Morven North Offshore Wind Array Project

Environmental Impact Assessment Report

Volume 2, Chapter 8: Benthic Subtidal Ecology

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8.1 Introduction

8.1.1.1 This chapter of the Morven North Offshore Wind Array Project (hereafter "Morven North") Environmental Impact Assessment (EIA) Report (hereafter, the EIA Report) presents the assessment of the Likely Significant Effects (LSE[1]) (as per the EIA Regulations, as defined in Volume 1, Chapter 2: Policy and Legislation) on benthic subtidal ecology. Specifically, this chapter considers the potential impacts of Morven North seaward of Mean High Water Springs during the construction, Operations and Maintenance (O&M) and decommissioning phases. Where relevant, this chapter also assesses the likely significant effects of Morven North on receptors landward of mean low water springs during the construction, O&M and decommissioning phases.

8.1.1.2 The assessment presented in this chapter has relied upon, or been informed by, the following technical chapters and reports:

- Volume 2, Chapter 7: Physical Processes, of the Morven North EIA Report;
- Volume 3, Annex 7.1: Physical Processes Technical Report, of the Morven South EIA Report;
- Volume 3, Annex 8.1: The Morven North and Morven South Benthic Subtidal Ecology Shared Technical Report (hereafter referred to as the Morven North and Morven South Shared Technical Report).

8.1.1.3 Benthic subtidal ecology was reported on in the Scoping Report for the Morven Option Lease Agreement Site (hereafter, "the Morven Site Scoping Report") (Morven Offshore Wind Limited (MvOWL), 2023). As described in Volume 1, Chapter 3: Site Selection and Consideration of Alternatives, of the Morven North EIA Report, the Morven Option Lease Agreement Site (hereafter "Morven Site") has since been divided into two smaller projects, Morven North and the Morven South Offshore Wind Array Project (hereafter "Morven South").

8.1.1.4 The potential impacts to benthic subtidal ecology are considered to generally be the same (or less) for Morven North as identified in the Morven Site Scoping Report. Consequently, there has been no change in the methodology or impacts that were scoped in or out in the Morven Site Scoping Report for benthic subtidal ecology. The advice provided by the Marine Directorate Licensing Operations Team (MD-LOT) in the Morven Site Scoping Opinion (MD-LOT, 2023) relevant to Morven North, has therefore been considered for the development of this chapter.

8.1.1.5 This chapter presents and assesses up-to-date parameters for Morven North and explains if and how any assessment aspects differ from the information set out in the Morven Site Scoping Report.

8.2 Study areas

8.2.1.1 Three study areas have been defined for benthic subtidal ecology:

- the Morven North Benthic Subtidal Ecology Study Area;
- the Survey Area;
- the Morven North and Morven South Regional Benthic Subtidal Ecology Study Area (hereafter the "Regional Benthic Subtidal Ecology Study Area").

8.2.1.2 The study areas defined for benthic subtidal ecology are shown in Figure 8.1 and defined as follows:

- The Morven North Benthic Subtidal Ecology Study Area informs the baseline for Morven North. The study area includes a buffer extending to a spring tidal excursion of approximately 5km in the east west orientation and to 14km in the north south orientation from the Morven North Boundary. This buffer is designed to incorporate the Zone of Influence (ZoI) from indirect impacts (e.g. increases in Suspended Sediment Concentrations (SSCs) and potential changes in physical processes) and equates to one maximum tidal ellipse over a large spring tide around the Morven North Boundary. Beyond this distance, any impacts from Morven North on

benthic subtidal ecology receptors would be minimal. There is an area of spatial overlap between the Morven North Study Area and the Morven South Study Area.

- The Survey Area (as shown in Figure 3.1 within Volume 3, Annex 8.1: Morven North and Morven South Shared Technical Report) is the area within which the benthic site specific survey was undertaken in 2022 (Section 8.6.5), covering both Morven North and Moven South and the predicted ZoI around both sites. Information reported for the Survey Area is equally relevant to both Morven North and Morven South. Where sampling points are located in the area of spatial overlap (i.e. within both the Morven North Benthic Subtidal Ecology Study Area and the Morven South Benthic Subtidal Ecology Study Area), these shared data points are described as "Shared Sampling Locations". Shared Sampling Locations inform the baseline for both Morven North and Morven South.
- The Regional Benthic Subtidal Ecology Study Area encompasses wider northern North Sea habitats and neighbouring designated sites, and consented, developing and planned Offshore Wind Farms (OWFs) in an area extending 50km to 191km from Morven North. Morven North and Morven South are both located within this wider regional area, which accordingly, provides the regional context for both projects. The Regional Benthic Subtidal Ecology Study Area has been characterised by desktop data to provide wider context to site specific data. The extent of the Regional Benthic Subtidal Ecology Study Area was chosen with consideration of feedback from MD-LOT and the Statutory Nature Conservation Bodies (SNCBs) on other OWF projects in the Firth of Forth region, namely Berwick Bank and Ossian OWFs. The feedback within the Berwick Bank Scoping Opinion advised that Regional Benthic Subtidal Ecology Study Areas should include neighbouring consented OWF projects with their associated export cable corridors, and all relevant designated sites (Marine Scotland, 2021).

8.2.1.3 The study areas for benthic subtidal ecology for the Morven Site were presented and agreed during the scoping process for the Morven Site. The underlying principles used to define the study area(s) for Morven North have not changed, other than the limits have been applied relative to the Morven North Boundary, rather than the Morven Site Boundary. The study areas for Morven North for benthic subtidal ecology were presented to and confirmed by MD-LOT via a "Targeted Consultation Exercise" undertaken in Quarter 1, 2025 and as detailed in Table 8.5.

8.2.1.4 There are two Cumulative Effects Assessment (CEA) study areas for benthic subtidal ecology. Firstly, for interactive/synergistic impacts (i.e. increases in SSC and changes in physical processes), the Morven North and Morven South Benthic Cumulative Study Area is defined as the Morven North Physical Processes CEA Study Area, which excludes any projects further than 28km from Morven North (two tidal excursions) due to this being the maximum distance at which physical processes impacts could cause cumulative effects, based on numerical modelling in Volume 3, Annex 7.1: Physical Processes Shared Technical Report and confirmed by the MD-LOT via the "Targeted Consultation Exercise" undertaken in Quarter 1, 2025. This is larger than the Morven North Benthic Subtidal Ecology Study Area, but is used to assess many of the same impacts. Secondly, for all other impacts, the Regional Benthic Subtidal Study Area of between 50km and 191km from Morven North has been used for the Morven North and Morven South Benthic Cumulative Study Area , which is within the central northern North Sea and encompasses neighbouring consented, developing and planned offshore wind farms and designated sites. This area has been defined based on feedback from MD-LOT and NatureScot.

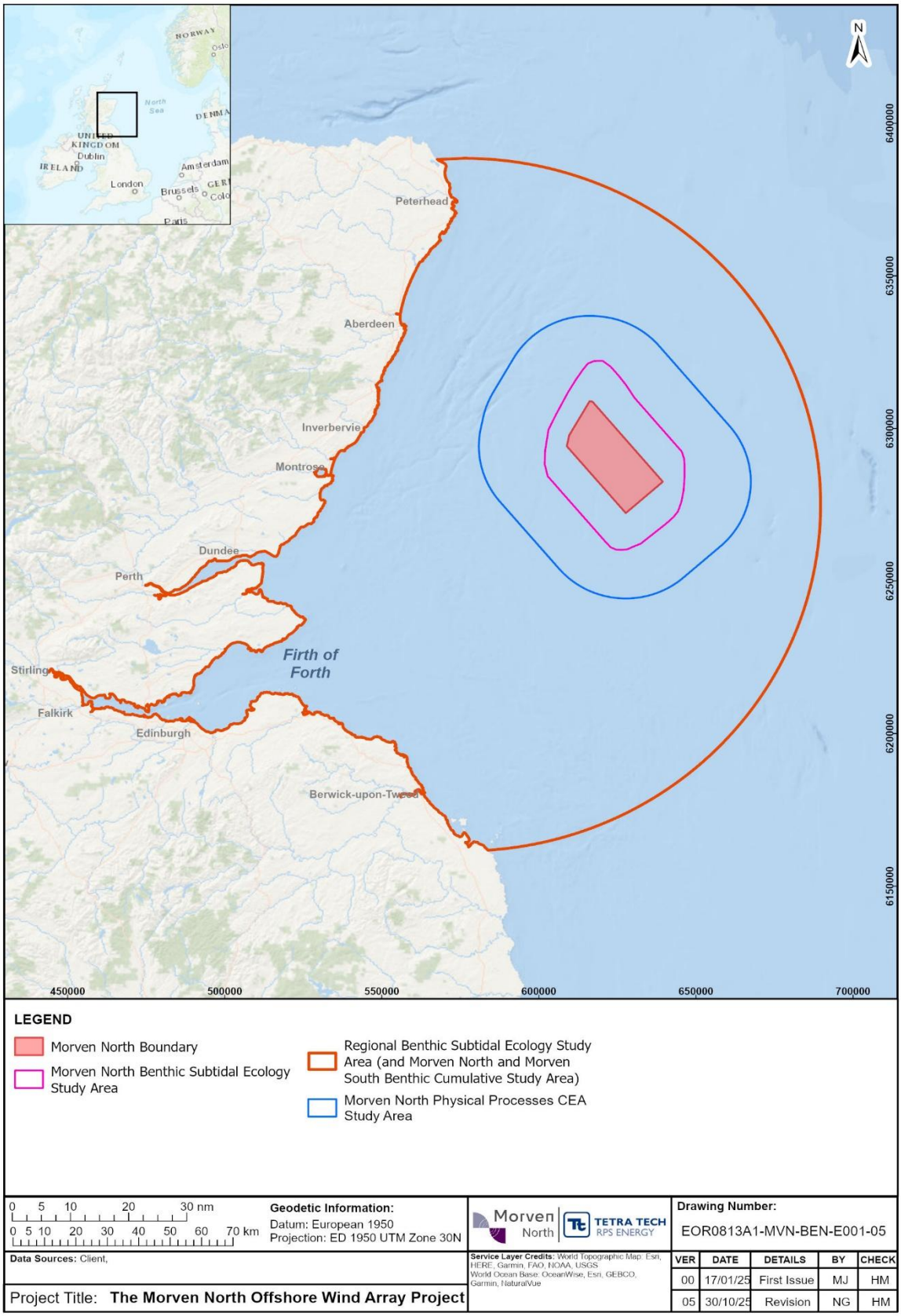

Figure 8.1: Benthic Subtidal Ecology Study Areas for Morven North Offshore Wind Array Project

8.3 Legislative and policy context

8.3.1.1 Policy and legislation on renewable energy infrastructure is presented in Volume 1, Chapter 2: Policy and Legislation, of the Morven North EIA Report. Policy specific to benthic subtidal ecology, is contained in the Sectoral Marine Plan (SMP) for Offshore Wind Energy (Scottish Government, 2020) and the updated draft SMP for Offshore Wind Energy (Scottish Government, 2025), the Scottish National Marine Plan (NMP) (Scottish Government, 2015), and the United Kingdom (UK) Marine Policy Statement (MPS) (UK Government, 2011). The updated draft SMP for Offshore Wind Energy does not include any new specific policies for benthic habitats which had not been previously covered in the original 2020 publication. A summary of the legislative provisions relevant to benthic subtidal ecology are provided in Table 8.1 below, with relevant policy provisions set out in Table 8.2 to Table 8.4.

Marine and Coastal Access Act 2009

8.3.1.2 Parts 3 and 4 of the Marine and Coastal Access Act 2009 introduced a new marine planning and licensing system for overseeing the marine environment and a requirement to obtain a marine licence for certain activities and works at sea, with consideration of potential impacts to Scottish Marine Protected Areas (MPAs) required under Sections 137A-D.

Table 8.1: Summary of provisions within the Habitats Regulations (UK Government, 2017a, UK Government, 2017b) of relevance to benthic subtidal ecology

Summary of relevant legislation	How and where considered in the EIA report
Designated Sites	
A competent authority must make an appropriate assessment of the implications of a plan or project (both alone and in combination with other plans and projects) on European sites, in view of that site's conservation objectives, where the plan or project is likely to have a significant effect on the European site. This must be done prior to deciding to undertake, or give consent, permission or other authorisation for a plan or project which is to be carried out on or in any part of the water and/or seabed comprising the offshore marine area.	All relevant European sites have been identified in Section 8.7.2. Due to large distances between Morven North and these European sites, no pathway to impact was identified.

Table 8.2: Summary of provisions within the Sectoral Marine Plan for Offshore Wind Energy (Scottish Government, 2020) of relevance to benthic subtidal ecology

Summary of relevant policy	How and where considered in the EIA report
Offshore Wind and Marine Renewable Energy Policy	
Regional cumulative effects should include the potential for adverse effects on benthic habitats, bird populations, cetaceans, navigational safety, seascape, landscape, and commercial fisheries. The SMP for Offshore Wind Energy includes measures to mitigate likely significant effects at various scales.	This chapter includes a CEA, which provides an assessment of the impacts of Morven North alongside other plans, projects, and activities within the Morven North and Morven South Benthic Cumulative Study Area (see Section 8.13).
Benthic surveys and subsequent spatial planning to avoid any key habitats identified should be undertaken within the East region of Scottish offshore waters.	This chapter is informed by a site-specific subtidal survey which was used to identify any potential key habitats (see Section 8.6.5).

Table 8.3: Summary of provisions within the Scottish National Marine Plan (Scottish Government, 2015) of relevance to benthic subtidal ecology

Summary of relevant policy	How and where considered in the EIA report
General Policies	
Development and use of the marine environment must: • comply with legal requirements for protected areas and protected species (including designated sites); • not result in significant impacts on the national status of Scottish Priority Marine Features (PMFs); • protect and enhance (where appropriate) the health of the marine area. (GEN 9 Natural Heritage)	Protected areas, species, and PMFs have been identified in Table 8.11 and Table 8.13. These have been included as Important Ecological Features (IEFs) (Section 8.7.3) and used to assess the significance of impacts on Morven North alone (Section 8.11) and cumulatively with other plans, projects, and activities (Section 8.13).
The management requirement of protected sites must be met. These include MPAs and Special Areas of Conservation (SACs), as well as former Natura 2000 sites and the marine components of Sites of Special Scientific Interest and Ramsar sites. (Site Protection, Paragraphs 4.41-4.50)	Designated sites relevant to benthic subtidal ecology have been given consideration in Section 8.7.2, with distances to Morven North presented in Table 8.11. Due to large distances between Morven North and most protected sites, no pathway to impact was identified in most cases. One site, the Firth of Forth Banks Complex MPA, overlapped with the Morven North Benthic Subtidal Ecology Study Area, and therefore a direct pathway to impact exists and this was scoped in, with justification provided in Section 8.5.1.
Requirement for all regulators to ensure that there is no significant risk of hindering the achievement of the conservation objectives of a MPA before giving consent to an activity, plan, or project. A management intervention will be required if an ongoing activity presents a significant risk of hindering the achievement of a MPAs conservation objectives. This intervention will be practical and proportionate, using the most appropriate statutory mechanism to reduce the risk. (Site Protection, Paragraphs 4.47)	Designated sites including MPAs relevant to benthic subtidal ecology have been considered in Section 8.7.2, with distances to Morven North presented in Table 8.11. Due to large distances between Morven North and most protected sites, no pathway to impact was identified in most cases. One site, the Firth of Forth Banks Complex MPA, overlapped with the Morven North Benthic Subtidal Ecology Study Area, and therefore a direct pathway to impact exists and this was scoped in, and justification for this is provided in Section 8.5.1.
Opportunities to reduce the risk of introduction of Invasive Non-Native Species (INNS) to a minimum or proactively improve the practice of existing activities should be taken. (GEN 10 Invasive Non-Native Species)	The potential for likely significant effects associated with INNS upon benthic subtidal ecology have been assessed in Section 8.11.5. Additionally, an Outline Invasive Non-Native Species Management Plan (INNSMP) and Biosecurity Plan (Volume 4, Annex 1, Appendix 1.2: Invasive Non-Native Species Management Plan and Biosecurity Plan) has been included as a designed-in measure, which will provide detail on required actions to reduce the risk of introduction and spread of INNS during all phases of Morven North, as far as reasonably practicable (Table 8.18).
Cumulative impacts affecting the ecosystem of the marine plan area should be addressed as part of the	This chapter includes a CEA, which assesses the impacts of Morven North alongside other plans, projects, and activities (see Section 8.13).

Summary of relevant policy	How and where considered in the EIA report
decision making and plan implementation process. (GEN 21 Cumulative Impacts)	
Offshore Wind and Marine Renewable Energy Policy	
Marine planners and decision makers should support the development of joint research and monitoring programmes for their offshore wind and marine renewable energy developments (RENEWABLES 9)	The proposed need for any additional monitoring is addressed in Section 8.11.10.

Table 8.4: Summary of provisions within the United Kingdom Marine Policy Statement (UK Government, 2011) of relevance to benthic subtidal ecology

Summary of relevant policy	How and where considered in the EIA report
General Policies	
Ensure a sustainable marine environment which promotes healthy, functioning marine ecosystems and protects marine habitats, species, and heritage assets (Introduction)	The magnitude of impacts and the sensitivity of IEFs are assessed in Section 8.11, with these used to determine if impacts represent a significant change from the baseline environmental conditions and if the effect on the IEF is likely to be significant as a whole. The effect of a shifting baseline due to climate change in the absence of Morven North is discussed in Section 8.7.4. Table 8.18 lists the designed-in measures adopted as part of Morven North, and these aim to reduce potential impacts to benthic subtidal ecology as far as reasonably practicable.
Biodiversity is protected, conserved, and recovered (where appropriate), and biodiversity loss has been halted (Section 2.2)	As per the row above.

8.4 Consultation

8.4.1.1 The approach to consultation for Morven North is set out in Volume 1, Chapter 5: Consultation, of the Morven North EIA Report. A summary of the issues raised during consultation activities undertaken to date specific to benthic subtidal ecology is presented in Table 8.5, together with how these issues have been considered in the production of this chapter. Further detail is presented within Volume 3, Annex 5.1: Consultation Annex, of the Morven North EIA Report.

8.4.1.2 The advice provided by MD-LOT in the Morven Site Scoping Opinion (MD-LOT, 2023) has been considered for the development of this chapter.

Table 8.5: Summary of key consultation issues raised during consultation activities undertaken for Morven North of relevance to benthic subtidal ecology

Date	Consultee and type of consultation	Summary of issue(s) raised	Applicant's response to issue raised and, if applicable, where considered in this chapter
April 2023	NatureScot: Scoping Workshop	NatureScot recommended electromagnetic fields (EMF) should be scoped in for assessment due to uncertainty around impacts on benthic species, even if only qualitatively. Confirmed that a qualitative assessment would be acceptable and advised reference to strategic projects (e.g. via ScotMER). NatureScot agreed that negligible impacts in project-alone assessment can be scoped out of cumulative assessment, except for EMF where cumulative effects may be significant.	The impact of EMF has been assessed in the cumulative assessment (see section 8.11.9).
		NatureScot advised that removal of hard substrates should be included in the assessment at this stage.	Removal of hard substrates has been considered and assessed within this chapter in section 8.11.8.
		NatureScot recommended potential impacts from scour should be considered in relation to sediment transport pathways. This would only require desktop calculations, not modelling.	Sediment transport pathways have been considered (see section 8.11.7)
November 2023	MD-LOT, Scoping Opinion	Attention is drawn to the representation by Natural England which advises consideration of the Farnes East Marine Conservation Zone (MCZ), the North East of Farnes Deep MCZ and Highly Protected Marine Area and Swallow Sand MCZ.	The highlighted MCZs have been considered and lie outside of the Regional Benthic Subtidal Ecology Study Area and have thus been scoped out of the assessment.
November 2023	MD-LOT, Scoping Opinion	The Scottish Ministers are broadly content with the baseline characterisation of the Scoping Report, and the data sources presented.	The data sources have been outlined in Section 8.6.3 and the baseline characterisation has been described in Section 8.7.
November 2023	MD-LOT, Scoping Opinion	The Scottish Ministers agree with the impacts scoped in and out of assessment, in line with the NatureScot	All relevant scoped in impacts have been assessed for the project alone in Section 8.11 and cumulatively with other

Date	Consultee and type of consultation	Summary of issue(s) raised	Applicant's response to issue raised and, if applicable, where considered in this chapter
		representation, however, advise that consideration be given to the representation from the Scottish Fishermen's Federation regarding the impacts to benthic invertebrates due to thermal emissions from subsea electrical cables. The Scottish Ministers are content with the approach to assessment as outlined in the Scoping Report.	plans and projects in Section 8.13. Impacts scoped out of the assessment have been presented in Section 8.5.2, with specific consideration given to thermal emissions from subsea electrical cables using up-to-date peer reviewed research.
November 2023	MD-LOT, Scoping Opinion	With regards to mitigation, the Scottish Ministers are broadly content with the designed-in measures and mitigation, however, advise that the full range of mitigation measures and published guidance is considered and discussed in the EIA Report. The Scoping Report does not mention any specific monitoring for benthic subtidal ecology and the Scottish Ministers advise that proposals for monitoring must be discussed in the EIA Report. This view is in line with the NatureScot representation (Scoping Opinion Appendix I NatureScot response).	Specific mitigation measures relevant to benthic subtidal ecology are listed in Section 8.10, and any proposed monitoring is listed in Section 8.11.10.
November 2023	MD-LOT, Scoping Opinion	The Scottish Ministers are content with the approach to cumulative assessment for benthic interests and agree that transboundary impacts can be scoped out from further assessment.	This chapter includes a CEA, which considers the impacts of Morven North alongside other plans, projects, and activities (see Section 8.13). Transboundary impacts have been given consideration in Section 8.14.
November 2023	MD-LOT, Scoping Opinion	In regard to the screening for nature conservation MPAs ("ncMPAs"), the Developer proposes to screen in the 'offshore subtidal sands and gravels' and 'ocean quahog *Arctica islandica* aggregations' features due to potential impacts from increased SSCs and associated depositions and changes in physical processed as they overlap	The designated sites with relevance to benthic subtidal ecology have been identified in Section 8.7.2, and relevant specific habitats or species have been identified as IEFs in Section 8.7.3.

Date	Consultee and type of consultation	Summary of issue(s) raised	Applicant's response to issue raised and, if applicable, where considered in this chapter
		with the ZoI. In line with the NatureScot representation, the Scottish Ministers are content with this approach.	
November 2023	MD-LOT, Scoping Opinion	The Scottish Ministers agree with the conclusion of the Habitats Regulations Appraisal (HRA) Screening Report that no sites with Annex 1 habitat features need to be taken forward for assessment. This view is in line with the NatureScot representation.	Relevant specific habitats or species have been identified as IEFs in Section 8.7.3, taking into account the outcome of the HRA Screening Report and the rescreening report for Morven North in Chapter 2.1: Report to Inform Appropriate Assessment (RIAA) Part 1: Introduction of the HRA Report.
August 2025	MD-LOT, Targeted Consultation Meeting	MD-LOT are content with the proposed approach to mitigation and post-consent plans and request that the appropriate level of detail is provided. MD-LOT would advise discussing further with NatureScot with regards to the cumulative and in-combination assessments. MD-LOT was content with the proposed cut-off dates for quantitative and qualitative CEA.	The relevant designed in mitigation is outlined in Table 8.18 and the CEA is presented in Section 8.13. The Applicant has had further discussions with NatureScot and MD-LOT and has agreed the approach to CEA, including cut off dates, as detailed in Volume 1, Chapter 6 EIA methodology.

8.5 Scope of the assessment

8.5.1 Impacts scoped into the assessment

8.5.1.1 The scope of this EIA Report has been developed in consultation with MD-LOT in Table 8.5, with scope to include the input of other statutory and non-statutory consultees where relevant. The scope of this assessment is to determine if any impacts, whether direct or indirect, are likely to have a significant effect on the benthic subtidal habitats and species which have been identified in the Morven North Benthic Subtidal Ecology Study Area. Taking into account the scoping and consultation process, Table 8.6 summarises the potential impacts which have been scoped into this assessment. Where an impact is likely to occur within a specific development phase of the project, this is indicated within each relevant topic chapter (a '✓' is used to denote the phase the potential impact can occur, conversely a 'X' outlines there is no impact within this project phase), where relevant.

Table 8.6: Potential impacts scoped into the benthic subtidal ecology assessment

C= Construction, O= Operations and Maintenance, D= Decommissioning phases

"✓" is used to denote the phase the potential impact can occur, "✗" outlines there is no impact within this project phase

Potential impact	Phase			Activity
	C	O	D	
Temporary habitat loss/disturbance	✓	✓	✓	Site preparation activities
				Cable installation (including Unexploded Ordnance (UXO) clearance, pre-cabling seabed clearance and anchor placements)
				Placement of spud-can legs from jack-up operations
				Cable repair/reburial
				Use of jack-up vessels to facilitate wind turbine component repairs
				Removal of foundations, scour and cable protection, and placement of spud-can legs from jack-up operations for decommissioning works
Increased SSCs and associated deposition	✓	✓	✓	Foundation, cable, and scour protection installation
				Drilling
				UXO clearance
				Seabed preparation
				Maintenance operations including:
				Cable repair/reburial
				Use of jack-up vessels to facilitate wind turbine component repairs
				Decommissioning activities including foundation removal, or scour and cable protection removal
Long-term habitat loss	✓	✓	✓	Installation of foundation structures and associated scour protection and cable protection
				Introduction and presence of hard structures including foundations, scour protection and cable protection

Potential impact	Phase			Activity
	C	O	D	
				Leaving in place all foundation structures and associated scour protection and cable protection which are not removed at the end of Morven North's project lifetime
Increased risk of introduction and spread of INNS	✓	✓	✓	Vessel movements increasing risk of introduction and spread of INNS
				Presence of artificial structures including foundations, scour protection and cable protection
				Leaving in place all foundation structures and scour and cable protection not removed at the end of the Morven North's project lifetime.
Colonisation of hard structures	✗	✓	✗	Presence of artificial structures such as foundations or scour protection placed on seabed expected to be colonised
Changes in physical processes	✗	✓	✗	Presence of foundation and turbine structures, associated scour protection, and cable protection
Removal of hard substrates	✗	✗	✓	Removal of foundations, scour and cable protection
Impacts to benthic invertebrates due to electromagnetic fields (EMF)	✗	✓	✗	Presence of additional EMF due to operational subsea cables

8.5.2 Impacts scoped out of the assessment

8.5.2.1 This assessment has taken a precautionary and proportionate approach, therefore impacts which are highly unlikely to result in a measurable change to the environment have been scoped out. A summary of the impacts scoped out, together with justification for scoping them out and whether the approach has been agreed with key stakeholders through either scoping or consultation, is presented in Table 8.7.

