FLOTATION ENERGY

The future of renewable energy

A leading developer in Offshore Wind Projects

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Cenos Offshore Windfarm Scoping Report

21st February 2023

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Acronyms

Type/description of data	Source
µPa	Micro Pascal
µT	Microtesla
AC	Alternating Current
ADD	Acoustic Deterrent Device
AEZ	Archaeological Exclusion Zone
AfL	Agreement for Lease
AIS	Automatic Identification System
AL	Action Level
AMC	Acceptable Means of Compliance
AQMA	Air Quality Management Areas
AR	Artificial Reef
As	Arsenic
Ba	Barium
BDMPS	Biologically Defined Minimum Population Scales
BEIS	Department for Business, Energy & Industrial Strategy
BGS	British Geological Survey
boe	barrel of oil equivalent
BSI	British Standards Institute
CA	Cruising Association
CAA	Civil Aviation Authority
CAFS	Cleaner Air for Scotland
CAPEX	Potential Capital Expenditure
CCME	Canadian Council of Ministers of the Environment
CCS	Carbon Capture Storage
CD	Chart Datum

Type/description of data	Source
Cefas	Centre for Environment, Fisheries and Aquaculture Science
CES	Crown Estate Scotland
CfD	Contract for Difference
CI	Coefficient Interval
CIEEM	Chartered Institute of Ecology and Environmental Management
CMACS	Centre for Marine and Coastal Studies
CNS	Central North Sea
CoCP	Code of Construction Practice
CO_2e	Carbon dioxide equivalent
COWRIE	Collaborative Offshore Wind Research into the Environment
CPT	Core Penetrometer Test
Cr	Chromium
CRM	Critical Raw Material
CS	Certification Specifications
Cu	Copper
CV	Coefficient Variation
dB	Decibel
DC	Direct Current
DDV	Drop Down Video
DoB	Depth of Burial
DoL	Depth of Lowering
DTL	Dutch Target Values
EcIA	Ecological Impact Assessment
EEA	European Economic Area
EEZ	Exclusive Economic Zone
EIA	Environmental Impact Assessment
EMF	Electromagnetic fields

Type/description of data	Source
EMODnet	European Marine Observation and Data Network
EPS	European Protected Species
ES	Environmental Statement
ESAS	European Seabirds at Sea
ETAP	Eastern Trough Area Project
EU	European Union
EUNIS	European Nature Information System
FAD	Fish Aggregating Device
FeAST	Marine Scotland's Feature Activity Sensitivity Tool
FID	Final Investment Decision
FLO	Fishing Liaison Officer
Flotation Energy	Flotation Energy Ltd
FPSO	Floating Production Storage and Offloading
FSA	Formal Safety Assessment
GEN	General Policies of Scotland's National Marine Plan
GHG	Green House Gas
GM	Guidance Material
GVA	Gross value added
GW	Gigawatt
HDD	Horizontal Directional Drilling
HiDef	High-resolution video aerial ornithological and marine megafauna survey
HM	His Majesty's
HRA	Habitat Regulations Appraisal
HSE	Health & Safety Executive
HVDC	high voltage direct current
Hz	Hertz
IACs	Inter-array cables

Type/description of data	Source
IAIA	International Association for Impact Assessment
IALA	International Association of Marine Aids to Navigation and Lighthouse Authority
ICES	International Council for the Exploration of the Sea
ICPC	International Cable Protection Committee
IEMA	Institute of Environmental Management and Assessment
IMO	International Maritime Organisation
INNS	Invasive Non-Native Species
INTOG	Innovation and Targeted Oil & Gas
IPR	Iterative Plan Review
IUCN	The International Union for Conservation of Nature
IUCN	The International Union for Conservation of Nature
JCP	Joint Cetacean Protocol
JNCC	Joint Nature Conservation Committee
kHz	Kilohertz
KIS-ORCA	Kingfisher Information Service - Offshore Renewable & Cable Awareness
km	Kilometre
kV	Kilovolt
LAT	Lowest Astronomical Tide
LiDAR	Light Detection and Ranging
LSE	likely significant effect
m	Metre
m	Meter
MAIB	Marine Accident Investigation Branch
MarLIN	Marine Life Information Network
MARPOL	International Convention for the Prevention of Pollution from Ships

Type/description of data	Source
Max	Maximum
MBES	Multi-beam Echo-sounders
MCA	Maritime and Coastal Agency
MCAA	Marine and Coastal Access Act 2009
MCZ	Marine Conservation Zone
MGN	Marine Guidance Note
MMO	Marine Mammal Observation
MMOs	Marine Mammal Observers
MPA	Marine Protected Area
MPI	Multi Point Interconnector
MS-LOT	Marine Scotland – Licensing Operations Team
MTe	Million Tonnes
MW	Megawatt
NATS	National Air Traffic Services
NCMPA	Nature Conservation Marine Protected Area
Ni	Nickel
NLB	Northern Lighthouse Board
nm	nautical miles
National Marine Plan	NMP
NMPi	National Marine Plan interactive
NOx	Nitrogen oxide
NPF3	National Planning Framework 3
NPS	National Policy Statement
NRA	Navigation Risk Assessment
NRIP	National Renewables Infrastructure Plan
NW	North West
O&M	Operation and maintenance

Type/description of data	Source
OESEAP	Offshore Energy Strategic Environmental Assessment Programme
OnTI	Onshore Transmission Infrastructure
OREIs	Offshore Renewable Energy Installations
OSP	single offshore substation platform
OSPAR	Oslo-Paris Convention for the Protection of the Marine Environment of the North-East Atlantic
OWF	Offshore Wind Farm
PAC	Pre-application Consultation
PAD	Procedure for Archaeological Discoveries
PAM	Passive Acoustic Monitoring
Pb	Lead
PEL	Probable Effect Level
PMF	Priority Marine Feature
PSU	Practical Salinity Units
PTS	Permanent Threshold Shift
PSD	Particle Size Distribution
REZ	Renewable Energy Zone
RNLI	Royal National Lifeboat Institution
ROV	Remotely Operated Vehicle
RYA	Royal Yachting Association
S.36	Section 36
SAC	Special Areas of Conservation
SBP	Sub-bottom Profilers
SCANS	Small Cetaceans in the European Atlantic and North Sea
ScARF	Scottish Archaeological Research Framework
ScotPHO	Scottish Public Health Observatory
SEL	Sound Exposure Level

Type/description of data	Source
SFF	Scottish Fishermen's Federation
SLVIA	seascape, landscape and visual impact assessment
SMP	Scottish Marine Plan
SNCBs	Statutory Nature Conservation Bodies
SNH	Scottish Natural Heritage
SOWEC	Scottish Offshore Wind Energy Council
SOx	Sulphur oxide
SPA	Special Protected Areas
SPL	Sound Pressure Level
SPM	Suspended Particulate Matter
SPP	Scottish Planning Policy
SSC	Suspended Sediment Concentration
SSS	Side Scan Sonar
STW	Scottish Territorial Waters
SVAs	Special Valuable Areas
T	Tesla
TEL	Threshold Effects Level
THCs	Total Hydrocarbons
TLP	Tension Leg Platform
TTS	Temporary Threshold Shift
TWh	Terra Watt hour
UHR	Ultra-High Resolution
UK	United Kingdom
UK BAP	UK Biodiversity Action Plan
UKCS	United Kingdom Continental Shelf
UKHO	United Kingdom Hydrographic Office
UKOOA	UK Offshore Operators Association

Type/description of data	Source
UNFCCC	United Nations Framework Convention on Climate Change
UXO	Unexploded Ordinance
v/m	Volt per Metre
VMS	Vessel Monitoring Systems
WeBS	Wetland Bird Survey database
WHO	World Health Organisation
WW1	World War 1
Zn	Zinc

1 Introduction

1.1 Purpose of this Report

This Scoping Report has been prepared to support a request for a formal Scoping Opinion in relation to the proposed Cenos wind farm project ('the Project') from Scottish Ministers. The Project will produce circa 1.4 Gigawatt (GW) of power and be connected to both oil and gas installations and the UK mainland for connection to the national grid. A full project description is provided in Section 2.

The focus of the Scoping Report relates to elements in UK waters (beyond 12 nautical miles (nm) from land) which will be subject to marine licence under the Marine and Coastal Access Act 2009. As the Project is a generating station in the Scottish Offshore region in excess of 50 Mega Watt (MW) it is also subject to a Section 36 (S.36) Consent under the Electricity Act 1989 (as amended).

The Project also falls under Schedule A2 of The Electricity Works (Environmental Impact Assessment (EIA)) (Scotland) Regulations 2017 and Schedule 2 of The Marine Works (EIA) Regulations 2007 as amended. Schedule A2/2 projects require an EIA if the size, nature or location of the project would indicate that it would likely have a significant effect on the environment. In this instance the Project scale in terms of wattage (~1.4 GW) and area (windfarm footprint ~ 333 km^2), and location within a Nature Conservation Marine Protected Area (NCMPA), are such that without further assessment likely significant effects cannot be ruled out. Hence it has been assumed by the project team that an EIA will be required and hence no request for screening has been submitted.

This Scoping Report has been produced to provide Marine Scotland and their consultees with appropriate information to allow them to respond to this request for a Scoping Opinion in accordance with Section 13 of the Marine Works (EIA) Regulations 2007 as amended and Section 12 of The Electricity Works (Environmental Impact Assessment (EIA)) (Scotland) Regulations 2017.

A description of the project and its location are provided in Section 2, the policy and legislative context is provided in Section 3, and the approach to scoping is outlined in Section 4, while Sections 5 to 20 provide details of the likely significant effects on the environment, where appropriate mitigation has been identified.

This scoping report provides details of the key impacts anticipated and outlines how the impacts will be assessed further in the EIA.

1.2 Project Overview

The proposal is to develop a floating offshore wind farm to facilitate decarbonisation of the oil and gas industry through the electrification of offshore oil and gas installations, while also providing renewable power to the UK grid. It is part of the Innovation and Targeted Oil and Gas (INTOG) leasing process currently being undertaken by Crown Estate Scotland (CES). The connection to shore will ensure power supply to the oil and gas assets when power is not available from the windfarm and provide a route to export excess power to the UK grid by providing a link to shore.

Figure 1-1 provides and overview of the initial project concept.

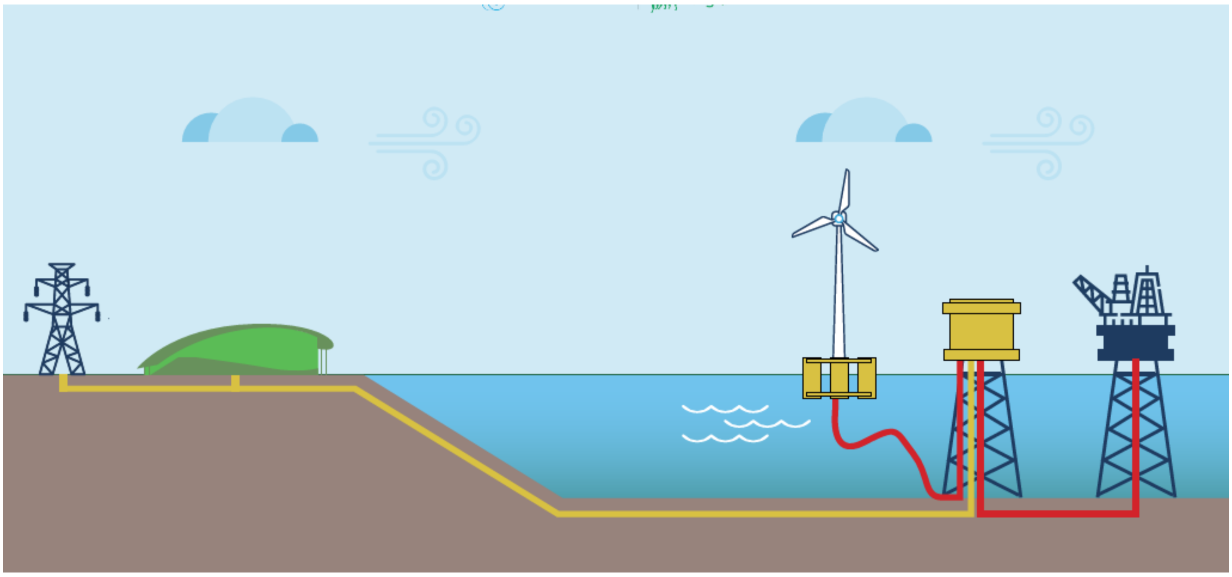


Figure 1-1: Project Concept.

The power generated by the wind turbines will be Alternating Current (AC) and routed to an offshore electricity hub. It is anticipated that AC power will be exported to the oil and gas assets within the area of the Project development area. Transport of AC power over long distances (circa >100 km) gives rise to significant electrical losses, as such Direct Current (DC) which has much lower electrical transmission losses is preferred for the primary export connection to shore and national grid infrastructure. Hence, the offshore electricity hub will include a converter station to change the AC power to DC, to facilitate export to the UK grid. The Project is collaborating with the consented NorthConnect interconnector project, to utilise their DC cable routing and applicable consents where the routes overlap and the onshore converter station planned for Fourfields near Boddam, which then has an agreed link into the Peterhead Substation.

The proposed Project will provide the means to achieve in supporting the decarbonisation of oil and gas activity assets in this part of the North Sea, whilst simultaneously providing an opportunity to scale Scotland's and the UK's growing supply chain capability in floating offshore wind. The Project will include development of a major offshore floating wind farm, which will be connected to the UK grid. This solution provides a number of advantages:

- The wind farm will provide power to the selected oil and gas installations;
- The link to the UK grid will ensure a reliable supply to the installations;
- The availability of a reliable power supply to the installation will allow onboard power generation on the selected oil and gas installations to be fully retired, mitigating substantial quantities of CO_2 emissions over the life of these installations;
- Estimated carbon dioxide equivalent (CO_2e) savings from the decarbonisation of oil and gas installation exceeds 1.16 million tonnes of CO_2e per year (see Section 18);
- Initially surplus power from the wind farm will be exported to the UK grid, providing approximately 5,500 GWh per year of renewable power, modifying the current mix of renewable / non-renewable power on the UK grid with knock on carbon savings;
- The wind farm would be expected to be operational beyond the life the oil and gas installations, at which point exports to the UK grid will increase;
- Cenos will provide renewable power to the UK grid for many decades to come contributing to Scotland's and UK targets for 2030, of 11 GW and 50 GW respectively; and
- Cenos would also stimulate Scotland's capability in floating wind by being one of the forerunning projects, providing the means for rapid deployment of this important technology.

It is noted the link up with the NorthConnect project also facilitates the opportunity to create a Multi-Point Interconnector (MPI) project in the future with the ability to transfer energy to and from Norway. NorthConnect has UK consents which were subject to EIA and hence NorthConnect impacts are only considered with regard to cumulative effects.

1.3 Project Developer

Flotation Energy Ltd (Flotation Energy), have submitted an application, to the Innovation and Targeted Oil and Gas (INTOG) process on behalf of Cenos Offshore Windfarm Ltd ('Cenos'), the proposed Tenant Organisation for the Crown Estate Scotland lease. Cenos is a planned Joint Venture between Flotation Energy and Vårgrønn As (Vårgrønn) which will each own 50 % of Cenos.

Flotation Energy have identified the opportunity to tie into the NorthConnect Interconnector project to facilitate export of power to shore and as such are working collaboratively with NorthConnect Ltd. Figure 1-2 summarises the project structure.

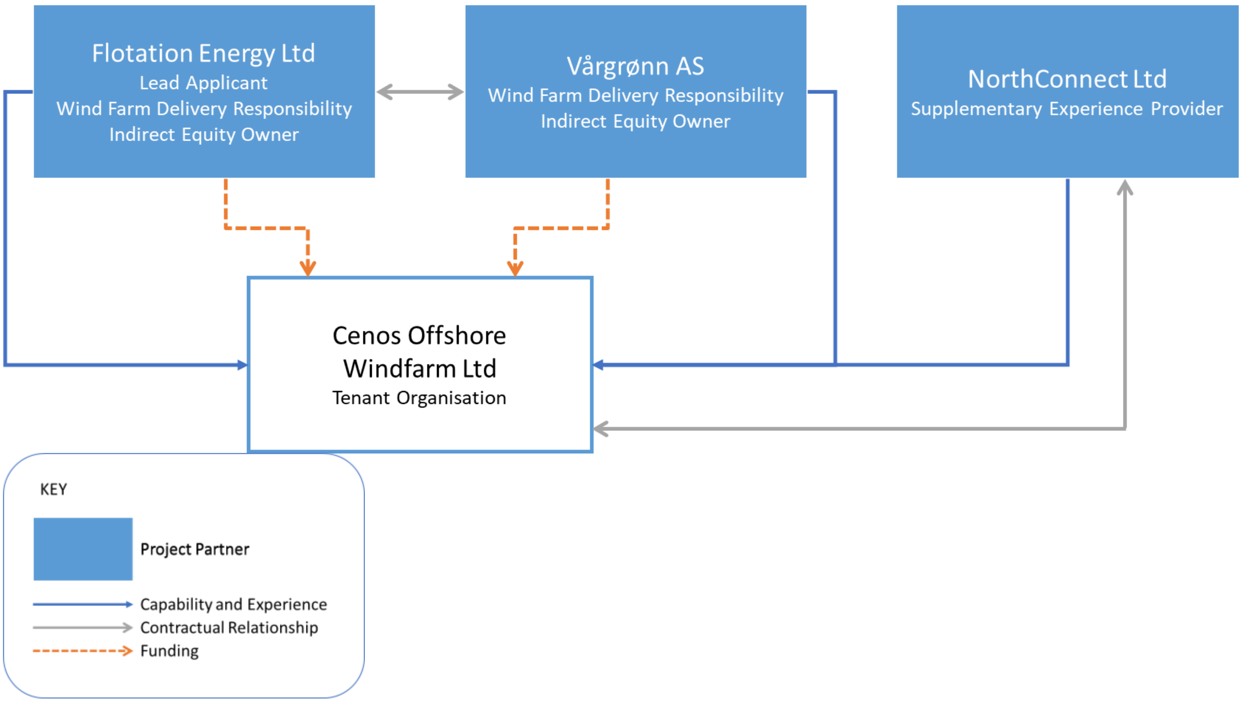


Figure 1-2: Summary of Project Structure

2 Project Description

2.1 Need for Development

The need to act to reduce the speed of the climate crisis is universally recognised. In order to reduce greenhouse gas (GHG) emissions there is a need to move away from the oil and gas industry as a primary method of energy generation and there are various policy and legislative drivers that underpin the need for development, which are outlined in Section 3.

The oil and gas industry remains responsible for 75 % (Department for Business, Energy & Industrial Strategy (BEIS, 2022a) of primary energy supply in the UK, and whilst there is a move towards the development of the renewables sector, with investment and various legislative drivers, this will take a period of transition. The oil and gas sector also remains a significant employer and decommissioning and divestment is lengthy and costly process.

Short-term solutions to meeting the energy demands of the UK are therefore needed whilst energy generation from renewables is developed to meet 100 % of the demand. The Cenos offshore wind farm development provides one such solution via increased decarbonisation of the oil and gas extraction process. The UK Government's Net Zero Strategy considers security of domestic hydrocarbon resources to be a part of the transition towards a low carbon economy. Electrification of offshore oil and gas installations is a key proposal for the energy transition (HM Government, 2021). Offshore oil and gas installations typically incorporate their own power generation system for oil and gas processing, export and essential utilities.

The North Sea Transition Deal (discussed further in Section 3.2.1) includes targets for the decarbonisation of oil and gas supply. The Cenos project is specifically sited between a number of oil and gas assets so it can assist in this process. The proposed development will enable the electrification and connectivity of eight to ten oil and gas installations while providing a hub from which cleaner electricity can be provided from onshore when there is a shortfall in offshore wind. The development will also provide renewable energy for export back to shore in times of surplus power generation and will remain in operation following decommissioning of the oil and gas infrastructure.

To facilitate meeting the targets set out in the North Sea Transition Deal, CES have developed the INTOG leasing round. INTOG is specifically designed for offshore wind projects that will directly reduce emissions from oil and gas production. Floatation Energy have applied for seabed rights for the Cenos windfarm via the INTOG process. The INTOG process is discussed further in Section 3.2.7.

With the opportunity to begin operation by 2028, Cenos can significantly contribute to the North Sea Transition Deal target of a 50 % reduction in offshore emissions associated with oil and gas activity by 2030.

The eight to ten oil and gas assets are expected to have an average annual power demand of 270.1 MW for the first five years. This is 2,366 GWh per year currently produced by fossil fuels being replaced with 100 % renewable power from Cenos for the majority of the time. When Cenos is not able to provide all the power, onshore power will be exported to the oil and gas assets during periods of low wind speed's (<4 ms) or excessive wind speed (>28 ms). The carbon cost of imported power will still be lower than that associated with offshore fossil fuel power generation as power from the National Grid has a lower carbon cost due to the inclusion of non-fossil fuel power sources (renewable and nuclear).

2.2 Site Selection

Oil and gas installations must be located no more than 100 km from the Cenos windfarm offshore electricity hub location. This is the approximate maximum technical limit of 33-66 kV AC power distribution from the windfarm. Furthermore, the oil and gas installations must be able to receive wind power from Cenos for a minimum of 5 years in line with requirements set out by Crown Estate Scotland's INTOG leasing process and to justify the economic case for the receiving facility to install the equipment required (transformer and switchgear) to receive 33-66 kV AC electricity. Since the target first power date of Cenos is 2028 (the date at which oil and gas installations can first receive electric power from the UK grid or available wind turbines) only oil and gas installations with an expected life beyond 2032 have been considered for electrification by Cenos. Figure 2-1 below shows the Central North Sea (CNS) oil and gas facilities with expected life beyond 2032 and have a case for electrification through the Cenos project.

Figure 2-1 shows 100km and 50 km radius rings which capture the maximum number of facilities. The centre of this ring is just east of the Madoes subsea oil field.

Hence the area of search shown in Figure 2-1 maximises the potential for decarbonisation of oil and gas facilities in the Central North Sea area. This is the primary purpose and focus of the project.

Key constraints were mapped in and around the search area to inform the siting, these included:

- Safe helicopter zones (6nm radius from oil and gas assets) (see Figure 2-2);
- Oil and gas subsea assets and pipelines with 500m buffers (see Figure 2-2);
- Oil and gas licence blocks (licenced or likely to be auctioned) (see Figure 2-2);
- Areas of high vessel use density;
- Wrecks; and
- Minimising impact on commercial fishing activities.

The search area is extremely constrained as shown on Figure 2-2. On review it was recognised that the oil and gas round 32 leasing areas may not all be used or activated, and as such should not necessarily be avoided during the search.

As can be seen in Figure 2-2, the remaining area where a windfarm can feasibly be constructed that meets the objectives of decarbonisation whilst avoiding key constraints has resulted in a site within the East of Gannet and Montrose Field NCMPA, discussed further in Section 10. Information available at the time (2020) was utilised to avoid sub littoral mud areas of the NCMPA. The search resulted in the identification of a 440 km^2 area which was taken forward for initial survey works as discussed in Section 10. Figure 2-3 shows the survey area identified, in relation to various oil and gas assets and the benthic habitat types present based on European Marine Observation and Data Network data (EMODnet, 2021).

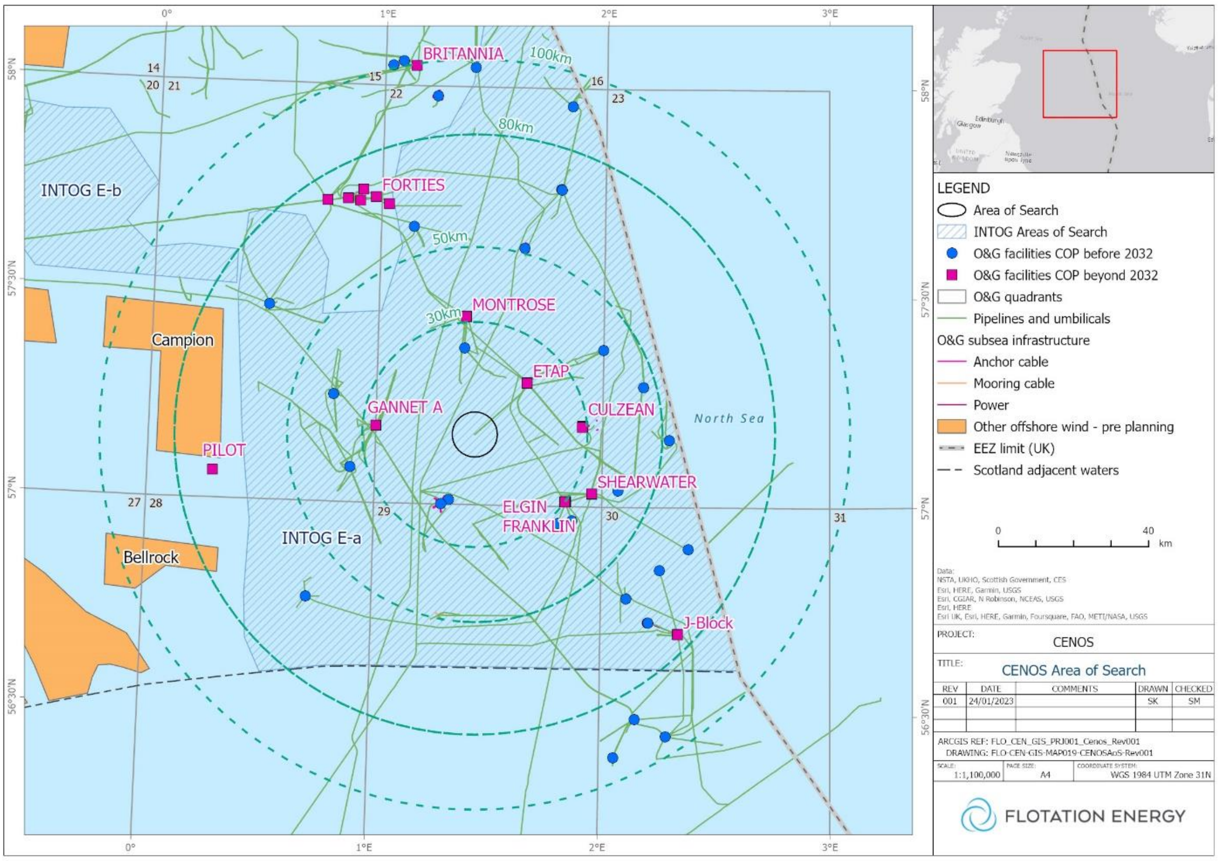


Figure 2-1: CNS Oil and Gas with Expected Life Beyond 2032

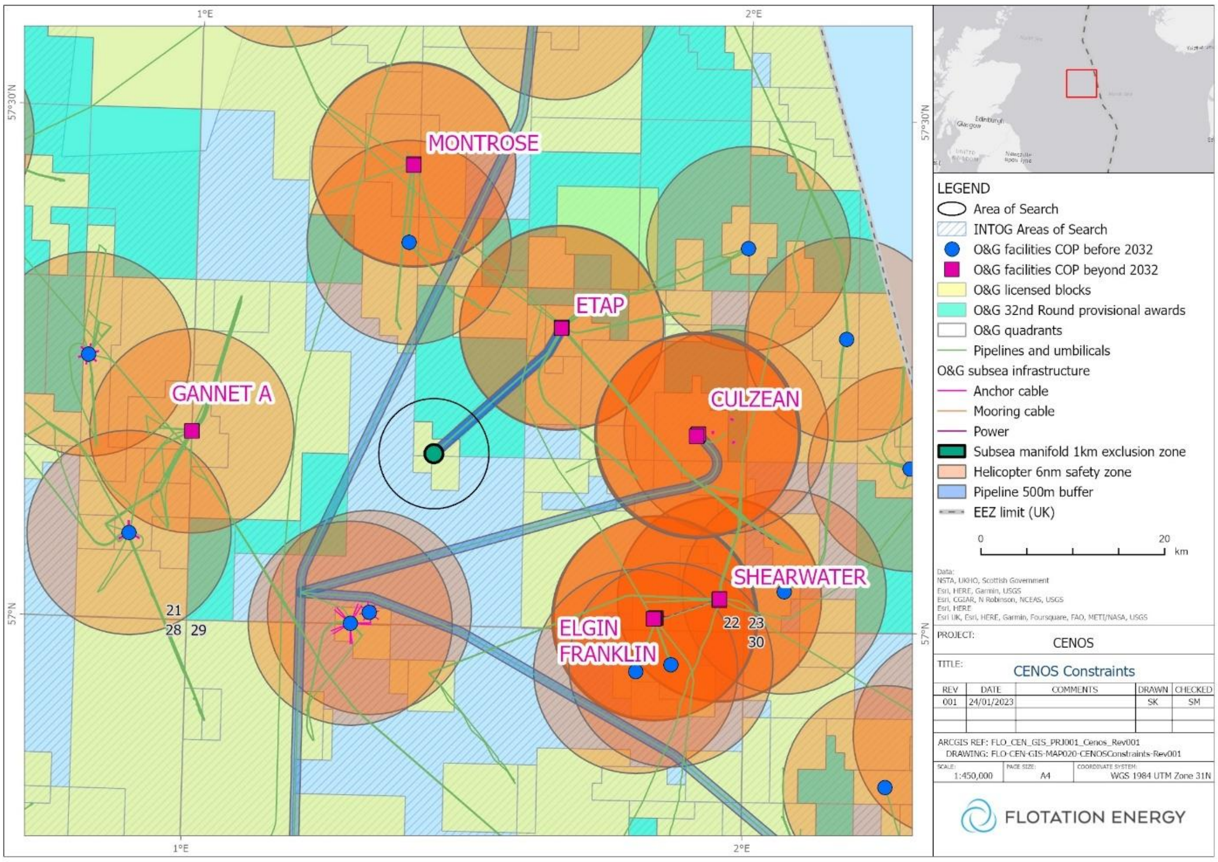


Figure 2-2: Constraint Mapping.

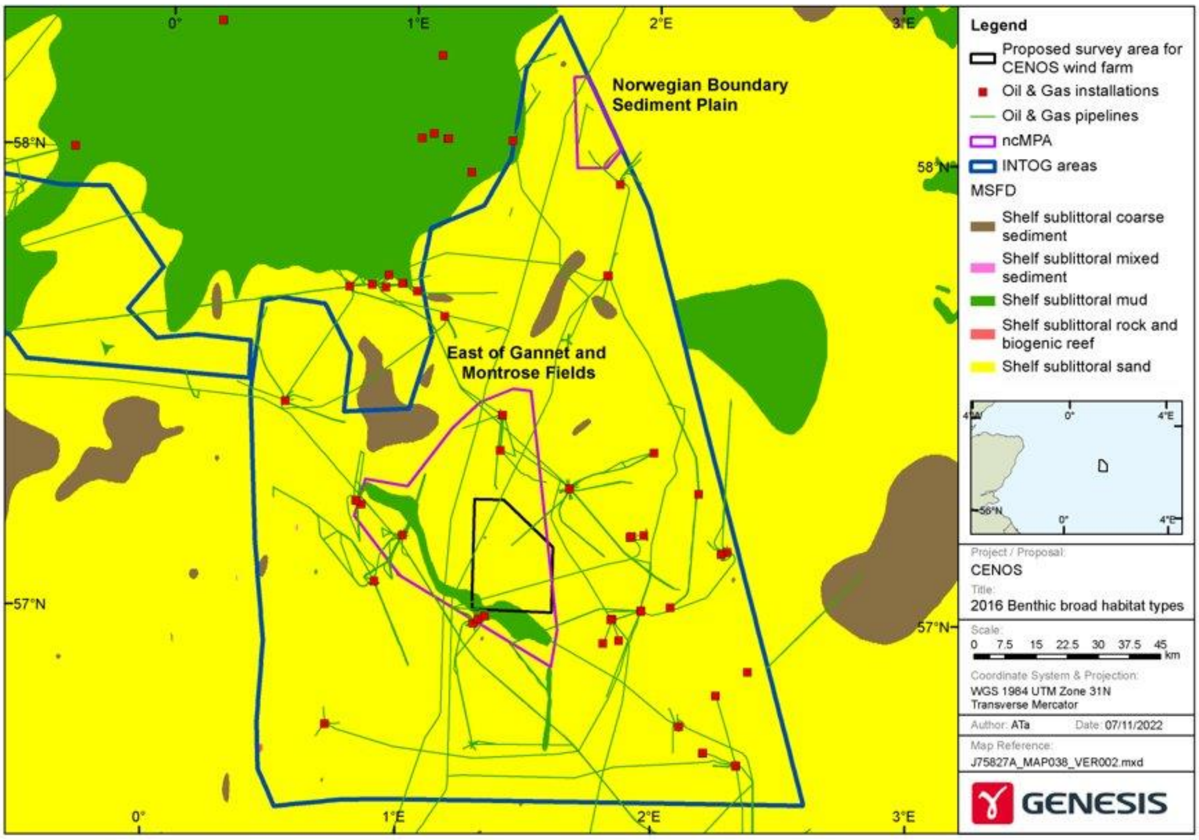


Figure 2.3: Survey Site Location.

In 2022 Crown Estate Scotland identified areas in the North Sea where projects targeting oil and gas decarbonisation would be considered through the INTOG leasing process. The Cenos survey area is located within INTOG Area Ea, and hence was suitable for consideration in the INTOG process. The maximum area available to lease through INTOG is limited to 333 km^2. Hence, prior to lease application submission the survey area had to be refined to identify an area to meet the INTOG requirements. The survey area included the Madoes field which cannot be built upon and hence that area was removed, optimisation was then carried for wind energy yield, Inter Array Cable (IAC) length and distances to oil and gas assets. The resulting leasing area is discussed in Section 2.3

2.3 Location

As shown in Figure 2-4, the Cenos project is located in the Central North Sea, in relation to other proposed and actual North Sea windfarms.

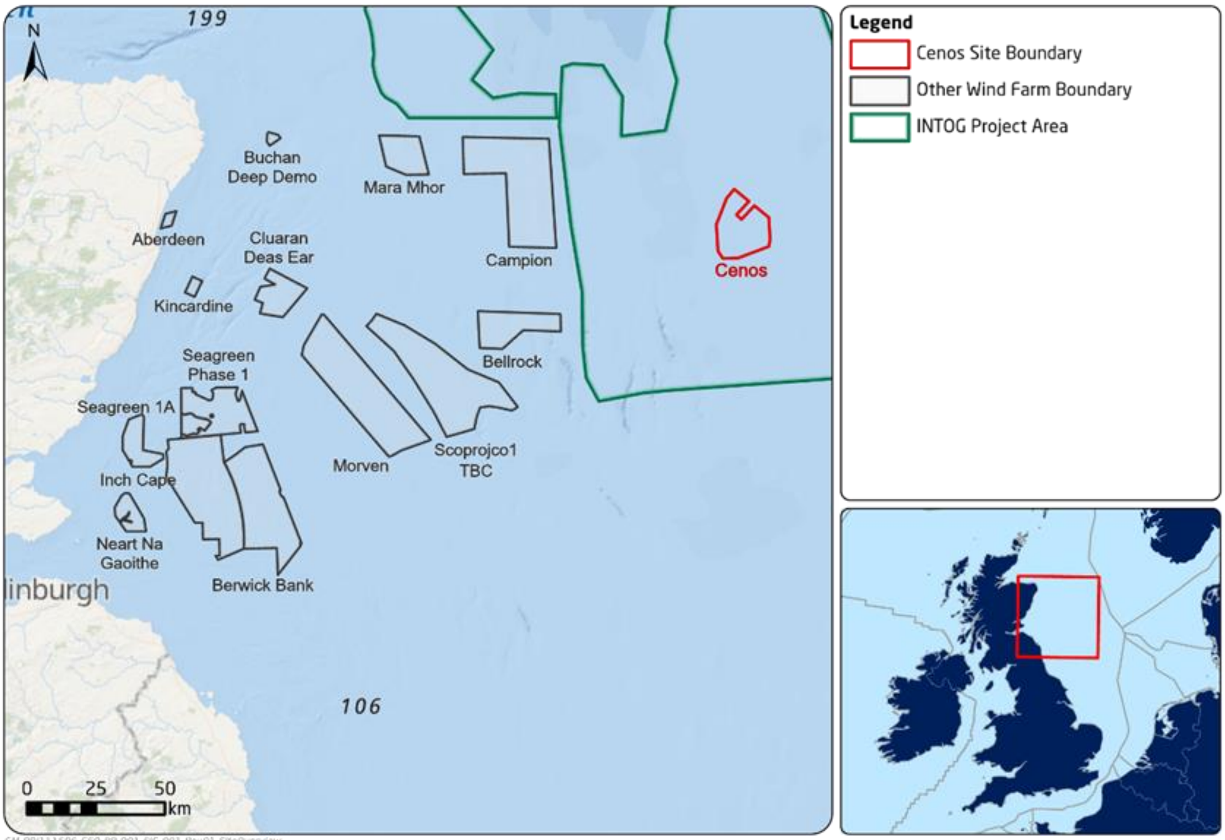


Figure 2-4: INTOG Lease Site Location

The wind farm area is bound by the coordinates provided in Table 2-1 and shown on Figure 2-3.

Table 2-1: Cenos Wind Farm Area Bounding Coordinates.

Latitude (D, DM)	Longitude (D, DM)	Easting (m) [UTM Zone 31 N]	Northing (m) UTM Zone 31 N]
57º15.141'N	01º24.138'W	403606.0995	6346607.811
57º12.585'N	01º29.185'W	408575.2963	6341750.573
57º10.126'N	01º24.371'W	403622.3300	6337299.568
57º9.145'N	01º26.070'W	405293.3592	6335440.089
57º11.662'N	01º31.002'W	410366.8394	6339999.395
57º9.167'N	01º35.907'W	415211.4039	6335263.981
57º4.853'N	01º35.816'W	414955.0042	6327264.469
57º3.541'N	01º35.251'W	414334.3166	6324840.988
57º1.679'N	01º24.023'W	402904.6451	6321638.414
57º1.790'N	01º18.496'W	397318.9324	6321979.403
57º3.230'N	01º16.945'W	395817.2484	6324689.669

Latitude (D, DM)	Longitude (D, DM)	Easting (m) [UTM Zone 31 N]	Northing (m) UTM Zone 31 N]
57º8.444’N	01º16.945’W	396061.4259	6334359.858
57º13.403’N	01º21.151’W	400524.9720	6343455.664

The Cenos wind farm is located on flat seabed, with gradients below 2°, in water depths ranging from 90 to 101 m below Lowest Astronomical Tide as shown in Figure 2-5 (note that the Banff oil field has now entered full decommissioning and the two Floating Production Storage and Offloading vessels (FPSOs) attached to this development have been removed from site).

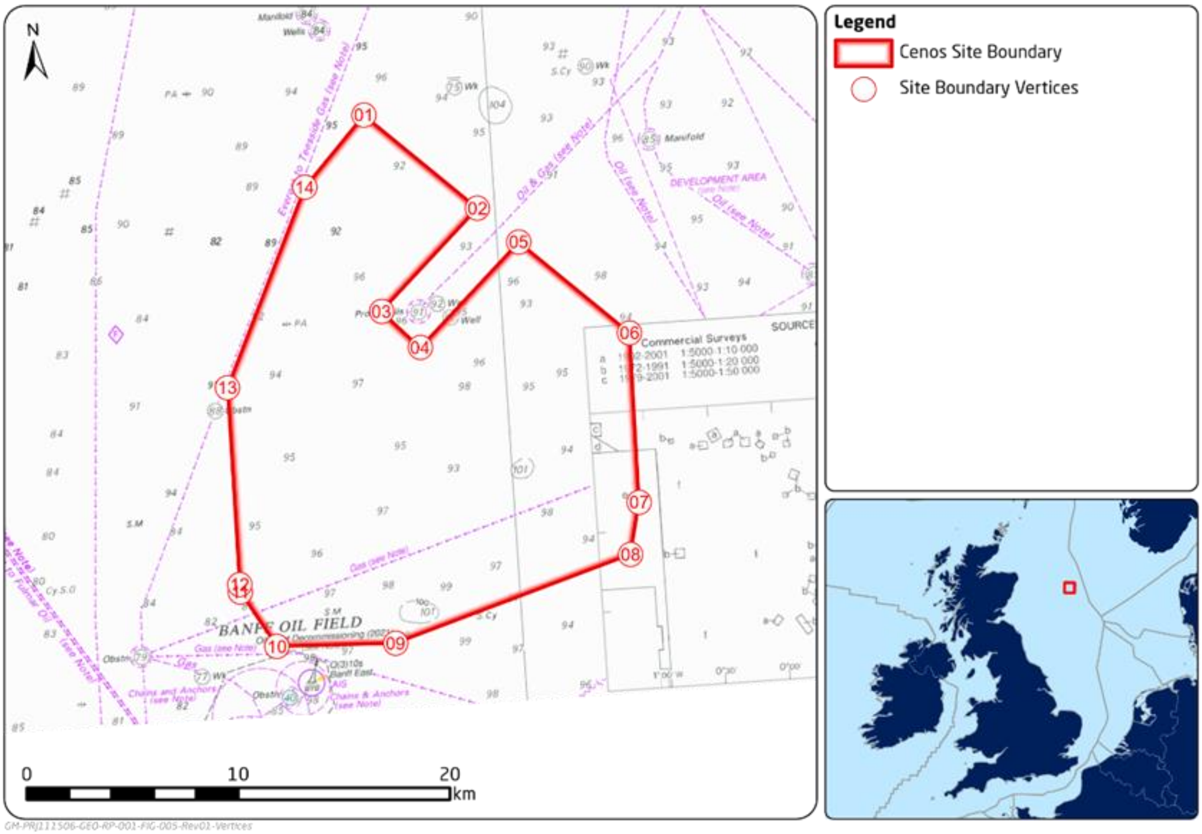


Figure 2-5: Cenos Location and Water Depths.

Table 2-2 provides an overview of the site.

Table 2-2 Site design envelope.

Parameter	Current assumed values
Project Area	333 km^2
Water depth	90-101m
Distance to shore from closest turbine	185 km
Mean Wind Speed	10.98 m/s

2.4 Design Envelope Approach

The Design Envelope approach (also known as the 'Rochdale Envelope' approach) will be adopted for the proposed Cenos offshore wind farm assessment, in accordance with the latest Marine Scotland published guidelines on using the design envelope approach for applications under S.36 of the Electricity Act 1989 (Marine Scotland, 2022).

The proposed Cenos offshore wind farm design envelope will provide maximum and minimum parameters where appropriate to ensure that the worst-case scenario can be quantified and assessed in the EIA. The project description, including the design envelope, is detailed here to provide an overview of proposed infrastructure of Cenos offshore wind farm. It is however, noted that the design is at a very early stage and hence, the envelope is likely to be refined or amended further prior to EIA being completed.

2.5 Cenos Infrastructure

Due to the water depths in the proposed Project area being in excess of 90 m, fixed bottom foundations are not a viable solution for the construction and installation of offshore wind turbines. Therefore, the wind turbines will be installed on floating substructures which are connected by mooring lines to anchors in the seabed used to hold position. There are a number of substructures, mooring and anchor design options available that are currently under consideration. These are included within the design envelope and discussed below.

Electricity from each wind turbine will be exported via array cables to the offshore electricity hub which will be located on a bottom fixed platform. Floating wind turbines will be connected by array cables in series or "strings" of four to six before connecting into the offshore electricity hub. Electricity will be transferred from the offshore electricity hub either to an oil and gas platform via a dedicated static subsea AC power cable, or back to shore via DC cables. The DC cables to shore will also facilitate the supply of power from land to the offshore electricity hub, wind turbines, and oil and gas platforms when required. Each component of the windfarm is described in more detail within this section.

It is noted that throughout the project lifecycle appropriate marker buoys and lighting to meet the requirements of the Civil Aviation Authority (CAA) and the Maritime and Coastguard Agency (MCA) will be installed.

2.5.1 Turbines

The wind turbine supplier has not been selected yet and hence specific wind turbine details cannot be provided at this point. It is also noted that turbine capacity continues to increase over time and turbines in the region of 15 MW to 20 MW are likely to be available by the time the project is deployed. Higher capacity wind turbines are preferred as this reduces the number of units required to meet the overall windfarm capacity. Table 2-3 provides the design envelope for the turbines, note heights are given from the top of the substructure, hence the height above water will be determined by the substructure utilised as discussed in Section 2.5.2.

Table 2-3: Turbine Design Envelope

Type/Option	Design Envelope
Individual Turbine Capacity	15 MW–20 MW per turbine
Development Size	70 to 100 turbines
Operational wind speed	3.5 m/s-30 m/s
Expected Rotor Blade Diameter	220 m–330 m*
Blade width	< 15 m
Turbine Hub Height (to centreline of hub)	132 m to 187 m
Maximum Blade Tip Height	242 m to 352 m

Type/Option	Design Envelope
Minimum Blade Clearance from Blade Tip to Sea	22 m**

*Some figures are anticipated based on scaling or other engineering methods

**Catenary moorings will maintain a fixed clearance and non-catenary moorings will be designed to maintain the necessary blade clearance as per met ocean design conditions

2.5.2 Substructure

A floating substructure will support each of the wind turbines. Floating substructures are a developing technology, and the Project team is currently reviewing several proven designs which could be suitable for the proposed offshore wind farm.

Figure 2-6 provides an illustration of the four main substructure categories available:

- Tension Leg Platforms (TLP) - a vertically moored floating structure consists of columns and pontoons. The vertical tensioned tendons provide stability to the structure (Du, 2021).
- Semi-submersible - a type of floating wind foundation that is semi-submerged to provide station keeping and stability. Semi-submersibles typically consist of multiple columns and pontoons. The columns mainly provide the stability, while pontoons provide additional buoyancy (Du, 2021).
- Spar - large diameter vertical buoyant cylinder ballasted (at the bottom end) with a deep draft, which makes the structure less responsive to wind, wave and current (Du, 2021).
- Barge - a floating platform that has a large surface area in contact with the water, which gives it stability (Iberdrola, n.d.).

Table 2-4 provides the design envelope for the floating substructures.

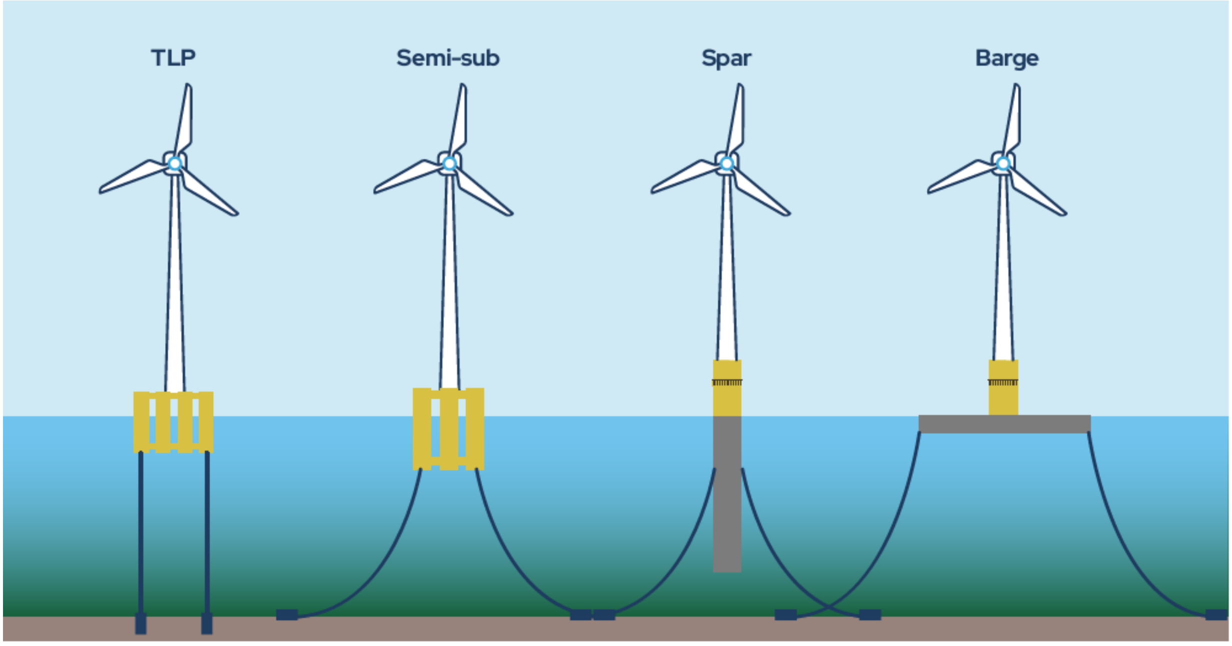


Figure 2-6: Substructure Technologies.

Table 2--4: Floating substructure design envelope.

Type/Option	Design Envelope
Substructure Type	Semi-submersible, barge, spar, or tension leg platform
Elevation Above Waterline	12 m to 30 m
Geometry	Equilateral 3 or 4 sided

Type/Option	Design Envelope
Approximate Weight	2,000 Te–20,000 Te
Horizontal Face Length	Circa 10 0m
Diameter of Vertical Columns (N/A to barge type)	Circa 14 m
Access Points	Two boat-landings
Primary Material	Metal or Concrete
Number of Mooring Points	Up to 6-point mooring

2.5.3 Mooring Systems

Floating substructures require attachment to the seabed by moorings systems to maintain position. A mooring system includes sections of chain and/or polymer rope (mooring lines), associated connectors (jewellery) on the substructure and anchors, terminated with an anchor, pile or gravity base (collectively referred to as anchors in this document) to fix the structure to the seabed. Compatible mooring system designs will be a key consideration when selecting a substructure design. The mooring system must be suitable for the applicable design loads whilst ideally minimising the number of lines and attachment points to the seabed. The mooring system designs under consideration: catenary, taut, semi-taut and tension leg (for TLP substructures only). All four mooring system types will be considered during the design process, these have been included in the design envelope to ensure all potential options and alternatives are taken account.

Catenary mooring lines consist of heavy chain forming a catenary shape through the water column with a long line of chain resting on the seabed typically terminated with a drag anchor. The substructure is held in position due to the suspended weight of the mooring lines, the deeper the water the longer the mooring lines need to be. More extreme excursions are prevented by the resisting force of the seabed chain and anchors. The expected mooring lines radius for the turbines in the 90 to 101 m water depth based on a catenary set up, is likely to be less than 1 km. The mooring line would be a combination of synthetic line and steel anchor chain as detailed in Figure 2-7.

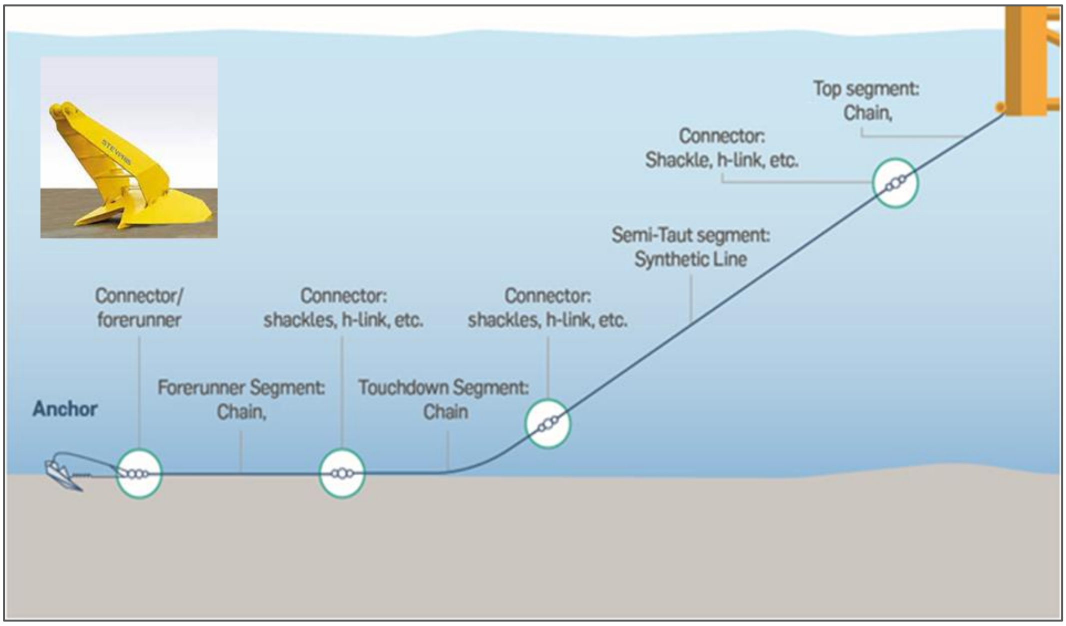


Figure 2-7: Elevation Sketch of Typical Catenary Mooring System. Insert - Drag Embedment Anchor (18 Te Stevpris Mk 6).

Taut mooring systems have mooring line running directly from the anchor to the substructure, the lines are typically at a 30-to-40-degree angle to the seabed (Figure 2-8). The mooring lines are typically polymer ropes that arranged around the substructure and are pre-tensioned. Each line provides a restorative force which keeps the substructure in place. The anchors are subject to both horizontal and vertical forces in this instance.

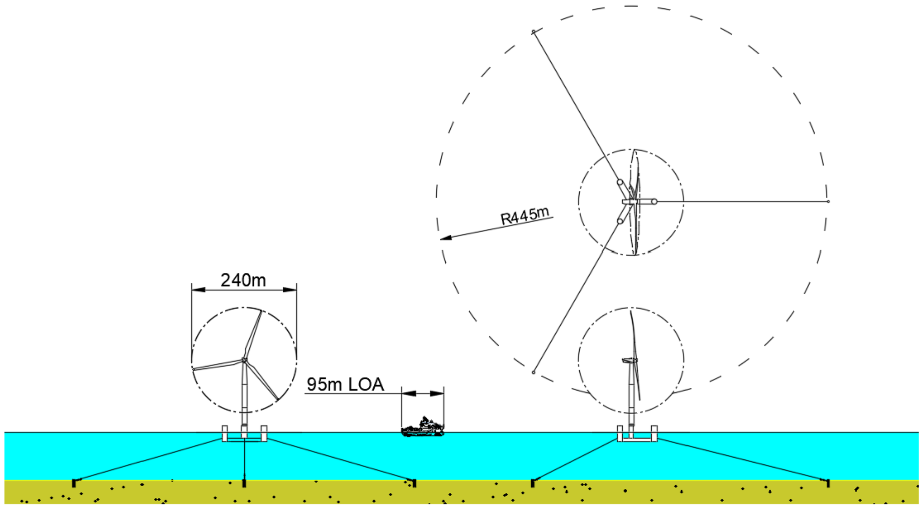


Figure 2-8: Sketch of Typical Taught Mooring System.

Semi-taut mooring systems use a combination of taut and catenary moorings. This arrangement allows for shorter mooring lines and hence less seafloor spread than a pure catenary system.

Catenary, taut and semi-taut systems are compatible with semi-submersible, spar and barge substructure designs.

TLP substructure requires a specific mooring system, which runs vertically from the substructure to the seabed (Figure 2-9). As opposed to mooring lines, tension mooring systems utilise tendons, these need to be stiffer than ropes or chains and are typically steel tubes. The tension limits the horizontal movement of the substructure.

