated with spending in the wider supply chain (indirect effects) and spending by staff (induced effects).
Demographic changes.	-	Scoped In	The impacts of demographic changes will be assessed as far as possible, including the scale of any impact and its potential to be significant. If ports have been determined by the time of the assessment, it will be possible to be more definitive on the likely significance of these impacts.
Changes to housing demand.	-	Scoped In	The impacts of demographic changes and the implications for housing demand will be assessed as far as possible, including the scale of any impact and its potential to be significant. If ports have been determined by the time of the assessment, it will be possible to be more definitive on the likely significance of these impacts.
Changes to other local public and private services.	-	Scoped In	The impacts of demographic changes and the implications for demand on local public and private services will be assessed as far as possible, including the scale of any impact and its potential to be significant. If ports have been determined by the time of the assessment, it will be possible to be more definitive on the likely significance of these impacts.
Socio-cultural impacts	-	Scoped Out	The potential socio-cultural impacts, including changes to community character or image and quality of life, will require primary stakeholder engagement in the communities around the key epicentres of impact. To avoid survey fatigue and ensure meaningful interactions, this engagement will occur post consent as decisions are made regarding the location of key activities, such as ports. These impacts have therefore been scoped out of the assessment.
Changes to visitor behaviour.	-	Scoped In	Potential changes to visitor behaviour may arise from changes to onshore activity associated with the construction of the proposed development, such as increased activity at ports and harbours.
Changes to commercial fisheries.	C-10, C-11, C-12, C-13, C-16, C-19, C-20	Scoped In	If the construction of the proposed development causes disruption to commercial fishing this may lead to reduced economic activity in the commercial fisheries sector. This will be informed by the commercial fisheries EIA.

Impact Pathway	Embedded Commitments	Scoped In or Scoped Out	Justification
Changes to shipping and marine recreation.	C-10, C-11, C-12, C-13, C-16, C-19, C-20	Scoped In	Changes to economic activity as a result of the construction of the proposed development may impact activity in the shipping and marine recreation sectors.
Operation and Maintenance			
Increase in employment and GVA.	C-30	Scoped In	O&M will require expenditure with companies and organisations in each of the study areas, supporting employment and generating GVA.
Demographic changes.	-	Scoped In	The impacts of demographic changes will be assessed as far as possible, including the scale of any impact and its potential to be significant. If ports have been determined by the time of the assessment, it will be possible to be more definitive on the likely significance of these impacts.
Changes to housing demand.	-	Scoped In	The impacts of demographic changes and the implications for housing demand will be assessed as far as possible, including the scale of any impact and its potential to be significant. If ports have been determined by the time of the assessment, it will be possible to be more definitive on the likely significance of these impacts.
Changes to other local public and private services.	-	Scoped In	The impacts of demographic changes and the implications for demand on local public and private services will be assessed as far as possible, including the scale of any impact and its potential to be significant. If ports have been determined by the time of the assessment, it will be possible to be more definitive on the likely significance of these impacts.
Socio-cultural impacts	-	Scoped Out	The potential socio-cultural impacts, including changes to community character or image and quality of life, will require primary stakeholder engagement in the communities around the key epicentres of impact. To avoid survey fatigue and ensure meaningful interactions, this engagement will occur post consent as decisions are made regarding the location of key activities, such as ports. These impacts have therefore been scoped out of the assessment.
Changes to visitor behaviour.	-	Scoped In	Potential changes to visitor behaviour may arise from changes to onshore activity associated with the O&M of the proposed development, such as increased activity at ports and harbours, or changes to seascape and visual impact.

Impact Pathway	Embedded Commitments	Scoped In or Scoped Out	Justification
Changes to commercial fisheries.	C-10, C-11, C-12, C-13, C-16, C-19, C-20, C26, C-33	Scoped In	If the O&M of the proposed development causes disruption to commercial fishing this may lead to reduced economic activity in the commercial fisheries sector. This will be informed by the commercial fisheries EIA.
Changes to shipping and marine recreation.	C-10, C-11, C-12, C-13, C-16, C-19, C-20, C26, C-33	Scoped In	Changes to economic activity as a result of the operation of the proposed development may impact activity in the shipping and marine recreation sectors.
Decommissioning			
Increase in employment and GVA.	-	Scoped In	Decommissioning will require expenditure with companies and organisations in each of the study areas, supporting employment and generating GVA.
Changes to visitor behaviour.	C-09	Scoped Out	Potential changes to visitor behaviour may arise from changes to onshore activity associated with decommissioning of the proposed development, such as increased activity at ports and harbours, or changes to seascape and visual impact. However, the locations, methods and approach to decommissioning is unlikely to be known at this stage and the tourism sector baseline has the potential to change significantly between now and the time of decommissioning. The significance of any effect will also be determined by the location of ports used in the decommissioning. This has been scoped out as a meaningful assessment will not be possible until the port location(s) are known.
Demographic changes.	-	Scoped In	The impacts of demographic changes will be assessed as far as possible, including the scale of any impact and its potential to be significant. If ports have been determined by the time of the assessment, it will be possible to be more definitive on the likely significance of these impacts.
Changes to housing demand.	-	Scoped In	The impacts of demographic changes and the implications for housing demand will be assessed as far as possible, including the scale of any impact and its potential to be significant. If ports have been determined by the time of the assessment, it will be possible to be more definitive on the likely significance of these impacts.
Changes to other local public and private services.	-	Scoped In	The impacts of demographic changes and the implications for demand on local public and private services will be assessed as far as possible, including the scale of any impact and its potential to be

Impact Pathway	Embedded Commitments	Scoped In or Scoped Out	Justification
			significant. If ports have been determined by the time of the assessment, it will be possible to be more definitive on the likely significance of these impacts.
Socio-cultural impacts	-	Scoped Out	The potential socio-cultural impacts, including changes to community character or image and quality of life, will require primary stakeholder engagement in the communities around the key epicentres of impact. To avoid survey fatigue and ensure meaningful interactions, this engagement will occur post consent as decisions are made regarding the location of key activities, such as ports. These impacts have therefore been scoped out of the assessment.
Changes to commercial fisheries.	C-09, C-10	Scoped In	If decommissioning the proposed development causes disruption to commercial fishing this may lead to reduced economic activity in the commercial fisheries sector. This will be informed by the commercial fisheries EIA.
Changes to shipping and marine recreation.	C-09, C-10	Scoped In	Changes to economic activity as a result of decommissioning the proposed development may impact activity in the shipping and marine recreation sectors.

17.8 Potential Cumulative Impacts

17.8.1 Chapter 4 (EIA Methodology) details how potential cumulative impacts will be assessed through a CIA and gives examples of the projects which are likely to be included in that assessment. For socio-economics, tourism and recreation, cumulative interactions may occur with other ScotWind projects.

17.8.2 There is the potential for the identified effects to interact with the onshore elements of the proposed development and other projects particularly other offshore wind farms being developed as part of the ScotWind consenting process. Cumulatively, the development of the ScotWind projects is expected to represent a substantial increase in demand at the Scottish level for the industries that will be involved in the construction of these projects.

17.8.3 By contributing to a critical mass, the proposed development 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, as opposed to relying on overseas facilities that may have higher transportation costs. Consideration will also be given to the cumulative effects on port facilities during both construction and operation and maintenance phases.

17.8.4 The CIA for socio-economics, tourism and recreation will consider the maximum adverse design scenario for each of the projects, plans and activities in line with the methodology outlined in Chapter 4 (EIA Methodology).

17.9 Potential Transboundary Effects

17.9.1 In general, most socio-economic impacts generated by the proposed development and considered within the assessment will be localised and relevant to the study areas used in the assessment.

17.9.2 The largest study area used in this assessment is the UK. However, the proposed development will result in supply chain expenditure abroad, in addition to demand for specialist skills which are not available locally. This in turn will lead to socio-economic impacts to areas outside of the UK in the form of job creation and contribution to GVA.

17.9.3 These will not be considered as part of the economic impact assessment because the economic impacts will be dependent on the properties of the national economies where this activity occurs. At the stage of the assessment, it will not be known what these countries will be and therefore it will not be possible to reliably model these impacts. It is therefore proposed to scope transboundary effects out of the EIA.

17.10 Proposed Approach to EIA

Guidance

17.10.1 In addition to the general approach and guidance outlined in Chapter 4 (EIA Methodology), the assessment of socio-economic, tourism and recreation receptors will also comply with the following guidance documents where they are specific to this topic:

- Marine Scotland (Dec 2022) General Advice for Socio-Economic Impact Assessment, Marine Analytical Unit;
- Marine Scotland (July 2022) Defining 'Local Areas' for assessing impacts of offshore renewables and other marine developments: Guidance Principles; and
- HM Treasury (2022), Green Book: Appraisal and Evaluation in Central Government.

17.10.2 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 shall be published prior to the submission of the EIA. This guidance will be taken into account, and it is assumed that it shall build on current best practice.

Additional data sources

17.10.3 A more detailed literature review will be developed for the EIA, building upon the high-level outline provided within this Offshore Scoping Report. This may include information published by the ONS, National Records of Scotland and Scotland's Census, which is expected to be published before the publication of the EIA.

Assessment Methodology

17.10.4 The EIA will follow the general approach outlined in Chapter 4 (EIA Methodology) of this Offshore Scoping Report.

17.10.5 To assess the socio-economic effects of the proposed development the focus will be on the direct and indirect (supply chain) effects, in line with the UK Offshore Wind Sector Deal (UK Government, 2020). In addition to this, the assessment shall also consider the effects of staff spending and the economic impact that this subsequent increase in demand stimulates (the induced effect).

17.10.6 The economic impacts will be considered for each study area and will be reported in terms of:

- GVA: this is a measure of economic value added by an organisation, industry or region and is typically estimated by subtracting the non-staff operational costs from the turnover of an organisation.
- Years of Employment: this is a measure of employment which is equivalent to one person being employed for a year and is typically used when considering short to medium term employment impacts, such as those associated with the construction phase of the proposed development.
- Jobs: this is a measure of employment which considers the headcount employment in an organisation or industry. This measure is used when considering long term impacts such as the jobs supported during the operation and maintenance phase of the proposed development.

17.10.7 The socio-economic assessment will consider the lowest, realistic levels of expenditure associated with the proposed development, since that would represent the 'worst case' scenario 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 may be revised to reflect subsequent revisions of the SCDS which will take account of any changes or development in the local supply chain.

17.10.8 The impact assessment will take account of deadweight, leakage, displacement and substitution. Sensitivity analysis will also be undertaken to account for risk, uncertainty and optimism bias, where they could have implications for the economic impacts.

17.10.9 The offshore elements will include the construction and installation of floating foundations and turbines, the offshore substations and the construction and installation of new IAC and export cabling. The analysis for the proposed development will cover three phases:

- Construction;
- O&M; and
- Decommissioning.

17.10.10 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 also consider the timings of impacts during this phase to understand the peaks and troughs of this activity.

17.10.11 The impacts during the operation and maintenance phase for the proposed development will be based on projected operational (including maintenance) expenditure.

17.10.12 In instances where impacts are expected to occur over several years, such as the operation and maintenance phase or the decommissioning phase, a discount rate will be applied. This allows impacts that occur sooner to be valued more highly than impacts that occur in the future, a concept known as time preference. In this instance a discount rate of 3.5% will be chosen, which is in line with the UK Government's Green Book (UK Government, 2022). On this basis it is expected that the decommissioning phase impacts will be substantially lower than for the construction phase.

17.11 Scoping Questions

17.11.1 The following Scoping questions refer to the Socio-Economics, Tourism and Recreation chapter and are designed to focus the scoping exercise and inform the Scoping Opinion:

- Do you agree with the proposed approach to the baseline characterisation?
- Do you agree with the use of those data listed in Section 17.3, and any additional anticipated data listed in Section 17.10, being used to inform the Offshore EIA?
- Are there any additional data sources or guidance documents that should be considered?
- Are there other types of socio-economic impacts that should be considered in the socio-economics assessment?
- Do you agree with the approach to define study area(s) defined for socio-economics, recreation and tourism?
- Are there any additional data sources or guidance documents that should be considered?
- Do you agree with the scoping in and out of impact pathways in relation to socio-economics, recreation and tourism?
- Do you agree with the proposed approach to assessing social impacts post consent when more details are available about potential locations of impacts and the communities affected?
- Do you agree with the assessment of the potential for transboundary effects in relation to socio-economics, recreation and tourism?
- Do you agree with the assessment of the proposed approach to cumulative effects in relation to socio-economics, recreation and tourism?

18 Climate

18.1 Introduction

18.1.1 This chapter of the Offshore Scoping Report identifies the climate receptors of relevance to the proposed development and considers the potential impacts from the construction, O&M and decommissioning phases of the proposed development on climate up to MHWS.

18.1.2 For the purposes of this Offshore Scoping Report and subsequent EIAR, the climate assessment includes the following three individual climate change assessments:

- GHG Emissions[24] assessment (i.e., carbon assessment) – this will identify the estimated GHG emissions associated with construction, O&M and decommissioning of the proposed development in comparison with current and future baseline GHG emissions. It will also identify mitigation measures to reduce GHG emissions through the life cycle of the proposed development. The term 'carbon' is used interchangeably to refer to GHG emissions.
- Climate Change Resilience (CCR) assessment – this will identify what climate changes are expected to occur in the future, and the vulnerability of the proposed development to those identified changes in climate.
- In-combination Climate Change Impact (ICCI) assessment – this will identify where a changing climate will combine with environmental impacts arising from the proposed development, resulting in significant effects on environmental receptors within the scope of the EIA which are not present under current climate conditions.

18.1.3 This chapter of the Offshore Scoping Report has been prepared by GoBe Consultants Limited.

18.2 Study Area

18.2.1 The study area that will apply to each type of assessment is set out below.

GHG Assessment

18.2.2 The spatial study area for the GHG emissions assessment includes various sources and removals of GHG emissions that may arise from the construction and O&M of the proposed development, as set out below.

18.2.3 For the construction-related assessment of GHG emissions, the study area is defined by the emissions sources associated with constructing the proposed development. This includes emissions arising through extraction, manufacture, and transportation of materials to the construction site (which may be sourced at a large distance from the proposed development) as well as emissions associated with the construction processes on site (such as fuel/energy use, and construction waste management).