Table 8.7: Impacts scoped out of the assessment for benthic subtidal ecology

C= Construction, O= Operations and Maintenance, D= Decommissioning phases

"✓" denotes the impact has been scoped out for this phase, "✗" denotes the impact has not been scoped out for this phase

Potential impact	Phase			Justification
	C	O	D	
Accidental pollution	✓	✓	✓	Pollution could accidentally be released during all phases due to the activities of vessels, equipment, and machinery. However, the risk of such events is managed by the implementation of measures set out in standard post-consent plans (e.g. Environmental Management Plan (EMP), including a Marine Pollution Contingency Plan (MPCP)). These designed-in measures include planning for accidental spills, address all potential contaminant releases and include key emergency contact details. They will also set out industry good practice and OSPAR (Oslo and Paris Conventions), International Maritime Organization and MARPOL (International Convention for the Prevention of Pollution from Ships) guidelines for preventing pollution at sea. Therefore, the likelihood of an accidental spill occurring is very low and in the unlikely event that such an event did occur, the magnitude will be minimised through measures such as the MPCP. As such, this impact is scoped out of further consideration within the Benthic Subtidal Ecology Chapter of the Morven North EIA Report. Scoping out of accidental pollution was agreed with MD-LOT in the Scoping Opinion (MD-LOT, 2023, Section 8.4).
Release of sediment-bound contaminants	✓	✓	✓	Seabed disturbance associated with activities such as foundation and cable installation or repair/replacement in all phases could lead to the remobilisation of sediment-bound contaminants that may result in harmful and adverse effects on benthic communities. Site specific sampling within the Morven North Benthic Subtidal Ecology Study Area has shown levels of sediment contaminants are very low (see Volume 3, Chapter 8.1: Morven North and Morven South Shared Technical Report). Sediment contamination analysis identified that all stations were below Marine Scotland Action Levels 1 and 2 (AL1 and AL2) and Canadian Sediment Quality Guidelines (CSQG) for polychlorinated biphenyls (PCBs) and below CSQG and Effects Range Low (ERL) and Effects Range Median (ERM) for polycyclic aromatic hydrocarbons (PAHs). Most stations were below Marine Scotland AL1, except for one station, ENV054, which exceeded AL1 slightly and the CSQG Threshold Effect Level (TEL) for arsenic. However, it should be noted that due to its location (in the far north of the Morven North Benthic Subtidal Ecology Study Area) this station is unlikely to be directly disturbed. The risk of sediment-bound contaminants being present in concentrations likely to be harmful to benthic receptors is considered negligible. This potential impact is scoped out of further consideration within the benthic subtidal ecology chapter of the Morven North EIA Report, and this was agreed with MD-LOT in the Scoping Opinion (MD-LOT, 2023, Section 8.4).
Impacts to benthic invertebrates due to thermal emissions from subsea electrical cables	×	✓	×	There will be no thermal emissions from cables during the construction and decommissioning phases as the cables will not be in operation, and therefore there is no impact pathway. In the O&M phase, thermal emissions generated by the subsea electrical cabling may affect benthic subtidal receptors. However, there is

Potential impact	Phase			Justification
	C	O	D	
				limited evidence for subsea cables significantly changing the temperature of the sea floor and surrounding water and, therefore, the impact of heat on benthic invertebrates. A review by Taormina *et al.* (2018) of the current knowledge on the impacts of subsea cables, including thermal emissions, identified that buried cables can warm the sediment in direct contact with the cable, which can then have an impact on the chemical and physical properties of the substrate. The thermal profile of a cable, however, can depend heavily on physical characteristics of the burial and the sediment (Taormina *et al.,* 2018). In addition, for buried cables, the temperature change at the seabed is reduced due to the distance between the cable and the seabed surface as a result of the increased dissipation of heat with distance from the cable (Meißner *et al.,* 2007). A study conducted at Nysted OWF in Denmark (Meißner *et al.,* 2007) found the temperature change in the top 30cm of sediment (where most infauna live) above a high voltage cable (132kV) to be a maximum of 2°C, which is well within the thermal tolerance for most benthic organisms. For cables that are unburied and instead protected by thick concrete mattresses or rock berms, the heat conduction is likely to be negligible due to the density of the structures. The Taormina *et al.* (2018) review concluded the small area associated with these cable corridors, and the expected weakness of thermal radiation, would not produce a significant impact. A Cable Plan for Morven North will include cable burial where possible or cables will be protected as necessary, therefore, there is limited scope for impacts to benthic invertebrates due to heat from subsea cables. This impact was specifically raised in the consultation from MD-LOT (see Section 8.4), in relation to the consultation response from the Scottish Fishermen's Federation. The Scottish Ministers were content with the approach to scoping of impacts and assessment as outlined in the Scoping Report, and consideration of this impact has been provided here.
Impacts to benthic invertebrates due to EMF	×	✓	×	The generation of EMFs is reliant on the flow of electricity through the cables during the O&M phase, and therefore this impact is scoped out during the construction and decommissioning phases, as the cables will not be operational and therefore will not generate EMFs.

8.6 Approach to baseline characterisation

8.6.1.1 The benthic subtidal ecology baseline environment has been characterised through site specific data and a literature review of key desktop datasets and reports (see Table 8.8). This list is not exhaustive; further datasets and reports are covered in more detail within Volume 3, Annex 8.1: Morven North and Morven South Shared Technical Report.

8.6.2 Relevant guidance

8.6.2.1 There are a number of guidance documents which have been considered when compiling the baseline for this chapter, and the key documents are described below.

8.6.2.2 The Guidelines for Ecological Impact Assessment in the UK and Ireland - Terrestrial, Freshwater, and Coastal (Chartered Institute of Ecology and Environmental Management (CIEEM, 2022)), which outline the standard approach to the EIA process, have been adapted for the details specific to Morven North.

8.6.2.3 The Oslo and Paris Conventions (OSPAR) guidance on Environmental Considerations for Offshore Wind Farm Development has a primary aim to provide scientific guidance to those involved with the gathering, interpretation, and presentation of data within an EIA as part of the consents application process (OSPAR Commission, 2008).

8.6.3 Desktop study

8.6.3.1 The benthic subtidal ecology baseline environment within the Benthic Subtidal Ecology Study Area has been characterised through site specific data and a literature review of key desktop datasets and reports (see Table 8.8). This list is not exhaustive; further datasets and reports are covered in more detail within Volume 3, Annex 8.1: Morven North and Morven South Shared Technical Report.

Table 8.8: Summary of key desktop reports used to characterise the benthic subtidal ecology baseline

Title	Source	Year	Author
European Marine Observation and Data Network (EMODnet) broad scale seabed habitat map for Europe (EUSeaMap)	EMODnet – Seabed Habitats	2024	(EMODnet)
National Biodiversity Network (NBN) Atlas	NBN Atlas	2024	(NBN Atlas)
The Marine Scotland National Marine Interactive (NMPi) maps	Marine Scotland	2024	NMPi (2025)
Cambois Connection – Marine Scheme. Environmental Statement (ES) – Volume 2, ES Chapter 8: Benthic Subtidal and Intertidal Ecology	SSE Renewables	2023	SSE Renewables (2023)
Berwick Bank Wind Farm Offshore EIA Appendix 8.1: Benthic Subtidal and Intertidal Ecology Technical Report	SSE Renewables	2022	SSE Renewables (2022a)
Eastern Green Link 2 - Marine Scheme Environmental Appraisal Report Volume 2 Chapter 8 - Benthic Ecology	National Grid Electricity Transmission and Scottish Hydro Electric Transmission	2022	National Grid Electricity Transmission and Scottish Hydro Electric Transmission plc (2022)
Benthic subtidal ecology validation survey undertaken for the Seagreen (Alpha) Export Cable Corridor marine licence application	Seagreen Ltd	2021	Seagreen (2021)
A big data approach to macrofaunal baseline assessment, monitoring and sustainable exploitation of the seabed	Centre for Environment, Fisheries and Aquaculture Science (Cefas)	2017	Cooper and Barry (2017)
Descriptions of Scottish PMFs	Scottish Natural Heritage	2016	Tyler-Walters *et al*. (2016)

Title	Source	Year	Author
Kincardine Offshore Wind Farm: ES	Kincardine Offshore Wind Farm	2016	Kincardine OWF Limited (2016)
Hywind Scotland Pilot Park ES	Hywind Offshore Wind Farm	2015	Statoil (2015)
Firth of Forth Banks Complex MPA – Relevant Documentation – Site Summary Document	Joint Nature Conservation Committee (JNCC)	2014	JNCC (2014)
Biotope Assignment of Grab Samples from Four Surveys Undertaken in 2011 Across Scotland's Seas (2012)	JNCC	2014	Pearce *et al*. (2014)
Analysis of seabed imagery from the 2011 survey of the Firth of Forth Banks Complex, the 2011 International Bottom Trawl Survey Quarter 4 survey and additional deep water sites from Marine Scotland Science surveys	JNCC	2014	Axelsson *et al*. (2014)
Mapping habitats and biotopes from acoustic datasets to strengthen the information base of MPAs in Scottish waters – Phase 2	JNCC	2014	Sotheran and Crawford-Avis (2014)
Environmental Impact Statement. Volume 1, Chapter 11 Benthic Ecology and Intertidal Ecology	Seagreen Ltd	2012	Seagreen Wind Energy Limited (2012)
Offshore ES, Volume 1B: Biological Environment, Chapter 12 Benthic Ecology	Inch Cape Offshore Ltd	2011	Inch Cape Offshore Limited (2011)
European Offshore Wind Deployment Centre: Request for an EIA, Scoping Opinion	Aberdeen Offshore Wind Farm Ltd	2010	Aberdeen OWF Limited (2010)
Appendix 7.1 Benthic Characterisation Survey Report	Neart na Gaoithe Offshore Wind Ltd	2010	Neart na Gaoithe Offshore Wind Ltd (2010)
The Marine Nature Conservation Review (MNCR) Area Summary for southeast Scotland and northeast England	JNCC	1998	Brazier *et al*. (1998)

8.6.4 Identification of designated sites

8.6.4.1 All designated sites within the Regional Benthic Subtidal Ecology Study Area and qualifying interest features that could be affected by the construction, O&M and decommissioning phases of Morven North were identified using the three-step process described below:

- Step 1: All designated sites of international, national and local importance within the Regional Benthic Subtidal Ecology Study Area were identified using a number of sources. These sources included the MPA Mapper (JNCC, 2025) and the Scottish NMPi (NMPi, 2025);
- Step 2: Information was compiled on the relevant designated benthic subtidal ecology features for each of these sites as follows: Firth of Forth Banks Complex MPA, Southern Trench MPA,

Firth of Tay and Eden Estuary SAC, Berwickshire and North Northumberland Coast SAC, and Isle of May SAC;

- Step 3: Using the above information and expert judgement, sites were included for further consideration if:
  - a designated site directly overlaps with the Morven North Boundary;
  - sites and associated features were located within the potential ZoI for impacts associated with Morven North, which varies dependent on impact and refers to the area in which benthic subtidal ecology could be impacted as a result, as detailed in Section 8.2.

8.6.5 Site specific surveys

8.6.5.1 A summary of the surveys undertaken to inform the benthic subtidal ecology assessment of effects is outlined in Table 8.9 and further detail of the survey methodologies and results is included within Volume 3, Annex 8.1: Benthic Subtidal Ecology Shared Technical Report.

8.6.5.2 These surveys were conducted to characterise both the Morven North and Morven South Benthic Subtidal Ecology Study Areas.

Table 8.9: Summary of site specific surveys

Title	Extent of survey	Overview of survey	Survey contractor	Date	Reference to further information
Pre-construction site investigation geophysical survey	Morven North Boundary and Morven South Boundary	Subtidal geophysical survey – Multi-beam echo sounder, side scan sonar, magnetometer, Innomar sub-bottom profiler and two dimensional Ultra-high resolution seismic survey.	Gardline Ltd	2022	Volume 3, Annex 8.1: Morven North and Morven South Shared Technical Report
Benthic Subtidal Survey	Survey Area	Grab and Drop Down Video (DDV) sampling.	Gardline Ltd	2022	Volume 3, Annex 8.1: Morven North and Morven South Shared Technical Report

8.7 Baseline environment

8.7.1 Overview of baseline environment

8.7.1.1 The following sections provide a summary of the benthic subtidal ecology baseline environment. The Volume 3, Annex 8.1: Morven North and Morven South Shared Technical Report includes full details of the analyses undertaken to develop the baseline and information on benthic subtidal ecology. Multivariate analysis was conducted for samples from across the entire Survey Area, to provide a full characterisation of the benthic habitats. Therefore, stations have been included for multivariate analysis in Morven North which fall outside of the Morven North Benthic Subtidal Ecology Study Area, as this provides the best characterisation of benthic habitats from across the entire Survey Area. Following this, univariate statistics were derived from stations present within the

Morven North Benthic Subtidal Ecology Study Area and the Morven South Benthic Subtidal Ecology Study Area separately, accounting for Shared Sampling Locations.

Regional Benthic Subtidal Ecology Study Area

8.7.1.2 The Regional Benthic Subtidal Ecology Study Area was characterised through a desktop review of key literature sources (presented in Table 8.8). Broadscale seabed substrate data indicated that, in terms of EMODnet sediment classifications, the Regional Benthic Subtidal Ecology Study Area is dominated by the European Union Nature Information System (EUNIS) classification of "deep circalittoral coarse sediment" (A5.15), interspersed with areas of "deep circalittoral sand" (A5.27). The sediment transitions to become more dominated by "deep circalittoral sand" (A5.27) in the east of the Regional Benthic Subtidal Ecology Study Area, with smaller patches of "deep circalittoral mud" (A5.37) in the west. Areas closer to the shore in the southwest were characterised by "Atlantic and Mediterranean moderate energy circalittoral rock" (A4.2) and "deep circalittoral mixed sediment" (A5.45). The distribution of these sediments is shown in Figure 8.2.

8.7.1.3 There were a diverse range of benthic species and communities identified within the Regional Benthic Subtidal Ecology Study Area by Axelsson *et al*. (2014), Sotheran and Crawford-Avis (2014), Tyler-Walters *et al*. (2016), Cooper and Barry (2017), and the Scottish Environmental Protection Agency (Pearce and Kimber, 2020, SEPA, 2018), and from site specific surveys undertaken for other OWFs (see Volume 3, Annex 8.1: Morven North and Morven South Shared Technical Report for a full account and Table 8.10 for a summary). However, it should be noted that these datasets were largely based on areas further inshore and with different sediment compositions compared to Morven North. Species and communities listed in Table 8.10 and identified in the site specific survey for Morven North include the brittlestar (*Amphiura filiformis*), the bivalves (*Kurtiella bidentata* and *Abra nitida*), the pea urchin (*Echinocyamus pusillus*), and the Ross worm (*Sabellaria spinulosa*).

Table 8.10: Overview of benthic communities from other projects within the Regional Benthic Subtidal Ecology Study Area

Project	Minimum distance to Morven North (km)	Community Overview	Source
Eastern Link 1	0	Relatively diverse polychaete dominated communities, including species such as *Paramphinome jeffreysii*, *S. spinulosa*, and *Peresiella clymenoides*, while the second most common group was composed of crustacean amphipods such as *Bathyporeia elegans* and *Centraloecetes kroyeranus*. Most stations along the installation corridor were classified as *Thyasira* spp. and *Ennucula tenuis* in circalittoral sandy mud (SS.SMu.CSaMu.ThyEten)	National Grid (2022)
Seagreen 1 Offshore Wind Farm	25.2	The west of Seagreen 1 Offshore Wind Farm was dominated by SS.SBR.PoR.SspiMx, *Moerella* spp. with venerid bivalves in infralittoral gravelly sand	Seagreen Wind Energy Limited (2012)

Project	Minimum distance to Morven North (km)	Community Overview	Source
		(SS.SCS.ICS.MoeVen) and *Flustra foliacea* and *Hydrallmania falcata* on tide-swept circalittoral mixed sediment (SS.SMX.CMx.FluHyd), with SS.SMx.OMx.PoVen in the east.	
Berwick Bank Offshore Wind Farm	31.7	The east of the Berwick Bank array area was populated by sand based communities including *Amphiura filiformis*, *Kurtiella bidentata* and *Abra nitida* in circalittoral sandy mud (SS.SMu.CSaMu.AfilKurAnit) and *Echinocyamus pusillus*, *Ophelia borealis* and *Abra prismatica* in circalittoral fine sand (SS.SSa.CFiSa.EpusOborApri), accompanied by smaller areas of offshore circalittoral sand (SS.SSa.OSa), and *Kurtiella bidentata* and *Thyasira* spp. in circalittoral muddy mixed sediment (SS.SMx.CMx.KurThyMx). The west of the Berwick Bank array area was characterised by mixed sediment and mud-based communities, including polychaete-rich deep Venus community in offshore mixed sediments (SS.SMx.OMx.PoVen) and SS.SMu.CSaMu.AfilKurAnit biotopes, with two patches of non-reef forming *Sabellaria spinulosa* on stable circalittoral mixed sediment (SS.SBR.PoR.SspiMx) in the south.	SSE Renewables (2022b)
Cambois Connection Marine Scheme	37.8	Subtidal biotopes were dominated by *Abra prismatica*, *Bathyporeia elegans* and polychaetes in circalittoral fine sand (SS.SSa.CFiSa.ApriBatPo), interspersed with less frequent *Paramphinome jeffreysii*, *Thyasira* spp. and *Amphiura filiformis* in offshore circalittoral sandy mud (SS.SMu.OMy.PjefThyAfil) and the higher level biotope of	SSE Renewables (2023), Xodus (2022)

Project	Minimum distance to Morven North (km)	Community Overview	Source
		offshore circalittoral mixed sediment (SS.SMx.OMx).	
Seagreen 1A Project	40.9	The Seagreen Project 1A survey recorded sandy mud biotopes (circalittoral sandy mud (SS.SMu.CSaMu) and SS.SMu.CSaMu.AfilKurAnit across the mid-section of the export cable corridor survey area. SS.SMx.OMx.PoVen and *Ophiothrix fragilis* and/or *Ophiocomina nigra* brittlestar beds on sublittoral mixed sediment (SS.SMx.CMx.OphMx) were recorded in the furthest offshore samples within the export cable corridor survey area. The inshore sections of the export cable corridor survey area were dominated by muddy sediment biotopes, seapens and burrowing megafauna in circalittoral fine mud (SS.SMu.CFiMu.SpnMeg) and *Melinna palmata* with *Magelona* spp. and *Thyasira* spp. in infralittoral sandy mud (SS.SMu.ISaMu.MelMagThy).	Seagreen Wind Energy Limited (2012)
Kincardine Floating Demonstration Offshore Wind Farm	43.2	Predominantly characterised by the biotope SS.SSa.OSa, with epifauna including *Alcyonium digitatum* and *Asterias rubens*.	Kincardine OWF Limited (2016)
Inch Cape Offshore Wind Farm	61.4	The dominant biotopes within Inch Cape OWF were SS.SMx.CMx.KurThyMx covering a majority of the OWF, offshore circalittoral coarse sediment SS.SCS.OCS covering a minority of the area, and *Mediomastus fragilis*, *Lumbrineris* spp. and venerid bivalves in circalittoral coarse sand or gravel (SS.SCS.CCS.MedLumVen) being present at a small number of stations.	Inch Cape Offshore Limited (2011)
Aberdeen Offshore Wind Farm	63.1	Communities associated with the biotopes circalittoral coarse sediment (SS.SCS.CCS) and circalittoral muddy sand (SS.SSa.CMuSa)	Aberdeen OWF Limited (2010)

Project	Minimum distance to Morven North (km)	Community Overview	Source
Hywind Offshore Wind Farm	63.9	Circalittoral fine sand characterised by sparse epifaunal hermit crabs, brittlestars, hydroids, and anemones, with infaunal polychaetes *Scoloplos armiger*, *Spiophanes bombyx* and *Owenia fusiformis*, the brittlestars *A. filiformis* and *Ophiocten affinis* and the burrowing sea urchins *Spatangus* sp. and *E. pusillus*.	Statoil (2015)
Neart na Gaoithe Offshore Wind Farm	81.5	*Amphiura filiformis* and *Ennucula tenuis* in circalittoral and offshore sandy mud (SS.SMu.CSaMu.AfilEten) was identified throughout the study area, with small patches of SS.SMu.CSaMu.ThyEten in the east. The biotope SS.SSa.CFiSa.ApriBatPo was identified in the south and the biotope *Owenia fusiformis* and *Amphiura filiformis* in offshore circalittoral sand or muddy sand (SS.SSa.OSa.OfusAfil) was present in the north and west.	Neart na Gaoithe Offshore Wind Ltd (2010)
Eastern Link 2	94.7	Characteristic species of coarse or mixed sediment habitats included the polychaetes *M. fragilis*, *Lumbrineris* spp., *Glycera lapidum*, *E. pusillus* and a range of encrusting fauna. Habitats dominated by sand were characterised by species such as the brittlestar *A. filiformis*, the polychaetes *Goniada maculata*, *Diplocirrus glaucus* and *Spiophanes kroyeri* and the bivalve *Timoclea ovata*.	National Grid Electricity Transmission and Scottish Hydro Electric Transmission plc (2022)

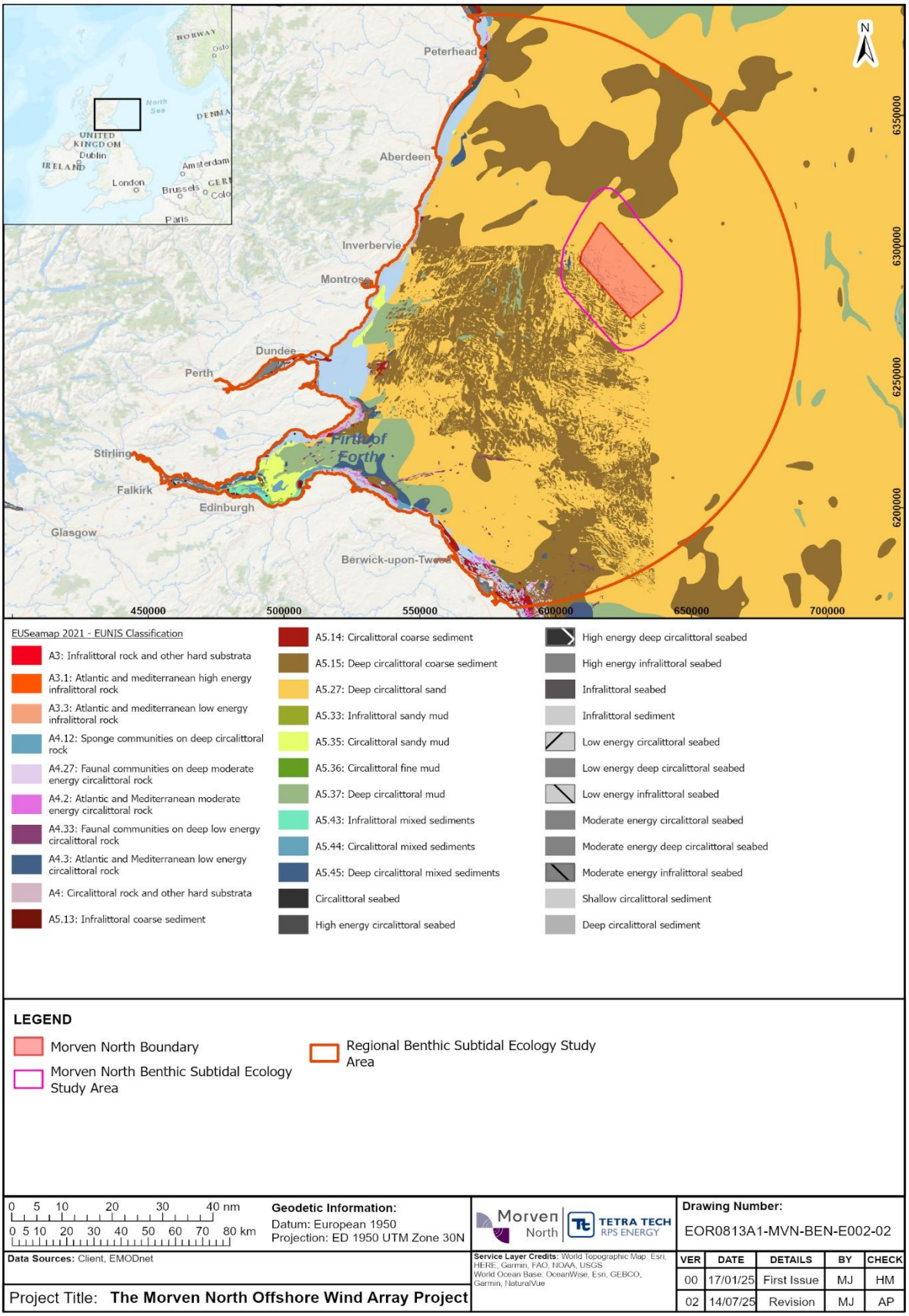

Figure 8.2: EUSeaMap data showing European Union Nature Information System seabed classifications for the Regional Benthic Subtidal Ecology Study Area

Morven North Benthic Subtidal Ecology Study Area

8.7.1.4 Overall, the results from the site specific benthic survey (see Table 8.9 and Volume 3, Annex 8.1: Morven North and Morven South Shared Technical Report) concluded that the Morven North Benthic Subtidal Ecology Study Area was dominated by fine to medium sand with varying amounts of gravel and shell fragments. The seabed was dominated by current induced bedform orientated from west-northwest to east-southeast, with the most defined bedforms found in the north, reaching wavelengths of up to 50m. The sediment composition was mainly dominated by sand, with coarser sediments found in the northwest of the Morven North Benthic Subtidal Ecology Study Area, and higher mud content found in the southeast. These results are broadly in line with the EUSeaMap broadscale substrate data, which indicate that the Morven North Benthic Subtidal Ecology Study Area is dominated by deep circalittoral sand (A5.27) interspersed with deep circalittoral coarse sediment (A5.15) (Figure 8.2).