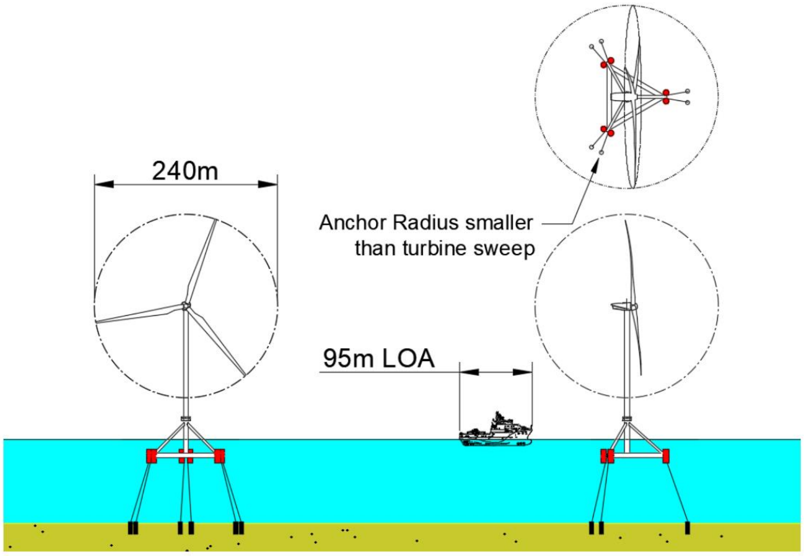


Figure 2-9: Sketch of Typical TLP Mooring System

Various anchorage types can be utilised within the mooring systems: drag embedment anchors, torpedo anchors, gravity-based anchors, suction piles and suction embedded plat anchors.

Drag-embedment anchors as shown in Figure 2-7, are designed to penetrate the seabed and are most suitable for catenary mooring systems as the horizontal forces pull the anchors into the seabed. The design of the anchors must consider the seabed substrates present as the holding capacity is generated by the resistance of the sediments in front of the anchor (American Bureau of Shipping, 2018).

Torpedo anchors are long narrow shafts with a conical tip and can have fins, also known as flukes, which increase the surface contact between the anchor and the surrounding sediments. Torpedo anchors are dropped vertically into the seabed utilising their own weight to produce the driving energy. The design in terms of length, weight and need for flukes is dependent on the sediment types present and loading factors required. As the torpedo can become entirely buried under the seabed, a chain is attached to the top of the torpedo prior to deployment, to allow mooring lines to be connected to the anchor. Torpedo anchors are particularly useful for taut and semi-taut systems (Aguiar et al, 2013).

Gravity-based anchors are simply a heavy item which sits on the seabed that mooring lines can be attached. Thus gravity-based anchors are not sensitive to the seabed substrates present, although they may settle into softer sediments under their own weight. Gravity-based anchors can take the form of a concrete cube sized to achieve the required forces, they can cope with high vertical forces and horizontal forces and can be utilised for all the mooring system types being considered.

Suction piles are tubular piles with a top cap and controllable valve. They are lowered to the seafloor, open end first, they sink into the seabed under their own weight (with the valve open) to around 60 % of their length, final embedment is achieved by suction, the water trapped in the top of the pile is pumped out, lowering the rest of the pile into the seabed. In addition to being suitable for use in anchorage systems they can also be utilised in the installation of the offshore electricity hub jacket (see Section 2.5.5).

Suction Embedded Plate Anchors, utilise the suction technology associated with the suction piles to install a plate anchor deep within the seabed, the suction pile part is removed and reused to install further plate anchors. The plates are held in place by the friction of the sediments above them similar to a drag anchor, but as they are installed much deeper in the seabed, a much smaller anchors can be used to provide the same strength (Acteon, 2022).

Most anchor types are sensitive to seabed soil conditions and hence the final anchor type cannot be validated until geotechnical surveys are complete to verify and quantify the seabed soil conditions.

The number of mooring lines and anchors in a system and their configuration will be determined as part of the mooring system design, however typically 3 to 6 are used per substructure. For the purposes of providing a conservative initial mooring design envelope, 6 mooring lines per substructure have been assumed. Table 2-5 summarises the mooring system design envelope.

Table 2-5: Mooring System Design Envelope.

Type/Option	Design Envelope
Number of Mooring lines/Anchors substructure	3 to 6
Mooring Type	Catenary, taut or semi-taut for a semi-submersible, spar or barge substructure Tendons for a TLP substructure
Anchor Type	Options include drag embedment anchors, torpedo anchors, gravity-based anchors, suction piles, and suction embedded plate anchors.
Mooring Lines	Mooring chain, steel mooring cables, polyester mooring lines
Maximum Mooring Line Radius	1,000 m

2.5.4 Inter Array Cables

Inter Arrays Cables (IACs) are required to allow power to be supplied to wind turbines during start-up, for power generated by turbines to be exported, and to facilitate communications to allow turbine operations to be monitored and controlled. IACs are AC cables that include all three electrical conductors (one per phase) and a fibreoptic cable; for communication purposes. All 3 conductors and the fibre optic cable are housed within a single insulated armoured sub marine (Figure 2-10). The IACs connect the wind turbines to the offshore electricity hub, they are typically installed from one turbine to its neighbour, forming a string (collection circuit) feeding the offshore electricity hub. The proposed Cenos offshore wind farm will consist of up to 100 floating turbines, each arranged within electrical strings of four to six units. As the IACs connect to floating substructures that are moving position continuously, dynamic rated IACs will be used. 66 kV dynamic AC cables will be qualified and available in time for the Cenos development.

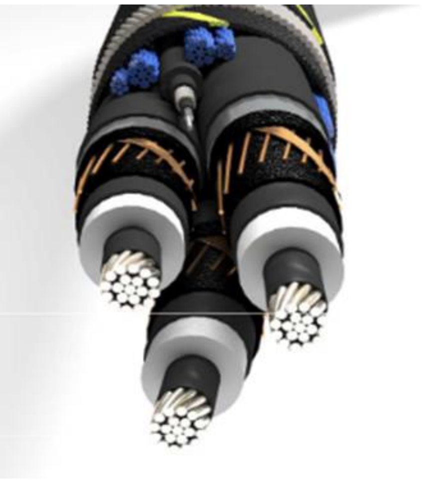


Figure 2-10: Typical IAC Cross Section.

Typically, the wind farm layout will be in a hub and spoke arrangement with the offshore electricity hub in the centre of the windfarm and strings of 4-6 wind turbines entering the hub radially (the spokes). This approach minimises the total length of IAC required and overall seabed footprint of the wind farm. The final arrangement of the wind turbines and array cables is determined through detailed analysis which includes consideration for wind turbine yield, IAC length, avoiding seabed constrains and other site constraints.

The dynamic portion of the IAC starts at the substructure and is configured in a catenary through the water column, usually a “lazy-s” shape down to the touch down point on the seabed. The catenary allows for motion between the fixed point on the seabed and the moving substructure to be absorbed by the cable with minimal forces. In order to achieve the catenary, the cable will be fitted with ancillary items such as buoyancy modules and hold back tether(s). The hold back tether holds the bottom portion of the cable on the seabed using a clump weight, suction pile or similar. To protect the cable portion entering or exiting the substructure typically an I-tube is used from surface to the bottom of the substructure. The I-tube is a steel pipe that protects the cable from both physical impact and wave and current induced forces. At the bottom of the I-tube there may be a requirement for a bend stiffener component to prevent the cable from over bending around the I-tube foot. For the static portions of the IACs on the seabed the depth of burial (DoB) required to ensure cables are protected is determined by a cable burial risk assessment, which considers the risks of damage to the cable, for example from anchors or fishing activities, and the seabed substrate present. The preference is to bury cables wherever practicable, but rock placement will be required for asset crossings and where DoB cannot be achieved.

Table 2-6 provides a summary of the expected design envelope for the inter-array cables.

Table 2-6: Inter-array cables design envelope.

Parameter	Design Envelope
Number of IACs	Up to 100 IAC
Length per IAC connecting wind turbines	1.6 km to 2.2 km
Number of wind turbines per IAC string	4 to 6
Total length of all IAC (max)	Up to 360 km
Total length of IAC run on the seabed	Up to 300 km

IAC Outer Diameter	~220 mm
Rated Capacity	66 kV
Internal Components	Three phase AC and fibre optic
External components (ancillaries)	Buoyancy modules, hold back tethers
Protective systems	I-tubes, bend stiffeners, steel protective structures and burial

2.5.5 Offshore Electrical Hub

A single offshore platform will be required to act as the electrical hub for the Cenos offshore wind farm. This will likely be supported on a fixed jacket structure which will provide the marshalling point for the 66 kV IAC feeders from the wind farm, 66 kV busbar, 66 kV offtake cables to oil and gas platforms, 66 kV to 320 kV voltage transformer and AC to DC voltage converter for power export to the UK grid. The offshore electrical hub will convert AC to DC power and vice versa to allow export and import of power from shore. The hub will also provide relevant metering of power to/from the oil and gas installations and to/from the onshore grid connection point.

Table 2-7 presents the expected offshore electrical hub parameters under consideration. The hub platform will be modular with a ~12,000 Te topside module and 12,000 Te 4 leg steel jacket. Each leg will be pinned into the sea by up to three piles to hold it in position.

Table 2--7: Offshore Electricity Hub Envelope.

Parameter	Design Envelope
Topside Dimensions (length x width x height)	70 m x 35 m x 32 m
Structure Type	Steel Jacket (x 1)
Topsides Weight	12,000 Te
Jacket Weight	12,000 Te
Jacket Height	122 m above seabed approximately 22m above chart datum (CD)
Pin Piles	Up to 12 (3 per leg)
Pin Pile Diameter	3 m per pile

2.5.6 Cables to Oil & Gas Platforms

Cables will provide AC power and communications from the offshore electricity hub to the oil and gas platforms. The platforms to be connected have not all be identified yet and hence neither have the cable routes. The potential impacts associated with cable installation, operation and decommissioning have been considered throughout this document and shall be considered within the EIA. Where available the specific routes will be considered within the EIA, where not available the cables to the platforms will be considered in general terms. The cable routing within the windfarm boundary will take into account the wind turbine and IAC locations, noting that suitable space will be required to allow access to the cables to facilitate maintenance in the event of damage. Seabed conditions will also inform the cable routing.

Cables routing out with the wind farm will take account of a range of environmental and infrastructure restraints, to minimise environmental impacts and asset crossings. A summary of the design envelope is provided in Table 2-8.

Table 2-8: Oil and Gas Platform Cables Design Envelope

Parameter	Design Envelope
Number	Up to 10
Length (max)	Up to 100 km each
Max Cable Outer Diameter	250 mm
Rated Capacity	66 kV
Components	Three phase AC and Fibre optic

2.5.7 Cables to NorthConnect Corridor

As discussed in Section 1.2 the cable from the offshore electricity hub to shore will partially utilise the NorthConnect Cable interconnector corridor and onshore cable routes and infrastructure. Initial cable route options between the offshore electricity hub and the NorthConnect cable corridor have been considered, this has resulted in three routes being taken forward for further consideration as shown by on Figure 2-11.

The corridors have been designed taking account of available data to:

- Minimise cable route length as far as practicable;
- Minimise the number of cable, pipeline, oil and gas lease area crossings;
- Avoid oil and gas assets including a safety exclusion zone;
- Avoid offshore wind energy plan areas;
- Avoid known wreck locations;
- Avoid all designated sites excluding the East of Montrose and Gannet Fields NCMPA which the wind farm is located within; and
- To provide synergy with a conceptual future export cable to Norway.

Route A is the longest of the three options but utilises more of the consented NorthConnect corridor which is well surveyed and understood. Route B and B1 utilise the NorthConnect cable corridor within 12 nm before making a more direct route and hence shorter route towards the Ceno offshore electrical hub. Route B and B1 run to the north and south of a pipeline in the gap between the two windfarm lease blocks INTOG E-b and E2 (see Figure 2-11).

The routes have been reviewed in consideration of seabed substrate and topography, shipping and navigation and the ability to tie-in to the converter station at landfall and the Cenos wind farm offshore electricity hub. No known significant issues or roadblocks were identified during this assessment. Additional tasks have been identified to allow a preferred route to be identified for consideration within the EIA. The route selection optioneering results will be presented in the EIA.

NorthConnect has UK consents which were subject to EIA and hence cables within the NorthConnect corridor and the associated NorthConnect infrastructure to be utilised by Cenos are only considered with regard to cumulative effects.

Figure 2-11: Cable to Shore Corridor

2.5.8 LiDAR and Wave Buoys

Floating, buoy mounted wave and Light Detection and Ranging (LiDAR) devices are proposed to be deployed within the proposed Cenos offshore wind farm area for the measurement of wind speeds and other metocean data, including:

- Atmospheric temperature and pressure;
- Water temperature and conductivity;
- Waves; and
- Current speed and direction.

Catenary moorings with gravity anchors to the seabed will be used to maintain these devices in position. It is noted that these may be installed during the project development stage and hence may be considered as part of a separate marine licence application but have been included here for completeness.

2.6 Cenos Project Timeline

The overarching aim of Cenos is to decarbonise the production of offshore oil and gas fields from the earliest possible time point. The proposed Cenos offshore wind farm project timeline shown in Figure 2-12 has been designed around this overarching aim and considered and addressed a number of constraints, which are summarised below:

1. The primary business case for execution of offshore Cenos wind farm rests upon its ability to remove CO_2 emissions produced by power generation from offshore oil and gas facilities, and to eliminate these emissions from the earliest possible time point, accelerating the UK's journey towards Net Zero emissions and the goals of the North Sea Transition Deal.
2. Oil and gas facilities have a limited lifetime and any delay to project completion impacts both the ability to mitigate emissions and the business case for completion ahead of eventual oil and gas decommissioning.
3. Floating wind is a developing technology with huge potential for the UK. His Majesty's (HM) Government has announced a target for 50 GW offshore floating wind installation by 2030 (HM Government, 2022) and the proposed Cenos offshore wind farm contribution towards this target, building UK experience and driving down the cost of future offshore floating wind.
4. In order to meet the criteria for the Contract for Difference (CfD) scheme in 2025, Cenos requires prior Consent for construction to be obtained from Marine Scotland.
5. To have the required documentation (e.g., EIA Report, Pre-application Consultation (PAC) report, etc) presented for submission in December 2023.
6. Installation of all the turbines will take two to three years, hence, the intent is to commission turbines at the earliest opportunity to allow first power to be exported prior to full wind farm completion.

Task	2023	2024	2025	2026	2027	2028	2029	2030
EIA Scoping	■							
EIA Preparation & Submission	■							
Consent Award		■						
CfD Application & Award			■					
FID				■				
Manufacturing				■	■	■	■	

Task	2023	2024	2025	2026	2027	2028	2029	2030
Construction					■	■	■	■
First Power to Platforms						■		
Wind Farm Complete								■

Figure 2--12: Indicative schedule for the proposed project.

2.7 Lifecycle

2.7.1 Construction

The three elements requiring installation are:

- The floating wind turbines including the mooring systems, substructure and turbines;
- The offshore electricity hub; and
- The cables: between turbines (IAC), to the oil and gas platforms and the connection to the NorthConnect cable corridor.

The nearshore and onshore elements of the electrical systems namely the DC cabling within the NorthConnect corridor, cable landfall, onshore cabling and onshore converter station with AC connection to Peterhead substation have already been consented, the Marine Licence application was accompanied by a Construction Method Statement (NorthConnect, 2018a). Hence the installation of that section of the cable is not discussed further here.

Initial onshore fabrication will start, following the project Final Investment Decision (FID) process. Onshore and offshore construction will start the following year and is likely to take three years, with the bulk of the works avoiding the winter periods. The wind turbines installation order will be by IAC string with each string of four to six turbines installed in the same campaign to facilitate prompt electrical connects to the offshore electricity hub to allow them to be fully tested and commissioning, prior to energy production and export.

Installing complete strings will allow energy from installed turbines to be utilised prior to all the turbines being installed. Hence, Cenos will produce power to help to decarbonisation of oil and gas supply at the earliest opportunity.

Throughout the construction phase and, subject to discussions with the MCA and other stakeholders, navigational marker buoys may be required to identify the location of the site boundaries or to provide warnings regarding the existence of temporary facilities under the seabed. These temporary measures may be replaced by permanent markings in accordance with agreed requirements, for the lifetime of the project. Additionally, guard boats may be required during some construction phase, and it would be expected that fishing vessels of appropriate classes could be repurposed for this activity.

2.7.1.1 Floating Wind Turbines

The mooring systems will be installed with marked buoys defining their locations prior to the delivery of their floating wind turbine, which will be towed to the development site from a suitable construction port that has not been confirmed currently. The preinstallation of the mooring system allows the floating wind turbines to arrive on location and rapidly installed on location using the pre-installed mooring system. The installation method is specific to the anchor type chosen, as described in Section 2.5.3. There may be a need for pre-tensioning of mooring lines depending on the system being employed. Mooring lines would be buoyed off temporarily, for later recovery and attachment to the wind turbine substructure following its arrival on site.

Substructures and turbines are typically fabricated separately, potentially at different locations. The turbines can be installed onto the substructures at a port location near to the windfarm. After pre-commissioning checks the fully assembled unit will be towed out to windfarm site and hooked up to pre-laid moorings. The practicalities of connecting the turbines to the mooring systems will be determined by the substructure and mooring systems utilised.

Wind turbines will be connected to the IACs as soon as practicable to allow them to be fully checked, commissioned prior to operation.

2.7.1.2 Offshore Electricity Hub

The offshore electricity hub jacket will be loaded in harbour onto a vessel and taken to the Cenos site. It will be launched from the vessel and placed into position by a crane. Piles will then be installed to hold it in place. The specifics of the piles will be determined by the local geology, traditional piling methods including vibration and percussion piling may be utilised. Alternatively suction piles may be utilised as described in Section 2.5.3. Once the jacket is piled into position the topside will be delivered by vessel and lifted by cranes onto the jacket and secured into position to allow it to be commissioned. Once in place cable connects can start to be made, to bring the systems online.

2.7.1.3 Cable Installation

Various cable installation techniques are available, their suitability's are determined by the substrates present and depth of burial required. Hence, at this stage no specific technique is proposed. Options available:

- Pre-lay trenching (with and without active back fill) – using a plough to create a trench for the cable to be placed into. It can then be left to naturally back fill, or the plough can be used to push material back into the trench.
- Post-lay jet trenching – where the seabed under the cable is fluidised to allow the cable to sink into the seabed.

Where cables cannot be buried due to hard substrates or existing infrastructure (pipelines, cables) protection in the form of rock or concrete matrices can be placed on top of the cables. This is not preferred but cannot be ruled out at this stage.

2.7.2 Operation and Maintenance

Once fully operational Cenos will supply power to the oil and gas assets and to the national grid. The offshore wind farm will be managed, monitored and operated from an onshore facility which will have remote access to the offshore electricity hub and individual wind turbines, such that it can control which turbines are operational and monitor their efficiency.

During the operational period, scheduled and unscheduled monitoring and maintenance of offshore infrastructure will be required. During the project life, it is likely that some refurbishment or replacement of offshore infrastructure will be required. All offshore infrastructure, including turbines, floating substructures, cables and offshore platforms will be included in monitoring and maintenance programmes.

Maintenance can be generally separated into three categories:

- Planned maintenance: Servicing of components in line with the maintenance schedule, which will take account of the lifespan of the various components such that they are replaced prior to failure. It will be including inspection and testing, fluid (oils and hydraulics) top-ups and part refurbishment/replacement.
- Unplanned maintenance: this applies to defects occurring that require rectification out with the planned maintenance periods. The scope of such maintenance would range from small defects on non-critical systems to failure or breakdown of main components potentially requiring them to be repaired or replaced.
- Periodic overhauls: these will be carried out in accordance with equipment manufacturer's warranty and specifications.

Planned maintenance activities and the majority of unplanned maintenance activities will be carried out in situ. Owing to the number of turbines, it is anticipated that planned maintenance activities will be ongoing approximately 7 to 9 months a year in the spring to autumn months when the weather is likely to be more favourable, offering an increased maintenance window. Due to the distance from shore onsite maintenance, will be carried out from a maintenance vessel stationed in the wind farm, which will return to port for crew change and resupply every two or three weeks. The ability to attend site in the winter months for unplanned maintenance will be retained.

In the case of periodic overhauls and major breakdowns, the floating wind turbine will be decoupled from the IAC and mooring system and towed back to shore for maintenance in port. The mooring lines will be attached to a buoy so that when the turbine is ready it can be reinstalled on the same mooring and cables reconnected.

Inspections of subsea cables and mooring systems will be performed on a periodic basis, using subsea survey techniques as required.

The CES lease for the proposed Cenos offshore wind farm will likely be for 50 years, with the design life of the turbines and other components of the wind farm being of a similar period of time when repowering will be considered.

The term 'operational' used throughout the remainder of this Scoping Report, refers to both operation and maintenance activities undertaken during the operational phase of the project.

2.7.3 Decommissioning

Decommissioning requirements are set out in the Energy Act 2004 (as amended) and latest Decommissioning of Offshore Renewable Energy Installation Guidance (Scottish Government, 2022e). These will influence all design of the proposed Cenos offshore wind farm. This will be a key requirement under the CES lease agreement.

A Decommissioning Programme will be prepared prior to construction, in line with the requirements of the Energy Act 2004 (as amended). However, for the purpose of this Scoping Report, the following has been assumed: floating substructures components would be removed, where practicable, with mooring lines, and anchors removed, if not possible they will be cut as low as possible in the seabed and left in situ. Similarly cables no longer required will be removed where safe to do so, where they cross live assets, they may be cut and left in situ to prevent damage to other infrastructure. The offshore electricity hub will also be decommissioned with the topside being removed and brought to shore, the piles holding the jacket in place will be cut as low as possible to allow the jacket to also be brought to shore for decommissioning.

If any of the infrastructure: moorings, cabling or offshore electricity hub are suitable for repowering then they will be retained for reuse in the updated system. All materials brought to shore will be decommissioned and waste managed in accordance with the waste hierarchy i.e., reused or recycled rather than disposed of to land.

The approach to decommissioning, including cable decommissioning, will be reviewed as part of the Decommissioning Programme. It is expected that decommissioning will require similar vessels to those used in construction and take a similar period of time.

The detail and scope of the decommissioning works will be determined by the relevant legislation and guidance at the time of decommissioning and agreed with the regulator.

3 Policy & Legislative Context

The key objective of the proposed Cenos offshore wind farm development is to enable the electrification and decarbonisation of a cluster of oil and gas installations in the central North Sea, and to export excess power for onshore use. The requirement for the project is embedded in the UK and Scotland's international obligations, national and regional policy and domestic legislation.

The UK and Scottish Governments are committed to reducing GHG emissions in line with both international treaties and domestic legislation. The Climate Change Act (2008) (as amended) and The Climate Change (Scotland) Act 2009 (as amended) commit the UK and Scottish Governments to achieving Net Zero GHG emissions by 2050 and 2045 respectively (versus a 1990 baseline).

Scotland has the infrastructure, technical skills and political will to champion renewable energy as a means of reducing global CO_2 emissions, along with an abundant offshore wind resource. This chapter sets out the key policies and legislation of relevance to the proposed Cenos wind farm area.

3.1 International Policy Context

3.1.1 United Nations Framework Convention on Climate Change

The UK is a signatory to a number of United Nations Framework Convention on Climate Change (UNFCCC) agreements (UNFCCC, 2022) including:

- The Kyoto Protocol, transposed into the Climate Change Act 2008 (as amended), which committed the UK to achieving a net carbon account for the year 2050 to be 100 % lower than the 1990 baseline;
- In 2016, The Paris Agreement, a legally binding international treaty aims to limit global warming to below 2, preferably to 1.5 degrees Celsius, compared to pre-industrial levels. It requires countries to reach global peaking of GHG emissions as soon as possible to achieve a climate neutral world by mid-century; and
- The 2021 Glasgow Climate Pact in which parties agreed to intensify efforts to build climate change resilience, to curb GHG emissions and to provide the necessary finance for both.

3.2 UK and Scottish Policy and Legislative Context

3.2.1 North Sea Transition Deal

The North Sea Transition Deal recognises that the offshore oil and gas sector provides the UK with energy security and is an important part of the economy (BEIS & OGUK, 2021). The sector also has a key role to play in helping the UK to meet its Net Zero commitments (BEIS & OGUK, 2021). The UK Government and the upstream oil and gas industry are committed to working together to identify opportunities for electrification of offshore oil and gas installations.

The UK oil and gas industry, in partnership with the government, has committed to explicit reductions in Scope 1: Direct GHG emissions. Scope 1 emissions are those from ‘sources that are owned or controlled by the company’ as defined in the GHG Protocol (World Resources Institute, 2022). The North Sea Transition Deal commits the UK oil and gas industry to the following targets (against a 2018 baseline) (BEIS & OGUK, 2021):

- 10 % GHG reduction by 2025;
- 25 % GHG reduction by 2027; and
- 50 % GHG reduction by 2030.

3.2.2 Offshore Wind Sector Deal

The Offshore Wind Sector Deal is a deal between the government and the industry and seeks to build on the UK’s strong position as a market leader in offshore wind development and identify opportunities for collaboration with other industries such as the oil and gas sector via a series of investments and key commitments.

3.2.3 Scotland’s Emissions Reduction Targets

Scotland has its own targets to reduce GHG emissions, which are set out in the Climate Change (Emissions Reduction Targets) (Scotland) Act 2019. This Act aims to ensure Scotland contributes appropriately to the world’s efforts to deliver on the Paris Agreement. The Emissions Reduction Targets includes a reduction of all GHGs to net-zero by 2045 at the latest, with interim targets for reductions of at least 56 % by 2020, 75 % by 2030 and 90 % by 2040.

3.2.4 Offshore Wind Policy Statement

The Offshore Wind Policy Statement (Scottish Government, 2020b) sets out ambitions to optimise offshore wind development and the role this technology could play in meeting Scotland’s emissions reduction targets. The statement outlines that up to 11 GW of offshore wind capacity is possible in Scottish waters by 2030, the course for this delivery is set out by the Sectoral Marine Plan (SMP) and subsequent updates with the aim of maximising deployment in Scottish waters whilst protecting marine users and the environment.

The Scottish Government published a Draft Energy Strategy and Just Transition Plan in January 2023 which consults on a map of actions to achieve Net Zero. Section 3.1.1 of the draft discusses offshore wind, acknowledging that the 8-11 GW target as set out in the Offshore Wind Policy Statement may need to be reviewed in light of market ambition which exceeds current planning assumptions. The results of the 2022 ScotWind leasing round resulted in lease options signed by developers for a total of 27.6 GW (Scottish Government 2023).

The Draft Energy Strategy and Just Transition Plan also recognises that such developments in offshore wind will have an impact on biodiversity and users of the sea. Thus, the volume of development that can be consented will depend on what is feasible within environmental protection regulation and what is technologically achievable. It is expected that current leasing options are sufficient to meet short term ambitions.

The Iterative Plan Review (IPR) process of the Sectoral Marine Plan for Offshore Wind Energy will take place in 2023, and this will give a clearer picture of the scale of permitted development. The Scottish Government has also committed to revising Scotland's National Marine Plan (NMP; 2015) (detailed in Section 3.2.7) following the outcome of the earlier (2021) review. This new NMP will update the planning framework and help to facilitate sustainable delivery of offshore renewable energy (Scottish Government, 2023).

3.2.5 The Scottish Energy Strategy: The Future of Energy in Scotland

This Strategy sets out the Scottish Government 2050 vision for energy in Scotland, which is built around six priorities:

- Consumer engagement and protection;
- Innovative local energy systems;
- Energy efficiency;
- Renewable and low carbon solutions;
- System security and flexibility; and
- Oil and gas industry strengths.

The strategy also sets out two targets for the Scottish energy system by 2030:

- The equivalent of 50 % of energy for heat, transport and electricity are to be supplied from renewable sources.
- An increase by 30 % in the productivity of energy use across the economy.

Most significant to the Cenos project are the production of renewable energy, assisting with the security of supply both on and offshore, and supporting of investment, innovation and diversification across the oil and gas sector. In addition to strengthening the oil and gas sector by decarbonise their production (Scottish Government, 2017).

3.2.6 Marine Planning

3.2.6.1 Scotland's National Marine Plan

The National Marine Plan provides an overarching framework for all activities in Scottish waters, incorporating sustainable use of marine resources, protection of natural and cultural heritage, interactions between different users and climate change adaptation/mitigation. The plan covers both inshore waters (within 12nm) and offshore waters (12 to 200 nm) (Scottish Government, 2015a).

3.2.6.2 Sectoral Marine Plan for Offshore Wind Energy

Scotland is committed to ensuring secure, reliable and affordable energy supplies, within the context of long-term decarbonised energy generation. The Sectoral Marine Plan for Offshore Wind Energy (Scottish Government, 2020a) incorporates recent technological, policy, regulatory and market developments to form a new strategic planning process. It provides a spatial strategy to inform the seabed leasing process for commercial offshore wind energy in Scottish waters, thereby contributing to the achievement of Scottish and UK energy targets.

This Plan identifies 15 options across four regions which are capable of generating several gigawatts of renewable energy. There is the potential for up to 10 GW to be deployed to reflect the anticipated future demand and market appetite, exceeding the Scottish Offshore Wind Energy Council's (SOWEC) goal to deliver at least 8 GW of offshore wind in Scottish waters by 2030. The final Sectoral Marine Plan for Offshore Wind Energy will guide relevant consenting bodies with decision making on licence and consent applications but will not predetermine decision-making processes.

The Plan has been developed in accordance with the strategic aims of the National Marine Plan (Marine Scotland, 2015), which addresses the potential for interactions between renewable energy development and other marine users.

3.2.7 Innovation and Targeted Oil and Gas Decarbonisation (INTOG)

The Scottish Government has published an initial plan framework for the targeted decarbonisation of the offshore oil and gas industry, which will help to deliver the commitments made in the North Sea Transition Deal (Scottish Government, 2022a). INTOG has been designed by CES to allow developers to apply for the rights to build offshore wind farms specifically for the purpose of providing low carbon electricity to power oil and gas installations. INTOG will support the delivery of smaller (<100 MW) innovation projects as well as larger (>100 MW) projects that seek to support the decarbonisation of the oil and gas sector.

Floatation Energy applied for an Exclusivity Agreement to CES for the Cenos offshore wind farm as part of the first INTOG leasing round, which closed on the 18th November 2022. The final stages of the process are as follows:

- Offers of Exclusivity Agreements are expected to be made by the end of April 2023.
- Exclusivity Agreements will give exclusive access to the area in question whilst the planning processes are completed.

Successful projects must request a lease (which will give rights to construct and operate the wind farm) within the Option Period via an Option Notice.

- A final Option Agreement covering the awarded area will be proposed for those projects that are compatible with the adopted INTOG Plan and meet CES leasing requirements.
- Projects that progress through the planning process will still require the appropriate marine licences and S.36 consent under the Marine (Scotland) Act 2010 and the Electricity Act 1989, respectively.

3.3 Licencing and Consents

The proposed Cenos wind farm development will require the following key consents:

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

Compliance with the associated underpinning legislations is also required.

3.3.1 Section 36 Consent

As the Cenos wind farm will be an offshore renewable energy installation with a capacity >50 MW located in the Scottish Offshore Waters (between 12 nm and 200 nm from the Scottish Coastline) within the Scottish Renewable Energy Zone (REZ), it requires consent under S.36 of the Electricity Act 1989 (as amended). S.36 consent will allow for the installation, operation and maintenance of wind turbines and IACs associated with the generation of power by the proposed Cenos wind farm development.

3.3.2 Marine Licence

The Marine and Coastal Access Act 2009 (MCAA) (as amended) applies to Scottish waters out with the 12nm territorial limit. Under the MCAA a marine licence must be obtained prior to the construction, alteration, or improvement of any works, or depositing any object in or over the sea, or on or under the seabed. As such, the renewable energy installation (wind turbines, cables, offshore electricity hub and associated infrastructure) will be subject to marine licence.

Section 12 of the MCAA provides the Marine Management Organisation (delegated to Marine Scotland on behalf of Scottish Minister in Scottish Waters) the power to determine certain consents under S.36 of the Electricity Act 1989. Under Section 79 of the MCAA, where applications for both a marine licence under the MCAA and consent under S.36 of the Electricity Act 1989 are made and where the Scottish Ministers are the determining authority, they may issue a note to the applicant stating that both applications will be subject to the same administrative procedure. In this case, the two related applications may be considered at the same time.

As the specific oil and gas platforms to be connected and hence routes to them may not be confirmed by the time the windfarm licence applications are ready, the cables to the platforms may be subject to separate licence applications. However, as discussed within Section 2.5.6, they will be considered as far as practicable within the EIA to ensure that the potential environmental effects are understood.

3.4 Environmental Impact Assessment

The Electricity Works (EIA) (Scotland) Regulations 2017 apply to applications made under S.36 of the Electricity Act 1989. Similarly, applications under the MCAA fall under the Marine Works (EIA) Regulations 2007 (as amended). Developments falling under Schedule 2 or A2 of the regulations respectively could be subject to EIA if it is '*likely to have significant effects on the environment by virtue of factors such as its nature, size or location'.*

The Electricity Works (EIA) Regulations 2017 Schedule A includes in Paragraph 1(1) generating stations. While Schedule A2 paragraph 21 includes 'Installations for the harnessing of wind power for energy production (wind farms), hence under both sets of regulations an EIA could be required.

As discussed in Section 1, the scale and nature of the project and location within a NCMPA, significant effects cannot be ruled out at this stage. Floatation Energy decided not to request a screening opinion and instead have made the assumption that and EIA is required and hence, are requesting a Scoping opinion.

A Scoping Opinion is requested in accordance with Section 13 of the Marine Works (EIA) Regulations 2007 as amended and Section 12 of The Electricity Works (EIA) (Scotland) Regulations 2017.

3.5 Pre-application Consultation

Pre-Application Consultation (PAC) is a requirement to support a marine licence application for developments that meet certain criteria. Section 4 of the Marine Licensing (Pre-application Consultation) (Scotland) Regulations 2013 ("PAC Regs"), it lists 'prescribed classes' of activity to which the PAC Regulations apply for activity in the Scottish Inshore Region. However, there is no provision for PAC in the Marine and Coastal Access Act 2009, so these requirements do not apply to applications in the Scottish Offshore Region (Scottish Government, 2018). As the proposed Cenos project is beyond the 12nm limit, there is no formal requirement for a PAC process.

The benefits of early engagement and discussion with statutory consultees and wider stakeholder groups are however, well understood by Floatation Energy and as such a stakeholder management plan is being developed to ensure appropriate informal engagement is undertaken pre-application.

3.5.1 Engagement to Date

Flotation Energy has engaged in early discussions with Marine Scotland – Licensing Operations Team (MS-LOT), NatureScot and Joint Nature Conservation Committee (JNCC) to discuss the proposed wind farm and to support the development of this Offshore Scoping Report. In addition, the East of Gannet and Montrose Fields NCMPA has been specifically discussed as it is a known sensitivity, and it was recognised that JNCC held survey data that would add to the baseline understanding of the project.

3.5.2 Future Engagement

Flotation Energy is fully committed to a thorough engagement process with regulators, marine stakeholders and local communities. The aim of this engagement is to ensure that stakeholders are consulted and informed of developments during, and beyond, the EIA process for the proposed Cenos wind farm area.

To this end Flotation Energy is developing a Project Communications Plan that will guide stakeholder consultation for all phases of the project. Communications with statutory and non-statutory consultees, the public, fishing representatives, elected representatives and the media for the proposed Project will be co-ordinated by the Project team. The outcomes of consultation will be recorded in appropriate sections of the EIA Report.

3.6 Habitats Regulations

The Bern Convention on the Conservation of European Wildlife and Natural Habitats was ratified by the UK in 1982. The obligations under this convention are transposed into UK and Scottish law by:

- The Wildlife and Countryside Act 1981 (as amended); and
- The Nature Conservation (Scotland) Act 2004 (as amended).

In the European Union (EU) the requirements of the Bern Convention are met by the Nature Directives (primarily the Habitats Directive (92/43/EEC) and the Birds Directive (2009/147/EC)) which are transposed into UK law by:

- The Conservation (Natural Habitats &c.) Regulations 1994 (as amended);
- The Conservation of Habitats and Species Regulations 2017 (as amended); and
- The Conservation of Offshore Marine Habitats and Species Regulations 2017 (as amended).

These are retained in UK law as 'retained transposing regulations' by The Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019. The requirements of the EU Nature Directives therefore continue to apply, for instance in how Special Areas of Conservation (SACs), Special Protection Areas (SPAs), and European Protected Species (EPS) are designated and protected.

Where a plan or project that is not directly connected with, or necessary to the management of a European site or European marine site, but is likely to have a significant effect, either individually or in combination with other plans or projects, it shall be subject to appropriate assessment of its implications for the site in view of the site's conservation objectives.

EPS are animals and plants (species listed in Annex IV of the Habitats Directive) that are afforded protection under The Conservation (Natural Habitats, &c.) Regulations 1994 (as amended) and The Conservation of Offshore Marine Habitats and Species Regulations 2017. All cetaceans are EPS. If any activity is likely to cause disturbance or injury to an EPS a separate licence is required to undertake the activity legally.

3.7 Decommissioning

Sections 105 to 114 of the Energy Act 2004 (as amended by the Energy Act 2008 and the Scotland Act 2016) (hereafter referred to as the Energy Act) contain statutory requirements in relation to the decommissioning of Offshore Renewable Energy Installations (OREI) and their related electric cables. Under the terms of the Energy Act, Scottish Ministers may require a person who is responsible for these installations or cables in Scottish Waters or in a Scottish part of a REZ to prepare (and carry out) a costed decommissioning programme for submission to and approval by Scottish Ministers (Scottish Government, 2019).

Scottish Ministers have the power to determine specific approaches to decommissioning, including stipulating what form, timing and size of financial securities are required. The expected content of a decommissioning programme includes decommissioning standards, financial security, residual liability, and industry cooperation and collaboration.

Marine Scotland has developed a guidance document for offshore renewable energy in Scottish waters on behalf of the Scottish Ministers that assists the persons responsible to understand their obligations under the Energy Act, including:

- The geographical scope of the decommissioning requirements as they apply in Scotland;
- The process for submitting, seeking approval for, reviewing and modifying a decommissioning programme;
- The expected content of decommissioning programmes;
- Decommissioning standards;
- Financial security; and
- Residual liability (Scottish Government, 2022b).

The guidance is applicable to the Cenos project as it is within the Scottish REZ, and hence will inform the scope of decommissioning considered within the EIA.

4 Approach to Scoping

The aim of this scoping report is to provide sufficient information to allow MS-LOT to provide a scoping opinion for the Cenos project. The approach taken is based on the Source – Pathway – Receptor model. An understanding of the sources of potential effects is provided in the form of the descriptions of the project infrastructure (see Section 2.5) and lifecycle phases (see Section 2.7). Receptors are identified for the relevant EIA topics in the form of the baseline descriptions provided within Sections 5 to 20. Potential impacts are then identified where there is a pathway linking a source to a receptor (Potential Impact sections in Sections 5 to 20). Where there is a Source - Pathway - Receptor linkage which could give rise to a potential effect, be that adverse or beneficial, consideration is given to whether, based on the information currently available, it could be significant in EIA terms. Where appropriate mitigation is proposed, this has been taken account of in the determination of whether a topic needs to be assessed. The proposed ways forward fall into three categories:

- Scoped-out: if potential effects, taking account of identified mitigation, are unlikely to be significant in EIA terms. These topics will not be considered further.

- Scoped-in: if potential effects, taking account of identified mitigation, are potentially significant in EIA terms. These topics will be taken forward for detailed consideration and significance assessment.
- Further consideration: where there is insufficient baseline information or project detail available to identify whether a significant impact could occur. The topic will therefore be taken forward for further consideration and discussed in the EIA, and thereafter if baseline or project detail identify potential significant effects then significance assessment will be undertaken.

The proposed assessments for topics scoped-in or taken forward for further consideration are detailed within each topic-specific Sections 5 to 20. Where mitigation has been utilised to 'Scope-out' a topic, it has been included within the Initial Schedule of Mitigation provided in Appendix B. The Initial Schedule of Mitigation will be taken forward into the EIA.

The use of this approach aims to limit the scope of the assessment to those aspects of the environment that are likely to be significantly affected (those scoped-in). In addition, it is recognised that one of the main purposes of the EIA process is to influence and improve design through iteration. Hence in some instances the topics taken forward for further consideration are included as they will aid the design process; for example, geology and sediment baseline surveys will inform the layout of turbines and cabling and inform the mooring design.

Potential cumulative, inter-related, and transboundary effects that may need to be taken forward for further consideration are discussed in Section 21.

5 Geology and Sediments

The structure of the seabed in terms of its underpinning geology and overlying sediments will influence the project design. The design of project components which are installed on or under the seabed, and the selection of techniques used for their installation, will be informed by the substrates present. The potential impacts of the project on the seabed are specific to the designs and installation techniques utilised, hence, an understanding of the seabed is essential to ensuring high quality design which minimises adverse impacts.

This interrelationship between the design of the project and the seabed, including potential impacts on geology and sediments are considered in this section. There is the potential for secondary impacts on marine ecosystems due to changes to the seabed, these are discussed in Section 10: Biodiversity where appropriate.

5.1 Data and Information Sources

As a specific seabed survey has not yet been undertaken publicly available data sources and data from historical surveys carried out in the vicinity of the proposed wind farm location, have been used to inform this section of the Scoping Report.

British Geological Survey (BGS) data with regard to sediments and quaternary geology has been used to understand the geology of the area. JNCC have studied the area and designated the valuable benthic habitats present, information from these studies has been utilised to further understand the overlying sediments and associated ecology of the seabed (further discussed in Section 10).

Seabed samples have been taken for the ETAP (Eastern Trough Area Project: Madoes, Marnock, Monan and Mungo) oil and gas area, by Fugro (2019a). As the Madoes field is in the immediate vicinity of the development the sample results have been reviewed to provide an indication of local conditions. The NorthConnect interconnector cable corridor has also been subject to geophysical and geotechnical surveys and relevant information from these have been considered within this section.

5.2 Baseline

5.2.1 Sediments

The seabed sediments in the Project area are mostly comprised of sand and muddy sand, with small, thin-cover patches of slightly gravelly and gravelly sand. Seabed sediment thickness ranges from a few centimetres to over a metre and overlies sands and clays of Pleistocene and early Holocene age (BGS, 1985).

The proposed Project area lies almost wholly within the East of Gannet and Montrose Fields NCMPA, which is dominated by sands and gravels but also has areas of offshore deep sea muds (Figure 5-1). These offshore deep sea muds are one of the few examples of Atlantic-influenced offshore deep sea muds on the continental shelf. In addition, the NCMPA is the only site in the CNS/Northern North Sea (NNS) region that is designated for the protection of deep sea muds (McCabe et al., 2020). See Section 10.2.2 for further information on the benthic ecology linked to these seabed habitats.

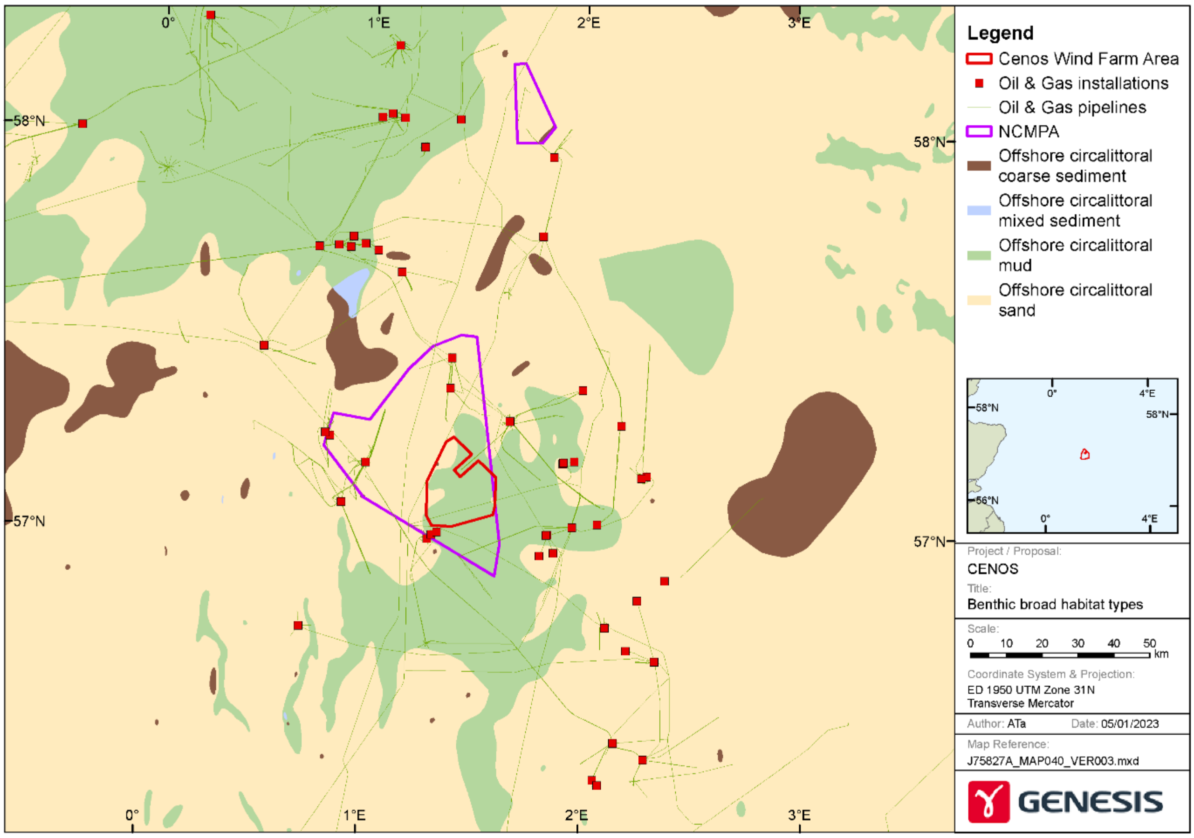


Figure 5-1 Seabed sediments in the vicinity of the proposed wind farm area (EMODnet MSFD (Marine Strategy Framework Directive) Broad Scale Benthic Habitats data for 2021).

There has been significant oil and gas activity in the vicinity of the proposed development, particularly the Madoes oil field. Surveys at this field (five sampling stations, as shown in Figure 5-2) reported a seabed comprising muddy sand with varying levels of shell fragments. Utilising the Wentworth Classification (Wentworth, 1922) four survey stations were classified as 'very fine sand', representative of EUNIS habitat type 'circalittoral muddy sand'. One station (MAD17-03) was classified as 'coarse silt' representative of EUNIS habitat type 'circalittoral mixed sediments' (Fugro, 2019a).

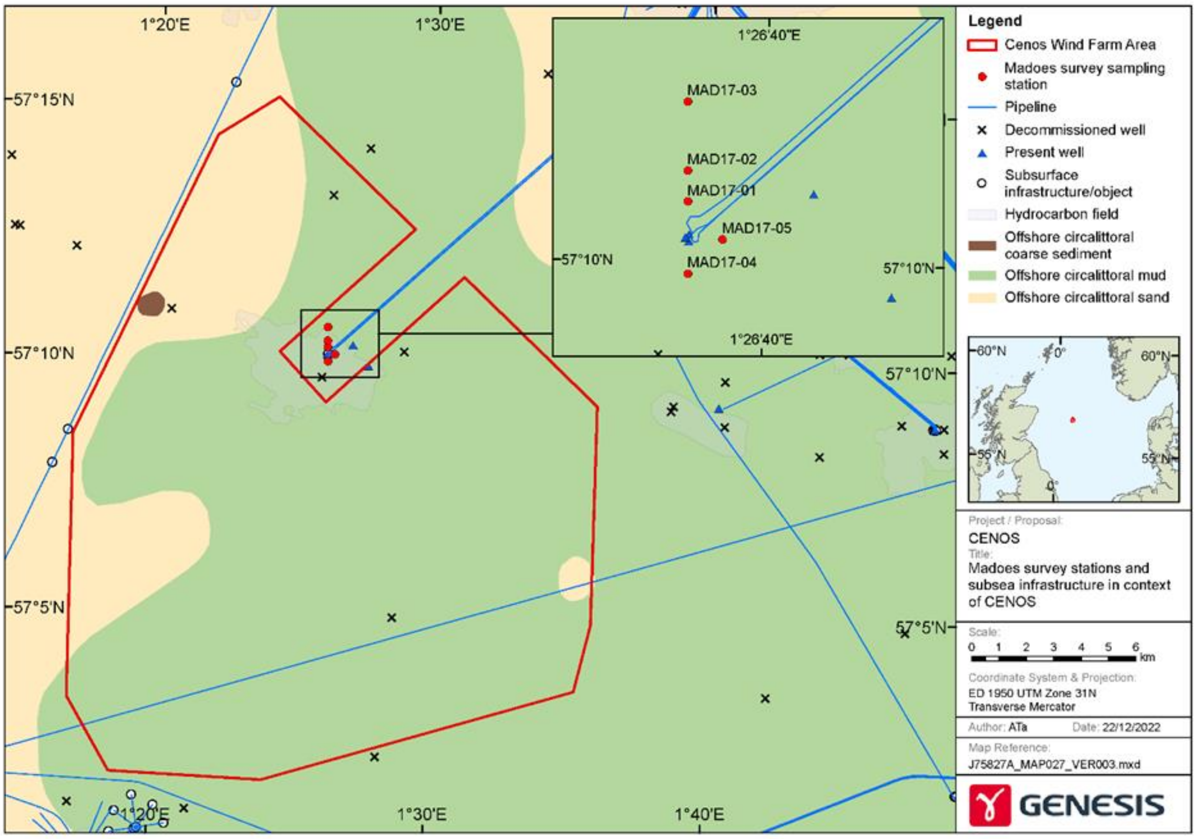


Figure 5-2 Survey Stations for the Madoes Field (Fugro, 2019a).

The location of the NorthConnect seabed surveys is shown in Figure 5-3. Particle Size Distribution (PSD) analysis was undertaken on samples, whereby the percentage of particles of a certain size are calculated and represented graphically (Figure 5-4). The results from the PSD analysis found that sands and gravels were dominant in the western end of the UK consenting corridor, with increasing silt and clay fractions towards the east. The high voltage direct current (HVDC) cable will probably join the NorthConnect cable in the vicinity of sample location S12 as shown on Figure 5-3. Hence, a relatively high proportion of silt and clay are likely to be present (NorthConnect, 2018).

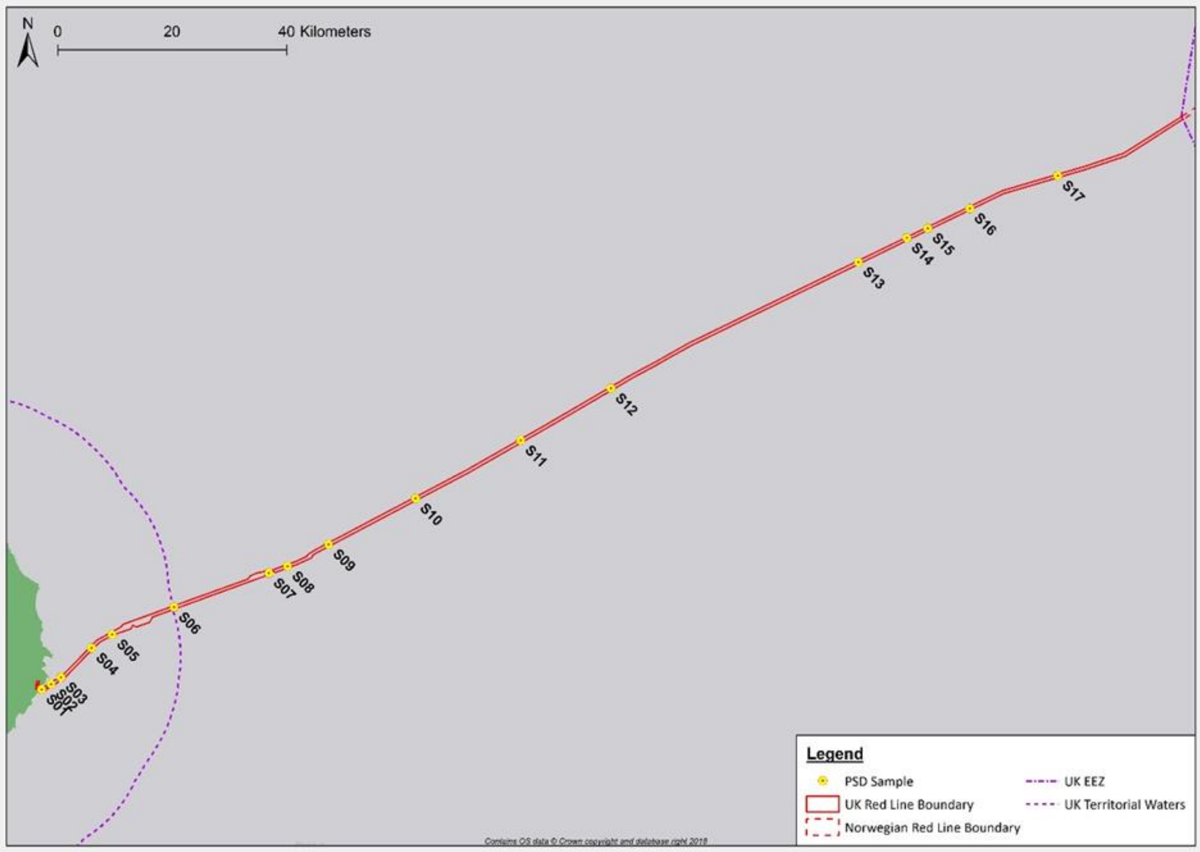


Figure 5-3: Locations of PSD samples within the NorthConnect Consenting Corridor (NorthConnect, 2018).

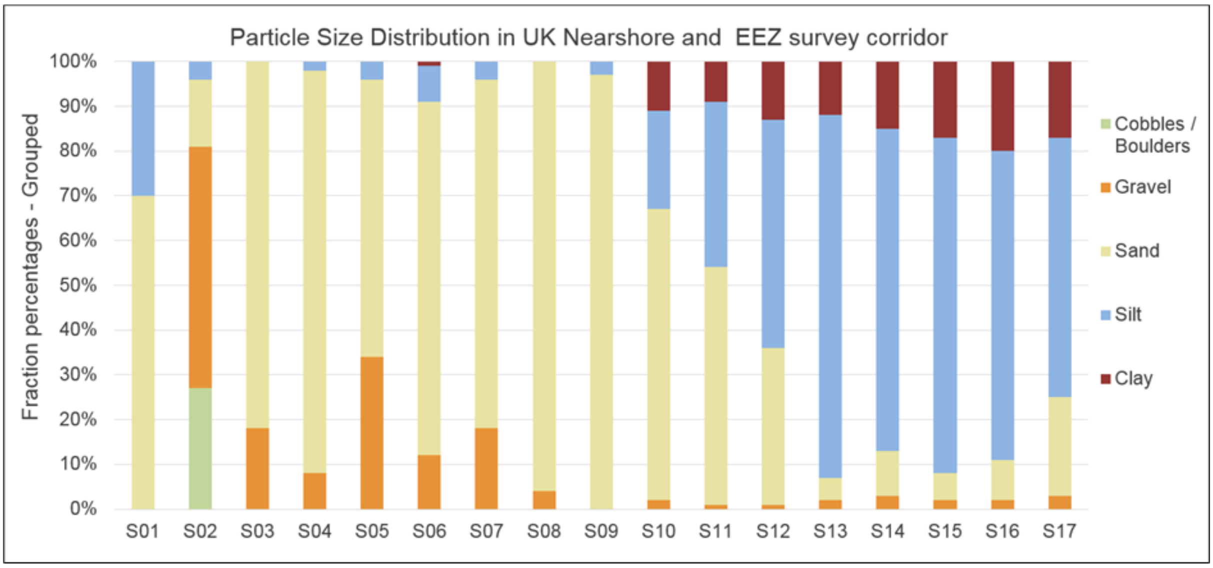


Figure 5-4: Particle Size Distribution (PSD) analysis from NorthConnect sediment samples, where samples generally contained a greater percentage of sand or silt (NorthConnect, 2018).