18.2.4 For the O&M assessment of GHG emissions, emissions arising from maintenance and replacement of the proposed development will be estimated. GHG emissions associated with the proposed development's operational energy consumption will also be considered. An assessment will also be made of the likely electricity generation output arising from the proposed development during operation (based on a common operational profile used across

[24] The 'basket' of GHGs defined under the Kyoto Protocol (which will form the basis of this assessment) comprises carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), perfluorocarbons (PFCs), hydrofluorocarbons (HFCs), sulphur hexafluoride (SF_6) and nitrogen trifluoride (NF_3).

the EIA), which will be contextualised against the forecast marginal carbon intensity of grid electricity for the UK in future years[25].

18.2.5 Aligning with Publicly Available Specification (PAS) 2080: Carbon Management in Infrastructure (British Standards Institute, 2023), 'Environmental Impact Assessment Guide to: Assessing Greenhouse Gas Emissions and Evaluating their Significance' (Institute of Environmental Management and Assessment (IEMA), 2022) guidance and best practice, a summary of GHG emission sources included within the PAS 2080 lifecycle assessment informing this assessment can be found below within Table 18-1.

Table 18-1: Summary of GHG study area components within the climate assessment.

Project Stage	PAS 2080 Lifecycle Stage	Description	Justification for Assessment Inclusion/ Exclusion
Pre-construction	A0	Preliminary studies, consultation	Excluded – work predominantly office-based and assumed to be negligible.
Construction	A1-3	Raw material supply	Included.
	A4	Transport to works site	Included.
	A5	Construction/installation processes	Included – emissions associated with plant use and fuel for vehicles/shipping during construction processes.
	D	Land use change	Excluded – offshore components assumed to be negligible.
Operation	B1	Use	Excluded – GHG emissions associated with fabric of products and materials once they have been installed is assumed to be negligible.
	B2, B3, B4	Maintenance, repair and replacement.	Included
	B5	Refurbishment	Excluded – the proposed development is not expected to undergo refurbishment during its lifetime[26].[27].
	B6	Operational energy use	Excluded – GHG emissions associated with energy consumption (e.g., lighting) are likely to be negligible offshore. Any assessment of low carbon electricity generation benefits will be included in this lifecycle stage.

[25] Benefits from generation and export of low carbon electricity in the GHG assessment will need clear attribution to distinct project assessments to avoid double-counting across associated/linked projects.

[26] At the end of the proposed development's lifetime, there will be an assessment of the viability for re-powering versus decommissioning. If re-powering was deemed feasible, an assessment process would be completed at a later stage (not included as part of the current EIA/application process).

Project Stage	PAS 2080 Lifecycle Stage	Description	Justification for Assessment Inclusion/ Exclusion
	B7	Operational water use	Excluded – GHG emissions associated with water use on site are likely to be negotiable offshore.
	B8	Other operational processes	Excluded – other GHG emissions associated with the proposed development (such as management of operational waste) are likely to be negligible offshore.
	B9	User utilization of infrastructure	Excluded – not applicable to the proposed development.
	D	Ongoing land use emissions and sequestered	Excluded – offshore components assumed to be negligible.
End of Life	C1	Deconstruction	Included.
	C2	Transport	Included.
	C3	Waste processing for recovery	Included.
	C4	Disposal	Included.

18.2.6 The temporal boundary for GHG emissions assessment constitutes the construction phase (assumed to commence offshore work in 2027 for a duration of approximately four years), O&M phase and decommissioning phase.

CCR Assessment

18.2.7 The study area for the CCR assessment includes permanent and temporary construction footprints within the Muir Mhòr array area and offshore ECC. The assessment includes all potential climate hazards for infrastructure and assets associated with the proposed development and the assessment of climate effects are assessed over the assumed appraisal period for the proposed development.

18.2.8 The spatial boundary for the proposed development includes the Muir Mhòr array area, the offshore ECC and the landfall up to MHWS, including offshore and coastal elements. The primary source of information to identify future changes in climate for the assessment will be the Met Office (2023) UKCP18 climate projections. These projections are developed to reflect likely climate change for land and coastal areas, and not specifically for offshore areas. However, for the purposes of a proportionate assessment of climate risk, the baseline and projection data used within the CCR are taken from UKCP18 projections for the local area and are assumed to broadly reflect changes in the vicinity of those elements of the proposed development in the offshore area. Some impacts identified via UKCP18 (e.g. flooding) will not be applicable to offshore areas.

ICCI Assessment

18.2.9 The study area for the ICCI assessment is the study area for each environmental discipline as described in the relevant technical chapters of this Offshore Scoping Report.

18.3 Baseline Environment

18.3.1 Despite outperforming on the carbon budget set out from the 'Climate Change (Scotland) Act, 2008' (then amended in 2019), the UK is not on track to meet future targets or the overall reduction target ('COP27: Key outcomes and next steps for the UK. December 2022' (Climate Change Committee, 2022)). The COP27 meeting in Egypt determined that 'wind projects are a key part in helping Scotland reach its climate change targets'. It is important that this proposed development, which will produce up to 1 GW of electricity once operational, is as carbon neutral as possible and minimises the release of GHG as much is feasible.

GHG Assessment

18.3.2 Aligning with IEMA guidance (IEMA, 2022), the baseline (Do-Minimum (DM)) scenario is used to establish, compare, and assess the impact of the proposed development. This baseline comprises the current situation where no infrastructure is present within the array area or the offshore ECC. Assumptions are made on the projected cumulative GHG emissions within the study area without implementation of the proposed development.

18.3.3 There is currently no offshore infrastructure present within the array area or offshore ECC. There is one other OWF proposed for development within the E2 PO area, the CampionWind OWF which is being progressed by Shell new Energies Holding Limited and Scottish Power Renewables (UK) Limited. This OWF has an indicative capacity of up to 2 GW and it is currently unknown what the GHG emissions will be for this project. CampionWind is in the pre-planning phase and is not yet consented or built. Currently it is likely that shipping will transit through the area associated with the proposed development but resulting in insignificant GHG emissions. Therefore, it is assumed that the baseline emissions associated with the study area are zero.

CCR Assessment

18.3.4 High level climatology observations are generated by the Met Office. The proposed development is based off the coast of Peterhead and as such, Aberdeen Airport is the nearest point of reference. Historical observations recorded over a 30-year period are presented in Table 18-2.

Table 18-2: Average climatic conditions and observations, taken from Aberdeen Airport, between 1991-2020 (source Met Office, 2023).

Climatic Conditions	Climate observations (1991-1920)
Temperature	Mean annual temperatures were around 8.79°C in the area surrounding Aberdeen Airport. November to February (winter) maximum daily temperatures ranged from 6.75°C to 9.34°C. The lowest temperatures on average in the winter period were between 0.89°C to 3.13°C. Between June-August (summer) the maximum daily averages were between 16.33°C to 18.49°C. The lowest summer daily averages were between 9.04°C to 10.78°C.
Sunshine	The annual average hours of sunshine were 1447.26 hours.
Rainfall	The annual average amount of rainfall was 832.55 mm. The amount of days it rained in the year on average was 142.72.
Snowfall	Snow lay for approximately 10 days annually.
Wind	The annual average speed of the wind at 10 m was 8.74 knots.
Air Frost	Air frost occurs when the temperature at 1.25 m above the ground falls below 0°C. The average of number of days of air frost was 48.81 annually.

Climatic Conditions	Climate observations (1991-1920)
Ground Frost	Ground frost occurs when a temperature below 0 °C is measured on a grass surface. Annually, there were 125 days of ground frost.

ICCI Assessment

18.3.5 The baseline for the ICCI assessment will be the baseline as described in each of the relevant technical chapters of this Offshore Scoping Report.

18.4 Embedded Commitments

18.4.1 As part of the project design process, several designed-in measures have been proposed to reduce the potential for impacts on environmental and socio-economic receptors. These are presented in Table 18-3 and detailed in the Commitments Register (Appendix A) and will likely evolve over the development process as the EIA progresses as well as in response to stakeholder consultation.

Table 18-3: Embedded commitment measures of relevance to climate.

Code	Commitment	Type (Primary, Secondary or Tertiary)	How Commitment Secured
C-05	Development of a CMS. This will detail the construction procedures (including piling), good working practices for constructing the works, and how the construction-related mitigation steps are to be delivered.	Tertiary	CMS
C-08	Development of and adherence to an EMP. This will set out mitigation measures and procedures relevant to environmental management, including but not limited to chemical usage, invasive and non-native species, pollution prevention and waste management.	Tertiary	EMP
C-09	Development of and adherence to a DP. The DP will outline measures for the decommissioning of the proposed development.	Tertiary	DP
C-38	Development of and adherence to a PEMP, which will set out commitments to environmental monitoring in pre-, during and post-construction phases.	Tertiary	PEMP

18.4.2 As a result of the commitment to implement these measures, and to align the proposed development with various standard sectoral practices and procedures, the embedded commitments are considered inherently part of the design of the proposed development and have, therefore, been included in the assessment presented in Section 18.5.

18.4.3 The requirement and feasibility of any additional mitigation measures will be dependent on the significance of the effects upon climate and will be consulted upon with statutory consultees throughout the EIA process.

18.5 Scoping of Impacts

18.5.1 An initial assessment of the likelihood of effects on climate receptors processes due to proposed development activities for the scoping stage of the EIA process are presented in

Table 18-6. The assessment is based on a combination of the following: the definition of the proposed development at the scoping stage; embedded commitments (as set out in Section 18.4, together with the means by which it will be secured); the level of understanding of the baseline at the scoping stage; the existing evidence base for climate effects due to project activities; relevant policy; and the professional judgement of qualified climate specialists.

GHG Assessment

18.5.2 The proposed development will lead to the generation of GHG emissions during construction. However, the proposed development will support the generation of low carbon electricity during operation which will (assuming it reduces or avoids fossil fuel use) provide a net benefit against a future baseline in the absence of the proposed development.

18.5.3 The potential sources of GHG emissions during the proposed development lifecycle are outlined in Table 18-4.

Table 18-4: Potential sources of GHG emissions during project lifecycle.

Sub-stage of PAS 2080 Lifecycle	Potential Source of GHG Emissions
Construction	
Product stage: including raw material supply, transport, and manufacture (A1-3)	Embodied GHG emissions associated with the required raw materials. Vehicle emissions for transportation prior to factory gate. Energy use for fabrication of offshore project elements (e.g., wind turbine generators (WTGs)). Industrial and energy emissions in the manufacture of materials.
Construction process stage: including transport to and from works site as well as construction and installation processes (A4-5)	Vehicle and shipping emissions for transportation of materials to site. Energy and fuel use in construction processes.
Operation	
Operation and maintenance (including repair and replacement) (B2-B5)	Energy consumption for infrastructure operation and activities of organisations conducting routine maintenance including extraction, manufacture, transportation, and installation energy use. Embodied carbon associated with materials used for repair and replacement activities.
End-Of-Life	
Decommissioning (C1-4)	Energy consumption in deconstruction process. Vehicle and shipping emissions for transportation of materials away from site. Waste management of decommissioning materials.

CCR Assessment

18.5.4 During the construction phase of the proposed development (currently assumed to be 2027 to end of 2030), there is potential for the anticipated changes to the climate (such as extreme weather events) to negatively impact the proposed development.

18.5.5 During the operational phase of the proposed development, there is potential for the anticipated changes to the climate and extreme weather events to impact the proposed development. For example, because of climate change, wind speeds may become excessive and this could be detrimental for the productivity of the wind turbines productivity (Susini *et al.*, 2022).

18.5.6 The potential weather events during the proposed development lifecycle are outlined in Table 18-5.

Table 18-5: The summary of primary weather events and the potential impacts on the proposed development across the full project lifecycle.

Primary Weather Event	Potential Impacts
Heavy Rain	Delay to construction programme. Damage to WTG blades in use, such as leading-edge erosion.
High winds and gales	Damage to WTGs/rotor blades from wind/wind borne debris in use. Uneven loading of WTGs. Delay to construction programme.
Increased temperatures and prolonged periods of hot weather	Health impacts of workers from breathing problems and sunstroke. Heat stress on electronic equipment. Increased frequency of maintenance and repair/replacement.
Lightning	Structural damage to infrastructure. Power surges and tripping electricity breakers. Fires. Health impacts from direct strikes. Danger to workers/shipping due to reduced visibility.
Snow and Ice	Damage to WTGs/rotor blades. Health impacts from slipping on icer and chest illnesses.
Fog	Danger to workers/shipping due to reduced visibility.

Table 18-6: Scoping assessment for Climate.

Impact Pathway	Embedded Commitments	Scoped In or Scoped Out	Justification
Construction & Decommissioning			
GHG emissions associated with construction materials (raw material supply, transportation, and manufacture)	C-05, C-08, C-38	Scoped In	Proposed development will lead to generation of GHG emissions during construction in relation to the construction materials.
GHG emissions associated with construction processes including transportation to site and installation processes.	C-05, C-08, C-38	Scoped In	Construction and installation activities associated with the proposed development will lead to generation of GHG emissions.
CCR of construction and decommissioning period	C-05, C-08, C-09, C-38	Scoped In	The proposed development has potential to be negatively impacted by changes in the climate (such as extreme weather events) during construction and decommissioning.
ICCI of construction and decommissioning period	C-05, C-08, C-09, C-38	Scoped In	The proposed development has potential to be negatively impacted by significant effects on environmental receptors within the scope of the EIA which are not present under current climate conditions, during construction and decommissioning.
GHG emissions associated with decommissioning processes and waste materials	C-08, C-09, C-38	Scoped In	The decommissioning of the proposed development will lead to generation of GHG emissions.
Operation and Maintenance			
GHG emissions associated with operation including energy use	C-08, C-38,	Scoped In	The generation of low carbon electricity during the O&M phase will be supported by the proposed development, but the net benefits against a future baseline will be assessed.
GHG emissions that are associated with maintenance including materials used for repair and replacement activities	C-08, C-38	Scoped In	There will be a generation of GHG emissions during the maintenance cycles associated with material replacement and repair activities for the proposed development.