8.7.1.5 Regarding sediment contamination, levels of organotins were below the limit of detection at all sampled stations. PCB concentrations at all stations were below Marine Scotland AL1 and AL2, and CSQG TEL thresholds. PAH concentrations were below CSQG TEL and CSQG Probable Effect Level (PEL) and ERL and ERM thresholds. Metals were under Marine Scotland AL1 and AL2, and CSQG TEL and PEL at all stations, except for station ENV054, located in the northernmost corner of the Morven North Benthic Subtidal Ecology Study Area, which exceeded AL1 and CSQG for arsenic. Total Organic Matter (TOM) and organic carbon varied across the Morven North Benthic Subtidal Ecology Study Area, with the highest TOM also noted at ENV054.

8.7.1.6 Across the survey area, the infaunal communities were generally dominated by Annelida (41.22% of all individuals) and Arthropoda (26.53% of all individuals). The most abundant individual taxon was *S. bombyx*, with a total of 5,958 individuals recorded. The phyletic composition of non-colonial fauna was dominated by annelids, mainly the polychaetes *S. bombyx* and *S. armiger*. The phyletic composition of sessile colonial fauna was dominated by cnidarians and bryozoans, with common colonial or encrusting species including *Electra monostachys*, *Alcyonidium diaphanum*, and *Leptothecata* spp. across many stations. Biomass between grab sampling sites was varied. Echinoderms comprised the majority of the biomass within the grab samples (48.77%), which was largely due to the common heart urchin *Echinocardium cordatum*.

8.7.1.7 The most abundant epifaunal non-colonial fauna identified in the DDV footage and photography were the broad group Animalia tube, which could not be further refined from the camera footage. The second most abundant non-colonial fauna was the polychaete *Ampharete falcata*. Of the 109 taxa recorded in the epifauna, Flustridae and Scaphopoda were recorded across the greatest number of stations.

8.7.1.8 Species richness, diversity, and evenness were relatively similar across most stations, potentially due to the limited overall variation in sediment composition. The number of taxa and the number of individuals ranged from 45 to 52 and 122 to 264 per 0.1m^2, respectively, within the survey area. There were 16 statistical groups identified by the Similarity Proofing (SIMPROF) test on square root transformed macrofaunal data, presented as a non-metric Multidimensional Scaling plot in two dimensions, excluding the outlier station ENV054, in Figure 8.3. The two-dimensional ordination has a stress value of 0.26 and is thus deemed not representative of the stations' three dimensional ordination but illustrates the 16 statistical groups. From the 16 statistical groups, four distinct biotopes were classified within the Morven North Benthic Subtidal Ecology Study Area. These were SS.SSa.CFiSa.ApriBatPo, SS.SSa.CFiSa.EpusOborApri, circalittoral fine sand (SS.SSa.CFiSa), and SS.SMx.OMx.PoVen. One station, ENV054, was the only station assigned the biotope SS.SMx.OMx.PoVen, due to the very poorly sorted sandy gravel sediment at this station, and lower abundances of all common species including *S. bombyx*, and the lack of *S. armiger* which was otherwise found at all but one other station.

8.7.1.9 Habitat analyses were performed, with conclusions of there been no stations which showed resemblance to the "seapen and burrowing megafauna communities" habitat; no *S. spinulosa* or *Modiolus modiolus* reef structures, no boulders or cobbles which could be classified as rocky reef,

and no habitats which could be classified as fragile sponge and anthozoan communities on subtidal rocky habitats.

8.7.1.10 The distribution of infaunal biotopes based on grab sample data, and epifaunal biotopes for two stations (ENV001 and ENV068) at which only DDV footage was collected, are presented in Figure 8.4.

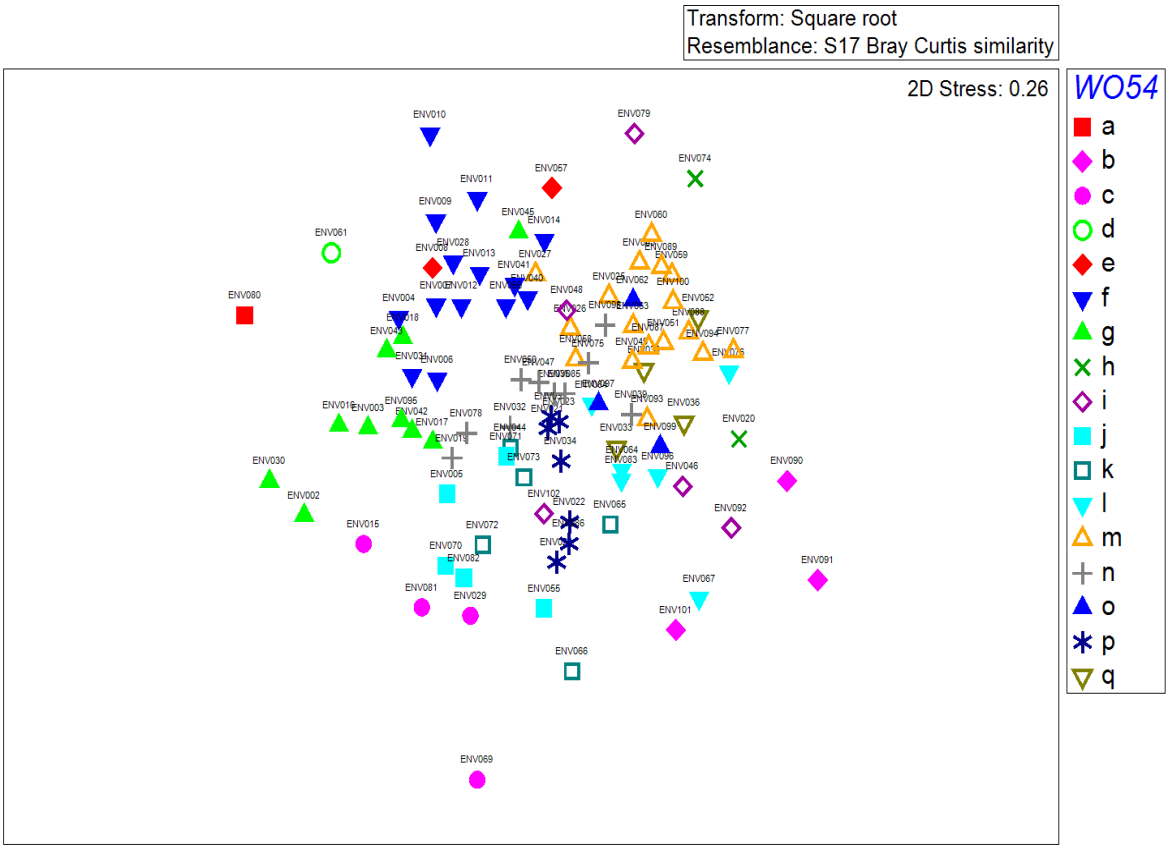

Figure 8.3: Two dimensional Multidimensional Scaling plot of faunal groups from benthic subtidal grab samples, excluding ENV054

Figure 8.4: Combined infaunal and epifaunal biotopes across the Survey Area

8.7.2 Designated sites

8.7.2.1 Designated sites identified for the benthic subtidal ecology chapter are described in Table 8.11 and shown in Figure 8.5.

Table 8.11: Designated sites and relevant qualifying interest features for the benthic subtidal ecology chapter

Designated site	Closest distance to Morven North (km)	Closest distance to Morven North Benthic Subtidal Ecology Study Area (km)	Relevant qualifying interest feature(s)
Firth of Forth Banks Complex MPA	0.04	0.00	Ocean quahog Offshore subtidal sands and gravels Shelf banks and mounds Quaternary of Scotland: Moraines
Southern Trench MPA	56.8	45.4	Burrowed mud Shelf deeps Quaternary of Scotland: Moraines Quaternary of Scotland: Sub-glacial tunnel valleys Submarine Mass Movement: Slide scars
Firth of Tay and Eden Estuary SAC	95.9	87.1	Estuaries Sandbanks which are slightly covered by sea water all the time
Berwickshire and North Northumberland Coast SAC	101.9	90.6	Large shallow inlets and bays Reefs Submerged or partially submerged sea caves
Isle of May SAC	104.7	93.8	Reefs

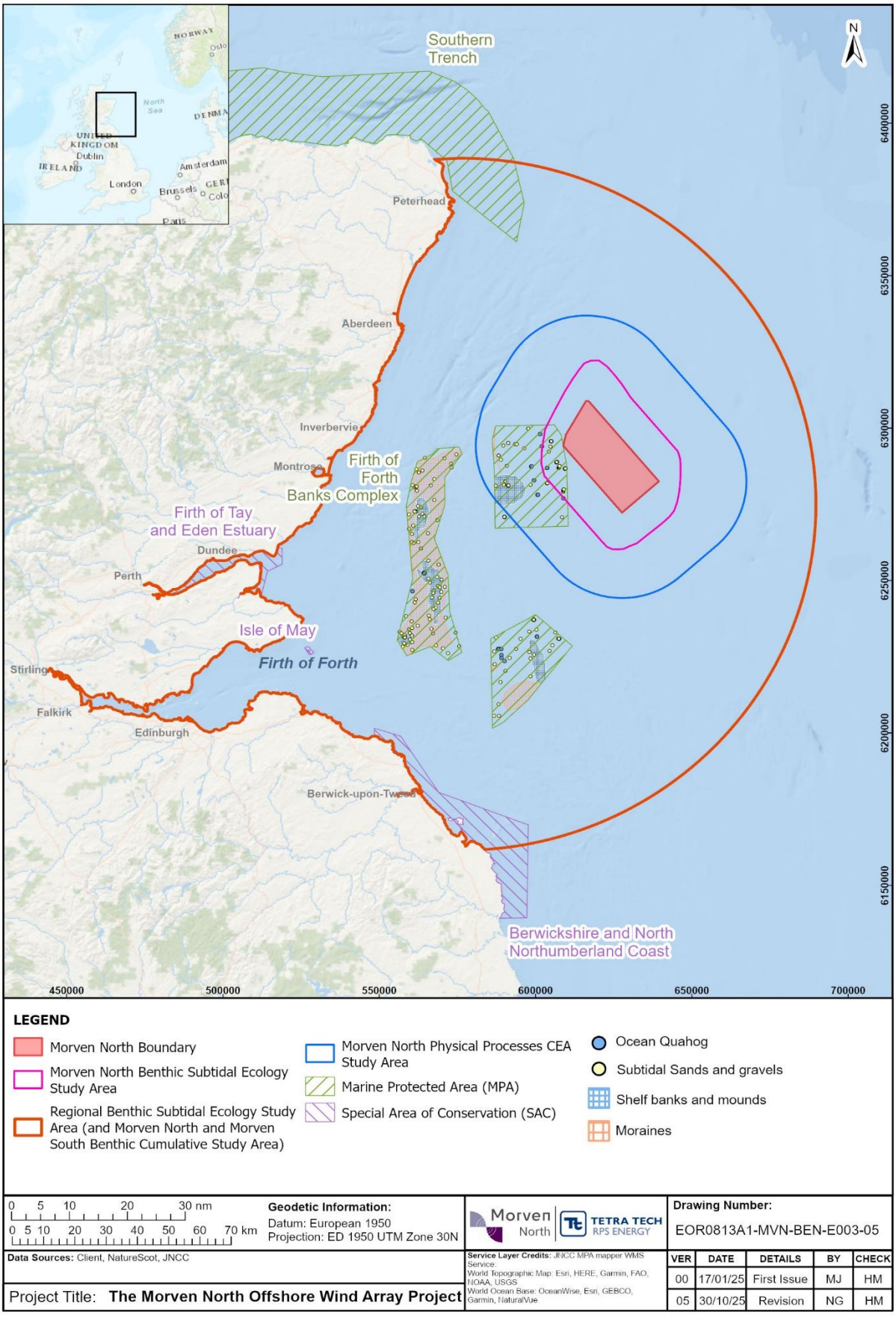

Figure 8.5: Designated sites with benthic ecology features within the Regional Benthic Subtidal Ecology Study Area

8.7.2.2 The Firth of Forth Banks Complex MPA overlaps with the Morven North Benthic Subtidal Ecology Study Area. This MPA covers a total area of 2,130km^2 and is split into three separate areas, known as the Berwick Bank, Scalp Bank and Montrose Bank, and Wee Bankie. Only the Montrose Bank overlaps directly with the Morven North Benthic Subtidal Ecology Study Area, with the Berwick Bank and Wee Bankie areas to the west and southwest respectively.

8.7.2.3 The Firth of Forth Banks Complex MPA is designated for ocean quahog aggregations, offshore subtidal sands and gravels, shelf banks and mounds, and moraines (JNCC, 2021), with conservation objectives to ensure the protected features so far as already in favourable condition remain in such condition, and features not in favourable condition be brought into that condition. The ocean quahog aggregations and offshore subtidal sands and gravels, both of which are currently in unfavourable condition, are present in the Montrose Bank and therefore overlap with the Morven North Benthic Subtidal Ecology Study Area and have been given consideration as IEFs in Section 8.7.3.

8.7.3 Important Ecological Features

8.7.3.1 In accordance with CIEEM guidelines (2018), IEFs have been identified for assessment within this chapter. Ecological features (habitats, species, ecosystems and functions/processes) recorded within the Morven North Benthic Subtidal Ecology Study Area have been evaluated and a nature conservation value assigned based on the criteria set out in Table 8.12.

8.7.3.2 The defining characteristics and the classification of IEFs within the Morven North Benthic Subtidal Ecology Study Area are provided in Table 8.13, with justifications for the importance rankings. These species and habitats will be taken forward for assessment. Impacts on IEFs will be described in terms of the magnitude of that impact and correlated against the sensitivity of each IEF to each impact, to produce a statement of significance.

Table 8.12: Defining Criteria for Important Ecological Features

Value of IEF	Defining criteria
International	Internationally designated sites. Species or habitats protected under international law (i.e. Annex I habitats listed as qualifying interests of SACs).
National	Nationally designated sites. Species protected under national law. OSPAR List of Threatened and/or Declining Species, and International Union for Conservation of Nature (IUCN) Red List species that have nationally important populations within the Morven North Boundary, particularly in the context of species/habitat that may be rare or threatened in Scottish waters. Species that are listed as PMFs as they have been deemed features characteristic of Scottish marine environment and are likely to be one of the characteristic species within the Regional Benthic Subtidal Ecology Study Area.
Regional	OSPAR List of Threatened or Declining Species, and IUCN Red List species that have regionally important populations within the Morven North Boundary (i.e. are locally widespread or abundant). Species that are of commercial value to the fisheries which operate within the Morven North Boundary. Species that form an important prey item for other species of conservation or commercial value and that are key components of the benthic assemblages within the Morven North Boundary. Species that are listed as PMFs but are not a key contributing species to the characterisation of the Regional Benthic Subtidal Ecology Study Area.

Value of IEF	Defining criteria
Local	Species that are of commercial importance but do not form a key component of the benthic assemblages within the Morven North Boundary (e.g. they may be exploited in shallower/deeper waters outside the Morven North Boundary). Species is common throughout Scottish waters but forms a component of the benthic assemblages in the Morven North Boundary.

Table 8.13: Important Ecological Feature Species within the Benthic Subtidal Ecology Study Area

IEF	Description and Representative Biotope	Protection status	Conservation interest	Importance within the Benthic Subtidal Ecology Study Area
Offshore subtidal sands and gravels	SS.SMx.OMx.PoVen SS.SSa.CFiSa SS.SSa.CFiSa.ApriBatPo SS.SSa.CFiSa.EpusOborApri	Throughout the entire Moven North Benthic Subtidal Ecology Study Area	PMFs (Scotland) Qualifying feature of Firth of Forth Banks Complex MPA Biodiversity Action Plan Priority Habitat	National
Ocean quahog	Arctica islandica	Within the Firth of Forth Banks MPA complex and across the Morven North Benthic Subtidal Ecology Study Area	PMFs (Scotland) Qualifying feature of Firth of Forth Banks Complex MPA OSPAR Annex V	International

8.7.4 Future baseline scenario

8.7.4.1 The EIA Regulations require the following to be included within the EIA Report: "a description of the relevant aspects of the current state of the environment (baseline scenario) and an outline of the likely evolution thereof without development as far as natural changes from the baseline scenario can be assessed with reasonable effort, on the basis of the availability of environmental information and scientific knowledge."

8.7.4.2 In the event that Morven North does not come forward, an assessment of the future baseline conditions has been carried out and is described within this section.

8.7.4.3 It is necessary to account for potential impacts caused by climate change outside of the natural existing cycles and fluctuations in processes. The Department of Energy and Climate Change (DECC, 2022) Offshore Energy Strategic Environmental Assessment indicates long-term impacts on the composition and distribution of benthic habitats and species are likely to occur due to climate change. This assessment was based on predictions of future changes in physical processes, and predictions of local and regional nutrient flows and siltation patterns (DECC, 2022). This reflects the findings of a Marine Climate Change Impacts Partnership report (Moore and Smale, 2020), which predicted significant shifts in shallow shelf habitat and species distributions within the North Sea based on future climate change models.

8.7.4.4 Anthropogenic activities, such as pollution, contamination, and seabed disturbance, will all continue to occur in the North Sea in relation to other projects and plans even if Morven North does not come forward, and these could cause potentially significant benthic community changes over time.

8.7.4.5 Recently, the Department for Environment, Food, and Rural Affairs (DEFRA) has centred their focus on the risk of climate change to ecosystem services on the following topics:

- INNS and their likely detriment to native communities and ecosystems;

- the increased risk to species of disease from new pathogens as their distributions shift;
- the impacts on areas of high biodiversity value in the coastal zone from increased storms and erosion (UK Government, 2022).

8.7.4.6 Overall, localised changes in community assemblage may occur due to pollution, contamination, and anthropogenic seabed disturbance and erosion (DECC, 2016, DECC, 2022, HM Government, 2022, UK Government, 2022). DEFRA also highlighted that the risks associated with INNS, ocean acidification, and higher water temperatures are linked to climatic changes (UK Government, 2022), which could also have impacts on benthic subtidal ecology on a wider scale. However, the potential pressures described are unlikely to result in any significant changes to substrate type, which is a key driver of species assemblages and biotope classification. Nonetheless, it is difficult to define, for certain, how the baseline will evolve in the future, particularly at the species-level.

8.7.5 Data limitations and assumptions

8.7.5.1 The data sources used in this chapter are detailed in Table 8.8 and Volume 3, Annex 8.1: Morven North and Morven South Shared Technical Report. The desktop data used are the most up to date available information published in the public domain, and the baseline characterisation is based on existing literature and guidance as outlined in Section 8.6.3. Data sources have been informed through consultation with stakeholders where relevant.

8.7.5.2 The benthic subtidal ecology baseline was also characterised using site specific surveys (see Table 8.9). However, there is a small possibility that the benthic communities will have changed in the period since the site specific surveys were carried out in 2022. Nonetheless, as the surveys were conducted less than five years prior to submission of this EIA Report, conditions are unlikely to have changed substantially and therefore the results are likely to still be representative of the current baseline environment and are considered to be fully valid. The sampling design and data collection processes have provided reliable and robust data on the benthic infaunal and epifaunal communities within the Morven North Benthic Subtidal Ecology Study Area, which fully encompasses Morven North.

8.7.5.3 Interpreting data collected from site specific surveys has its limitations. Specific to these surveys, two stations were unable to be sampled using a grab sampler and could instead only be surveyed using DDV, limiting the amount of detail which could be gathered from these stations. More generally, it can often be difficult to interpolate data collected from discrete sample locations to cover an extensive area such as the entire Survey Area and define the precise extent of each biotope. Benthic communities generally show a transition from one biotope to another and, therefore, boundaries indicate where communities grade into one another rather than where one ends, and another begins. Biotope boundaries were, therefore, broadly based on the geophysical survey results and bedform features. The classification of the community data into biotopes is not always straightforward, as some communities do not readily fit the available descriptions in the biotope classification system due to the natural complexity of benthic habitats and species distribution. However, this site specific study does provide a suitable baseline characterisation which describes the main habitats and communities within the Morven North Benthic Subtidal Ecology Study Area.

8.8 Methodology for assessment of effects

8.8.1 Overview

8.8.1.1 The benthic subtidal ecology assessment of effects has followed the methodology set out in Volume 1, Chapter 4: EIA Methodology, of the Morven North EIA Report. Specific to the benthic subtidal ecology assessment of effects, the following guidance documents have also been considered:

- Guidelines for Ecological Impact Assessment in the UK and Ireland. Terrestrial, Freshwater, and Coastal (CIEEM, 2022);

- Advances in Assessing *Sabellaria spinulosa* Reefs for Ongoing Monitoring (Jenkins *et al*., 2018);
- Marine Evidence Based Sensitivity Assessment – A Guide (Tyler-Walters *et al*., 2018);
- Guidelines for Data Acquisition to Support Marine Environmental Assessments of Offshore Renewable Energy Projects (Judd, 2012);
- Guidance on Survey and Monitoring in Relation to Marine Renewables Deployments in Scotland – Volume 5: Benthic Habitats (Saunders *et al*., 2011);
- Best Methods for Identifying and Evaluating *Sabellaria spinulosa* and Cobble Reef (Limpenny *et al*., 2010);
- Identification of the Main Characteristics of Stony Reef Habitats under the Habitats Directive (Irving, 2009);
- Guidance on Environmental Considerations for Offshore Windfarm Development (OSPAR Commission, 2008);
- Defining and Managing *Sabellaria spinulosa* Reefs (Gubbay, 2007).

8.8.1.2 In addition, the benthic subtidal ecology assessment of effects has considered the policy framework as defined by:

- the SMP for Offshore Wind Energy (Scottish Government, 2020);
- the Scottish NMP (Scottish Government, 2015);
- the UK Marine Policy Statement (UK Government, 2011).

8.8.2 Assessment criteria

8.8.2.1 The approach for determining the significance of effects is a two-stage process that involves defining the magnitude of the potential impacts and the sensitivity of the receptors. This section describes the criteria applied in this chapter to assign values to the magnitude of potential impacts and the sensitivity of the receptors. The terms used to define magnitude and sensitivity are based on those which are described in further detail in Volume 1, Chapter 4: EIA Methodology.

8.8.2.2 The criteria for defining magnitude in this chapter are outlined in Table 8.14 below. Each assessment considered the spatial extent, duration, frequency, and reversibility of impact when determining magnitude, which are outlined within the magnitude section of each impact assessment (e.g. a duration of hours or days would be considered for most receptors to be of short-term duration, which is likely to result in a low magnitude of impact). The frequency refers to the regularity of events, with irregular events being classified as intermittent. The spatial extent gives consideration to the distance potential impacts have a pathway to affect, with local effects usually being notable at the scale of kilometres but rapidly dissipating to background conditions.

Table 8.14: Definition of terms relating to the magnitude

Magnitude of impact	Definition
High	Loss of resource and/or quality and integrity of resource; severe damage to key characteristics, features or elements (Adverse)
	Large scale or major improvement or resource quality; extensive restoration or enhancement; major improvement of attribute quality (Beneficial)
Medium	Loss of resource, but not adversely affecting integrity of resource; partial loss of/damage to key characteristics, features or elements (Adverse)
	Benefit to, or addition of, key characteristics, features or elements; improvement of attribute quality (Beneficial)
Low	Some measurable change in attributes, quality or vulnerability, minor loss of, or alteration to, one (maybe more) key characteristics, features or elements (Adverse)
	Minor benefit to, or addition of, one (maybe more) key characteristics, features or elements; some beneficial impact on attribute or a reduced risk of negative impact occurring (Beneficial)
Negligible	Very minor loss or detrimental alteration to one or more characteristics, features or elements (Adverse)
	Very minor benefit to, or positive addition of one or more characteristics, features or elements (Beneficial)

8.8.2.3 The criteria for defining sensitivity in this chapter are outlined in Table 8.15 below. When an IEF is deemed to be not sensitive to an impact, the overall sensitivity has been recorded as negligible.

Table 8.15: Definition of terms relating to the sensitivity of the receptor

Value (sensitivity of the receptor)	Description
Very high	Very high importance and rarity, international receptor with no potential or very limited potential for recovery
High	High importance and rarity, international and/or national receptor and limited potential for recovery
Medium	High or medium importance and rarity, regional receptor, and potential for recovery
Low	Low or medium importance and rarity, local receptor and high potential for recovery
Negligible	Very low importance and rarity, local receptor and very high potential for recovery

8.8.2.4 The significance of the effect upon benthic subtidal ecology is determined by correlating the magnitude of the impact and the sensitivity of the receptor. The particular method employed for this assessment is presented in Table 8.16.

8.8.2.5 In cases where a range is suggested for the significance of effect, there remains the possibility that this may span the significance threshold (i.e. the range is given as minor to moderate). In such cases the final significance is based upon the expert's professional judgement as to which outcome delineates the most likely effect, with an explanation as to why this is the case.

8.8.2.6 For the purposes of this assessment:

- a level of effect of moderate or more will be considered a 'significant' effect in terms of the EIA Regulations;
- a level of effect of minor or less will be considered 'not significant' in terms of the EIA Regulations.

8.8.2.7 Effects of moderate significance or above are therefore considered important in the decision-making process, whilst effects of minor significance or less warrant little, if any, weight in the decision-making process.

Table 8.16: Matrix used for the assessment of the significance of the effect

Sensitivity of receptor	Magnitude of impact			
	Negligible	Low	Medium	High
Negligible	Negligible	Negligible to minor	Negligible to minor	Minor
Low	Negligible to minor	Negligible to minor	Minor	Minor to moderate
Medium	Negligible to minor	Minor	Moderate	Moderate to major
High	Minor	Minor to moderate	Moderate to major	Major
Very high	Minor	Moderate to major	Major	Major

8.8.3 Designated sites

8.8.3.1 Where Natura 2000 sites (i.e., nature conservation sites in Europe designated under the Habitats or Birds Directives) or sites in the UK that comprise the National Site Network (collectively termed "European sites") are considered, this chapter makes an assessment of the likely significant effects in EIA terms on the qualifying interest feature(s) of the European sites described within Section 8.7.2 of this chapter. The assessment of the likely significant effects on the sites are in Chapter 2.1: RIAA Part 1: Introduction of the HRA Report.

8.8.3.2 With respect to locally designated sites and national designations, where these sites fall within the boundaries of a European site and where qualifying interest features are the same, only the European site has been taken forward for assessment. This is because potential impacts on the integrity and conservation status of the locally or nationally designated site are assumed to be inherent within the assessment of the European site (i.e., a separate assessment for the local or national site is not undertaken). However, where a local or nationally designated site falls outside the boundaries of a European site, but within the Benthic Subtidal Ecology Study Area, an assessment of the likely significant effects on the overall site is made in this chapter using the EIA methodology.