The UK Offshore Operators Association (UKOOA) publish mean concentrations of chemicals present in sediment that are representative of background levels in the CNS (UKOOA, 2001). Analyses from the Madoes samples indicated that total hydrocarbons (THCs) averaged at 8.7µg/g, which is below the CNS mean of 9.51µg/g. The metal analysis of the samples identified an average concentration (dry weight) of Barium (Ba), Copper (Cu), Chromium (Cr), Lead (Pb) and Zinc (Zn) that was slightly higher than the UKOOA mean concentrations for the CNS (Fugro, 2019a). However, all samples are well below the Canadian Council of Ministers of the Environment (CCME) Threshold Effect Levels (TEL) (CCME, 2002) and Marine Scotland's Action Level (AL) 1 utilised for the consideration of Pre-disposal Sampling (Marine Scotland, 2017). As such they are not considered to be at a level that could cause environmental harm.

Chemical analysis of sediment samples taken during the NorthConnect Interconnector Offshore Cable Corridor survey generally identified low concentrations of metals. However, there were individual samples with concentrations of Arsenic (As), Cu, Nickel (Ni) and Zn greater than TEL (NorthConnect, 2018), however, in all instances they were below the Probable Effect Level (PEL; CCME, 2001). When compared with the Marine Scotland AL, only three samples had metal concentrations slightly greater than AL1, but all were well below AL2. All hydrocarbon concentrations were below the Dutch Target Values (DTL; Hin et al., 2010) and Marine Scotland's AL1. As such, no impact associated with the release of existing contamination in sediments was predicted (NorthConnect, 2018).

It is recognised that there is a potential for presence of metal and hydrocarbon contaminants associated with decommissioned oil and gas wells. There are four decommissioned wells in the proposed Cenos wind farm area, as shown on Figure 5-2.

5.2.2 Geology

The Quaternary sequence within the Project area is relatively thick (>50 m) and interpreted to comprise Fisher Formation overlaying Aberdeen Ground Formation. Within the top 100m below seabed, Coal Pit and Forth Formations are also interpreted to be present, incising the Fisher Formation. Figure 5-5 presents a summary of the expected geological conditions within the Project Area (BGS, 1987).

Forth Formation is interpreted to comprise sand with thin clay layers, whilst the Coal Pit Formation is interpreted to comprise very stiff, over-consolidated sandy silty stiff clay with occasional pebbles. Fisher Formation is interpreted to comprise silty clay intercalated with sand, and likely to be the most abundant within the Project area and top 50m below seabed. This formation overlays Aberdeen Ground Formation, interpreted to comprise a harder and over-consolidated clay with sand layers. Ling Bank sediments are interpreted in the region, and its presence in the Project area is not confirmed. Where present, the Ling Bank Formation is interpreted to comprise stiff to very stiff clays, often with abundant pebbles (BGS, 1987).

Bedrock within the Project Area is interpreted to comprise Eocene-Pliocene Sandstone. Based on available BGS interpretation of the Quaternary sequence, the bedrock is not expected within wind turbine anchorage depths (top ~20m) or the offshore electricity hub pile depths (top ~50m below seabed).

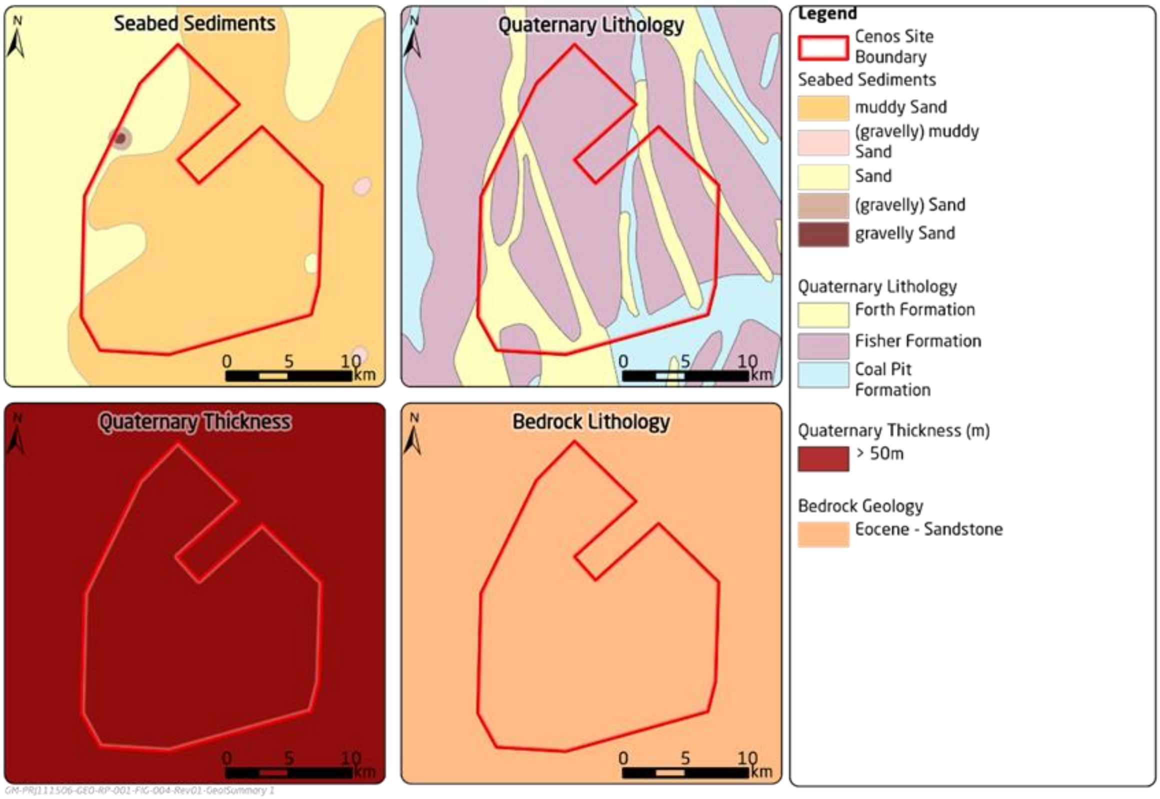


Figure 5-5: Summary of Geological Conditions.

5.3 Potential Impacts

There are three components that interface with the seabed, these are the:

- Wind turbine anchors;
- Cables; and
- Offshore electricity hub piles.

The potential impacts of these components on the seabed will be considered in relation to the construction, operation and decommissioning phases in this section.

5.3.1 Construction Impacts

Subsea installation activities, including anchor deployment, electrical cable installation, piling and rock placement will interact with seabed sediments and potentially underpinning geology during the construction phase.

Sediment Disturbance

The mooring system arrangement and specifically the anchor selection will determine the interactions with the seabed. For example, gravity-based anchors are placed upon the seabed not within it, although they are likely to settle into sediments to some degree. Embedment anchors and suction piles are placed within the seabed. There is a potential for temporary arrangements for the pre-installed moorings which may also give rise to seabed disturbance. As the level of potential seabed disturbance is dependent on the anchor design and temporary mooring arrangements, the likelihood of significant effects is subject to the finalised Project design.

As discussed in Section 2.5.4, 2.5.6 and 2.5.7, the intent will be to bury the electrical cables wherever possible to protect them from damage. Where they cannot be buried, rocks will be placed on top of them to provide protection. Cables are typically buried to depths of less than 2m below the seabed surface. Several cable installation techniques are available including jet trenching and ploughing, and the seabed substrate present will determine which techniques are most appropriate in each circumstance. The impact on the seabed is determined by the technique utilised. For example, ploughing physically pushes material out of a trench to allow the cable to be placed, giving rise to minimal suspension of solids into the water column. Jet trenching fluidises the seabed to allow cables to drop into the seabed, actively increasing solids in the water column for short time periods.

The disturbance of sediments during construction has the potential to temporarily increase solids present in the water column. The solid particles will drop out of the water back onto the seabed. The size of the particles will determine how long they stay in the water column, with large particles dropping out quicker than smaller particles. Whilst in the water column, particles will move with the underlying currents and hence, be transported and re-deposited on adjacent areas of the seabed, with small particles potentially travelling further from the point of origin.

The impacts of the disturbance of sediments are dependent on the type of substrate present and the forces exerted upon them by the construction techniques employed. Appropriate understanding of the seabed should inform the design, such that appropriate techniques can be employed to minimise adverse effects.

Geology and Geomorphology Effects

Offshore electricity hub piles have the deepest interactions with the seabed. As discussed in Section 2.5.5 the Project design estimates a dozen or fewer of these structures to be installed and the subsequent impacts will primarily relate to the sensitivity of the geology in the area. Appropriate sighting of the offshore electricity hub will be key to minimising adverse effects on sediments and any valuable geology/geomorphology present (effects on Geomorphology are discussed further in Section 14).

Re-release of Contaminated Sediments

Due to the prevalence of oil and gas activity in the region there is also the potential for hydrocarbon or heavy metal contaminant to be present in the seabed, if it were to be dispersed then this could spread the contamination or release contaminants into the water column affecting water quality. The preference is to avoid the disturbance of contamination (if present) to prevent impacts on geology, water quality and associated adverse ecological impacts. The project will ensure that locations around known well head locations will have suitable exclusion zones (>500 m) to ensure no disturbance occurs.

Unexploded Ordinance

There is also a risk that Unexploded Ordinance (UXO) is disturbed during installation works, which if it were to explode could cause physical damage to seabed geology. Surveys prior to installation works should locate UXO such that appropriate plans for avoidance or controlled detonation can be made to minimise effects.

5.3.2 Operational Impacts

Sediment Disturbance

Once in place, equipment within the seabed (piles, anchors and cables) are unlikely to have ongoing environmental effects. However, there is a potential for cables to fail and need repaired, hence maintenance effects would be similar to those experienced during construction but on a much smaller scale.

Scour and Sediment Movement Effects

There is the potential for ongoing disturbance of the seabed sediments to occur due to interactions between equipment laid on the seabed (for example catenary moorings, gravity anchors and rock) and those elements which pass from the seabed into the water column (for example cables, piles). Lighter items laid on the seabed may move with currents and abrade the seabed. While those installed into or in fixed positions on the seabed, can affect current flow and associated sediment movements giving rise to potential impacts on sediment transport and sediment transport pathways resulting in seabed scour. This scouring can develop into localised depressions around components. As discussed in Section 5.3.1, the specific issues will be determined by the design of the components.

However, due to the water depth (>100m) and the limited tidal currents due to distance offshore, the potential for seabed movement and scour around windfarm infrastructure on the seabed is expected to be extremely limited and therefore potential impacts limited or minor in nature.

5.3.3 Decommissioning Impacts

On the basis that cables, rocks, anchors and piles will be removed during decommissioning, sources of impacts of the proposed project on geology and sediments during the decommissioning phase are considered to be very similar as those identified for the construction phase. If, however, piles are utilised and they are unable to be removed fully, then this may have a long-term effect on localised geology. The significance of such impacts can be reduced by appropriate sighting at the construction stage. It would be expected that CES would require the piles to be cut 2m below the current seabed level and as noted above with limited seabed movement in this zone this is likely to be sufficient to stop any remnant piles from being exposed at the seabed level.

5.4 Mitigation Measures

The sediments geology present in the proposed project area, will be taken into account during the design process, with the aim to avoid and minimise effects during the design of the mooring systems and piles, the appropriate siting of components (where practicable away from sensitive/valuable, contaminated areas or UXO containing areas) and the selection of appropriate installation techniques for the conditions found.

5.5 Proposed Assessment

The baseline for geology and sediments needs to be fully understood in order to appropriately design the seabed infrastructure and construction methods utilised. Hence, it will be taken forward for **further consideratio**n. Geophysical surveys are planned including:

- Acquisition of Multibeam Echosounder (MBES) dual swathe bathymetry, complete coverage within Project Area and to 1000m beyond the site boundary;
- Acquisition of Single Beam Echosounder (SBES) as a control for the MBES;
- Backscatter, in the same setup as MBES system;
- Side Scan Sonar (SSS) data, required for the identification of seabed features and geological conditions. The coverage will extend to 500m beyond the site boundary;
- Single and multichannel 2D ultra-high resolution survey (UHRS) data to at least 50m depth;
- Magnetometer data, used to identify ferrous objects, potential UXOs, archaeological assets and infrastructure. Data to be acquired in the same survey line plan as the MBES, with a single magnetometer. The magnetometer data will be used to de-risk future geotechnical surveys;

- Sub Bottom Profiler (SBP): To image the top 5-10m below seabed, with adequate equipment to achieve high resolution and maximum penetration; and
- 2D Ultra High-Resolution (UHR) single-channel (as a minimum): To image the uppermost 50-100m.

The data gathered will be interpreted to give a detailed understanding of:

- Seabed surface features such as pipelines, infrastructure, wrecks, boulders, gas escape features, scour patterns, erosion and deposition features;
- Seabed Surface Geology including seabed sediments, Eunis habitat classification and outcropping till and bedrock;
- Morphological features, such as paleochannels;
- Geohazards shall be identified, such as shallow gas, pockmarks and boulders; and
- Major Formational and Intra-Formational boundaries.

Based on the interpretation, areas will be selected for ground truthing in the form of visual inspection (video transects and still photograph) to inspect surface features. In addition, grab samples will be taken for particle size, chemical and benthic analysis. Grab samples will be taken close to areas of previous or current oil and gas activities to understand the potential contamination present in sediments.

The baseline data will be reported within the EIA, and the influence this has had on the design will also be recorded. An assessment of effects on sediments in terms of sedimentation and sediment movement (scour) during construction, operations and decommissioning specific to the equipment and methods utilised will be undertaken. If contaminated sediments are found and they cannot be avoided by the design, an assessment of the effect disturbance of them would have, will be carried out.

Effects on any geomorphological features if present and unavoidable will be considered as part of the archaeological chapter as discussed in Section 14. Effects on benthic ecology and the East of Gannet and Montrose Fields NCMPA will be considered as part of the biodiversity assessment as discussed in Section 10, taking account of the findings of the sediment and geological assessment. Potential impacts sediments can have on water quality are considered in Section 6.

6 Water Quality

Water quality describes the condition of the water, including: chemical, physical and biological characteristics. Water quality is measured by several factors, such as the concentration of dissolved oxygen, and the amount of suspended particulate matter (SPM) in the water. In offshore waters, the concentration of microscopic algae, heavy metals, and other contaminants may also be measured to determine water quality. This section considers the potential impacts of the planned activities on water quality. Note this section focuses on impacts on water quality. It is recognised that changes in water quality can have knock on implications for ecological receptors, these are considered within Section 10.

6.1 Data and Information Sources

Information with regard to sediments presented within Section 5.2.1 has been utilised to inform this section. Data available through Marine Scotland's (2023) National Marine Plan interactive (NMPi) has been used to provide a general understanding of water temperature and salinity, while information on SPM levels has been gleaned from reports by the Centre for Environment Fisheries and Aquaculture Science (Cefas) (2016).

6.2 Baseline

Based on long term data collected between 1971 and 2000, the annual mean temperature at the surface in this region of the North Sea is between 9°C and 10°C, while the near seabed is two degrees less between 7°C and 8°C. Annual mean salinity near-seabed and at the surface is 3.5 % or 35 practical salinity units (PSU) (Marine Scotland, 2023).

The long-term average for SPM in the North Sea at the proposed Cenos wind farm site is < 1 mg/L (Figure 6-1). The long term monthly average SPM for the Northern North Sea is relatively stable and of very low concentrations (Cefas, 2016) as shown in Figure 6-2. As shown in Figure 6-1 SPM levels are higher in shallow waters such as close to shore and in the Southern North Sea. This is due to high energy events, such as storms, mobilising particulate matter from the seabed into the water column. Storms occur more frequently in the winter months, giving rise to higher SPM as shown in Figure 6-2. In deeper waters storm events have less of an influence on the movement of sediments and hence SPM are consistently lower.

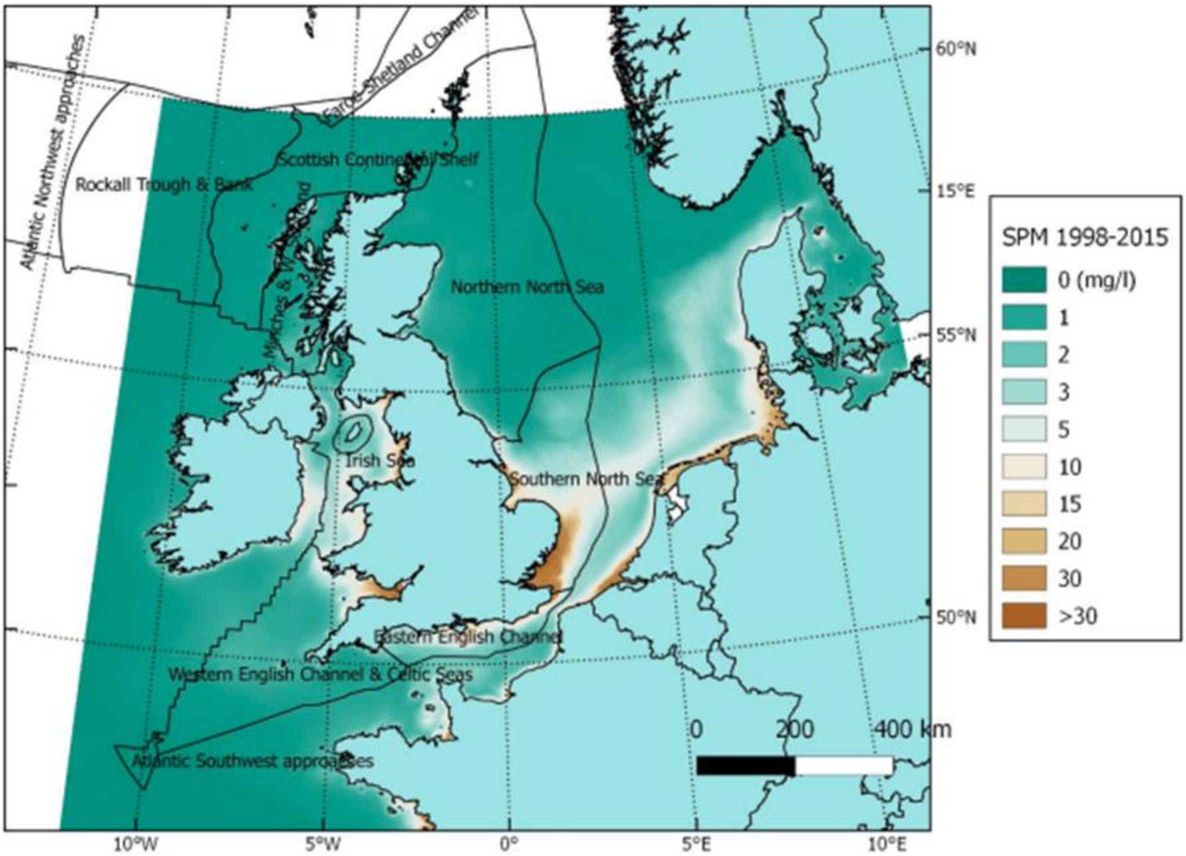


Figure 6-1: Average SPM for the Period 1998-2015 (Cefas, 2016).

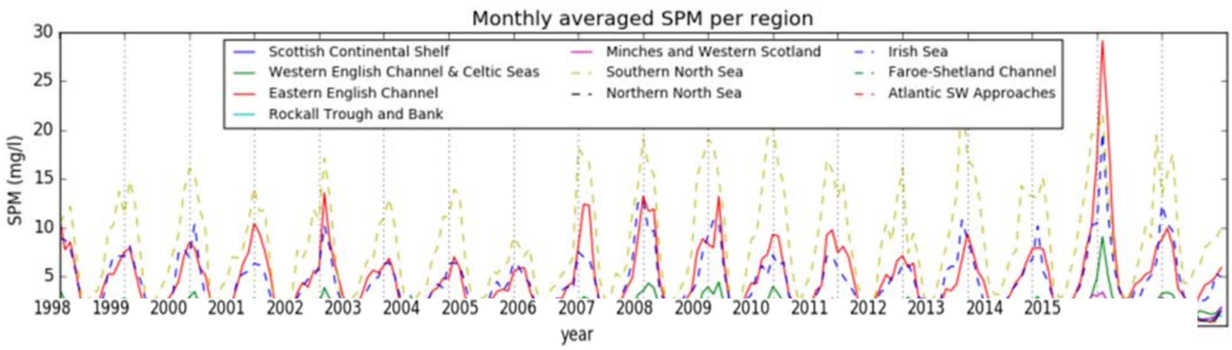


Figure 6-2: Monthly Average SPM per Region (Cefas, 2016).

It is recognised that the proposed Wind Farm Site is located within a busy oil and gas area, however, given the legal requirements associated with the discharge of contaminants from oil and gas installations and the location of the nearest platform (Arbroath platform c. 12km north of the proposed windfarm location), any discharges from these installations are not expected to significantly impact on the water quality in the proposed Project area. Given the water mixing resulting from currents in the area, and the careful regulation of discharges from the oil and gas developments, it is anticipated the water quality at the proposed Cenos wind farm area will be typical of the offshore CNS area.

6.3 Potential Impacts

6.3.1 Construction Impacts

Sources of impacts on water quality associated with the construction phase include:

- Increased SPM due to construction activities including, cable installation (jetting, ploughing, etc.) and anchor laying;
- Re-release of contamination from the seabed; and
- Release of Hazardous Substances.

Suspended Particulate Matter

As discussed in Section 5.3.1 various construction activities can cause disturbance of sediments, mobilising solids into the water column, the majority of which will drop out relatively quickly. Where sediments include very small particulates these can increase the amount of SPM in the water column, the effects will however, be very localised, short-lived and unlikely to be significantly reduce water quality.

Re-release of Contaminated Sediments

There is a potential for hydrocarbon or heavy metal contaminant to be present in the seabed, within the footprint of the works due to oil and gas activities in the region. If contamination is disturbed, then it could release contaminants into the water. The way a contaminant affects water quality is specific to the substances involved; they may disperse in the water column, dissolve in water (potentially including an oxidation state change) or if immiscible in water float to the surface or sink to the seabed. The significance of the release of contaminates into the water column, relates to the amounts involved, the toxicity of the specific compound and its characteristics (biodegradable or a bio-accumulator). As discussed in Section 5.3.1 the preference is to avoid the disturbance of contamination (if present) to avoid the impact on water quality and associated adverse ecological impacts.

Releases of Hazardous Substances

The release of hazardous substances could occur during construction works due to:

- Loss of chemicals and fuels from vessels and installation equipment;
- Discharge of wastewaters and sewage from installation vessels; and
- Accidental damage to subsea oil and gas infrastructure.

Loss of chemicals and fuels from vessels or equipment during construction has the potential to degrade water quality. The magnitude of any reduction in water quality is dependent on the type of pollutant and volumes released into the sea. Vessels are expected to carry a range of chemicals with hydrocarbon-based fuels, lubricants and hydraulic fluids being the biggest potential pollution sources. Equipment including Remotely Operated Vehicles (ROV) have hydraulic lines which if damaged could release hydraulic fluids (all be it relatively small volume). It is, however, appropriate to assume that all vessels and equipment are well maintained and operated by suitably trained personnel. In addition, all installation and support vessels are required to comply with the International Convention for the Prevention of Pollution from Ships (MARPOL) regulations. The regulations cover the prevention of chemical spills and hydrocarbons during both routine operations and incidents.

The worst-case scenario would be associated with the loss of a vessel's fuel tank load of fuel, as this would give rise to the largest release. It would require a significant incident such as a collision to cause a fuel tank to lose its contents, which is an extremely unlikely scenario given that all appropriate navigational safety measures will be followed (see Section 12). The risk of a significant loss of chemicals or fuels from vessels or installation equipment is low and unlikely to give rise to a significant effect.

All vessels employed to facilitate the installation of the Cenos windfarm will be MARPOL compliant and, as such, all discharges of wastewaters and sewage will be appropriately treated to reduce potential contaminants to acceptable levels and conducted in an appropriate manner to minimise water quality impacts. When considered in the context of existing shipping levels and associated discharges in the North Sea, the magnitude of the impact is low. Therefore, the effect will not be significant.

The North Sea in the vicinity of the Project is widely exploited by the oil and gas sector and, as such, numerous existing submarine pipelines are present in the area. The cables to oil and gas platforms and the connection to the NorthConnect corridor will require pipelines to be crossed. Cable installation (laying and burial), together with the placement of rock to protect the existing asset and the proposed cables, have the potential to damage submarine pipelines. Damage to an oil pipeline has the potential to result in a significant release of oil into the marine environment, which could lead to a major reduction of marine water quality over an extended area. Hence it is imperative to minimise the likelihood of such an occurrence to avoid a significant effect.

6.3.2 Operational Impacts

There is a potential that cables can fail during the operational phase requiring replacement, the removal of cables from the seabed and reburial could give rise to increased SPM, this is unlikely to be significant due to the small footprint of any repair works.

During the operational phase vessels will continue to be utilised giving rise to the same water quality risks as construction namely:

- Loss of chemicals and fuels from vessels and installation equipment; and
- Discharge of wastewaters and sewage from installation vessels.

However, fewer vessels will be involved hence the risks are less than during construction and hence it is unlikely that they will be significant.

The operational wind farm does however pose an additional risk to oil and gas infrastructure during severe storms. As discussed in Section 17: Major Accident/ Disasters, in an extreme situation where a floating turbine mooring system fails, anchors could be dragged across subsea oil and gas assets causing a breach similar to that identified in construction for cable laying. Alternatively, a floating turbine which breaks loose could collide into other oil and gas assets such as a platform. A loose floating turbine would also cause increased vessel collision risks. All of which could damage oil or gas containment and leading to a significant pollution incident. These risks can be minimised by designing mooring systems with sufficient redundancy.

6.3.3 Decommissioning Impacts

Decommissioning effects on water quality include:

- Increased SPM due to removal of seabed equipment: cable, anchors and piles;
- Release of Hazardous Substances:
  - Loss of chemicals and fuels from vessels and decommissioning equipment;
  - Discharge of wastewaters and sewage from installation vessels; and
  - Accidental damage to subsea oil and gas infrastructure.

Effects on SPM and risks of release of hazardous substances from vessels and equipment will be similar to construction activities.

The risk of accidental damage to subsea oil and gas infrastructure could arise when cables are being removed in the vicinity of oil and gas pipelines, if live there might be a preference to cut cables either side of crossings and leave them insitu until the oil and gas asset is being decommissioned. This will however, have to take account of decommissioning requirements at that point as discussed in Section 3.7.

6.4 Mitigation Measures

Vessel Pollution Prevention

Mitigation to minimise risks of pollution for vessel related activities are well understood and implemented via legislation, hence it can be assumed that all vessels will comply with the relevant sections of the International Convention for the Prevention of Pollution from Ships (MARPOL) regulations.

Pipeline Crossing

With regard to cable crossing of oil and assets, the International Cable Protection Committee (ICPC) recommendations for existing infrastructure crossings will be implemented. Individual crossing agreements will be made with the respective asset owners prior to cable installation commencing, so that the crossing design, installation techniques and associated safety exclusion zones for different installation tools, can be agreed. Emergency response procedures will also be agreed to ensure that, in the event of damage to a pipeline occurring, all parties can work quickly to minimise the magnitude of the spill.

Detailed crossing engineering will be performed by the cable installation contractor, in close cooperation with Floatation Energy and the asset owners. The engineering will allow mitigation to be designed and implemented for each crossing, further reducing the likelihood of a submarine pipeline being damaged.

As such, it is extremely unlikely that the installation activities will result in damage to a submarine pipeline which would lead to a significant reduction in water quality.

Mooring Design

The design of moorings with sufficient redundancy to prevent a turbine breaking free in event of adverse weather conditions will be ensured. It will take into account the MCA and HSE Regulatory Expectations on Moorings for Floating Wind and Marine Devices (MCA & HSE, 2017). Hence, third party verification of the design, hardware, installation and operations will be sought.

6.5 Proposed Assessment

It is proposed the Water Quality is **scoped-out**. If, however, during the seabed surveys (see Section 5.5), it is identified that there are contaminated sediments present which cannot be avoided, then the potential for impacts on water quality of contamination release will be considered.

It is noted that there is a potential for significant effects in event of a worst-case major pollution incident occurring due to interactions with oil and gas assets however, appropriate design as discussed in Section 6.4 will significantly reduce the risk of these occurring.

7 Air Quality

Air quality is the term used to refer to the level of pollutants in the air. Good or clean air is needed for optimal health for humans, animals and vegetation. When air quality is good, the air is clear and contains only small amounts of solid particles and chemical pollutants. This section considers the potential impact of the Cenos wind farm on air quality. The impact of GHG emissions on climate change are considered separately in Section 18.

The Scottish Government suggests there have been long-term reductions in emissions for all pollutants due to various policies and strategies implemented within Scotland. These include:

- Cleaner Air for Scotland (CAFS): The Road to a Healthier Future (Scottish Government, 2015b and Scottish Government, 2020a);
- Climate Change (Emissions Reduction Targets) Act (2019) setting a 2045 target for Net Zero. emissions (Climate Change (Emissions Reduction Targets) (Scotland) Act 2019); and
- Establishment of Low Emission Zones (The Transport (Scotland) Act 2019).

7.1 Data and Information Sources

The International Convention for the Prevention of Pollution from Ships (MARPOL) Annex VI regulates the Prevention of Air Pollution from Ships and their contribution to local and global air pollution, and hence are a relevant source of information of marine air quality. Onshore air quality information for Scotland can be found on the Air Quality in Scotland website (Ricardo Energy & Environment, 2021).

7.2 Baseline

The North Sea is designated under regulation 14 of MARPOL Annex VI as an Emission Control Area (ECA) for Sulphur Oxide (SOx). Vessels in the North Sea ECA are required to utilise fuels with a sulphur content of less than 0.1 % mass/mass (IMO, 2020). This is in recognition of the potential for high volumes of marine traffic having the potential to impact upon the atmospheric environment and on human health, particularly for those people living in port cities and coastal communities.

A review of the coastal areas to the east of the CNS, has identified that there are three Air Quality Management Areas (AQMA) in Aberdeen City associated with the City Centre, Wellington Road and Anderson Drive. All of which are designated due to high levels of nitrogen dioxide and Particulate Matter (PM_{10}) associated with road transport. There are no AQMA in Aberdeenshire or Angus (Ricardo Energy & Environment, 2021). This would suggest that air pollution associated with marine activities is not having a detrimental effect onshore.

It is recognised that oil and gas platforms provide numerous point sources of atmospheric pollution (BEIS, 2022b), including PM_{10} and SOx due to the burning of fossil fuels to generate power for the platform. The nearest platform to the prosed site is approximately 12km from the Cenos windfarm site and hence, unlikely to have a noticeable impact on air quality, as such it is expected that air quality will be good.

7.3 Potential Impacts

The primary source of offshore emissions is the movement of vessels, including emissions of GHGs (discussed in Section 18) and particulates, nitrogen oxides (NOx) and (SOx) as a by-product of fuel combustion. There may also be some small-scale localised emissions related to plant operation and construction activities.

7.3.1 Construction Impacts

During construction, a number of vessels will be required for the tow, transport and installation of the wind turbines, mooring systems, cables and offshore electricity hub. The specific port location where vessels will travel to and from to support the offshore activities have not yet been identified, however they are likely to be established commercial/industrial ports. Engine exhausts from the offshore vessels will contribute, at a small scale, to atmospheric emissions from existing shipping traffic in the area. Marine exhaust emissions are limited in line with the North Sea ECA provisions of MARPOL Annex VI (IMO, 2020).

Taking account of (i) the offshore location whereby any emissions to air are expected to disperse rapidly, (ii) the use of MARPOL compliant vessels and (iii) the lack of sensitive receptors in the vicinity of the development, the potential impacts on air quality during the Construction are not considered to be significant.

7.3.2 Operational Impacts

During operations, it is likely that there will be one maintenance vessel in the wind farm area for the majority of the time, transiting back to port approximately one every three weeks to change crews and resupply. The impacts of vessel emissions on air quality during the operational phase are minimal not considered to be significant.

It is noted that the decarbonisation of the oil and gas sector by providing electricity to platforms, will negate the need for the burning of fossil fuels to generate power. This will have the beneficial effect of reducing emissions of PM_{10} and SOx as well as carbon emissions discussed in Section 18.

7.3.3 Decommissioning Impacts

Vessel activity during the decommissioning phase is not expected to exceed vessel activity associated with the construction phase such that the potential impacts on air quality are not considered to be significant.

7.4 Mitigation Measures

In summary, the mitigation measures to be applied in order to minimise impacts on air quality will include:

- Use of MARPOL compliant vessels utilised for all works.

7.5 Proposed Assessment

The impacts of the proposed Project on air quality in all phases has been **scoped-out** for further assessment in the EIA, due to the changes being minimal. Section 18: Climate Change considers the impacts on air quality in terms of greenhouse gas (GHG) emissions.

8 Noise

Noise can be defined as a sound that may cause harm or disturbance to receptors in the area. This section considers in-air and underwater noise sources associated with the proposed Project.

8.1 In-Air Noise

Sound propagates through air as a longitudinal wave. The sound level from a sound source will decrease with distance from the source, the propagation of sound will also be affected by atmospheric conditions and surface effects. Due to the difference in density between air and water, and the occurrence of waves, some sound may reflect away from the water and some sound transmission into the water (ISO, 1996). The focus of this section is on human receptors, it is noted that in-air noise can cause disturbance to ornithological receptors, birds are specifically considered in Section 10.5. It is noted that workers involved in the project may be much closer to noise sources, however this is addressed through the Control of Noise at Work Regulations 2005 and not considered further here.

8.1.1 Data and Information Sources

Potential receptors have been identified using information associated with the location of oil and gas assets (presented in Section 2.2), marine traffic information (see Section 12.2.2).

8.1.2 Baseline

Receptors to in-air noise in the Cenos wind farm area and areas associated with cable installation are limited to humans present on oil and gas assets, or on vessels in the area, and birds.

As discussed in Section 2.2 and shown in Figure 2.2, the Cenos site was selected to be at least 6nm from all oil and gas platform, as such there are no human noise receptors within 6nm distance of the windfarm for significant periods of time. Humans present on boats may transit past or through the site on vessels as discussed in Section 12.2.2 only six vessels intersecting the Cenos offshore wind farm area per day. The most common vessel types were oil and gas vessels although fishing vessels also utilise the area, no recreational vessels were identified.

The noise environment in the area is likely to be dominated by point source operational noise from existing oil and gas facilities, which will dissipate with distance from the source, while transiting vessels will provide the main moving source of noise. Other natural noise sources include wind noise and noise due to waves.

As construction ports have not been selected, baseline information cannot be identified, however it is assumed that an operational port with ongoing port activities will be selected and hence the noise baseline will be typical of an industrial port.

8.1.3 Potential Impacts

8.1.3.1 Construction Impacts

The onshore and nearshore fabrication and assembly activities will give rise to noise. However, it is assumed that these activities will be carried out in ports where these types of noise generating activities are normal, and that appropriate management and mitigation is in place. It is assumed that these noise sources will not exceed the noises of the general port operations and hence no new impacts will arise.

In air-noise sources during the construction phase will primarily be associated with vessel use and above the water construction activities, such as the installation and commissioning of the offshore electrical hub. However, works at the wind farm site are too far from receptors on oil and gas platforms for them to be able to hear the works. Vessels transiting past the wind farm site will need to be at a navigationally safe distance from the works and hence although they may be able to hear the works the noise levels will not be at a level that will cause disturbance and any effect will be temporary and non-significant.

Similarly, vessels transiting to and from the site, and cable installation vessels may pass platforms and other vessels, but this will be by a safe navigational distance and hence will not give rise to noise disturbance. The potential impact of in-air noise during the Construction phase is therefore unlikely to be significant.

8.1.3.2 Operational Impacts

During operation, the wind turbines will generate noise due to the motion of air around the blades, and noise due to the motion of mechanical and electrical components. In addition, a maintenance vessel will be present on site the majority of the year. Given the distance from the nearest platforms >6nm and the transient effect on passing vessels in-air noise is unlikely to cause disturbance and thus is not deemed to be significantly in EIA terms.

8.1.3.3 Decommissioning Impacts

The amount of vessel activity and works required during the decommissioning phase is not expected to be greater than the activity during the construction phase such that the potential impacts of in-air noise during the decommissioning phase are not likely to be significant.

8.1.4 Proposed Assessment

No significant impacts associated with in-air noise have been identified primarily due to the lack of receptors in the vicinity. No specific mitigation is identified, however best practice with regard to maintenance of vessels and equipment will aid in minimising source noise levels. In-air noise is therefore **scoped-out** for further assessment in the EIA.

8.2 Underwater Noise

Background or “ambient” underwater noise is created by several natural sources, such as rain, breaking waves, wind at the surface, and seismic, biological and thermal noise. Seabed bathymetry can strongly influence the propagation (how a sound travels from its source) of sound. Sound propagating in shallow waters interacts strongly with the seabed, which typically results in the sound being dampened, otherwise known as attenuation. In deeper waters, there is less interaction of sound with the seabed and attenuation due to bottom loss is decreased compared to that in shallow waters, which can result in longer range sound propagation (Jensen et al., 2011). The type of sediments in an area also influences sound propagation through reflection, attenuation, and scattering effects (Jensen et al., 2011). Biological sources include marine mammals (using sound to communicate, build up an image of their environment and detect prey and predators) as well as certain fish species. Anthropogenic sources of noise in the marine environment include fishing boats, ships, industrial noise, seismic surveys and leisure activities, all of which add to ambient background noise.

8.2.1 Data and Information Sources

In the areas surrounding the proposed development, several oil and gas installations are active and have associated shipping routes (see Figures 2-1 and 12-3). As such, the baseline underwater noise levels are expected to be slightly elevated within the proposed project area. However, no data are available for the underwater noise levels within the specific region. Shipping is examined in further detail in Section 12.

8.2.2 Baseline

Underwater noise can cause disturbance or harm to fish, marine mammals depending on the frequencies and sound levels involved. The significance of the impacts of underwater noise on various ecological receptors can be found in the Fish and Shellfish Ecology (Section 10.3) and Marine Mammals (Section 10.4) sections, respectively, although ranges for auditory injury are described here. This section focuses on the sources of underwater noise and whether they can give rise to significant noise levels at frequencies that need to be considered for marine ecological receptors. The relevant policy and guidance for underwater noise includes general policy (GEN) 13 Noise: Development and use of the marine environment should avoid significant adverse effects of man-made noise and vibration, especially on species sensitive to such effects (Scottish Government, 2015a).

The North Sea is heavily industrialised and is subject to several sources of anthropogenic underwater noise, described in this context as the production of unwanted or disturbing sound. As such, the region has elevated background noise levels across multiple frequency bands (Merchant et al., 2016). Oil and gas installations found throughout the North Sea are localised sources, which may generate high underwater noise levels in their vicinity. Shipping is also a major contributor to elevated background noise levels, typically at low frequencies (<1kHz; Wilcock et al., 2014). Impulsive noise sources may also occur as a result of construction activities, particularly from piling structures into the sea floor (JNCC, 2010).

Marine Mammals

The latest marine mammal auditory injury criteria provided by Southall et al. (2019) groups marine mammals into functional hearing groups and applies filters to the unweighted noise to approximate the hearing response of the receptor (Table 8-1). Southall et al. (2019) also presents acoustic injury onset-thresholds for both unweighted sound pressure level peak criteria (SPL_{peak}) and cumulative (i.e., more than a single sound impulse) weighted sound exposure level criteria (SEL_{cum}). This is presented as the received level thresholds which onset permanent threshold shift (PTS), where unrecoverable hearing damage may occur, and temporary threshold shift (TTS), where a temporary reduction in hearing sensitivity may occur for marine mammal species. Marine mammals are typically sensitive to noise at frequencies between 10Hz and 180kHz (Southall et al., 2019).

Table 8-1: Impulsive criteria for PTS and TTS in marine mammals (Southall et al., 2019).

Functional Hearing Group	Impulsive			
	Unweighted SPL_{peak} (dB re 1 µPa)		Weighted SEL (dB re 1 µPa^{2}s)	
	PTS	TTS	PTS	TTS
LF Cetaceans	219	213	183	168
HF Cetaceans	230	224	185	170
VHF Cetaceans	202	196	155	140

Fish

Fish have been grouped according to their estimated hearing characteristics in order to assess their ability to perceive sound and therefore their sensitivity (Hawkins et al., 2020). Such characteristics depend on the presence of a swim bladder, and whether the organ is positioned close to, or connected to, the ear (Hawkins et al., 2020). The thresholds of effects from noise also depend on the type of anthropogenic noise being assessed. These include explosions, pile driving, seismic airguns, sonar, and continuous noise sources such as shipping (Popper et al., 2014). Typically, fish are sensitive to frequencies between 20Hz and 5kHz (Hawkins & Popper, 2014).

The impacts of underwater noise on ecological receptors can be summarised into four categories:

- Physical injury and fatality;
- Acoustic masking;
- Auditory injury (PTS and/or TTS); and
- Disturbance.

8.2.3 Potential Impacts

The following sub-sections identify potential subsea noise sources associated with the proposed development. Potential impacts on ecological receptors, in terms of significance and with regards to underwater noise, are addressed in the Fish Ecology (Section 10.3) and Marine Mammals (Section 10.4) sections of this report respectively.

8.2.3.1 Construction Impacts

Construction activities associated with the proposed project may generate underwater noise, which has the potential to affect marine mammals and fish. These are listed below:

- Vessel movements;
- Anchor, mooring, cable installation and rock placement;
- Use of sonar for geophysical surveys;
- Piling for the sub-station; and
- Removal of Unexploded Ordinance (UXO).

Vessel Movements

Vessel traffic is a substantial contributor to general anthropogenic underwater noise, with the primary sources of sound coming from the propellers, propulsion and other machinery (Ross, 1976; Wales and Heitmeyer, 2002). During construction there will be increased vessel activity as materials are transported to the site and used to place structures in their relevant locations. There are no studies to quantify the levels of shipping related noise within the proposed Project location. Studies to examine the impact of ship noise on cetaceans often cite 120 dB re 1 µPa as a disturbance threshold (Hatch et al., 2012; McQuinn et al., 2011), and it is recognised that noise produced by shipping can cause stress impacts in marine mammal populations (Rolland et al., 2012). In the wind farm area, vessel movements may be more frequent than during normal time periods (assuming vessel activity from adjacent oil and gas sites), however, overall noise levels are not expected to be significantly elevated. as these operations will be undertaken a very slow vessel transit speeds due to the nature of the vessels and activities undertaken.

It should be noted that mooring vessels and large supply vessels are regular users and operators in this area of the North Sea as part of standard oil and gas operations.

Anchor, Mooring and Cable Installation

Similarly, installation of the anchors and mooring lines, cables (including the inter-array, and export cables and any associated rock armour) are not expected to create noise at levels that could cause disturbance or injury to marine mammals or fish. There are no clear indications that underwater noise caused by the installation of sub-sea cables poses a risk of harm to marine fauna (OSPAR, 2012).

Use of Sonar for Geophysical Surveys

Geophysical surveys will be required in the project area to better understand sediment composition, habitat types, and seabed topography. Surveys will include the use of sub-bottom profilers (SBPs) and Multi-beam Echo-sounders (MBES). SBP operate at frequencies from 400Hz to 14kHz, while MBES operate at frequencies between 200–400kHz, with typical operations ~400kHz. MBES typically operates at ultrasonic frequencies above the hearing thresholds for many marine mammals (MacGillivray et al., 2013), and there is evidence to suggest that some species can perceive such signals (Hastie et al., 2014). In addition, SBP operational frequencies have been shown to impact marine mammals (MacGillivray et al., 2013) and may have the potential to be perceived by basking sharks (Chapuis et al., 2019). The impacts on other fish species are less clear, but sonar does not appear to have significant effects (Halvorsen et al., 2012; 2013; Kane et al., 2010). Overall, there is potential for these activities to be within the hearing thresholds of relevant ecological receptors and hence need considered further. As discussed in Section 5.5, geophysical surveys are expected to be conducted in the summer of 2023, prior to EIA submission. Such surveys will be subject to EPS licencing and mitigation in line with JNCC guidelines for minimising the risk of injury to marine mammals from geophysical surveys (JNCC, 2017). Additional geophysical surveys may also be required during installation activities.

Piling for the Sub-Station

As the wind turbines associated with the proposed Project will be floating turbines, extensive pile driving will not be required on site and will be limited to the offshore electricity hub foundation installation. If suction piles are used, then there will not be a significant source of underwater noise. However, there may be a need to install pin piles with diameters of <3m. Pin piles are inserted into a sleeve at the foot of the leg of the jacket, to pin the jacket to the seabed. The sound levels arising from the percussion piles depends on numerous factors such as the size and operating energy level of the hammer, the diameter and length of the piles, the sub-surface depth of pile, number of hammer strikes, and the physical factors that will influence sound propagation (such as bathymetry, type of seabed substrate, water temperature and salinity). Pin piles do not extend to the water's surface, instead they are installed using underwater equipment, this reduces the amount of pile in contact with the water and hence, the underwater noise dissipation associated with its installation. Piles will be vibro-piled as far as practicable prior to percussion piling to ensure they are appropriately inserted. Percussion piling noise can cause disturbance, communication masking and potentially auditory injury for marine mammals and fish (JNCC, 2010).

Removal of Unexploded Ordinance (UXO)

The North Sea is known to contain UXO, which pose a threat to both human activity and, if detonation is required, to acoustically sensitive marine organisms. Detonation poses a risk to marine mammals and fish by increasing noise levels at distances of several kilometres (Robinson et al., 2022). However, the extent of such risk is dependent on the specific UXO characteristics (size/type) and location. As the presence and characteristics of UXO cannot be predicted, however, would require assessment if found in the Project area and if detonation was required.

8.2.3.2 Operational Impacts

Activities associated with the operational phase that have the potential to generate underwater noise include:

- Vessel movements;
- Operational turbine blades and;
- Geophysical surveys.

Vessel Movements

As detailed for the construction phase, vessel movements during the operational phase are not expected to create significantly elevated noise emissions.

Operational turbine blades

Noise can be transmitted into the seabed through operational fixed wind turbines; however, it does not appear to significantly raise background levels beyond 1-2 dB_{ht} (species; frequency weighted scale to understand effects across multiple species), with noise only measurable <500 Hz (Nedwell et al., 2007; Tougaard et al., 2009). Farr et al. (2021) have subsequently indicated that less reverberation occurs from operational floating turbines and the noise produced typically at low frequencies and levels. While empirical measurements from deep water floating offshore wind farms noise emissions are not yet available (Farr et al., 2021), it is expected that underwater noise emission from the operations of the proposed development are unlikely to significantly impact ecological receptors.

Geophysical Surveys

Maintenance and monitoring activities could require geophysical surveys which can give rise to noise levels which can cause disturbance to marine mammals as discussed in Section 8.2.3.1.

8.2.3.3 Decommissioning Impacts

Sources of underwater noise during the decommissioning phase will include;

- Vessel movements; and
- Geophysical surveys.

Vessel Movements

As also identified in the construction and operations phases, vessel movements during the decommissioning phase are not expected to create significantly elevated noise emissions compared to the background levels of the area, however further investigation may be required to assess impacts fully.

Geophysical Surveys

Geophysical surveys may be required to inform decommissioning activities and the impact associated with which will be similar to those assessed for construction.

8.2.4 Mitigation Measures

Noise sources will be minimised where practicable, however where this is not possible the appropriate protocols will be followed to minimise the effects of underwater noise on marine mammals (see Section 10.4.4). Minimisation of noise sources will include switching off equipment when appropriate and safe to do so, and ensuring construction, operational and decommissioning activities are optimised to avoid unnecessary noise production.

With regard to UXO, noise modelling of the specific UXO found will be carried out to inform marine mammal risk assessment as deemed appropriate.

8.2.5 Proposed Assessment

Underwater noise will be **scoped-out** of further assessments on the assumption that mitigation identified in Section 8.2.4 and 10.4.4 is implemented.

The noise emissions from cable and turbine installation using non-piled methods are unlikely to have significant environmental impacts and are therefore scoped out of the assessment. Similarly, vessel movement associated with all phases of the development are not expected to significantly elevate background noise levels to an extent that might impact ecological receptors such that further assessment of the impacts of vessel noise are also scoped out.

The installation of pin piles to fix the offshore electricity hub into position may create short-term impulsive noise that could have impacts on fish and marine mammals (further examined in Section 10.3 and 10.4). In addition, the use of sonar for geophysical surveys could have potential to affect these acoustically sensitive groups (further discussed in Section 10.3 and 10.4), however effects can be appropriately mitigated.

9 Electromagnetic Fields and Heat

Electromagnetic fields (EMFs) are generated by electrically charged objects. While the turbines do not create EMF, IACs, AC cables to oil and gas platforms and the DC cables to the NorthConnect Cable Corridor will generate these once energised.

DC voltages produce static electric fields, and AC voltages produce alternating (fluctuating) electric fields. For insulated cables, the electric fields are contained inside the cable, hence, there will be no direct external electric field caused by the Project’s cables.

Magnetic fields are produced by electric current flow and are measured in Tesla (symbolised as T), being the standard unit for magnetic flux density. Magnetic Fields are not easily screened and can pass through infrastructure, including cable protection. They decrease rapidly with distance from the cable. Magnetic fields can induce weak electric fields, the induced electric fields and magnetic fields are both covered by the term EMF.

High levels of EMF can cause interference with electronic equipment, magnetic equipment and communications such as radios and compasses. In addition, a wide range of marine species are sensitive to EMF as they use natural fields to navigate and locate prey and other resources. As such, fluctuations, increases or alterations of EMF can result in behavioural changes in organisms that could have overall significant impacts on their survival (Hutchison et al., 2020). Elasmobranchs, mammals, turtles, fishes, molluscs and crustaceans are known to utilise EMF, and artificial EMF generation can therefore result in changes to predator/prey dynamics, attraction or repulsion to habitats, impacts on navigation and effects on physiology and development (Taormina et al., 2018). Therefore, this section considers EMF associated with the Project, to allow them to be appropriately considered within the relevant Biodiversity topic areas in Section 10.

As energy is passed through power cables, some of the power is also lost as heat which can be transferred into the marine environment (Taormina et al., 2018). AC cables produce more heat than DC cables (Taormina et al., 2018). Changes in temperature can influence the behaviour and reproductive success of marine species, and hence is considered in this section.

9.1 Data and Information Sources

Information with regard to EMF and heat produced by DC cables has been gleaned from the assessments completed as part of the NorthConnect EIA (NorthConnect, 2018).

9.2 Baseline

The Earth's core produces a magnetic field, which is oriented in a north-south alignment, and gives rise to varying magnetic field strengths across the globe. The Earth's magnetic field is strongest towards the poles and weakest at the equator.

The Earth provides a background static magnetic field ranging between 25 and 65 microtesla (μT) and the intensity tends to decrease from the poles to the equator. At the latitude of the Cenos project, the Earth's magnetic field is approximately 50 μT (NOAA, 2013).

There are no known electricity cables within the footprint of the Cenos windfarm, nor on the proposed cable route to the NorthConnect Corridor. However, the North Sea Link 1.4GW HVDC interconnector buried cables pass to the southeast of the proposed windfarm location (see Figure 12-2).

There are oil and gas pipelines in the vicinity of the works, these may be a source of heat.

9.3 Potential Impacts

9.3.1 Construction Impacts

There will be no significant sources of heat, electric or magnetic fields associated with the construction works.

9.3.2 Operational Impacts

EMF and heat will be produced by all electrified cables, EMF can also cause compass deviation and hence these are considered below.

EMF

DC Cables are utilised to transmit power over long distances as they give rise to lower power losses. It is assumed that the export cables to shore utilised by the Cenos project will be equivalent to those assessed by the NorthConnect project EIA. Two DC cables will be required and laid in close proximity to each other, as their currents will be in opposite directions, there will be some degree of cancelling out of the magnetic fields generated by each cable.

Magnetic fields strengths were calculated by NorthConnect based on a number of scenarios covering a number of offshore cable configurations. These are analogous to the Cenos cable from the Offshore

Electrical Hub to the NorthConnect Cable route, as they are in a similar location in terms of the Earth's magnetic fields. Magnetic flux density (B) is a measure of magnetic interaction, calculated using the Biot-Savart Law, where I is the current (1400 Amps in this instance), μ is the magnetic permeability of the medium, and R is the radial distance from the current axis. The equation is expressed as follows:

$$B = \frac{\mu I}{2\pi R}$$

All relevant media have relative permeability constants very close to 1. Only ferromagnetic materials have deviating permeabilities. Hence, a permeability of 1 was assumed for all media. The levels of magnetic flux experienced on the seabed varies based on the distance between the cables and the depth of burial (DOB). If DC cables were bundled together at a depth of 0.04m the peak magnetic flux will be negligible (<200 μT). The worst case scenarios modelled used a DOB of 0.4 m, cable separations of 20 m, 40m and 100m were considered. The peak magnetic flux is 640 μT, with levels reducing to <300 μT within 2m of the seabed in all cases. The majority of the DC cable will have a DOB of over 0.8m. hence the realistic scenario is shown in Figure 9-1, it assumes a cable separation of 40m and a DOB of 1m. The peak DOB is 310 μT for a cable with a DOB of 1m (NorthConnect, 2018).

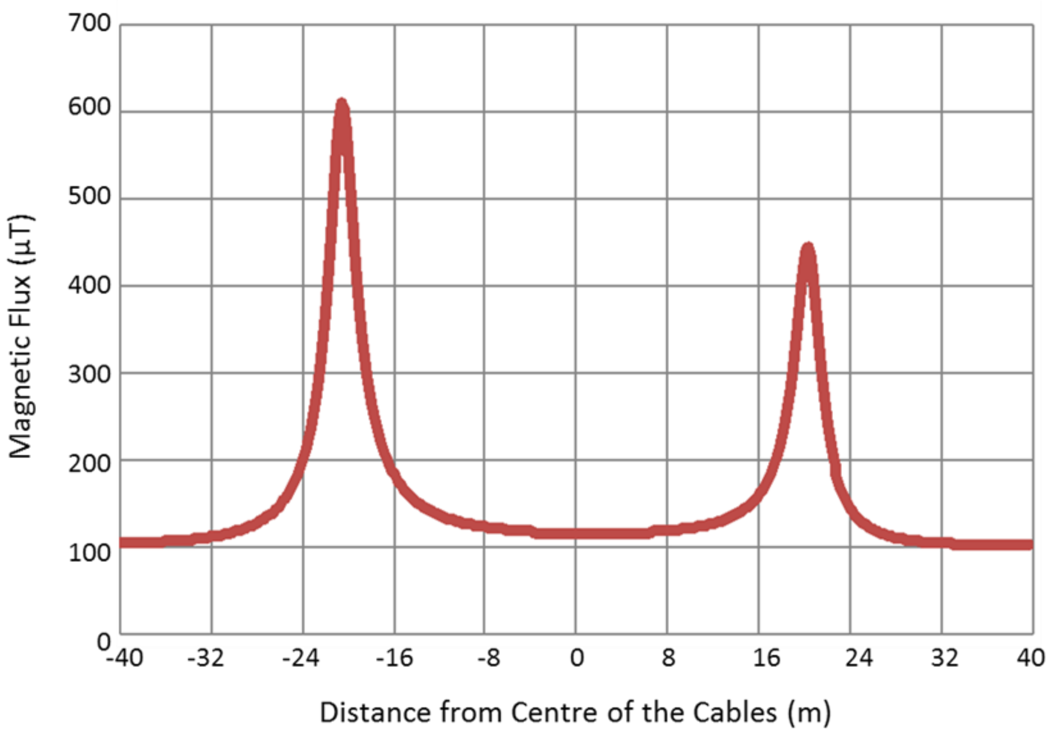


Figure 9-1: DC Cables Magnetic Flux on seabed When Crossing Perpendicular, 40m Separation, 1m DOB (NorthConnect, 2018).