Impact Pathway	Embedded Commitments	Scoped In or Scoped Out	Justification
CCR of operational period	C-08, C-38	Scoped In	Anticipated changes of climate (like extreme weather events) may negatively impact the proposed development during O&M.
ICCI of operational period	C-08, C-38	Scoped In	The proposed development has potential to be negatively impacted by significant effects on environmental receptors within the scope of the EIA which are not present under current climate conditions, during O&M.

18.6 Potential Cumulative Impacts

18.6.1 Chapter 4 (EIA Methodology) details how potential cumulative impacts will be assessed through a CIA and gives examples of the projects which are likely to be included in that assessment. For Climate, cumulative interactions may occur with the other OWFs and infrastructure in the area such as CampionWind and HyWind OWFs; INTOG projects and other offshore cables.

18.6.2 The CIA for Climate will consider the maximum adverse design scenario for each of the projects, plans and activities in line with the methodology outlined in Chapter 4 (EIA Methodology).

18.6.3 Cumulative impacts will be scoped out of the GHG Assessment, in line with IEMA GHG guidance (IEMA., 2022).

18.6.4 For the CCR assessment, a cumulative impact would be needed where other development may increase climate risks to the proposed development. Given the discrete nature of offshore infrastructure it is not considered likely that other developments would increase risks. These will be scoped out of the assessment.

18.6.5 For the ICCI assessment, cumulative impacts would occur where climate change impacted upon other environmental receptors which were themselves at risk from cumulative impacts. It is expected these cases are likely to be minimal but risks of ICCI cumulative impacts will be scoped into the main review of ICCI risks.

18.7 Potential Transboundary Effects

18.7.1 GHG emissions are characteristically transboundary and will be continually assessed against national carbon targets which represent the international consensus on reducing global GHG concentrations, as stated in the COP27 agreement.

18.7.2 The proposed development is a significant distance from the nearest adjacent exclusive economic zone (EEZ) of another state and, therefore, it is considered that transboundary impacts will not occur and will therefore be scoped out from further consideration within the EIA.

18.7.3 For the CCR and ICCI assessments, it is not considered likely that there will be significant transboundary impacts, and these are scoped out of the assessment.

18.8 Proposed Approach to EIA

Guidance

18.8.1 In addition to the general approach and guidance outlined in Chapter 4 (EIA Methodology), the assessment of Climate receptors will also comply with the following guidance documents where they are specific to this topic:

- UKCP18 (UK Climate Projection data base office, 2018) - Climate resilience assessment
- Inventory of Carbon and Energy Database (REF) - Obtain emission factors for the GHG assessment.
- Climate Change Act (2008) - Help to reach the six carbon budgets.
- BEIS - Data for GHG emissions
- IEMA (2022): EIA Guide to Assessing GHG Emissions and Evaluating their Significance.
- IEMA (2020): EIA Guide to Climate Change Resilience and Adaptation.

Additional data sources

18.8.2 A more detailed literature review will be developed for the EIA, building upon the high-level outline provided within this Offshore Scoping Report. The information to inform this carbon assessment will be from a combination of project specific information available at the current design stage alongside publicly available industry benchmarks that can be used to provide a preliminary estimate of embodied carbon emissions and operational energy.

GHG Assessment

18.8.3 The carbon emissions for the proposed development will be calculated by converting 'activity' data into carbon emissions through the application of referenced typical emissions conversion factors widely used within the industry. These emissions may include the following across the Muir Mhòr array area and offshore ECC:

- Greenhouse Gas Reporting: Conversion Factors (published annually);
- Inventory of Carbon and Energy database V3; and
- Valuation of energy use and greenhouse gas emissions for appraisal: supplementary guidance to the HM Treasury Green Book.

18.8.4 The main reference periods for assessing emissions will be in line with the UK Carbon Budget Periods, covering 2025-2037 (Fourth, Fifth and Sixth Budget), summarised in Table 18-7.

Table 18-7: Carbon budget periods.

Carbon Budget and Period	Carbon Budget Limit	Reduction below 1990 levels
Fourth (2023-2027)	1,950 $MtCO_2e$	50% by 2025
Fifth (2028-2032)	1.725 $MtCO_2e$	68% by 2030*
Sixth (2033-3037)	969 $MtCO_2e$	78% by 2035

* Originally 57% when Fifth Carbon Budget was enshrined in law, has recently been increased to 68% as the UK's National Determined Contribution ahead of the United Nations' Conference of the Parties (26) (COP26) in November 2021 (BEIS, 2020).

CCR Assessment

18.8.5 As part of the CCR Assessment, future projected climate conditions and extreme weather events for the area encompassing the proposed development will be provided for the 2060s. These time periods will cover the assumed operational life of the proposed development.

18.8.6 Using the historical baseline data, changes in average climate conditions will be obtained from the UKCP18 probabilistic projections of climate change to establish the future climate baseline.

18.8.7 In the Offshore EIAR, climate change projections for a range of meteorological parameters will be presented for different probability levels within the RCP8.5 high emission scenario for the near-term and long-term future time periods for the 2060s.

Assessment Methodology

The EIA will follow the general approach outlined in Chapter 4 (EIA Methodology) of this Offshore Scoping Report.

GHG Assessment

18.8.8 The best practice approach will be consistently used in the carbon assessment, which is found in the IEMA (2022) guidance on assessing GHG emissions and evaluating their significance.

18.8.9 The GHG assessment will quantify and report the GHG emissions anticipated to be generated or avoided by the proposed development. This will be reported in tonnes of carbon dioxide equivalent (tCO_2e), a single metric of the global warming potential of the main GHGs.

18.8.10 The methodology will focus on assessing the impact of the proposed development on carbon emissions by quantifying the net carbon emissions arising from each lifecycle stage. Emissions associated with the proposed development will be completed to the baseline DM scenario to quantify the net impact of the proposed development.

18.8.11 As part of the assessment process, the Developer will identify opportunities to reduce the whole-life carbon of the proposed development across both construction and operational phases.

18.8.12 The proposed development is expected to result in increased GHG emissions through the construction stage. It will generate and export renewable energy throughout the operational stage. These assumptions will be confirmed within the Offshore EIAR and will be presented in the context of wider sectoral and geographic GHG emissions.

CCR Assessment

18.8.13 The CCR assessment relates to the resilience of the proposed development to the impacts of climate change. Potential hazards to the proposed development will be addressed in the CCR assessment, which will present results from the construction, operation and decommissioning phases of the proposed development.

18.8.14 The CCR assessment will be qualitative and will identify future climate hazards and consider potential impacts and risks arising from these for the proposed development. A qualitative appraisal of the significance of impacts will be carried out based on consideration of the likelihood and consequence of each impact in line with the approach set out in IEMA guidance on Climate Change and Resilience and Adaptation.

18.8.15 Extreme weather events, sea level rises and storm surges are key issues related to climate change. It is pertinent that they are taken into consideration during construction and operation of the proposed development.

18.8.16 There are five ways that risks can be scored:

- Very high;
- High;
- Medium;
- Low; and
- Very low.

18.8.17 The risk assessment identifies the need for any additional resilience measures to protect against the impacts of climate change, based on the risks that are marked as high or very high. High level resilience measures will be designed as part of a workshop with key engineering and design experts.

18.8.18 Adequate mitigation will be included within wider environmental and engineering design approaches. This should result in it being unlikely that climate resilience effects will be

identified, or where the potential for climate resilience to be inadequate. The EIAR will further confirm this.

ICCI Assessment

18.8.19 Once potential climate change impacts have been considered, professional judgement will be further used by environmental discipline experts to produce high level, qualitative statements about potential topic specific impacts resulting from projected climate change (i.e. changes and trends in climate averages and extreme weather events) for receptors and resources in the area surrounding the proposed development. These will include recommendations for any required mitigation measures as well as allowances for future monitoring which will ensure the identification of unexpected impacts on environmental receptors and resources are carried out.

18.8.20 The potential significance of in-combination climate change impacts will be assessed qualitatively (if required), based upon the professional judgement of relevant environment and climate change specialists.

18.8.21 Climatic conditions may impact all environmental topics with the Offshore EIAR. The proposed development will be designed to be resilient to forecast changes in climate and the in-combination impacts will be assessed for all topics.

18.9 Scoping Questions

18.9.1 The following Scoping questions refer to the Climate chapter and are designed to focus the Scoping exercise and inform the Scoping Opinion:

- Do you agree with the study area(s) defined in Section 18.2 for climate?
- Do you agree with the use of those data listed in Section 18.3 being used to inform the Offshore EIA?
- Are there any additional data sources or guidance documents that should be considered?
- Do you agree that all receptors related to climate have been identified?
- Do you agree with the scoping in and out of impact pathways in relation to climate?
- Do you agree with the assessment of the potential for transboundary effects in relation to climate?
- Do you agree with the assessment of the proposed approach to cumulative effects in relation to climate?
- Do you agree with the proposed assessment methodology for climate?

19 Infrastructure and Other Users

19.1 Introduction

19.1.1 This chapter of the Offshore Scoping Report identifies the Infrastructure and Other User (IOU) receptors of relevance to the proposed development and considers the potential impacts from the construction, O&M and decommissioning of the proposed development on these receptors.

19.1.2 This chapter should be read alongside the following chapters:

- Chapter 12: Commercial Fisheries;
- Chapter 13: Shipping and Navigation;
- Chapter 15: Military and Civil Aviation; and
- Chapter 17: Socio-Economics, Tourism and Recreation.

19.1.3 This chapter of the Offshore Scoping Report has been prepared by GoBe Consultants Limited.

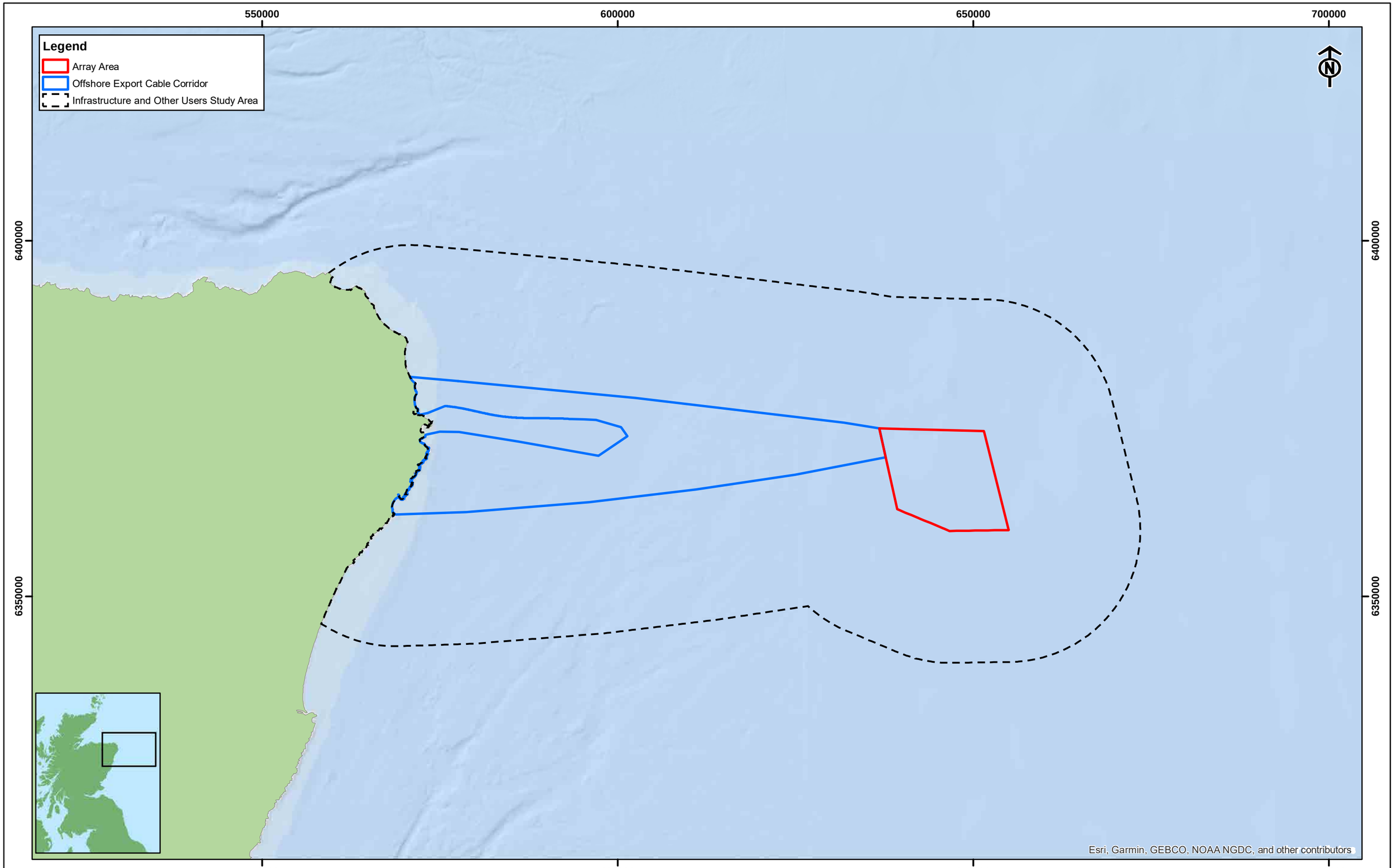
19.2 Study Area

19.2.1 The IOU study area is defined by the footprint of the proposed development (array area, offshore ECC and any associated infrastructure) plus a buffer of 10 nm. This is to ensure that the IOU study area is aligned with that defined within the Shipping and Navigation chapter of this Offshore Scoping Report (Chapter 13) and considers the movement of other marine activities (Figure 19-1).

19.3 Baseline Environment

Data Sources

19.3.1 A desk-based review has been carried out for this chapter of the Offshore Scoping Report, with the identification of known/planned activities and projects undertaken using relevant spatial and scientific data sources. The data sources that have been used to inform this IOU chapter are presented in Table 19-1. These data sources will be taken forward and used to inform the EIA.



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0 4 8 12 16 20 km

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Infrastructure and Other Users Study Area

Confidentiality Class	C1
Drg No	GoBe-0009
Rev	A
Layout	NA

Figure 19.1

Ref files: MMH_IOU_Fig19.1_StudyArea_RevA

Table 19-1: Key sources of Infrastructure and Other Users data.