8.9 Parameters for assessment

8.9.1 Maximum Design Scenario

8.9.1.1 The Maximum Design Scenarios (MDSs) identified in Table 8.17 have been selected as those having the potential to result in the greatest effect on an identified receptor or receptor group. These scenarios have been selected from the details provided in Volume 1, Chapter 4: Project Description. Effects of greater adverse significance are not predicted to arise should any other development scenario, based on details within the Project Design Envelope (PDE) (e.g. different infrastructure layout), to that assessed here, be taken forward in the final design scheme.

Table 8.17: Maximum Design Scenario considered for the assessment of potential impacts on benthic subtidal ecology

C= construction, O= Operations and Maintenance, D= decommissioning phases; "✓" is used to denote the phase the potential impact can occur, "X" outlines there is no impact within this project phase

Potential impact	Phase			Maximum Design Scenario	Justification
	C	O	D		
Temporary habitat loss/disturbance	✓	✓	✓	**Construction phase** Up to 74,055,400m^2 of temporary subtidal habitat loss/disturbance in total across Morven North. Maximum duration of the offshore construction phase is up to five years. • Jack-up events: up to 1,958,400m^2 of disturbance from the use of jack-up vessels during foundation installation, with up to three jack-up events at each of 96 wind turbines and three jack-up events at each of the five Offshore Substation Platforms (OSPs) – four High Voltage Alternating Current (HVAC) OSPs and one bridge-linked High Voltage Direct Current (HVDC) OSP. • Cable installation (including sandwave clearance and pre-lay preparation including boulder and debris clearance): up to 18,160,000m^2 of disturbance comprising: – Inter-array cables sandwave clearance: up to 1,272,000m^2 disturbance from installation of up to 424km of inter-array cables (assumes 15% requires sandwave clearance with a 20m width of disturbance). – Inter-array cables boulder clearance: up to 7,208,000m^2 disturbance from installation of up to 424km of inter-array cables (assumes 85% requires boulder clearance with a 20m width of disturbance). – Interconnector cables sandwave clearance: up to 1,452,000m^2 disturbance from installation of up to 484km of interconnector cables (assumes 15% requires sandwave clearance with a 20m width of disturbance).	**Construction phase** Maximum footprint which would be affected during the construction, O&M and decommissioning phases. The MDS assumes 100% of all cables are buried. The MDS assumes that the width of disturbance for sandwave and pre-lay preparation (boulder and debris clearance) also includes subsequent burial. For the purposes of the MDS, and to avoid double counting of disturbance associated with site preparation activities (i.e. boulder clearance and sandwave clearance), the MDS assumes 80% of inter-array and interconnector cables will be subject to pre-lay preparation only. The MDS assumes that the remainder of the cables will be subject to sandwave clearance. The area of seabed affected by the placement of sandwave clearance material has been calculated based on the maximum volume of sediment to be placed on the seabed, assuming all this sediment is coarse material (i.e. is not dispersed through tidal currents; see "Increased SSCs" impact assessment below). The total footprint of seabed affected has been calculated, for the purposes of the MDS, assuming a mound of uniform thickness of 0.5m height. The MDS assumes temporary loss of benthic habitat is beneath this.

Potential impact	Phase			Maximum Design Scenario	Justification
	C	O	D		
				– Interconnector cables boulder clearance: up to 8,228,000m^2 disturbance from installation of up to 484km of interconnector cables (assumes 85% requires boulder clearance with a 20m width of disturbance). • Sandwave clearance material deposition: Up to 52,875,000m^2 of habitat disturbance associated with the deposition of sandwave clearance material comprising: – 26,731,800m^2 from deposition of 13,365,900m^3 of sandwave clearance material associated with seabed preparation for wind turbine and OSP foundations. – 26,143,200m^2 from deposition of 13,071,600m^3 of sandwave clearance material associated with seabed preparation for inter-array and interconnector cables. • Anchor placements: up to 908,000m^2 of habitat disturbance from 500m^2 anchor sets (5 anchors per set) every 500m per inter-array/interconnector cable link during installation. • Cable removal: Up to 100,000m^2 from the removal of 5,000m of disused cables with a width of disturbance of 20m. • UXO removal: clearance of up to 15 UXOs within Morven North ranging from 25kg up to 554kg with 132kg the most likely (common) maximum. **O&M phase** Up to 9,221,800m^2 of temporary subtidal habitat disturbance in total across Morven North. O&M phase up to 35 years. • Up to 777,000m^2 of temporary habitat disturbance due to jack-ups at wind turbines (342,300m^2) and OSPs (434,700m^2) over the lifetime of Morven North for the following:	The area of seabed affected by the placement of sandwave clearance material arising from seabed preparation for wind turbine and OSP foundations has been calculated based on the maximum volume of sediment which is associated with 3-legged suction bucket jacket foundations for wind turbines and gravity base foundations for OSPs. Maximum number and maximum size of UXOs encountered within Morven North. Due to uncertainties in size of UXOs the assessment presents a range, highlighting the most likely size (common) to be encountered. **O&M Phase** The O&M phase will involve repair and replacement events which will cause associated temporary habitat loss, although the overall magnitude at any one time will be lower than during the construction phase. The expected number of repair and replacement events has been based on knowledge of equipment wear and previous experience of cable reburial within this area on other projects. **Decommissioning phase** Parameters for decommissioning will be significantly lower than for the construction phase as sandwave clearance and pre-lay preparation will not be required in advance of cable removal and cable protection and scour protection may be left in situ. The MDS assumes the complete removal of all wind turbine and OSP foundations and cables.

Potential impact	Phase			Maximum Design Scenario	Justification
	C	O	D		
				– Up to 75 major component replacements for wind turbines – Up to 48 major component replacements (one every three years over the lifetime per OSP) for OSPs – Up to 18 access ladder replacements and up to 70 modifications to/replacement of J-tubes for wind turbines – Up to 12 access ladder replacements and up to 147 modifications to/replacement of J-tubes for OSPs • Up to 5,174,400m^2 of temporary habitat disturbance due to inter-array cable maintenance associated with: – 2,374,000m^2 from 7 reburial events affecting up to 16,960m of cable per reburial event – 2,800,000m^2 from 14 repair events (two every five years) affecting up to 10,000m per cable repair events – Assuming 20m width seabed disturbance for repair and remedial burial • Up to 3,270,400m^2 of temporary habitat disturbance due to interconnector cable maintenance: – 2,710,400m^2 from 7 reburial events affecting up to 19,360m per reburial event – 560,000m^2 from 14 repair events (one event per interconnector every 25 years) affecting up to 2,000m of cable per repair event – Assuming 20m width seabed disturbance for repair and remedial burial. **Decommissioning phase** Temporary subtidal habitat loss/disturbance due to: • Cable removal: disturbance from the removal of 424km of inter-array cables and 484km of interconnector cables.	

Potential impact	Phase			Maximum Design Scenario	Justification
	C	O	D		
				• Anchor placements: habitat disturbance from anchor placements during cable removal • Jack-up events: disturbance from the use of jack-up vessels during foundation removal.	
Increased SSCs and associated deposition	✓	✓	✓	**Construction phase** Site Preparation Foundations: • Sandwave clearance activities undertaken over an approximate fifteen month duration within the wider five year construction programme. • Wind turbines and OSP foundations: sandwave clearance has been calculated based on the assumption of clearance at up to 80% of locations. Spoil volume per location has been calculated on the basis of 58 locations supporting the three-legged suction bucket wind turbine foundations and 5 locations supporting a total of six gravity base OSP foundations. This equates to a total sandwave clearance area for Morven North of 3,753,226m^2 or 11,259,679m^3 based on sandwaves 3m in height. The single greatest sandwave clearance area may occur due to the bridge-linked HVDC converter substation OSP with gravity base foundations, with a clearance area up to 597,800m^2 or volume of up to 1,793,400m^3. Site Preparation Cabling: • Inter-array cables: sandwave clearance along 63.6km of cable length, with a base width of 20m, to an average depth of 3m. Total spoil volume of 6,102,000m^3. • Interconnector cables: sandwave clearance along 72.6km of cable length, with a base width of 20m, to an average depth of 3m. Total spoil volume of 6,969,600m^3.	**Construction Phase** **Seabed Preparation** The volume of material to be cleared from individual sandwaves will vary according to the local dimensions of the sandwave (height, length, and shape) and the level to which the sandwave must be reduced. These details are not fully known at this stage, however based on the available data, it is anticipated that the sandwaves requiring clearance in Morven North are likely to be circa 3m in height. The MDS for sandwave clearance to allow the installation of wind turbines and OSPs and their associated scour protection has been selected in line with standard practice and based on the greatest potential volume of suspended sediments at an individual location, rather than over the Morven North Boundary. The 58 three-legged suction bucket wind turbine foundations have been calculated to cause the greatest amount of sediment deposition during site preparation due to the larger size of these 58 foundations compared to the installation of 96 smaller foundations as noted in the long-term habitat loss impact. Similarly, during foundation installation, 34 monopiles were calculated to cause the greatest amount of sediment deposition due to being larger than other

Potential impact	Phase			Maximum Design Scenario	Justification
	C	O	D		
				• Total Cabling spoil volume of 13,071,600m^3, which assumes that 15% of total length of inter-array and inter-connector cables will require sandwave clearance. • Removal of up to 5km of disused cables. Foundation installation • Undertaken over an approximate 21 month duration • Wind turbines: installation of up to 34 monopiles of 16m diameter, drilled to a depth of 64m at a rate of up to 1.5m/h. Three monopiles installed concurrently. Spoil volume of 14,358m^3 per pile. • OSPs: installation of four HVAC collector substation OSPs with foundations consisting of 16m diameter monopiles, drilled to a depth of 64m at a rate of up to 1.5m/h. Two monopiles installed concurrently. Spoil volume of 14,357m^3 per pile. • OSPs: installation of one bridge-linked HVDC converter substation OSP with six-legged jacket foundations, each with a pile diameter of 5m, drilled to a depth of 80m at a rate of up to 1.45m/h. Three piles installed concurrently. Spoil volume of 1,888m^3 per pile. Cable installation • Inter-array cables: Installation via trenching of up to 424km of cable, with a trench width of up to 3m and a depth of up to 3m. Total spoil volume of 1,908,000m^3 assuming triangular cross-section of the trench. Installed over a period of one year. • Interconnector cables: installation via trenching of up to 484km of cable, with a trench width of up to 3m and a depth of up to 3m. Total spoil volume of 2,178,000m^3 assuming	potential foundation options, with drilling involved in this installation process. Maximum SSCs within the water column at a particular location at a particular time during a tidal cycle that are considered critical with regards to the maximum potential deposition on the seabed. Note that although sediment plumes from a sandwave clearance operation at an individual foundation may extend and interact with sediment plumes resulting from similar works at an adjacent turbine location, if these operations are undertaken simultaneously, sediment plumes will align with the tidal currents, with concentration rapidly diminishing with increasing distance from the works. Thus, selection of the MDS is based upon maximum concentrations and the maximum potential seabed deposition at any one location. For all scenarios considered, this would be the bridge-linked HVDC converter OSP with gravity base foundations, thus MDS selection has also focused on the maximum potential concentrations at individual wind turbine foundations. On consideration of the total area over the Morven North Boundary as a whole, the selected MDS covers in excess of 80% of the alternative option with the greatest site coverage. Similarly, the MDS for sandwave clearance to allow for the installation of cables and associated cable protection has been selected in line with standard practice, based on the greatest potential volume of suspended sediments at an individual location. However, as

Potential impact	Phase			Maximum Design Scenario	Justification
	C	O	D		
				triangular cross section of the trench. Installed over a period of one year. **O&M phase** Project lifetime of 35 years. • Inter-array cables: repair of up 10km of cable in two events every five years. Reburial of up to 17km of cable in a maximum of one event every five years. • Interconnector cables: repair of up to 2km of cable in each of 10 events every 25 years. Reburial of up to 19km of cable in a maximum of one event every five years. **Decommissioning phase** Inter-array and inter-connector cables will be removed where it is possible and appropriate to do so. The MDS will assess the removal of all cables.	sandwave clearance width, proportion of cables requiring clearance and sandwave heights remain the same for all scenarios considered, the selected MDS is also capable of producing the largest sandwave clearance areas and volumes over the site as a whole. Site clearance activities may be undertaken using a range of techniques - the suction hopper dredger will result in the greatest increase in suspended sediment and largest plume extent as material is released near the water surface during the disposal of material. Boulder clearance activities will result in minimal increases in SSCs and have therefore not been considered in the assessment. **Foundation Installation** Installation of foundations via augured (drilled) operations results in the release of the largest volume of sediment. The greatest volume of sediment disturbance by drilling at individual foundation locations and across the site as a whole is associated with monopiles for wind turbines. The selected OSP scenario represents the greatest volume of sediment to be released for a drilling event. The greatest drilling rate represents the maximum level of increase in SSC. Maximum drilling rates are similar for all scenarios.

Potential impact	Phase			Maximum Design Scenario	Justification
	C	O	D		
					Cable Installation Cable routes inevitably include a variety of seabed material and in some areas 3m depth may not be achieved or may be of a coarser nature which settles in the vicinity of the cable route. The assessment therefore considers the upper bound in terms of suspended sediment and dispersion potential. Cables may be buried by ploughing, trenching or jetting with trenching or jetting mobilising the greatest volume of material to increase SSCs. **O&M phase -** the greatest foreseeable number of cable reburial and repair events is considered to the MDS for sediment dispersion. **Decommissioning phase** - The removal of cables may be undertaken using similar techniques to those employed during installation, therefore the potential increases in SSCs and deposition would be in-line with the construction phase. Scour and cable protection are anticipated to remain in-situ.
Long-term habitat loss	✓	✓	✓	**Construction and O&M phase** Up to 2,052,797m^2 of long-term habitat loss/habitat alteration in total across Morven North. O&M phase up to 35 years. • Presence of foundations and scour protection: up to 1,116,247m^2 of habitat loss comprising: – Wind turbines: up to 804,914m^2 from the presence of up to 96 wind turbine foundations on suction bucket 3-legged jacket foundations (57,906m^2) with associated scour protection (747,008m^2).	The MDS includes the wind turbine and OSP foundation type and associated scour protection option with the largest seabed footprint, maximum length of cable protection and cable crossings resulting in the greatest extent of habitat loss. The 96 foundations were calculated as these represent the greatest long-term habitat loss during the O&M phase (whereas the 58 foundations noted in the increased SSCs and associated deposition impact represent the greatest amount of

Potential impact	Phase			Maximum Design Scenario	Justification
	C	O	D		
				– OSPs: up to 311,334m^2 from OSPs on gravity base foundations (14,103m^2 for Alternating Current Gravity Bases, and 99,450m^2 for bridge-linked HDVC Gravity Bases) with associated scour protection (197,78m^2) • Presence of cable protection for inter-array and interconnector cables: up to 907,750m^2 of habitat loss comprising: – Inter-array cable protection: 423,750m^2 associated with up to 42,375m of inter-array cables requiring cable protection (10m width of cable protection) – Interconnector cable protection: 484,000m^2 for up to 10% of 484km of interconnector cables requiring cable protection (10m width of cable protection) • Presence of cable crossing protection: up to 28,800m^2 of habitat loss comprising: – Cable protection for cable crossings for inter-array cables: 14,400m^2 from five cable crossings (each up to 80m in length and 36m in width) – Cable protection for cable crossings for interconnector cables: 14,400m^2 from five cable crossings (each up to 80m in length and 36m in width). **Decommissioning phase** Up to 1,881,338m^2 of permanent subtidal habitat loss due to scour and cable protection and cable crossings left in situ post decommissioning.	sediment disturbance and deposition in the construction phase). The MDS for decommissioning (and permanent habitat loss following decommissioning) assumes removal of the foundations, if any additional infrastructure is decommissioned, this will result in a reduced area of permanent habitat loss. Greatest amount of cable and scour protection resulting in the largest area of infrastructure to be left in situ after decommissioning.
Increased risk of introduction and spread of INNS	✓	✓	✓	**Construction phase** Increased risk of INNS due to: • Introduction of artificial structures: up to 3,139,362m^2 as set out in the colonisation of hard structures impact	Maximum surface area created by offshore infrastructure and maximum number of vessel movements during construction, O&M and decommissioning phases.

Potential impact	Phase			Maximum Design Scenario	Justification
	C	O	D		
				• Vessel movement: vessels associated with site preparation, wind turbine installation, OSP installation, inter-array cables and interconnector cables, with up to 3,060 vessel round trips in total over the construction phase • Maximum duration of the offshore construction phase is up to five years. **O&M phase** Increased risk of INNS due to: • Introduction of artificial structures: up to 3,139,362m^2 as set out in the colonisation of hard structures impact • Vessel return trips: Up to 293 vessel return trips per year during the O&M phase • Removal of marine growth from foundations or access ladders • O&M phase up to 35 years. **Decommissioning phase** Increased risk of INNS due to: • Presence of artificial structures: up to 1,785,234m^2 due to scour and cable protection left *in situ* post decommissioning • Vessel return trips: Up to 3,060 decommissioning vessel return trips during the decommissioning phase • Maximum duration of the offshore decommissioning phase is up to five years.	
Colonisation of hard structures	×	✓	×	**O&M phase** Introduction of up to 3,139,362m^2 of artificial structures across Morven North. O&M phase up to 35 years.	Maximum number of wind turbine and OSP foundations and associated scour protection, maximum length of cables and cable protection resulting in greatest surface area for colonisation.

Potential impact	Phase			Maximum Design Scenario	Justification
	C	O	D		
				• Wind turbines and OSPs: Presence of up to 96 wind turbines 4-legged suction bucket jacket foundations and five OSPs on a total of six gravity base foundations. • Scour protection: Presence of scour protection for wind turbine foundations and OSP foundations • Cable protection: Presence of cable protection associated with up to 42,375m of inter-array cables and 10% of the 484km of interconnector cables • Cable crossing protection: Presence of cable protection for cable crossings, five cable crossings for inter-array cables (each up to 80m in length and 36m in width) and five cable crossings for interconnector cables (each up to 80m in length and 36m in width). Maintenance activities including the removal of marine growth from foundations or access ladders.	The estimate of area associated with the introduction of artificial structures from the presence of foundations has been calculated as if the foundations were a solid structure. This is, therefore, likely to be a conservative estimate of the introduction of artificial structures on the basis that the jacket foundations will have a lattice design rather than a solid surface. The MDS for decommissioning assumes removal of the foundations but that cable and scour protection could be left in situ after decommissioning, which could represent a permanent new hard structure for colonisation, which is assessed in long-term habitat loss.
Changes in physical processes	×	✓	×	**O&M phase** Foundations • Wind turbines: 96 installations with monopile foundations, each with a 15m diameter with scour protection to a height of 2.5m. Total footprint of 3,578m^2 per wind turbine, including scour protection. • OSPs: four HVAC collector substation installations with circular footprint gravity base foundations, each with a diameter of 17m at the surface and 67m at the seabed, with a caisson diameter of 51m and with scour protection to a height of 4.0m. Total footprint of 40,471m^2 per OSP. • OSPs: one bridge-linked HVDC converter substation installation with two rectangular footprint gravity base foundations, each with dimensions of 180x240m at the surface and 195x255m at the bed and with scour protection	Physical processes are comprised of tides, waves and sediment transport and these aspects are integrated (i.e. without the influence of tides and waves there would be no sediment transport) as outlined below: The tidal regime is influenced by changes in bathymetry due to the placement of scour protection and the obstruction of tidal flow due to foundation structures within the water column: • The tidal regime is influenced by changes in bathymetry due to the placement of scour protection and the obstruction of tidal flow due to foundation structures within the water column.

Potential impact	Phase			Maximum Design Scenario	Justification
	C	O	D		
				to a height of 4.0m. Total footprint of 74,725m^2 per foundation. Cabling • Inter-array cables: cable protection along 42.4km of the cable, with a height of up to 3m and up to 10m width. Up to five cable crossings, each crossing has a height of up to 4m, a width of up to 36m and a length of up to 80m. • Interconnector cables: cable protection along 48.4km of the cable, with a height of up to 3m and up to 10m width. Up to five cable crossings, each crossing has a height of up to 4m, a width of up to 36m and a length of up to 80m. The inclusion of five cable crossings within the MDS is a conservative assumption.	• The wave climate regime is influenced by obstruction within the water column however changes in bathymetry would only cause effects in shallow water • The sediment transport regime is affected by obstructions in the sediment transport pathways and also potential changes to the littoral currents which drive this process (i.e. those factors which also affect tide and wave climate). A holistic approach has therefore been applied to assessing the MDS, with this combining the impacts to the wave and tidal regimes due to the presence of infrastructure and the impacts to sediment transport and sediment transport pathways due to the presence of infrastructure assessed in Volume 2, Chapter 7: Physical Processes, of the Morven North EIA Report. The greatest surface blockage to influence wave climate is generally from the monopile foundations, which also provide a much larger obstruction to tidal flows within the Morven North Boundary. Three-legged suction bucket foundations have the largest footprint at each wind turbine and over the site as a whole in terms of scour protection and provide the greatest influence on bathymetry. Monopiles have been selected as the MDS due to the magnitude of the water column obstruction over the Morven North Boundary as a whole, compounded with the largest surface obstruction within the Morven North Boundary.

Potential impact	Phase			Maximum Design Scenario	Justification
	C	O	D		
					The greatest in-water column blockage to influence tidal flow and wave climate from the HVAC and bridge-linked HVDC OSPs are the gravity base foundations, which also present the largest footprints to affect changes in bathymetry and sediment transport pathways. The gravity base foundations also result in the greatest-surface blockage which will predominantly affect wave climate and overall have been selected as the MDS for both HVAC and bridge-linked HVDC OSPs.
Removal of hard substrates	×	×	✓	**Decommissioning phase** Removal of up to 3,139,362m^2 of hard substrates in total across Morven North. • Wind turbines and OSPs (including scour protection): Removal of up to 96 suction bucket four-legged jacket foundations for wind turbines and up to five OSPs supported by a total of six gravity base foundations including all scour protection • Inter-array and interconnector cable protection: Removal of cable protection associated with up to 42,375m of inter-array cables and 10% of the 484km of interconnector cables • Cable crossing protection: Removal of cable protection for five cable crossings for inter-array cables (each up to 80m in length and 36m in width) and five cable crossings for interconnector cables (each up to 80m in length and 36m in width).	Volume 1, Chapter 4: Project Description of the ES states that it is likely that cable and scour protection will be left *in situ* following decommissioning however the MDS for benthic receptors is that all hard substrate could be removed.
Impacts to benthic invertebrates due to EMF	×	✓	×	**O&M phase** Presence of inter-array and interconnector cables: • Up to 424km of 66kV inter-array cables	The MDS for this impact is based on the greatest proposed cable length which is exposed to the water column and buried in the

Potential impact	Phase			Maximum Design Scenario	Justification
	C	O	D		
				• Up to 484km of 275kV interconnector cables • Minimum burial depth of 0.5m • Up to 10% of inter-array cables and up to 10% of interconnector cables requiring cable protection • Cables will also require cable protection at asset crossings (up to five crossings for inter-array cables and up to five crossings for interconnector cables) • O&M phase of up to 35 years.	seabed, with consideration given to cable protection.

8.10 Designed-in measures and mitigation

8.10.1.1 As part of the project design process, a number of measures (primary and tertiary) have been adopted to reduce the potential for impacts on benthic subtidal ecology (see Table 8.18). For the purposes of the EIA process, the term "designed-in measure" is used to include the following measures (adapted from Institute of Environmental Management and Assessment (IEMA), 2016 and IEMA, 2024):

- Measures included as part of the design of Morven North. These include modifications to the location or design of Morven North, which are integrated into the application for consent. These measures are considered standard industry practice for this type of development and are referred to as primary mitigation in IEMA, 2016 and IEMA, 2024.
- Measures required to meet legislative requirements, or actions that are generally standard practice used to manage commonly occurring environmental effects. These measures are secured through the conditions of the marine licences and referred to as tertiary mitigation in IEMA, 2016 and IEMA, 2024.

8.10.1.2 As there is a commitment to implementing these measures, they are considered inherently part of the design of Morven North and have therefore been considered in the assessment presented in Section 8.11 (i.e. the determination of magnitude and therefore significance assumes implementation of these measures).

8.10.1.3 The requirement for any additional mitigation measures is dependent on the significance of the effects on benthic subtidal ecology. Where likely significant effects have been identified, further mitigation measures (referred to as secondary mitigation in IEMA, 2016 and IEMA, 2024) have been identified to reduce the significance of effect to acceptable levels following the initial assessment. These are measures that could further prevent, reduce and, where possible, offset any adverse effects on the environment. These measures are set out, where relevant, in Section 8.11.

8.10.1.4 All designed-in and secondary mitigation measures are detailed in Volume 3, Chapter 5: Morven North EIA Commitments Register, of the Morven North EIA Report.