66kV AC cables will be utilised in the IAC and to export power from the Offshore Electricity Hub to the oil and gas platforms. Similar cables are proposed as part of Floatation Energy's Green Volt project and hence modelling of this cable type have been undertaken. Figure 9-2 shows the magnetic flux levels associated with 66kV AC with a DOB of 0.6m (Royal HaskoningDHV, 2023). Peak magnetic flux levels of less than 40 μT are therefore expected for the buried Cenos AC cables.

The dynamic portion of the IAC passes through the water column, and hence is not buried, similarly connections to the Offshore Electrical Substation and oil and gas platforms will pass through the water column. As the magnetic permeability of the medium (μ) is assumed to be 1 for both water and sediments, it can be assumed that the graphed peak flux levels shown in Figures 9-1 and 9-2, will be reached within 1m and 0.6m respectively.

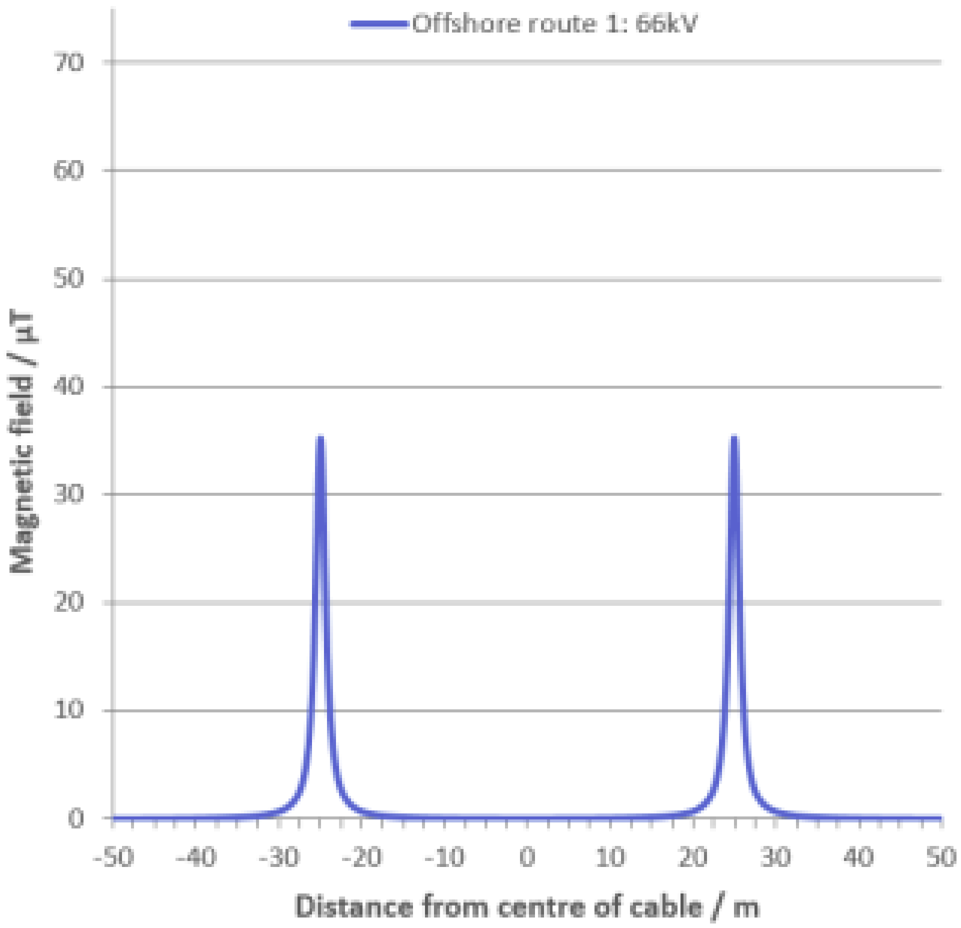


Figure 9-2: AC Cables Magnetic Flux on seabed When Crossing Perpendicular, 40m Separation, 0.6m DOB (Royal HaskoningDHV, 2023).

The effects of EMF on biological receptors are considered in Section 10.

Compass Deviation

The magnetic fields associated with the cables could cause compass deviation. Magnetic fields reduce with distance, hence, the deeper the water the lower the compass deviation effect experienced by vessels on the surface. Similarly, the closer cables are to each other, the greater the cancelling effect between the two cables. Compass deviations of greater than 5 degrees are of a concern to navigation. Figure 9-3 shows the maximum cable separation that can be employed while achieving compass deviations of less than 5 degrees at various water depths.

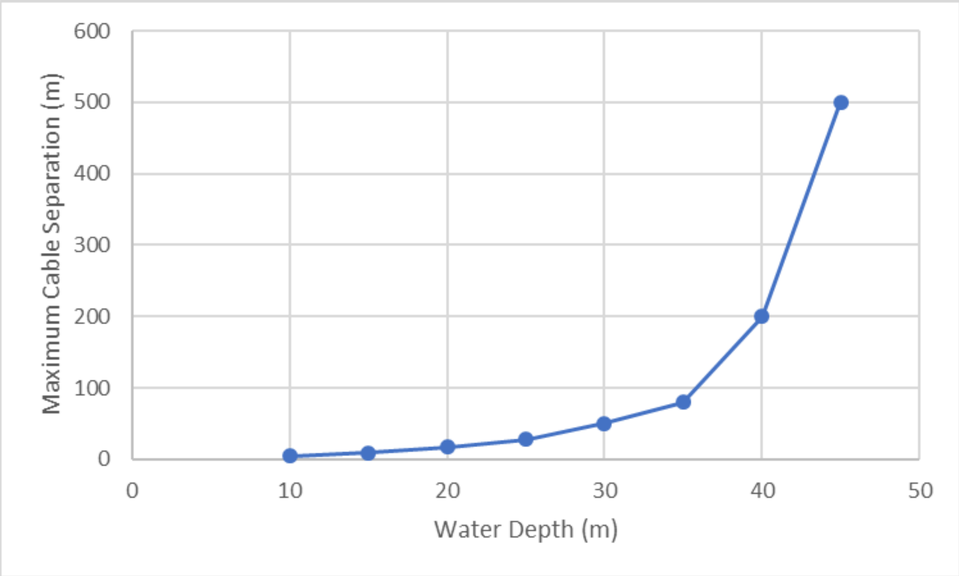


Figure 9-3: Maximum Cable Separation by Water Depth to Achieve <5-degree Compass Deviation.

As the DC cable route from the Cenos Offshore Electricity Platform to the NorthConnect Cable route is through deep water >50m and cables are unlikely to be more than 100m apart, compass deviations are predicted to be much less than 5 degrees. The peak magnetic flux associated with the AC cables is predicted to be less than those associated with the DC cables, as such associated compass deviation effects will also be less. No significant effects on compass deviation are expected from the Cenos windfarm cables due to the water depths.

Heat

The production of heat from energised cables may have an impact on benthic receptors, as discussed in Section 10.2. The extent of sediment heating from cables was modelled by NorthConnect for DC cables, assuming a DOB of 0.5m, an ambient seawater temperature of 9°C and a 20m distance between adjacent cables (Figure 9-4).

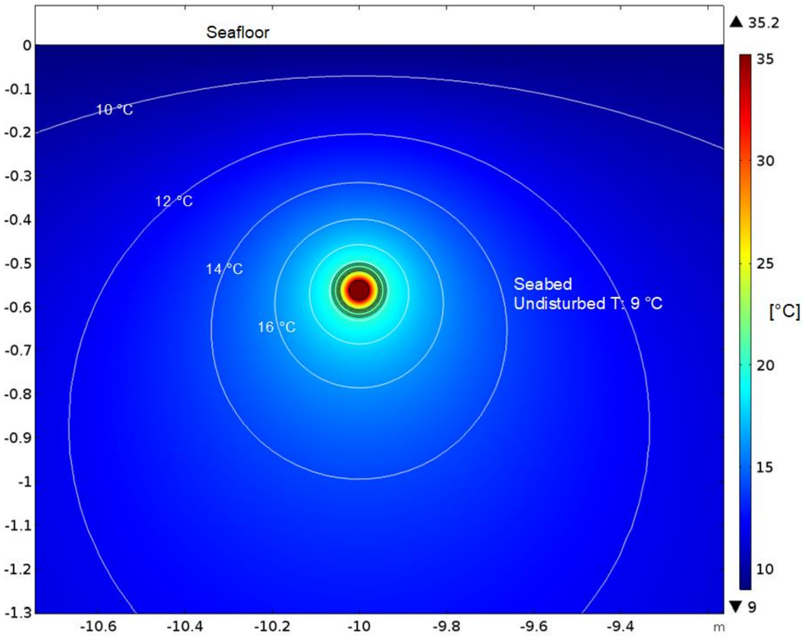


Figure 9-4: Sediment temperatures for a cable buried at 0.5m and separated from the nearest adjacent cable by 20m (NorthConnect, 2018).

The model output demonstrated that sediment heating effects were extremely localised. No interaction effects were found between cables at a 20m separation. Temperature increases >1°C were localised to an area with a radius <2.5m, with the centre point positioned below the cable. This was likely due to heat dissipation nearer the top of the seabed, caused by increased heat dissipation facilitated by the overlying seawater. Temperature changes up to 7°C were restricted to an area with a radius of 0.2m, meaning significant deviations in temperature were localised.

NorthConnect also assessed potential heat output from bundled cables, which give rise to higher temperatures as they interact with each other and have an additive effect. As with single cables, temperature increases >1°C were localised to an area with a radius <2.5m however, an increase of up to 7°C covered a slightly wider area with a radius of 0.5m (NorthConnect, 2018). It is expected that the production of heat for the DC cables within the proposed Project will be similar to that modelled for by NorthConnect.

The AC cables have lower currents levels passing through them than the DC cables, and it is assumed they will give rise to lower temperatures than the DC cables. The DC cables are assumed to be the worst case with regard to temperature effects on the seabed.

9.3.3 Decommissioning Impacts

There should be no significant sources of electric or magnetic fields associated with decommissioning.

9.4 Mitigation Measures

To minimise the potential for cable damage, cables will be armoured and where practicable buried. This will minimise the EMF and heat issues arising.

9.5 Proposed Assessment

EMF and Heat will be **considered further** for the operational phase to provide sufficient understanding to inform the relevant ecological assessments. Compass deviation will be **scoped-out** as it is not an issue due to the Project being set in water depths of greater than 50m.

EMF and heat will be considered taking account of the cables types, voltages likely to be utilised, DOB targets where available and the conductivity properties of the substrates found during the seabed surveys (see Section 5.5). Where the proposals differ from those modelled by NorthConnect (2018) and Royal Haskoning DHV (2023) new calculations, modelling will be undertaken. The EMF and heat level predictions will be utilised to inform the relevant ecological assessments (see Section 10).

10 Biodiversity

10.1 Protected Areas

A network of designated sites is in place to aid the protection of vulnerable and endangered species and habitats through structured legislation and policies. These sites include SACs and SPAs, which were designated in the UK under the EU Nature Directives (prior to January 2021) and are now maintained and designated under the Habitats Regulations for England and Wales, Scotland and Northern Ireland. Amendments to the Habitats Regulations mean that the requirements of the EU Nature Directives continue to apply to how European sites (SACs and SPAs) are designated and protected in Scotland. The Habitats Regulations also provide a legal framework for species requiring strict protection, e.g., EPS.

NCMPAs are designated under the Marine (Scotland) Act 2010 or the MCAA. The MCAA also allows for the creation of Marine Conservation Zones (MCZs) in English, Welsh and Northern Irish waters. In addition, NatureScot and JNCC list 81 species and habitats considered Priority Marine Features (PMFs) of conservation importance in Scotland's seas.

Figure 10-1 shows the designated sites in the vicinity of the proposed windfarm location, whilst Table 10-1 provides the approximate distances of the sites from the windfarm location. In addition, Table 10-1 lists the species and or habitats for which the sites are designated.

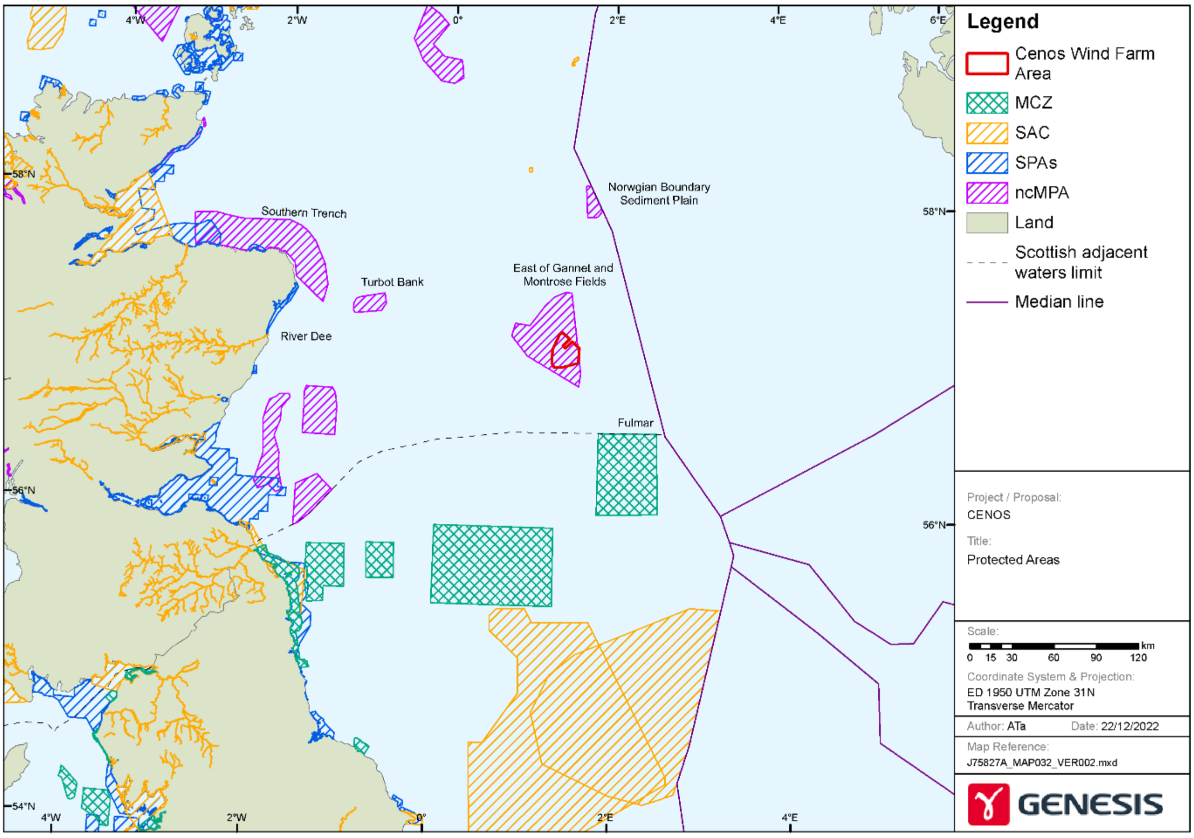


Figure 10-1: Designated areas on the vicinity of the proposed windfarm location.

In addition to the protected areas detailed above for UK waters, there are several legally protected areas in Norwegian waters, however these are situated in coastal waters and are therefore not relevant to the Project (Figure 10-2). However, some offshore Special Valuable Areas (SVAs) are recognised as areas of significant importance for biological diversity and production within, and often also outside, the area (Figure 10-2). SVAs do not directly impose restrictions on business activity; but signal the importance of exercising particular caution in these areas. Of the identified SVAs, two designated for the protection of fish spawning habitats, including mackerel (*Scomber scomber*) and sandeels (Ammodytidae) are closest to the proposed Project (Table 10-1).

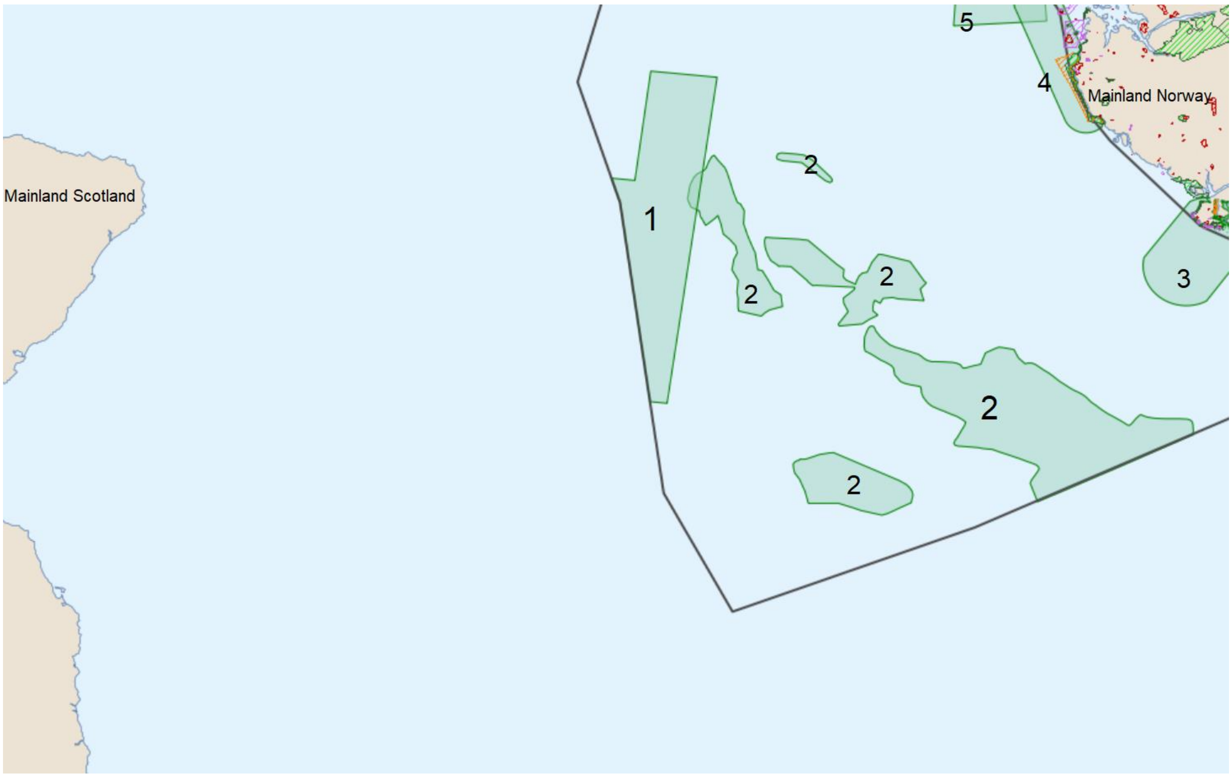


Figure 10-2. Norwegian Special Vulnerable Areas (in green; SVAs) and protected areas (in red). 1- mackerel spawning grounds; 2- sandeel spawning grounds, 3- Listastrendene og Siragrunnen; 4- Boknafjorden og Jærstrendene; 5- Karmøyfeltet. Those areas that are SVAs but within the Norwegian coastal area and therefore not relevant to the Project are numbered 3-5. From kart.barentswatch.no.

*Table 10-1: Protected areas in the vicinity of the proposed windfarm location, with nearest boundaries to Project area. Norwegian SVAs indicated by **.*

Name and type	Distance inkm from proposed wind farm area (direction)	Designated features
East of Gannet and Montrose Fields NCMPA	0	Offshore deep-sea muds; Ocean quahog (*Arctica islandica (A. islandica)*) (including sands and gravels as their supporting habitat).
Gytefelt makrell**	~45 (E)	Mackerel spawning grounds
Fulmar MPA (Marine Conservation Zone)	48 (SE)	Subtidal sand; Subtidal mud; Subtidal mixed sediments; *A. islandica*.
Norwegian Boundary Sediment Plain NCMPA	82 (NE)	*A. islandica.*
Tobisfelt sør**	~100 (E)	Sandeel spawning grounds
Turbot Bank NCMPA	119 (W)	Sandeel (*Ammodytes marinus*)

Name and type	Distance inkm from proposed wind farm area (direction)	Designated features
Southern Trench NCMPA	162 (NW)	Minke whale (*Balaenoptera acutorostrata*); Burrowed mud; Fronts Quaternary of Scotland; Shelf deeps; Submarine Mass Movement
Southern North Sea SAC	172 (S)	Harbour porpoise (*Phocoena phocoena*)
Buchan Ness to Collieston Coast SPA	188 (W)	Fulmar (*Fulmarus glacialis*); Guillemot (*Uria aalge*); Herring gull (*Larus argentatus*); Kittiwake (*Rissa tridactyla*); Shag (*Phalacrocorax aristotelis);* Seabird assemblage, breeding
Ythan Estuary, Sands of Forvie and Meikle Loch SPA	190 (W)	Common tern (*Sterna hirundo*); Eider (*Somateria mollissima*); Lapwing (*Vanellus vanellus*); Little tern (*Sternula albifrons*); Pink-footed goose (*Anser brachyrhynchus*); Redshank (*Tringa tetanus*); Sandwich tern (*Sterna sandvicensis*); Waterfowl assemblage, non-breeding
Fowlsheugh SPA	209 (SW)	Fulmar (F*ulmarus glacialis*); Guillemot (*Uria aalge*); Herring gull (*Larus argentatus*); Kittiwake (*Rissa tridactyla*); Razorbill *(Alca torda*); Seabird assemblage, breeding
Outer Firth of Forth and St Andrews Bay Complex SPA	209 (SW)	Arctic tern (*Sterna paradisaea*); Black-headed gull (*Chroicocephalus ridibundus*); Common gull (Larus canus); Common scoter (Melanitta nigra); Common tern (*Sterna hirundo*); Eider (*Somateria mollissima*); Gannet (Morus bassanus); Goldeneye (*Bucephala clangula*); Guillemot (*Uria aalge*); Herring gull (*Larus argentatus*); Kittiwake (*Rissa tridactyla*); Little gull (*Hydrocoloeus minutus*); Long-tailed suck (*Clangula hymalis*); Manx shearwater (*Puffinus puffinus*); Puffin (*Fratercula arctica*); Razorbill (*Alca torda*); Red-breasted merganser (*Mergus serrator*); Red-throated diver (*Gavia stellata*); Seabird assemblage; Shag (*Phalacrocorax aristotelis*); Slavonian grebe (*Podiceps auratus*); Velvet scooter (*Melanitta fusca*); Waterfowl assemblage
Firth of Tay and Eden Estuary SAC	250 (SW)	Harbour seal (*P. vitulina*); Estuaries; Intertidal mudflats and sandflats; Subtidal sandbanks
Isle of May SAC	253 (SW)	Grey seal (*Halichoerus grypus*) Reefs
Moray Firth SAC	280 (NW)	Bottlenose dolphin (*Tursiops truncatus*); Subtidal sandbanks
Dornoch Firth and Morrich More SAC	320 (NW)	Harbour seal (*Phoca vitulina*); Atlantic salt meadows; Coastal dune heathland; Dune grassland; Dunes with juniper thickets; Estuaries; Glasswort and other annual colonising mud and sand; Humid dune slacks; Intertidal mudflats and sandflats; Lime-deficient dune heathland with crowberry; Otter (*Lutra lutra*); Reefs; Shifting dunes; Shifting dunes with marram; Subtidal sandbanks
Faray and Holm of Faray SAC	323 (NW)	Grey seal (*Halichoerus grypus*)

10.1.1 Proposed Assessment

Designated sites will be considered under the relevant topic areas, in some instances this will mean that they are considered in multiple sections. For example, the proposed windfarm will be located within the East of Gannet and Montrose Fields NCMPA. This site is designated for offshore deep-sea muds and ocean quahog (*Arctica islandica*; including sands and gravels as their supporting habitat). Scoping of the potential impacts on the benthic ecology in the area which includes the habitat types is presented in Section 10.2. Ocean quahog are considered in Section 10.3 while the impacts on the sediment type are considered in Section 5.

In addition, as discussed in Section 3.6 SPA and SAC will be considered under the Habitats Regulations.

10.2 Benthic Ecology

This section of the Scoping Report identifies the potential impacts of the proposed Project on the benthic ecology in the area.

10.2.1 Data and Information Sources

This Scoping Report has been informed by publicly available data sources and data from historical surveys carried out in the vicinity of the proposed wind farm location. Table A-1 in Appendix A identifies relevant survey reports undertaken primarily by the oil and gas sector and the approximate distance from the proposed wind farm location.

The proposed wind farm is also located within the East of Gannet and Montrose Fields Nature NCMPA, and as such, the designation, site selection and characteristics are detailed in sources provided by JNCC and NatureScot. These resources are referenced in the following sections to provide baseline data and context for the benthic ecology identified and expected within the area.

10.2.2 Baseline

Bacteria, plants and animals living on or within seabed sediments are collectively referred to as benthos. Species living on top of the sea floor may be sessile (non-mobile, e.g., seaweeds) or freely moving (e.g., starfish) and collectively are referred to as epibenthic or epifaunal organisms. Animals living within the sediment are termed infaunal species (e.g., tubeworms). Semi-infaunal animals, including sea pens and some bivalves, lie partially buried in the seabed.

The East of Gannet and Montrose Fields NCMPA has been extensively surveyed to describe the extent and distribution of benthic habitats and the ocean quahog using sediment grab samples and seabed photography (McCabe et al., 2020). Three main habitat types were identified; A5.2 Sublittoral sand, A5.3 Sublittoral mud and A5.4 Sublittoral mixed sediment (Figure 10-3). Within the north-west of the NCMPA the sediments were sandy sedimentary, while the south-east had more muddy sediments. Overall, mixed sediment had a sparse distribution within the area (Figure 10-3; McCabe et al., 2020). The extent of the PMF 'offshore deep muds' had increased from previous surveys conducted and were found in deeper areas within the East of Gannet and Montrose Fields NCMPA (e.g., 88-102m) (McCabe et al., 2020).

The Madoes field located immediately adjacent to the proposed windfarm area (and within the initial survey area) has been developed for oil and gas activities (subsea field tied back to the bp operated ETAP platform, see Section 5). A habitat/benthic survey carried out at the Madoes field identified two main biotope complexes; 'circalittoral muddy sand' (A5.26/SS.SSa.CMuSa; a soft sediment habitat), and 'circalittoral mixed sediment' (A5.44/SS.SMx.CMx; a coarser gravel sediment type; Fugro, 2019a). Elements of the OSPAR-listed threatened and/or declining habitat 'Sea pen and burrowing megafauna communities' (OSPAR, 2010) were also detected as part of the survey carried out at the Madoes field. It should be noted that the European Nature Information System (EUNIS) biotope 'circalittoral muddy sand' also falls within the broad habitat PMF 'offshore subtidal sands and gravel'. Other surveys carried out in the vicinity of the proposed windfarm location (see report references in Table A-1, Appendix) identified similar habitats i.e., circalittoral muddy sand', 'circalittoral mixed sediment', as well as the OSPAR-listed threatened and/or declining habitat 'Sea pen and burrowing megafauna communities'. Representative images of the seabed found during JNCC and Madoes field surveys may be found in Figure 10-4.

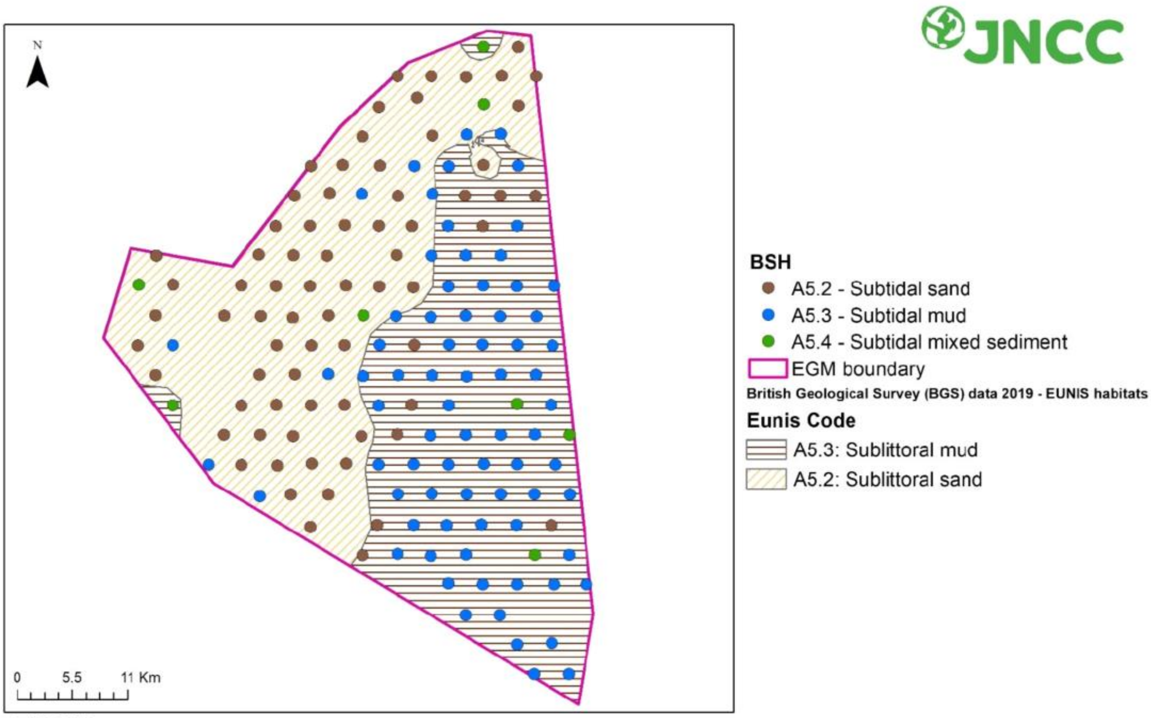


Figure 10-3: Distribution of EUNIS sedimentary habitats based on particle size analysis from survey 151S to East of Gannet and Montrose Fields NCMPA (EGM; 2015). Underlaid is the predictive map of habitats, indicating the difference between predicted and sampled habitat extents (McCabe et al., 2020).

Figure 10-4: Example seabed photographs within the East of Gannet and Montrose Fields NCMPA (A,B; O'Connor, 2016), and the Madoes survey area (C; Fugro, 2019a).

The benthic species present in the wider Central North Sea (CNS) area are largely correlated with the substrate type and associated hydrodynamic conditions. This was also confirmed within the East of Gannet and Montrose Fields NCMPA as the infaunal assemblages present were associated with the three main sediment types identified above (McCabe et al., 2020). Following the Marine Habitat Classification of Britain and Ireland, several biotopes were identified (Table 10-2). Overall, the benthic community within the NCMPA was considered to be rich and even (McCabe et al., 2020). No invasive species were identified during surveys undertaken within the East of Gannet and Montrose Fields NCMPA (McCabe et al., 2020).

Table 10-2: The main biotopes and qualifying species identified within the East of Gannet and Montrose Fields NCMPA (McCabe et al., 2020). Infaunal biotope, and epifaunal biotope**.*

Biotope name	Biotope code	Species associated
Paramphinome jeffreysii, Thyasira spp. and Amphiura filiformis in offshore circalittoral sandy mud*	SS.SMu.OMu.PjefThyAfil	*Paramphinome jeffreysii*- Annelid (polychaete worm) *Thyasira* spp.- Mollusc (bivalve) *Amphiura filiformis*- Echinoderm (Ophiuroidea)
Owenia fusiformis and *Amphiura filiformis* in offshore circalittoral sand or muddy sand*	SS.SSa.OSa.OfusAfil	*Owenia fusiformis*- Annelid (polychaete worm) Amphiura filiformis- Echinoderm (Ophiuroidea)
Sea pens and burrowing megafauna in circalittoral fine mud**	SS.SMu.CFiMu.SpnMeg	
Circalittoral sandy mud**	SS.SMu.CSaMu	
Circalittoral mixed sediment**	SS.SMx.CMx	
Virgularia mirabilis and *Ophiura* spp. with *Pecten maximus* on circalittoral sandy or shelly mud**	SS.SMu.CSaMu.VirOphPmax	Virgularia mirabilis- Cnidaria (Virgularia) *Ophiura* spp.- Echinoderm (*Ophiuroidea*) *Pecten maximus*- Mollusc (bivalve)

The three main species that are typical within the SS.SMu.OMu.PjefThyAfil biotope are *P. jeffreysii, Thyasira* spp., and *A. filiformis. P.jeffreysii* is a polychaete commonly found throughout the North Atlantic. As typical of many polychaete species, it has a short lifespan and is considered to have a high potential recovery rate after disturbance (De-Bastos, 2016b). There are multiple species within the *Thyasira* genus, characterised by a fragile shell and slow growth rates which make them vulnerable to physical disturbance. They are also thought to have reduced and sporadic recruitment, increasing their potential sensitivity to physical anthropogenic pressures (De-Bastos, 2016b). *A. filiformis* is a small species of brittlestar, with a central disc ~10 mm in diameter. It is a suspension feeder, using its long arms (typically 10x length of disc diameter) to sieve particulates from the water (Hill & Wilson, 2008). It is long-lived, with a lifespan possibly up to 25 years and sexual maturity gained at approximately two years (Sköld et al., 2008). They breed annually and the larvae can be dispersed over large distances (Hill & Wilson, 2008). The species is considered an important prey item for benthic fish and invertebrates, however, generally only the arms are consumed, allowing the brittlestar to regenerate (Hill & Wilson, 2008). Overall, this biotope is considered to have a 'medium' resilience to disturbance, where recovery is likely to occur within 2-10 years but where slightly longer recovery durations are expected within low-energy environments. However, confidence in this assessment is 'low' (De-Bastos, 2016b).

The SS.SSa.OSa.OfusAfil biotope is associated with both *A. filiformis* and the polychaete worm *O. fusiformis*. *O. fusiformis* grows to around 10 cm in length and creates a flexible tube within the sediment formed of sand grains and shell fragments which in turn helps to stabilise the benthic environment (De-Bastos, 2016a). The species can live up to four years and larval settlement is highly dependent on the proportion of mud within the sediment, where reduced mud content negatively affects tube building ability and therefore survival (De-Bastos, 2016a). The resilience of this biotope is dependent on whether adult individuals can re-colonise the area ('high' resilience), or if recovery is reliant on juvenile re-settlement ('medium' resilience; De-Bastos, 2016a).

Epifaunal biotopes were also identified within the EGM (see Table 10-2). SS.SMu.CFiMu.SpnMeg frequently occurs within habitats consisting of fine mud, particularly at depths greater than 15m (Hill et al., 2022). The occurrence of burrowing megafauna and sea pens are not always concurrent within this biotope and other species groups are often present including polychaetes, nematodes and bivalves. Three species of sea pen were identified, *V. mirabilis*, *Pennatula phosphorea* and *Funiculina quadrangularis* (Figure 10-5), and few damaged or broken individuals were observed within the area. The resilience of this biotope depends largely on the species present and the intensity and frequency of impact. Where adult animals remain undisturbed the recovery rate may be 'very high' (<2 years), however, where significant proportions of the population are damaged, this may reduce to 'low' (>10 years; Hill et al., 2022). This biotope falls under the PMF category 'Burrowed mud' and was present within 82 % and 100 % of still images and video transects, respectively (McCabe et al., 2020).

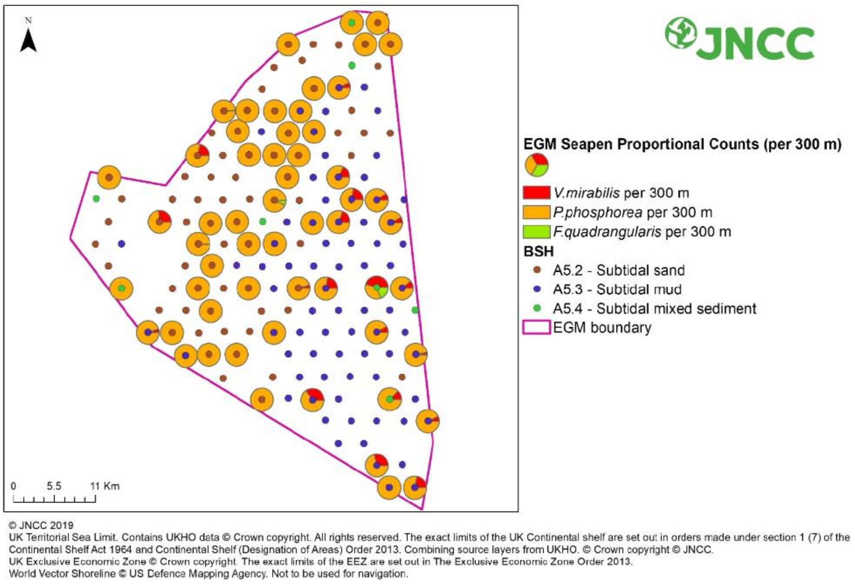


Figure 10-5: Proportional counts of the three observed sea pen species per 300m video tow (EGM; 2015). 58 video tows were undertaken.

SS.SMu.CSaMu.VirOphPmax was also identified in 1.9 % of still images taken during surveys (McCabe et al., 2020). The slender sea pen (*V. mirabilis*) is an organism composed of polyp colonies. They extend their long stalks into the water column to feed upon drifting zooplankton and a portion of the stalk remains within a burrow in the sediment, where the whole colony can withdraw if disturbed (Hill & Wilson, 2000). Sea pen species are considered to have long lifespans and slow growth rates; however, the slender sea pen may be fairly disturbance resilient due to its ability to quickly retreat into its burrow (Hill et al., 2016). The great scallop (*P. maximus*) is a shellfish of commercial interest (see Section 13). They may live up to 20 years and become sexually mature at two years. This species has a limited ability to swim away from predation attempts by rapid movement of the shell valves (Marshall & Wilson, 2008). While recovery rates of *Ophiura* spp. are considered to be rapid and the slender sea pen may be resistant to impact damage, the life history characteristics of all species associated with the biotope suggest its overall resilience is 'low' (10-25 years; Hill et al., 2016).

Surveys conducted within the Madoes oil and gas field found similar species assemblages. Polychaetes (*P. jeffreysii*) and (*Galathowenia oculata*) were the most abundant and dominant species, which is generally typical of background communities in this area of the North Sea. Macrofaunal analysis showed that the dominant taxa were annelids (46.1 %), arthropods (25.8 %), molluscs (19.1 %), and echinoderms (3.4 %). Other phyla comprised the remaining 5.6 % of taxa (Fugro, 2019a).

As described previously in Section 10, the ocean quahog (*A. islandica*) is one of the designating features associated with the East of Gannet and Montrose Fields MPA. Evidence of juvenile *A. islandica* were found in the grab samples collected at the Madoes field (Fugro, 2019a), and in the surveys conducted by JNCC. The presence and distribution of ocean quahog is examined further in Section 10.3.

10.2.3 Potential Impacts

As discussed in Section 5.3 there are three components that interface with the seabed, these are the:

- Wind turbine anchors;
- Cables and cable protection; and
- Offshore electricity hub piles.

Interactions during construction, operations and decommissioning phases of the project can have implications for benthic ecology, both directly and indirectly.

10.2.3.1 Construction Impacts

Sources of impacts of the proposed Project on benthic ecology during the construction phase include:

- Habitat loss;
- Sedimentation & Increased SPM;
- Disturbance of contaminated sediments; and
- Introduction of invasive species.

Habitat Loss

The sighting of components on the seabed including anchors, cable protection and the electrical hub piles, will give rise to permanent (at least for the lifetime of the project) direct habitat loss, all be it in localised, limited areas.

The installation of cables into the seabed requires seabed substrates to be fluidised (jet trenched) or moved (ploughed), both of which give rise to localised habitat disturbance. Similarly, the embedment of anchors into position (if drag anchors are used) can cause habitat disturbance. Habitat can recover once the cables/ anchors are installed and sediments have settled. Habitat loss associated with cable and anchor installation is expected to be localised and temporary. Recovery rates will be determined by the sediments present, techniques employed and species present. As identified within the baseline information detailed in Section 10.2.2, the recovery rates of species and habitats within the Project area vary. Further surveys to identify species and habitats will inform the assessment, however, the biotope within the area is likely to recover over time (De-Bastos, 2016b).

Sedimentation & Increased SPM

As discussed in Section 5.3.1 a variety of construction activities can cause disturbance of sediments, which has the potential to temporarily increase solids present in the water column, which will be re-deposited on adjacent areas of the seabed, with small particles potentially travelling further from the point of origin. This may have negative effects on the benthic ecology of the area due to the potential for smothering or loss of suitable habitat. Resilience or otherwise to smothering and habitat loss is species/habitat dependent, further surveys will help inform the distribution of these and the significance of the impact.

The movement of sediments can also increase SPM concentrations as discussed in Section 6.3.1. Sessile epifaunal species may be particularly affected by increases in SPM concentrations due to potential clogging or abrasion of sensitive feeding and respiratory apparatus (including *A. islandica* and burrowing megafauna which are known to occur in the area; Nicholls et al., 2003). Larger, more mobile animals are expected to be able to avoid any adverse suspended solid concentrations and areas of deposition (Wilber & Clarke, 2001). The depth of sedimentation, the size of impacted areas and levels of SPM will be determined by the sediments present and techniques employed, however due to the sensitivity of the benthos in the area it has the potential to be significant, However, as discussed in Section 6, the localised and short-term nature of SPM reduces the likelihood of this being significant in EIA terms. The impact of sedimentation and increased SPM from the construction phase on shellfish such as the ocean quahog and *Nephrops* is explored in Section 10.3.

Disturbance of Contaminated Sediments

As extensively discussed in Section 5, no contamination at levels that could cause harm to benthos are currently identified. If they were to be, the intent is to avoid disturbance. It is however recognised that if contamination was to be disturbed then the identified habitats in the area (i.e., burrowed mud, continental shelf mixed sediments) are sensitive to non-synthetic compound contamination (inc. heavy metals and hydrocarbons; Marine Scotland, 2020), therefore, re-mobilised contaminants could impact on the wider area.

Introduction of Invasive Non-native Species

An invasive non-native species (INNS) is defined as a species that is non-native to the ecosystem under consideration and whose introduction may cause economic or environmental harm. Invasive species can be introduced to an area by ship ballast water or from colonised structures moved to the area by sea. The risk of non-native species colonisation on hard surfaces may be dependent on the material (e.g., metal vs concrete) and where the equipment is brought from. Typically, vessels are treated with antifoul to prevent establishment of biofouling organisms. The specific ports of origin and transport routes will determine the risk of INNS introduction during the construction phase.

10.2.3.2 Operational Impacts

Sources of potential impacts of the proposed Project on benthic ecology during the operational phase include:

- Habitat loss;
- Creation of additional habitat;
- EMF and heat; and
- Introduction of invasive species.

Habitat Loss

During the operational phase, any additional infrastructure to be laid will be limited to the replacement of damaged inter-array cables (estimated to be one per annum). Therefore, this minimal area of seabed take/disturbance per annum is unlikely to be significant to benthic receptor species and habitats. No significant additional habitat loss from that identified in the construction phase is associated with the operational phase.

Creation of Additional Habitat

Additional habitat may be created during the operational phase through the biological colonisation of hard artificial surfaces and structures, such as mooring systems, cable protection, legs of the offshore electrical hub and the floating turbines. The growth of colonising organisms on structures in the North Sea has been extensively studied and has used to promote biodiversity in oil and gas projects (e.g., 'Rig-to-Reef'; Draeger et al., 2020). While organisms growing upon or sheltering within mid-water or benthic structures may improve biodiversity and create additional habitat (Krone et al., 2013), in a deep-water soft sediment benthic assemblage as identified within the East of Gannet and Montrose Fields NCMPA and subsequently the project area, the impacts may not necessarily advantage the species already present. Soft-bottom communities rely on specific water movement, low levels of disturbance, and particular levels of predation, and changes to the environment could allow different species to colonise and potentially out-compete, effect additional predation pressure or change overall ecosystem processes (Draeger et al., 2020). '*Mytilus*-sation' of the North Sea has been identified as a potential pressure, as extensive blue mussel (*Mytilus edulis*) growth on sub-sea structures increase filtration rates and provide fewer feeding opportunities for other filter-feeding species (Krone et al., 2013).

At the Project site, the likely nearest hard surfaces are oil and gas infrastructure. The likelihood of such structures acting as reservoir populations depends on the dispersal capabilities of the species present (Schröder et al., 2006). While colonisation of structures may involve hydroid, bivalve and amphipod species (Schröder et al., 2006), how such communities form at greater depths (>30 m, where the majority of large structures are likely to be placed in the Project) and their potential effect on the original epifaunal species in the area is unclear.

The risk or benefit to the benthic ecological receptors from creation of additional habitat requires further consideration.

EMF and Heat

The generation of EMF and heat from energised cables will occur during the operational phase of the proposed Project (see Section 9). Benthic organisms are known to be sensitive to EMF and heat emission, which could cause alteration of spatial distribution and changes to survival rates, however there is a significant knowledge gap associated with this topic (Taormina et al., 2018). In a review by Albert et al. (2020), 75 % of studies stated a response to EMF at an individual level across examined invertebrate infaunal and epifaunal species, yet it was unclear whether observed impacts would have population or community level effects. There are few studies that examine cable heat emission and its impacts on receptors *in situ*.

As discussed in Section 9, cables in the seabed (AC and DC) will be buried or rock protected. As EMF and heat from undersea power cables decrease rapidly with distance from the cable, burying the cables substantially reduces the levels of heat, magnetic and induced electric fields both in the water column and on the surface of the seabed. Sessile organisms that are associated with the benthos may be more likely to be exposed to heat and EMFs at a localised scale, the impact of which needs further consideration.

Introduction of Non-Native Invasive Species

There is potential for the introduction of invasive species during the operation phase through the movement of colonised maintenance equipment/structures, or from ship ballast water. While the use of antifouling agents to control the colonisation of surfaces will be beneficial in preventing non-native species growth, the potential impact of such chemicals leaching into the environment should also be further considered. The ports and transport routes utilised during maintenance activities will determine the risk of INNS introduction.

10.2.3.3 Decommissioning Impacts

Sources of potential impacts of the proposed Project on benthic ecology during the decommissioning phase include:

- Habitat Loss
- Removal of Colonised Surfaces; and
- Sedimentation & Increased SPM

Habitat Loss

The removal of components from the seabed including anchors, cables, cable protection and the electrical hub, will give rise to localised habitat disturbance. The habitat can recover once the components have been removed and sediments have settled. Hence, habitat loss associated with equipment removal is expected to be localised and temporary. The effects are likely to be similar to those associated with installation of cables and anchors discussed in Section 10.2.3.1.

Removal of Colonised Surfaces

During the decommissioning phase, infrastructure will be removed, including cables, wind turbines, piles and anchors. It is likely that over the course of the operational phase of the project that these hard surfaces will be colonised by marine organisms (Draeger et al., 2020). Removal of the infrastructure will therefore destroy established communities and reduce the biodiversity of the area. However, the species that colonise the structures may not be the 'natural' assemblages present in the area pre-construction, and the extent of colonisation may be highly dependent on the type of surface available (i.e., concrete vs metal).

Sedimentation and Increased SPM

Removal of wind farm infrastructure will likely cause some movement of the sediment and subsequent at least temporary increase in SPM. However, the impacts of this are likely to be localised and short-term, allowing for the recovery of benthic habitats and species.

10.2.4 Mitigation Measures

Detailed mitigation will be identified within the EIA, however the imbedded mitigation of compliance with International Maritime Organisation (IMO) Conventions. Specifically including the application of:

- IMO Ballast Water Management Convention; and
- IMO Convention on the Control of Harmful Anti-Fouling Systems on Ships

IMO 2011 Guidelines for the Control and Management of Ships' Biofouling to Minimize the Transfer of Invasive Species will be used.

10.2.5 Proposed Assessment

A number of potential impacts to the sensitive benthic ecology of the area have been identified, and hence benthic ecology will be **scoped-in** for all project phases.

For the construction phase, habitat loss, sedimentation and non-native invasive species are scoped-in. Non-native invasive species inclusion is based on the potential risk of hard surface colonisation and not for organisms within ship ballast water, as the latter will be controlled by the implementation of the IMO Ballast Water Management Convention detailed above. Additionally, the effects of EMF and heat, and the creation of new habitat during the operations phase, and the removal of colonised surfaces during decommissioning are also scoped-in.

As discussed in Section 5.5, surveys of the seabed are proposed. Investigation into the habitats and species present will be carried out to provide a complete baseline to inform the project design and inform the impact assessment. The data gathered will be considered alongside that already presented in the Scoping Report to create fine-scale habitat maps and provide further understanding to inform the design and assess the scoped-in topics. Assessments on impact will utilise published scientific data to understand the potential effects the planned activities may have. A generic INNS risk assessment will be completed to understand the effects the introduction of an INNS could have and to inform mitigation identification. It should however, be recognised that task specific INNS risk assessments are likely to be required as the project proceeds to take account of port and transport route specific considerations.

10.3 Fish and Shellfish Ecology

This section of the Scoping Report identifies the potential impacts of the proposed project on fish and shellfish in the area. Adult and juvenile finfish and shellfish are an important source of food for marine mammals (see Section 10.4), seabirds (see Section 10.5) and other fish species; as well as being of commercial value for the fishing industry (see Section 13).

10.3.1 Data and Information Sources

Given that fish are highly mobile, it is not proposed to carry out specific site surveys to identify fish species occurrence in the area. Rather, a desk top study will be carried out using multiple publicly available data sources, many of which provide large-scale coverage of fish species distribution within the North Sea (see Table A-2, Appendix A). A key source of information to be used in this report and in further assessments will be fisheries landings data, reported by Marine Scotland at an International Council for Exploration of the Seas (ICES) rectangle level. It is recognised the data will have some limitations in that they may likely be skewed towards species with a commercial interest.

Available scientific literature and landings reports have been utilised to inform the scoping for shellfish.

10.3.2 Baseline

Fish

More than 330 fish species inhabit the shelf seas of the United Kingdom Continental Shelf (UKCS; BEIS, 2016). Pelagic species (i.e., herring, mackerel, blue whiting, and sprat) are found mid-water and typically make extensive seasonal movements or migrations. Demersal species (i.e., cod, haddock, sandeels, sole and whiting) live on or near the seabed and, similar to pelagic species, many are known to passively move (i.e., drifting eggs and larvae) and/or actively migrate (i.e., juveniles and adults) between areas during their lifecycle. Spawning sites are where adult fish congregate to breed, and nursery grounds are where young juvenile fish can be found (Ellis et al., 2012).

Spawning and nursery sites, in addition to spawning timings are species-specific, and dependent on life history characteristics, environmental conditions and availability of breeding-age individuals. Many fish species within the North Sea are commercially important species, and data on the former attributes are often generalised across the whole of the North Sea, challenging attempts to assess fish presence within the project site. Nonetheless, some data are available that indicate the potential for nursery grounds, with Atlantic cod (*Gadus morhua*) being identified as potentially having ‘high’ intensity nursery grounds in the area (Table 10-3), suggestive of juvenile fish presence. Few data were available for the identification of commercial species spawning grounds in the area; however, Norway pout (*Trisopterus esmarki*) was suggested as having a ‘higher’ intensity by Coull et al. (1998; Table 10-3).

Table 10--3: The presence of some commercial fish species spawning and nursery grounds in the proposed wind farm area. Species presence was determined by capture surveys. Low intensity y= fewer individuals caught during surveys.

Species	Spawning	Nursery	Conservation Designations
Cod (*G. morhua*)	Low intensity[1]	High intensity[1]	PMF, UK Biodiversity Action Plan (BAP), OSPAR species, IUCN (vulnerable)
Lemon sole (*Microstomus kitt*)	Undetermined intensity[2]	-	United Kingdom Biodiversity Action Plan (UK BAP)
Plaice (*Platessa platessa*)	N/A	Low intensity[1]	UK BAP, IUCN (least concern)
Sandeel (Ammodytidae spp.)	Low intensity[1]	Low intensity[1]	PMF, UK BAP
Whiting (*Merlangius merlangus*)	-	Low intensity[1]	PMF, UKBAP
Blue whiting (*Micromesistius poutassou*)	-	Low intensity[1]	PMF, UK BAP, IUCN (least concern)
Mackerel (*Scomber scombrus*)	Undetermined Intensity[2]	Low intensity[1]	UK BAP, IUCN (least concern)
European hake (*Merluccius merluccius*)	-	Low intensity[1]	UK BAP
Haddock (*Melanogrammus aeglefinus*)	-	Undetermined intensity[2]	IUCN (vulnerable)
Ling (*Molva molva*)	-	Low intensity[1]	PMF, UK BAP
Herring (*Clupea harengus*)	-	Low intensity[1]	PMF, UK BAP, IUCN (vulnerable)
Anglerfish (*Lophius piscatorius*)	-	Low intensity[1]	PMF, UK BAP
Norway pout (*T. esmarki*)	Higher intensity[2]	Undetermined intensity[2]	PMF
Spurdog (*Squalus acanthias*)	-	Low intensity[1]	Scottish Nature Conservation MPA search feature (marine life stages), PMF, UK BAP, OSPAR, IUCN (Vulnerable)
Data sets: [1]Ellis et al., (2012) and [2]Coull et.al., (1998)			

As shown in Figure 10-2 (Section 10.1) there are important mackerel and sandeel spawning grounds to the east of the Project area in Norwegian waters.

In addition to many fish species having an important role commercially, they also form integral roles within the North Sea ecosystem as a whole. Fish are prey items for marine mammals and birds during all life stages, while they also predate pelagic and demersal invertebrate communities. Some species, such as sandeels and herring are particularly important forage fish, providing cyclic foraging opportunities for other predators. Other species, such as elasmobranchs, have slow growth rates and low fecundity, making them vulnerable to environmental change and anthropogenic impacts.

Migrating diadromous fish species such as Atlantic salmon (*Salmo salmo*) and European eel (*Anguilla anguilla*) are present in the North Sea, as part of their migration between natal rivers and the ocean. No records of either species are documented within the Project area. A recent study showed that tagged salmon leaving Danish, German and Norwegian natal rivers travelled north towards Iceland and the

Barents Sea, and no individuals passed near the Project region (Rikardsen et al., 2021). Similarly, tagged eels from Germany and Belgium did not appear to travel close to the Project area, and migrated either west through the English Channel, or north across the eastern portion of the North Sea on their way towards spawning grounds in the Sargasso Sea (Verhelst et al., 2022). Considering the available information on diadromous fish species migration routes and distribution, it is unlikely they will be present within the Project area for significant time periods. Recent tracking studies from European offshore wind development centre at Aberdeen, which has used extensive tagging studies and buoyed offshore sensors, has indicated that the tagged fish species either travel north or south from the rivers in this area of the Scotland. This data therefore backs up the other available data that migrating diadromous fish do not migrate through the wind farm development area for Cenos due its location >200km offshore in significant numbers.