Source, Author and Year	Summary	Coverage of Muir Mhòr array area and ECC
Marine Themes Vector – OceanWise Kingfisher Information Service – Cable Awareness (KIS-ORCA)	Offshore cables and pipelines	Full coverage of the Muir Mhòr array area and offshore ECC and the IOU study area.
NMPiMaps	Dredging and disposal areas.	Full coverage of the Muir Mhòr array area and offshore ECC and the IOU study area.
Energy and Infrastructure Spatial Data (CES)	Information on seabed leases, OWFs, and other infrastructure.	Full coverage of the Muir Mhòr array area and offshore ECC and the IOU study area.
NSTA Open Data – Data centre (nstauthority.co.uk)	Publicly available GIS data, details on the oil and gas licencing rounds and UK oil and gas activity.	Full coverage of the Muir Mhòr array area and offshore ECC and the IOU study area.

19.4 Description of Baseline Environment

19.4.1 The initial findings from the desk-based review to support this chapter are set out in the following sections, providing an understanding of the marine environment surrounding the Project, in relation to IOU. The key IOU receptors identified include:

- Offshore renewables (wind, wave and tidal marine infrastructure);
- Subsea cables and utilities (telecommunications and subsea cables);
- Marine dredging and disposal (capital, maintenance, and aggregate);
- Oil and gas (including Carbon Capture, Utilisation and Storage (CCUS)); and
- Other marine infrastructure (aquaculture and nuclear).

Offshore Renewables

Offshore Wind

19.4.2 There are three existing or proposed OWFs (other than the proposed development) within the IOU study area, namely Hywind Scotland, CampionWind, and Aberdeen OWFs, as shown in Figure 19-2. These projects are at different stages of development, with further details of the projects provided in the paragraphs below.

19.4.3 Hywind Scotland is a floating OWF operated by Equinor that covers approximately 4 km^2 and consists of five WTGs, four inter-array cables and one export cable connecting to Peterhead Grange substation. The Hywind Scotland array area is located approximately 25 km east of Peterhead and 48.7 km west of the Muir Mhòr array area (Figure 19-2) and the 6 MW floating WTGs are moored to the seabed by three anchors. The project has been operational since 2017 and has an installed capacity of 30 MW (Megawatts), powering approximately 200,000 homes (Equinor, 2023).

19.4.4 Following the announcement of the ScotWind leasing rounds in 2022, the proposed development and CampionWind OWF were awarded option agreements within the E2PO area identified in the Sectoral Marine Plan for Offshore Wind Energy (Sectoral Marine Plan for Offshore Wind Energy Sectoral Marine Plan for Offshore Wind Energy (2020) 2, 2020)). CampionWind Ltd is based 100 km east of Peterhead and 42.6 km east of the Muir Mhòr array area (Figure 19-2). It is a joint venture between ScottishPower Renewables (UK) Limited and Shell new Energies Holding Limited and is currently in the early pre-planning stage and has been projected to generate 2GWof electricity (ScottishPower and Shell, 2023).

19.4.5 Aberdeen OWF is also known as the European Offshore Wind Deployment Centre (EOWDC) and is Scotland's largest offshore wind test and demonstration facility. The project is located 3 km east of Aberdeen, with the northern section of the array area overlapping with the IOU study area for the proposed development (Figure 19-2). The project is made up of 11 8.8 MW fixed foundation WTGs, has a capacity of 93.2 MW and has been operational since 2018 (Vattenfall, 2023).

Wave and Tidal

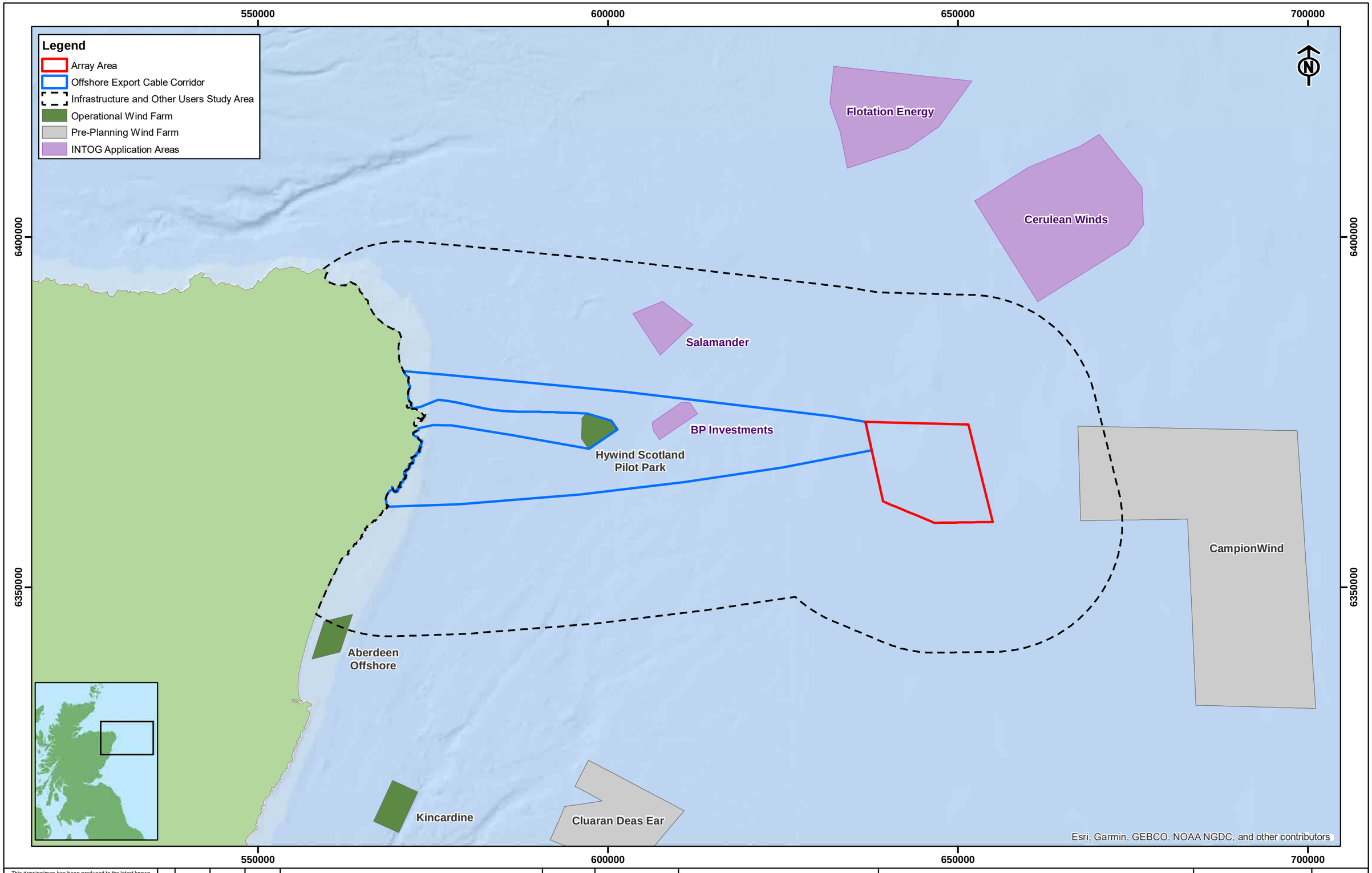
19.4.6 The Crown Estate and CES are responsible for leasing areas of the UK seabed that are suitable for installation of wave and tidal arrays, and for managing the associated seabed rights. There are currently no planned wave or tidal energy projects identified within the study area, from the Muir Mhòr array area (Marine Scotland, 2023).

Innovation and Targeted Oil and Gas (INTOG)

19.4.7 INTOG is a leasing round for offshore wind projects that aims to directly reduce emissions from oil & gas production and boost further innovation. In March 2023, 13 INTOG projects were awarded Exclusivity Agreements by CES, with two of these projects falling within the IOU study area, Salamander OWF and an unnamed project being developed by BP Alternative Energy Investments. Other sites in the vicinity of (but outwith) the IOU study area are two sites, one being developed by Floatation Energy and the other being developed by Cerulean Winds. The INTOG sites in the vicinity of the proposed development are shown in Figure 19-2.

19.4.8 The site being developed by BP Alternative Energy Investments overlaps with the Muir Mhòr offshore ECC and is located 24.1 km from the Muir Mhòr array area. The project is in the early pre-planning stages and will have a maximum capacity of 50 MW (CES, 2023).

19.4.9 Salamander OWF is being developed by Simply Blue Energy (Scotland) Limited, a joint venture partnership between Ørsted, Simply Blue Group and Subsea7. The project is in pre-planning stage with a Scoping Report submitted to Scottish Ministers in March 2023. The project will have an installed capacity of up to 100 MW and is located 28.5 km from the Muir Mhòr array area and 9.8 km from the offshore ECC (Ørsted, Simply Blue and Subsea7, 2023).



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0 4 8 12 16 20 km

MUIR MHÒR WIND FARM

Offshore Renewable Energy Developments within the Infrastructure and Other Users Study Area

Confidentiality Class	C1
Drg No	GoBe-0010
Rev	A
Layout	NA

Figure 19.2

Ref files: MMH_IOU_Fig19.2_RenewableDevelopments_RevA

Subsea Cables and Utilities

19.4.10 There are several submarine cables in the vicinity of the IOU study area, as shown in Figure 19-3. These cables are used for telecommunications and the transfer of power from onshore to offshore assets, and between Scotland and neighbouring countries.

Telecommunication Cables

19.4.11 The Tempnet Central North Sea Fibre Telecommunications Company (CNCFTC) fibre-optic telecommunications cable is an active cable, owned by EQT infrastructure is located 11.3 km from the Muir Mhòr array area at its closest point and crosses the Muir Mhòr offshore ECC (OceanWise, 2023).

Power Cables

19.4.12 The offshore export cables for Hywind Scotland OWF (as discussed in paragraph 19.4.3) are located in the gap between the north and south sections of the Muir Mhòr offshore ECC (Figure 19-3). These cables connect the OWF with the substation in Peterhead (Equinor, 2023).

19.4.13 NorthConnect is a HVDC interconnector cable currently being proposed between Scotland (Long Haven Bay) to Simadelen (Norway) that crosses the Muir Mhòr offshore ECC (Figure 19-3). NorthConnect is currently a joint venture between four publicly owned Scandinavian companies: Lyse, Agder Energi, Hafslund E-Co and Vattenfall (NorthConnect, 2023).

19.4.14 Cables related to the Aberdeen OWF (as discussed in paragraph 19.4.5) marginally overlap with the southernmost section of the IOU study area (Figure 19-3) (Vattenfall, 2023).

19.4.15 The offshore export cables for the proposed Salamander OWF (as discussed in paragraph 19.4.9) may cross the northern section of the Muir Mhòr offshore ECC (Figure 19-3) (Ørsted, Simply Blue and Subsea7, 2023).

19.4.16 The scoping boundary for the MarramWind OWF which is being developed by ScottishPower Renewables and Shell also overlaps with the Muir Mhòr offshore ECC (Figure 19-3). The proposed array area for MarramWind is located northeast of Rattray Head on the Aberdeenshire coast in northeast Scotland and is outwith the IOU study area. MarramWind OWF will have a capacity of up to 3 GW and a Scoping Report for the project was submitted to Marine Scotland and Aberdeenshire Council in January 2023 (ScottishPower Renewables and Shell, 2023).

19.4.17 The offshore export cables for the proposed Green Volt OWF may also overlap with the Muir Mhòr offshore ECC (Figure 19-3). Green Volt OWF is being developed by Flotation Energy Plc and CNOOC Petroleum Europe Ltd and the project is being proposed to facilitate the decarbonisation of the oil and gas industry through the complete electrification of the Buzzard oil and gas field with a grid connection back to the New Deer substation in Aberdeenshire. A Marine Licence application for the project was submitted to Marine Scotland in February 2023.

Marine Dredging and Disposal

19.4.18 Within the IOU study area, there are seven marine dredging and disposal sites licensed for various activities. The sites are shown in Figure 19-4. Of these sites, two sites are open disposal sites (North Buchan Ness and Peterhead Harbour) that are located in the gap between the north and south sections of the Muir Mhòr offshore ECC. The other five sites within the IOU study area are closed disposal sites (Marine Scotland, 2023). No marine aggregate extraction is licensed within the IOU study area (Marine Scotland, 2023).