Table 8.18: Designed-in (primary and tertiary) measures adopted as part of Morven North

Reference number	Designed-in measures adopted as part of Morven North	Justification	Primary or tertiary
MM-1	Development of and adherence to a Scour Protection Management Plan	Scouring of seabed sediments may occur due to interactions between the metocean regime (including waves, sand and currents) and foundations or other seabed structures including cable protection. This scouring has the potential to develop into depressions around the structure, with scour protection employed around offshore structures and foundations, as described in detail in Volume 1, Chapter 4: Project Description, of the Morven North EIA Report. The scour protection has been included in the modelled scenarios used within the assessment of effects. The SPMP will set out the approach to scour protection installation and monitoring. This will maximise protection of offshore infrastructure as far as possible during the project lifecycle.	Primary

Reference number	Designed-in measures adopted as part of Morven North	Justification	Primary or tertiary
MM-2	Development of and adherence to a Cable Plan which will include a cable burial risk assessment (CBRA) and cable burial and protection monitoring throughout the operational phase.	There is potential for cable exposure to occur due to interactions between the metocean regime (wave, sand and currents) and the foundations. Sediment transportation can lead to exposure of cables and infrastructure, although the use of a target cable burial depth alongside the cable installation strategy should provide sufficient depth to avoid exposure. A Cable Plan will set out the approach to protection of cables during the project life cycle. It will reduce the risks of vessel underwater allision with cable protection, anchor or fishing gear interaction with subsea cables and interference with magnetic position fixing equipment. The Cable plan will implement management and monitoring of cable protection (via burial or external protection where adequate burial depth, as identified via risk assessment, is not feasible) with any damage, destruction or decay of cables notified to Maritime and Coastguard Agency, Northern Lighthouse Board, Kingfisher and UK Hydrographic Office no later than 24 hours after discovered. This will reduce the probability of cables becoming unburied and impacting other sea users and marine ecology receptors. Cable burial and protection monitoring will be undertaken throughout the operational phase to assess the status of cable burial and any deployed protection. It will include the requirement of minimum burial depths of 0.5m or the use of cable protection around inter-array and interconnector cables and will include a Cable Burial Risk Assessment.	Primary
MM-5	Development of and adherence to an Invasive Non-Native Species Management Plan, and Biosecurity Plan.	To reduce the risk of introduction and spread of INNS during all phases of the Morven North projects, as far as practicable. The Biosecurity Plan and an Invasive Non-Native Species Management Plan will control invasive non-native species and their potential impact on marine ecology receptors.	Tertiary
MM-6	Development and adherence to a Marine Pollution Contingency Plan.	To reduce the potential for release of pollutants from construction, operation and maintenance and decommissioning, a MPCP will be developed. The Marine Pollution Contingency Plan will include planning for accidental spills, addressing all potential contaminant releases and include key emergency details, and will be in line with appropriate regulations and guidelines.	Tertiary
MM-32	Development of and adherence to an	The EMP will ensure appropriate environmental controls are in place for Morven North, and the	Primary

Reference number	Designed-in measures adopted as part of Morven North	Justification	Primary or tertiary
	Environmental Management Plan.	agreed procedures to mitigation and potential risk to the receiving environment. Measures will cover a wide range of management measures including environmental awareness training, auditing, reporting procedures and waste management. It is expected that the EMP will include a Marine Pollution Contingency Plan (MPCP) and an Invasive Non-Native Species Management Plan (INNSMP). The EMP is also expected to limit potential environmental damage from small quantities of drill fluids which may be released and as regulated by the UK Registration, Evaluation, Authorisation and Restriction of Chemicals REACH Regulations.	

8.11 Assessment of likely significant effects

8.11.1.1 The potential impacts arising from the construction, O&M and decommissioning phases of Morven North are listed in Table 8.17, along with the MDS against which each impact has been assessed.

8.11.1.2 An assessment of the likely significant effects of Morven North on benthic subtidal ecology receptors caused by each identified impact is given below.

8.11.2 Temporary habitat loss/disturbance

8.11.2.1 Temporary habitat loss/disturbance of benthic subtidal habitats within the Morven North Boundary will occur during the construction, O&M, and decommissioning phases. This temporary habitat loss/disturbance may result from a range of activities including boulder and debris clearance and seabed preparation activities, cable installation and repair and associated seabed clearance, UXO clearance, placement of spud-can legs from jack-up operations, and anchor placements, and existing cable removal. The MDS for temporary habitat loss/disturbance is summarised in Table 8.17.

8.11.2.2 The relevant Marine Evidence-based Sensitivity Assessment (MarESA) and Feature Activity Sensitivity Tool (FeAST) pressures and associated benchmarks used to inform this impact assessment are listed below:

- Habitat structure changes: removal of substratum (extraction): the benchmark for which is the extraction of substratum to 30cm. This pressure is considered to be analogous to the impacts associated with sandwave clearance and pre-lay preparation (e.g. boulder and debris clearance), and UXO clearance;
- Abrasion/disturbance at the surface of the substratum or seabed: the benchmark for which is damage to surface structures (e.g. species and physical structures within the habitat). This pressure corresponds to the impacts associated with anchor placement and jack-up vessel operation;
- Penetration and/or disturbance of the substratum subsurface: the benchmark for which is damage to sub-surface features (e.g. species and physical structures within the habitat). This pressure corresponds to the impacts associated with cable installation, jack-up vessel operation, and the removal of existing cables;
- Smothering and siltation rate changes (heavy): the benchmark for which is heavy deposition of up to 30cm of fine material added to the habitat in a single discrete event. This pressure

corresponds to impacts associated with the deposition of sandwave clearance material and site preparation activities prior to cable installation.

Construction phase

Magnitude of impact

8.11.2.3 The MDS accounts for up to a total of 74,055,400m^2 of temporary habitat loss/disturbance during the construction phase (Table 8.17). This represents 4.12% of the total Morven North Benthic Subtidal Ecology Study Area. The MDS has been based on the total temporary habitat loss/disturbance as a result of sandwave clearance, cable installation, jack-up events, anchor placements, cable removal, and UXO removal. Further refinement of the MDS may occur as the project parameters are further developed, thereby reducing the area of temporary habitat loss/disturbance from site preparation activities.

8.11.2.4 Site and seabed preparation activities (sandwave clearance) will account for up to 52,875,000m^2 of temporary habitat loss/disturbance (Table 8.17). The mounds of cleared sediment material which will be deposited within the Morven North Benthic Subtidal Ecology Study Area will erode over time, and this displaced material will rejoin the natural surrounding sedimentary environment, gradually reducing the size of these mounds of displaced material. The type of sediment deposited onto the seabed causing temporary habitat loss/disturbance will be similar in composition to that of the surrounding areas (consisting of fine to medium sand, see Section 8.7.1). Due to this similarity, displaced benthic communities would be anticipated to recolonise the disturbed areas.

8.11.2.5 The cable installation activities (which include sandwave clearance) will account for up to 18,160,000m^2 of temporary habitat loss/disturbance, which represents 1.01% of the total Morven North Benthic Subtidal Ecology Study Area. Cable installation will also include the removal of disused existing cables, with this representing up to 100,000m^2 of temporary habitat loss/disturbance. The boulder clearance activities, which account for up to 7,208,000m^2 for the inter-array cables, and up to 8,228,000m^2 for the interconnector cables, will likely involve moving the boulders likely to impact installation to the side, but remaining within the immediate vicinity of the cable trench. It is likely that the redistribution of boulders in the local area by these methods will not cause a significant shift in the baseline patchiness of boulder distribution on the surrounding seabed. Therefore, it is unlikely the redistribution of boulders will act as a barrier to the recovery of disturbed epifaunal communities.

8.11.2.6 A recent study (RPS, 2019) reviewed the effects of cable installation on subtidal sediments and habitats, drawing on monitoring reports from over 20 UK OWFs. Following cable installation, sandy sediments were shown to recover to baseline conditions quickly, with little to no evidence of disturbance within two years of cable installation. The review presented evidence that remnant cable trenches through coarse and mixed sediments remained visible for several years following installation. However, these depressions were of limited depth (tens of centimetres) relative to the surrounding seabed, and these were spread over a horizontal distance of several metres and therefore did not represent a large shift from the baseline environment (RPS, 2019). In areas of muddy and muddy sandy seabed, trenches were observed years following cable installation, although these were again relatively shallow (tens of centimetres). As sediments within the Morven North Benthic Subtidal Ecology Study Area are dominated by fine to medium sands with varying amounts of gravel and shell fragments, the results of the review (RPS, 2019) indicate that disturbance to these sediments is likely to be reversible. In addition, post-construction monitoring of the Block Island Offshore Wind Farm (off the coast of Rhode Island, United States of America (USA)) demonstrated that 62% of the trenches formed during export cable installation had recovered within four months, and the remainder was partially recovered (BOEM, 2020), which further highlights the reversibility of this impact.

8.11.2.7 In addition to site preparation and cable trenching, jack-up events associated with foundation installation will result in compression of the seabed beneath spud-cans, and this may cause up to 1,958,400m^2 of temporary habitat loss/disturbance in the form of depressions in the seabed. Also, anchor placements may cause up to 908,000m^2 of depressions during inter-array and interconnector

cable installation. The depressions formed by these activities are likely to infill over time, but may remain visible for a number of years after the end of construction (Barrow Offshore Windfarm Ltd., 2008, RPS, 2019). Monitoring at the Barrow OWF showed that depressions were infilled almost totally one year after construction (Barrow Offshore Windfarm Ltd., 2008). Monitoring at the Lynn and Inner Dowsing OWF also showed some infilling of footprints, although depressions were still visible four years following the end of construction (Centrica Energy Ltd, 2016).

8.11.2.8 The MDS accounts for the clearance of up to 15 UXOs within Morven North ranging from 25kg to 554kg, with 132kg the most likely (common) maximum. Studies undertaken for the Norfolk Vanguard OWF (Ordtek, 2018) and the Sheringham Shoal and Dudgeon OWF Extension Projects (Equinor, 2022) calculated likely crater sizes for a range of UXOs. Modelling showed that a 150kg UXO (the option most similar to the most likely (common) maximum) is likely to produce a crater with an estimated diameter of 12.61m and a likely depth of 1.8m to 2.8m (Ordtek, 2018). Other modelling indicated that craters of up to a maximum of 21m in diameter could be created from UXO detonation of a similar magnitude, with a disturbed area of approximately 346m^2 per crater (Equinor, 2022). With up to 15 UXOs, this could represent a total of up to 5,190m^2 of temporary habitat loss/disturbance. However, this estimate is precautionary, and is based on the use of high order detonation. A designed in measure for the use of low order UXO clearance has been included, and therefore the overall area of impact expected is much lower. It is anticipated that the craters will infill over time, with displaced material rejoining the surrounding natural sedimentary environment.

8.11.2.9 The impact is predicted to be of local spatial extent, medium term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore considered to be low.

Sensitivity of the receptor

8.11.2.10 The sensitivities of the IEFs and their constituent biotopes and species to temporary habitat loss/disturbance, based on the MarESA, are presented in Table 8.19. The biotope SS.SSa.CFiSa.ApriBatPo has been used as a proxy for SS.SSa.CFiSa, which does not have a separate MarESA assessment. This is appropriate as SS.SSa.CFiSa.ApriBatPo is a level 5 biotope within the SS.SSa.CFiSa level 4 biotope, and therefore the sensitivities will apply to both biotopes.

8.11.2.11 The four representative biotopes for the offshore subtidal sands and gravels IEF (Table 8.13) were concluded to have an overall medium sensitivity to this impact based on three MarESA pressures (Tillin and Watson, 2023a, Tillin, 2022, Tillin and Watson, 2023c). All representative biotopes have medium sensitivity to the habitat structure change – removal of substratum (extraction) pressure. Specifically, all biotopes had no resistance to the extraction pressure as all species occur within shallow sediment and this would remove the biological assemblage, with recovery dependent on local current, wave action, and sediment availability (Desprez, 2000). Recovery is expected to be rapid, due to the medium resilience of these biotopes and being characterised by opportunistic species (Tillin and Watson, 2023c). All representative biotopes also have medium sensitivity to the smothering and siltation rate changes (heavy). Bivalve species common to these biotopes can move throughout a maximum increase in sediment deposition of approximately 50cm in sandy habitats, with a smaller burial tolerance depending on species (Essink, 1999). This 50cm of sediment deposition is the maximum modelled sediment mound depth expected from installation activities. The biotopes each have low sensitivity to the abrasion/disturbance of the surface of the substratum or seabed and penetration or disturbance of the substratum subsurface pressures (Table 8.19). Abrasion and penetration are likely to damage a small proportion of the characterising species at the surface of the substratum, with large amounts of disturbance known to significantly reduce organism number, biomass, species diversity, and species richness compared to undisturbed sites (Collie *et al*., 1997). However, as the disturbance will likely be of a relatively low magnitude, a significant reduction is unlikely to occur. Also, it is likely that burrowing species will remain unaffected, or will be able to re-burrow if disturbed (Hauton *et al*., 2003).

8.11.2.12 The ocean quahog IEF was concluded to be of high sensitivity to this impact (Table 8.19) based on the MarESA pressures (Tyler-Walters and Sabatini, 2017). This species has low to no resistance to

the habitat structure changes due to the removal of substratum, the abrasion/disturbance at the surface of the substratum or seabed and the penetration and/or disturbance of the substratum subsurface pressures (Tyler-Walters and Sabatini, 2017). This is due to this species feeding at the surface of the substratum, and otherwise burrowing to several centimetres below the surface of the substratum, down to approximately 14cm (Morton, 2011). These pressures would therefore result in the total removal of or damage to the substratum that individuals of this species rely on, with associated damage or removal of the ocean quahog individuals in the affected areas (Tyler-Walters and Sabatini, 2017). This species is also vulnerable to these pressures due to their long lifespan (up to hundreds of years), very slow growth rate, and high age of sexual maturity (Thorarinsdóttir *et al*., 2010, Thorarinsdóttir and Jacobson, 2005). An example of the impacts of these pressures includes a report on hydraulic dredging in a bay in Iceland, which recorded a 93% decrease in ocean quahog abundance, with recovery of only 7% to 26% over five years following cessation of dredging (Ragnarsson *et al*., 2015). Examination of recovery of commercial bivalve communities, including this species, following experimental dredging indicated that dredging resulted in a 67% reduction in bivalve biomass including ocean quahog (Gilkinson *et al*., 2005), with recovery to baseline conditions expected to take longer than ten years (Gilkinson *et al*., 2015). In the site-specific survey, very few ocean quahog were noted, indicating that the likelihood of this species being impacted is minimal, despite their international importance.

8.11.2.13 The offshore subtidal sands and gravels IEF is deemed to be of medium vulnerability, medium to high recoverability and national value. The sensitivity of the receptor is therefore, considered to be medium.

8.11.2.14 The ocean quahog IEF is deemed to be of high vulnerability, low recoverability, and international value. The sensitivity of the receptor is therefore, considered to be high.

Table 8.19: Sensitivity of Important Ecological Features to temporary habitat loss/disturbance

IEF	Representative Biotopes and Species	Habitat Structure Changes – Removal of Substratum (Extraction)	Abrasion/disturbance of the Surface of the Substratum or Seabed	Penetration or Disturbance of the Substratum Subsurface	Smothering and Siltation Rate Changes (Heavy)	Overall Sensitivity
Offshore subtidal sands and gravels	SS.SMx.OMx.PoVen	Medium	Low	Low	Medium	Medium
	SS.SSa.CFiSa.ApriBatPo SS.SSa.CFiSa	Medium	Low	Low	Medium	
	SS.SSa.CFiSa.EpusOborApri	Medium	Low	Low	Medium	
Ocean quahog	*Arctica islandica*	MarESA: High FeAST: High	MarESA: High FeAST: Low	MarESA: High FeAST: High	MarESA: Not sensitive FeAST: High	High

Significance of the effect

8.11.2.15 For the offshore subtidal sands and gravels IEF, the magnitude of the impact is deemed to be low and the sensitivity of the receptor is considered to be medium. The effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.

8.11.2.16 For the ocean quahog IEF, the magnitude of the impact is deemed to be low and the sensitivity of the receptor is considered to be high. The effect will, therefore, be of minor to moderate adverse significance, with the overall significance being **minor adverse**, which is not significant in EIA terms. This minor adverse conclusion is due to the low numbers of ocean quahog recorded from the site specific survey, therefore limiting the significance of effect.

Secondary mitigation and residual effect

8.11.2.17 No mitigation measures for benthic subtidal ecology are considered necessary because the likely effect in the absence of further mitigation (beyond the designed-in measures outlined in Table 8.18), is not significant in EIA terms.

O&M phase

Magnitude of impact

8.11.2.18 O&M activities will account for up to 9,221,800m^2 of temporary habitat loss/disturbance, from activities including jack-up events for component replacement and repair on wind turbines, and repair and reburial of inter-array and interconnector cables. This area of temporary habitat loss/disturbance represents 0.51% of the Morven North Benthic Subtidal Ecology Study Area. It should also be noted that only a very small proportion of the total temporary habitat loss/disturbance is likely to occur at any one time over the 35 year operational lifetime and each maintenance event will be highly localised.

8.11.2.19 The repair and reburial of inter-array and interconnector cables, and jack-up events, will affect benthic habitats in the immediate vicinity of these operations, with impacts on seabed habitats and associated benthic communities expected to be smaller than during the construction phase due to the reduced area of impact. There is the potential for repeat disturbance to the habitats in the immediate vicinity of the cables because of these activities, but this compounding impact is likely to be minimal overall. Also, following the cessation of each activity, the sediment will recover quickly to baseline conditions (see the construction phase of Section 8.11.2 for further detail). This indicates that the reversibility of this impact during the O&M phase for any single activity will be high.

8.11.2.20 The impact is predicted to be of local spatial extent, long-term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore considered to be low adverse.

Sensitivity of the receptor

8.11.2.21 The sensitivity of the benthic subtidal ecology IEFs to temporary habitat loss/disturbance during the O&M phase is as described for the construction phase in Paragraphs 8.11.2.10 to 8.11.2.14.

8.11.2.22 The offshore subtidal sands and gravels IEF is deemed to be of medium vulnerability, medium to high recoverability and national value. The sensitivity of the receptor is therefore, considered to be medium.

8.11.2.23 The ocean quahog IEF is deemed to be of high vulnerability, low recoverability and international value. The sensitivity of the receptor is therefore, considered to be high.

Significance of the effect

8.11.2.24 For the offshore subtidal sands and gravels IEF the magnitude of the impact is deemed to be low and the sensitivity of the receptor is considered to be medium. The effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.

8.11.2.25 For the ocean quahog IEF, the magnitude of the impact is deemed to be low and the sensitivity of the receptor is considered to be high. The effect will, therefore, be of minor to moderate adverse significance, with an overall **minor adverse** significance, which is not significant in EIA terms. This conclusion is due to the low numbers of ocean quahog recorded from the site specific survey, therefore limiting the significance of effect.

Secondary mitigation and residual effect

8.11.2.26 No mitigation measures for benthic subtidal ecology are considered necessary because the likely effect in the absence of further mitigation (beyond the designed-in measures outlined in Table 8.18), is not significant in EIA terms.

Decommissioning phase

Magnitude of impact

8.11.2.27 Decommissioning activities include removal of foundations and cables where possible and appropriate to do so, with associated jack-up activities and anchor placements. It is proposed that cable and scour protection is left *in situ*. Any direct impacts from jack-up vessels and anchor placements will be similar to the construction phase, with similar recovery periods. Overall the extent of temporary habitat disturbance to subtidal habitat IEFs that may occur as a result of decommissioning activities is predicted to be in line with that described for the construction phase in Paragraphs 8.11.2.3 to 8.11.2.4). On the basis that there will be no requirement for sandwave clearance or pre-lay preparation during decommissioning, the magnitude of the impact is likely to be lower than during construction.

8.11.2.28 The impact is predicted to be of local spatial extent, medium term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore considered to be low adverse.

Sensitivity of the receptor

8.11.2.29 The sensitivity of the benthic subtidal ecology IEFs to temporary habitat loss/disturbance during the decommissioning phase is as described for the construction phase in Paragraphs 8.11.2.10 to 8.11.2.14.

8.11.2.30 The offshore subtidal sands and gravels IEF is deemed to be of medium vulnerability, medium to high recoverability and national value. The sensitivity of the receptor is therefore, considered to be medium.

8.11.2.31 The ocean quahog IEF is deemed to be of high vulnerability, low recoverability and international value. The sensitivity of the receptor is therefore, considered to be high.

Significance of the effect

8.11.2.32 For the offshore subtidal sands and gravels IEF, the magnitude of the impact is deemed to be low and the sensitivity of the receptor is considered to be medium. The effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.

8.11.2.33 For the ocean quahog the magnitude of the impact is deemed to be low and the sensitivity of the receptor is considered to be high. The effect will, therefore, be of minor to moderate adverse significance, with an overall **minor adverse** significance, which is not significant in EIA terms. This

conclusion is due to the low numbers of ocean quahog recorded from the site specific survey, therefore limiting the significance of effect.

Secondary Mitigation and Residual Effect

8.11.2.34 No mitigation measures for benthic subtidal ecology are considered necessary because the likely effect in the absence of further mitigation (beyond the designed-in measures outlined in Table 8.18), is not significant in EIA terms.

8.11.3 Increased suspended sediment concentrations and associated deposition

8.11.3.1 Increases of SSCs and associated deposition are predicted to occur during the construction and decommissioning phases as a result of the installation/removal of foundations, sandwave clearance, seabed preparation activities, the installation/removal of inter-array and interconnector cables, and the removal of disused and out of service cables. Increases of SSCs and associated deposition are predicted to occur in the O&M phase from cable repair and reburial events. Volume 2, Annex 7.1: Physical Processes Technical Report provides a full description of the physical assessment, including numerical modelling used to inform the predictions made with respect to increases in suspended sediment and subsequent deposition.

8.11.3.2 The benchmarks for the relevant MarESA and FeAST pressures which have been used to inform this impact assessment across all IEFs are:

- Changes in suspended solids (water clarity): the benchmark for which is a change in one rank on the Water Framework Directive (WFD) scale (e.g. from clear to intermediate for one year, caused by activities disturbing sediment or organic particulate material and mobilising it into the water column such as dredging, disposal at sea, cable and pipeline burial).
- Smothering and siltation rate changes (light): the benchmark for light deposition is up to 5cm of fine material added to the habitat in a single discrete event.
- Smothering and siltation rate changes (heavy): the benchmark for which is heavy deposition of up to 30cm of fine material added to the seabed in a single discrete event.

Construction phase

Magnitude of impact

8.11.3.3 The seabed preparation and activities and installation of infrastructure associated with Morven North may lead to increased SSCs and associated deposition. During the construction phase, these activities will include sandwave clearance and installation of wind turbines and OSPs, and sandwave clearance and installation of inter-array and interconnector cables.

8.11.3.4 For the wind turbines and OSPs, sandwave clearance has been calculated on the basis of 58 locations supporting three-legged suction bucket wind turbine foundations (which will have associated sediment plumes during installation which are larger than the 96 smaller foundations considered in other impacts) and five locations supported by a total of six gravity base OSP foundations requiring clearance of sandwaves of an average height of 3m, which represents the maximum possible impact calculated from the PDE and presented in the MDS (Table 8.17). This is expected to result in a total sandwave clearance volume of 11,259,679m^3. Modelling was undertaken to quantify the potential increases in SSC and sedimentation by the use of a suction hopper dredger to remove material from the crest of sandwaves and deposit the material into an adjacent area. This modelling indicated increased concentrations of up to 14,500mg/l at the release site during disposal, with resuspension on the following slack tide resulting in concentrations of up to 500mg/l. On average, SSCs across the Morven North Boundary were modelled to be <1mg/l, with the sediment plume envelope limited to within 14km of the disposal activity, which falls within the Morven North Benthic Subtidal Ecology Study Area. Resuspension of deposited material would continue to occur on successive tides but would be fully incorporated into the background sediment transport regime following the cessation of sandwave clearance activities.

8.11.3.5 For the inter-array and interconnector cables, sandwave clearance will occur along a total of up to 15% of the length of both cables, resulting in a cable spoil volume of up to 13,071,600m^3. For cable sandwave clearance, modelling indicated SSCs of up to 750mg/l in the immediate vicinity of releases, with plumes of concentrations of 40mg/l extending up to 8km in a north northeasterly direction within the Morven North Boundary. Average SSCs over the entire clearance campaign were typically <100mg/l, with average sedimentary of <10mm noted within the Morven North Boundary and rapidly reducing following the cessation of activity.

8.11.3.6 For the foundation installation, up to 34 monopiles for wind turbines (calculated to represent the greatest potential increase in SSCs and associated deposition of all considered foundation options, based on the assumption that only half would be drilled), up to four HVAC collector substation OSPs with 16m diameter monopile foundations, and one bridge-linked HVDC converter substation OSP with six 5m diameter jacket foundations may be installed. Modelling of drilling operations indicated average SSCs of <0.2mg/l at the discharge locations, rapidly decreasing within a short distance within the plume envelope. Instantaneous concentrations on the peak ebb and flood tides were modelled at <0.15mg/l within the plume envelope, with these levels localised and only persisting for a short period.

8.11.3.7 For the inter-array and interconnector cable installation, activities may cause the production of up to 1,908,000m^3 and 2,178,000m^3 of spoil volume respectively. For the installation of these cables, the SSCs were modelled as larger than for pile installation, with resuspension giving rise to concentrations of up to 0.6mg/l in an amalgamated plume but only causing an average of <0.003mm of sedimentation.

8.11.3.8 The impact is predicted to be of local spatial extent, medium term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be low.

Sensitivity of the receptor

8.11.3.9 The sensitivities of the IEFs and their constituent biotopes and species to increased SSCs and associated deposition, based on the MarESA, are presented in Table 8.20. The biotope SS.SSa.CFiSa.ApriBatPo has been used as a proxy for SS.SSa.CFiSa, which does not have a separate MarESA assessment. This is appropriate as SS.SSa.CFiSa.ApriBatPo is a level 5 biotope within the SS.SSa.CFiSa level 4 biotope, and therefore the sensitivities will apply to both biotopes.

8.11.3.10 The offshore subtidal sands and gravels IEF was assessed to have an overall medium sensitivity to increased SSCs and associated deposition (Table 8.20). Specifically, all constituent biotopes were assessed to have low sensitivity to changes in suspended solids (water clarity) due to transport of phytoplankton from unaffected areas into areas with reduced water clarity ensuring no significant reduction in food availability for filter feeding organisms (Tillin and Watson, 2023b, Tillin, 2022, Tillin and Watson, 2023c). Similarly, all biotopes were assessed to have low sensitivity to smothering and siltation changes (light), with it being noted that common bivalve species including *Donax* sp. and *Tellina* sp. have been recorded to migrate through up to 50cm of sand in response to deposition of sediment (Essink, 1999), and *Abra alba* are capable of upwardly migrating if lightly buried under deposited sediment (Schafer, 1972). Also, polychaetes common within the Morven benthic community including *Nephtys hombergii* and *Lagis koreni* are able to migrate through up to 41cm of deposited sand (Powilleit *et al.*, 2009), and through up to 90cm of sediment for *Nephtys* sp. (Essink, 1999). As heavy siltation may result in sediment deposition to these depths, all biotopes have been classified as having a medium sensitivity to this pressure.