Basking sharks (*Cetorhinus maximus)* are the second largest cartilaginous fish in the world. They are listed as globally endangered and are protected under Schedule 5 of the Wildlife and Countryside Act (as amended). They are present in UK coastal waters primarily in the summer (May-October) and have been found to move to offshore shelf waters in winter months (Sims et al., 2003). Their distribution is linked to oceanographic features such as thermal fronts and productive chlorophyll patches which aggregate their plankton prey (Miller et al., 2015). Hot spots of basking shark presence are known off the Scottish west and the English southwest coasts. Habitat suitability modelling has shown that these areas, in addition to the north and east Scottish coasts and waters north of the river Humber are potentially suitable for the species. Offshore waters in the North Sea, including the Project area, were not found to have high habitat suitability for basking shark presence (Austin et al., 2019). No basking sharks have been identified from the aerial survey data of the development area and the wider survey area during the last two years.

Shellfish & Crustaceans

Two species are of note within the Project area; the Norway lobster (*Nephrops norvegicus*) and the ocean quahog (*Arctica islandica*), the latter being a qualifying feature of the East of Gannet and Montrose NCMPA.

The Norway lobster is classified as burrowing megafauna and creates burrows within the sediment (Sabatini & Hill, 2008). These burrows enhance sediment stability and aeration. The Norway lobster is fished commercially in the North Sea, and 1423 tonnes were caught in 2021 using predominately trawl methods which rake the seafloor to remove individuals from their burrows (Scottish Government, 2022c). They are an important prey species for many fish species, including those of commercial interest. The Norway lobster has a small range and stay near their burrows (Sabatini & Hill, 2008). Individuals do not become sexually mature until 2-3 years old, and coupled with low survival rates of larvae, may have prolonged recovery rates from anthropogenic pressures (Sabatini & Hill, 2008). Within the East of Gannet and Montrose NCMPA, JNCC did not identify species presence in video transects, but found evidence of burrows particularly in the south-east of the Marine Protected Area (MPA), yet these were not specifically attributed to Norway lobster (McCabe et al, 2020).

As identified from JNCC surveys within the East of Gannet and Montrose Fields NCMPA, the ocean quahog can be found in the Project area (McCabe et al, 2020). Indeed, the East of Gannet and Montrose Fields NCMPA is partly designated for the presence of this long-lived mollusc, which may live to over 400 years old, making it one of the long-lived species known to science. It can be found at depths >400m and has a thick rounded shell up to 13cm in length. Recruitment may occur infrequently, often at intervals over 10 years, and up to 100 years in certain locations (Tyler-Walters & Sabatini, 2017). With exceptional longevity and slow reproductive rates, the species is vulnerable to anthropogenic pressures, particularly if large portions of a population are removed. In such cases, ocean quahog resilience is graded as 'very low' (>25 years; Tyler-Walters & Sabatini, 2017). While the species is not of commercial interest in the UK, markets exist in North America, Norway and Iceland. Quahogs are a PMF and listed through OSPAR as 'threatened and/or declining' (Tyler-Walters & Sabatini, 2017).

Grab sample surveys found juvenile ocean quahog in 44 % of samples taken within the East of Gannet and Montrose Fields NCMPA. Greater numbers of quahogs were found in the south-west, north and north-west of the area (McCabe et al., 2020). The majority of specimens found were juveniles, however, the JNCC surveys were unable to identify the overall population structure of the species in the NCMPA (McCabe et al., 2020). The distribution of quahog appears correlated to the sediment type, and more individuals were found within area with a high proportion of fine mud, (see Figure 10-6; McCabe et al., 2020). Section 5 provides more information on the distribution of geological features and sediments in the Project area.

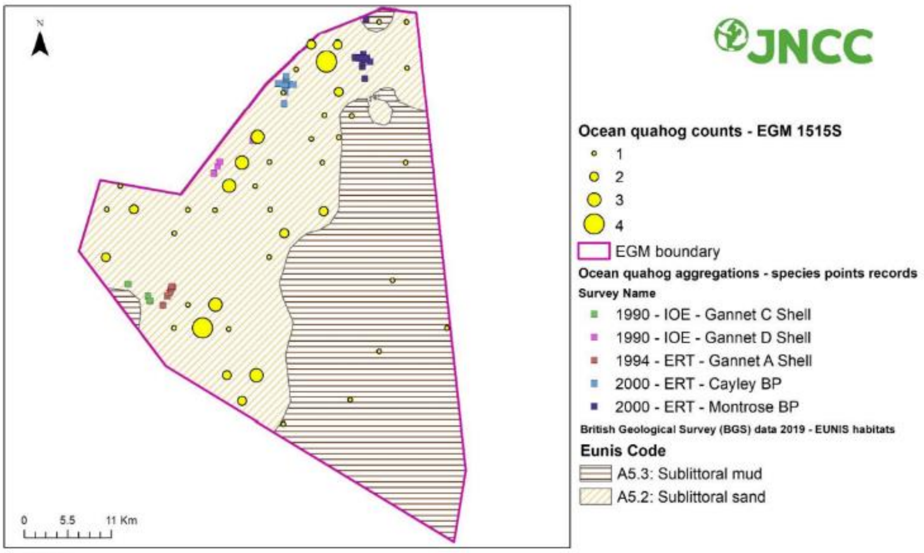


Figure 10--6: Distribution of ocean quahog (Arctica islandica) obtained from grab samples conducted within the East of Gannet and Montrose Fields NCMPA. Abundance data from previous surveys is also shown (McCabe et al., 2020).

10.3.3 Potential Impacts

10.3.3.1 Construction Impacts

Sources of impacts of the proposed Project on fish and shellfish during the construction phase include:

- Habitat loss;
- Sedimentation and Increased SPM;
- Injury or incidental loss;
- Underwater noise; and
- Changes to fishing activity.

Habitat Loss

The installation of structures associated with the Project may cause permanent or temporary habitat loss which could affect both fish and shellfish receptors. Permanent habitat loss will occur where equipment such as mooring structures are placed on the seabed and in the water column. Temporary loss occurs where the seabed is disturbed for installation of components such as cables, similar to those discussed in Section 10.2.3.1.

As shown previously, sandeels and herring may spawn in the area (at low densities), laying their eggs on the seabed. As such, take of the seabed could reduce the area of seabed available for spawning. In addition, burying of the cables could result in a change in sediment type on the seabed e.g., clay soils could be brought to the surface, thus reducing the area of seabed suitable for sandeel or herring spawning. For other species, changes to the seabed as a result of construction activities may reduce foraging habitat and cause displacement, however, these effects will likely be short-term and become less significant after the cessation of this phase.

For shellfish, installation of infrastructure may also reduce suitable habitat. The impact on the benthic habitat relied upon by shellfish receptors is examined in further detail in Section 10.2. The risk to the Norway lobster may be less than to the ocean quahog, as the former is more mobile and may be able to seek new habitat if disturbed during construction activities. Ocean quahog may be more at risk of predation if uncovered during construction activities, and being sessile, it is unlikely to move to more suitable habitat after disturbance.

Spawning fish, quahog and Norway lobster are dependent on specific habitats and low levels of disturbance to maintain populations and have a potentially low recovery rate. The scale of the impact will be determined by the sediment types affected, the total areas affected and the specific installation and construction techniques utilised.

Sedimentation and Increased SPM

As discussed in Section 5.3.1 and 6.3.1, construction activities can give rise to sedimentation and increases in SPM. Sediment suspension may cause fish to leave the areas in which a plume may be found, however, such impacts will be localised and short-term.

Changes to water quality as a result of sediment suspension will also be localised and short-term for shellfish species. However, for the ocean quahog, smothering as a result of sediment resettlement could have impacts on survival. The ability of the species to burrow free from layers of deposited sediment appears to be linked to the type of substrate and the depth to which the animal is buried. Burial with coarser sediments may result in high mortality rates and an inability to burrow above the deposited layer (Powilleit et al., 2009). However, the species is considered resilient to burial to ~5cm of substrate depth, which may reduce the significance of the impact (Tyler-Walters & Sabatini, 2017). The extent and depth of sedimentation during construction will be dependent on the sediments found and construction techniques utilised.

As discussed in Section 5 and 6 the intent is to avoid areas of contaminated sediment if identified within the Project area, hence avoiding a risk associated with remobilisation of contamination.

Injury or Incidental Loss

Installation of sub-surface structures such as piles or cables is unlikely to cause injury or incidental loss to mobile receptors such as fish and Norway lobster. Shellfish may be at more risk, particularly in the case of the ocean quahog which is largely sessile after larval settlement. The shell of the quahog is thick, and fairly resistant to impact, however, studies have found that larger individuals are more likely to sustain damage from activities like bottom-contact fisheries (Tyler-Walters & Sabatini, 2017). While individuals would be at risk of injury or loss from construction phase activities, the small footprint associated with the proposed infrastructure suggests such impacts will be localised and have negligible population level impacts overall.

Underwater Noise

Sources of underwater noise associated with the construction phase of the proposed Project are described in Section 8. Geophysical surveys and potentially percussion piling are the two main sources of underwater noise predicted during construction. Sensitivity to underwater noise is species-specific and dependant on frequency and levels. Underwater noise may cause behavioural changes, hearing damage, physiological effects, masking of biologically significant sounds, or in extreme cases, mortality (Popper et al., 2020).

During construction, geophysical surveys and piling would be the most likely noise sources that may impact fish and shellfish receptors. The threshold for impact varies slightly between fish species that possess a swim bladder and use it for hearing, those that do not, and those without a swim bladder. Mortal injury from pile driving and seismic activity may occur for fish with swim bladders at noise levels >207 dB re 1 µPa (peak).

Basking sharks do not have swim bladders, making them less sensitive to underwater noise than the diadromous receptors. They perceive sounds through particle motion and are considered able to detect frequencies between 20 – 1500 Hz (Chapuis et al., 2019). No studies have yet documented changes to stress levels or mortality rates due to sound exposure (Wilson et al., 2020). The species is afforded legal protection from disturbance within The Wildlife and Countryside Act 1981 and therefore requires a licence for activities that may cause disturbance. However, as basking sharks are not expected within the Project area, it is unlikely this will be required.

The specific equipment and techniques utilised will determine source noise levels as discussed in Section 8. However, as noise dissipates rapidly with distance, the area in which noise levels are likely to be of a level that could cause harm or mortally to fish will be extremely small, hence will not significantly impact upon fish species.

The impacts of underwater noise on shellfish are poorly understood, however, they may show responses to noise from particle motion or sediment vibration. Invertebrates may change their behaviour when subjected to noise, with one study showing that *Nephrops* moved and buried less frequently under *ex situ* exposure to 100 Hz-2 kHz noise at continuous SPLs between 135-140 dB re 1 µPa and impulse SELs of 150 dB re 1 µPa^{2}s (Solan et al., 2015). While further studies are needed to examine the impacts of anthropogenic noise, underwater noise produced during the construction phase is unlikely to significantly impact shellfish receptors due to its short-term nature and dissipation into the environment.

Changes to Fishing Activity

As described in Section 13, low levels of commercial fishing takes place within the proposed windfarm area. Installation of the wind turbines and associated moorings and cables will result in fishing activity being displaced from the proposed windfarm area around the turbine and mooring locations. This displacement will begin during the construction phase as the wind turbines are being installed.

The Project area may contain fish and shellfish species of commercial interest. The current East of Gannet and Montrose Fields NCMPA designation recommends limitation of bottom-contact mobile fishing methods which may be used to catch groundfish and Norway lobster, however, fishing activity still takes place within the area (Marine Scotland, 2016). Movement of vessels and equipment within the Project area is likely to prevent fishing from occurring in the region during the construction phase. This may be beneficial for the designated habitats within the NCMPA and for the Norway lobster and ocean quahog. The quahog has a low resilience and high sensitivity to fishing activity (Tyler-Walters & Sabatini, 2017), and cessation of these activities would have a positive impact on the species within this zone.

10.3.3.2 Operational Impacts

Sources of impacts of the proposed Project on fish and shellfish during the operational phase include:

- Habitat Loss
- Creation of Additional Habitat;
- EMF and heat; and
- Changes to fishing activity.

Habitat Loss

During the operational phase, any additional infrastructure to be installed will be limited to the replacement of damaged inter-array cables (estimated to be one per annum). Therefore, this minimal area of seabed take/disturbance per annum is unlikely to be significant to fish and shellfish receptors. No significant additional habitat loss from that identified in the construction phase is associated with the operational phase.

Creation of Additional Habitat

The operational phase of the Project may also create new habitat through the creation of hard surfaces. The presence of wind farm infrastructure (including anchors, offshore electricity hub, and cable protection) is known to provide refuge or foraging opportunities for fish species and provide a refuge for fish and shellfish species (Hoffman et al., 2000). As detailed in Section 10.2.3.2, artificial structures are typically colonised by invertebrate and algae species (in the photic zone). Additional foraging opportunities represented by colonisation can cause fish aggregations to associate around infrastructure and may be termed ‘fish-aggregating devices’ (FADs) or Artificial Reefs (ARs; van Elsen et al., 2019). The overall effect on the ecosystem is complex, and likely site and species-specific. Despite the potential for increased aggregations, results from monitoring at other sites suggest that there were no gross changes to local fish communities due to operational wind farms (Gray et al., 2016; MMO, 2014, Ashley et al., 2014, Stenberg et al., 2015). The potential habitat creation associated with floating turbines for fish and shellfish receptors in deeper waters may be less than those provided for fixed bottom turbines, but this needs further consideration.

EMF and Heat

EMF and heat produced from energised cables in the operational phase may impact fish species, for example if has been found that speeds of European eel slightly decreased as individuals crossed a non-buried 130 kV cable (Westerberg & Lagenfelt, 2008).

EMF and heat may also change shellfish and fish distribution, survival and reproductive rates. The effects of EMF and heat from cables is an emerging topic and as such, has limited data associated with *in situ* studies (Taormina et al., 2018). However, EMF and heat emissions for HVDC cables similar to the ones proposed for use in the current Project were calculated for the NorthConnect project. It was found that when the HVDC cables were bundled and placed at a depth 0.5m below the seabed, temperature and EMF was localised and at low levels (1°C increase above the cable and at most 640 µT reducing to <300 µT within 2m of the seabed at both worst-case and best-case separation distances). As such, neither EMF or heat were expected to significantly affect fish and shellfish receptors. This was despite the potential for sensitivity in shark species known to detect even low levels of magnetic fields.

In the present Project, burial of the cables will reduce the likelihood of mobile animals such as fish and elasmobranchs encountering changes to natural energy fields or temperature changes within the water column. Mobile and sessile shellfish species that are associated with the benthos may be more likely to be exposed to heat and EMFs, particularly over the longer term. However, the burial depths of ~0.5m will allow greater field dissipation and reduce the likelihood of impacts for such organisms.

Changes to Fishing Activity

As in the construction phase, fishing activities will likely be excluded from the wind farm area during the wind farm operational phase. Excluding fishing vessels from the area has the potential to enhance fish and shellfish densities/populations by providing refuge from fishing activities. However, it may also lead to additional pressure on fish stocks in neighbouring areas due to the displaced vessels fishing more intensely in available waters. There will likely be positive benefits for sessile shellfish species such as the ocean quahog. The potential impact on fishers is considered further in Section 13.

10.3.3.3 Decommissioning Impacts

Sources of impacts of the proposed Project on fish and shellfish during the decommissioning phase include:

- Sedimentation and increased SPM; and
- Return of previous situation (infrastructure removal and vessel asset).

Sedimentation and Increased SPM

Removal of wind farm infrastructure will likely cause some movement of the sediment and subsequent at least temporary increase in SPM. However, the impacts of this are likely to be localised and short-term, allowing for the recovery of fish and shellfish species.

Return to Previous Situation

The removal of all the windfarm components will remove the habitat provided during the construction phase (see Section 10.3.3.2), in addition unless precluded by other means, fishing activities will be able to return to the area once decommissioning is complete. The effects of which will relate to the effects observed during the operational effect, it would be hoped that any beneficial effects will not be reversed although this could occur over time.

10.3.4 Mitigation Measures

Mitigation measures identified to minimise the potential impact of the proposed Project on fish and shellfish ecology in the area include:

- Project design to minimise seabed footprint; and
- IAC buried to a target depth in accordance with BEIS Guidelines (2021) which will reduce the potential for impacts relating to EMF, and where this is not possible due to substrate conditions, cables could be shielded to an equivalent depth through rock placement or other means of burial.

10.3.5 Proposed Assessment

As the available information lacks evidence of significant effects for fish, these have been **scoped-out**. Shellfish have also been **scoped-out**, however, as the ocean quahog is particularly sensitive and intrinsically linked the benthic ecology of the site (with both listed as designated features of the MPA), it is proposed the species are considered further as part of benthic ecology.

10.4 Marine Mammal Ecology

This section of the Scoping Report identifies the potential impacts of the proposed project on marine mammals in the area.

10.4.1 Data and Information Sources

Two study areas have been identified to define offshore marine mammals:

- Wind Farm Survey Area: The area that is currently being surveyed for birds and marine mammals by HiDef (2022) (see Section 10.4.2).
- Offshore Regional Area: This area is species dependent and encompasses an extensive geographical region, recognising the mobile nature of marine mammals. The area is defined by

both the Small Cetaceans in the European Atlantic and North Sea (SCANS) III Blocks, in this case Blocks R and Q and the relevant Management Unit areas for each species (IAMMWG, 2021; **Error! Reference source not found.**-7).

Publicly available data and historical site-specific surveys are used in the subsequent sections for marine mammal baseline information. Sources used include, but are not limited to, those listed in Table A-3 (Appendix A).

To provide baseline data for the offshore marine mammal and ornithology assessments, a programme of monthly digital aerial surveys across the initial survey area with an additional 4km buffer (the Survey Area) began in April 2021 and will be complete in March 2023 (HiDef, 2022). The area covered by the digital aerial survey measured *c.* 835.97km^2.

The surveys were undertaken using HiDef's digital video survey method which follows the relevant industry standard. For this method, parallel transects were flown across the wind farm area spaced 1km apart and images from each camera are obtained across 125m strip. Two years of data will be collected, and the first year of data has been used to inform this Scoping Report. Once the second year of data collection is complete, abundance estimates for all marine mammal species will be calculated. For species for which there is an adequate number of sightings, density estimates will be calculated using the most appropriate methods. This information will then be used to inform the EIA.

10.4.2 Baseline

As mentioned in Section 3.6, all UK cetacean species are listed under Annex IV of the European Habitats Directive and Schedule 2 of the Habitats Regulations 1994 as EPS, which has been transposed into Scottish Law through the Wildlife and Countryside Act 1981 and The Conservation (Natural Habitats, &c.) Regulations 1994. Regulation 39(1) of the Habitats Regulations 1994, makes it is an offence to deliberately or recklessly kill, injure, harass, or disturb an EPS.

The relevant Management Unit areas (Figure 10-7) for species predicted to occur in the offshore regional area are:

- Cetaceans:
  - Harbour porpoise (*Phocoena phocoena*) – North Sea
  - Bottlenose dolphin (*Tursiops truncatus*) – Coastal East Scotland and Greater North Sea
  - White-beaked dolphin (*Lagenorhynchus albirostris*) - Celtic and Greater North Seas
  - Atlantic white-sided dolphin (*Lagenorhynchus acutus*) - Celtic and Greater North Seas
  - Minke whale (*Balaenoptera acutorostrata)* - Celtic and Greater North Seas
- Pinnipeds:
  - Grey seal (*Halichoerus grypus*) – North Coast and Orkney, Moray Firth and East Scotland

Other marine mammal species that have been recorded in the northeast region of Scotland include long-finned pilot whale, sperm whale, humpback whale and fin whale (e.g., Reid et al., 2003). However, these species are likely to be in lower numbers and less frequent than the key species listed above. Note that the distribution of bottlenose dolphin is predominantly coastal but occasional sightings do occur further offshore.

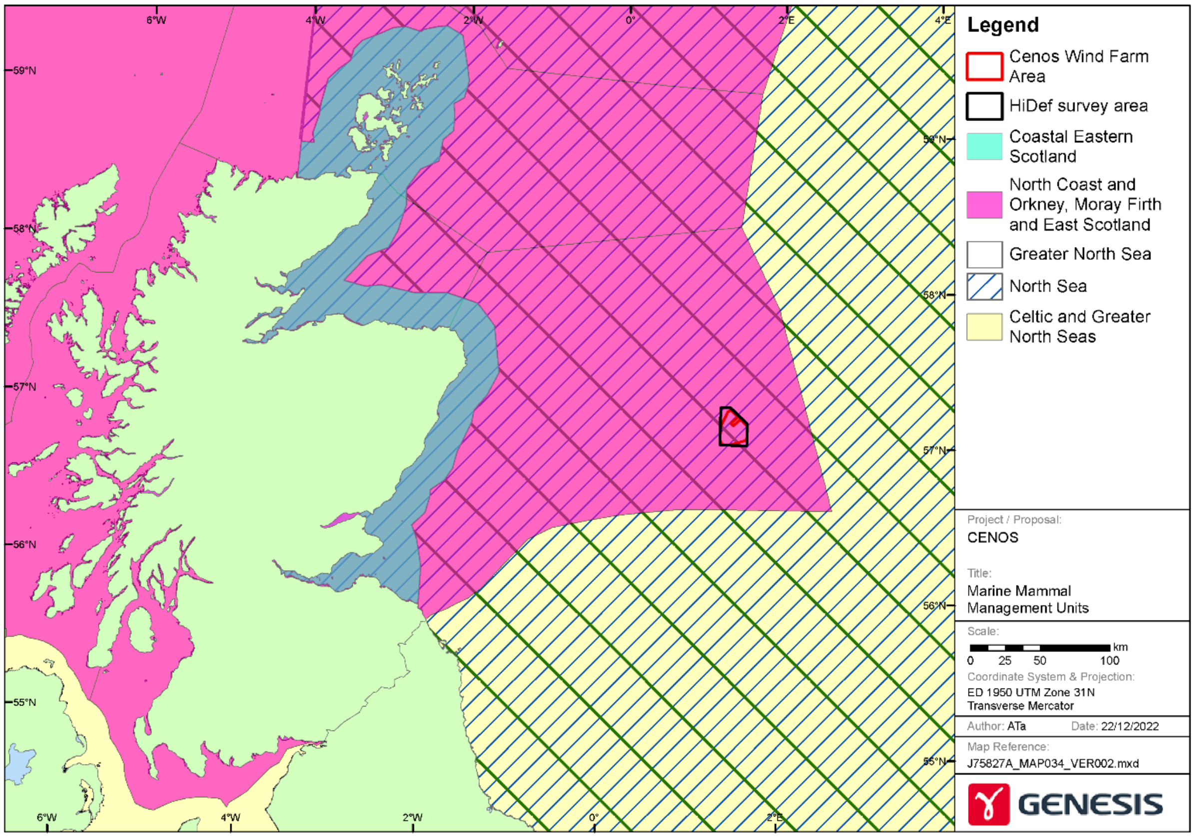


Figure 10-7: Marine mammal Management Unit areas.

The CNS has a moderate to high diversity and density of cetaceans, with a general trend of increasing diversity and abundance with increasing latitude. Harbour porpoise and white-beaked dolphin are the most widespread and frequently encountered species, occurring regularly throughout most of the year. Minke whales are regularly recorded as frequent seasonal visitors. Coastal waters of the Moray Firth and the east coast of Scotland support an important resident population of bottlenose dolphins, while killer whales are sighted with increasing frequency towards the north of the CNS area. Atlantic white-sided dolphin, Risso's dolphin, and long-finned pilot whale can be considered occasional visitors to the North Sea, particularly in the north of the area (BEIS, 2022a).

The distribution of cetacean species in UK waters has been compiled by the JNCC in the Atlas of Cetacean Distribution in North-West European Waters (Reid et al., 2003), which provides an indication of the monthly presence of cetacean species in the proposed wind farm area. The data suggest that four cetacean species are typically present between May and November, with white beaked dolphin being present across more months than the other species (Table 10-4).

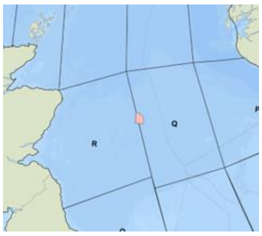
Table 10-4: Marine mammal monthly presence in the vicinity of the survey area (Reid et al., 2003).

Species	J	F	M	A	M	J	J	A	S	O	N	D
Minke whale							P					
White-beaked dolphin					P		P	P	P	P	P	
Atlantic white-sided dolphin						P			P			
Harbour porpoise						P	P		P			
Key:	**P** = Presence					Blank = Absence						
Source: Reid et al., 2003.												

Additionally, marine mammal observers (MMOs) onboard a Fugro geophysical survey (September 2019) in an area immediately east of the wind farm survey area (Block 22/24) recorded five visual sightings and two Passive Acoustic Monitoring (PAM) detections of marine mammals in the area, predominantly identified as minke whales and unidentified dolphins (Fugro, 2019a). These were recorded over a period of 64 hours and 32 minutes of visual monitoring and 58 hours and 40 minutes of PAM effort. There was also one sighting of an unidentified baleen whale.

A series of SCANS surveys have been conducted to obtain an estimate of cetacean abundance in North Sea and adjacent waters, the most recent of which is SCANS-III (Hammond et al., 2021). The proposed wind farm area is located within SCANS-**III** Block ‘R and Q’ (see map in Table 10-5). The data confirm that most of those species identified by Reid et al. (2003) frequent Block R, with some presence in Block Q (Table 10-5).

Table 10-5: SCAN-III cetacean density estimates for Survey Blocks R and T. Ab.= abundance. Density= animals/km^2.

SCANS-III Block R and Q	Sp.	Ab. Block R[1]	Ab. Block Q[1]	Density Block R[1]	Density Block Q[1]	Management Units (MU) Population[2]
	Minke Whale	2,498	383	0.039	0.010	20,118 (CV = 0.18; 95 % CI = 14,061 – 28,786)
	White-beaked Dolphin	15,694	N/A	0.243	N/A	43,951 (CV = 0.22; 95 % CI = 28,439 – 67,924)
	Atlantic white-sided dolphin	644	N/A	0.010	N/A	18,128 (CV = 0.61; 95 % CI = 6,049 – 54,323)
	Harbour Porpoise	38,646	16,569	0.599	0.333	346,601 (CV = 0.09; 95 % CI = 289,498 – 419,967)
	Bottlenose dolphin	1,924	N/A	0.030	N/A	2,022 (CV = 0.75; 95 % CI = 548 – 7,453)
[1] Hammond et al., (2021) *CV: Coefficient of variation			[2] IAMMWG (2021) CI: confidence interval			

The Joint Cetacean Protocol (JCP) Phase III report (Paxton et al., 2016) also noted moderate densities of minke whale and low densities of bottlenose dolphin and white-beaked dolphin in the surrounding Cenos wind farm area. Further to this, distribution maps of cetacean species within the north-east Atlantic indicate that harbour porpoise and white-beaked dolphin may be present in the CNS at high densities, followed by Risso’s dolphin, killer whale and minke whale, while bottlenose dolphin[1], short-beaked common dolphin and Atlantic white-sided dolphin are present but at lower densities (Figure 10-8 & Table 10-6; Waggitt et al., *2*020).

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[1] *These density maps show the presence of offshore bottlenose dolphin only, and do not therefore include consideration of the resident populations around the UK and northern Europe coastlines.*

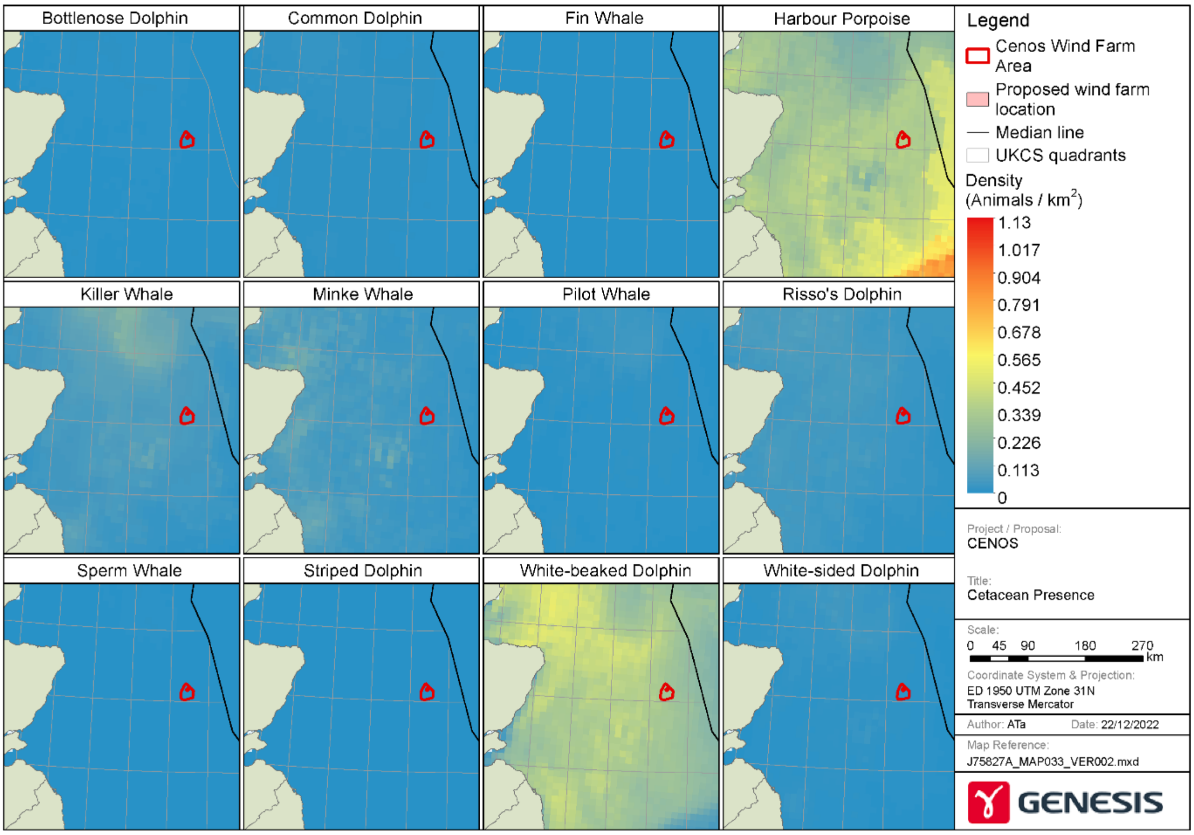

Figure 10-8: Spatial variation in predicted annual densities (animals per km^2) of cetacean species in the vicinity of the proposed wind farm area. Values are provided at 10km resolution. Bottlenose dolphin represent the offshore ecotype (Waggitt et al., 2020).

Table 10-6: Cetacean annual density estimates (Waggitt et al., 2020).

Species	Annual cetacean species density (animals/km^2)
Bottlenose Dolphin	0.002
Common Dolphin	0.014
Fin Whale	0
Harbour Porpoise	0.352
Killer Whale	0.001
Minke Whale	0.003
Pilot Whale	0.001
Risso's Dolphin	0.001
Sperm Whale	0
Striped Dolphin	0
White-beaked Dolphin	0.065
White-sided dolphin	0.014

Pinnipeds

Two species of seals live and breed in the UK, the grey seal (*Halichoerus grypus)* and the harbour seal (*Phoca vitulina*) (BEIS, 2022a). Both grey and harbour seals are listed under Annex II of the EU Habitats Directive, meaning that their core habitat must be protected under the Natura 2000 Network and managed in accordance with their ecological requirements. Under the Marine (Scotland) Act 2010, it is an offence to kill, injure or take a seal, as well as to deliberately or recklessly harass a seal at a significant haul out site. They are also PMFs. Approximately 36 % of the world's grey seals breed in the UK (81 % of these at colonies in Scotland, with the main concentrations in the Outer Hebrides and in Orkney).

Harbour seals are widespread around the west coast of Scotland and throughout the Hebrides and Northern Isles (SCOS, 2020). Their distribution is more restricted on the east coast, with concentrations in the major estuaries, including the Moray Firth in Scotland. Approximately 32 % of harbour seals are found in the UK, however, this proportion has declined from approximately 40 % in 2002. Note this proportional decline is not due to reducing numbers in the UK, rather it is associated with a more rapid recovery and higher sustained rates of increase in the Wadden Sea population (south-eastern North Sea; SCOS, 2021).

Grey and harbour seals will feed in both inshore and offshore waters depending on the distribution of their prey, which changes both seasonally and yearly. Both species tend to be concentrated close to shore, particularly during the pupping and moulting season. Seal tracking studies from the Moray Firth have indicated that the foraging movements of harbour seals are generally restricted to within a 40-50km range of their haul-out sites (SCOS, 2020). The movements of grey seals can involve much larger distances with results from the tracking of individual seals showing they can feed up to several hundred kilometres offshore, though foraging generally occurs within around 100km of their haul-out sites (SCOS, 2020). Figure 10-9 shows species distribution maps based on telemetry data (1991–2016) and count/effort data (scaled to the estimated population size in 2015). The maps indicate that neither harbour nor grey seals occurred in the area during the survey period, however, indicate low grey seal abundance in adjacent regions.

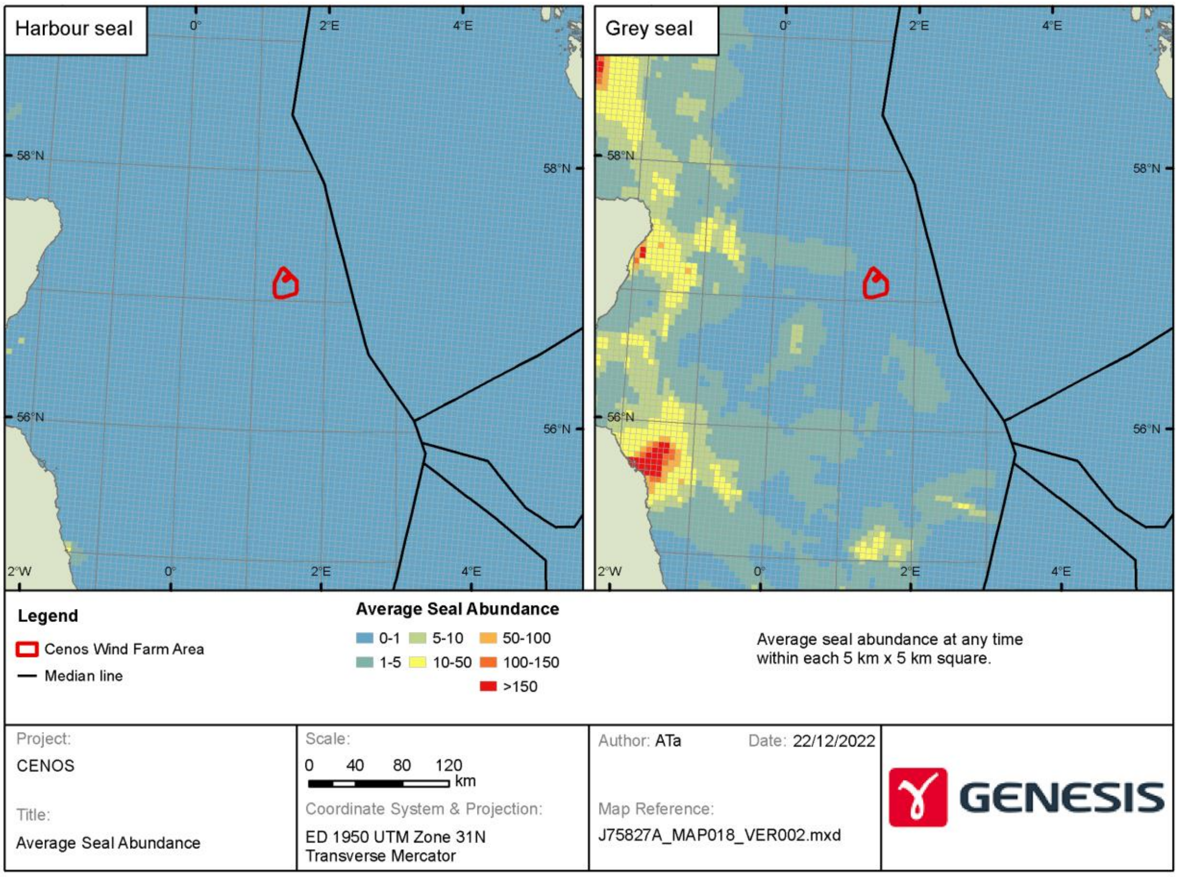

Figure 10-9: Harbour and grey seal distribution in relation to the proposed wind farm area (Russell et al., 2017).

Site-Specific Surveys

The initial monthly aerial surveys conducted by HiDef between April 2021 and March 2022 report sightings of 142 individual cetaceans representing three species: minke whale (n=1), white-beaked dolphin (n=12) harbour porpoise (n=125; HiDef, 2022). Most cetacean sightings occurred in April, June and November 2021.

Harbour porpoises were the dominant species sighted during the first year of the HiDef (2022) surveys, comprising c. 88 % of the cetaceans observed. Porpoises occurred in nine of the 12 months surveyed, with most sightings in November 2021, followed by April 2021 and June 2021 (Figure 10-10). These data indicate slight differences in peak species occurrence predicted between June and September by Reid et al. (2003). In addition, the HiDef surveys suggest porpoises exhibit temporal distribution changes within the survey area, where increased sightings in April 2021 occurred to the east and then to the west in June 2021. In November, when most individuals were sighted, distribution was more widely spread throughout the survey area.

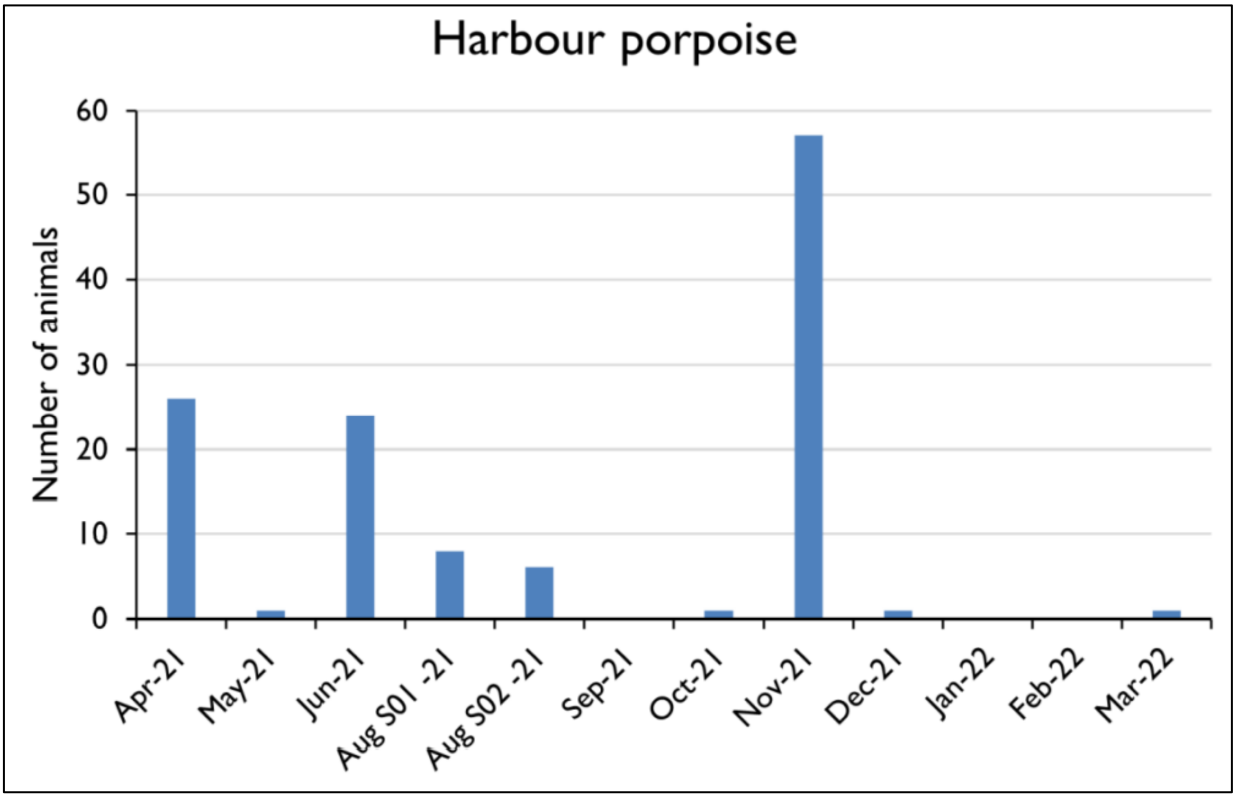

Figure10-10: Number of harbour porpoise recorded between April 2021 and March 2022 in the survey area (HiDef, 2022).

The two sightings of white-beaked dolphins were made in April and November 2021, and each time consisted of a pod containing six individuals. The single minke whale sighting occurred in November 2021, with one individual seen.

Low numbers (5 individuals) of grey seals were also sighted across the survey area from June to August 2021, and January and March 2022 (HiDef, 2022).

Overall, the HiDef surveys conducted thus far have corroborated other research that suggests harbour porpoise, white-beaked dolphin, minke whale and grey seal are the most likely marine mammal species present within the survey area. However, the timing of peak occurrence differs slightly to previous estimates, and individuals may show temporal changes to distribution. The second year of HiDef surveys will add to the information presented here and will provide additional data on seasonal distribution and numbers of individuals expected in the area.

10.4.3 Potential Impacts

10.4.3.1 Construction Impacts

Sources of impacts of the proposed Project on marine mammals during the construction phase include:

- Underwater noise;
- Vessel interaction, e.g. collision of marine mammals with vessels;
- Changes to water quality; and
- Changes to Prey Resources.

Underwater Noise

The potential noise levels for some construction activities (e.g., geophysical surveys and percussion piling) would be at risk of causing auditory injury or disturbance. The main sources of underwater noise and the levels/activities that would exceed known marine mammal hearing thresholds for the proposed project are discussed in Section 8.2.

It should be recognised that noise levels associated percussion piling (if required) for the offshore electrical hub platform will be at much lower levels than associated with fixed bottom wind farms, which use much larger piles (for example., up to 3.6MW turbines with monopiles of 4.8m on average, but up to 7.8m diameter, may be utilised (Negro et al, 2017)). The larger the pile the greater the noise levels arising (ITAP, 2020). In addition, pin piles are not in contact with the whole water column further reducing the transfer of energy into the water column.

Underwater noise has the potential to induce PTS, where unrecoverable hearing damage may occur, and TTS where a temporary reduction in hearing sensitivity may occur in marine mammal species. Marine mammal group hearing thresholds are well understood and classified, as are the noise levels and frequencies that are outwith such thresholds (e.g., Popper et al., 2014; Southall et al., 2019). Noise emissions may also cause disturbance, behavioural and physiological impacts (Richardson et al., 1995).

Marine mammals are grouped into functional hearing groups in order to generalise their hearing frequency range and estimate potential noise level thresholds. The species found to be present in the Project area by the HiDef surveys fall into the Low Frequency (LF; minke whale), Mid Frequency (HF; white-beaked dolphin) and Very High Frequency (VHF; harbour porpoise) categories, representing a wide range of frequencies between 7Hz and 160kHz (Southall et al., 2019). For the various possible underwater noise sources represented by construction activities, each generalised hearing group has an estimated SEL and SPL, whereby noise levels exceeding such thresholds may cause TTS or PTS.

As discussed in Section 8.2 the specifics of the geophysical survey equipment must be understood to allow task specific assessments of noise, and hence the potential effects on marine mammals. Task specific assessments are utilised to inform the details of mitigation protocols and EPS licencing (see Section 10.4.4 below). Similarly, if percussion piling is required that could cause disturbance of cetaceans, then this will need to be specifically assessed, mitigated and licenced.

Taking account of the relatively low use of the area by marine mammals, especially seals, and the legal requirements to implement mitigation in order to gain an EPS licence for disturbance of cetaceans, no significant effects on marine mammals due to noise are expected.

Vessel Interaction

Construction activities will involve the use of vessels to move personnel and equipment to the Project area, which may put marine mammals at risk of collision. However, being a busy shipping area, the North Sea has well developed fishing and oil and gas industries, such that marine mammals in the region are regularly exposed to the presence of vessels (Kinneging & Tougaard et al., 2021). In addition, the evidence for lethal injury from boat collisions with marine mammals suggests that collisions with vessels are very rare (Cetacean Stranding Investigation Programme, 2011). Out of 478 post-mortem examinations of harbour porpoise in the UK carried out between 2005 and 2010, only four (0.8 %) were attributed to boat collisions. While this may indicate that collision with vessels infrequently occur, care must be taken when drawing conclusions from strandings data for overall population mortality, as many carcasses sink or drift at sea where they are not recorded. However, vessel strikes appear to be uncommon within the CNS region (Hammond et al., 2004). Out of the species observed in the Project area, the minke whale may be at greatest risk of collision with larger vessels. However, their occurrence within the area is rare, and vessels associated with the Project will likely move at slow speeds and along defined, straight line routes, reducing the likelihood of collision risk. As such, vessel interaction is unlikely to be significant to marine mammal receptors in this context when appropriate mitigation is implemented. This includes avoiding transiting the Southern Trench MPA for the conservation of minke whale wherever possible.

Changes to Water Quality

Water quality changes such as increased turbidity caused by increased SPM may impact the ability of marine mammals to locate prey and may also impact fish prey species presence and distribution. Changes to SPM are discussed in Section 6, they are expected to be localised and short lived hence there will be no noticeable effect on marine mammals' ability to prey locate and limited to the base of the 110m water column where the SPM could be created, and this is unlikely to propagate to the upper levels of the water column. Pollution incidents could impact on marine mammals both directly and indirectly (via prey species availability or contamination), however as discussed in Section 6, no significant pollution scenarios are expected with appropriate mitigation in place and hence no significant effects on marine mammals are predicted.

Changes to Prey Resources

The marine mammal species identified as being present in the Project area are primarily piscivorous (fish-eating). As such, changes to the availability of fish prey caused by construction activities may impact the presence, behaviour or survival of marine mammals, particularly as they are reliant on patchy resources that involve substantial energy to locate. If fish are disturbed from the Project area it may result in marine mammals moving away, causing additional energy expenditure. However, construction activities will be short-term, with changes to fish distribution within the area likely to be over short time periods. The lack of potential significant impacts identified during construction works for fishing in Section 10.3.3.1 indicate that there will not be significant effects on availability of prey species to marine mammals due to construction.

10.4.3.2 Operational Impacts

Sources of impacts of the proposed Project on marine mammals during the operational phase include:

- Underwater noise;
- Entanglement;
- Vessel interaction;
- Changes to prey resources;
- Physical barrier effects; and
- EMF and heat

Underwater Noise

Activities that have the potential to generate underwater noise and impact marine mammal receptors during the operations phase are detailed in Section 8. During the operational phase, underwater noise is produced at a relatively low level (compared to background sound levels) by the rotation of the wind turbine blades (Nedwell et al., 2007). This noise is then transmitted to the water by the turbine and support structure. It is also possible that the mooring lines in the water column may be a source of noise through vibration or chain linkage impacts. While few *in situ* measurements are available for operational floating windfarms (Farr et al., 2021), it is unlikely that the underwater noise emissions from the turbine operations of the proposed development will significantly impact marine mammals. It is noted however, that geophysical surveys are required during the operational phase of the project, the likelihood for impact is the same as previously mentioned (Section 8).

Entanglement

There is a potential for entanglement of marine mammals in the mooring systems associated with floating offshore wind turbines. However, to date, there have been no recorded instances of marine mammal entanglement from mooring systems of renewable devices (Sparling et al., 2013; Isaacman and Daborn, 2011), or for anchored FPSO vessels in the oil and gas industry (Benjamins et al., 2014) with similar mooring lines as proposed for floating turbine structures.

The level of risk of becoming entangled varies between species, and depends on body size, movement flexibility, ability to detect mooring lines and the species feeding ecology (Benjamins et al., 2014). Small species of toothed whales (such as harbour porpoise and bottlenose dolphin) have a lower risk than baleen whales, primarily due to their size and manoeuvrability. Seal species have a similar low risk level to small cetaceans, due to increased manoeuvrability.

Benjamins et al. (2014) also identified that catenary moorings would increase the likelihood of entanglement compared to taut-line systems. Mooring characteristics such as tension, cable swept volume ratio and the curvature values along the mooring line during its maximum horizontal extent also influence the risk to marine mammals (Harnois et al., 2015). Given the number, size and physical characteristics of mooring lines associated with offshore wind turbines it is unlikely that upon encountering them, a marine mammal of any size would become directly entangled in the moorings themselves (Farr et al., 2021).

Fishing gear has been identified as a major entanglement risk for whales (NOAA, 2018) and it is possible that lost or abandoned fishing gear may get caught in the mooring lines such that there is a risk to marine mammals from indirect entanglement in anthropogenic debris. Secondary entanglement risk can only be monitored once the array is in place (Green et al., 2022), however, the likelihood for such fishing gear/marine debris to be caught in the mooring lines is expected to be low, and the significance to marine mammals is therefore also low. There is no recorded evidence from the oil and gas sector over the last 30 years that this has occurred on a floating offshore structure or from the Kincardine floating offshore wind project that has been in place for over five years.

Vessel Interaction

The likelihood for vessel interactions during the operational phase is extremely low, with one vessel transiting to and from the site every two or three weeks. Only during major maintenance will turbines be towed to port, and the frequency of such activity is much lower than during the construction phase and considered to be insignificant. As in the construction phase, vessel routes will be planned to avoid the Outer Trench MPA for the conservation of the minke whale wherever possible.

Changes to Prey Resources

As for the construction phase, changes to fish prey availability from operational activities could have adverse impacts on marine mammal receptors. However, several studies have shown that anthropogenic structures in the marine environment may provide shelter or foraging opportunities for fish and in term attract marine mammal predators (Clausen et al., 2021; Todd et al., 2020). The phenomenon of such ‘artificial reefs’ and ‘fish aggregating devices’ created by structures is examined in Section 10.3.3.2. Aggregations of fish prey around windfarm structures may be beneficial to marine mammals and offer more consistent prey sources than normally found in the CNS. It is expected that such changes to prey resources will not have overall significant impacts on marine mammal populations.

Physical Barrier Effects

The presence of a wind farm may have the potential to create a physical barrier to marine mammals, preventing movement or migration between important feeding and/or breeding areas, or potentially increasing swimming distances if they circumvent the site.

The proposed wind farm area is not located on any known marine mammal migration routes. Data from operational wind farms show no evidence of exclusion of marine mammals, including harbour porpoise and seals (e.g., Diederichs et al., 2008; Lindeboom et al., 2011; Marine Scotland, 2012; McConnell et al., 2012; Scheidat et al., 2011; Teilmann et al., 2006; Tougaard et al., 2005, 2009a, 2009b). Both harbour porpoise and seals have been shown to forage within operational fixed wind farm areas (e.g., Lindeboom et al., 2011) indicating no restriction to movements. The impact of the proposed project on the movement of marine mammals is therefore considered to be minimal.

Electromagnetic Fields & Heat

The production of EMF and heat from energised cables (see Section 9) may impact marine mammal receptors. However, while it is assumed that marine mammals are capable of detecting small differences in magnetic field strength, this is as of yet, unproven and therefore based on circumstantial information. There is also, at present, no evidence to suggest that existing subsea cables influence cetacean movements. For example, in the Baltic Sea, harbour porpoises are known to move over several operating subsea HVDC cables in the Skagerrak and western Baltic Sea with no apparent effect to their migratory movements (Walker, 2001). There is also no evidence to suggest that seal species respond to electromagnetic fields (Gill et al., 2005). In addition, as outlined above, data from several operational wind farms show no evidence of exclusion of marine mammals, including harbour porpoise and seals (e.g., Diederichs et al., 2008; Lindeboom et al., 2011; Marine Scotland, 2012; McConnell et al., 2012; Scheidat et al., 2011; Teilmann et al., 2006; Tougaard et al., 2005, 2009a, 2009b). As EMF and heat production from cables is localised (see Section 9), it is unlikely to cause changes that may impact marine mammals.

10.4.3.3 Decommissioning Impacts

The sources of impacts on marine mammals associated with the decommissioning phase are similar to those associated with the construction and operational phase:

- Underwater noise;
- Vessel interaction, e.g., collision of marine mammals with vessels;
- Changes to water quality; and
- Changes to prey resources.

Underwater Noise

Underwater noise sources associated with the decommissioning phase will arise from vessel movements, and geophysical surveys, which may be undertaken to aid in the removal of sub-surface infrastructure such as cables. The characteristics of the geophysical survey equipment (frequency, noise level) must be known to allow task specific assessments of emitted noise and its potential impact on marine mammals. Such task specific assessments are then used to inform mitigation protocols and the requirements for EPS licencing if required, as also identified during the construction phase. With the appropriate mitigation and protocols in place, it is not expected that decommissioning geophysical surveys nor vessel noise will have significant impacts on marine mammal receptors.

Vessel Interaction

Project infrastructure may need to be removed and then towed from the area by vessels. As identified for the construction phase, vessel speeds are likely to be slow and travel routes consistent, reducing the likelihood of collision with marine mammal receptors. In addition, the only large species with an associated greater strike risk identified in the area was the minke whale, which are shown to occur infrequently. As such, the likelihood for vessel interactions during the decommissioning phase are considered to be similar to those associated with the construction phase and are not likely to significantly impact marine mammal receptors. As in the construction/operation phase, vessel routes will be planned to avoid the Outer Trench MPA for the conservation of the minke whale wherever possible.

Changes to Water Quality

Water quality changes may occur from decommissioning activities, especially through increased SPM from removal of infrastructure or the release of hazardous substances (see Section 6.3.3). Based on the mitigation identified in Section 6.3.3, the likelihood of hazardous substance release will be low, and any changes to SPM will be localised and short-term. As such, the impacts of changes to water quality on marine mammal receptors are not expected to be significant.

Changes to Prey Resources

Decommissioning activities may cause changes to prey resources for marine mammals with the removal of colonised structures that prey species use for shelter or foraging. However, as identified in Section 10.3.3, such changes are likely to be short-term and localised (such as increased SPM). Decommissioning would also cause prey resources to return to the previous post-Project situation which would unlikely cause significant impacts to marine mammal populations in the area.

10.4.4 Mitigation

Mitigation to prevent and minimise impacts on water quality and fish discussed in Sections 6.4 and 10.3.4 respectively ensure secondary effects on marine mammals are avoided/minimised.

Underwater Noise

- Underwater Noise from Surveys:
  - Complete a marine mammal risk assessment of planned survey activities to inform an application for an EPS licence to disturb cetaceans; and
  - Implement mitigation in alignment with JNCC Guidelines for Minimising the Risk of Injury to Marine Mammals from Geophysical Surveys (JNCC, 2017), as agreed through the EPS licence. Note the mitigation will be implemented for pinnipeds and cetaceans.
- Underwater noise from piling (if required):

    - Consider use of pile type that doesn't require percussive piling (e.g. suction pile);
    - If piling is required, size pile appropriately;
    - Utilise vibropiling as far as practicable to reduce the amount of percussion piling required;
    - Complete a marine mammal risk assessment to inform an application for an EPS licence; and
    - Implement mitigation in alignment with JNCC protocol for minimising the risk of injury to marine mammals from piling noise (JNCC, 2010) as agreed through the EPS licence. Note the mitigation will be implemented for pinnipeds and cetaceans.
- UXO Detonation:
    - If required, an underwater noise assessment specific to the UXO found will be completed to inform the identification of appropriate mitigation and EPS application; and
    - Implementation mitigation agreed in the EPS licence. Mitigation will be implemented for pinnipeds and cetaceans.

Vessel Interactions

All vessels will carry a copy of and adhere to the provisions of The Scottish Marine Wildlife Watching Code (SNH, 2017a).