550000 600000 650000 700000

6400000

6350000

Legend

- Array Area
- Offshore Export Cable Corridor
- Infrastructure and Other Users Study Area
- CES Cable Agreement - North Connect
- Proposed Salamander Offshore Export Cable Corridor
- Possible Green Volt Export Route Options
- Proposed Marram Offshore Scoping Boundary

Subsea Cable (Type - Status)

- Power - Active
- Telecom - Active

Moray West OWF Cables

Shefa 2

Tampnet CNS Fibre Optic

Hywind OWF Cables

Aberdeen OWF Cables

Kincardine Export Cable 1

Esri, Garmin, GEBCO, NOAA NGDC, and other contributors

550000 600000 650000 700000

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0 4 8 12 16 20 km

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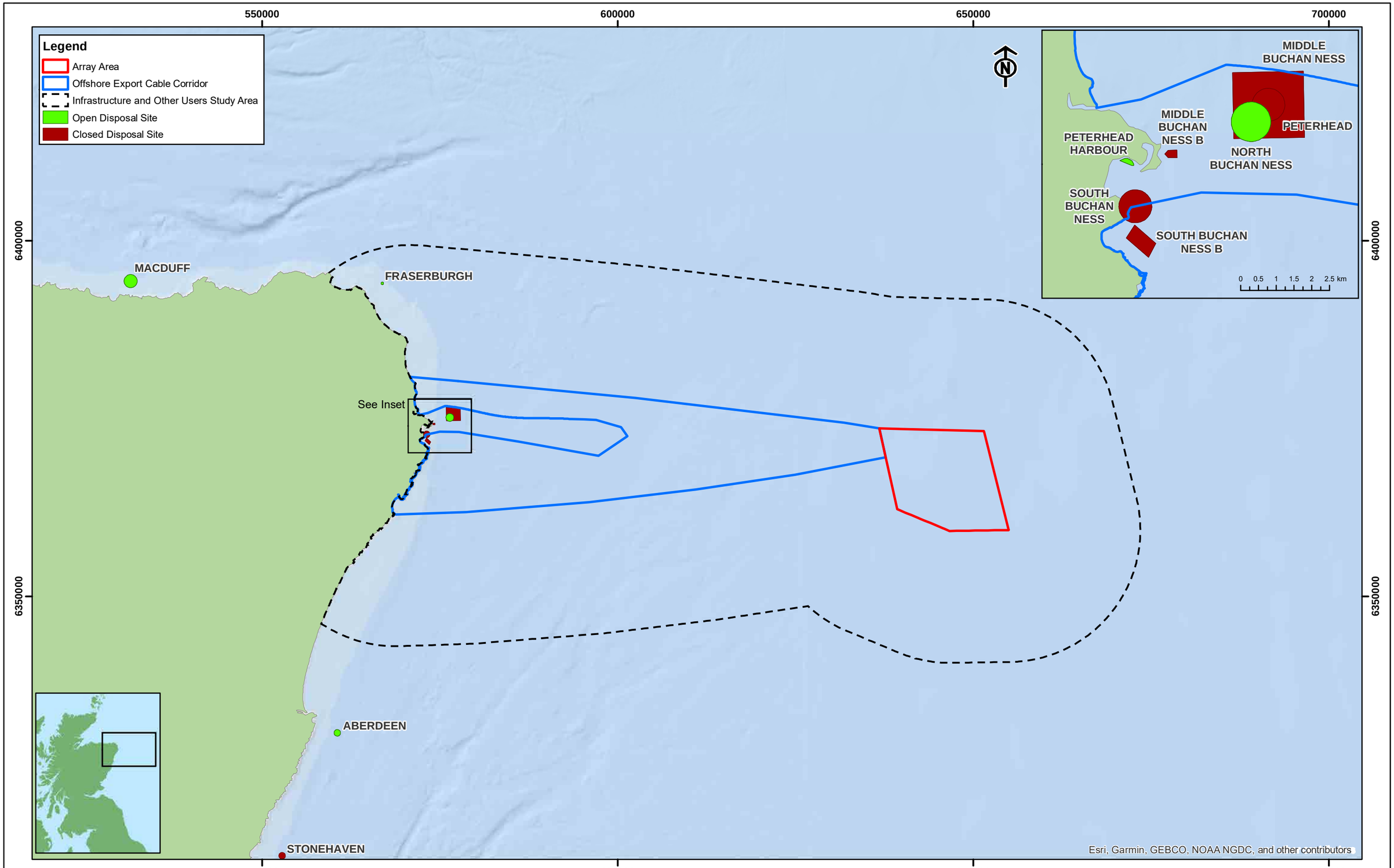
Subsea Cables and Utilities within the Infrastructure and Other Users Study Area

Confidentiality Class	C1
Drg No	GoBe-0011
Rev	A
Layout	NA

Figure 19.3

Ref files: MMH_IOU_Fig19.3_Utilities_RevA



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Disposal Sites within the Infrastructure and Other Users Study Area

Confidentiality Class	C1
Drg No	GoBe-0012
Rev	A
Layout	NA

Figure 19.4

Ref files: MMH_IOU_Fig19.4_DisposalSites_RevA

Oil and Gas (including CCUS)

19.4.19 The proposed development is located in the Central North Sea (CNS), a well-developed area for oil and gas infrastructure (DECC, 2016). These infrastructures include pipelines, wells, and surface and subsurface structures. Given the extensive infrastructure within the CNS, is it expected that decommissioning of existing assets will rapidly increase within the next 20-30 years (DECC, 2016). It is therefore possible that the decommissioning of these structures could overlap with the operations of the proposed development. The oil and gas infrastructure in the vicinity of the IOU study area is shown in Figure 19-5.

Licence Blocks

19.4.20 There are three oil and gas licence blocks that overlap with the IOU study area. These are 20/11a, 20/12a and 20/6c and the equity holders of each of these blocks are Dana Petroleum (E&P) Limited and Finder Energy UK Limited. There is no oil and gas platforms within the IOU study area (NSTA, 2023).

Wells, Manifolds and Subsea Structures

19.4.21 There are no wells or manifolds that overlap with the proposed development, with two active subsea structures located within the offshore ECC. In the wider IOU study area, there are five wells, one manifold and 13 other substructures situated outwith the proposed development in the IOU study area (Figure 19-5) (NSTA, 2023).

Pipelines

19.4.22 There are two pipelines that cross the proposed development; the abandoned *in situ* and active Forties C to Cruden Bay oil pipelines (which run parallel to one another). An additional 15 oil and gas pipelines overlap with the IOU study area. All pipelines in the vicinity of the IOU study area and shown in (Figure 19-5) (NSTA, 2023).

Carbon Capture, Utilisation and Storage (CCUS)

19.4.23 The Scottish Government has a clear policy to decarbonise electricity generation by 2030 and it is intended that CCUS will support this. It is understood that there are no current plans to develop CCUS projects in the IOU study area, with the closest CCUS licence area located approximately 54 km (Acorn CCUS) from the proposed development. On this basis, potential interactions between the proposed development and CCUS activity will not be assessed further.

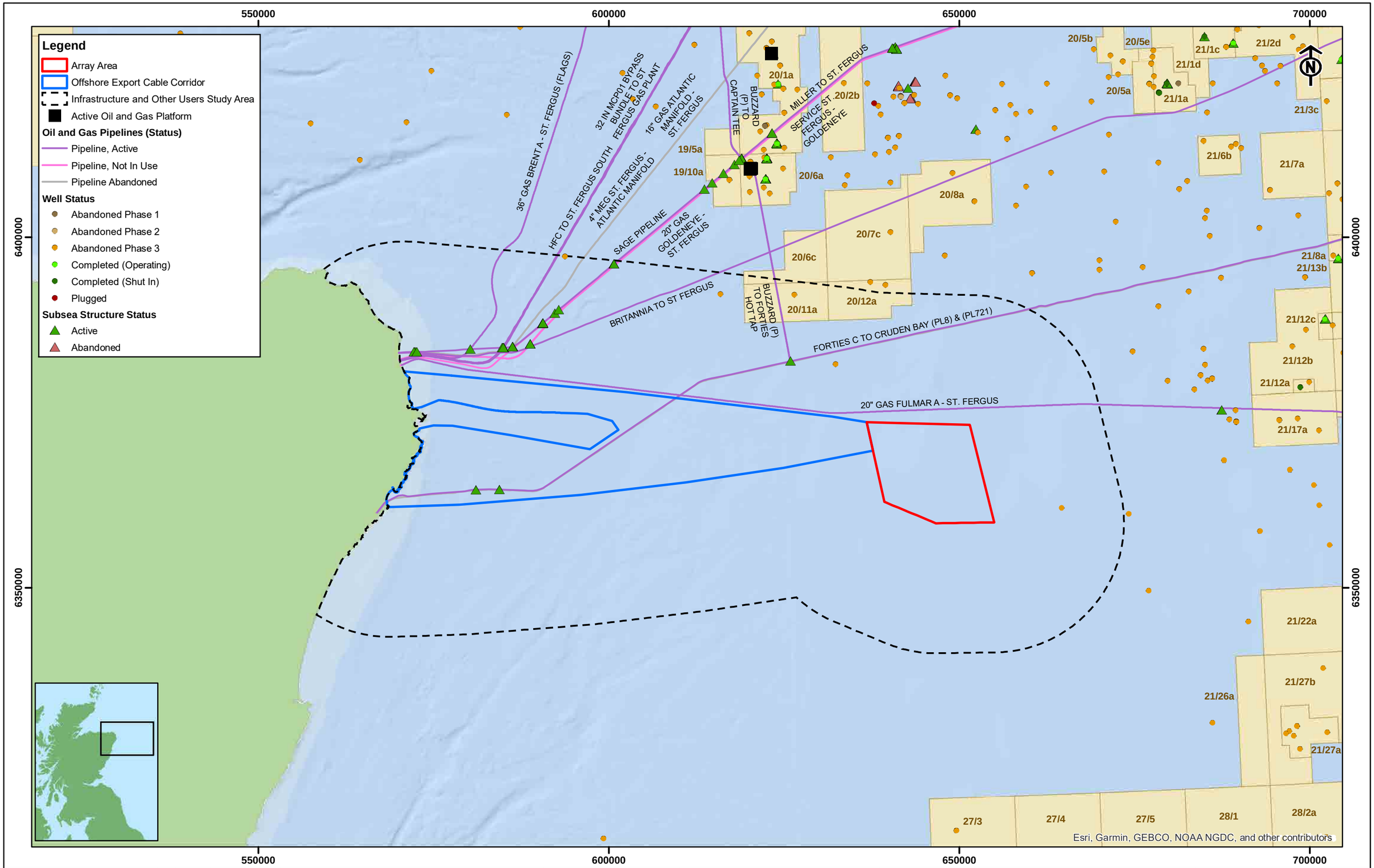
Other Marine Infrastructure

Aquaculture

19.4.24 Scotland is a global leader in aquaculture; however, these activities occur primarily on the west coast, with very few aquaculture sites along the east coast of Scotland (DECC, 2016). There are no active finfish or shellfish marine aquaculture sites within the IOU study area and as such, potential interactions between the proposed development and aquaculture activity will not be assessed further (Marine Scotland, 2023).

Nuclear

19.4.25 There are no nuclear facilities or plans for future nuclear developments in the Central North Sea (Scottish Government, 2017) and as such, potential interactions between the proposed development and nuclear activity will not be assessed further.



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Oil and Gas Licence Blocks and Other Infrastructure in the Infrastructure and Other Users Study Area

Confidentiality Class	C1
Drg No	GoBe-0013
Rev	A
Layout	NA

Figure 19.5

Ref files: MMH_IOU_Fig19.5_OilandGasPipelines_RevA

19.5 Summary and Key Issues

19.5.1 The key infrastructure and other marine users study area are identified as follows:

- Hywind Scotland, CampionWind and Aberdeen OWFs;
- Two INTOG projects;
- Tampnet CNCFTC telecommunication cable, Hywind Scotland and Salamander OWF offshore export cables and NorthConnect HVDC cable; and
- Forties C to Cruden Bay oil pipelines.

19.6 Embedded Commitments

19.6.1 As part of the project design process, several designed-in measures have been proposed to reduce the potential for impacts on environmental and socio-economic receptors. These are presented in Table 19-2 and in the Commitments Register (Appendix A) and will likely evolve over the development process as the EIA progresses and in response to stakeholder consultation.

Table 19-2: Embedded commitment measures of relevance to infrastructure and other users.

Code	Commitment	Type (Primary, Secondary or Tertiary)	How Commitment Secured
C-02	Development of and adherence to a CaP. The CaP will confirm planned cable routing, installation methods, cable specifications and any additional protection and requirement for any post-installation monitoring.	Tertiary	CaP
C-09	Development of and adherence to a DP . The DP will outline measures for the decommissioning of the proposed development.	Tertiary	DP
C-16	Development of and adherence to a NSP. The NSP will describe measures put in place by the proposed development related to navigational safety, including information on Safety Zones, charting, construction buoyage, temporary lighting and marking, and means of notification of proposed development activity to other sea users (e.g., via Notice to Mariners).	Tertiary	NSP
C-17	Applications to be made, where appropriate, for Safety Zones (500m) for construction and major maintenance works, and for pre commissioning works (50m).	Secondary	NSP
C-18	Use of guard vessels where deemed appropriate to ensure adherence with Safety Zones or advisory passing distances, as defined by risk assessment, to mitigate any impact which poses a risk to surface navigation during construction, maintenance and decommissioning phases. Such impacts may include partially installed structures or cables, extinguished navigation lights or other unmarked hazards.	Secondary	NSP
C-19	Advance warning and accurate location details of construction, maintenance and decommissioning operations, associated Safety Zones and advisory passing distances will be given via Notices to Mariners and Kingfisher Bulletins.	Tertiary	NSP
C-21	Compliance with Maritime and Coastguard Agency (MCA) MGN 654 (MCA, 2021) and its annexes where applicable (including consideration of a SAR checklist, an ERCoP and Under Keel Clearance. Consideration will also be given to MGN 543 SAR Annex 5 (MCA, 2018).	Tertiary	CaP CMS DSLP

Code	Commitment	Type (Primary, Secondary or Tertiary)	How Commitment Secured
C-22	Compliance of all project vessels with international marine regulations as adopted by the Flag State, notably COLREGs (IMO, 1974) and the International Convention for the Safety of Life at Sea (SOLAS) (IMO, 1974).	Tertiary	NSP
C-24	Aids to navigation (marking and lighting) will be deployed in accordance with the latest relevant available standard industry guidance and as advised by NLB, MCA and CAA and MOD as appropriate. This will include a buoyed construction area around the array area in consultation with NLB.	Tertiary	NSP LMP
C-25	Appropriate marking of the proposed development on Admiralty and aeronautical charts. This will include provision of the positions and heights of structures to the UKHO, CAA, MOD and Defence Geographic Centre (DGC).	Tertiary	NSP LMP
C-26	Compliance with regulatory expectations on moorings for floating wind and marine devices published by Maritime and Coastguard Agency (MCA) and the HSE.	Tertiary	CMS
C-27	Crossing and proximity agreements with known existing pipeline and cables operators will be sought.	Tertiary	Secured by commercial agreements with pipeline and cable operators.
C-29	Where practicable, cable burial will be the preferred means of cable protection. Cable burial will be informed by the CBRA and detailed within the CaP. In areas where CBRA deems burial not feasible, suitable implementation and monitoring of cable protection will be employed.	Primary	CaP
C-36	Development of and adherence to a Lighting and Marking Plan (LMP). The LMP will confirm appropriate lighting and marking mitigation whilst ensuring compliance with legal requirements with regards to shipping, navigation and aviation marking and lighting.	Tertiary	LMP
C-41	Where offshore export cables must cross third party infrastructure, such as existing cables and pipelines, both the third-party asset and the installed cables will be protected.	Tertiary	CaP
C-42	Lighting and marking failures appropriately reported/rectified as soon as possible and interim hazard warnings put in place as required.	Tertiary	LMP

19.6.2 As a result of the commitment to implement these measures, and to align the proposed development with various standard sectoral practices and procedures, the embedded commitments are considered inherently part of the design of the proposed development and have, therefore, been included in the assessment presented in Section 19.7.