8.11.3.11 Ocean quahog was assessed to be not sensitive to increased SSCs and associated deposition, as they are commonly located in silty sediments in sheltered to wave exposed conditions (Tyler-Walters and Sabatini, 2017), and are adapted to deposit feeding in sedimentary environments (Morton, 2011). In conditions with greater levels of wave exposure, the sediment surface is regularly mobilised, with moderate to high levels of associated sediment accretion, and therefore an increase in turbidity may not adversely affect this species. Also, avoidance of sudden changes in SSCs has been recorded,

with individuals of this species burrowing for several days (Tyler-Walters and Sabatini, 2017). In terms of burial or smothering, this species has been noted as surviving with very little impact when buried under 1.5m of sediment (Powilleit *et al.*, 2006), with a similar population structure to pre-burial conditions noted two years later, with no apparent change in growth rates. Individuals of the species were able to burrow to the surface of 32cm to 41cm of sediment in a laboratory setting (Powilleit *et al.*, 2009). This indicates a high resistance to this impact, with a high speed of recovery. The FeAST tool highlights that this species uses a short inhalant siphon at the sediment surface for feeding and respiration (Taylor, 1976) which may be susceptible to heavy siltation and burial, with a high sensitivity applied. However, this is a low confidence assessment and more recent research has indicated that this species has resilience to smothering and burial (Powilleit *et al.*, 2009, Powilleit *et al.*, 2006).

8.11.3.12 The offshore subtidal sands and gravels IEF was deemed to be of low to medium vulnerability, high recoverability and national value. The sensitivity of the receptor is therefore considered to be medium.

8.11.3.13 The ocean quahog IEF was deemed to be of no vulnerability, high recoverability and international value. The sensitivity of the receptor is therefore considered to be negligible.

Table 8.20: Sensitivity of Important Ecological Features to increased Suspended Sediment Concentrations and associated deposition

IEF	Representative Biotopes and Species	Changes in Suspended Solids (Water Clarity)	Smothering and Siltation Rate Changes (Light)	Smothering and Siltation Rate Changes (Heavy)	Overall Sensitivity
Offshore Subtidal Sands and gravels	SS.SMx.OMx.PoVen	MarESA: Low	MarESA: Low	MarESA: Medium	Medium
	SS.SSa.CFiSa.ApriBatPo SS.SSa.CFiSa	MarESA: Low	MarESA: Low	MarESA: Medium	Medium
	SS.SSa.CFiSa.EpusOborApri	MarESA: Low FeAST: Not sensitive	MarESA: Low FeAST: Not sensitive	MarESA: Medium FeAST: Low	Medium
Ocean quahog	*Arctica islandica*	MarESA: Not sensitive FeAST: Not exposed	MarESA: Not sensitive FeAST: Not sensitive	MarESA: Not sensitive FeAST: High (addressed in text)	MarESA and FeAST: Negligible

Significance of the effect

8.11.3.14 For the offshore subtidal sands and gravels IEF, the magnitude of the impact is deemed to be low and the sensitivity of the receptor is considered to be medium. The effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.

8.11.3.15 For the ocean quahog IEF, the magnitude of the impact is deemed to be low and the sensitivity of the receptor is considered to be negligible. The effect will, therefore, be of negligible to minor adverse significance, with the overall significance being **minor adverse**, which is not significant in EIA terms. This minor adverse conclusion is due to the international importance of ocean quahog and classification as a PMF.

Secondary mitigation and residual effect

8.11.3.16 No mitigation measures for benthic subtidal ecology are considered necessary because the likely effect in the absence of further mitigation (beyond the designed-in measures outlined in Table 8.18), is not significant in EIA terms.

O&M phase

Magnitude of impact

8.11.3.17 The repair and reburial of inter-array and interconnector cables may lead to increased SSCs and associated deposition which could impact benthic subtidal ecology IEFs.

8.11.3.18 The repair of up to 10km of inter-array cables in two events every five years and up to 2km of interconnector cables in 10 events every 25 years may cause seabed disturbance which could create sediment plumes. Reburial of up to 17km of inter-array cables and up to 19km of interconnector cables in a maximum of one event each in every five year period may also cause increased SSCs. These activities will utilise similar methods as cable installation, with the use of trenching or jetting in trenches of up to 3m depth and width.

8.11.3.19 In either case, the maximum length of the repair or reburial activity may be up to 19km; therefore, the magnitude of the impacts would be a fraction of those for the construction phase, with events being undertaken intermittently over the duration of the 35 year project lifetime. The sediment plumes and sedimentation footprints would be dependent on which section of the cables is being repaired but would be smaller in magnitude than the construction phase in all cases.

8.11.3.20 The impact is predicted to be of local spatial extent, short-term duration, intermittent and high reversibility. The magnitude is therefore considered to be negligible.

Sensitivity of the receptor

8.11.3.21 The sensitivity of the benthic subtidal ecology IEFs to increased SSC and associated deposition during the O&M phase is as described for the construction phase in Paragraphs 8.11.3.9 to 8.11.3.13.

8.11.3.22 The offshore subtidal sands and gravels IEF was deemed to be of low to medium vulnerability, high recoverability and national value. The sensitivity of the receptor was therefore considered to be medium.

8.11.3.23 The ocean quahog IEF was deemed to be of no vulnerability, high recoverability and international value. The sensitivity of the receptor was therefore considered to be negligible.

Significance of the effect

8.11.3.24 For the offshore subtidal sands and gravels IEF, the magnitude of the impact is deemed to be negligible and the sensitivity of the receptor is considered to be medium. The effect will, therefore, be of negligible to minor adverse significance, with an overall **minor adverse** significance, which is not significant in EIA terms. This minor adverse significance is due to the national importance of this

IEF and the medium sensitivity of all constituent biotopes to increased SSCs and associated deposition.

8.11.3.25 For the ocean quahog IEF, the magnitude of the impact is deemed to be negligible and the sensitivity of the receptor is considered to be negligible. The effect will, therefore, be of **negligible adverse** significance, which is not significant in EIA terms.

Secondary mitigation and residual effect

8.11.3.26 No mitigation measures for benthic subtidal ecology are considered necessary because the likely effect in the absence of further mitigation (beyond the designed-in measures outlined in Table 8.18), is not significant in EIA terms.

Decommissioning phase

Magnitude of impact

8.11.3.27 During decommissioning, increases in SSCs and the potential impact on the benthic subtidal ecology IEFs would be of lesser magnitude than the construction phase due to removal of the cables, with scour and cable protection remaining *in situ*, which would only have a negligible effect on increased SSCs and associated deposition, with further explanation provided in Volume 2, Chapter 7: Physical Processes, of the EIA Report. Increases in SSC due to the removal of inter-array and interconnector cables would be similar or smaller to those experienced during the construction phase, as retrieval would be undertaken using similar techniques to installation. In the case of piled foundations, there is no significant disturbance of the seabed during decommissioning as piles are to be cut off. SSCs would increase temporarily if suction caissons were removed using overpressure to release. Decommissioning of gravity bases would involve the removal of ballast, which may release sediment into the water column. The increase in suspended sediments may persist during decommissioning, however they are likely to be temporary and localised in nature. Following decommissioning, changes in SSCs and associated deposition would return to baseline levels.

8.11.3.28 The impact is predicted to be of local spatial extent, short-term duration, intermittent and high reversibility. The magnitude is therefore considered to be negligible.

Sensitivity of the receptor

8.11.3.29 The sensitivity of the benthic subtidal ecology IEFs to increased SSC and associated deposition during the decommissioning phase is as described for the construction phase in Paragraphs 8.11.3.9 to 8.11.3.13.

8.11.3.30 The offshore subtidal sands and gravels IEF was deemed to be of low to medium vulnerability, high recoverability and national value. The sensitivity of the receptor was therefore considered to be medium.

8.11.3.31 The ocean quahog IEF was deemed to be of no vulnerability, high recoverability and international value. The sensitivity of the receptor was therefore considered to be negligible.

Significance of the effect

8.11.3.32 For the offshore subtidal sands and gravels IEF, the magnitude of the impact is deemed to be negligible and the sensitivity of the receptor is considered to be medium. The effect will, therefore, be of negligible to minor adverse significance, with an overall **minor adverse** significance, which is not significant in EIA terms. This minor adverse significance is due to the national importance of this IEF and the medium sensitivity of all constituent biotopes to increased SSCs and associated deposition.

8.11.3.33 For the ocean quahog IEF, the magnitude of the impact is deemed to be negligible and the sensitivity of the receptor is considered to be negligible. The effect will, therefore, be of **negligible adverse** significance, which is not significant in EIA terms.

Secondary mitigation and residual effect

8.11.3.34 No mitigation measures for benthic subtidal ecology are considered necessary because the likely effect in the absence of further mitigation (beyond the designed-in measures outlined in Table 8.18), is not significant in EIA terms.

8.11.4 Long-term habitat loss

8.11.4.1 Long-term habitat loss within the Morven North Benthic Subtidal Ecology Study Area will begin during the construction phase as infrastructure is installed across the construction period, and will continue during the O&M phase, and during the decommissioning phase if infrastructure is left *in situ*. Long-term habitat loss will occur directly under all foundations, scour protection, cable protection, and cable crossing protection, and will lead to habitat alteration to another seabed type. The assessment of the construction and O&M phases have been combined as the structures placed during construction will persist throughout the O&M phase. The potential impact of long-term habitat loss throughout and beyond the decommissioning phase has been considered due to the cable and scour protection being left *in situ* based on the MDS (Table 8.17).

8.11.4.2 The relevant MarESA and FeAST pressure and its benchmark which has been used to inform this impact assessment is:

- Physical change (to another seabed type): the benchmark for which is change in sediment type by one Folk class (based on UK SeaMap simplified classification (Long, 2006)) and change from sedimentary or soft rock substrata to hard rock or artificial substrate or vice-versa.

Construction and O&M phases

Magnitude of impact

8.11.4.3 The presence of the Morven North infrastructure will result in long-term habitat loss, with the MDS (Table 8.17) accounting for up to 2,052,797m^2 of long-term habitat loss due to the installation of foundations and associated scour protection, cable protection on inter-array and interconnector cables, and cable crossing protection. This equates to 0.11% of the Morven North Benthic Subtidal Ecology Study Area.

8.11.4.4 Long-term habitat loss potential impacts will be introduced during the construction phase and will be continuously present throughout the 35 year O&M phase and will impact benthic receptors directly.

8.11.4.5 The impact is predicted to be of local spatial extent, long-term duration, continuous and low reversibility during the construction and O&M phases. It is predicted that the impact will affect the receptor directly and will only represent a small area of long-term habitat loss compared to similar nearby habitats which will remain unimpacted. The magnitude is therefore considered to be low.

Sensitivity of the receptor

8.11.4.6 The sensitivity of the IEFs to long-term habitat loss is presented in Table 8.21 based on the MarESA and FeAST pressures.

8.11.4.7 All representative biotopes of the offshore subtidal sands and gravels IEF are characterised by their sedimentary habitats (ranging from mixed sediment to circalittoral fine sand). Based on the MarESA pressure for these three IEFs (Tillin and Watson, 2023a, Tillin, 2022, Tillin and Watson, 2023c), a change from a sedimentary to an artificial hard substratum would alter the characteristics of the biotopes in the long-term, and therefore result in a loss of the characterising species (such as *E. pusillus*, *O. borealis*, *A. prismatica*, and a range of other polychaetes and bivalves) that live buried within sandy sediments. Recovery of the same biotopes would be unable to occur in the locations where infrastructure was introduced due to the permanent change from sedimentary habitat.

8.11.4.8 The ocean quahog IEF also requires a soft sedimentary habitat, and physical change to hard artificial substratum would represent habitat loss for individuals affected. These species are therefore highly vulnerable to this impact (Tyler-Walters and Sabatini, 2017). In the site-specific survey, very few ocean quahog were noted, indicating that the likelihood of this species being impacted is minimal, despite their international importance.

8.11.4.9 The offshore subtidal sands and gravels IEF is deemed to be of high vulnerability, low recoverability, and national value. The sensitivity of this receptor is, therefore, considered to be high.

8.11.4.10 The ocean quahog IEF is deemed to be of high vulnerability, low recoverability, and international value. The sensitivity of the receptor is, therefore, considered to be high.

Table 8.21: Sensitivity of the Important Ecological Features to long-term habitat loss

IEF	Representative Biotopes and Species	Sensitivity to Physical Change (to another seabed type)	Overall sensitivity
Offshore subtidal sands and gravels	SS.SMx.OMx.PoVen	High	High
	SS.SSa.CFiSa.ApriBatPo SS.SSa.CFiSa	High	High
	SS.SSa.CFiSa.EpusOborApri	High	High
Ocean quahog	*Arctica islandica*	MarESA and FeAST: High	High

Significance of the effect

8.11.4.11 Overall, for offshore subtidal sands and gravels the magnitude of the impact is deemed to be low and the sensitivity of the receptor is considered to be high. The effect will, therefore, be of minor to moderate adverse significance, with an overall **minor adverse** significance, which is not significant in EIA terms. This is due to the relatively low area impacted by long-term habitat loss compared to the large areas of unimpacted similar habitat nearby.

8.11.4.12 Overall, for ocean quahog the magnitude of the impact is deemed to be low and the sensitivity of the receptor is considered to be high. The effect will, therefore, be of minor to moderate adverse significance, with an overall **minor adverse** significance, which is not significant in EIA terms. This conclusion is due to the low numbers of ocean quahog recorded from the site-specific survey, therefore limiting the significance of effect.

Secondary mitigation and residual effect

8.11.4.13 No mitigation measures for benthic subtidal ecology are considered necessary because the likely effect in the absence of further mitigation (beyond the designed-in measures outlined in Table 8.18), is not significant in EIA terms.

Decommissioning phase

Magnitude of impact

8.11.4.14 Infrastructure which may remain in situ post-decommissioning may total up to 1,881,338m^2 of cable and scour protection. This accounts for a small proportion (0.1%) of the Morven North Benthic Subtidal Ecology Study Area.

8.11.4.15 Some areas of cable protection may gradually become buried by sediment, which may facilitate some recolonisation of sedimentary species into these areas. However, this burial is not guaranteed and therefore the habitat will not return to soft sediments, and there will be no potential for recovery of sedimentary communities. Any cable or scour protection remaining after decommissioning which is not buried over time will provide an ongoing substrate for colonisation by benthic communities although the communities that develop and persist will be different from those originally found in the previously soft sediment environment. This will represent a permanent loss of the underlying sedimentary environment.

8.11.4.16 The impact is predicted to be of local spatial extent, long-term duration, continuous and low reversibility during the decommissioning phase. It is predicted that the impact will affect the receptor directly and will only represent a small area of long-term habitat loss compared to similar habitats within the Morven North Benthic Subtidal Ecology Study Area which will remain unimpacted. The magnitude is, therefore, considered to be low.

Sensitivity of the receptor

8.11.4.17 The sensitivity of the benthic subtidal ecology IEFs to long-term habitat loss during the decommissioning phase is as described for the construction phase in Paragraphs 8.11.4.6 to 8.11.4.10.

8.11.4.18 The offshore subtidal sands and gravels IEF is deemed to be of high vulnerability, low recoverability, and national value. The sensitivity of this receptor is, therefore, considered to be high.

8.11.4.19 The ocean quahog IEF is deemed to be of high vulnerability, low recoverability, and international value. The sensitivity of the receptor is, therefore, considered to be high.

Significance of the effect

8.11.4.20 For the offshore subtidal sands and gravels IEF, the magnitude of the impact is deemed to be low and the sensitivity of the receptor is considered to be high. The effect will, therefore, be of minor to moderate adverse significance, with an overall **minor adverse** significance, which is not significant in EIA terms. This is due to the relatively low area impacted by long-term habitat loss compared to the large areas of unimpacted similar habitat nearby.

8.11.4.21 For the ocean quahog IEF, the magnitude of the impact is deemed to be low and the sensitivity of the receptor is considered to be high. The effect will, therefore, be of minor to moderate adverse significance, with an overall **minor adverse** significance, which is not significant in EIA terms. This conclusion is due to the low numbers of ocean quahog recorded from the site specific survey, therefore limiting the significance of effect.

Secondary mitigation and residual effect

8.11.4.22 No mitigation measures for benthic subtidal ecology are considered necessary because the likely effect in the absence of further mitigation (beyond the designed-in measures outlined in Table 8.18), is not significant in EIA terms.

8.11.5 Increased risk of introduction and spread of invasive non-native species

8.11.5.1 Vessels used during the construction, O&M, and decommissioning phases of Morven North have the potential to introduce and facilitate the spread of INNS. These species could potentially settle and establish on introduced hard artificial structures. The relevant MarESA pressure and its benchmark which has been used to inform this impact assessment is:

- Introduction or spread of INNS: the benchmark for which is the introduction of one or more INNS.

8.11.5.2 Similarly, the FeAST pressure and its benchmark which has been used to inform this impact assessment is:

- Introduction or spread of non-indigenous species and translocations (competition): the benchmark for which is the direct or indirect introduction of invasive non-indigenous species and their subsequent spreading and out-competing of native species.

Construction, O&M, and Decommissioning phases

Magnitude of impact

8.11.5.3 During the construction phase, the MDS accounts for up to 3,060 vessel round trips associated with site preparation, wind turbine installation, OSP installation, inter-array cable and interconnector cable installation. The vessels provide vectors for the potential introduction or spread of INNS into the habitats within the Morven North Benthic Subtidal Ecology Study Area. Although the decommissioning methods are yet to be fully determined, the decommissioning phase will likely be of the same or smaller magnitude. Also, the introduction of 3,139,362m^2 of artificial hard structures (Section 8.11.4) could provide new habitat for INNS to colonise throughout the construction and O&M phases, and the decommissioning phase if the infrastructure is left in situ.

8.11.5.4 During the O&M phase, the MDS accounts for up to 293 vessel round trips per year for repairs and removal of marine growth from foundations or access ladders during the 35 year O&M phase, resulting in up to 10,255 vessel round trips overall. As in the construction and decommissioning phases, these vessels could act as vectors for the introduction and spread of INNS.

8.11.5.5 There are a number of benthic INNS widespread throughout Scottish waters and the wider North Sea, including:

- Wireweed (*Sargassum muticum*);
- Green sea-fingers (*Codium fragile* subspecies *fragile*);
- Red alga (*Dasysiphonia japonica*);
- Acorn barnacles (*Austrominius modestus*);
- Japanese skeleton shrimp (*Caprella mutica*);
- Leathery sea squirt (*Styela clava*);
- Orange tipped sea squirt (*Corella eumyota*);
- Orange ripple bryozoan (*Schizoporella japonica*) (NatureScot, 2023).

8.11.5.6 However, no INNS were recorded during the site specific surveys for Morven North (see Volume 3, Annex 8.1: Morven North and Morven South Shared Technical Report).

8.11.5.7 It is anticipated that vessels for site preparation and infrastructure installation will mostly use ports and harbours on the east coast of Scotland, which reduces the potential for introduction and spread of INNS from outside this area. However, some INNS such as the acorn barnacle are known to spread as fouling on ships, and these have the potential to be introduced into the Morven North Benthic Subtidal Ecology Study Area via these vessels. Also, delivery of some materials to site may take place directly from fabrication yards in international ports or harbours, which could increase the risk of introduction or spread of INNS, but all vessels will be required to comply with the INNSMP (Volume 4, Annex 1, Appendix 1.2: Invasive Non-Native Species Management Plan and Biosecurity Plan, MM-5, Table 8.18) to mitigate this impact as far as reasonably practicable.

8.11.5.8 The impact is predicted to be of local spatial extent, long-term duration (across all phases), intermittent, and low reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore considered to be low adverse.

Sensitivity of the receptor

8.11.5.9 The offshore subtidal sands and gravels IEF was assessed to have high sensitivity to the introduction and spread of INNS. Specifically, the constituent biotopes SS.SSa.CFiSa.EpusOborApri (Tillin and Watson, 2023c) and SS.SSa.CFiSa.ApriBatPo (Tillin, 2022) have the potential to be colonised by the slipper limpet (*Crepidula fornicata*), which can settle on stones and hard surfaces in substates, with few bivalve species able to live among high densities of this species (Blanchard, 1997). These

biotopes are also susceptible to the colonial ascidian (*Didemnum vexillum*), which can colonise habitats with high gravel components or hard substrates (Valentine *et al*., 2007), which will be installed during the construction phase. The SS.SMx.OMx.PoVen constituent biotope is also highly sensitive to INNS (Tillin and Watson, 2023b), with the potential for slipper limpet to colonise medium sands at a moderate density (Montaudouin and Sauriau, 1999), and hard substrata at a high density (Tillin *et al*., 2020).

8.11.5.10 The ocean quahog IEF was not assessed in the MarESA due to lack of research into the impacts of INNS on this species. Ocean quahog are known to take between five and 11 years to reach sexual maturity, depending on growth rate and environmental conditions (Thorarinsdóttir, 1998), which likely gives rise to a high sensitivity to INNS, which can spread much faster and outcompete ocean quahog if introduced. Also, the potential exists for INNS such as the Pacific oyster (*Magallana gigas*) to outcompete this similar bivalve species, although current evidences indicates this INNS is only present in a patchy distribution around Scotland (NatureScot, 2023) and therefore may not pose a threat to the small number of ocean quahog within the Morven North Benthic Subtidal Ecology Study Area.

8.11.5.11 The offshore subtidal sands and gravels IEF is deemed to be of high vulnerability, low recoverability and national value. The sensitivity of the receptor is therefore considered to be high.

8.11.5.12 The ocean quahog IEF is deemed to be of high vulnerability, low recoverability, and international value. The sensitivity of the receptor is therefore considered to be high.

Significance of the effect

8.11.5.13 For the offshore subtidal sands and gravels IEFs, the magnitude of the impact is deemed to be low and the sensitivity of the receptor is considered to be high. The effect will, therefore, be of minor to moderate adverse significance, with an overall conclusion of **minor adverse** significance, which is not significant in EIA terms. This was based on the mitigation measures within the INNSMP (Volume 4, Annex 1, Appendix 1.2: Invasive Non-Native Species Management Plan and Biosecurity Plan) reducing the potential of introduction and spread of INNS, and the large areas of otherwise unimpacted habitats within the Morven North Benthic Subtidal Ecology Study Area.

8.11.5.14 For the ocean quahog IEF, the magnitude of the impact is deemed to be low and the sensitivity of the receptor is considered to be high. The effect will, therefore, be of minor to moderate adverse significance, with an overall conclusion of **minor adverse** significance, which is not significant in EIA terms. This was based on the low numbers of ocean quahog which could be impacted by INNS within the Morven North Benthic Subtidal Ecology Study Area, and the implementation of the INNSMP.

Secondary mitigation and residual effect

8.11.5.15 No mitigation measures for benthic subtidal ecology are considered necessary because the likely effect in the absence of further mitigation (beyond the designed-in measures outlined in Table 8.18), is not significant in EIA terms.

8.11.6 Colonisation of hard structures

8.11.6.1 The introduction of the offshore infrastructure may result in the colonisation of wind turbines and OSPs, scour protection, cable protection, and cable crossing protection, and this could lead to local biodiversity changes. The relevant MarESA and FeAST pressures associated with this impact are the same as assessed above for long-term habitat loss:

- Physical change (to another seabed type): the benchmark for which is change in sediment type by one Folk class (based on UK SeaMap simplified classification (Long, 2006)) and change from sedimentary or soft rock substrata to hard rock or artificial substrate or vice-versa.

O&M phase

Magnitude of impact

8.11.6.2 The MDS accounts for up to a total of 3,139,362m^2 of hard structure surface area installed throughout the construction phase and persisting into the up to 35 year O&M phase (Table 8.17). The MDS is based on the total introduction of artificial structures as a result of the installation of wind turbines and OSPs, scour protection, cable protection, and cable crossing protection.

8.11.6.3 During these phases, it is likely that the foundations, scour protection, and cable protection will become colonised by hard structure adapted communities similar to those which occur on natural hard substrates (further information is provided in Section 8.11.4). Therefore, the permanent placement of infrastructure may be more accurately considered habitat alteration. This shift in baseline conditions from soft substrate areas (muds, sands, and gravels) to hard substrate has the potential to cause beneficial effects, such as through biodiversity increases and increased abundance of reef species as observed on monopile foundations at the Lysekil research site for offshore wind-based research in Gothenburg, Sweden (Bender *et al*., 2020). This was supported by (Lefaible *et al*., 2023), which found increased species richness and abundance in the immediate vicinity of foundations (approximately 37m from foundations), but the effect was absent at a distance of 350m from the foundations.

8.11.6.4 The structural complexity of the introduced hard structures may provide refuge and increased feeding opportunities for larger and more mobile species. Specifically, the presence of mobile benthic species is dependent on the presence of sufficient food sources, sufficient coverage of epibenthic communities, and appropriate habitat for sheltering to hide from predators (Langhamer and Wilhelmsson, 2009). Benthic diversity and density of individuals were also noted to be elevated around a range of foundation types, including jacket foundations (Degraer *et al*., 2021) and gravity-based foundations (Mavraki *et al*., 2020), indicating hard substrates increase these measures and can increase food web complexity.

8.11.6.5 Although this impact is expected to be beneficial in terms of increasing biodiversity and enhancing reef effects, the installation of hard structures will result in habitat loss of the offshore subtidal sands and gravels and ocean quahog IEFs. However, these habitats are widely available throughout the Morven North Benthic Subtidal Ecology Study Area and the Regional Benthic Subtidal Ecology Study Area, and this loss or alteration of soft bottom sediments will only represent a very minor reduction overall.

8.11.6.6 The impact is predicted to be of local spatial extent, long-term duration, continuous, and low reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is considered to be low due to the wide availability of similar habitats within the Regional Benthic Subtidal Ecology Study Area.

Sensitivity of the receptor

8.11.6.7 As the introduction of hard structures represents a permanent change from sedimentary to hard rock substrata, both the offshore subtidal sands and gravels and the ocean quahog IEF have a high sensitivity to this impact as this represents a change away from the sediment types these habitats rely upon. In the site-specific survey, very few ocean quahog were noted, indicating that the likelihood of this species being impacted is minimal, despite their international importance. In terms of the MarESA and FeAST pressure and benchmark, the IEFs have the same sensitivity as previously described in long-term habitat loss (Section 8.11.4).

8.11.6.8 The colonisation of hard structures may have indirect adverse effects on baseline communities and habitats due to increased predation on and competition between the existing species. The full extent of these effects is difficult to predict, as most research to date has monitored the changes related to colonisation near to foundations rather than broad scale habitats. Introduced hard substrates are known to replace a flat sedimentary environment with a complex three-dimensional structure, which increases the surface area and complexity, and increases the number of available niches in which

colonisation may occur (Dannheim *et al*., 2020). These introduced substrates may only be suitable for colonisation following weathering, the loss of any surface contaminants, the production of biofilms and the subsequent community succession and development after settlement of new species (Chase, 2015, Thompson *et al*., 1998).