10.4.5 Proposed Assessment

Based on the current understanding on marine mammal presence in the Project area, and the mitigation identified, this topic and the impacts therein have the potential to be scoped-out. However, as baseline surveys are still being carried out, it is prudent to include the topic for **further consideration** within the EIA. Within the ElA, all the collected survey data will be presented to ensure the potential for significant impacts has not changed from initial assessment presented here and the mitigation proposed in Section 10.4.4 is adequate for the species occurring in the Project area.

10.5 Offshore Ornithology

This section of the Scoping Report identifies the potential impacts of the proposed project on birds in the area.

10.5.1 Data and Information Sources

The baseline data gathered during the HiDef surveys (detailed below) will be used in conjunction with published guidance, research and datasets. These will include, but are not limited to, those listed in Table A-4 (Appendix A). Any relevant new guidance, studies and research which become available during the timescale for the EIA will also be included.

The project specific HiDef survey data are the primary source to be used in the assessment. To provide baseline data for the offshore ornithology assessment, a programme of monthly digital aerial surveys across the initial survey area and a 4km buffer (the Survey Area) began in April 2021 and will be complete in March 2023 (HiDef, 2022). The surveys of offshore birds were carried out using HiDef's digital video survey method which follows the relevant industry standard methods. The data will then be used to calculate abundance estimates for all species. For species for which there is an adequate number of sightings, density estimates will be calculated using the most appropriate methods at the time.

10.5.2 Baseline

Desk Study

The North Sea is an internationally important area for breeding and feeding seabirds. Several bird species are known to occur in the Cenos wind farm area, identified from density-at-sea maps from European Seabirds at Sea (ESAS) that use data collected over 30 years of observation (Kober et al., 2010). The study identified several species that may be of importance within the proposed wind farm site. These included, black-legged kittiwake (*Rissa tridactyla*; breeding), common guillemot (*Uria aalge*; breeding/other seasons), Atlantic puffin (*Fratercula arctica*; winter), and northern gannet (*Morus bassanus*; breeding). However, it also recognised that impacts on other less frequently recorded species may be of concern, due to either long-term overall population declines (e.g., Arctic skua and Arctic tern) or sudden population declines due to avian influenza (e.g., great skua).

Kober *et al*., (2010) indicated that several seabird species are likely to occur in the area over the summer breeding season and winter months. For all species combined, around 17 individual seabirds are predicted to occur per km^2 during the breeding season (April to October), whilst during the winter months (November to March) around 12 seabirds are predicted to occur per km^2. Common guillemot, northern gannet and Atlantic puffin represent some of the most frequent species in the area (1 to 5 individuals per km^2; Kober *et al.,* 2010).

As well as foraging and over-wintering at sea in the proposed wind farm area, both seabirds and non-seabirds may also use the region as an annual migration route between breeding and wintering grounds. Two main migration routes transit the North Sea. The East Atlantic Flyway is used by hundreds of migratory bird species moving from high-latitude Arctic regions to Europe and Africa for the winter months (van Roomen et al., 2022a,b). Birds also traverse the North Sea between the European mainland (particularly Norway, Finland, Sweden, Denmark, and the Netherlands) and the UK (and vice versa; van Roomen et al., 2022b; Bradarić et al., 2020).

Site-specific Surveys

Between April 2021 and March 2022, 13 bird species were sighted, amounting to 2,798 individuals over the survey period (Figure 10-11) (*Please note that the HiDef survey area uses an area of approximately 900km^2, rather than the Cenos development area of 333km^2 and therefore total bird observations should be considered within this context)*. A further 53 individual bird observations could not be identified to species level. Table 10-7 illustrates the total counts of birds observed during each survey month, where most sightings were made in November 2021. Common guillemots were the most common species observed, followed by fulmars (*Fulmarus glacialis*). Other species listed as 'moderately abundant' were kittiwakes, gannets, and puffins. While surveys are still being undertaken to provide additional baseline data, the results indicated that most of the observed seabird species occur in the area outside the breeding season, with gannets occurring within the breeding season.

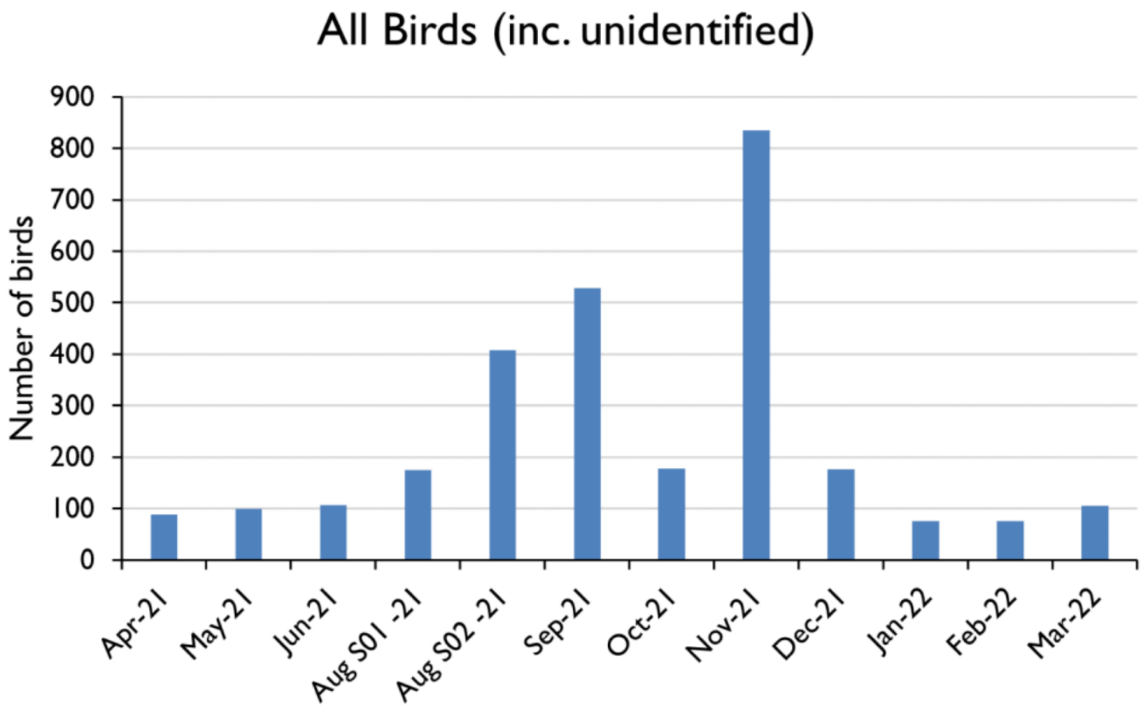

Figure 10-11: Total number of birds recorded between April 2021 and March 2022 during the HiDef aerial surveys.

Table 10-7: Total species counts recorded between April 2021 and March 2022 during the HiDef aerial surveys.

Species	Total	Species	Total
Common guillemot (*Uria aalge*)	2055	**Knot** (*Calidris canutus*)	8
Fulmar (*Fulmarus glacialis*)	441	**Herring gull** (*Larus argentatus*)	7
Gannet (*Morus bassanus*)	115	**Common gull** (*Lurus canus*)	2
Kittiwake (*Rissa tridactyla*)	73	**Great skua** (*Stercorarius skua*)	2
Atlantic puffin (*Fratercula arctica*)	63	**Little auk** (*Alle alle*)	1
Black-backed gull (*Larus argentatus*)	17	**Arctic skua** (*Sterocorarius parasiticus*)	1
Arctic tern (Sterna paradisaea)	13	Unidentified spp.	53

10.5.3 Potential Impacts

The impacts on ornithological receptors will vary from species to species and season to season. For example, as Cenos is located approximately 185km from shore, it will be outwith the foraging range for some (but not all) breeding seabirds. The consideration of potential impacts provided here, does not detail the effects at a species level, rather it identifies areas for consideration.

10.5.3.1 Construction Impacts

Sources of impacts of the proposed Project on offshore ornithology during the construction phase include:

- Direct disturbance and displacement; and
- Changes to prey resources.

Direct Disturbance/Displacement

There is the potential for in-air noise and visual disturbance to birds from the presence, movement and lighting of vessels and structures during the construction phase. It is also recognised that disturbance from vessels could also occur when transiting to and from the wind farm area. In addition, activities associated with the construction and installation of project infrastructure may create additional noise that could disrupt birds from typical behaviours (Fox & Petersen, 2019). Birds are not considered to be sensitive to underwater noise as they may not hear well underwater (Dooling & Therrien, 2012).

It is expected that potential disturbance and displacement would be temporary and localised around areas that are the focus of construction activity at a given time, making it unlikely to have significant, long-term impacts on seabird species.

Changes to Prey Resources

Changes to prey resources, which may in turn impact ornithological receptors, may occur from disturbance to the seabed. Seabed disturbance may cause prey mortality associated with high levels of sedimentation in the water column, while destruction of seabed habitat may make it unsuitable for sandeel or other prey species. Long-term and wide scale changes to prey distribution has the potential to impact seabird receptor species in the area and is assessed further in Section 10.3. As determined previously, changes to prey availability from construction impacts are likely to be localised and short term, reducing the potential for significant impacts on bird species.

10.5.3.2 Operational Impacts

Sources of impacts of the proposed Project on offshore ornithology during the operational phase include:

- Disturbance/displacement due to the physical presence of the wind turbines and vessels;
- Collision risk from the wind turbines; and
- Changes to prey resources.

Disturbance/Displacement

The presence of novel visual stimuli such as rotating blades and turbine towers may displace birds from important areas or cause them to change flight routes. The barrier effect caused by operational wind farms may therefore cause birds to expend extra energy, and overall reduce fitness and survival (Fox & Petersen, 2019). However, studies suggest that birds tend to transit around windfarms, or if they enter, fly at low heights and exit via the shortest route, reducing the likelihood of significant energy expenditure or collision risk (see below; Fox & Petersen, 2019). Vessel attendance at the proposed site will be limited. As such, the risk of disturbance from vessels is unlikely to impact seabird receptors.

Of the numerous species that use the North Sea for wintering, foraging or migration, several are deemed at a high risk of displacement from operational turbines. These include the greater scaup, common goldeneye, common scoter, goosander, red-throated diver, black-throated diver and white-bellied diver (Piggott et al., 2021). However, none of these species were identified within the proposed wind farm area during HiDef surveys (HiDef, 2022). As such, the risk of displacement is considered to be low for the species identified within the area, and further data to be collected will clarify the absence of more sensitive species that may be at higher risk.

Collision Risk

Birds which fly through a wind farm at a height equivalent to that of the rotating blades will be at risk of collision with operational wind turbines. In addition, depending on the final turbine design, a semi-submersible floating wind turbine could also act as an attractant by providing suitable roosting or resting areas for birds; which could increase the risk of collisions (Fox & Petersen, 2019). Studies suggest that large-bodied birds and night-migrating passerines are most at risk of collision, while illumination of turbine structures increase the likelihood of bird strike (Fox & Petersen, 2019). In general, not all bird species have the same risk, with differences in ecology, flight characteristics and breeding season having an impact on collision probability (Fox & Petersen, 2019).

Of the numerous species that use the North Sea for wintering, foraging or migration, several are deemed at a high risk of collision with operational turbines. From the species identified within the Project area (HiDef, 2022), these include black-legged kittiwake and northern gannet (high collision risk), as well as great black-backed gulls and herring gulls (very high collision risk; Piggott et al., 2021). Low numbers of these species were observed during HiDef surveys, indicating the collision risk may be low, however, the likelihood of collision requires further assessment.

Changes to Prey Resources

As identified in Section 10.3.3.2, the installation of sub-surface infrastructure may create additional habitat and change fish prey availability for ornithological receptors. Such infrastructure may change prey species occurrence (e.g., species that associate with hard substrate/structures may colonise turbines) and provide additional foraging opportunities. While some bird species are reluctant to forage within wind farms (Fox & Petersen, 2019), additional prey resource may provide benefits, however, such impacts are unlikely to be significant at population scales.

10.5.3.3 Decommissioning Impacts

Sources of impacts of the proposed Project on offshore ornithology during the decommissioning phase include:

- Disturbance/displacement; and
- Changes to prey resources.

Disturbance/Displacement

The potential for disturbance/displacement as a result of decommissioning activities are expected to be similar to those associated with the construction phase, localised around the decommissioning activity ongoing at that time and as such, unlikely to be significant for ornithological receptors.

Changes to Prey Resources

There is potential for activities associated with the decommissioning phase to impact prey availability/distribution, which may impact ornithological receptors. These include lifting of anchors and chains, removal of cables, and removal of hard infrastructure that may have been colonised by marine organisms. For ornithological receptors this may remove foraging opportunities. However, such changes are likely to return foraging opportunities in the area to pre-Project levels and is unlikely to have significant population level effects.

10.5.4 Mitigation Measures

As the Project design develops and baseline data are further analysed, potential mitigation measures will be reassessed and further defined as the potential impacts to receptors are better understood.

10.5.5 Proposed Assessment

As baseline surveys on ornithological receptors are still underway within the Project area, this topic will be **scoped-in**.

The potential impacts upon ornithological receptor prey species identified from the construction, operational and decommissioning phases are assessed as non-significant and will not be considered further (further details may also be found in Section 10.3.3). Full assessment of the other potential impacts (disturbance/displacement and collision risk) requires additional baseline data on species presence at spatial and temporal scales. Species specific assessments will therefore be undertaken in the EIA. Additionally, mitigation measures will be expanded as further baseline data are collected, reviewed and considered within the EIA. It is recognised that certain challenges associated with available collision risk modelling may confound attempts to identify impacts on bird receptors, and appropriate alternatives will be investigated further.

11 Seascape, Landscape and Visual Resources

11.1 Data and Information Sources

Information sources used to inform this section include:

- Offshore Energy Strategic Environmental Assessments Review and Update of Seascape and Visual Buffer study for Offshore Wind farms (White Consultants, 2020); and
- Siting and Designing Wind Farms in the Landscape Guidance (Scottish Natural Heritage, 2017)

11.2 Baseline

The CNS is home to oil and gas platforms which have some intervisibility with each other however, due to the distance from the coast, very few of these existing installations are visible from the Scottish mainland. Rig workers are in theory a receptor to changes in seascape, but they are considered to have low sensitivity to seascape change.

As discussed in Section 12, vessels pass through and by the proposed development area, people on these vessels could be classed as receptors, particularly those travelling for recreational purposes, as they may place a high value on the seascape vistas.

11.3 Potential Impacts

The visibility and visual impact of a wind farm are affected by distance and other aspects such as siting and weather conditions (Scottish Natural Heritage, 2017). A review undertaken as part of the Offshore Energy Strategic Environmental Assessment programme (OESEAP) found that for offshore turbines with a height of 250 – 300m (to blade tip) a visual effect may occur at distances of up to 47.6km (White Consultants, 2020). The turbines used for the Cenos project may be up to 352m in height and hence in theory could be seen at even greater distances. Hence, project specific consideration is required as suggested by the relevant guidance (Scottish Natural Heritage, 2017).

The curvature of the earth affects the visibility of an object, particularly when there are no other visual obstructions between the viewpoint and the object, as is the case in marine situations. Figure 11-1 demonstrates the effect of the curvature of the Earth on the visibility of objects at distance, the horizon may obscure all or part of the object, depending on the height of the observer and the distance from the object.

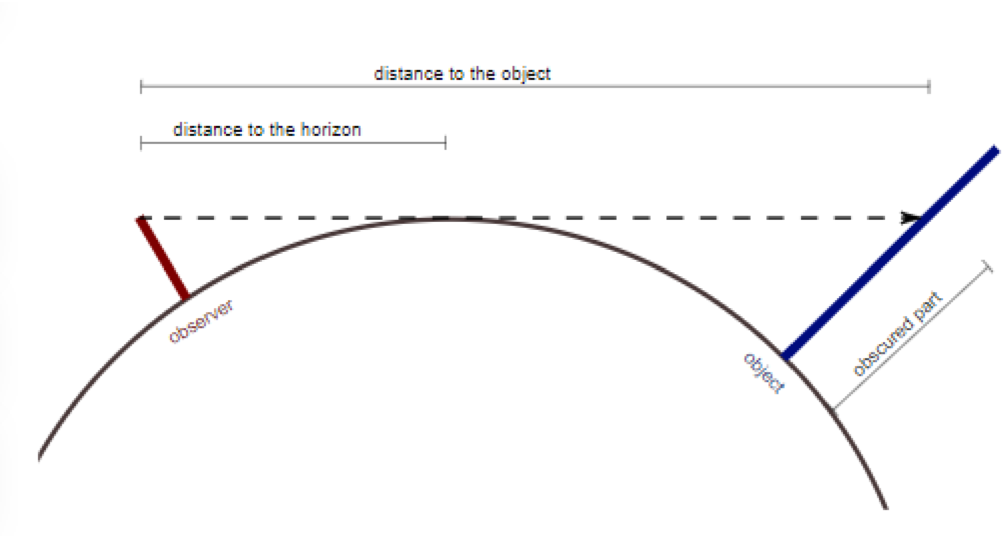

Figure 11-1 The effect of curvature of the earth on the visibility of objects at distance (Omni, n.d.)

The visibility of an object can be calculated using two equations:

1. The distance between the observer and the horizon given by the equation:

$$a = \sqrt{(r+h)^2 - r^2}$$

2. The height in metres that is obstructed by the curvature of the Earth, given by the equation:

$$x = \sqrt{a^2 - 2ad + d^2 + r^2} - r$$

Where a = distance to the horizon, h = eyesight level above mean sea level, r = Earth's radius (6371 km), x = the height of the obstructed part and d = the distance between the observer and lowest point of the object.

To understand the potential visibility of from a receptor's viewpoints, a number of scenarios have been assumed and the afore mentioned calculations performed (see Table 11-1). Receptors that have been considered include land-based receptors, vessels operating in and around the area and existing oil and gas installations in the vicinity of the Project.

Table 11-1 Example scenarios demonstrating visibility of the Cenos Windfarm.

Scenario	d - Distance to Cenos Wind farm (km)	h - Eyesight level (m)	a - Distance to Horizon (km)	x - Obscured object part (m)
On-land (low-lying coastal area)	185	5	8	2,459
On-land (mountain peak)	185	1000	113	408
Oil Rig/ Large Cruise Vessel	10	25	18	0

Scenario	d - Distance to Cenos Wind farm (km)	h - Eyesight level (m)	a - Distance to Horizon (km)	x - Obscured object part (m)
Oil Rig/ Large Cruise Vessel	50	25	18	81
Oil Rig/ Large Cruise Vessel	75	25	18	256
Oil Rig/ Large Cruise Vessel	100	25	18	530
Small vessel	10	5	8	0
Small vessel	50	5	8	139
Small vessel	75	5	8	352

The Cenos windfarm could utilise turbines with blade tips height of up to 352m and the Project area is 185km from the Scottish coast. Due to the distance from the shore and the curvature of the Earth the Cenos windfarm will not be visible to land-based receptors be they at sea level or on top of a Munro (see Table 11-1).

As Table 11-1 shows that the upper parts of wind turbines would be visible to small vessels over 50km, away, larger vessels may have intervisibility of the upper parts at over 75km away. Receptors on vessels passing closer to the windfarm will see more of the windfarm and are likely to have a view for a longer period of time. However, the effect will still be short lived as they transit past, and as such is not deemed significant.

It is acknowledged that oil and gas platforms within 85km of the Cenos wind farm will have intervisibility with at least parts of turbines. The closest platforms will be able to see full turbines. However, workers on the assets are not classed as a sensitive receptor to landscape and visual impacts.

11.4 Proposed Assessment

Given the distance from land and low sensitivity of seascape receptors, it is proposed that an assessment of the impacts of the proposed windfarm on seascape, landscape and visual resources is **scoped-out** for any further assessment in the EIA.

12 Shipping and Navigation

This section of the scoping report considers the potential effect of the proposed Project on shipping and navigation across all phases (construction, operation and maintenance, and decommissioning) and for all relevant shipping and navigation users.

12.1 Data and Information Sources

The key baseline data sources are identified in Appendix A, Table A-5.

The primary data sources considered within this Scoping Report are the two 14-day Automatic Identification System (AIS) datasets from 9th to 22nd of June and 3rd to 16th December 2021, which have been used to characterise the marine traffic baseline.

There are limitations associated with AIS assessment, data may underrepresent levels of fishing vessels below 15m (it should be noted that as the development site is located over 200km from the nearest coast the number of such vessels operating in this area will be very minimal) and recreational vessels, as these vessels are not required to broadcast via AIS. Therefore, in line with (Marine Guidance Note) MGN 654, data collection for the Navigation Risk Assessment (NRA) will include radar data to ensure all vessels are captured. Admiralty publications including nautical charts have been used to establish the navigational features baseline, and maritime incident data provided by the Marine Accident Investigation Branch (MAIB) and RNLI has been used to establish baseline incident rates.

12.2 Baseline

Data assessment has primarily been undertaken within a 10 nautical mile (nm) buffer of the Cenos offshore wind farm survey area (referred to as the 'study area' in this section), as presented in Figure 12-1. This buffer is standard for shipping and navigation assessments as it is typically large enough to capture the most relevant navigational features and passing marine traffic whilst remaining site specific. Assessment may extend beyond the 10nm threshold where deemed appropriate.

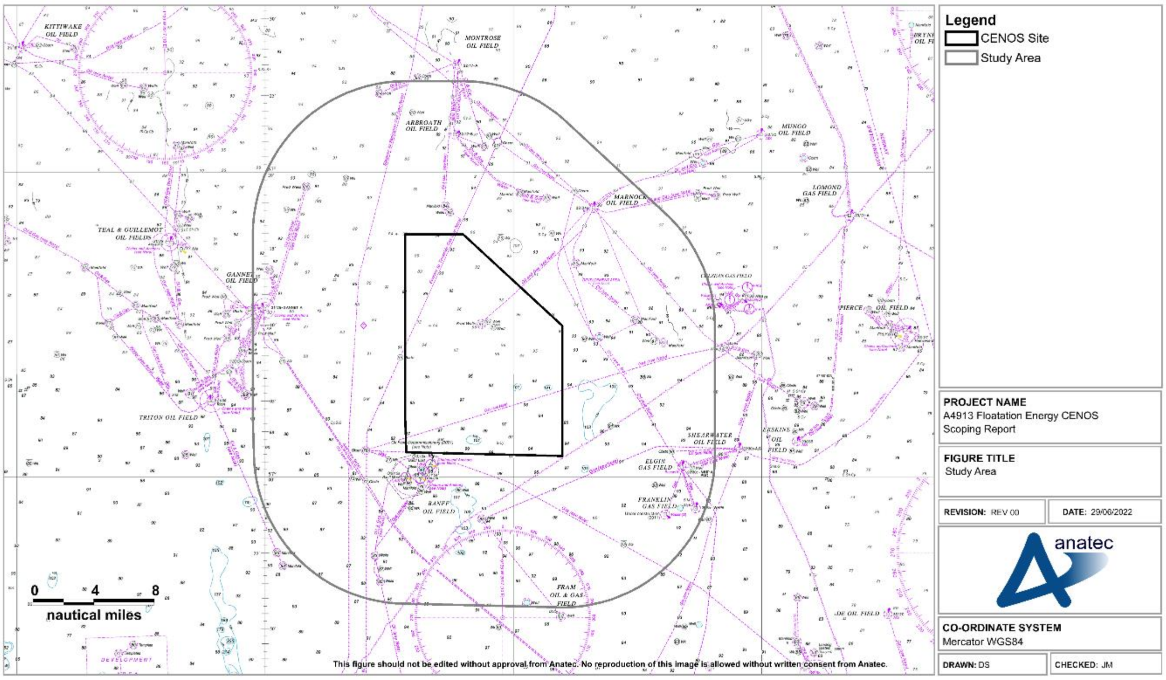

Figure 12-1: Study area.

Cable routes outwith the study area are yet to be refined, however as impacts on navigation due to cable installation is very short lived it is unlikely that a greater understanding of them would change scoping considerations.

12.2.1 Navigational Features

This section provides preliminary assessment of key navigational features located in proximity of the Cenos offshore wind farm area. An overview of the identified features is presented in Figure 12-2.

There are seven oil and gas fields located within the study area, with various offshore infrastructure located at each, as detailed in Table 12-1.

Chains and anchors can be seen at multiple nearby oil and gas installations.

A total of 142 pipelines run through the study area with a number of these running parallel to one another. Five of the pipelines are at the pre-commissioning stage, four are not in use and one is proposed but is charted and therefore considered relevant to the baseline.

The North Sea Link subsea cable runs between the UK and Norway. The cables pass 0.2nm to the southeast of the Cenos offshore wind farm study area.

Planned developments are not considered baseline but will be considered on a cumulative basis within the NRA.

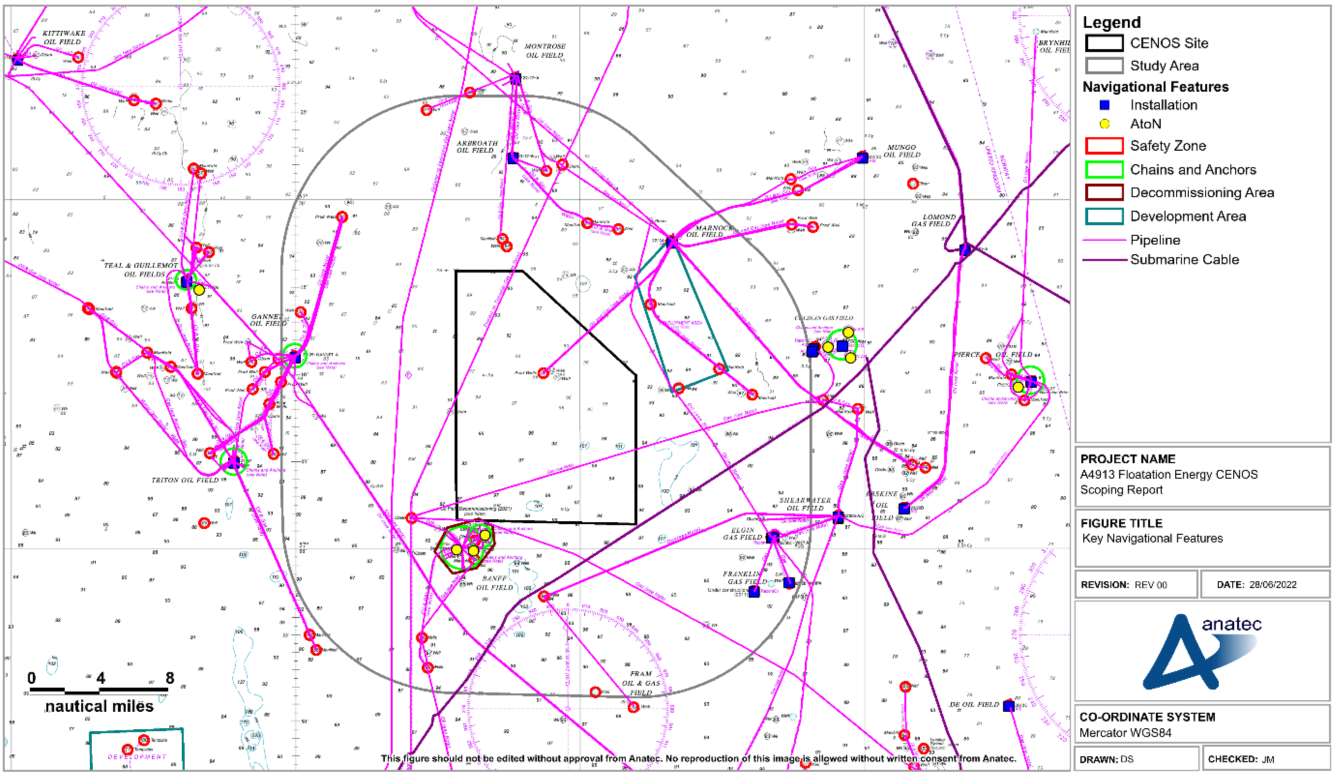

Figure 12-2: Key Navigational Features.

Table 12-1: Offshore Infrastructure within the Study Area.

Name	Distance from Cenos area (nm)	Manned Status	Field Type	Phase
Arbroath Platform	6.5	Manned	Oil	Operational
Marnock Complex (i.e. ETAP)	7.0	Manned	Oil & Gas	Operational
Franklin West Platform	7.8	NUI	Gas	Operational
Elgin Complex	7.9	Manned	Gas	Operational
Gannet Alpha Platform	9.2	Manned	Oil	Operational
Franklin Platform	9.4	NUI	Gas	Operational

12.2.2 Marine Traffic

This section provides preliminary assessment of the available marine traffic data at the scoping stage.

The vessels recorded within the study area during the summer and winter 2021 periods are presented in Figure 12-3, colour-coded by vessel type. Vessels involved in temporary drilling operations were excluded from analysis; this also includes fixed installations including drilling rigs which broadcast on AIS.

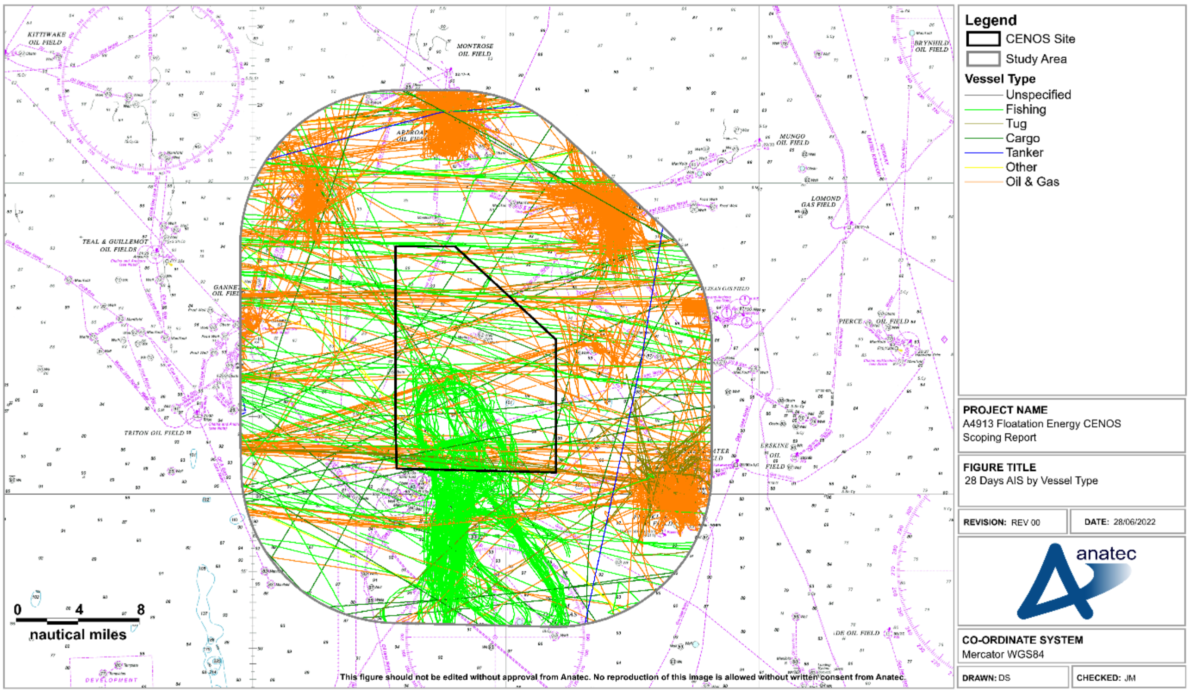

Figure 12-3: 28 days AIS by Vessel Type.

An average of 20 vessels per day were recorded within the study area, and six per day intersecting the Cenos offshore wind farm area. The most common vessel types were oil and gas vessels (approximately 13 per day) and fishing vessels (approximately five per day).

Active fishing was observed within the southern portion of the Cenos offshore wind farm study area, with the majority of these being demersal trawlers (approximately 89 %). Fishing activity was typically recorded during the summer months (96 %). No recreational activity was noted within the study area during the 28-day period.

Anchoring activity may be identified via an interrogation of navigational status broadcast on AIS, a speed analysis of vessels and a check of vessel track behaviour. Based on these processes, no anchoring activity was recorded within the study area, which may be expected given the distance offshore and charted water depths within the study area (minimum 80m below CD).Maritime Incidents

This section reviews maritime incidents that have occurred in the vicinity of the Cenos offshore wind farm area based on recent RNLI data and MAIB data. The analysis is intended to provide a general indication as to whether the area of the proposed development is currently a low or high-risk area in terms of maritime incidents.

The MAIB incident locations (excluding false alarms and hoaxes) recorded within the study area during the 10-year period between 2010 and 2019 are presented in Figure 12-4 colour coded by incident type.

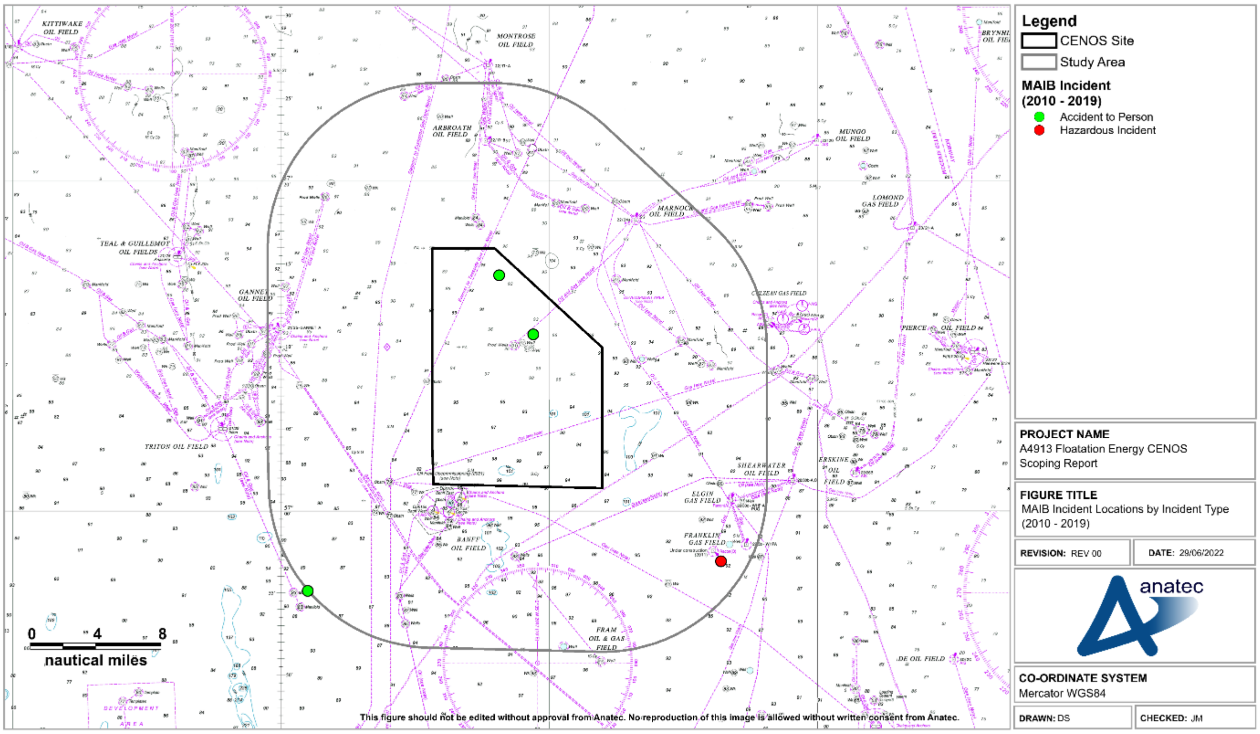

Figure 12-4: MAIB incident locations (2010-2019).

Over the 10-year period, four incidents were recorded within the study area based on MAIB data, all of which involved offshore industry vessels. Two incidents occurred within the initial proposed Cenos offshore wind farm area, both of which were accidents to persons. Of the other incidents, one was an accident to person and the other was a hazardous incident.

No incidents were recorded by the RNLI within the study area. The nearest incident was a person in danger, 18nm northeast of the Cenos offshore wind farm area.

Overall, based on the reported incidents and considering the number of vessels recorded within the study area during the survey periods, the total number of reported incidents is relatively low.

12.3 Potential Impacts

Potential impacts relating to shipping and navigation due to the presence of the proposed Cenos offshore wind farm are considered below. Impacts identified will also be considered for potential cumulative effects within the NRA.

12.3.1 Construction Impacts

Vessel to Vessel Collision Risk

Vessel to vessel collision risk could increase during construction due to:

- Displacement of vessels from existing routes due to construction, resulting in an increase in the likelihood of vessel to vessel encounters between third-party vessels with a subsequent increase in vessel-to-vessel collision risk; and
- The presence of additional vessels associated with construction activities may result in an increase in the likelihood of vessel to vessel encounters between third-party vessels and project vessels with a subsequent increase in vessel-to-vessel collision risk.

12.3.2 Operational Impacts

Vessel to Vessel Collision Risk

Vessel to vessel collision risk could increase during the operational phase due to:

- Displacement of vessels from existing routes due to the presence of the windfarm resulting in an increase in the likelihood of vessel to vessel encounters between third-party vessels with a subsequent increase in vessel-to-vessel collision risk; and

- The presence of maintenance vessels associated with operational activities may result in an increase in the likelihood of vessel to vessel encounters between third-party vessels and project vessels with a subsequent increase in vessel-to-vessel collision risk.

Allision Risk for Third-Party Vessels

The presence of array infrastructure may introduce a vessel to structure allision risk, including for vessels under power, adrift and navigating internally within the array.

Anchor Snagging Risk for Third Party Vessels

The presence of offshore cables and mooring lines associated with floating wind turbines may increase the likelihood of a third-party vessel's anchor interacting with a cable including a snagging risk.

Loss of Station for a Floating Structure

A failure of the mooring or anchoring system may lead to the detachment (complete or partial) of a floating structure resulting in the structure losing station and creating a hazard to third-party vessels.

Use of Aids to Navigation

The presence of surface infrastructure may reduce the effectiveness or prevent use of existing aids to navigation located in proximity to the proposed Cenos offshore wind farm.

Under Keel Clearance Interaction

Due to the water depth being greater than 50m for the entire project area, there are no issues with regard to cable protection or anchors reducing the charted water depths. There will always be sufficient under keel clearance for passing vessels.

Emergency Response Capability

The presence of the proposed Cenos offshore wind farm and maintenance activities may increase the number of emergency incidents resulting in a reduction in emergency response capability and/or reduced access for emergency responders including Search and Rescue (SAR) assets.

Use of Navigation, Communication, and Position Fixing Equipment

The presence of infrastructure may affect a vessel's use of its navigation, communication, and position fixing equipment.

12.3.3 Decommissioning Impacts

It is anticipated that decommissioning of the Cenos wind farm is likely to present the same impacts on shipping and navigation as those experienced during construction.

12.4 Mitigation Measures

Navigational risks can be minimised by embedding good practice within the project design, and by implementing standard mitigation measures. The specific mitigation to be incorporated within the project will be identified through the NRA process but will likely include:

- Compliance with MGN 654 (MCA, 2021) and its annexes where applicable;
- Appropriate marking on UKHO Admiralty charts;
- Promulgation of information for vessel routes, timings and locations, safety zones and advisory passing distances as required (e.g. Notifications to Mariners, Kingfisher Bulletin);
- Application for exclusion zones of up to 500m during construction and periods of major maintenance and up to 50m around completed structures pre-commissioning;
- Marine coordination and communication to manage project vessel movements;
- Marking and lighting of infrastructure in agreement with NLB and in line with International Association of Marine Aids to Navigation and Lighthouse Authority (IALA) Recommendation O-139 and G1162 (IALA, 2021a; IALA, 2021b);
- Compliance with regulatory expectations on moorings for floating wind and marine devices (Health & Safety Executive (HSE)/MCA, 2017);
- Minimum blade clearance of 22m above the water line; and
- Guard vessel(s) as required by risk assessment.

12.5 Proposed Assessment

Shipping and Navigation will be **scoped-in** to the EIA. The EIA for shipping and navigation will follow the methodology and be informed by the following guidance documents:

- MGN 654 Offshore Renewable Energy Installations (OREIs) – Guidance on UK Navigational Practice, Safety and Emergency Responses and its Annexes (MCA, 2021);
- Revised Guidelines for Formal Safety Assessment (FSA) for Use in the Rule-Making Process (IMO, 2018);
- International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA) Recommendation O-139 on the Marking of Man-Made Offshore Structures (IALA, 2021a);
- IALA Guideline G1162 The Marking of Offshore Man-Made Structures (IALA, 2021b);
- MGN 372 OREIs – Guidance to Mariners Operating in the Vicinity of United Kingdom (UK) OREIs (MCA, 2008);
- The RYA's Position on Offshore Energy Developments: Paper 1 – Wind Energy (RYA, 2019); and
- MCA and HSE Regulatory Expectations on Moorings for Floating Wind and Marine Devices (MCA & HSE, 2017).

As per the methodology provided in the MCA methodology (Annex 1 to MGN 654) (MCA, 2021), the NRA should assess impacts on a preliminary basis to identify which should be included within the EIA. Given that the NRA includes a set of criteria under MGN 654 (MCA, 2021) which must be considered, no impact will be scoped out at this scoping stage i.e., all impacts will be considered within the NRA process.

The IMO FSA Methodology (IMO, 2018) is the internationally recognised approach for assessing impacts to shipping and navigation users, and is the approach required under MGN 654 (MCA, 2021). This methodology is centred on risk control and assesses each impact in terms of its frequency and consequence in order that its significance can be determined as "broadly acceptable", "tolerable", or "unacceptable". Any impact assessed as "unacceptable" will require additional mitigation measures implemented beyond those considered embedded to reduce the impact to within "tolerable" or "broadly acceptable" parameters.

To inform the NRA, consultation during the pre-application phase is planned with the following statutory and non-statutory organisations, noting other organisations as identified may also be consulted:

- MCA;
- NLB;
- UK Chamber of Shipping;
- Royal Yachting Association (RYA) Scotland;
- Cruising Association (CA);
- Scottish Fishermen's Federation (SFF); and
- Regular commercial operators, including those operating oil and gas support services.

A Hazard Workshop will also be held with these organisations to discuss the potential hazards relating to shipping and navigation due to the presence of the project, with the findings used to inform a hazard log which will be used as input to the risk assessment. Relevant fishing industry representatives will also be invited to attend the Hazard Workshop.

13 Commercial Fisheries

This section of the Scoping Report identifies the potential impacts of the proposed project on commercial fishing activity in the area.

13.1 Data and Information Sources

Fisheries data are recorded and collated by statistical rectangles within each ICES Division. The proposed wind farm area lies within ICES rectangle 43F1. Government data for this ICES rectangle is used to describe the fishing effort and value of the area to the fishing industry. Vessel Monitoring Systems (VMS) data sets also provide useful information with regard to understanding fishing efforts. Data sources used in this section are listed in Table A-6, Appendix A.

13.2 Baseline

Fishing takes place throughout the year across the proposed Project area. Within ICES rectangle 43F1, gear types used include demersal trawlers (including bottom trawls, otter trawls, twin-rig trawls, pair trawls and Scottish seines) and seine nets. An indication of the principal fishing activities undertaken within the commercial fisheries study areas is provided below, based on analysis of landings (tonnes) and landings value (GBP) by species and fishing method for UK vessels (annual average 2017 to 2021).

Although fishing takes place throughout the year within 43F1 there are peaks in landings during summer and early autumn. Figure 13-1 provides a breakdown of the average value of landings by species. In rectangle 43F1 the highest average annual value of landings was of *Nephrops* (£134,403) (see Figure 13-2).

Within ICES rectangle 43F1 landings (tonnes) of haddock, *Nephrops*, haddock, and herring by demersal trawlers make up most landings. It should be noted from Figure 13-1 that this ICES zone is one of the lower landing catch value fishing zones significantly lower than the areas to the north (44E8-44F1 and 45E9-45F1) and east (43E8-43F0). Although those to the east have lower *Nephrops* landing values as shown on Figure 13-2.

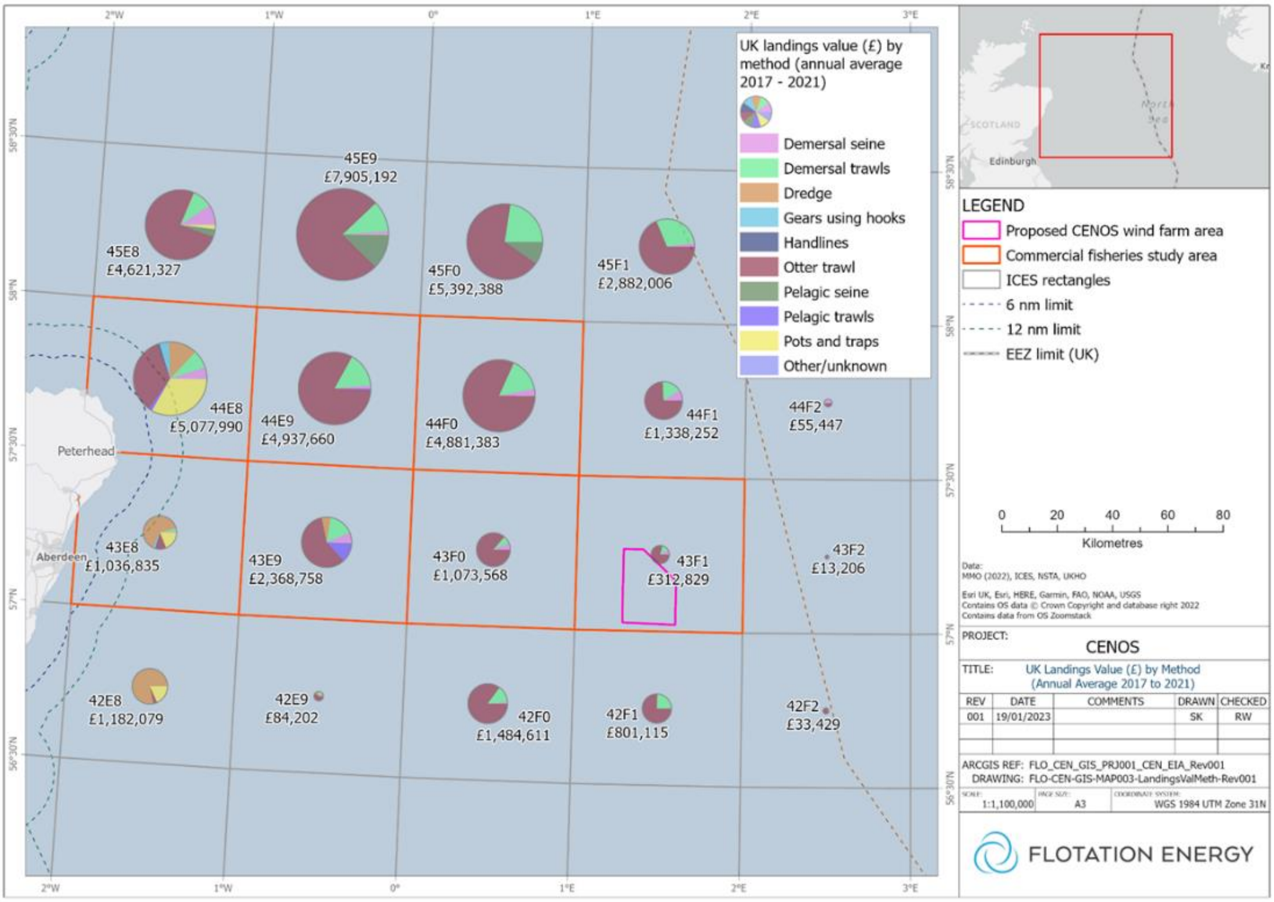

Figure 13-1: Average value of fisheries landings (GBP) by gear type (2017-2021).

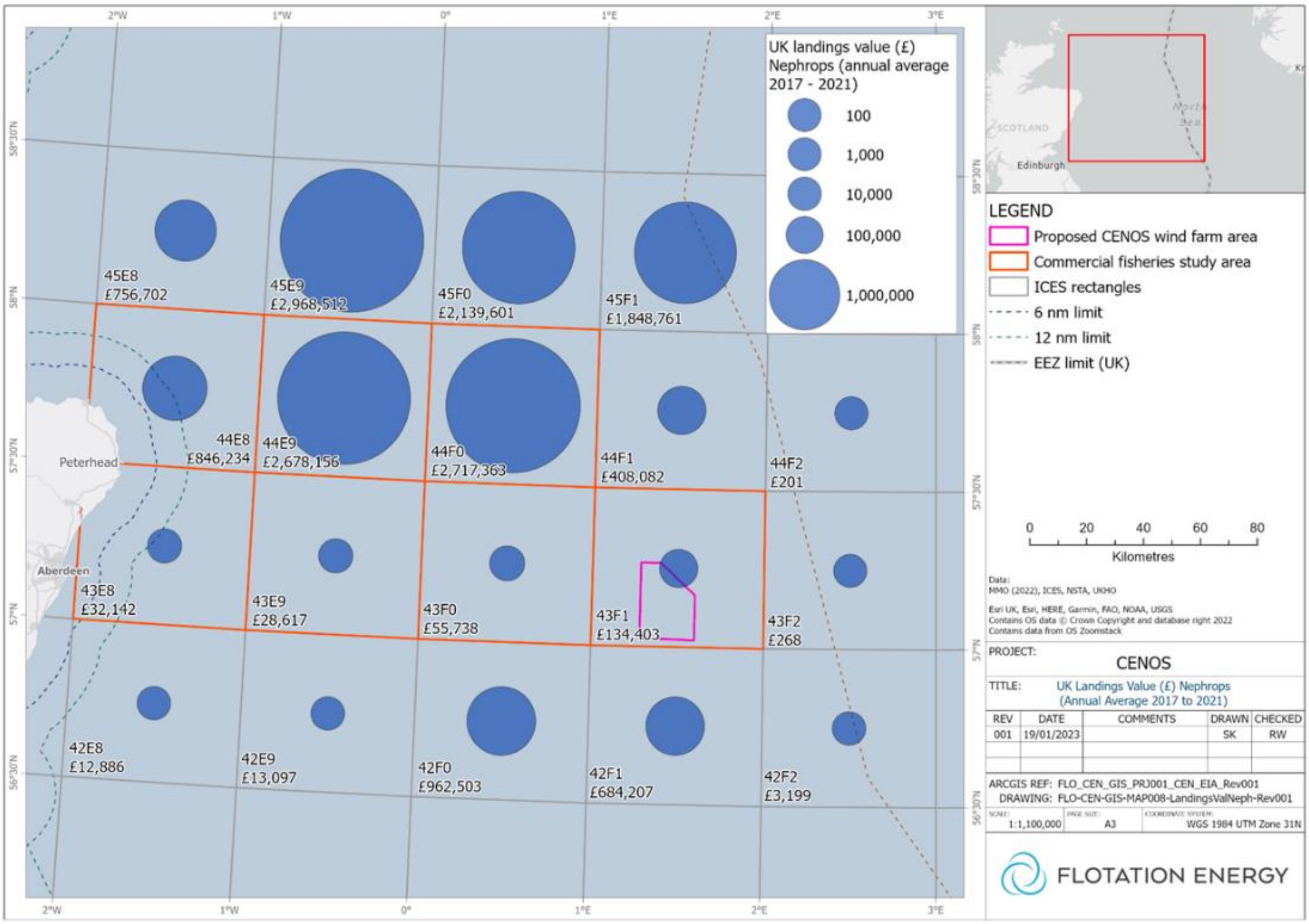

Figure 13-2: Average value of fisheries landings (GBP) for Nephrops (2017-2021).

VMS datasets demonstrate very low levels of fishing effort within the Project Area, other than a small nephrops habitat zone that is located within the East of Gannet and Montrose Field NCMPA. Figure 13-3 shows VMS data from 2017 and 2021 and demonstrates minimal fishing effort within the Cenos Project Area (as reflected in the landing data shown in Figure 13-1).

As noted within the recent SFF report on the spatial squeeze in fisheries (ABPmer 2022), the SFF expect that some commercial fishing activities could be limited or banned in MPAs prior to 2030. Management Options for the East of Gannet and Montrose Field NCMPA were considered in 2014. the three options were:

a) No Additional Management.
b) Additional Management to reduce/limit pressures – considering a range of measures including area restrictions, temporal restrictions, seasonal restrictions and gear restrictions
c) Additional management to remove/avoid pressures – where those fishing activities known to adversely affect the feature would be excluded and prevented from occurring in the future (JNCC, 2014).

Although the Management Options Paper (JNCC, 2014) identified that there was a risk of not achieving the conservation objectives for ocean quahog aggregations and offshore deep sea muds no statutory measures have been implemented in the MPA. It is not currently known if either of the additional management options will be implemented in the future.

Along the possible export route options, there are areas of relatively high fishing effort, particularly to the northwest of the Cenos Project area (southern part of 44F0) and close to shore where dredging activity is higher. However, there are areas where fishing activity is very low with on average less than 10 hours of effort over the period between 2017 and 2021.

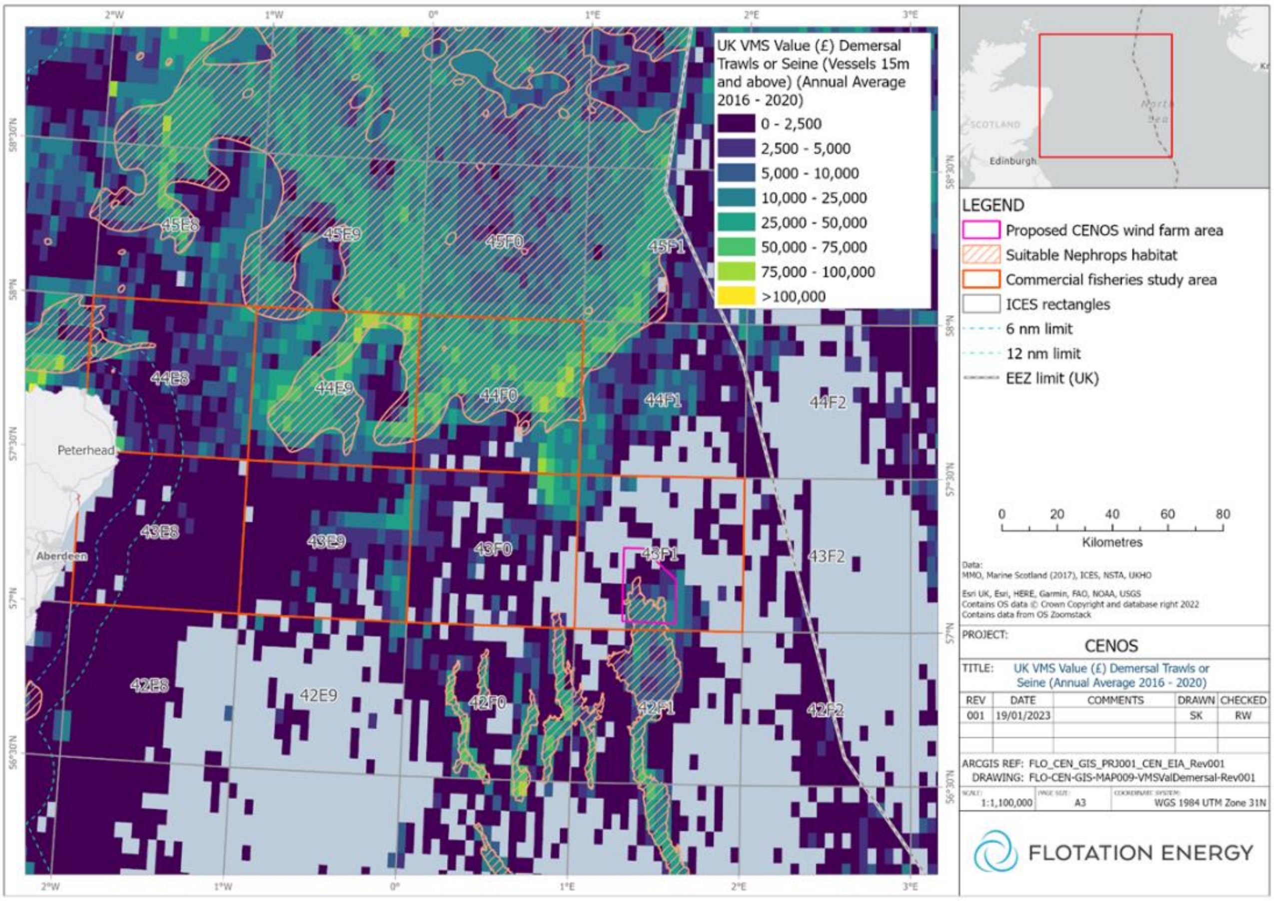

Figure 13-3: VMS data showing fishing effort between 2017 and 2021 (ICES, 2021).