19.6.3 The requirement and feasibility of any additional mitigation measures will be dependent on the significance of the effects upon the infrastructure and other marine users and will be consulted upon with statutory consultees throughout the EIA process.

19.7 Scoping of Impacts

19.7.1 Table 19-3 sets out an initial assessment of the likelihood of effects on infrastructure and other marine users due to proposed development activities for the scoping stage of the EIA process. The assessment is based on a combination of the following: the definition of the

proposed development at the scoping stage; embedded commitments (as set out in Section 19.6, together with the means by which it will be secured); the level of understanding of the baseline at the scoping stage; the existing evidence base for infrastructure and other marine users effects due to proposed development activities; relevant policy; and the professional judgement of qualified infrastructure and other users specialists.

Table 19-3: Scoping assessment for infrastructure and other marine users.

Impact Pathway	Embedded Commitments	Scoped In or Scoped Out	Justification
Construction (and Decommissioning)			
Temporary obstruction to other OWFs	C-02, C-16, C-17, C-18, C-19, C-21, C-22, C-24, C-26, C-27, C-29, C-36, C-41, C42	Scoped In	The study area overlaps with the array areas and/or offshore ECC routes (either proposed or consented) of Hywind Scotland, CampionWind, Aberdeen, Green Volt and MarramWind OWFs. As such, during construction of infrastructure and adherence to safety distances around construction vessels, there is potential to obstruct activities necessary for their development.
Temporary obstruction to wave and tidal renewable energy developments and associated activities	-	Scoped Out	There are no wave or tidal renewable developments in the study area.
Temporary obstruction to subsea cables and utilities developments and associated activities	C-02, C-16, C-17, C-18, C-19, C-21, C-22, C-24, C-26, C-27, C-29, C-36, C-41, C42	Scoped In	Due to the proximity of subsea cables and telecommunication cables associated with utilities to the study area, this will be included in future assessment as part of the EIA.
Temporary obstruction to oil and gas developments and associated activities	C-02, C-16, C-17, C-18, C-19, C-21, C-22, C-24, C-26, C-27, C-29, C-36, C-41, C42	Scoped In	The construction of infrastructure and implementation of safety distances around construction vessels may obstruct activities associated with the oil and gas activities.
Temporary obstruction to CCUS developments and associated activities	-	Scoped Out	There are no current plans to develop CCUS projects in the study area.
Temporary obstruction to nuclear activities	-	Scoped Out	There are no nuclear activities in the study area.
Temporary obstruction to licensed marine disposal sites and associated activities	C-02, C-16, C-17, C-18, C-19, C-21, C-22, C-24, C-26, C-29, C-36, C42	Scoped In	There are two open disposal sites within the study area; the consideration of impacts to these sites will be included in future assessment as part of the EIA.
Temporary obstruction to marine aggregate activities.	-	Scoped Out	There are no marine aggregate dredging activities in the vicinity of the study area.

Impact Pathway	Embedded Commitments	Scoped In or Scoped Out	Justification
Temporary obstructions to aquaculture activities	-	Scoped Out	There are no aquaculture sites in the vicinity of the study area.
Temporary obstruction to INTOG activities	C-02, C-16, C-17, C-18, C-19, C-21, C-22, C-24, C-26, C-27, C-29, C-36, C-41, C42	Scoped In	There are two INTOG projects that have been awarded Exclusivity Agreements for sites within the study area; the consideration of impacts to these sites will be included in future assessment as part of the EIA.
Operation and Maintenance			
Temporary obstruction to other OWFs	C-09 , C-16, C-17, C-18, C-19, C-21, C-22, C-24, C-25, C-26, C-27, C-29, C-36, C-41, C42	Scoped In	The study area overlaps with the array areas and/or offshore ECC routes (either proposed or consented) of Hywind Scotland, CampionWind, Aberdeen, Green Volt and MarramWind OWFs. As such, during the O&M of infrastructure and adherence to safety distances around O&M vessels, there is potential to obstruct activities necessary for their development.
Temporary obstruction to wave and tidal renewable energy developments and associated activities	-	Scoped Out	There are no wave or tidal renewable developments in the study area.
Temporary obstruction to subsea cables and utilities developments and associated activities	C-09 , C-16, C-17, C-18, C-19, C-21, C-22, C-24, C-25, C-26, C-27, C-29, C-36, C-41, C42	Scoped In	Due to the proximity of subsea cables and telecommunication cables associated with utilities to the study area, this will be included in future assessment as part of the EIA.
Temporary obstruction to oil and gas developments and associated activities	C-09 , C-16, C-17, C-18, C-19, C-21, C-22, C-24, C-25, C-26, C-27, C-29, C-36, C-41, C42	Scoped In	The O&M of infrastructure and adherence to safety distances around O&M vessels may obstruct activities associated with the oil and gas activities.
Temporary obstruction to CCUS developments and associated activities	-	Scoped Out	There are no current plans to develop CCUS projects in the study area.
Temporary obstruction to nuclear activities	-	Scoped Out	There are no nuclear activities in the study area.

Impact Pathway	Embedded Commitments	Scoped In or Scoped Out	Justification
Temporary obstruction to licensed marine disposal site and associated activities	C-09 , C-16, C-17, C-18, C-19, C-21, C-22, C-24, C-25, C-26, C-27, C-29, C-36, C-41, C42	Scoped In	There are two open disposal sites within the study area; the consideration of impacts to these sites will be included in future assessment as part of the EIA.
Temporary obstruction to marine aggregates activities	-	Scoped Out	There are no marine aggregate dredging activities in the vicinity of the study area.
Temporary obstruction to INTOG activities	C-09 , C-16, C-17, C-18, C-19, C-21, C-22, C-24, C-25, C-26, C-27, C-29, C-36, C-41, C42	Scoped In	There are two INTOG projects that have been awarded Exclusivity Agreements for sites within the study area; the consideration of impacts to these sites will be included in future assessment as part of the EIA.

19.8 Potential Cumulative Impacts

19.8.1 Chapter 4 (EIA Methodology) details how potential cumulative impacts will be assessed through a CIA and gives examples of the projects which are likely to be included in that assessment. For infrastructure and other marine users, cumulative interactions may occur with the INTOG projects oil and gas developments, cables, and other wind farm projects (e.g. Campion and Hywind).

19.8.2 Given the overlap of the study area and the proximity of the proposed development to other renewable energy developments off the coast of Peterhead, there is potential for cumulative impacts to arise, especially in relation to Hywind and CampionWind OWFs and the two INTOG projects in the area.

19.8.3 The CIA for IOU will consider the maximum adverse design scenario for each of the projects, plans and activities in line with the methodology outlined in Chapter 4 (EIA Methodology).

19.9 Potential Transboundary Effects

19.9.1 No IOU receptors have been identified associated with neighbouring EEZ. There is no potential for transboundary impacts from the construction, O&M and decommissioning of the proposed development.

19.9.2 The proposed development is a significant distance from the nearest adjacent exclusive economic zone (EEZ) of another state and, therefore, it is considered that transboundary impacts will not occur and will therefore be scoped out from further consideration within the EIA.

19.10 Proposed Approach to EIA

Guidance

19.10.1 In addition to the general approach and guidance outlined in Chapter 4 (EIA Methodology), the assessment of IOU receptors will also comply with the following guidance documents where they are specific to this topic:

- Assessment of Impact of Offshore Wind Energy Structures on the Marine Environment (Marine Institute, 2000);
- European Subsea Cables Association (ESCA) Guideline No. 6, The Proximity of Offshore Renewable Energy Installations and Submarine Cable Infrastructure in UK Waters (Marine Institute, 2000);
- International Cable Protection Committee (ICPC) recommendations (ICPC, 2021);
- Oil and Gas UK, Pipeline Crossing Agreement and Proximity Agreement Pack (Oil and Gas UK, 2015);
- The Crown Estate Guidance: Export transmission cables for offshore renewable installations – Principles of cable rerouting and spacing (The Crown Estate, 2012a); and
- The Crown Estate Guidance: Submarine cables and offshore renewable energy installation – Proximity study (The Crown Estate, 2012b).

Additional data sources

19.10.2 A more detailed literature review will be developed for the EIA, building upon the high-level outline provided within this Offshore Scoping Report. For the EIA, stakeholder engagement

and consultation will be a primary source of data to identify all current or known/planned activities in the vicinity of the proposed development.

Assessment Methodology specific EIA guidance

19.10.3 The EIA will follow the general approach outlined in Chapter 4 (EIA Methodology) of this Offshore Scoping Report.

19.10.4 Any potential impacts that are scoped in will be identified and assessed on a desk-based capacity, while considering the maximum design envelope of the proposed development for both the project-specific and cumulative impacts.

19.10.5 Aligning with other chapters of the EIAR for the proposed development, such as Shipping and Navigation (see Chapter 13) or Military and Civil Aviation (see Chapter 15), the information from both direct and indirect impacts will be incorporated. The magnitude of an impact will be drawn from the maximum design scenario of the proposed development, while the sensitivity of a receptor will be based on the capacity to accommodate any change and the value/importance of each receptor.

19.11 Scoping Questions

19.11.1 The following scoping questions refer to the IOU chapter and are designed to focus the Scoping exercise and inform the Scoping Opinion:

- Do you agree with the study area(s) defined in Section 19.2 for infrastructure and other marine users?
- Do you agree with the use of those data listed in Section 19.3, and any additional anticipated data listed in Section 19.10, being used to inform the Offshore EIA?
- Are there any additional data sources or guidance documents that should be considered?
- Do you agree that all receptors related to infrastructure and other marine users have been identified?
- Do you agree with the scoping in and out of impact pathways in relation to infrastructure and other marine users?
- Do you agree with the assessment of the potential for transboundary effects in relation to infrastructure and other marine users?
- Do you agree with the assessment of the proposed approach to cumulative effects in relation to infrastructure and other marine users?
- Do you agree with the proposed assessment methodology for infrastructure and other marine users?

20 Summary of Offshore EIA Scoping and Next Steps

20.1 Impacts and Commitments

20.1.1 Each technical topic assessment within this Offshore Scoping Report has identified the potential impacts that may arise because of the construction, O&M and decommissioning of the proposed development, and therefore the potential impacts that are proposed to be scoped into the Offshore EIAR for the proposed development. For the relevant impacts and receptors that have been scoped into the Offshore EIAR, the proposed approach for the analysis and assessment has been described and questions have been posed to consultees to comment. Additional impacts identified following receipt of the Scoping Opinion, or as a result of stakeholder engagement or public consultation will be documented within the Offshore EIAR that will be prepared to support the Section 36 Consent and the Marine Licence applications.

20.1.2 Each technical chapter and assessment within this Offshore Scoping Report has made reference to embedded commitments that have been made by the Developer as part of the project design process. These are detailed within Appendix A (Commitments Register) in relation to the corresponding technical topics. This Commitments Register will be a live document and will be developed further as the EIA progresses and in response to stakeholder consultation.

20.1.3 As a result of the commitment to implement these measures, and to align the proposed development with various standard sectoral practices and procedures, the embedded commitments are considered inherently part of the design of the proposed development and have therefore been included in the assessment presented in each of the technical chapters.

20.2 Topics Scoped into the Offshore EIA

20.2.1 The following environmental topics are scoped in to the Offshore EIAR for the proposed development:

- Marine and Coastal Processes;
- Marine Water and Sediment Quality;
- Benthic Subtidal and Intertidal Ecology;
- Fish and Shellfish Ecology;
- Offshore Ornithology;
- Marine Mammals;
- Commercial Fisheries;
- Shipping and Navigation;
- Marine Archaeology and Cultural Heritage;
- Military and Civil Aviation;
- Seascape, Landscape and Visual Resources;
- Socio-economics, Tourism and Recreation;
- Climate; and
- Other Human Users.

20.2.2 The following topics have been scoped out of further assessment within the Offshore EIAR for the proposed development:

- Offshore Airborne Noise and Vibration;
- Offshore Air Quality;
- Health; and
- Major Accidents and Disasters.

20.2.3 Justification for the scoping out of the above impacts is presented in Section 4.10.

20.3 Next Steps - Preparation of the EIA Report (EIAR)

20.3.1 The Offshore EIAR will be written in accordance with relevant and latest legislation and policy, with particular focus on EIA Regulations and relevant good practice guidance available at the time of writing. As with this Offshore Scoping Report, each individual technical topic set out in the EIAR will have specific guidance and standards for assessment that will be applied alongside the generic EIA guidance and standards.

20.3.2 The EIAR will follow the proposed content outlined in Table 20-1. The offshore and onshore EIARs will be combined at this stage. However, the components of the onshore EIAR will be outlined within the Onshore Scoping Report which is being submitted separately to this Offshore Scoping Report.

20.3.3 The EIAR will be prepared by relevant technical experts and will utilise the most recent guidance, assessment methodology, latest desk-based data and any relevant site-specific survey data. Information on the competent experts for respective topics will be provided within the Offshore EIAR.

20.3.4 The technical chapters will likely include the following topics:

- Introduction;
- Policy and guidance;
- Consultation;
- Baseline environment;
- Design basis for assessment;
- Impact assessment methodology;
- Assessment of potential impacts;
- Commitments and mitigation;
- Consideration of whether it is appropriate to include proportionate measures to monitor the predicted impacts of the proposed development;
- Transboundary and inter-related effects (where relevant for the EIA topic in question); and
- Cumulative effects.

20.3.5 It is envisaged that a range of Technical Appendices will support the Offshore EIAR, with those relating to the offshore elements of the proposed development listed in Table 20-2.