8.11.6.9 Some studies on soft sediment environments show no significant effects in community composition following hard structure installation. Specifically, De Backer *et al*. (2020) found no changes in soft sediment communities eight to nine years after installation of the C-power and Belwind OWFs in Belgium, with sandy substrate present and still dominant in both wind farms. A review of the post-construction monitoring of the Block Island Wind Farm in the USA, Hutchison *et al.* (2020a) found no strong gradients of change in sediment grain size, enrichment, or benthic macrofauna within 30m to 90m of the wind turbines.

8.11.6.10 Post-construction monitoring of other wind farms including Beatrice OWF demonstrated extensive biofouling on all wind turbines with signs of zonation and successional development (APEM, 2022). Plumose anemones (*Metridium senile*) and tube worms *Spirobranchus triqueter* were most highly abundant, with the highest biomass at 40m depth on the introduced structures. Fish and shellfish species, including the hermit crab (*Pagurus bernhardus*) and flatfish species, were found at the bases of wind turbines, with decreasing abundance further from the foundations, indicating a source of food at these locations and the potential for hard structures to increase habitat and community complexity (APEM, 2022, Bender *et al*., 2020).

8.11.6.11 The offshore subtidal sands and gravels and the ocean quahog IEFs are deemed to be of high vulnerability, low recoverability, and national to international value. The sensitivities of both receptors are, therefore, considered to be high.

Significance of the effect

8.11.6.12 For both the offshore subtidal sands and gravels and the ocean quahog IEFs, the magnitude is deemed to be low and sensitivity is considered to be high. The effect will, therefore, be of minor to moderate significance, with an overall conclusion for both IEFs of **minor adverse** significance, which is not significant in EIA terms. This is based on the wide availability of other sandy and gravelly habitats in the Morven North Benthic Ecology Study Area, and the low number of ocean quahog individuals lowering the overall significance.

Secondary mitigation and residual effect

8.11.6.13 No mitigation measures for benthic subtidal ecology are considered necessary because the likely effect in the absence of further mitigation (beyond the designed-in measures outlined in Table 8.18), is not significant in EIA terms.

8.11.7 Changes in physical processes

8.11.7.1 Changes in physical processes may arise during the operation and maintenance phase from the installation of infrastructure into the water column, including scour effects and changes in the sediment transport and wave and tidal regimes resulting in potential effects on benthic subtidal receptors. Volume 2, Annex 7.1: Physical Processes Technical Report provides a full description of the physical assessment used to inform this impact assessment.

8.11.7.2 The relevant MarESA pressures and benchmarks used to inform this impact assessment are:

- Changes in local water flow (tidal current): change in peak mean spring bed flow velocity between 0.1m/s to 0.2m/s for more than one year. The pressure is associated with activities that have the potential to modify hydrological energy flows. This pressure corresponds to the impacts associated with the presence of cable protection;
- Local wave exposure changes: change in nearshore significant wave height >3% but <5% for one year. This pressure corresponds to the impacts associated with the presence of cable protection.

8.11.7.3 The relevant FeAST pressures and benchmarks used to inform this impact assessment are:

- Water flow (tidal current) changes – local: the benchmark for this pressure is the peak mean spring tide flow change of greater than 0.1m/s over an area >1km^2 or 50% of the width of the water body for >1 year;
- Wave exposure changes – local: the benchmark for this pressure is a change in nearshore significant wave height >3% for one year.

O&M phase

Magnitude of impact

8.11.7.4 In terms of tidal currents and water levels, the potential for localised spatial changes in current speed is limited to narrow wakes of slightly reduced current speed extending downstream of individual foundations, cable protection, and cable crossings, with proportionally increased turbulence expected in these areas. Changes to current speed at the resolution of the physical processes modelling found a maximum variation of 0.4m/s in the immediate vicinity of infrastructure, which constitutes approximately 60% of the peak baseline flow. However, this reduced to <0.01m/s within 5km, representing <2% of the baseline current speeds, indicating that changes would be imperceptible beyond the Morven North Boundary. The infrastructure being present and remaining *in situ* may have some impact on physical processes, but it is likely that this will be highly limited due to the water depth and the limited height of the scour and cable protection.

8.11.7.5 In terms of changes to wave regimes, Morven Morth infrastructure has the potential to impact wave height, period, and direction. Modelling indicated that waves in a yearly southerly storm event would be deflected around the structures, and wave height could increase by up to 0.35m or decrease by 0.8m around an OSP gravity base foundation, equating to <10% of the baseline significant wave height. For a once in 20 year southerly storm event, wave height could increase by up to 0.4m or decrease by up to 0.9m in the immediate vicinity of infrastructure, although this represents a small impact within the Morven North Benthic Ecology Study Area throughout the O&M phase overall.

8.11.7.6 The impact is predicted to be of local spatial extent, long-term duration, continuous and low reversibility during the lifetime of Morven North. It is predicted that the impact will affect the receptor directly. Based on the site specific physical processes modelling, as summarised above, the magnitude is considered to be low.

Sensitivity of the receptor

8.11.7.7 Offshore subtidal sands and gravels are considered to not be sensitive to this impact (Table 8.22), due to many species of the constituent biotopes occurring in a range of sediment types (Tillin and Watson, 2023b, Tillin, 2022, Tillin and Watson, 2023c), indicating a natural resilience to hydrodynamic changes which could impact seabed conditions. Also, although polychaete and bivalve species may be directly physically moved or impacted by changes in water flows at the seabed as it may result in changes to the sediment transport regime (Tillin, 2023a), the presence of all biotopes in environments with a range of wave action exposure (JNCC, 2015) indicates resistance to this impact.

8.11.7.8 Ocean quahog adults which are buried at a sufficient depth within the sediment are unlikely to be impacted by changes to either physical processes pressure (Tyler-Walters and Sabatini, 2017). Pelagic larvae and juveniles have the potential to be damaged or prevented from settling if exposed to water flow changes (Witbaard and Bergman, 2003), but the recovery of adult ocean quahog is considered to be very high. Changes to wave exposure can cause coarse sediment to become unstable and difficult to burrow into, but affected coarse sediments will lack the fine particles which could clog gills or filtering mechanisms and therefore the impact of these changes on adults would be low (Earll and Erwin, 1983).

8.11.7.9 The offshore subtidal sands and gravels IEF was deemed to be of no vulnerability, high recoverability, and national value. The sensitivity of the receptor was therefore considered to be negligible.

8.11.7.10 The ocean quahog IEF was deemed to be of medium vulnerability, high recoverability, and international value. The sensitivity of the receptor was therefore considered to be medium.

Table 8.22: Sensitivity of Important Ecological Features to changes in physical processes

IEF	Representative Biotopes and Species	Changes in Local Water Flow (Tidal Current)	Local Wave Exposure Changes	Overall Sensitivity
Offshore Subtidal Sands and Gravels	SS.SMx.OMx.PoVen	MarESA: Not sensitive	MarESA: Not sensitive	Negligible
	SS.SSa.CFiSa.ApriBatPo SS.SSa.CFiSa	MarESA: Not sensitive	MarESA: Not sensitive	
	SS.SSa.CFiSa.EpusObor Apri	MarESA: Not sensitive	MarESA: Not sensitive	
Ocean quahog	*Arctica islandica*	MarESA: Not sensitive FeAST: Low	MarESA: Not sensitive FeAST: Medium	Medium

Significance of the effect

8.11.7.11 For the offshore subtidal sands and gravels IEF, the magnitude of the impact is deemed to be low and the sensitivity of the receptor is considered to be negligible. The effect will, therefore, be of negligible to minor adverse significance, with an overall **negligible adverse** significance, which is not significant in EIA terms. This negligible significance was concluded based on the negligible magnitude of both pressures as confirmed by site specific modelling.

8.11.7.12 For the ocean quahog IEF, the magnitude of the impact is deemed to be low and the sensitivity of the receptor is considered to be medium. The effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.

Secondary mitigation and residual effect

8.11.7.13 No mitigation measures for benthic subtidal ecology are considered necessary because the likely effect in the absence of further mitigation (beyond the designed-in measures outlined in Table 8.18) is not significant in EIA terms.

8.11.8 Removal of hard substrates

8.11.8.1 The removal of hard substrates in the decommissioning phase may affect the established benthic community associated with Morven North, with the seabed returning to its current sand sediments from the introduced hard surfaces. The artificial structures introduced are expected to have been colonised by a range of epifauna and associated communities over the 35 year life of Morven North (assessed in Section 8.11.6). The relevant MarESA and FeAST pressure associated with this impact is the same as assessed for the long-term habitat loss and the colonisation of hard structures:

- Physical change (to another seabed type): the benchmark for which is change in sediment type by one Folk class (based on UK SeaMap simplified classification (Long, 2006)) and change from sedimentary or soft rock substrata to hard rock or artificial substrate or vice-versa.

Decommissioning phase

Magnitude of impact

8.11.8.2 The approach for decommissioning is yet to be determined, but for the purposes of this MDS the total removal of all introduced infrastructure has been assumed, as this would represent the greatest potential impact. The exact programme for decommissioning will be submitted to MD-LOT for

consultation and approval by the Scottish Ministers. Up to a total of 3,139,362m^2 of hard structure surface area may be removed, along with all colonised organisms and associated communities.

8.11.8.3 The impact is predicted to be of local spatial extent, long-term (permanent where any infrastructure is removed) duration, continuous and of low reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is, therefore, considered to be low.

Sensitivity of the receptor

8.11.8.4 Removal of hard substrate will represent a permanent shift in seabed type and associated species assemblage, with the MarESA and FeAST pressure and benchmark sensitivities to this impact being the same as previously described for long-term habitat loss (Section 8.11.4). All IEFs are assessed as having a high sensitivity to the introduction of hard substrates, as these features are dependent on the presence of sedimentary substrates. However, the removal of hard substrate would allow the gradual return of sediment substrates into the affected footprints, resulting in an overall increase in the available habitat for the IEFs to recover into.

8.11.8.5 Both the offshore subtidal sands and gravels and ocean quahog IEFs are deemed to be of low vulnerability, high recoverability, and national to international value. The sensitivities of both receptors were therefore considered to be low.

Significance of the effect

8.11.8.6 For both the offshore subtidal sands and gravels and ocean quahog IEFs, the magnitude of the impact is deemed to be low and the sensitivity of the receptors was deemed to be low. The effect will, therefore, be of negligible to minor adverse significance, with an overall **minor adverse** significance, which is not significant in EIA terms. This minor adverse conclusion is due to the potential removal of benthic habitats as well as international importance of ocean quahog and classification as a PMF.

Secondary mitigation and residual effect

8.11.8.7 No mitigation measures for benthic subtidal ecology are considered necessary because the likely effect in the absence of further mitigation (beyond the designed-in measures outlined in Table 8.18) is not significant in EIA terms.

8.11.9 Impacts to benthic invertebrates due to Electromagnetic Fields

8.11.9.1 Impacts to benthic ecology due to EMFs may arise due to the presence and operation of inter-array and interconnector cables during the O&M phase.

8.11.9.2 The evidence base for EMF impacts on benthic invertebrates is limited, with research mostly focusing on impacts on crustaceans (Hutchison *et al*., 2020b, Hutchison *et al*., 2021, Jakubowska-Lehrmann *et al*., 2025, Scott *et al*., 2021, Scott *et al*., 2018). A knowledge gap exists concerning the ability of benthic species to detect EMFs (Harris *et al*., 2025), with further research required on whether any physiological or behavioural impacts are associated with exposure to EMFs (Albert *et al*., 2020).

8.11.9.3 The following MarESA and FeAST pressure and associated benchmarks used to inform this impact assessment are listed below:

- Electromagnetic changes: A local electric field of 1V/m or a local magnetic field of 10μT.

8.11.9.4 For all MarESA and FeAST assessments for the 'electromagnetic changes' pressure, it was not possible to undertake sensitivity assessments on EMF impacts for any of the benthic IEFs (Tillin and Watson, 2023b, Tillin, 2022, Tillin and Watson, 2023c, Tyler-Walters and Sabatini, 2017). This is due to a lack of research currently undertaken on these IEFs. Therefore, a broad overview of available evidence on EMF impacts has been presented in this assessment.

O&M phase

Magnitude of impact

8.11.9.5 EMFs comprise the electrical fields, measured in microvolts per metre (μV/m) or millivolts per metre (mV/m), and the magnetic fields, measured in microtesla (mT) or milligauss (mG). Within the North Sea, background measures of magnetic fields tend to be approximately 50μT, and the naturally occurring electric field in this area is approximately 25μV/m (Tasker *et al*., 2010). Electrical fields are typically blocked through use of conductive sheathing in cables, with EMFs therefore only emitting magnetic fields and the resultant induced electrical field into the environment. Cable burial reduces the strength of the magnetic field at the seabed surface due to field decay over distance (Snyder *et al*., 2019), but it is broadly impractical to assume all cables will always be buried at depths to reduce both electrical and magnetic fields to below detection levels of benthic marine organisms (Gill *et al*., 2005, Gill *et al*., 2009).

8.11.9.6 The levels of EMFs around cables are affected by a range of design and installation factors, including current flow, distance between cables and cable configuration, cable insultation type and thickness, the number of conductors, and burial depth. Electricity flow associated with an alternating current (AC) cable changes direction (at a rate based on the frequency of the AC transmission) and creates a constantly varying electric field in the marine environment surrounding the cable (Huang, 2005).

8.11.9.7 The magnetic field strength (and associated induced electrical fields) decreases rapidly in all directions with increased distance from the source. Evidence showed that burial or covering using concrete mattresses of inter-array cables at a depth of 1m to 2m reduced magnetic field strength at the seabed surface by a factor of four (Snyder *et al*., 2019). This study also investigated the relationship between voltage, current, and burial depth, and found EMF levels decreased 1m away from cables, and returned to background levels at 3m to 7.5m from the cable, indicating a very limited range of effect.

8.11.9.8 During the O&M phase, there will be up to 424km of 66kV inter-array cables and up to 484km of 275kV interconnector cables operating for the 35 year operational lifetime. Where feasible, a minimum burial depth of 0.5m will be applied to all cables during installation. Where burial is not possible, cable protection will be used on up to 10% of both the inter-array and interconnector cables. Also, cable crossing protection will be used at up to five asset crossings each for inter-array and interconnector cables.

8.11.9.9 The magnitude is predicted to be of local spatial extent, long-term duration, continuous, and high reversibility when cables are removed or are no longer operating in the decommissioning phase. It is predicted that the impact with affect the receptor directly. The magnitude is, therefore, considered to be low.

Sensitivity of the receptor

8.11.9.10 Subsea power cables generate EMFs, which are increasingly recognized as a potential stressor for benthic marine organisms (Taormina *et al*., 2018). While much of the early research focused on elasmobranchs and crustaceans, recent studies have begun to explore the responses of other benthic taxa, including polychaetes, molluscs, and echinoderms (Taormina *et al*., 2018). For instance, some benthic invertebrates including the painted urchin (*Lytechinus pictus*) and purple urchin (*Strongylocentrotus purpuratus*) exhibit altered behaviour and physiological stress responses when exposed to EMFs between 10μT and 100,000μT (Cameron *et al*., 1993, Levin and Ernst, 1997, Zimmerman *et al*., 1990), although the magnitude and nature of these effects vary widely among taxa (Schultz *et al*., 2010, Woodruff *et al*., 2012). A study by Chapman *et al*. (2023) investigated the behavioural and physiological responses of the echinoderms common starfish (*Asteria rubens*) and common sea urchin (*Echinus esculentus*), as well as velvet swimming crab (*Necora puber*), and common periwinkle (*Littorina littorea*) to EMF exposure from subsea power cables. The Chapman *et al*. (2023) study exposed specimens to EMFs of 500μT for 24 hours, and found no significant behavioural or physiological responses in any of the species investigated. Similarly, Bochert and Zettler (2006) found no effect of 24 hours of exposure to a 2,700μT EMF on common starfish or

ragworm *Hediste diversicolor*. Only one third of isopod (*Saduria entomon*) specimens in a treatment were found to be slightly attracted towards an EMF source compared to more evenly distributed controls after 22 hours of exposure (Bochert and Zettler, 2006).

8.11.9.11 The effects of EMFs on ragworms were also investigated by Jakubowska *et al*. (2019), which found no avoidance or attraction, or changes in food consumption rates following exposure to 1mT EMFs from a cable of 50Hz for eight days. However, the ragworms exhibited significant lower burrowing activity and ammonia extraction when exposed to EMFs, although the mechanisms for these observations remain unclear and require further research (Jakubowska *et al*., 2019). Also, genotoxic and cytotoxic effects (DNA and cellular damage, respectively) of exposure to a 50Hz 1mT EMF over 12 days were investigated on ragworm and the bivalve Baltic tellin (*Macoma balthica*) (Stankevičiūtė *et al*., 2019). This found no significant cell damage responses in ragworm, but an increased frequencies of cell abnormalities were found in Baltic tellin. Both investigated species displayed DNA damage due to EMF exposure, with increased production of micronuclei and nuclear buds indicating chromosomal loss and mitotic disruption.

8.11.9.12 Although there are no studies specifically on ocean quahog sensitivity to EMFs, the results described above for the Baltic tellin could be applicable, as both species are North Sea burrowing bivalves. Also, Albert *et al*. (2022) observed no change in the feeding behaviour of *Mytilus edulis* exposed to artificial magnetic field treatment of 300μT. Similarly, Jakubowska-Lehrmann *et al*. (2022) found no reduction in respiration rate of lagoon cockle (*Cerastoderma glaucum*) when exposed to 50Hz 1mT EMFs for eight days, although ammonia excretion was lowered significantly following EMF exposure, indicating the potential for oxidative stress from continuous exposure. Additional research found increased oxidative stress responses of the mollusc *Elysia leucolegnote* (Fei *et al*., 2023), although this is a species of sea slug found only in Hong Kong, and therefore does not represent the IEFs, but does provide further evidence of potential impacts of EMFs.

8.11.9.13 As no IEFs are directly assessed within the literature, and the evidence of impacts varies, a precautionary assessment of medium vulnerability, medium recoverability, and national to international value has been applied to all IEFs. This is likely to be over-precautionary, as studies typically use EMF levels greater than would typically be associated with buried or protected undersea cables. Also, some of the studies (Bochert and Zettler, 2006, Chapman *et al*., 2023) found little to no impact on the species in their assessments. The sensitivities of the receptors were, therefore, considered to be medium, on a precautionary basis.

Significance of the effect

8.11.9.14 For the offshore subtidal sands and gravels and ocean quahog IEFs, the magnitude is deemed to be low and the sensitivity of the receptor is deemed to be medium. The effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.

Secondary mitigation and residual effect

8.11.9.15 No mitigation measures for benthic subtidal ecology are considered necessary because the likely effect in the absence of further mitigation (beyond the designed-in measures outlined in Table 8.18), is not significant in EIA terms.

8.11.10 Proposed monitoring

8.11.10.1 No benthic subtidal ecology monitoring to test the predictions made within the assessment of potential impacts and likely significant effects on benthic subtidal ecology is considered necessary.

8.12 Whole project assessment and cumulative effects assessment Methodology

8.12.1 Methodology

8.12.1.1 The Morven Programme comprises four distinct projects: Morven North, Morven South, Morven Hawthorn Pit Grid Connection Project (MHPGC Project) (Morven Offshore Wind Limited, 2025), and Morven Branxton Area Grid Connection Project (MBAGC Project) .

8.12.1.2 The following assessment scenarios have been considered to identify the likely significant effect of Morven North in combination with other projects on the same receptor, as follows (and summarised in Table 8.23):

- Whole project assessment: to identify the potential impacts associated with Morven North together with each grid connection option in turn, (Scenario 1: MHPGC and Scenario 2: MBAGC Project), each of which would comprise a "Whole Project";
- Morven Programme assessment: to identify potential impacts associated with all four components of the Morven Programme together with other relevant projects, plans and activities (Scenario 3);
- CEA: to identify the potential impacts associated with Morven North together with other relevant projects, plans and activities including other components of the Morven Programme, using a tiered approach (Scenario 4).

8.12.1.3 The Whole Project assessment and CEA have been undertaken in accordance with the methodology described in Volume 1, Chapter 6: EIA methodology.

Table 8.23: Scenarios to be considered in the Morven North Whole Project assessment and cumulative effects assessment for benthic subtidal ecology

Whole Project assessment		Morven Programme assessment (Offshore Ornithology and Shipping & Navigation only)	Cumulative effects assessment
Scenario 1	**Scenario 2**	**Scenario 3**	**Scenario 4**
Morven North + MHPGC Project	Morven North + MBAGC Project	Morven North + Morven South + MHPGC Project + MBAGC Project	Morven North + Tier 1, Tier 2 and Tier 3 Plans/Projects screened in

8.12.1.4 For the purposes of this benthic subtidal ecology chapter, Scenarios 1, 2, and 4 have been taken forward for assessment; Scenario 3 has not been included as it is not applicable to this chapter. As discussed in Volume 1, Chapter 6: EIA Methodology, the Morven Programme assessment (Scenario 3) is only required for specific chapters to provide further context to, and to support, the conclusions of the CEA scenario (Scenario 4), in agreement with the relevant stakeholders for these topics. As Scenario 3 does not form the basis of the CEA conclusions, it is considered a supplementary assessment to the CEA scenario (Scenario 4) for these specific topics. The approach to cumulative effects assessment presented in this benthic subtidal ecology chapter complies with the requirements under the EIA Regulations to assess the likely significant effect on the environment arising from a project cumulatively with other relevant plans, projects and activities, and no supplementary assessment of the Morven Programme (Scenario 3) is required or has been requested by relevant stakeholders with regard to benthic subtidal ecology.

8.12.1.5 The projects and plans selected as relevant to the CEA presented within this chapter are based upon the results of a screening exercise (see Volume 3, Annex 6.1: Cumulative Effects Screening, of the Morven North EIA Report). Each project or plan has been considered on a case-by-case basis for screening in or out of this chapter's assessment based upon data confidence, effect-receptor pathways and the spatial/temporal scales involved.

8.12.1.6 In undertaking the CEA for Morven North, it should be noted that other projects and plans under consideration will have differing potential for proceeding to an operational stage and hence a differing potential to ultimately contribute to a cumulative effect alongside Morven North. Therefore, a tiered approach has been adopted, whereby all third-party projects and plans considered have been allocated into 'tiers' reflecting their current stage within the planning and development process. This provides a framework for placing relative weight upon the potential for each project/plan included in the CEA to ultimately be realised, based upon the project/plan's current stage of maturity and certainty in the project/plan's parameters. The tiered approach utilised within the Morven North CEA employs the following tiers:

- Tier 1 assessment – Existing developments either built (operational) or under construction[1]; approved developments awaiting implementation; and permitted/submitted application(s), but not yet determined;
- Tier 2 assessment – All plans/projects assessed under Tier 1, and plans/projects where a scoping report has been submitted and is in the public domain;
- Tier 3 assessment – All plans/projects assessed under Tier 1 and 2, plus plans/projects that are reasonably foreseeable (e.g., projects identified in development plans, projects in other plans and programmes, offshore renewable energy projects that have a Crown Estate Scotland Lease Option Agreement).

8.12.1.7 The specific projects and plans scoped into the CEA for benthic subtidal ecology are outlined in Table 8.24 and shown in Figure 8.6, with projects shaded grey when parts or sections fall outside of the Regional Benthic Subtidal Study Area (a section of the MarramWind Export Cable Scoping Boundary includes terrestrial sections, but this all falls outside of the Regional Benthic Subtidal Study Area and therefore is not relevant to the CEA). The study areas include the Regional Benthic Subtidal Study Area and the smaller Morven North Physical Processes CEA Study Area, as defined in Paragraph 8.2.1.4. Where relevant, quantitative percentages have been calculated to indicate the potential proportional cumulative magnitude of each impact from all projects on the benthic IEFs. However, this may not represent a complete value, as many aspects of each project are located outside of the Regional Benthic Subtidal Study Area.

8.12.1.8 All potential impacts from the Morven North alone assessment that have been considered in the CEA (listed in Table 8.25).

8.12.1.9 Some of the potential impacts considered within the Morven North alone assessment are specific to a particular phase of development (e.g. construction, operation and maintenance or decommissioning). Where cumulative effects with other plans or projects only have potential to occur where there is spatial or temporal overlap with Morven North during certain phases of development, impacts associated with a certain phase may be omitted from further consideration

[1] Note that existing developments are included in the Tier 1 CEA long list but are generally screened out of the CEA assessments, aside from the following exceptions:

1)Existing developments which were not present at the time of baseline characterisation, where a potential cumulative impact-receptor pathway has been identified.

2) Existing developments are screened into tier 1 assessments for specific topics where there is a large conceptual, temporal and spatial overlap between project impacts. In these instances, the potential for ongoing effects through cumulative impact-receptor pathways throughout project lifetime, across the development phases, means that they are considered within quantitative assessment for these topic CEAs (e.g., offshore ornithology assessments consider the cumulative effects of operational offshore wind farms).

where no plans or projects have been identified that have the potential for cumulative effects during this period.

Table 8.24: List of other projects and plans considered within the Cumulative Effects Assessment for benthic subtidal ecology

Project/plan	Status [i.e. Application, Consented, Under Construction, Operational]	Distance from Morven North (km)	Description of project/plan	Estimated dates of construction (If applicable)	Estimated dates of operation (If applicable)	Overlap with Morven North [e.g. Project construction phase overlaps with Morven North construction phase]
Morven North	Pre-application	N/A	See Section 8.11	2033-2042	2038-2073 or 2043-2078	N/A
Tier 1						
Wind Farms						
Morven South Offshore Wind Array Project	Application submitted, awaiting decision	0	The Morven South Offshore Wind Array project is proposed for up to 1500MW capacity.	2033-2042	2038-2073 or 2043-2078	All phases overlap temporally with all phases of Morven North.
Ossian Offshore Wind Farm	Consenting/Pre-Construction	9	The Ossian Floating Wind project is proposed for up to 3,610MW capacity.	2029-2038	2039-2078	Construction and O&M overlap temporally with construction of Morven North. O&M overlaps temporally with construction and O&M of Morven North.
Seagreen 1	Operational	25	Seagreen 1 Offshore Wind Farm consists of up to 114 wind turbines at a capacity of 1,075MW.	N/A	2024-2048	O&M overlaps temporally with construction of Morven North. O&M and decommissioning temporally overlap with O&M of Morven North.
Berwick Bank	Consented	32	Berwick Bank Offshore Wind Farm is proposed for up to 307 turbines with a capacity of up to 4,100MW.	2025-2029	2030-2051	O&M overlaps temporally with construction of Morven North. O&M and decommissioning overlaps temporally with O&M of Morven North.

