Potential key interactions between offshore wind installations and the receiving environment

Development phase	Activity	Impact mechanism	Interactions with the physical environment	Interactions with the biological environment	Interactions with conservation (ecological designations, natural heritage, anthropogenic heritage etc.)	Interactions with the socio-economic environment
Preparatory works	Surveying	Disturbance of seabed through sampling	Minor impacts may result from baseline environmental surveys. For example, localised loss of substrates, plants and animals on the seabed through coring, boring and grab sampling, disruption to mammals from seismic and other vessel-based surveys.			Local contractors and scientific experts can be employed to conduct and support baseline surveys for example, vessel operators, consultants and divers etc.
		Noise disturbance through increased vessel activity and sonar / seismic surveying	No key interactions anticipated	Potential harm to fish species	Disruption of marine mammal behaviour	No key interactions anticipated
		Disruption of seabed and water column during and after dredging	Areas of the seabed may be dredged affecting seabed morphology and increasing water turbidity	Plants and animals may be removed and directly impacted by any dredging prior to construction	Protected migratory fish species and protected predatory bird species may be affected.	Temporary disruption to other sea users and navigation resulting from vessel activity and marine works.
Construction and Installation	Foundation and infrastructure installation	Physical presence of vessels and associated equipment/structures	No key interactions anticipated	No key interactions anticipated	Potential disturbance to marine mammals	Increased potential navigational risk to other sea users Creation of exclusion zones to other sea users including fishermen
		Disturbance to seabed and generation of noise through piling	Localised impact on morphology – cuttings will become established on the seabed. These may subsequently be distributed over a wider area.	Direct localised impact on seabed species and habitats	Underwater noise may impact marine mammal species over significant distances	Unfamiliar vessels and superstructures associated with onsite fabricating and installation will be visible within the local seascape for extended periods of time
		Disturbance to seabed and water column through installation of foundations	Alteration of hydrological and sedimentation patterns Alteration of wave height Changes in tidal current behaviour and character downstream of installation	Installations may act as artificial reefs and fish aggregation devices Interference with migration patterns	Potential disturbance to marine mammals	Increased potential navigational risk to other sea users
		Disturbance to the seabed and other sea users through the installation of subsea cables	Resuspension of sediments and particulate matter into the water column	Direct localised impact on seabed species and habitats	Potential disturbance to marine mammals	Increased potential navigational risk to other sea users Creation of exclusion zones to other sea users including fishermen
	Turbine installation	Physical presence of supersurface structures	Creation of 'wind shadow' downwind of installed structures	Collision between birds and turbines (both migratory and resident)	Protected bird species may be affected	Changes to landscape and seascape character Visual intrusion Interference with recreational sailing access Increased potential navigational risk to other sea users Creation of exclusion zones to other sea users including fishermen

Development phase	Activity	Impact mechanism	Interactions with the physical environment	Interactions with the biological environment	Interactions with conservation (ecological designations, natural heritage, anthropogenic heritage etc.)	Interactions with the socio-economic environment
Commissioning, operation and management	Extraction of wind energy and generation of power	Turbine blade movement	No key interactions anticipated	Risk of collision with birds	Protected bird species may be affected	Interference with radar installations, telecommunications and televisions
		Noise generated by turbines	No key interactions anticipated	Localised avoidance by some fish species may be observed	Potential disturbance to marine mammals over significant distances - localised avoidance may be observed	No key interactions anticipated (dependent on distance from shore)
		Reduction of greenhouse gas and exhaust emissions from fossil fuel combustion	Reduction in air pollution and atmospheric anthropogenic greenhouse gasses	Ecological effects resulting from greenhouse gas emissions and air pollution will be reduced	Ecological effects resulting from greenhouse gas emissions and air pollution will be reduced	Clean energy produced helping to meet national/international targets
		Transmission of electricity through subsea cable	No key interactions anticipated	Electrical and magnetic interference with movements of fish species (shark and ray species will be especially sensitive)	Electro-magnetic Fields (EMF) may affect sea mammals passing through the vicinity of the installation	Electric, magnetic interference and heat affects resulting from the operational electricity transmission lines
		Increased vessel activity for maintenance	No key interactions anticipated	No key interactions anticipated	Potential disturbance to marine mammals	Regular additional vessel activity within the local seascape
		Local business and employment opportunities	No key interactions anticipated	No key interactions anticipated	No key interactions anticipated	Potential employment opportunities for local residents and benefits for the local economy
Accidental events	Incident leading to chemical spill	Chemical pollution	Local/widespread changes in water and sediment chemistry	Species and habitats may be harmed and damaged by chemical pollution		Chemical pollution may affect other sea users for example; fish farmers, tourists and mariners etc.
	Incident leading to oil/fuel spill	Oil pollution	Transitory oil slicks on surface waters and risk of long-term seabed and shoreline pollution	Species and habitats may be harmed and damaged by oil pollution		Oil pollution may affect other sea users for example; fish farmers, tourists and mariners etc
	Loss of equipment / structural components	Disruption to the seabed from sinking debris	Changes to the seabed profile and seabed composition	Localised disruption to seabed species and habitats		Additional hazard to navigation, disruption of fishing grounds
		Pollution of surface waters and shorelines from floating debris	No key interactions anticipated	Disruption to shoreline habitats through smothering and harm to species through ingestion/entanglement		Risk of release of oils, fuels and other pollutants Risk of release of substances (e.g. hydraulic fluids)
Decommissioning	Total removal of installation	Reversion to baseline conditions	Dispersal of any accumulated sediments around the installation Loss of and 'wind shadow areas' around the installation Loss of any calming effects around the installation (current movement and wave action)	Potential disruption to ecosystems established and adapted to post-installation hydrographic conditions Impacts of EMF on fish species will be eradicated	Protected species foraging and migrating within the water column may be disrupted Impacts of noise generation on marine mammals will be eradicated Protected bird species no longer affected by the presence of moving turbine parts	Removal of navigational risks 'Exclusion zones' removed
	Replacement of turbines	Increased vessel activity	No key interactions anticipated	No key interactions anticipated	Potential temporary disturbance to marine mammals	No key interactions anticipated
		Local business and employment opportunities	No key interactions anticipated	No key interactions anticipated		Potential economic benefits from utilisation of local resources, support companies and services