Table 20-1: Proposed structure of the EIAR covering both offshore and onshore elements of the Project

Volume	Contents	Sections	Outline
Volume 1	Overview	1. Introduction 2. Legislation and Policy Context 3. Project Description 4. Site Selection, Alternatives and Design Evolution 5. Consultation 6. Environmental Impact Assessment Methodology 7. Cumulative Effects	The introductory chapters of the EIAR will introduce the Proposed Development, providing the relevant project context; including an introduction, the planning and policy context, the EIA methodology being used, any alternative design options that have been considered, as well as a description of the Proposed Development and construction strategy. This section should summarise the findings of the EIAR in a clear, accessible format that uses non-technical language and supporting graphics.
Volume 2	Offshore EIAR	1. Marine and Coastal Processes 2. Marine Water & Sediment Quality 3. Benthic, Subtidal and Intertidal Ecology 4. Fish and Shellfish Ecology 5. Offshore Ornithology 6. Marine Mammals 7. Commercial Fisheries 8. Shipping and Navigation 9. Marine Archaeology and Cultural Heritage 10. Military and Civil Aviation 11. Seascape, Landscape and Visual Resources 12. Socio-Economics, Tourism and Recreation 13. Climate 14. Other Human Users	Assessment chapters for each offshore environmental aspect will be provided in accordance with Article IV of the EIA Directive for the offshore infrastructure seawards of MHWS. These chapters will provide a description of the relevant environmental receptors, a description of the existing baseline characterisation within the appropriate study area, relevant project committed embedded commitments, identification of potential impacts and the anticipated significant effects. Any additional mitigation measures will be identified, and residual effects summarised. The assessment of cumulative effects will be considered within each technical chapter.

Volume	Contents	Sections	Outline
Volume 3	Onshore EIAR	To be provided in the Onshore Scoping Report for Muir Mhòr Offshore Wind Farm	The Onshore EIAR will follow the same structure as the Offshore EIAR that is described above.
Volume 4	Summary	1. Schedule of Mitigation (Offshore) 2. Schedule of Mitigation (Onshore) 3. Summary and Conclusions	Summary chapters will provide a concise presentation of the key findings and mitigation commitments.
Volume 5	Technical Appendices	See Table 20-2	Technical appendices for the offshore assessment chapters that support and are cross-referenced with Volume 2 will be included (as well as those relating to the Onshore EIAR). These may include modelling outputs, background reports and/or supporting documents.

Table 20-2: Indicative list of technical appendices to support the Offshore EIAR.

Technical Appendices
Draft Environmental Management Plan
Draft Decommissioning Programme
Offshore and Onshore Scoping Opinions
Scoping and Consultation Gap Analysis
Cumulative Impact Assessment Screening List
Commitments Register
Marine and Coastal Processes Technical Report
Benthic Subtidal and Intertidal Technical Report
Marine Mammal Technical Report
Underwater Noise Modelling Report
Draft EPS Risk Assessment / Licence Application(s)
Ornithology Baseline Technical Report
Ornithology Collision Risk Modelling Technical Report
Ornithology Displacement Technical Report
Commercial Fisheries Technical Report
Draft Fisheries Management and Mitigation Strategy
NRA
Initial Aviation Assessment (including TOPA Assessment)
Radar Propagation Modelling
Greenhouse Gas Assessment
Socio-economics Technical Report
Marine Archaeology and Cultural Heritage Technical Report
Unexploded Ordnance Risk Assessment
WFD Compliance Assessment

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Appendix A – Commitments Register

Appendix A: Commitments Register

Commitment Code	Commitment	Phase			Offshore Technical Topic													How Commitment Secured	Type
		Construction	O&M	Decommissioning	Marine & Coastal Processes	Marine Water & Sediment Quality	Benthic Subtidal and Intertidal Ecology	Fish and Shellfish Ecology	Offshore Ornithology	Marine Mammals	Commercial Fisheries	Shipping and Navigation	Marine Archaeology & Cultural Heritage	Military and Civil Aviation	Seascape, Landscape & Visual Resources	Socio-economics, Tourism and Recreation	Climate	Other Human Users		
C-01	Scour protection or other appropriate mitigation to be employed around seabed infrastructure where there is the potential risk for significant scour to develop.	✓	✓		✓	✓	✓	✓					✓						Cable Plan Construction Method Statement	Tertiary
C-02	Development of and adherence to a Cable Plan (CaP). The CaP will confirm planned cable routing, installation methods, cable specifications and any additional protection and any post-installation monitoring.	✓	✓		✓	✓	✓	✓			✓	✓	✓					✓	Cable Plan	Tertiary
C-03	Development of and adherence to a Development Specification and Layout Plan (DSLP). The DSLP will confirm layout and relevant design parameters.	✓	✓	✓	✓	✓					✓	✓	✓	✓	✓				Development Specification and Layout Plan	Tertiary
C-04	The layout of WTGs and substation(s) will be designed in such a way as to minimise the impacts on Seascape, Landscape, Visual Impacts Assessment (SLVIA).	✓	✓	✓											✓				Design Statement	Primary
C-05	Development of a Construction Method Statement (CMS). This will detail the construction procedures (including piling), good working practices for constructing the works, and how the construction-related mitigation steps are to be delivered.	✓	✓	✓	✓	✓		✓	✓	✓							✓		Construction Method Statement	Tertiary
C-06	Development of and adherence to a Construction Programme (CoP). This will detail the timeline and duration of the primary construction and commissioning activities.	✓			✓	✓				✓						✓			Construction Programme	Tertiary
C-07	All dropped objects will be reported. Where recovery is possible and the dropped object may cause a hazard, object will be retrieved.	✓	✓	✓							✓								Environmental Management Plan	Tertiary
C-08	Development of and adherence to an Environmental Management Plan (EMP). This will set out mitigation measures and procedures relevant to environmental management, including but not limited to chemical usage, invasive and non-native species, pollution prevention and waste management.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓					✓		Environmental Management Plan	Tertiary
C-09	Development of and adherence to a Decommissioning Programme (DP). The DP will outline measures for the decommissioning of the Proposed Development.			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Decommissioning Programme	Tertiary
C-10	Development of and adherence to a Vessel Management Plan (VMP). The VMP will confirm the types and numbers of vessels that will be engaged on the proposed development, and consider vessel coordination including indicative transit route planning.	✓	✓	✓			✓		✓	✓	✓	✓				✓			Vessel Management Plan	Tertiary
C-11	Development of and adherence to a Fisheries Management and Mitigation Strategy (FMMS). The FMMS will set out the means of ongoing fisheries liaison through construction and operation and maintenance (O&M) phases of the proposed development and detail any mitigation measures of relevance to commercial fisheries to be put in place.	✓	✓	✓							✓	✓				✓			Fisheries Management and Mitigation Strategy	Tertiary
C-12	Ongoing liaison with fishing fleets will be maintained during construction, maintenance and decommissioning operations via an appointed Fisheries Liaison Officer and Fishing Industry Representative.	✓	✓	✓							✓	✓				✓			Fisheries Management and Mitigation Strategy	Tertiary
C-13	Adherence to best practice guidance with regards to fisheries liaison and procedures in the event of interactions between the proposed development and fishing activities (e.g., FLOWW, 2014; 2015).	✓	✓	✓							✓	✓				✓			Fisheries Management and Mitigation Strategy	Tertiary

Commitment Code	Commitment	Phase			Offshore Technical Topic													How Commitment Secured	Type
		Construction	O&M	Decommissioning	Marine & Coastal Processes	Marine Water & Sediment Quality	Benthic Subtidal and Intertidal Ecology	Fish and Shellfish Ecology	Offshore Ornithology	Marine Mammals	Commercial Fisheries	Shipping and Navigation	Marine Archaeology & Cultural Heritage	Military and Civil Aviation	Seascape, Landscape & Visual Resources	Socio-economics, Tourism and Recreation	Climate	Other Human Users		
C-14	Development of and adherence to a Piling Strategy (PS) (applicable where piling is undertaken). The PS will detail the method of pile installation and associated noise levels. It will describe any mitigation measures to be put in place (e.g., soft starts and ramp ups, use of Acoustic Deterrent Devices) during piling to manage the effects of underwater noise on sensitive receptors.	✓						✓	✓	✓	✓					✓		✓	Piling Strategy	Tertiary
C-15	Development of and adherence to Marine Mammal Mitigation Plan (MMMP). This will identify appropriate mitigation measures during offshore activities that are likely to produce underwater noise and vibration levels capable of potentially causing injury or disturbance to marine mammals. This will be developed alongside the Piling Strategy and referred to in European Protected Species (EPS) licence applications.	✓	✓	✓				✓		✓	✓					✓		✓	Marine Mammal Mitigation Plan	Tertiary
C-16	Development of and adherence to a Navigational Safety Plan (NSP). The NSP will describe measures put in place by the proposed development related to navigational safety, including information on Safety Zones, charting, construction buoyage, temporary lighting and marking, and means of notification of proposed development activity to other sea users (e.g., via Notice to Mariners).	✓	✓	✓							✓	✓				✓		✓	Navigational Safety Plan	Tertiary
C-17	Applications to be made, where appropriate, for Safety Zones (500m) for construction and major maintenance works, and for pre commissioning works (50m).	✓	✓	✓				✓			✓	✓						✓	Navigational Safety Plan	Secondary
C-18	Use of guard vessels where deemed appropriate to ensure adherence with Safety Zones or advisory passing distances, as defined by risk assessment, to mitigate any impact which poses a risk to surface navigation during construction, maintenance and decommissioning phases. Such impacts may include partially installed structures or cables, extinguished navigation lights or other unmarked hazards.	✓	✓	✓							✓	✓						✓	Navigational Safety Plan	Secondary
C-19	Advance warning and accurate location details of construction, maintenance and decommissioning operations, associated Safety Zones and advisory passing distances will be given via Notices to Mariners and Kingfisher Bulletins.	✓	✓	✓							✓	✓				✓		✓	Navigational Safety Plan	Tertiary
C-20	Participation in any fisheries working group to assist with liaison between the proposed development and the fishing community.	✓	✓	✓							✓								Fisheries Management and Mitigation Strategy	Tertiary
C-21	Compliance with Maritime and Coastguard Agency (MCA) Marine Guidance Note (MGN) 654 (MCA, 2021) and its annexes where applicable (including consideration of a Search and Rescue (SAR) checklist, an Emergency Response and Cooperation Plan (ERCoP) and Under Keel Clearance. Consideration will also be given to MGN 543 Search and Rescue (SAR) Annex 5 (MCA, 2018).	✓	✓	✓							✓	✓		✓				✓	Cable Plan Construction Method Statement Development Specification and Layout Plan	Tertiary
C-22	Compliance of all project vessels with international marine regulations as adopted by the Flag State, notably the International Regulations for Preventing Collisions at Sea (COLREGs) (IMO, 1974) and the International Convention for the Safety of Life at Sea (SOLAS) (IMO, 1974).	✓	✓	✓							✓	✓						✓	Navigational Safety Plan	Tertiary

Commitment Code	Commitment	Phase			Offshore Technical Topic													How Commitment Secured	Type
		Construction	O&M	Decommissioning	Marine & Coastal Processes	Marine Water & Sediment Quality	Benthic Subtidal and Intertidal Ecology	Fish and Shellfish Ecology	Offshore Ornithology	Marine Mammals	Commercial Fisheries	Shipping and Navigation	Marine Archaeology & Cultural Heritage	Military and Civil Aviation	Seascape, Landscape & Visual Resources	Socio-economics, Tourism and Recreation	Climate	Other Human Users		
C-23	Notification of damage or decay to cables to the Maritime and Coastguard Agency (MCA), Northern Lighthouse Board (NLB) Kingfisher and UK Hydrographic Office (UKHO) within 24 hours of discovery.	✓	✓	✓							✓	✓							Cable Plan Navigational Safety Plan	Tertiary
C-24	Aids to navigation (marking and lighting) will be deployed in accordance with the latest relevant available standard industry guidance and as advised by Northern Lighthouse Board (NLB), MCA and Civil Aviation Authority (CAA) and MoD as appropriate. This will include a buoyed construction area around the array area in consultation with NLB.	✓	✓	✓					✓		✓	✓		✓				✓	Navigational Safety Plan Lighting and Marking Plan	Tertiary
C-25	Appropriate marking of the proposed development on Admiralty and aeronautical charts. This will include provision of the positions and heights of structures to the UK Hydrographic Office (UKHO), Civil Aviation Authority (CAA), Ministry of Defence (MoD) and Defence Geographic Centre (DGC).		✓								✓	✓		✓				✓	Navigational Safety Plan Lighting and Marking Plan	Tertiary
C-26	Compliance with regulatory expectations on moorings for floating wind and marine devices published by Maritime and Coastguard Agency (MCA) and the Health and Safety Executive (HSE).	✓	✓	✓							✓	✓				✓		✓	Construction Method Statement	Tertiary
C-27	Crossing and proximity agreements with known existing pipeline and cables operators will be sought.	✓	✓	✓							✓							✓	Secured by commercial agreements with pipeline and cable operators.	Tertiary
C-28	The archaeological assessment of marine geophysical and geotechnical survey datasets would facilitate the implementation of archaeological exclusion zones (AEZs), micrositing of infrastructure, and the implementation of a Protocol for Archaeological Discoveries (PAD), as detailed in the Marine Written Scheme of Investigation (WSI).	✓	✓	✓									✓						Written Scheme of Archaeological Investigation	Primary
C-29	Where practicable, cable burial will be the preferred means of cable protection. Cable burial will be informed by the cable burial risk assessment (CBRA) and detailed within the CaP. In areas where CBRA deems burial not feasible, suitable implementation and monitoring of cable protection will be employed.	✓			✓		✓	✓			✓	✓						✓	Cable Plan	Primary
C-30	Adherence to the Supply Chain Development Statement in relation to local manufacturers and contractors.	✓	✓								✓					✓			Supply Chain Development Statement	Tertiary
C-31	Unexploded ordnance (UXO) hazards will be avoided where practicable and appropriate. If avoidance is not possible, decision making will relate to removal, with detonation considered if avoidance or removal is not possible. If detonation is required, and where practicable and appropriate, low-order deflagration will be the preferred method. Licencing of UXO clearance works will be subject to a standalone Marine Licence (and EPS licence) application. These applications will provide details of measures to minimising impacts on marine mammals where appropriate.	✓						✓		✓										Tertiary
C-32	Over trawl surveys of offshore export cables will be undertaken through the operational life of the project where mechanical protection of cables laid on the sea bed has been deployed.		✓								✓								Cable Plan	Tertiary