Offshore, landings are generally dominated by *Nephrops* and haddock targeted using demersal trawls, with crabs and lobsters targeted using pots and scallops using dredges becoming more important in inshore waters. Inshore waters also see catches taken by gears using hooks, mainly seasonal handlining for mackerel but also catching plaice, cod, pollack and squid. While the regional picture is of a very active and valuable fishery, VMS and AIS data across the site demonstrate the location has virtually no fishing activity.

In summary, fishing activity in the ICES rectangle surrounding the proposed windfarm site has lower levels of use by the commercial fishing fleets when compared to other regions of this zone of the North Sea.

13.3 Potential Impacts

13.3.1 Construction

Sources of impacts of the proposed Project, on commercial fishing activity in the area, during the Construction phase include:

- Reduced access or exclusion;
- Displacement; and
- Increased vessel traffic.

Reduced Access

Reduced access or exclusion of fishing vessels from the proposed windfarm location and cable routes during the construction phase could occur. With regard to cable installation outwith the footprint of the windfarm the effects will be temporary, as once cables are installed and protected (buried or rock placed), safe fishing vessel access will be permissible. The windfarm will take time to construct (two to three years for all turbines to be deployed, and as such access to parts of the area will not be restricted until later in the construction phasing. The resultant effect of the reduced access from the Cenos area is not likely to be significant due to the low levels of fishing activity in the vicinity as identified in Section 13.2.

Displacement

When access is reduced or fishing vessels are excluded from an area they are displaced into adjacent grounds, this can lead to increased fishing pressure. This can impact for fish stocks in that area and cause conflict between fishers. The scale of displacement is unlikely to be significant in this instance due to the lack of fishing activity currently being undertaken in the area. In theory displacement can increase transit time for fishing vessels but in this instance that is unlikely as the majority of the Scottish fishing areas are closer to land than the Cenos site.

Increased Vessel Traffic

As discussed in Section 12, there will be increased vessel movements during the construction phase of the works both within the windfarm area and between the mainland ports and the Cenos site. The transit routes to port are of particular interest here, as they will pass through multiple fishing areas. Tugs moving wind turbines will be moving on set courses with little ability to manoeuvre. This gives rise for the potential for fishing vessels to need to alter course to avoid collisions interference with fishing activity and potential productivity. The construction ports utilised (discussed in Section 15) will determine the transiting routes and hence the specific fishing grounds affected.

13.3.2 Operations

Sources of impacts of the proposed Project on commercial fishing activity in the area during the Operational Phase include:

- Reduced Access;
- Displacement; and
- Gear Snagging Risk.

Vessel traffic associated with operations will be limited, with turbines being towed to shore for large scale maintenance an infrequent activity and hence increased vessel traffic during operations is not considered.

Reduced Access

Once operational the access to the area for commercial fisheries is likely to be restricted to some degree to protect the mooring systems interfering with fishing gear. The area of reduced access is yet to be determined. As discussed in Section 2.5.3, the radius of the mooring lines from the turbines could be up to 1km in the case of catenary moorings, with turbines located 1.6 to 2km apart there will be no area between the turbines which can be safely bottom dredged. The maximum footprint of the windfarm is 333 km^2 all of which could have access restricted for commercial fishing, in the location of the turbines and their associated mooring systems. It should be noted that turbine spacing are likely to exceed 1,600m with mooring separation likely to exceed 1,000 m. The resultant effect of the reduced access from the Cenos area is not likely to be significant due to the low level of fishing activity as identified in Section 13.2.

Displacement

Displacement of fishing effort will occur during operations with similar effects as experienced during construction.

Gear Snagging

As discussed under reduced access fishing vessels will be excluded from areas of the offshore wind farm where snagging with mooring systems could occur.

The cables to the oil and gas installations and the export cable will be trenched and buried with rock being laid on any areas where required depth of trenching is not reached. This rock will be laid in a profile suitable for over trawling, specifically to reduce the likelihood of gear snagging.

13.3.3 Decommissioning

Reduced access and displacement will continue until decommissioning is completed, in addition there will be increased vessel traffic with similar effects to those discussed for construction during decommissioning. It is assumed that the majority of component will be removed during decommissioning as discussed in Section 2.7.3, hence fishing activity will be able to safely return to the area.

13.4 Mitigation

Mitigation measures identified to minimise the impact of the proposed windfarm development include:

- IAC buried or rock covered to a target depth in accordance with BEIS Guidelines (2021) that will not interact with fishing gear;
- Any rock laid will align with industry standard and be over trawlable;
- Notifications to FishSafe providing location of windfarm infrastructure; and
- Implementation of a cable route inspection campaign (to ensure cables remain appropriately covered).

13.5 Proposed Assessment

Commercial Fisheries will be **scoped-in** to the EIA, with particular focus being given to effects associated with increased vessel traffic during construction and decommissioning. This will take account of the results of the shipping and navigation assessment (see Section 12). As discussed in Section 13.3 the effects associated with reduced access and displacement are not expected to be significant for the Cenos project in isolation. It is however recognised that cumulative effects due to access reduction and displacement from multiple marine developments could have a significant effect and hence these topics will be considered (see Section 21).

To support the EIA, Flotation Energy propose to engage with the Scottish Fishermen's Federation to support wider data and information gathering. In addition, Flotation Energy has engaged a suitably qualified Fishing Liaison Officer (FLO) to support the project moving forward and also to liaise with the wider fishing community on behalf of the project. Available data on fishing effort across the area will be used to support the EIA assessment.

14 Marine Archaeology, Cultural Heritage and Geomorphology

Marine archaeology is the study of how historical society interacted with oceans via physical remains. Marine cultural heritage refers to both physical archaeological features and cultural tradition. Geomorphology is the study of landforms and landform evolution. As the proposed Project area was once part of a land mass, there is a potential for features of geomorphological interest, such as historic river channels to be present, as well as the potential for archaeological remains.

14.1 Data and Information Sources

Publicly available data sources as detailed in Table A-7 (Appendix A) have been examined in order to identify records of known archaeology in the vicinity of the proposed wind farm. Data sources include Canmore, a database compiled and managed by Historic Environment Scotland, which contains records for archaeological sites, buildings, industry, and maritime heritage across Scotland. The ADMIRALTY Marine Data Portal provides access to marine data held by the United Kingdom Hydrographic Office (UKHO) within the UK EEZ.

14.2 Baseline

Marine historic assets include a wide variety of man-made structures, including wrecked vessels and aviation crash sites. They can also include more scattered remains such as groups of artefacts on the seabed or submerged prehistoric landscapes (Historic Environment Scotland, 2019). There are no designated sites for archaeology within the vicinity of the proposed windfarm location.

The available data from Canmore and the ADMIRALTY Marine Data Portal details the number of known archaeological features in the proposed Project area. There is one Canmore record within the proposed Cenos wind farm area, it relates to a World War 1 (WW1) submarine (U74). Although U74 appears as a Canmore record within the Proposed project area, it has since been positively identified at another location closer to shore (see Canmore ID 322289). The proposed Cenos wind farm area does not contain any wrecks identified by the ADMIRALTY Marine Data Portal.

The wider INTOG E-a lease area however, does contain a further 103 Canmore records, including fishing and trawler vessels, WW1 submarines and other unknown wrecks and foul ground. Foul ground is an obstruction on the seabed of known or unknown origin. It should be noted that Canmore records do not necessarily relate to physical remains of vessels at the recorded locations, but document records of lost vessels which have the potential to be present, currently undiscovered, within the area (Historic Environment Scotland, 2019). The wider INTOG E-a area also contains 55 non-dangerous wrecks as identified by the ADMIRALTY Marine Data Portal (UKHO, 2022). The distribution of known wrecks and foul ground across the proposed wind farm area is presented in Figure 14-1.

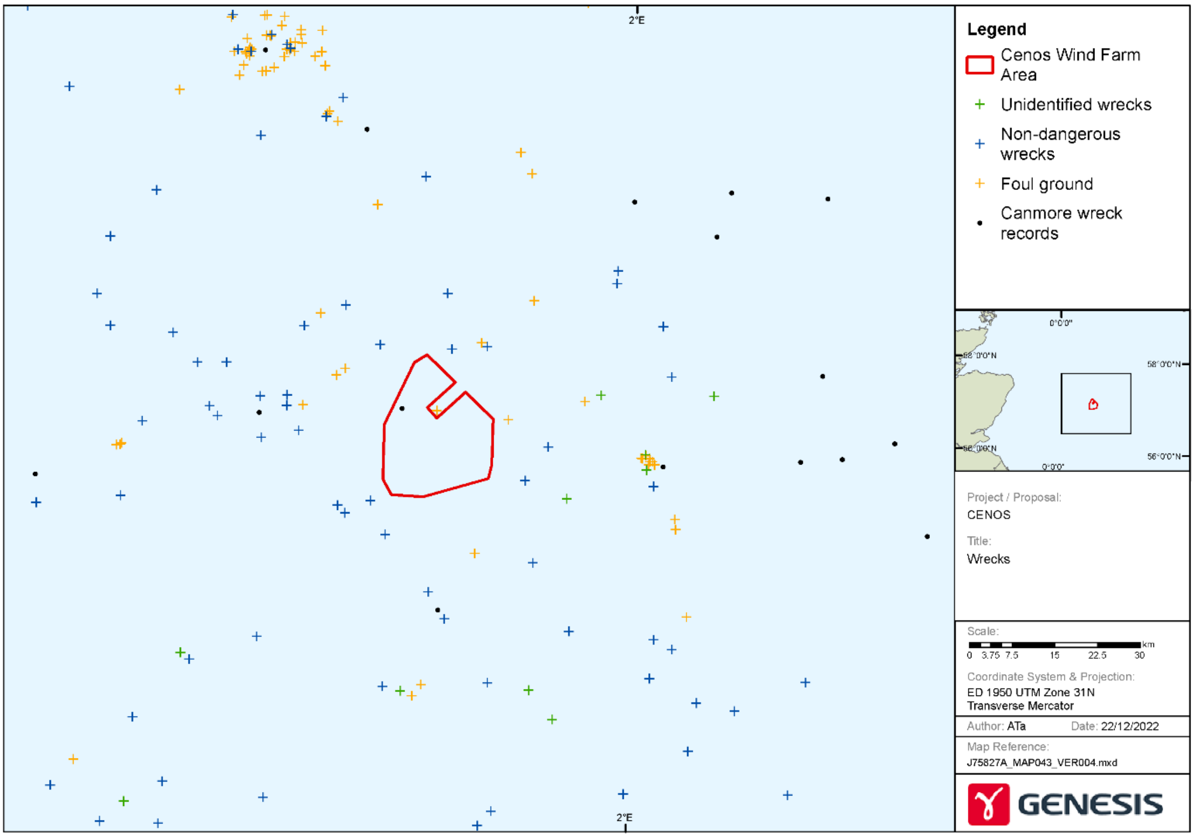

Figure 14-1: Wrecks in the vicinity of the proposed Cenos wind farm area.

The submerged prehistoric landscapes of the North Sea are of world-wide significance, with regards to archaeology and geomorphology. Although there is some uncertainty as to the full extent of land that was accessible/habitable by humans prior to sea-level rise. It is assumed that there are ancient landscapes in the North Sea that are now covered by marine sedimentation, however there are fundamental gaps in the knowledge regarding the extent of these landscapes (NSPRMF, 2009). Therefore, the available baseline is limited with regard to ancient human habitation and geomorphological features in this area. Information on sediment depths and types are detailed in Section 5.

As discussed in Section 2.5.7 the potential cables routes outwith the windfarm site, have all been routed away from known wreck locations by at least 50m.

14.3 Potential Impacts

As discussed in Section 14.2 there are no known archaeological assets in the planned windfarm site, and cable routes will specifically avoid known assets by at least 50 m. However, the potential for unknown or mis-charted assets cannot be ruled out.

Direct impacts may occur if archaeological material is present within the footprint of the proposed development area. Direct disturbance or damage may be associated with seabed preparation (including UXO and boulder clearance) and installation of subsea infrastructure (e.g. anchors, mooring lines, sub-station, inter array, array and export cables). The significance of any direct effect would be dependent on the value of the archaeological asset and the extent of the activities undertaken.

If present, geomorphological features are likely to be buried under the sediment layer at unknown depths. Therefore, the potential for direct disturbance or damage due to installation of subsea infrastructure is also unknown. Seabed survey data gathered by the project team to inform the design (as discussed in

Section 5.5) will contribute to a greater understanding of the geomorphology in this area. This could be seen as a benefit of the project.

14.3.1 Mitigation Measures

In order to prevent significant impacts, the following mitigations will be implemented:

- Known assets will be avoided by the planned cable corridor (see Section 2.5.7) by a minimum of 50 m.
- A procedure for archaeological discoveries (PAD) to be developed based on the PAD established by Wessex Archaeology on behalf of the Crown Estate for marine finds and would include the protocol for:
  - Discovery;
  - Initial steps for in-situ and out of situ finds;
  - Find management;
  - Restarting works; and
  - Reporting.
- If archaeological features are found, PAD will be followed.

14.4 Proposed Assessment

Based on current information there are no known archaeological assets in the Project area, therefore there is no need for an impact assessment, however it is recognised that the geomorphological baseline is limited and hence should be **considered further**. The results of the planned geophysical surveys, detailed in Section 5.5, will be reviewed for potential anomalies that could be of archaeological or geomorphological interest. If features are found on the surface of the seabed then they will be visually inspected using video and still photograph in order to provide an additional understanding of the feature.

If archaeological or geomorphological features are found that the Project could interact with (on or in the seabed) then, where practicable, they will be avoided with a suitable buffer zone. If a feature is unable to be avoided, then it would be taken forward for an impact assessment and if appropriate a Written Scheme of Investigation (WSI) will be proposed and agreed.

Any information that could be of archaeological or geomorphological interest will be shared with relevant bodies in order to contribute to the understanding in this area.

15 Socio-economic

Socio-economic impacts of the proposed Project include direct and indirect effects on the economy, livelihoods and social or cultural practices. While socio-economic effects will be linked to both offshore works and onshore activities, it is expected these impacts will manifest at local and regional scales from the port(s) from which the vessels for the various phases (construction, operation and decommissioning) will mobilise, and other onshore epi-centres supporting the development (e.g., construction and assembly/integration yards and the onshore control facility used to manage, monitor and operate the windfarm facility).

The impacts of the proposed Project on shipping/navigation and commercial fisheries are considered separately in Sections 12 and 13 and therefore are not considered further in this section.

15.1 Data and Information Sources

Baseline data has been primarily collated from publicly available, secondary data sources. Key sources include the Scottish Government's Office for National Statistics and the Annual Population Survey 2021, which were selected on the merits of government endorsement. In addition, the baseline assessment cites conclusions from reports released by the Office of the Chief Economic Advisor and the Fraser of Allander Institute, selected for their reputability.

15.2 Baseline

Gross Value Added (GVA) is a key indicator used to measure economic performance. Total GVA estimates for all industries in 2020 (in May 2022 prices) (ONS, 2023) was:

- £2,221 billion in the UK; and
- £145 billion in Scotland.

GVA in both the UK and Scotland increased steadily in the period from 2011 to 2019, until dipping in 2020 when the UK economy as a whole contracted by 9.7 % as a result of the coronavirus pandemic (ONS, 2023).

Statistics from the Annual Population Survey 2021 estimated the employment rate (16 to 64 years) in Scotland in 2021 was 73.2 % (Scottish Government, 2022d). This was slightly lower than the United Kingdom estimated employment rate of 74.7 % (Scottish Government, 2022d). Scottish employment rate breakdown by local authority in 2021 is depicted in Figure 15-1. The national Scottish employment rate (16 to 64 years) in October 2022, was estimated at 76.1 % (ONS, 2022), demonstrating a slight increase in the wake of the Covid-19 pandemic. The estimated Scottish unemployment rate in October 2022 was 3.3 % (ONS, 2022).

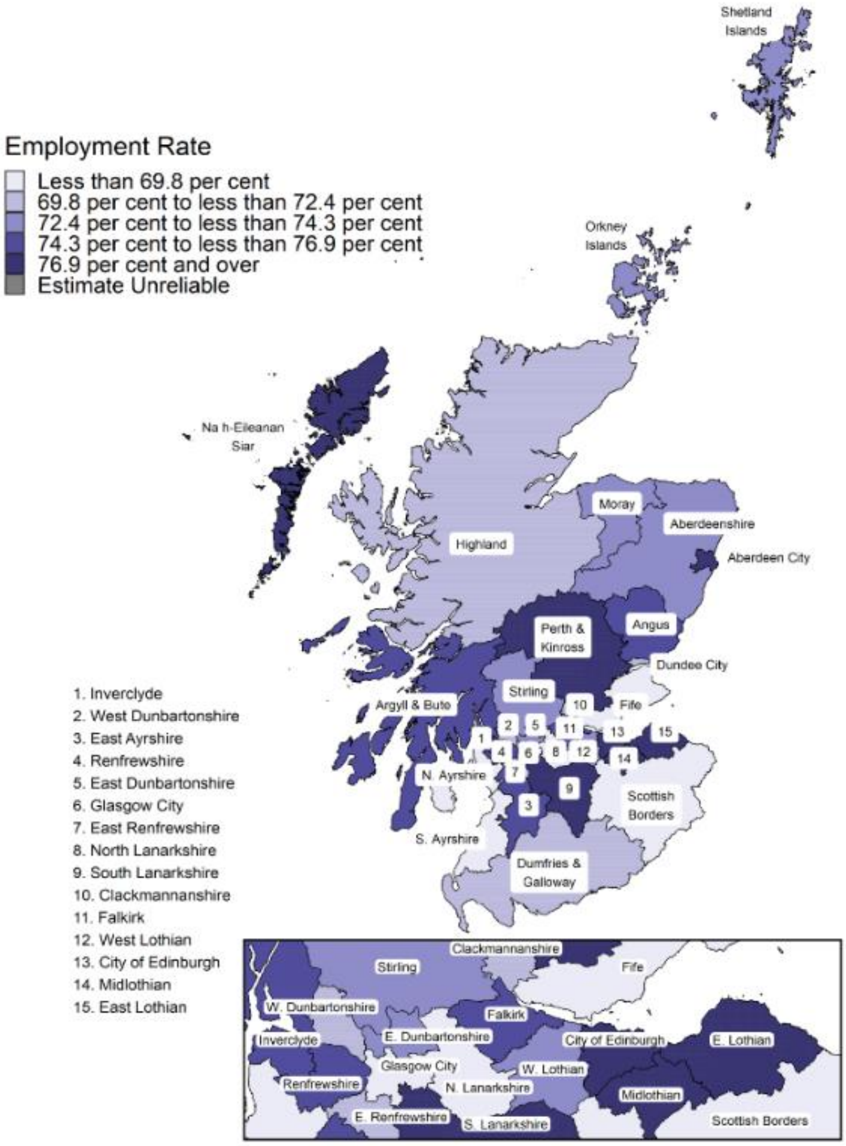

Figure 15-1: Estimate Employment Rate (ages 16 to 64) by Local Authority, 2021 (Scottish Government, 2022d).

The UK and Scottish economies have benefited from oil and gas income for half a century, and the industry continues to play a key role in terms of economic and energy security. Scotland has a comparative advantage in the energy sector, with rapid expansion of wind power complementing the hydrocarbon and hydroelectric sectors to retain Scotland's position as a net exporter of electricity (Office of the Chief Economic Adviser, 2022).

The Fraser of Allander Institute report (2021) suggested from a survey conducted in 2019 that there were around 22,660 full-time employees in the Scottish renewable energy sector which includes direct, indirect and induced jobs. This report further estimated there were approximately 4,700 jobs in the offshore wind segment in 2019 and that this number was expected to grow significantly over the next decade.

15.3 Potential Impacts

Crown Estate Scotland estimated in 2018 that the UK floating offshore wind market had potential to support 17,000 jobs and £33.6 billion of GVA, with particular potential for deployment in Scotland's 462,000km^2 of waters (Crown Estate Scotland, 2018).

One objective of the UK's Offshore Wind Sector Deal is the offshore wind sector committing to increase UK content (i.e., UK sourced employment) to 60 % by 2030, including increases in the capital expenditure phase (Scottish Government, 2022c). As such, the proposed Project will consider local content where possible.

15.3.1 Construction Impacts

The construction of the offshore wind farm requires winning of materials, fabrication of all the infrastructure components discussed in Section 2.5, their assembly, transport offshore and installation processes. This requires a significant upstream supply chain. Ideally fabrication is completed close to ports, to allow components to be taken be sea to the marshalling port (if different). The marshalling port will ideally be close to the development, assembly and initial commissioning works will be carried out there.

Scotland is currently lacking fabrication capabilities for offshore wind turbines and cables, but there is a potential for substructures and mooring systems to be fabricated in Scotland. Due to proximity, it is likely that marshalling, assembly and subsequent mobilisation for deployment of components will be performed at a Scottish port.

The National Renewables Infrastructure Plan (NRIP) identified potential port locations to support the development of the offshore renewables sector (Scottish Government, 2018 b). Major ports identified in the study are shown in Figure 15-2. Subsequently, ports that may be suitable for Project infrastructure assembly include Cromarty, Peterhead, Aberdeen or Dundee however, it is not yet determined which ports will be utilised. Smaller ports may also be utilised to provide support activities, such as crew transfer and restocking.

It is recognised that the socio-economic effects will be largest in the local communities around the selected ports, with effects rippling out into the region, Scotland and UK as a whole. The need for a diverse supply chain coupled with the transient nature of an offshore shift-pattern workforce will also have implications on the spread of socio-economic effects.

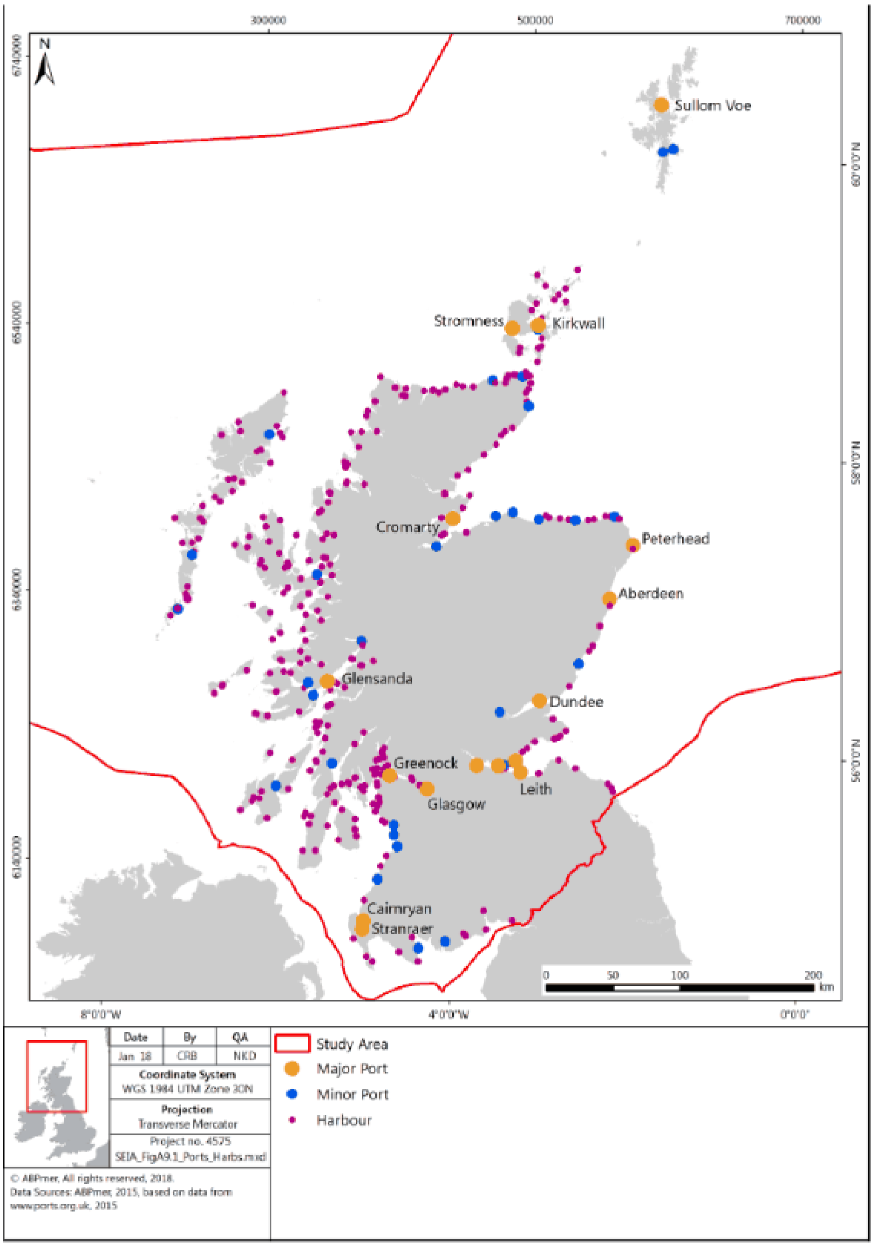

Figure 15-2. Ports and Harbours in Scotland (Scottish Government, 2018 b).

Socio-economic impacts associated with the construction phase of the proposed Project include:

- Direct and indirect employment;
- Direct and indirect, GVA; and
- Demand for housing, accommodation, and local services.

Direct and Indirect Employment

The Construction phase of the proposed Project is expected to increase the range and supply of employment demand and subsequent opportunities accessible to residents local to ports and those in the wider region. It is likely the proposed Project will provide employment opportunities across numerous industrial sectors and to a wide catchment of employees due to the potential for flexible work arrangements/shift.

Potential Capital Expenditure (CAPEX) during the Construction phase, will support employment in companies that are directly engaged in the construction supply chain. This can be expected to subsequently support employment indirectly in the wider Scottish/UK supply chain.

GVA Impacts

An increase in demand due to potential Project CAPEX investment during the Construction phase is expected to support an increase in GVA in Scottish companies that are directly or indirectly engaged in the Project supply chain. As with employment, there is the opportunity to proactively engage and/or prioritise procurement award to local and Scottish suppliers in line with local content policy.

Demand for Housing, Accommodation and Local Services

Direct and indirect employment generated by the Construction phase of the Project is expected to increase demand for housing, accommodation and services local to deployment ports, with subsequent demand on supply chains of these services. This demand may be advantageous, detrimental or a combination of both to the local and regional economies and communities.

15.3.2 Operational Impacts

It can be reasonably assumed that ports with closer proximity to the windfarm will be favoured as home port(s) for service operations such as crew changes and service vessel restocking. As depicted in Figure 15-2, there are a number of ports along Scotland's east coast (including Peterhead and Aberdeen) which may be used to support the lifecycle of the proposed Project, although service ports have not yet been selected for the purposed Project. In addition, there will be an onshore centre (location yet to be identified), where the windfarm will be controlled from and management activities undertaken.

Sources of socio-economic impacts associated with the Operational Phase of the proposed Project are the same as those identified for the Construction phase. However, as the scale of Project activities and expenditure will be considerably less than that of the Construction phase, the scale of socio-economic effects can be expected to be considerably less also.

15.3.3 Decommissioning Impacts

Large scale disassembly and decommissioning of the windfarm will require the use of major port(s), with a preference for ports with closer proximity to the windfarm, however port(s) to support decommissioning have not been selected. As discussed in Section 19 turbines will be dismantled probably at the port, while components will be refurbished or reused, where this is not possible, they will ideally be recycled. The refurbishment and recycling activities are likely to take place outwith ports but nearby, to minimise transport. This provides a supply chain opportunity. Hence decommissioning is likely to give rise to:

- Direct and indirect employment;
- Direct and indirect, GVA; and
- Demand for housing, accommodation, and local services.

It is recognised that the supply chain may not be suitably developed currently, but due to the timescales involved, there is a potential to prepare to meet the demand. As such, decommissioning should be recognised as a key opportunity for the Scottish and UK supply chains.

15.4 Mitigation Measures

It is anticipated that the overriding socio-economic impacts of the proposed Project will be positive in nature. As such, there are no mitigation measures considered for socio-economic receptors at this time. Consultation will be carried out with local stakeholders and public sector bodies, such as Scottish Enterprise, to raise awareness of the potential opportunities stemming from the proposed Project, with the aim of maximising the positive socio-economic impacts.

15.5 Proposed Assessment

Socioeconomics is **scoped-in** to the EIA as there is a potential for significant beneficial effects.

The socio-economic impact assessment process will be guided by publications including the International Association for Impact Assessment (IAIA) Social Impact Assessment guidance (Vanclay et al., 2015), Methods of Environmental and Social Impact Assessment 4th Edition (Therivel and Wood (eds), 2018) and HM Treasury Green Book (HM Treasury, 2022). The socio-economic impact assessment will utilise publicly available data from reputable sources, including, if available, 2022 Scottish census data.

15.5.1 Local Study Area(s)

Local study areas will be determined where the majority of socio-economic effects from both onshore and offshore project activities are expected to accumulate. As the port(s) and onshore epi-centres (i.e., construction yards, operations centre(s)) used to support the various phases of the project have not been determined, local study areas have not been defined at this time. If necessary, multiple local study areas will be established and assessed based on the expected accumulation of socio-economic effects.

15.5.2 Regional Study Area(s)

Larger, regional social and economic study area(s) will be defined taking into account the spatial scale at which impacts on receptors are likely. The regional study area(s) will be determined following the selection of construction sites, transport routes, port locations and operations and/or maintenance base(s) for the proposed Project. Assessment of these study area(s) will be undertaken to reflect the wider reach of the proposed development, particularly in terms of both the Scottish and UK economies, employment and skills, supply chain and interactions with other industrial sectors.

16 Human Health

As defined in the World Health Organisation’s (WHO) constitution, health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity (WHO, 1946). From an EIA perspective public health is considered in terms of both potential positive and negative impacts on the health of the population. Worker health and safety is covered under other regulator frameworks, and hence is not considered within EIA.

16.1 Data and Information Sources

The new Institute of Environmental Management and Assessment (IEMA) Guide to Effective Scoping of Human Health in EIA (IEMA, 2022a) has provided the framework for this scoping assessment. However, no external stakeholder engagement has been undertaken, as due to the nature of the project and potential effects, and uncertainty with regard to ‘local community’ (see Section 15) input from the Public Health experts was deemed appropriate at this stage.

The Scottish Public Health Observatory (ScotPHO) website has been utilised as a source of relevant information with regard to the health of the Scottish Public (ScotPHO, 2023).

16.2 Baseline

As discussed in Section 15, the ports which will be utilised during all phases of the project have not been identified, as such the populations potentially most influenced by the project are not known. Hence for the purpose of scoping it is assumed that the population health and influencing factors in terms of a range of behavioural, social, economic and bio-physical factors are typical for Scotland.

There are many clinical, behavioural and lifestyle risk factors which impact on health. A 2009 report from the WHO identifies five behaviours that contribute to around 90 % of the total burden of disease in high income country populations. These are tobacco use, alcohol consumption, poor diet, physical inactivity, overweight and obesity. All of these behaviours have an impact on health and wellbeing in Scotland. For example 63 % of the adult population are categorised as "Overweight including obesity" resulting in health care impacts with an approximate economic cost at as much as £4.6 billion per annum (ScotPHO, 2023).

The sum of these contributing factors result in Scotland having one of the lowest life expectancies in Western Europe. Boys can expect to live 76.8 years on average, 61.7 of these in a ‘healthy’ state. Girls can expect to live 81 years on average, 61.9 of these years being 'healthy'. In addition, deprivation also has an impact on health, wellbeing and overall life expectancy and at present almost one in five working age adults in Scotland live in poverty (ScotPHO, 2023).

Those living in deprived areas are less likely to meet five-a-day recommendation for daily fruit and vegetable consumption and are less likely to be physically active, resulting in higher body mass index and a higher risk of obesity related illness. Neighbourhood satisfaction is also lower in urban and deprived places, and more disadvantaged groups are more likely to be impacted by aspects of the physical environment (such as climate change and traffic congestion) (ScotPHO, 2023).

16.3 Potential Impacts

The IEMA guide proposes a list of determinants of health to be considered in scoping and a number of steps to be undertaken to identify whether any of the determinant factors should be scoped in to EIA. In the first instance there needs to be a source – pathway – receptor linkage to make an impact likely. Where determinant factor is likely to occur, then the scale of the change be it positive or negative needs to identify if it could be significant. In the event that a negative effect could be significant, then committed mitigation can be taken into account to identify if it can be scoped out. In the event of a potentially positive effect, consideration is given to whether committed enhancements are sufficient to maximise the benefits, if they are the topic can be scoped out (IEMA, 2022). Table 16-1 provides a list of determinants, identifies if there is a likelihood of an effect, considers significance and present the committed mitigations/ enhancements to inform the scoping in or out of each determinant.

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Table 16-1: *Consideration of Potential Human Health Effects.*

Categories	Wider Determinants of Health	Likelihood (Source, Pathway, Receptor)	Comments	Significance (Positive or Negative)	Committed Mitigation / Enhancements	Scoped In / Out
Health Related Behaviours	Physical activity	None	The development does not have any elements which would give rise to changes in health-related behaviours of the population.			Scoped Out
	Risk taking behaviour	None				Scoped Out
	Diet and nutrition	None				Scoped Out
Social Environment	Housing	Potential primarily during construction and decommissioning.	Increased demand for housing due to an influx of workers (see Section 15). This could put pressure on housing availability but could also increase the status of the housing stock due to increased affluence in the area. Will mainly occur during construction and decommissioning when there are larger supply chain requirements.	Positive & Negative – Non-significant. Due to the relatively small scale and temporary nature, effects on housing are unlikely to have a significant population health impact.		Scoped Out
	Relocation	Potential temporarily during construction and decommissioning.	Potential for workforce to relocate to areas closer to construction / decommissioning ports, to gain employment. The upheaval of a move can have mental health implications. Influx of new people into a community can also cause conflict and concerns.	Negative – Nonsignificant Due to the relatively small numbers involved it is unlikely to have an effect on population health.		Scoped Out
	Open space, leisure and play	None	The development will not impact upon availability of open space, leisure or play, or its use.			Scoped Out
	Transport modes, access and connections	None	No connectivity foreseen.			Scoped Out
	Community safety	None	No linkages from the project to these determinants have been identified.			Scoped Out
	Community identity, culture, resilience and influence	None				Scoped Out

Categories	Wider Determinants of Health	Likelihood (Source, Pathway, Receptor)	Comments	Significance (Positive or Negative)	Committed Mitigation / Enhancements	Scoped In / Out
	Social participation, interaction and support	None				Scoped Out
Economic Environment	Education and training	Potential at all phases of the development.	Supply chain opportunities are considered in Section 15, highly likely that there will be training opportunities to allow people to fulfil roles within the supply chain. There are potential mental health benefits of education on self-esteem.	Positive - potentially significant. Significance will depend on specific local baselines.	Positive engagement with the Scottish supply chain and creation of opportunities will be maximised through project procurement and implementation of enhancements identified in the socio-economic assessment (Section 15).	Scoped Out
	Employment and income	Potential at all phases of the development.	There will be direct and indirect employment opportunities as a result of the development. Employment is considered in Section 15. There are potential health benefits associated with increased affluence.	Positive, potentially significant. Significance will depend on specific local baselines.	Positive engagement with the Scottish supply chain and creation of opportunities will be maximised through project procurement and implementation of enhancements identified in the socio-economic assessment (Section 15).	Scoped Out
Bio-physical Environment	Climate change mitigation and adaptation	Potential	The projects operational contribution towards minimising climate change is considered in Section 18. This will help to minimise the effects of climate change on population health.	Positive, contributes towards health impact however this is unlikely to be significant when considered in isolation.		Scoped Out
	Air quality	None	Air quality is considered in Section 7, no significant effects have been identified, hence no knock on health implications.			Scoped Out
	Water quality or availability	None	Water quality is considered in Section 6, no effects on fresh water have been identified, hence no implication for human health.			Scoped Out
	Land quality	None	Geology and sediments are considered in Section 5. Effects are all associated with the marine environment and hence will not effect human health.			Scoped Out

Categories	Wider Determinants of Health	Likelihood (Source, Pathway, Receptor)	Comments	Significance (Positive or Negative)	Committed Mitigation / Enhancements	Scoped In / Out
	Noise and vibration	None	Noise and vibration are considered in Section 8. No significant noise effects have been identified, hence no knock on impacts for human health.			Scoped Out
	Radiation	None	The development does not give rise to radiation. Electromagnetic fields (EMF) are considered in Section 9, these are associated with marine cables and hence have no linkages to human health.			Scoped Out
Institutional and Built Environment	Health and social care services	Potential, during construction and decommissioning.	Potential increase demand due if there is any relocation of workforce to support supply chain demands.	Negative, non-significant due to relatively small numbers for temporary time period.		Scoped Out
	Built environment	None	No linkages from the project to these determinants have been identified.			Scoped Out
	Wider societal infrastructure and resources	None				Scoped Out

16.4 Mitigation

Mitigation and enhancements identified through the assessment of socio-economic effects will help to minimise negative and maximise positive health effects associated with the project.

16.5 Proposed Assessment

It is proposed that Human Health is **scoped-out** of the EIA on the basis that the potentially significant effects are positive and will occur without specific enhancement measures being employed or with enhancements identified by the socio-economic assessment.

17 Major Accidents/Disasters

Major accidents and/or disasters should be considered where the development has the potential to cause permanent injury or loss of life, and/or temporary or permanent destruction of an environmental receptor which cannot be restored through minor clean-up and restoration.

A major accident is an event that threatens immediate or delayed serious environmental effects to human health, welfare and/or the environment and requires the use of resources beyond those of the client or its appointed representatives to manage. Whereas a disaster is a natural or manmade hazard that has the potential to meet the definition of a major accident (IEMA, 2020a).

17.1 Potential Impacts

Offshore floating wind turbines and associated infrastructure do not include sources of hazard that could result in a major accident of disaster. The power from the Cenos project will be utilised on oil and gas facilities, which could be considered a potential source of hazard to the environment. If the interruption in power supply could impact the safety of the oil and gas assets then this could be an area of concern. However, loss of power and fail safe systems identified within the oil and gas assets safety cases will ensure that no major accidents or disasters will occur in event of a loss of power.

It is recognised that there is a potential that if an external man-made or natural hazard occurred the presence of the development would increase the environmental effects. A list of potential major accidents and disasters has been developed and considered in terms of how the location and proposed use may affect the risk of each accident/disaster (Table 17-1). The IEMA (2020a) guidance in its scoping decision process flow asks the question: 'Do existing design measures or legal requirements, codes and standards adequately control the potential major accident and/or disaster, or will it be adequately covered/assessed by another topic?' If the answer is yes the topic can be scoped out for further consideration. Hence the Table 17-1 signposts to relevant sections within this document, design standards, legal requirements, codes and standards.

Table 17-1: Consideration of Potential Major Incidents and Disasters.

Major Accidents and Disasters	Location Risk?	Proposed Use Risk?	Comments	Design Measures or Legal Requirements, Codes and Standards	Topic Section
Malicious Attacks	No	No	Risk of attack is minimal due to location.		
Serious Organised Crime	No	No	Risk of attack is minimal due to location.		
Epidemic / Pandemic	No	No	There is no specific risk of epidemic/pandemic associated with the development, however in the event of a communicable disease outbreak workers may be prevented from exiting the vessel and spreading the illness to the wider population. If a communicable disease has been reported, no other person other than the pilot, customs officer, immigrations officer or port health officer can board or leave the ship without consent from an authorised officer.	The Public Health (Ships) (Scotland) Regulations 1971 (as amended).	
Biological Hazards: Animal/ Insect Infestation	No	No	No major disaster sources identified. Risk of non-native invasive species introduction has been considered in		Section 10: Biodiversity
Earthquakes	Yes	No	The CNS experiences low-moderate seismic activity. Could add strain to mooring systems and risk turbines breaking free with knock on increases in collision risk with vessels or oil and gas assets.	Design of anchoring system will take account of low to moderate seismic events.	Section 6: Water Quality Section 12: Shipping and Navigation
Severe Storms	Yes	No	Due to the location severe storms are expected, the frequency and severity could be exacerbated by climate change see Section 18. Could add strain to mooring systems and risk turbines breaking free with knock on increases in collision risk with vessels or oil and gas assets.	Design of anchoring system will take account of severe storm events.	Section 6: Water Quality

Major Accidents and Disasters	Location Risk?	Proposed Use Risk?	Comments	Design Measures or Legal Requirements, Codes and Standards	Topic Section
					Section 12: Shipping and Navigation
Transport incidents: Vessels	Yes	Yes	Significant number of vessel movements in the CNS, and project will have associated vessel movements and is placing infrastructure in the sea. Hence increase potential for issues associated with vessels.		Section 12: Shipping and Navigation.
Transport incidents: Aviation	No	Yes	Due to the height of turbines, potential to interact with low flying aircraft, primarily helicopters. Wind turbine site specifically been located away from oil and gas platform due to their associated helicopter movement to avoid issue (see Section 2.2). Furthermore, the windfarm will be appropriately charted to allow the area to be avoided by helicopters	UK Air Regulations and underpinning, Acceptable Means of Compliance (AMC), Guidance Material (GM) and, where appropriate, Certification Specifications (CS)	
Industrial Accidents	No	Yes	The potential to damage oil and gas infrastructure during construction and decommissioning, could be classed as an industrial accident.		Section 6: Water Quality
Fire	No	No	The offshore electricity hub could pose a risk of electrical fires, however, it will be appropriately designed to take account of fire standards. The hub is unmanned the majority of the time and hence there is very low risk to human life. Environmental impacts on air quality and potential the marine environment would be localised unlikely to be classed as major. Similarly fires in offshore wind turbines are if they were to occur will be limited in scale and impact. Fires on vessels managed via standard practices.	Health and Safety at Work Act. Offshore Installations (Prevention of Fire and Explosion, and Emergency Response) Regulations 1995. Associated HSE Approved Code of Practice and Guidance.	

17.2 Mitigation Measures

Mitigation measures are identified within the relevant topic sections identified in Table 17-1. The design measures or legal requirements, codes and standards outlined within Table 17-1 will be taken forward into the project design and implementation stages.

17.3 Proposed Assessment

Major Accidents and Disasters will be **scoped-out** of the EIA on the basis that relevant issues are considered under other topics or can be mitigated against by appropriate consideration within the design and/or are covered by other legal requirements, codes and standards.

18 Climate Change

This section identifies the potential environmental impacts, GHG emissions and/or savings, and resulting carbon footprint arising from construction, operational, and decommissioning phases of the development. It also considers the ways in which the effects of climate change, such as extreme weather and rising sea levels, may impact on the development during its lifecycle.

18.1 Data and Information Sources

The following data and information sources were used to inform this section:

- IEMA Guide: Assessing Greenhouse Gas Emissions and Evaluating their Significance 2nd Edition (IEMA, 2022);
- Environmental Impact Assessment Guide to: Climate Change Resilience & Adaptation (IEMA, 2020);
- Net Zero Stewardship Expectation 11 (North Sea Transition Authority, 2021);
- GHG Protocol Corporate Standard (World Resources Institute, 2015); and
- Pathways to Net Zero: Using the IEMA GHG Management Hierarchy (IEMA, 2020c).

The relevant policy and guidance relating to climate change are as follows:

- **GEN 1 General planning principle (Scotland's National Marine Plan):** There is a presumption in favour of sustainable development and use of the marine environment when consistent with the policies and objectives of this Plan (Scottish Government, 2015a);
- **GEN 3 Social benefit (Scotland's National Marine Plan):** Sustainable development and use which provides social benefits is encouraged when consistent with the objectives and policies of this Plan (Scottish Government, 2015a);
- **GEN 5 Climate Change (Scotland's National Marine Plan):** Marine planners and decision makers must act in the way best calculated to mitigate, and adapt to, climate change;
- **GEN 14 Air quality (Scotland's National Marine Plan):** Development and use of the marine environment should not result in the deterioration of air quality and should not breach any statutory air quality limits (Scottish Government, 2015a;
- **The Fifth Carbon Budget:** This report produced by the Committee on Climate Change (CCC) details carbon budgets within UK sectors and identifies reductions that are required to meet the 100 % reduction target by 2050; and

18.2 Baseline

18.2.1 Carbon Emissions

Electricity in the UK is produced from a combination of fossil fuel, nuclear and renewable sources. As shown in Figure 18-1, the reliance on coal has dropped dramatically since 1990, being replaced by gas and increasingly renewable power sources. In 2021 the CO_2 emissions from the energy sector were provisionally estimated to be 80.7 million tonnes (MTe).

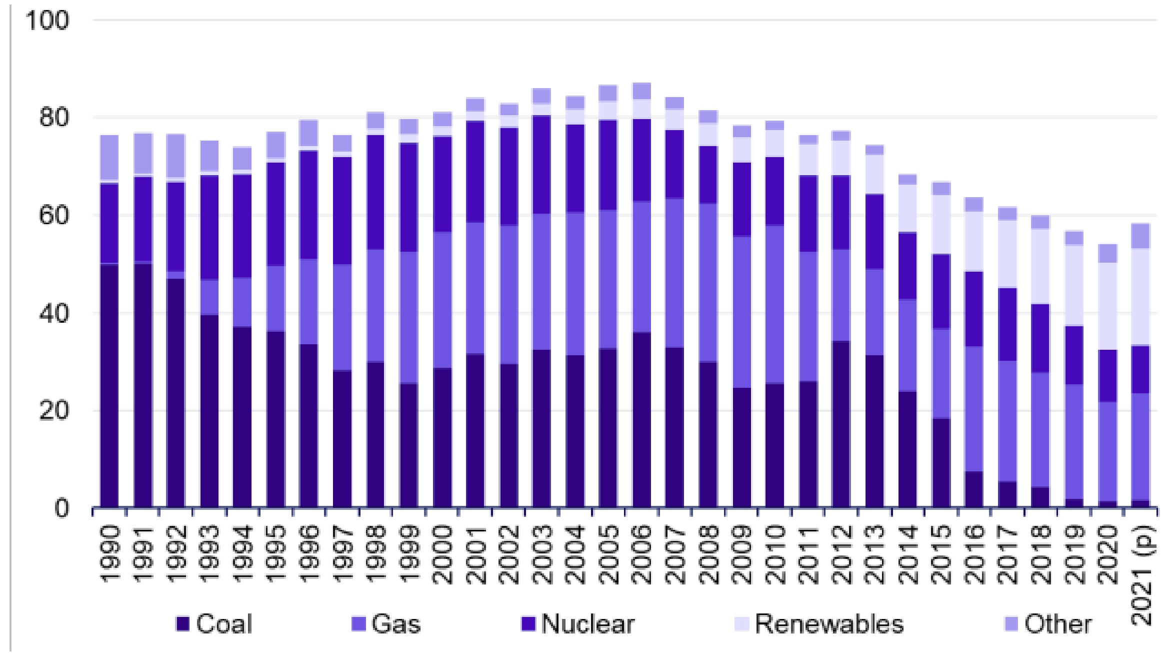

Figure 18-1: Fuel mix for UK Electricity Generation (million tonnes of oil equivalent) (BEIS, 2022b).

Electricity generated by coal has almost double the CO_2 cost of that generated by oil (1,016Te verses 489 Te per GWh), hence the move away from coal has helped to reduce the overall carbon cost of electricity. In 2021 GHG Emissions per unit of electricity supplied from fossil fuels in the UK were estimated to have been around 527 tonnes of carbon dioxide per gigawatt hour (GWh) (BEIS, 2022b). Figure 18-2 details carbon emissions by fuel type from 1990-2020 (Note that 2021 are provisional figures).

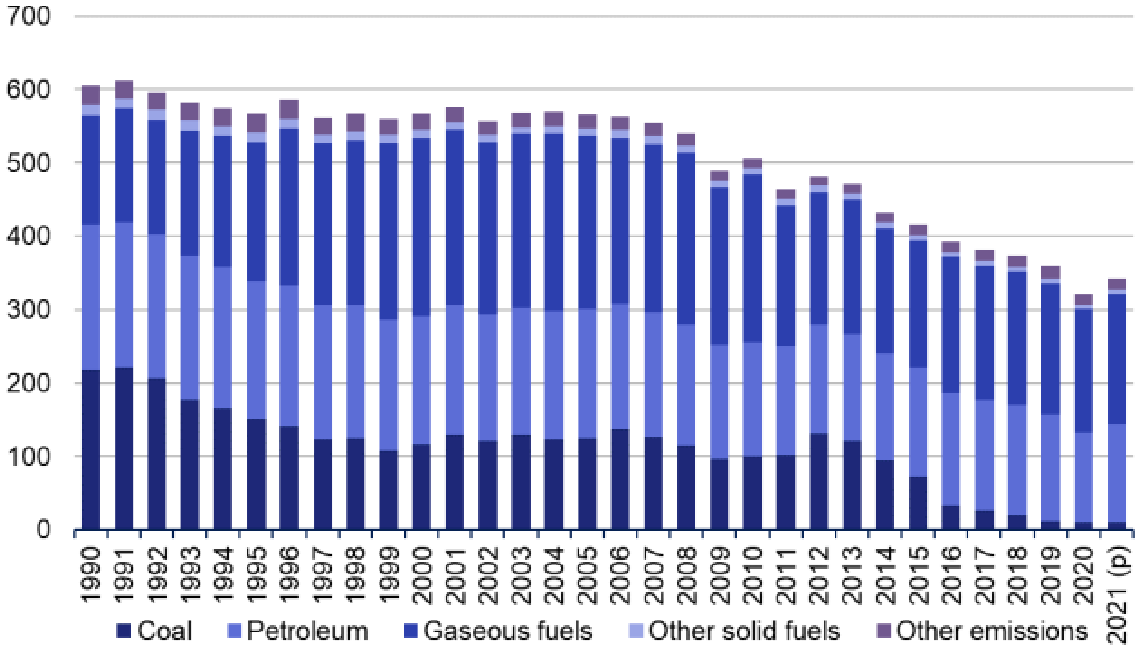

Figure 18-2: UK Carbon Emissions by Fuel Type (MtCO$_2$) (BEIS, 2022b).

The exploitation of oil and gas gives rise to carbon emissions, in the order of 10 MTe of CO_2e, is discharged each year from the UKCS (Oil and Gas Authority, 2020). Approximately 70 % of all GHG emissions from the oil and gas industry were from the combustion of fuels, with the remainder from flaring and venting. Figure 18-3 depicts the GHG emissions intensity on the UKCS between 2010 – 2022 in barrel of oil equivalent (boe) (North Sea Transition Authority, 2022).

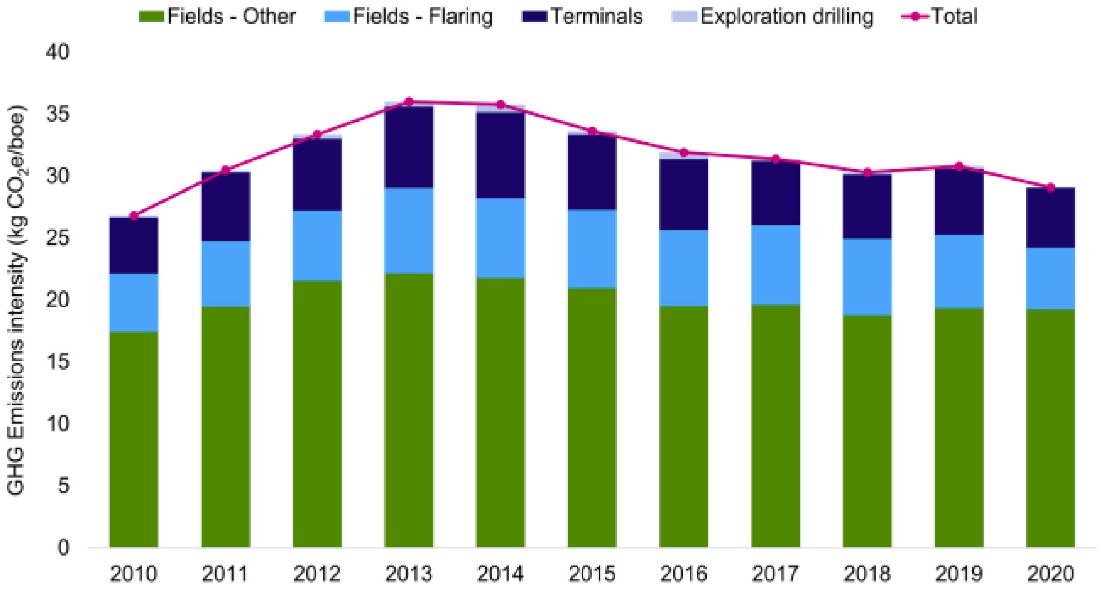

Figure 18-3: UKCS GHG Emissions Intensity by Source and Total (North Sea Transition Authority, 2022)

21 Terra Watt hour (TWh) of power is generated offshore each year, this was approximately 6 % of the UKs power generation in 2018. The CNS is responsible for 57 % of the UKCS oil and gas power consumption ~11.97 TWh per year (Oil & Gas Authority, 2020).

18.2.2 Climate Change

Since the mid 1800's, the human population has actively contributed towards the release of carbon dioxide and greenhouse cases into the air, causing global temperatures to rise and long-term changes in climate patterns. This was mainly due to burning of fossil fuels during the Industrial Revolution. Since the start of the Industrial Revolution (1850) until 2022 the global mean temperature has increased by over 1 degree (Met Office, 2023).

It is predicted that by 2070:

- Winters will be between 1 and 4.5 °C warmer and up to 30 % wetter; and
- Summers will be between 1 and 6 °C warmer and up to 60 % drier (Met Office, 2023).

Furthermore, we can also expect an increase in the volume of extreme weather events, which may be more intense than previously experienced.

18.3 Potential Impacts

Operational wind turbines create carbon free energy; however, the manufacture, installation and decommissioning phases may lead to GHG emissions (Haapala et al., 2014). The main sources of GHG emissions associated with floating wind farm developments include turbine, platform and foundation materials, steel and glass fibre production, and fuel use during installation, maintenance, and decommissioning activities (Raadal et al., 2014).

18.3.1 Construction Impacts

Carbon Emissions

In order to determine the GHG emissions that may contribute to the project's carbon footprint during the construction phase, carbon calculations are required. At this stage of the consenting process, the most likely sources of GHG emissions are identified, however, these will be better understood when a detailed project design has been finalised.

The construction of the floating windfarm and associated infrastructure will require vessel movements, including cable laying vessels, survey vessels, material delivery vessels, tugs and other supporting craft. Such diesel-powered vessels are significant GHG sources, maritime transport is estimated to contribute to 3 % of global anthropogenic GHG emissions (Smith *et al*., 2014). As the Project is located over 185km from shore, there will be notable fuel requirements associated with vessel movement to and from the site during the construction phase.