Commitment Code	Commitment	Phase			Offshore Technical Topic													How Commitment Secured	Type
		Construction	O&M	Decommissioning	Marine & Coastal Processes	Marine Water & Sediment Quality	Benthic Subtidal and Intertidal Ecology	Fish and Shellfish Ecology	Offshore Ornithology	Marine Mammals	Commercial Fisheries	Shipping and Navigation	Marine Archaeology & Cultural Heritage	Military and Civil Aviation	Seascape, Landscape & Visual Resources	Socio-economics, Tourism and Recreation	Climate	Other Human Users		
C-33	Minimum blade clearance of 30 m above Mean Sea Level (MSL).		✓						✓		✓	✓				✓		✓	Development Specification and Layout Plan Construction Method Statement	Primary
C-34	Offshore infrastructure will be micro-sited, where reasonably practicable (to an extent not resulting in a hazard for marine traffic and Search & Rescue capability), around any sensitive seabed habitats including Annex I habitat (if present) , informed through the undertaking of survey works pre-construction.	✓	✓		✓		✓		✓										Development Specification and Layout Plan Project Environmental Monitoring Plan	Primary
C-35	Adherence by vessels to guidelines laid out in the Scottish Marine Wildlife Watching Code	✓	✓	✓					✓	✓									Vessel Management Plan	Tertiary
C-36	Development of and adherence to a Lighting and Marking Plan (LMP). The LMP will confirm compliance with legal requirements with regards to shipping, navigation and aviation marking and lighting.	✓	✓	✓					✓		✓	✓		✓				✓	Lighting and Marking Plan	Tertiary
C-37	Development of and adherence to an Entanglement Management Plan to reduce the potential entanglement risk to marine life.	✓	✓	✓				✓	✓	✓									Entanglement Management Plan	Tertiary
C-38	Development of and adherence to a Project Environmental Monitoring Programme (PEMP), which will set out commitments to environmental monitoring in pre-, during and post-construction phases.	✓	✓	✓				✓	✓	✓	✓	✓					✓		Project Environmental Monitoring Programme	Tertiary
C-39	The Turbot Bank Nature Conservation Marine Protected Area (NC MPA) will not be crossed by the offshore ECC.	✓						✓											Development Specification and Layout Plan Cable Plan	Primary
C-40	Development of and adherence to a Wet Storage Plan (WSP) to provide details on requirements (if applicable) for assembled WTGs and cabling. WTGs to be held at a nearshore wet storage location before being transported to site.	✓	✓						✓		✓	✓		✓	✓	✓		✓	Wet Storage Plan	Tertiary
C-41	Where offshore export cables must cross third party infrastructure, such as existing cables and pipelines, both the third-party asset and the installed cables will be protected.	✓																✓	Cable Plan	Tertiary
C-42	Lighting and marking failures appropriately reported/rectified as soon as possible and interim hazard warnings put in place as required.	✓	✓	✓							✓	✓		✓				✓	Lighting and Marking Plan	Tertiary

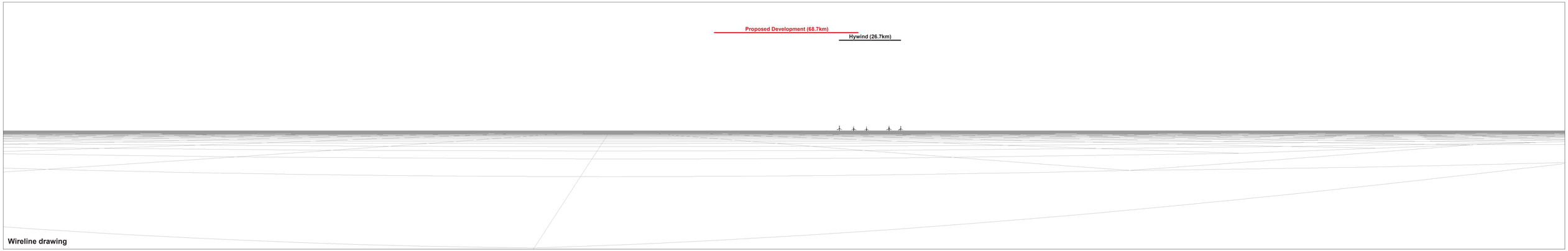
Column Name	Content
Commitment Code	The commitment reference code refers to this specific commitment and will be used to refer to this measure throughout the Offshore Scoping Report .
Commitment	A description of the commitment.
Phase	The project development phase of relevance to the commitment (e.g. construction, operation & maintenance or decommissioning).
Offshore Technical Topic	The offshore technical topic that the commitment is relevant to.
How Commitment Secured	The mechanism by which this commitment will be secured. For example, the consent plan that will set out the information relevant to this measure.
Mitigation Type	Primary (inherent) mitigation: Modifications 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.
	Secondary (foreseeable) mitigation: 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 Environmental Impact Assessment.
	Tertiary (inexorable) mitigation: 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 requirements, or actions that are considered to be standard practices used to manage commonly occurring environmental effects.

Appendix B - Seascape, Landscape and Visual Resources Wirelines

OS reference: 410813 E 857762 N
Eye level: 1.5 mAOD
Direction of view: 105°
Nearest turbine: 70.98 km

Horizontal field of view: 90° (cylindrical projection)
Principal distance: 522 mm
Paper size: 841 x 297 mm (half A1)
Correct printed image size: 820 x 130 mm

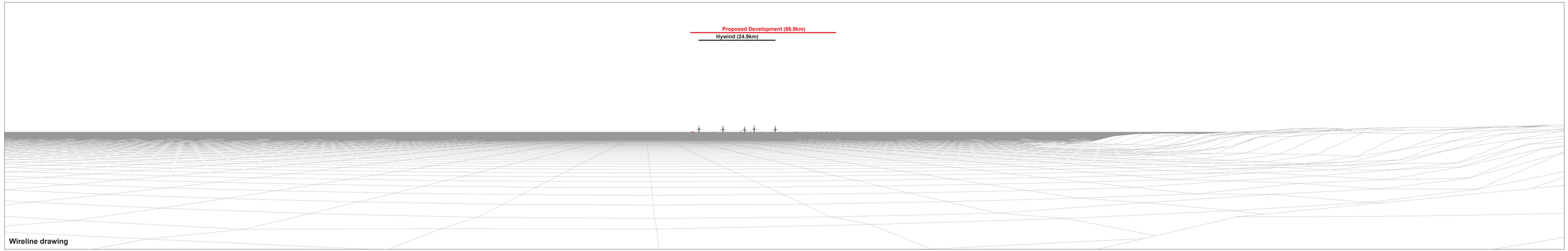
Figure 16.6
Viewpoint 1: Rattray Head
Muir Mhor



OS reference: 411851 E 851873 N
Eye level: 1.6 mAOD
Direction of view: 101°
Nearest turbine: 68.69 km

Horizontal field of view: 90° (cylindrical projection)
Principal distance: 522 mm
Paper size: 841 x 297 mm (half A1)
Correct printed image size: 820 x 130 mm

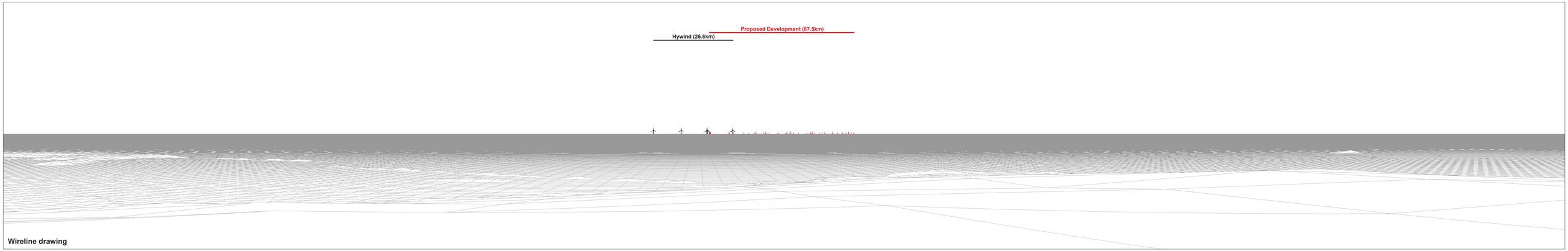
Figure 16.7
Viewpoint 2: Scotstown Head
Muir Mhor



OS reference: 412963 E 847099 N
Eye level: 9.9 mAOD
Direction of view: 99°
Nearest turbine: 66.91 km

Horizontal field of view: 90° (cylindrical projection)
Principal distance: 522 mm
Paper size: 841 x 297 mm (half A1)
Correct printed image size: 820 x 130 mm

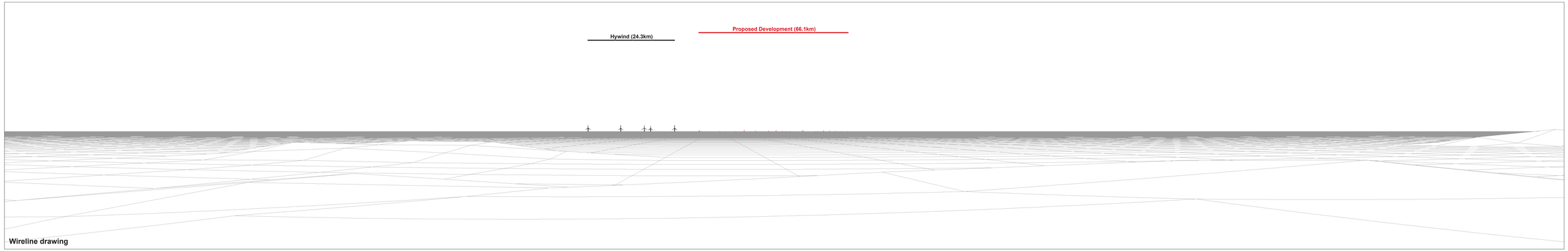
Figure 16.8
Viewpoint 3: Gadle Braes, Peterhead (Night Viewpoint)
Muir Mhor



OS reference: 412167 E 844655 N
Eye level: 54.4 mAOD
Direction of view: 96°
Nearest turbine: 67.48 km

Horizontal field of view: 90° (cylindrical projection)
Principal distance: 522 mm
Paper size: 841 x 297 mm (half A1)
Correct printed image size: 820 x 130 mm

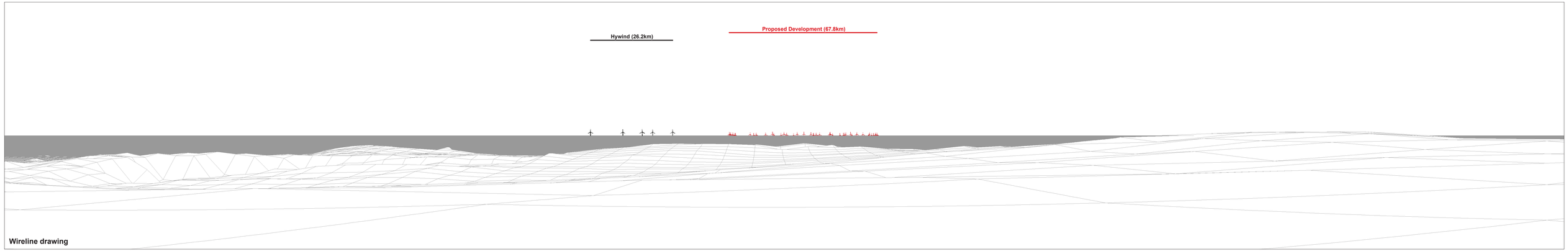
Figure 16.9
Viewpoint 4: Reform Tower
Muir Mhor



OS reference: 413469 E 842640 N
Eye level: 5.5 mAOD
Direction of view: 95°
Nearest turbine: 66.06 km

Horizontal field of view: 90° (cylindrical projection)
Principal distance: 522 mm
Paper size: 841 x 297 mm (half A1)
Correct printed image size: 820 x 130 mm

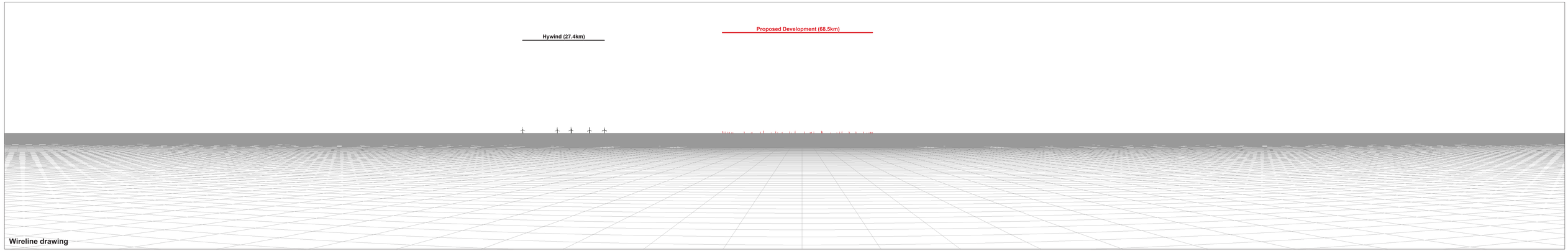
Figure 16.10
Viewpoint 5: Boddam
Muir Mhor



OS reference: 411655 E 841107 N
Eye level: 96.4 mAOD
Direction of view: 92°
Nearest turbine: 67.82 km

Horizontal field of view: 90° (cylindrical projection)
Principal distance: 522 mm
Paper size: 841 x 297 mm (half A1)
Correct printed image size: 820 x 130 mm

Figure 16.11
Viewpoint 6: Stirling Hill
Muir Mhor



OS reference: 411020 E 838106 N
Eye level: 30.2 mAOD
Direction of view: 90°
Nearest turbine: 68.46 km

Horizontal field of view: 90° (cylindrical projection)
Principal distance: 522 mm
Paper size: 841 x 297 mm (half A1)
Correct printed image size: 820 x 130 mm

Figure 16.12
Viewpoint 7: Bullers O' Buchan
Muir Mhor