A large volume of raw materials will be required during the construction phase. These include but are not limited to; concrete, metals (most likely steels, aluminium, and copper), fiberglass and plastics or resins. Each component will have a varying degree of intrinsic carbon cost associated with mining (virgin or recycling), processing and transport of the raw materials and their manufacture and delivery. Significant innovation in material composition is ongoing, the aim being to develop materials and components which are more durable, lighter and stronger with reduced intrinsic carbon costs. Hence the design of components and associated material selection could play a significant role in minimising GHG emissions associated with construction.

Climate Change

Installation of the windfarm requires appropriate weather windows, for the installation of moorings and to allow the floating wind turbines to be towed to site. Unpredictable and extreme weather can compromise worker safety and reduce the available weather windows for installation works, hence causing delays to installation. This is a recognised project risk which needs to be managed however, it is unlikely to impact upon the environment.

It is recognised that adverse weather conditions and unexpected extremes increase the likelihood of a major accident occurring, this is considered within Section 17: Major Accidents/Disasters.

18.3.2 Operational Impacts

Carbon Emissions

There are three main sources of carbon emissions from the operations of an oil and gas rig; these include in situ combustion of fuel gas, diesel or fuel oil to produce power and heat, flaring (emissions from the combustion of waste gas at the flare stack) and venting (emissions from the controlled release of waste gas, and includes gas vented via cold flaring). The overall aim of the development is to replace fossil fuel combustion with offshore wind energy, resulting in net benefit by reducing GHG emissions from oil and gas platforms in the North Sea. The CNS has oil and gas assets that could remain operational until the 2040's.

The average annual power demand of the oil and gas sector from Cenos for the first five years is 270.1MW. It is assumed that Cenos will provide 80 % of this 2,366GWhr per year demand. Based on these figures, the estimated carbon dioxide equivalent (CO_2e) saving due to the move from gas to wind power is 1.16 MTe of CO_2e per year. The remaining 20 % of the power required by the oil and gas assets would be from the UK grid and hence have some element of renewables contribution and hence a lower carbon cost than the fossil fuel power it would be replacing.

The proposed windfarm will generate more power than is required for the oil and gas assets and therefore the excess energy (approximately 3,766 GWh per annum) will be exported to the grid, contributing to reducing the carbon cost of electricity in the UK.

General maintenance operations will give rise to carbon emissions due to the transportation of personnel and replacement materials, primarily by vessel but may include helicopter usage for crew transfer. Helicopters are significant sources of GHG emissions; however, 'low emission' helicopters have been identified for various tasks and project needs (Orhan, 2021). The raw oil will also have to be transported to refineries and oil plants for processing.

Although there are some carbon costs during the operational phase, there will be a net carbon benefit.

Climate Change

The design of the development will take into consideration that sea levels are likely to rise and that extreme weather events may be more intense and frequent. Therefore, it is expected that there will be no environmental impacts from climate change with respect to the operations of the development.

18.3.3 Decommissioning Impacts

Carbon Emissions

The removal of wind turbines associated infrastructure and cables will require significant vessel movements to and from the shore and within the windfarm, which will have an associated carbon cost. Vehicles on land will also be required in order to take materials or wastes to reprocessing sites.

The majority of components will be suitable for recycling, which will help to offset the carbon costs of the components. Generally, the recycling of materials such as metals has a lower carbon cost than virgin materials hence, putting materials back into circulation for a future use is beneficial. Any items left in situ, notably steel, are effectively taken out of the 'materials loop' and cannot be reused, resulting in GHG emissions from manufacturing of new primary materials.

In order to prevent methane seepage from decommissioned oil wells, they are plugged with cement. As previously discussed, cement has a significant carbon cost.

Climate Change

Decommissioning of the windfarm requires appropriate weather windows, for the transportation of components to land for reuse/recycling or disposal. Unpredictable and extreme weather can compromise worker safety and reduce the available weather windows and hence cause delays to be decommissioning.

18.4 Mitigation Measures

Opportunities to minimise carbon cost and maximise benefits will be sought throughout the design process for all lifecycle phases. In addition, the design will ensure that it takes account of potential climate change effects including rising sea-levels and extreme weather events.

18.5 Proposed Assessment

It is recognised that the main aim of the project is to reduce carbon emissions associated with the oil and gas industry and electricity usage. As such it is proposed that the Cenos project's contribution to addressing climate change is **scoped-in** to the EIA. However, climate change effects on the project will be scoped out as they will be taken account of in the project design.

Carbon dioxide equivalent (CO_2e) calculations will be undertaken for all stages of the development, to allow a lifecycle carbon assessment to be undertaken. Where appropriate the current UK Government GHG Conversion Factors for materials and activities will be utilised (BEIS, 2022d).

19 Materials and Waste

This section of the Scoping Report identifies the potential impacts resulting from materials and waste during the construction, operational and decommissioning phases of the proposed development. Efforts to integrate a sustainable circular economy into the design, development, operation and decommissioning of offshore wind infrastructure will be made.

The carbon cost of materials and waste are considered within Section 18.

19.1 Data and Information Sources

Relevant policy and guidance includes:

- GEN 11 Marine Litter (Scotland's National Marine Plan): Developers, users and those accessing the marine environment must take measures to address marine litter where appropriate. Reduction of litter must be taken into account by decision makers [Scottish Government, 2015a];
- The Waste (Scotland) Regulations 2012 [Scottish Government, 2012];
- Zero Waste Plan [Scottish Government, 2010]; and
- Waste Hierarchy.

There are currently no regulations on, or pertaining to, sustainable resourcing in Scotland, out with the Public Sector. However, in 2010 the Scottish Government published Scotland's Zero Waste Plan (Scottish Government, 2010), which sets out the government's vision for a sustainable and resource efficient future. While the sustainable resourcing aspect of the vision is still to be brought into the legislation, the proposed project will strive to fulfil the following two components of the vision:

'Individuals, the public and business sectors - appreciate the environmental, social and economic value of resources, and how they can play their part in using resources efficiently.'

and;

'Reduce Scotland's impact on the environment, both locally and globally, by minimising the unnecessary use of primary materials, reusing resources where possible, and recycling and recovering value from materials when they reach the end of their life.'

Other information sources are as follows:

- IEMA guide to: Materials and Waste in Environmental Impact Assessment (IEMA, 2020c) .

19.2 Baseline

Materials

The total amount of materials currently installed in Scottish offshore windfarms before 2023 and the amount still required to complete the planned sites and future estimates up to 2050 can be seen in Table 19.1.

Table 19-1: Total Estimated Materials Currently Installed and Required up to 2050 (Catapult Offshore Renewables Energy, 2022)

Leasing round/period	Total installed (kt)	Total Required (kt)
Steel	1,040	14,630
Concrete	0	8,350
Synthetic Mooring	0	115
Copper	7	70
Plastic/insulation	12	110
Lead	5	20
Optic Fibre	0.6	3
Carbon Fibre	7	140
Fibre glass	30	540
Ductile iron casting	80	1,540
Neodymium	5	90
Resin/Adhesive	12	230
Total	1194.6	25,839

Resources mentioned in Table 19-1 are almost all finite and some notable examples can be seen below:

- Iron – world resources are estimated to be greater than 800 billion tons of crude ore containing more than 230 billion tons of iron. (U.S Geological Survey, 2022);
- Neodymium – rare earths are relatively abundant in the Earth's crust, but minable concentrations are less common. There are estimated resources of 2.4 million tonnes in the United States and 15 million tonnes in Canada (U.S Geological Survey, 2022;
- Lead – identified world lead resources total more than 2 billion tons (U.S Geological Survey, 2022); and
- Copper – A U.S. Geological survey in 2015 indicated that world resources are around 2.1 billion tonnes and there are an estimated 3.5 billion tonnes of undiscovered Copper (U.S Geological Survey, 2022).

Waste

Marine litter especially plastic is a world wide issue, and the United Nations have estimated that there are 75-199 million tonnes of plastic in the world's oceans, 80 % of which arising on lands (European

Commission, 2023). Of Scottish Waters, the North Sea was identified as having the highest density of sea-floor litter (Scottish Government, 2020c).

19.3 Potential Impacts

19.3.1 Construction Impacts

Materials

Lifecycle assessments show that the materials used for manufacturing turbines account for 70-80 % of the associating environmental impacts (Jensen, 2019). As such it is important to understand the types and quantities of material likely to be associated with the construction of the windfarm. Table 19-1 provides an understanding of materials utilised in the offshore wind sector; however, the specifics of the project will be determined by the selection of the substructure and mooring systems. Substructures which as discussed in Section 2.5.2 are normally steel on concrete can weigh between 2,000 and 20,000 Te. As discussed in Section 2.5.3 mooring systems can utilise steel chains, anchors and piles, synthetic ropes and/or concrete gravity bases. As highlighted in Section 5 the mooring design will partially be determined by the sediments present. The need for rock to protect cables will also be determined by the seabed and the ability to achieve appropriate burial depths. Rock will be required where cables cross other assets (pipelines or cables). Cable routing has aimed to minimise crossings, but a number will be required. Regardless of the finalised design, a large volume of raw materials will be required during the construction phase.

In addition to material volumes, there will be a requirement to use materials such as oils and fuels which if released could give rise to pollution. The release of hazardous substances is discussed in Section 6, however appropriate identification of materials with the potential to cause pollution, assessment, storage and use is essential in preventing pollution. As such the potential for materials to cause harm is recognised.

Waste

Waste arising from the construction of the proposed development will include, but is not limited too;

- Cement washings (at onshore construction facilities);
- Arising from vessels/welfare facilities (i.e., packaging and sewage); and
- Various other miscellaneous materials (oils and greases).

With the generation of waste, there is the potential for litter and pollution, and hence the potential wastes arisings need to be recognised to allow them to be appropriately handled and managed. It is acknowledged that where marine litter is encountered including ghost fishing equipment, it will be removed wherever safe to do so.

19.3.2 Operational Impacts

Materials

During operations and maintenance, there will be a lower requirement for resources. Any materials usage will predominantly be associated with repair/replacement activities and fuel usage for maintenance vessels. These will be similar in type to those used in construction, but in greatly reduced quantities.

Waste

Minimal waste will be generated during the operations of the proposed development. The type of waste generated are likely to be generated include failed components, oils and greases, and vessel/ welfare facility arisings. Volumes will be a fraction of those expected during decommissioning.

19.3.3 Decommissioning Impacts

Materials

During decommissioning, there will be a low requirement for resources. Any materials usage will predominantly be associated with the dismantling of components and fuel usage for maintenance vessels.

Waste

Offshore wind turbines have an expected design lifetime in the range of 20-25 years (Jensen, 2019) and therefore, decommissioning needs to be planned for. As vast quantities of materials are used to construct wind turbines and their associated infrastructure, it is imperative that the decommissioning process is considered in both economic and environmental terms at the project design stage.

Materials used during the construction of offshore windfarms, will become waste during the decommissioning phase. Steel or iron accounts for 93 % of overall waste expected from offshore turbine decommissioning for the 2020-2024 period, the amount reduces over time due to the move from fixed bottom to floating turbines and hence the associated use of concrete associated with floating structures (K. Tota-Maharaj, A. McMahon, 2020). Figure 19-1 details the total waste expected from offshore turbine decommissioning in the UK.

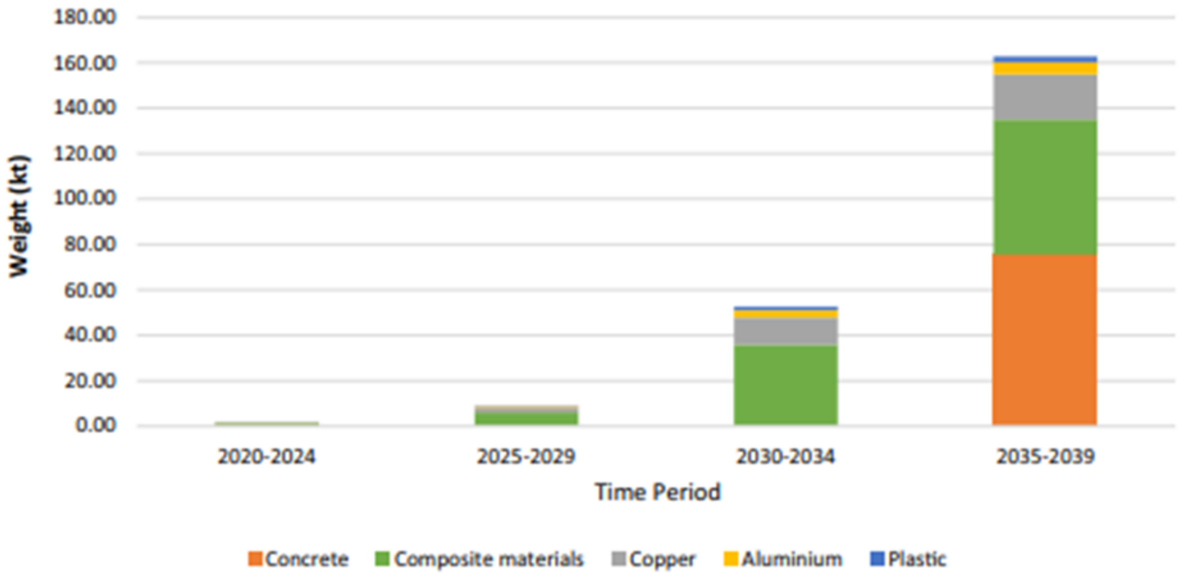

Figure 19-1: Total Waste Expected from Offshore Turbine Decommissioning in the UK(K. Tota-Maharaj, A. McMahon, 2020

The lifespan of wind turbines will be maximised as far as possible, it is recognised that whole turbines and/or components can be refurbished and reused. Reuse/repair ranks higher than recycling in the hierarchy of the circular economy and as such, are preferential and more sustainable. Where reuse and refurbishment are not an option for the materials, they will be recycled. There is a consensus that 80-90 % of materials (by weight) in a turbine, can theoretically be recycled (Jensen, 2019). While the metals in wind turbines are already commonly recycled, only approximately 40 % of recycled scrap metal is retained in the UK (Catapult Offshore Renewable Energy, 2022). Thus, there is a further carbon cost for the transport of large quantities of metals abroad for processing. Steel is the largest contributor to decommissioning, however, is also in highest demand to meet future requirements for offshore wind farms, with approximately 14.7 million tonnes needed to meet the 2050 turbine building targets (Catapult Offshore Renewable Energy, 2022). Therefore, there is an opportunity for the steel to be reused in future renewables developments, including repowering of developed sites.

Materials such as resin, silica and fibreglass are less widely treated, recycled and mechanical recycling technologies and facilities will need to be developed. There is a current lack of commercially available sustainable solutions to recover the composites of which blades are made. It is likely that when the time comes to decommission the proposed development, there will be advancements in the decommissioning sector and better facilities in the UK, which will improve the circular economy.

It is recognised that waste handling and reprocessing can also give rise to pollution and be water and energy intensive.

19.4 Mitigation Measures

The detailed design process will inform the selection of materials, this will however take account of:

- Technical (including seabed consideration) performance requirements;
- Volume of materials utilised;
- Availability;

- Recycled content;
- Reusability and recyclability;
- Energy production/ intrinsic carbon cost; and
- Toxicity (potential pollution prevention considerations).

A waste management system will be maintained for the production, handling/segregation, transport, storage, treatment and disposal of waste during all lifecycle phases.

Marine litter including ghost nets identified, will be recovered from the sea whenever safe to do so.

19.5 Proposed Assessment

Materials and Waste will be **scoped-in** to the EIA. It is proposed that the main materials are identified and quantified, any relevant management requirements to prevent pollution highlighted, and their fate once no longer required, considered in terms of the waste hierarchy and opportunities for developing a circular economy. As discussed in Section 18.5, CO_2e calculations will be undertaken for all stages of the development, to allow a lifecycle carbon assessment to be undertaken.

20 Aviation Consideration

20.1 Data and Information Sources

Publicly available mapping has been utilised to inform the assessment, including the location of oil and gas assets with helicopter decks. The NATS self-assessment maps have been utilised to gain an understanding of radar operating off the east coast of Scotland that could be affected by the Project (NATS, 2023).

20.2 Baseline

Figure 20-1 provides an overview of the radar locations and operational ranges in relation to the Cenos windfarm initial survey location.

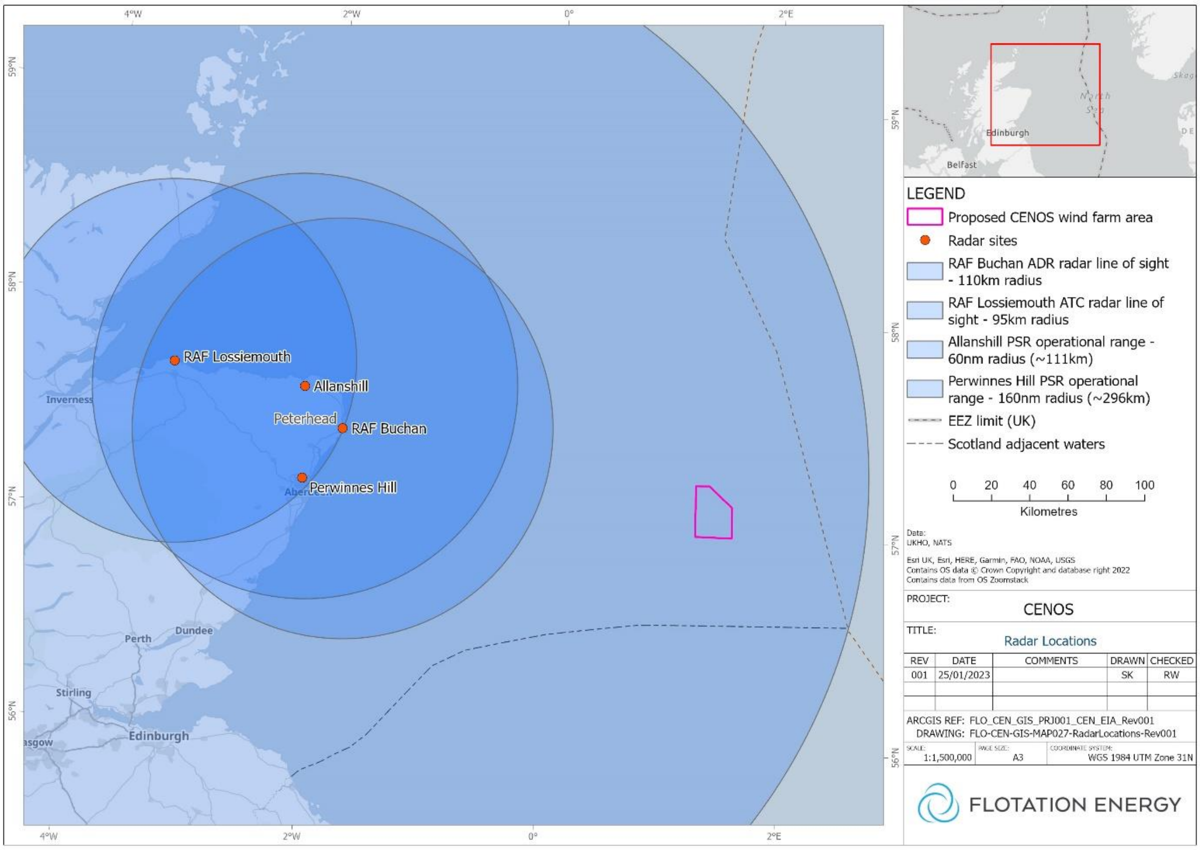

Figure 20-1: Radar Locations and Operational Ranges (NATS, 2023)

20.3 Potential Impacts

As discussed in Section 2.2 and shown in Figure 2-2, the project team specifically considered helicopters associated with oil and gas assets in the locating of a suitable site for the windfarm. The Cenos project development site has also been located outside of the 6nm consultation zone for the surrounding offshore platforms and associated helideck operations. This was one of the key site location criteria and means that helicopter operations at the surrounding platforms will not be impacted. The potential for a major accident involving a helicopter is considered in Section 17.1.

Due to the offshore location aeroplanes are not expected to be flying at heights that would cause them to interact with the windfarm.

As shown in Figure 20-1 only the Perwinnes Hill Primary Surveillance Radar has a range far enough out to sea to cover the Cenos wind farm area. However, as discussed in Section 11, the curvature of the earth will have an influence. There is no line of sight between the radar and any element of the wind farm, as such it is highly unlikely that any interference will occur.

The RAF radar stations will not have line of sight of the Cenos offshore windfarm and therefore would not be considered an issue for MOD radar. The turbines would be illuminated as per the standard MOD/CAA lighting requirements for offshore wind turbines and substations.

20.4 Mitigation

As discussed in Section 17.1 the relevant UK Air Regulations and underpinning, Acceptable Means of Compliance (AMC), Guidance Material (GM) and, where appropriate, Certification Specifications (CS) will be appropriately applied, to minimise aviation risks.

It is noted that the Cenos project is being developed to support the decarbonisation of the oil and gas sector. As such there are ongoing communications with the local asset owners, operational considerations will be discussed with them directly.

20.5 Proposed Assessment

Aviation is **scoped-out** of the EIA due to a lack of potential effects other than a major accident, which adequate mitigation has been identified for.

21 Cumulative & Transboundary Effects

21.1 Cumulative Effects

The Marine Works EIA Regulations 2007 state that cumulative effects should be addressed within an EIA. Project for consideration will include:

- Projects under construction;
- Permitted application(s), but not yet implemented;
- Submitted application(s) not yet determined; and
- Plans and projects which are “reasonably foreseeable” (i.e., developments that are being planned, including, for example, offshore renewable energy projects which have a Crown Estate Scotland Agreement for Lease (AfL), offshore renewable energy projects that have been scoped).

Only projects which are reasonably well described and sufficiently advanced to provide information on which to base a meaningful and robust assessment will be included in the cumulative effects assessment. Projects which are sufficiently implemented during the site characterisation for the proposed Project will be considered as part of the baseline for the EIA. Where possible, Flotation Energy will seek to agree with stakeholders the use of as-built project parameter information (if available) as opposed to consented parameters to reduce over-precaution in the cumulative assessment.

For some topics (where for example the receptors include highly mobile or migratory species, fishing or shipping) the cumulative effects assessment will have a large geographic scale and involve many plans and projects, for others where receptors (or impact ranges) are more spatially fixed the cumulative effects assessment will be narrower. The scope of the cumulative effects assessment will therefore be established on a topic-by-topic basis with the relevant consultees as the EIA progresses.

Offshore cumulative impacts may come from interactions with the following project types:

- Other offshore wind farms;
- Offshore aggregate extraction;
- Subsea cables and pipelines;
- Potential port and harbour development;
- Oil and gas activities; and
- Carbon Capture Storage (CCS).

21.2 Transboundary Effects

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

The procedures involve providing information to the Member State and for the Scottish Ministers to enter into consultation with that State regarding the significant impacts of the development and the associated mitigation measures.

Transboundary impacts, like cumulative impacts, are considered on a topic-by-topic basis. In terms of the proposed Cenos wind farm area, transboundary impacts will relate primarily to projects that may affect mobile species, and to projects that are located close to the national boundaries, or to areas administered by other relevant authorities.

21.3 Cumulative and Transboundary Projects

Known Scottish and Norwegian offshore wind projects are presented in Appendix C. For completeness the Appendix includes projects which have recently been awarded CES leases and hence have not all started the consenting process. Of the 31 wind projects identified, 13 are identified at this stage as potentially requiring consideration within the EIA. The list of projects will be further reviewed prior to EIA to take into account the results of the INTOG leasing round process. It is however noted that the INTOG projects and some of those included within Appendix C may not be sufficiently developed to allow a comprehensive cumulative effects assessment to be completed.

Table 21-1 considers each of the EIA topics and identifies which are likely to require consideration (scoping in/out) as they may give rise to cumulative effects with other windfarms. Note this will be reviewed on a project by project basis once at EIA stage.

Table 21-1 Potential Cumulative Effects with Other Windfarm Projects

Topic	Construction	Operation	Decommissioning
Geology & Sediments	Effects are localised and hence unlikely to have cumulative effects.		
Water Quality	No significant effects expected for Cenos or other projects.		
Air Quality	No significant effects expected for Cenos or other projects.		
In-Air Noise	No significant effects expected for Cenos, nor cumulative effects predicted due to location.		
Underwater Noise	Effects mitigated on a project by project basis.		
EMF and Heat		Cables too far apart to have cumulative effects.	
Benthic Ecology (and Ocean Quahog)	Benthic ecology effects are very localised, hence cumulative effects unlikely.		

Topic	Construction	Operation	Decommissioning
Fish and Shellfish	No significant effects expected for Cenos or other projects.		
Marine Mammals	May need considered for other projects as populations could be affected by more than one development.		
Ornithology	Cumulative assessment required for projects within specific species range.		
Landscape, Seascape and Visual Resources	No significant effect for Cenos unlike to cumulate with other projects.		
Shipping & Navigation	Cumulative assessment required for projects potentially using the same or crossing shipping routes.		
Commercial Fisheries	Cumulative assessment required for projects potentially affecting the same fishing fleets.		
Marine Archaeology, Cultural Heritage and Geomorphology	Effects are localised and hence unlikely to be cumulative.		
Socio-economic	Cumulative assessment may be required for projects utilising the same ports, supply chain.		
Human Health	No significant effects expected for Cenos or other projects.		
Major Accident and Disaster	Specifics considered under other topic areas, however collaborative working with the wider sector may be required to ensure common approaches.		
Climate Change	Impacts are expected to be positive for all windfarms no need to present cumulative benefits within the EIA.		
Materials and Waste	Potential for cumulative effects due to scaling of material needs.		
Aviation	Effects are location specific, hence unlikely to be cumulative.		

Key	
	Scoped Out
	Scoped In
	Further Consideration Required

Two eastern link cable projects were identified in Appendix C but neither are likely to give rise to cumulative effects due to their location. The NorthConnect project is intrinsic to the Cenos project as discussed in Section 1.2, and as such, relevant in-combination effects will be considered.

It is recognised that there are multiple ongoing port and harbour projects in Scotland. Effects of ports and harbour projects tend to very localised, hence once the ports to be utilised by the project are identified, a review of projects will be carried out. Ports or harbours being utilised or in the vicinity of transit routes may need to be considered as part of the cumulative assessment process.

22 Conclusion

Flotation Energy and Vårgrønn propose to develop the Cenos offshore wind farm area in the UK sector of the CNS. The proposed development site is approximately 185km east of the Aberdeenshire Coast. The intent is to utilise power generated to aid in the decarbonisation of the oil and gas sector fulfilling the demands of supporting the North Sea Transition Deal and also the Scottish Governments net zero targets. The Cenos project has applied for a lease to Crown Estate Scotland via the INTOG leasing round process. To facilitate export of power to the National Grid, Flotation Energy and Vårgrønn are collaborating with NorthConnect and plan to utilise their offshore and onshore assets as far as practicable. It is noted that the NorthConnect elements of the project have previously been subject to EIA and hence will be considered within Cenos EIA as part of the cumulative assessment only.

This scoping report has identified where there are potential for significant effect and where topics need to be considered further to allow a greater understanding to inform the project design and impact assessment. Table 22-1 provides a summary of the topics proposed to be taken forward to the EIA stage. Where topics are scoped out based on the mitigation proposed, the mitigation has been included within the Initial Schedule of Mitigation provided in Appendix B, which will be taken forward into the EIA.

Table 22-1: Scoping Summary

Topic	Construction	Operation	Decommissioning
Geology & Sediments			
Water Quality			
Air Quality			
In-Air Noise			
Underwater Noise			
EMF and Heat			
Benthic Ecology (and Ocean Quahog)			
Fish and Shellfish			
Marine Mammals			
Ornithology			
Landscape, Seascape and Visual Resources			
Shipping & Navigation			
Commercial Fisheries			
Marine Archaeology, Cultural Heritage and Geomorphology			
Socio-economic			
Human Health			
Major Accident and Disaster			
Climate Change			
Materials and Waste			
Aviation Considerations			

Key	
	Scoped Out
	Scoped In
	Further Consideration Required

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Appendix A Data Sources

Table A-1: Baseline Information – Benthic Ecology

Type / description of data	Source	Distance from Proposed wind farm area (km)
Environmental Monitoring Report	Edinburgh & Gannet Environmental Surveys - Gannet Monitoring Survey (Fugro, 2020a).	25
Environmental Monitoring Report	Shearwater Environmental Monitoring Survey (Fugro, 2017).	33
Environmental Baseline Survey and Habitat Assessment Report	Shearwater Field Environmental Baseline Survey and Habitat Assessment Report (Fugro, 2020b).	33
Habitat Assessment	Jackdaw 30-2a Jack-up Site and Habitat Assessment Survey (Gardline, 2010).	63
Platform Site Survey, Pipeline Route Surveys, Habitat Assessment & EBS	Jackdaw Platform Site and Pipeline Route Habitat EBS (Gardline, 2014).	63
Habitat Assessment and EBS	Multiple habitat and environmental baseline surveys at the Catcher Development.	25-55
Habitat Assessment and EBS	Pre-decommissioning environmental survey reports at Beauly and Burghley.	125
Environmental Monitoring Report / habitat assessment surveys	Multiple environmental surveys across the ETAP area (including the Madoes field)	< 2km to 38 km.
Geophysical Survey and Habitat Assessment & EBS	Chestnut Pre-decommissioning Environmental Survey (Fugro, 2022a; Fugro, 2022b)	96
and Habitat Assessment surveys & EBS	Multiple environmental baseline and habitat assessment surveys at the Culzean field	30
Habitat Assessment & EBS	Shearwater Monitoring Survey Report (Fugro, 2019b)	28
EBS	Fram Development Environmental Baseline Survey (Gardline, 2011)	28
Geophysical and habitat assessment	Pipeline Route Survey Kittiwake to Mallard (Including Eagle) for EnQuest (Fugro, 2016)	49
EBS	Arran Development Environmental Baseline Report for Dana Petroleum plc (Gardline, 2016)	55
Habitat Assessment	Arran Development Habitat Assessment Report for Dana Petroleum plc (Gardline, 2015)	55
East of Gannet and Montrose Fields MPA Monitoring Report	McCabe, C., McBreen, F. & O'Connor, J. 2020. East of Gannet and Montrose Fields MPA Monitoring Report 2015 (version 2). JNCC-MSS Partnership Report No. 1. JNCC,Peterborough, ISSN 2634-2081.	Within proposed project area

Type / description of data	Source	Distance from Proposed wind farm area (km)
EMODNet MSFD data	EMODnet (2021). Seabed habitats project. http://www.emodnet-seabedhabitats.eu.	Regional
Offshore benthic monitoring data	The OEUK Database of Offshore Environmental Surveys (UKBenthos Database 5.6)	Regional
North Sea benthic data	UK Offshore Energy Strategic Environmental Assessment 4 (OESEA4) (BEIS, 2022)	Regional
Marine Protected Areas	Marine Protected Area reports from NatureScot.	Regional
Priority Marine Habitats	Priority marine habitats information from NatureScot and JNCC.	Regional
North Sea benthic data	National Biodiversity Network (NBN) Atlas (https://nbnatlas.org/) (NBN, 2021).	Regional
North Sea benthic data	UKSeamap 2010 Interactive Map (https://jncc.gov.uk/our-work/marine-habitat-data-product-ukseamap/) (UKSeamap, 2010).	Regional
North Sea habitats	EMODnet (2021). Seabed habitats project. http://www.emodnet-seabedhabitats.eu.	Regional
North Sea benthic data	Marine Life Information Network (MarLIN) (https://www.marlin.ac.uk/) (MarLIN, 2022).	Regional
North Sea habitats	NatureScot Habitat Map of Scotland (HabMoS) (https://www.environment.gov.scot/our-environment/habitats-and-species/habitat-map-of-scotland/) (NatureScot, 2018).	Regional
North Sea benthic and intertidal habitats	MAGIC interactive map (https://magic.defra.gov.uk/) (MAGIC, 2023).	Regional

Table A-2: Data Sources to Support Assessment of Impacts on Fish and Shellfish

Type / description of data	Source	Distance from survey area (km)/Other information
Spawning and nursery grounds	Spawning and nursery grounds of selected fish species in UK waters mapped by Coull et al (1998); and revised by Ellis et al (2012).	Regional
Juveniles Present	Aires et al. 2014.	Regional
MMO Landings Data	North Sea – Landings from various ports in the area (weight and value) by species.	Regional
Species assemblage	National Biodiversity Network (NBN) Atlas.	Regional
Existing Environmental Reports in Vicinity of the Cenos Wind Farm Area	Environmental Monitoring Survey Report ETAP (Madoes, Marnock, Monan and Mungo) (2017) Site Surveys Skua and Andrew (September and October 2019) (Fugro, 2019a).	Within proposed project area (Madoes) Skua – 14 Andrew - 102
Herring spawning grounds	International Council for the Exploration of the Sea (ICES) International Herring Larvae Survey (IHLS) data North Sea 2005 – 2021.	Regional
Cod and Plaice	ICES Working Group 2 on North Sea Cod and Plaice Egg Surveys in the North Sea (WGEGGS2) North Sea 2004, 2009, 2010 – 2019..	Regional
Piling impacts	Offshore Renewables Joint Industry Programme (ORJIP) study on impacts to fish from piling at offshore wind farms.	Regional
Basking sharks	European Seabirds at Sea (ESAS) surveys (which include data on basking sharks).	Regional
	HiDef site specific survey	Ongoing
Underwater noise on diadromous fish	Gill and Bartlett (2010); Gill et al., (2012) and Popper et al., 2014.	Regional
Fish and shellfish biomass estimates in the North Sea	Cefas data (1991 – 2014).	Regional

Table A-3: Data Sources to Support Assessment of Impacts on Marine Mammals

Type / description of data	Source	Distance from Survey Area (km)
Marine mammal abundance – cetaceans and pinnipeds	Site specific HiDef survey	Site specific
	Small Cetaceans in the European Atlantic and North Sea (SCANS-III): Estimates of cetacean abundance in European Atlantic waters in summer 2016 from the SCANS-III aerial and shipboard surveys, June 2021 (Hammond et al., 2021).	Regional
Cetacean presence	An atlas of cetacean distribution on the northwest European continental shelf (Reid et al., 2003).	Regional
	Revised Phase III data analysis of Joint Cetacean Protocol (JCP) data resources (Paxton et al., 2016).	Regional
	Distribution maps of cetacean and seabird populations in the North-East Atlantic (Waggitt et al., 2019).	Regional
	BEIS (2022). Offshore Energy Strategic Environmental Assessment 4 (OESEA4).	Regional
	Management Units for cetaceans in UK waters (Inter-Agency Marine Mammal Working Group (IAMMWG), 2021).	Obtained
	Management Units for cetaceans in North Atlantic waters (North Atlantic Marine Mammal Commission (NAMMCO), 2020).	Regional
Pinniped abundance and density	Special Committee on Seals (SCOS) annual reporting of scientific advice on matters related to the management of seal populations (SCOS, 2020).	Regional
Pinniped telemetry	Seal telemetry data (Carter et al., 2020; Russel and McConnell, 2014).	Regional
Pinniped density	UK seal at sea density estimates and usage maps (Russell et al., 2017; Carter et al., 2020).	Regional
North Sea marine mammal density in North Sea	Regional baselines for marine mammal knowledge across the North Sea and Atlantic areas of Scottish waters (Hague et al., 2020).	Regional
O&G marine mammal data at site	Relevant information from nearby oil and gas fields, including the Marine Mammal Mitigation Report from the Skua Site Survey (Fugro, 2019a).	14
Marine mammal associations with offshore wind farms	Diederichs et al., 2008; Lindeboom et al., 2011; Marine Scotland, 2012; McConnell et al., 2012; Scheidat et al., 2011; Teilmann et al., 2006; Tougaard et al., 2005, 2009a, 2009b.	Regional

Table A-4: Data Sources to Support Assessment of Impacts on Birds

Type/description of data/information	Source	Distance from Survey Area (km)
Greater North Sea Ecoregion Seabirds Overview	ICES, 2021a	Regional
Industry Standard Guidance on Ecological Impact Assessments in the UK and Ireland	CIEEM, 2018	N/A
A Stochastic Collision Risk Model for Seabirds in Flight	McGregor, 2018.	N/A
HiDef aerial survey over Cenos area (April 2021)	High-resolution video aerial ornithological and marine megafauna survey Monthly report – April 2021 - Survey 01	0 km/within site area
Guidance and research – sensitivity of birds to OWFs	Wade et al. 2016; Furness et al., 2013; Langston 2010; Stienen et al., 2007; Drewitt and Langston 2006; Garthe and Hüppop 2004.	Regional
Guidance, research and methodology – OWF displacement / barrier effects on birds	SNCBs 2017; Dierschke et al. 2016; Masden et al. 2012, 2010; Speakman et al., 2009.	Regional
Guidance, research and methodology – collision risk modelling, flight heights and avoidance rates for birds and OWFs, including the Band deterministic model, the stochastic model and the migratory species model	Bowgen and Cook 2018; MacGregor et al., 2018; Skov et al. 2018; Cook et al. 2014; Johnston et al., 2014a and b; SNCBs 2014; Band 2012; Wright et al., 2012; Cook et al. 2012.	Regional
Population viability analysis modelling tool for seabirds	Searle et al. 2019.	Regional
Seabird foraging ranges and distribution at sea	Cleasby et al., 2020; Waggit et al., 2019; Woodward et al. 2019; Wakefield et al., 2017, Kober et al., 2010; Stone et al. 1995, site specific tracking studies for eastern Scotland seabird breeding colonies e.g. MacArthur Green (2018, 2019).	Regional
Bird population estimates	Furness 2015; Mitchell et al. 2004; JNCC seabird monitoring programme database; designated site citations / departmental briefs / conservation advice from the websites of SNCBs.	Regional
Information and data for cumulative (and in combination (HRA)) assessment	Relevant documents from marine licence applications for other OWFs in UK offshore waters (in particular Scottish and English East Coast Waters), and Transboundary OWFs	Regional
Other empirical evidence and studies relevant to assessment	Relevant ecological studies for species included in EIA (peer reviewed scientific papers and 'grey' literature), including post-construction monitoring studies (e.g. Moray Firth Regional Advisory Group https://marine.gov.scot/ml/moray-firth-regional-advisory-group-mfrag), Kincardine OWF bird collision	Regional

Type/description of data/information	Source	Distance from Survey Area (km)
	study (KOWL, 2019). Aberdeen offshore wind farm post construction monitoring.	
Other relevant strategy and policy documents	For example, published documents relating to Scottish Government plans for offshore wind energy (Scottish Government, 2020a; Scottish Government, 2020b).	Regional

Table A-5: Data sources to support assessment of impact on shipping and navigation.

Type/description of data	Source
14 Days Automatic Identification System (AIS) between 9 and 22 June 2021	Onshore and offshore receivers
14 Days AIS between 3 and 16 December 2021	Onshore and offshore receivers
Royal National Lifeboat Institute (RNLI) Incident Data	RNLI
Marine Accident Investigation Branch (MAIB) Incident Data	MAIB
NP54 Admiralty Sailing Directions North Sea (West) Pilot (United Kingdom Hydrographic Office (UKHO), 2021)	UKHO
UKHO Admiralty Charts 272-0, 273-0, 274-0 and 278-0	UKHO
Royal Yachting Association (RYA) Coastal Atlas (RYA, 2019)	RYA

Table A-6: Data sources to support assessment of impact on commercial fisheries.

Type/description of data	Source	Status
Fisheries landings (tonnes), landings value (GBP) and effort data by ICES rectangle 2015 - 2019	Marine Management Organisation (MMO)	Obtained
Vessel Monitoring System (VMS) data 2017 - 2021	MMO	Obtained
Vessel Monitoring System (VMS) data 2008 - 2021	Marine Scotland (2020 data is provisional)	Obtained
Fisheries datasets available from the Marine Scotland MAPS NMPi (including ScotMap data)	**https://marine.gov.scot/maps/nmpi and https://marinescotland.atkinsgeospatial.com/nmpi/**	Obtained

NorthConnect HVDC Cable Infrastructure EIA Report	Chapter 20: Commercial Fisheries	Obtained

Table A-7: Data sources to support assessment of impacts on marine archaeology and cultural heritage.

Data source	Data contents
United Kingdom Hydrographic Office (UKHO) ADMIRALTY Marine Data Portal	Records of wrecks and obstructions data including 'dead' and salvaged wrecks that are no longer charted as navigational hazards. (National database).
Maritime records maintained by Canmore (National Record of the Historic Environment)	Canmore is a service provided by Historic Environment Scotland. Maritime records, including documented losses of vessels, and records of terrestrial monuments and findspots, including the archaeological excavation index. (National database).
OceanWise	Sites and vessels designated under the Protection of Military Remains Act 1986 ("war graves") - protected wrecks. (National database).
Historic Environment Scotland	Records of designated heritage assets within Scotland, maintained by Historic Environment Scotland. GIS data for all Protected Wrecks, Scheduled Monuments, Listed Buildings, Registered Parks and Gardens and Registered Battlefields. (>200 km).
Scottish Archaeological Research Framework (ScARF)	The primary resource for Scottish archaeology, one which provides an overview of the subject and also a set of relevant research questions to guide assessment. (National database).

Appendix B Initial Schedule of Mitigation

Topic	Impact	Mitigation
Air Quality	Vessel Emissions to Air	All vessels will comply with relevant section of the International Convention for the Prevention of Pollution from Ships (MARPOL) regulations.
Water Quality	Vessel Pollution Prevention	All vessels will comply with relevant section of the International Convention for the Prevention of Pollution from Ships (MARPOL) regulations.
Water Quality	Pipeline Crossing	The International Cable Protection Committee (ICPC) recommendations for existing infrastructure crossings will be implemented.
Water Quality	Pipeline Crossing	Individual crossing agreements will be made with the respective asset owners prior to cable installation commencing, so that the crossing design, installation techniques and associated safety exclusion zones for different installation tools, can be agreed.
Water Quality	Pipeline Crossing	Emergency response procedures will also be agreed to ensure that, in the event of damage to a pipeline occurring, all parties can work quickly to minimise the magnitude of the spill.
Water Quality	Mooring Design	The design of moorings with sufficient redundancy to prevent a turbine breaking free in event of adverse weather conditions will be ensured. It will take into account the MCA and HSE Regulatory Expectations on Moorings for Floating Wind and Marine Devices (MCA & HSE, 2017).
Water Quality	Mooring Design	Third party verification of the wind turbine mooring design, hardware, installation and operations will be sought.
Benthic	Introduction of Marine Non-Native Species	The IMO Ballast Water Management Convention will be implemented on all relevant vessels.
Benthic	Introduction of Marine Non-Native Species	The IMO Convention on the Control of Harmful Anti-Fouling Systems on Ships will be complied with

Topic	Impact	Mitigation
Benthic	Introduction of Marine Non-Native Species	IMO 2011 Guidelines for the Control and Management of Ships' Biofouling to Minimize the Transfer of Invasive Species will be followed.
Fish & Shellfish	EMF	IAC buried or rock covered to a target depth in accordance with BEIS Guidelines (2021).
Underwater Noise	Underwater Noise - UXO Detonation	If found, noise modelling of the specific UXO found will be carried out to inform marine mammal risk assessment as deemed appropriate.
Marine Mammals	Disturbance from Underwater Noise - UXO Detonation	If required, an underwater noise assessment specific to the UXO found will be completed to inform the identification of appropriate mitigation and EPS application.
Marine Mammals	Disturbance from Underwater Noise - UXO Detonation	Implementation mitigation agreed in the EPS licence for UXO detonation. Mitigation will be implemented for pinnipeds and cetaceans.
Marine Mammals	Disturbance from Underwater Noise - Surveys	Complete a marine mammal risk assessment of planned survey activities to inform an application for an EPS licence to disturb cetaceans.
Marine Mammals	Disturbance from Underwater Noise - Surveys	Implement mitigation in alignment with JNCC Guidelines for Minimising the Risk of Injury to Marine Mammals from Geophysical Surveys (JNCC, 2017), as agreed through the EPS licence. Note the mitigation will be implemented for pinnipeds and cetaceans.
Marine Mammals	Disturbance from Underwater Noise - Piling (if required)	Consider use of pile type that doesn't require percussive piling (e.g. suction pile).
Marine Mammals	Disturbance from Underwater Noise - Piling (if required)	If percussion piling is required, size pile appropriately.

Topic	Impact	Mitigation
Marine Mammals	Disturbance from Underwater Noise - Piling (if required)	Utilise vibropiling as far as practicable to reduce the amount of percussion piling required.
Marine Mammals	Disturbance from Underwater Noise - Piling (if required)	Complete a marine mammal risk assessment to inform an application for an EPS licence.
Marine Mammals	Disturbance from Underwater Noise - Piling (if required)	Implement mitigation in alignment with JNCC protocol for minimising the risk of injury to marine mammals from piling noise (JNCC, 2010) as agreed through the EPS licence. Note the mitigation will be implemented for pinnipeds and cetaceans.
Shipping and Navigation	Collision Risk	Compliance with MGN 654 (MCA, 2021) and its annexes where applicable.
Shipping and Navigation	Collision Risk	Appropriate marking on UKHO Admiralty charts.
Shipping and Navigation	Collision Risk	Promulgation of information for vessel routes, timings and locations, safety zones and advisory passing distances as required (e.g., Notifications to Mariners, Kingfisher Bulletin).
Shipping and Navigation	Collision Risk	Application for exclusion zones of up to 500m during construction and periods of major maintenance and up to 50m around completed structures pre-commissioning.
Shipping and Navigation	Collision Risk	Marine coordination and communication to manage project vessel movements.
Shipping and Navigation	Collision Risk	Marking and lighting of infrastructure in agreement with NLB and in line with International Association of Marine Aids to Navigation and Lighthouse Authority (IALA) Recommendation O-139 and G1162 (IALA, 2021a; IALA, 2021b).
Shipping and Navigation	Collision Risk	Compliance with regulatory expectations on moorings for floating wind and marine devices (Health & Safety Executive (HSE)/MCA, 2017).
Shipping and Navigation	Collision Risk	Minimum blade clearance of 22m above the water line.
Shipping and Navigation	Collision Risk	Guard vessel(s) as required by risk assessment.

Topic	Impact	Mitigation
Commercial Fishing	Gear Snagging	IAC buried or rock covered to a target depth in accordance with BEIS Guidelines (2021) that will not interact with fishing gear.
Commercial Fishing	Gear Snagging	Any rock laid will align with industry standard and be over trawlable.
Commercial Fishing	Gear Snagging	Notifications to FishSafe providing location of windfarm infrastructure.
Commercial Fishing	Gear Snagging	Implementation of a cable route inspection campaign (to ensure cables remain appropriately covered).
Marine Archaeology, Cultural Heritage and Geomorphology	Unexpected Discoveries	A procedure for archaeological discoveries (PAD) to be developed based on the PAD established by Wessex Archaeology on behalf of the Crown Estate for marine finds and would include the protocol for: o Discovery; o Initial steps for in-situ and out of situ finds; o Find management; o Restarting works; and o Reporting.
Marine Archaeology, Cultural Heritage and Geomorphology	Unexpected Discoveries	If archaeological features are found, PAD will be followed.
Materials & Waste	Material Selection - Finite Resources	The detailed design process will inform the selection of materials, this will however take account of: o Technical (including seabed consideration) performance requirements; o Volume of materials utilised; o Availability; o Recycled content; o Reusability and recyclability; o Energy production/ intrinsic carbon cost; and o Toxicity (potential pollution prevention considerations).
Materials & Waste	Waste	A waste management system will be maintained for the production, handling/segregation, transport, storage, treatment and disposal of waste during all lifecycle phases.

Topic	Impact	Mitigation
Materials & Waste	Litter	Marine litter including ghost nets identified, will be recovered from the sea whenever safe to do so.
Aviation Considerations	Aviation Accidents	UK Air Regulations and underpinning, Acceptable Means of Compliance (AMC), Guidance Material (GM) and, where appropriate, Certification Specifications (CS) will be appropriately applied.
Aviation Considerations	Helicopter Operations	The Cenos project will communications with the local asset oil and gas asset owners, with regard to operational considerations for helicopters to be incorporated into the project design.

Appendix C Projects Considered for Potential Cumulative

Project	Description	Status	Distance & Direction	Consideration (In/Out)
Scotwind, Muir/Mara Mhor, Vattenfall	Floating Wind, 798 MW, 200 km^2	Pre-application	W 104 km	In – potential for in combination effects due to location and similarity of development
Scotwind, Shell New Energies, Campion Wind Ltd	Floating Wind, 2000 MW	Pre-application	W 60 km	In – potential for in combination effects due to location and similarity of development.
Scotwind, Bellrock Gemini, Falck Renewables	Floating Wind, 1200 MW	Pre-application	SW 63 km	In – potential for in combination effects due to location and similarity of development.
Green Volt	Floating Wind, <480 MW, 116 km^2	Application	NW 130 km	In – potential for in combination effects due to location and similarity of development.
Scotwind, Ossian, SSE Renewables	Floating Wind, 2610 MW, 859 km^2	Pre-planning	SW 93 km	In – potential for in combination effects due to location and similarity of development.
Scotwind, Morven offshore wind Ltd. BP Alternative Energy Investments	Fixed Wind, 2907 MW, 860 km^2	Pre-planning	SW 132 km	In – potential for in combination effects due to location and similarity of development.

Project	Description	Status	Distance & Direction	Consideration (In/Out)
Scotwind, Cluaran Deas Ear, DEME, Thistle Wind Partners Cluaran	Fixed Wind, 1008 MW, 187 km^2	Pre-application	SW 153 km	In – potential for in combination effects due to location and similarity of development.
Berwick Bank **SSE Renewables**	Fixed Wind, 4100 MW	Application	SW 185 km	In – potential for in combination effects due to location and similarity of development.
Marr Bank Firth of Forth	Fixed Wind, 1850 MW	Early stages of development	SW 200 km	Out – been incorporated into Berwick Bank
Seagreen Phase 1 **Seagreen Wind Energy Ltd.**	Fixed Wind, 1140 MW	In construction	SW 199 km	Out – no overlap in construction activities. Distance and different development location (shallower waters) type fixed bottom reduce chance of in combination effects.
Neart Na Gaoithe **NnGOWL**	Fixed Wind, 432 MW, 102.6 km^2	In construction	SW 230 km	Out – no overlap in construction activities. Distance and different development location (shallower waters) type fixed bottom reduce chance of in combination effects.
Inch Cape **Inch Cape Offshore Ltd.**	Fixed Wind, 634 MW	Early stages of development	SW 219 km	Out – Distance and different development location (shallower waters) type fixed bottom reduce chance of in combination effects.

Project	Description	Status	Distance & Direction	Consideration (In/Out)
Utsira Nord **(Norwegian terrestrial waters)**	Floating, 1500 MW, 1010km^2	Pre-application	Approx. NE 233 km	In – potential for in combination effects due to similarity in location and similarity of development type.
Sørlige Nordsjø II **(Norwegian terrestrial waters)**	Floating Wind, 3000 MW	Early stages of development (Phase 1)	Approx. NE 218 km	In – potential for in combination effects due to location and similarity of development.
Forthwind, Cierco	Fixed Wind, 14 MW, 0,4 km^2	Consented	SW 296km	Out – Small installation, unlikely to have in combination effect due to scale and distance from Cenos.
Scotwind, Marram **Scottish Power Renewables (SPR)**	Floating Wind, 3000 MW, 684 km^2	Pre-application	NW 177 km	In – potential for in combination effects due to location and similarity of development, potential use of ports in the same area during construction.
Scotwind, Buchan **BayWa**	Floating Wind, 960 MW, 330 km^2	Pre-application	NW 216 km	In – potential for in combination effects due to location and similarity of development, potential use of ports in the same area during construction.
Scotwind, Broadshore **Orion Offshore Wind farm, Falck Renewables**	Floating Wind, 500 MW, 134 km^2	Pre-application	NW 225 km	In – potential for in combination effects due to location and similarity of development, potential use of ports in the same area during construction.

Project	Description	Status	Distance & Direction	Consideration (In/Out)
Scotwind, Stromar **Falck Renewables**	Floating Wind, 1000 MW, 256 km^2	Pre-application	NW 270 km	Out – due to distance unlikely to impact upon the same receptors hence no in combination effects.
Scotwind, Cluaran Ear-Thuath, DEME **Thistle wind partners**	Floating Wind, 1008 MW, 201 km^2	Pre-application	NE 281 km	Out – due to distance unlikely to impact upon the same receptors hence no in combination effects.
Scotwind, Caledonia **Ocean Winds**	Fixed Wind, 1000 MW, 429 km^2	Pre-application	NE 250 km	Out – Distance and different development location (shallower waters) type fixed bottom reduce chance of in combination effects.
Moray West Offshore Wind Farm	Fixed Wind, 850 MW, 225 km^2	In construction	NE 270 km	Out – Distance and different development location (shallower waters) type fixed bottom reduce chance of in combination effects.
Pentland Floating Offshore Wind Farm, Copenhagen Infrastructure Partners, Highland Wind Ltd.	Floating Wind, 100 MW, 10 km^2	Application	NE 346 km	Out – due to locations unlikely to impact upon the same receptors hence no in combination effects.

Project	Description	Status	Distance & Direction	Consideration (In/Out)
Scotwind, West of Orkney Wind Farm, Offshore Wind Power Ltd.	Fixed Wind, 2000 MW, 225 km^2	Pre-application	NE 361 km	Out – Distance and different development location (shallower waters) type fixed bottom reduce chance of in combination effects.
Scotwind, Area 14, Northland Mhairi, Northland Power	Floating Wind, 1500 MW, 390 km^2	Pre-application	NE 431 km	Out – due to location unlikely to impact upon the same receptors hence no in combination effects.
Scotwind, Talisk, Magnora Offshore Wind N3	Fixed and Floating Wind, 495 MW, 103 km^2	Pre-application	NE 482 km	Out – due to location unlikely to impact upon the same receptors hence no in combination effects.
Scotwind, Area 16 Northland Sheena, Northland Power	Fixed Wind, 840 MW, 161 km^2	Pre-application	NE 494 km	Out – Distance and different development location (shallower waters) type fixed bottom reduce chance of in combination effects.
Scotwind, Machair, Scottish Power Renewables (SPR)	Fixed Wind, 2000 MW, 754 km^2	Pre-application	NE 492 km	Out – Distance and different development location (shallower waters) type fixed bottom reduce chance of in combination effects.
Scotwind (new), Area 18, Ocean Winds	Floating Wind, 500 MW, 100 km^2	Pre-application	NNE 337 km	Out – due to location unlikely to impact upon the same receptors hence no in combination effects.

Project	Description	Status	Distance & Direction	Consideration (In/Out)
Scotwind (new), Arven Offshore Wind Farm, Mainstream Renewable Power	Floating Wind, 1800 MW, 360 km^2	Pre-application	NNE 341 km	Out – due to location unlikely to impact upon the same receptors hence no in combination effects.
Scotwind, Sealtainn **ESB Asset Development**	Floating Wind, 500 MW, 100 km^2	Pre-application	NNE 365 km	Out – due to location unlikely to impact upon the same receptors hence no in combination effects.
SEGL/ Eastern Link 1 **Torness to Hawthorn Pit**	HVDC Cable and Protection	Application	SW 350km	Out – cable routes don't cross, unlikely to be in-combination construction issues.
SEGL/Eastern Link 2 **Peterhead to Drax**	HVDC Cable and Protection	Application	E 150km	Out – cable routes don't cross, unlikely to be in-combination construction issues.
NorthConnect	HVDC Cable	Licenced	Connected	In – project required to facilitate Cenos.

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