Project/plan	Status [i.e. Application, Consented, Under Construction, Operational]	Distance from Morven North (km)	Description of project/plan	Estimated dates of construction (If applicable)	Estimated dates of operation (If applicable)	Overlap with Morven North [e.g. Project construction phase overlaps with Morven North construction phase]
Berwick Bank Export Cable – Branxton Connection	Consented	56	The Branxton Connection is an offshore export cable connecting Berwick Bank to the coast.	2025-2032	2032-2065	O&M overlaps temporally with construction of Morven North. O&M and decommissioning overlaps temporally with O&M of Morven North.
Seagreen 1A	Construction	41	Seagreen 1A Offshore Wind Farm is consented for up to 36 turbines with no maximum generating capacity.	2030-2031	2032-2046	O&M overlaps temporally with construction of Morven North. O&M and decommissioning temporally overlap with O&M of Morven North.
Kincardine Offshore Windfarm	Operational	43	Existing wind farm, with Section 36 variation application to seek to amend the Description of the Development - License reference 171543/S36.	N/A	2024-2046	O&M overlaps temporally with construction of Morven North. O&M and decommissioning temporally overlap with O&M of Morven North.
Muir Mhor Offshore Wind Farm	Application submitted, awaiting decision	58	Muir Mhor Offshore Wind Farm is proposed for a capacity of 798MW.	2030-2033	2034-2078	Construction and O&M overlap temporally with construction of Morven North. O&M overlaps temporally with construction and O&M of Morven North.
Inch Cape Offshore Wind Farm	Construction	61	Inch Cape Offshore Wind Farm is consented for up to 72	2025-2026	2027-2078	O&M overlaps temporally with construction and O&M of Morven North.

Project/plan	Status [i.e. Application, Consented, Under Construction, Operational]	Distance from Morven North (km)	Description of project/plan	Estimated dates of construction (If applicable)	Estimated dates of operation (If applicable)	Overlap with Morven North [e.g. Project construction phase overlaps with Morven North construction phase]
			turbines at a capacity of 1,100MW.			
Aberdeen Offshore Wind Farm	Operational	63	Aberdeen Offshore Wind Farm consists of up to 11 turbines at a capacity of 96.8MW.	N/A	2024-2043	O&M overlaps temporally with the construction of Morven North. O&M and Decommissioning overlaps with O&M of Morven North.
Hywind (Buchan Deep Demo)	Operational	64	Hywind Offshore Wind Farm consists of up to 5 turbines at a capacity of 30MW.	N/A	2024-2037	O&M and decommissioning overlap temporally with construction of Morven North.
INTOG: Salamander	Consented	75	INTOG site 3 is proposed for up to 100MW.	2028	2029-2063	O&M overlaps temporally with construction and O&M of Morven North. Decommissioning temporally overlaps with O&M of Morven North.
Neart Na Gaoithe Offshore Wind - 66600019	Operational	80	Neart na Gaoith Offshore Wind Farm is consented for up to 54 turbines at a capacity of 450MW.	2024	2025-2049	O&M overlaps temporally with construction of Morven North. O&M and decommissioning temporally overlap with O&M of Morven North.
INTOG: Aspen	Application submitted	93	INTOG site 8 is proposed for up to 1,008MW, with only the Export Cable corridor overlapping the Morven North and	2028	2029-2078	O&M overlaps temporally with construction and O&M of Morven North.

Project/plan	Status [i.e. Application, Consented, Under Construction, Operational]	Distance from Morven North (km)	Description of project/plan	Estimated dates of construction (If applicable)	Estimated dates of operation (If applicable)	Overlap with Morven North [e.g. Project construction phase overlaps with Morven North construction phase]
			Morven South Benthic Cumulative Study Area.			
Green Volt Floating Offshore Wind Farm	Construction	103	Green Volt Offshore Wind Farm is proposed for up to 35 turbines at a capacity of 560MW. Only the export cable corridor will overlap spatially with the Morven North and Morven South Benthic Cumulative Study Area.	2025-2029	2030-2059	O&M overlaps temporally with construction of Morven North. O&M and decommissioning temporally overlap with O&M of Morven North.
Forthwind Demonstration Project	Operational	129	Forthwind Offshore Wind Demonstration Project is consented for up to 7 turbines at a capacity of 54MW.	2026	2027-2049	O&M overlaps temporally with construction of Morven North. O&M and decommissioning temporally overlap with O&M of Morven North.
INTOG: Cenos	Application submitted	130	INTOG site 11 is proposed for up to 1,350MW, with up to 95 turbines. Only a small section of the Export Cable Corridor overlaps with the Morven North and Morven South Benthic Cumulative Study Area.	2030-2031	2035-2078	O&M overlaps temporally with construction and O&M of Morven North.
Wind cable agreements and Carbon Capture and Storage (CCS)						

Project/plan	Status [i.e. Application, Consented, Under Construction, Operational]	Distance from Morven North (km)	Description of project/plan	Estimated dates of construction (If applicable)	Estimated dates of operation (If applicable)	Overlap with Morven North [e.g. Project construction phase overlaps with Morven North construction phase]
Cambois Connection – OWF Export Cable	Construction	38	The 'Cambois connection' is an offshore Export Cable connecting Berwick Bank to the coast.	2025-2032	2033-2078	O&M overlaps temporally with construction and O&M of Morven North.
Seagreen Phase 1 – OWF Export Cable	Operational	40	Seagreen Phase 1 Export Cable is consented for up to 6 cables with no maximum capacity.	N/A	2024-2048	O&M overlaps temporally with construction of Morven North. O&M and decommissioning temporally overlap with O&M of Morven North.
Seagreen 1A – OWF Export Cable	Construction	41	Seagreen Phase 1A Export Cable is consented for up to 6 cables with no maximum capacity.	2024-2025	2026-2046	O&M overlaps temporally with construction of Morven North. O&M and decommissioning temporally overlap with O&M of Morven North.
Kincardine – OWF Export Cable	Operational	47	Kincardine Export Cable consists of 2 cables at a capacity of 33kV.	N/A	2024-2046	O&M overlaps temporally with construction of Morven North. O&M and decommissioning temporally overlap with O&M of Morven North.
Aberdeen – OWF Export Cable	Operational	66	Aberdeen Offshore Wind Farm Export Cable consist of up to 4 cables at a capacity of 66kV.	N/A	2024-2045	O&M overlaps temporally with construction of Morven North. O&M and decommissioning temporally overlap with O&M of Morven North.

Project/plan	Status [i.e. Application, Consented, Under Construction, Operational]	Distance from Morven North (km)	Description of project/plan	Estimated dates of construction (If applicable)	Estimated dates of operation (If applicable)	Overlap with Morven North [e.g. Project construction phase overlaps with Morven North construction phase]
Hywind (Buchan Deep Demo) – OWF Export Cable	Operational	66	Hywind Export Cable consists of 1 cable at a capacity of 132kV.	N/A	2024-2037	O&M overlaps temporally with construction of Morven North. Decommissioning overlaps temporally with O&M of Morven North.
Inch Cape Offshore Export Cable Route	Operational	66	Inch Cape transmission is consented for 1 cable at a capacity of 132kV.	N/A	2025-2051	O&M overlaps temporally with construction of Morven North. O&M and decommissioning temporally overlap with O&M of Morven North.
Salamander - OWF Export Cable	Consented	81	Transmission infrastructure with up to 2 cables, each with up to 66kV.	2027-2028	2029-2063	O&M overlaps temporally with construction and O&M of Morven North. Decommissioning temporally overlap with O&M of Morven North.
Neart Na Gaoithe – OWF Export Cable	Operational	85	Neart na Gaoithe Export Cable is consented for 2 cables with no maximum capacity.	N/A	2025-2049	O&M overlaps temporally with construction of Morven North. O&M and decommissioning temporally overlap with O&M of Morven North.
Buchan - OWF Export Cable	Consented	88	Transmission infrastructure	2030-2032	2033 - 2063	O&M overlaps temporally with construction and O&M of Morven North. Decommissioning temporally overlap with O&M of Morven North.
Acorn - CCS	Construction	119	Acorn is one of the leading UK carbon capture and storage	2024-2025	2026-2049	O&M overlaps temporally with construction of Morven North.

Project/plan	Status [i.e. Application, Consented, Under Construction, Operational]	Distance from Morven North (km)	Description of project/plan	Estimated dates of construction (If applicable)	Estimated dates of operation (If applicable)	Overlap with Morven North [e.g. Project construction phase overlaps with Morven North construction phase]
			(CCS) and hydrogen projects. A section of the pipeline overlaps with the Morven North and Morven South Benthic Cumulative Study Area.			O&M and decommissioning temporally overlap with O&M of Morven North.
Pipelines						
Forties C To Cruden Bay (PI721)	Operational	61	169km oil pipeline from the Forties C platform to Cruden bay	N/A	2024-2041	O&M and decommissioning overlaps temporally with construction of Morven North.
20" Gas Fulmar A - St. Fergus	Decommissioning (2024-2033)	68	Gas pipeline from Fulmar A to St Fergus gar processing plant	N/A	N/A	Decommissioning overlaps temporally with construction of Morven North.
Buzzard (P) To Forties Hot Tap	Operational	74	Oil pipeline from Buzzard field to the Forties pipeline	N/A	2024-2041	O&M and decommissioning overlaps temporally with construction of Morven North.
Hfc To St. Fergus South	Operational	81	361km gas pipeline from Heider Riser platform to St Fergus	N/A	2024-2041	O&M and decommissioning overlaps temporally with construction of Morven North.
Sage Pipeline	Operational	81	323km gas pipeline connecting Beryl and SAGE pipelines to the SAGE terminal at ST Fergus	N/A	2024-2041	O&M and decommissioning overlaps temporally with construction of Morven North.
Cables						

Project/plan	Status [i.e. Application, Consented, Under Construction, Operational]	Distance from Morven North (km)	Description of project/plan	Estimated dates of construction (If applicable)	Estimated dates of operation (If applicable)	Overlap with Morven North [e.g. Project construction phase overlaps with Morven North construction phase]
Spittal to Peterhead HVDC Link	Application submitted/Awaiting decision	85	2GW bi-pole 525kV HVDC link	2026 - 2030	2031 onward	O&M overlaps temporally with construction and O&M of Morven North.
Tier 2						
Wind Farms						
Bowdun	Consenting/Pre-Construction	10	Bowdun Offshore Wind Farm is proposed for up to 67 turbines at a capacity of 1,008MW.	2029-2033	2034-2064	Construction and O&M overlap temporally with construction of Morven North. O&M and decommissioning overlap temporally with construction and O&M of Morven North.
Bellrock Offshore Wind Farm	Consenting/Pre-Construction	37	Bellrock Floating Offshore Wind Farm is proposed for a capacity of 1,800MW and up to 132 wind turbines.	2027-2030	2031-2078	O&M overlaps temporally with construction and O&M of Morven North.
MarramWind	Consenting/Pre-Construction	125	Marram Offshore Wind Farm is proposed for up to 150 turbines at a capacity of 3,000MW. A section of the Export Cable overlaps with the Morven North and Morven South Benthic Cumulative Study Area.	2026-2029	2030-2054	O&M overlaps temporally with construction of Morven North. O&M and decommissioning temporally overlap with O&M of Morven North.

Project/plan	Status [i.e. Application, Consented, Under Construction, Operational]	Distance from Morven North (km)	Description of project/plan	Estimated dates of construction (If applicable)	Estimated dates of operation (If applicable)	Overlap with Morven North [e.g. Project construction phase overlaps with Morven North construction phase]
Wind cable agreements and CCS						
Morven Hawthorn Pit Grid Connection Project	Consenting/Pre-Construction	0	Potential transmission for Morven North.	Unknown	Unknown	O&M overlaps temporally with construction and O&M of Morven North. Potential for project decommissioning to overlap with Morven North decommissioning phase.
Ossian – OWF Export Cable	Consenting/Pre-Construction	9	Maximum 6 offshore Export Cables, no indicative construction start date or transmission capacity mentioned.	N/A	N/A	Unknown. Project construction phase, O&M and decommissioning phases may overlap with Morven North construction, O&M and decommissioning phases.
Eastern Green Link 3	Consenting/Pre-Construction	5	Scotland to England Green Link 3	2028 - 2033	2034 onwards	Construction and O&M overlap temporally with Morven North. Project decommissioning phase may overlap with Morven North O&M and decommissioning phases.
Eastern Green Link 5	Consenting/Pre-Construction	27	Scotland to England Green Link 5. Up to 555km in length	2030 - 2034	2035 onwards	Construction and O&M overlap temporally with Morven North. Project decommissioning phase may overlap with Morven North O&M and decommissioning phases.
Eastern Green Link 4	Consenting/Pre-Construction	68	Scotland to England Green Link 4	2028 - 2033	2034 onwards	Construction and O&M overlap temporally with Morven North. Project decommissioning phase

Project/plan	Status [i.e. Application, Consented, Under Construction, Operational]	Distance from Morven North (km)	Description of project/plan	Estimated dates of construction (If applicable)	Estimated dates of operation (If applicable)	Overlap with Morven North [e.g. Project construction phase overlaps with Morven North construction phase]
						may overlap with Morven North O&M and decommissioning phases.
Tier 3						
Wind Farms						
INTOG: Flora	Consenting/Pre-Construction	63	INTOG site 4 is proposed for up to 50MW	Unknown	Unknown	Unknown
Wind cable agreements and CCS						
Morven Branxton Area Grid Connection Project	Pre-Planning	0	Potential transmission for Morven North.	Unknown	Unknown	Unknown. Construction phase, O&M and decommissioning phases may overlap with Morven North construction, O&M and decommissioning phases.

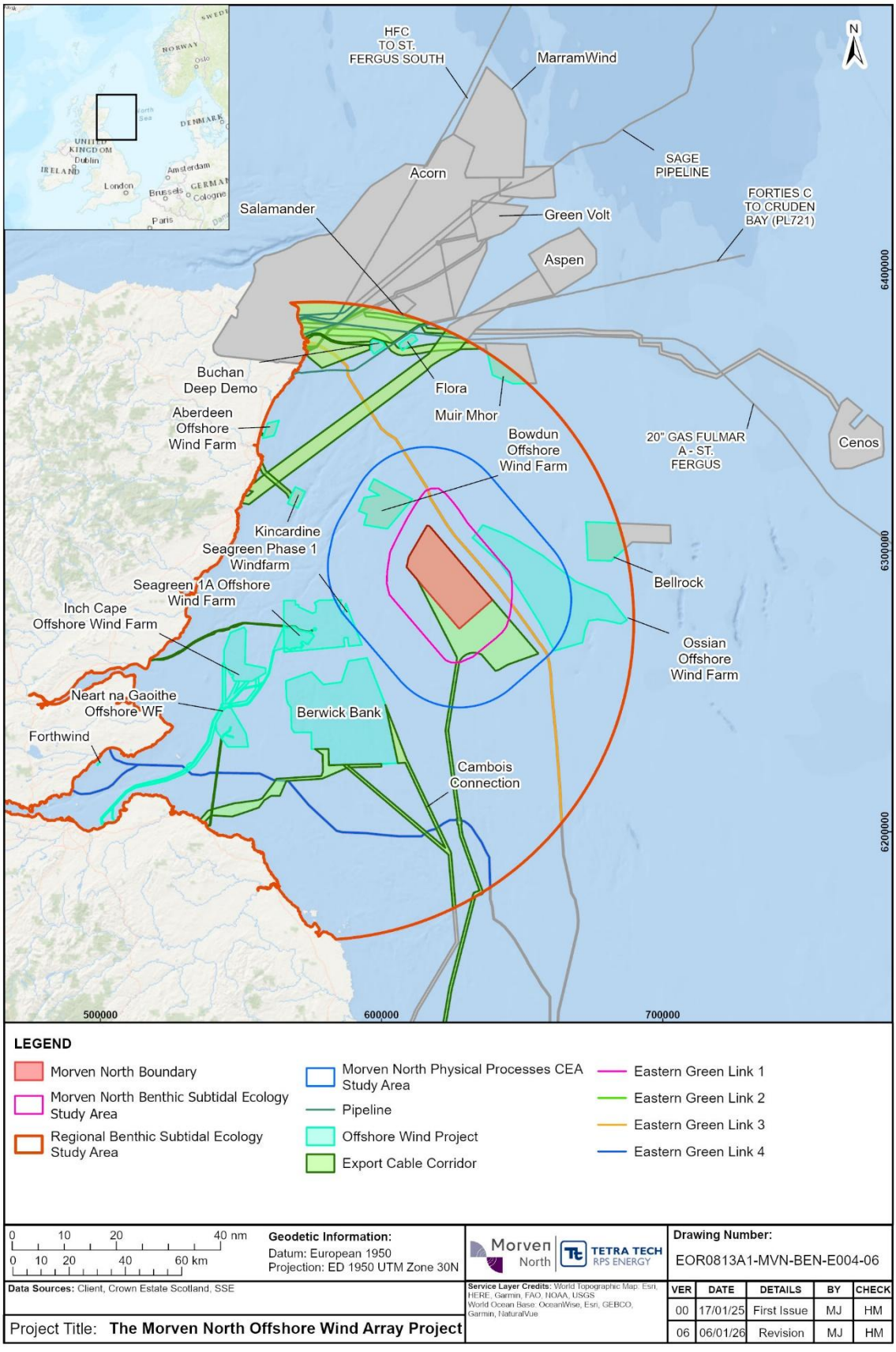

Figure 8.6: Other projects/plans screened into the cumulative effects assessment for benthic subtidal ecology

8.12.2 Maximum Design Scenario

8.12.2.1 The cumulative MDSs identified in Table 8.25 have been selected as those having the potential to result in the greatest potential cumulative effect on an identified receptor or receptor group. The cumulative MDSs have been based on the Morven North alone assessment MDS (Table 8.17), the Morven South alone assessment MDS, the Project Description contained within the MHPGC Project Scoping Report (EnBW, 2024) and project information available for MBAGC Project, as well as publicly available information on other third party projects and plans that have been screened into the CEA (Table 8.24).

Table 8.25: Maximum Design Scenario considered for the assessment of the likely significant Whole Project and cumulative effects on benthic subtidal ecology

C= Construction, O= Operations and Maintenance, D= Decommissioning phases

Potential Impact	Phase			Maximum Design Scenario	Justification
	C	O	D		
Temporary habitat disturbance/loss	✓	×	×	Scenario 1 MDS as described for Morven North (Table 8.17), assessed cumulatively with MHPGC Project. Scenario 2 MDS as described for Morven North (Table 8.17), assessed cumulatively with MBAGC Project. Scenario 4 MDS as described for Morven North (Table 8.17), assessed cumulatively with the following other projects and plans: Tier 1 • Offshore Wind Farm projects: – Morven South (Construction phase); – Ossian Offshore Wind Farm (Construction and O&M phases); – Berwick Bank Offshore Wind Farm (O&M phase); – Berwick Bank Export Cable – Branxton Connection (O&M phase);	These projects all involve activities which will result in temporary habitat disturbance/loss which may contribute to the impact upon a habitat that the Morven North will also affect within the Regional Benthic Subtidal Study Area.

Potential Impact	Phase			Maximum Design Scenario	Justification
	C	O	D		
				– Seagreen 1 Offshore Wind Farm (O&M phase); – Seagreen 1A Offshore Wind Farm (O&M phase); – Kincardine Offshore Wind Farm (O&M phase); – Muir Mhor Offshore Wind Farm (Construction and O&M phase); – Inch Cape Offshore Wind Farm (O&M phase); – Neart Na Gaoithe OWF (O&M phase); – Aberdeen Offshore Wind Farm (O&M phase); – Hywind Offshore Wind Farm (O&M and Decommissioning phases); – INTOG: Salamander Offshore Wind Farm (O&M phase); – INTO: Aspen Offshore Wind Farm Export Cable (O&M phase); – INTOG: Cenos Offshore Wind Farm - Export Cable Corridor (O&M phase); – Green Volt Floating Offshore Wind Farm (O&M phase); – Forthwind Demo Offshore Wind Farm (O&M phase);	

Potential Impact	Phase			Maximum Design Scenario	Justification
	C	O	D		
				• Wind cable agreements and CCS – Cambois Connection Offshore Wind Farm Cable (O&M phase); – Salamander OWF Export Cable (O&M phase); – Buchan OWF Export Cable (O&M phase); – Acorn – CCS pipeline (O&M phase); • Pipelines – 20" Gas Fulmar A - St. Fergus (Decommissioning phase); – Forties C To Cruden Bay (O&M and Decommissioning phases); – Buzzard (P) To Forties Hot Tap (O&M and Decommissioning phases); – Hfc To St. Fergus South (O&M and Decommissioning phases); – Sage Pipeline (O&M and Decommissioning phases); • Cables – Spittal to Peterhead HVDC link (O&M phase); Tier 2 • Offshore Wind Farm project: – Bellrock Offshore Wind Farm (O&M phase);	

Potential Impact	Phase			Maximum Design Scenario	Justification
	C	O	D		
				– Bowdun Offshore Wind Farm (Construction and O&M phases); – MarramWind Offshore Wind Farm Export Cable (O&M phase); • Wind cable agreements: – Ossian Offshore Wind Farm Cable (Unknown); • Cables: – Eastern Link 3 (Construction and O&M phases); – Eastern Link 4 (Construction and O&M phases); – Eastern Link 5 (Construction and O&M phases); – MHPGC Project. Tier 3 • Offshore Wind Farm Projects: – INTOG: Flora Offshore Wind Farm (Unknown). • Cables: – MBAGC Project	
	×	✓	×	**Scenario 1** MDS as described for Morven North (Table 8.17), assessed cumulatively with MHPGC Project. **Scenario 2**	

Potential Impact	Phase			Maximum Design Scenario	Justification
	C	O	D		
				MDS as described for Morven North (Table 8.17), assessed cumulatively with MBAGC Project. **Scenario 4** MDS as described for Morven North (Table 8.17), assessed cumulatively with the following other projects and plans: **Tier 1** • Offshore Wind Farm Projects: – Morven South (O&M phase); – Ossian Offshore Wind Farm (O&M phase) – Berwick Bank Offshore Wind Farm (O&M and Decommissioning phases) – Berwick Bank Export Cable – Branxton Connection (O&M and Decommissioning phases); – Seagreen 1 Offshore Wind Farm (O&M and Decommissioning phases) – Seagreen 1A Offshore Wind Farm (O&M and Decommissioning phases) – Kincardine Offshore Wind Farm (O&M and Decommissioning phases) – Muir Mhor Offshore Wind Farm (O&M phase)	

Potential Impact	Phase			Maximum Design Scenario	Justification
	C	O	D		
				– Inch Cape Offshore Wind Farm (O&M phase) – Neart Na Gaoithe Offshore Wind Farm (O&M and Decommissioning phases) – Aberdeen Offshore Wind Farm (O&M and Decommissioning phase) – INTOG: Salamander Offshore Wind Farm (O&M) – INTO: Aspen Offshore Wind Farm Export Cable (O&M phase) – INTOG: Cenos Offshore Wind Farm - Export Cable Corridor (O&M phase) – Green Volt Floating Offshore Wind Farm (O&M and Decommissioning phases) – Forthwind Demo Offshore Wind Farm (O&M and Decommissioning phases) • Wind cable agreements and CCS: – Cambois Connection Offshore Wind Farm Cable (O&M phase) – Salamander OWF Export Cable (O&M and Decommissioning phases)	

Potential Impact	Phase			Maximum Design Scenario	Justification
	C	O	D		
				– Buchan OWF Export Cable (O&M and Decommissioning phases) – Acorn - CCS pipeline (O&M and Decommissioning phases) • Cables: – Spittal to Peterhead HDVC link (O&M phase). **Tier 2** • Offshore Wind Farm Projects: – Bellrock Offshore Wind Farm (O&M phase) – Bowdun Offshore Wind Farm (O&M and Decommissioning phases) – MarramWind Offshore Wind Farm Export Cable (O&M and Decommissioning phases). • Cables: – MHPGC Project (O&M phase) – Ossian Offshore Wind Farm Cable (Unknown) – Eastern Link 3 (O&M phase) – Eastern Link 4 (O&M phase) – Eastern Link 5 (O&M phase) **Tier 3** • Offshore Wind Farm Projects:	

Potential Impact	Phase			Maximum Design Scenario	Justification
	C	O	D		
				– INTOG: Flora Offshore Wind Farm (Unknown) • Wind Cable Agreements: – MBAGC Project (Unknown).	
	×	×	✓	**Scenario 1** MDS as described for Morven North (Table 8.17), assessed cumulatively with MHPGC Project. **Scenario 2** MDS as described for Morven North (Table 8.17), assessed cumulatively with MBAGC Project. **Scenario 4** MDS as described for Morven North (Table 8.17), assessed cumulatively with the following other projects and plans: **Tier 1** • Offshore Wind Farm Projects: – Morven South (Decommissioning phase) – Ossian Offshore Wind Farm (O&M and Decommissioning phase) – Muir Mhor Offshore Wind Farm (O&M phase)	

Potential Impact	Phase			Maximum Design Scenario	Justification
	C	O	D		
				– Inch Cape Offshore Wind Farm (O&M phase) – INTOG: Salamander Offshore Wind Farm (O&M phase) – INTOG: Aspen Offshore Wind Farm Export Cable (O&M phase) – INTOG: Cenos Offshore Wind Farm - Export Cable Corridor (O&M phase) • Wind cable agreements and CCS: – Cambois Connection Offshore Wind Farm Cable (O&M phase) **Tier 2** • Offshore Wind Farm Projects: – Bellrock Offshore Wind Farm (O&M phases) • Wind Cable Agreements: – Ossian Offshore Wind Farm Cable (Unknown) • Cables: – Eastern Link 3 (O&M phase) – Eastern Link 4 (O&M phase) – Eastern Link 5 (O&M phase) **Tier 3** • Offshore Wind Farm Projects: – INTOG: Flora Offshore Wind Farm (Unknown)	

Potential Impact	Phase			Maximum Design Scenario	Justification
	C	O	D		
				• Wind Cable Agreements: – MBAGC Project (Unknown)	
Increased SSCs and associated deposition	✓	×	×	**Scenario 1** MDS as described for Morven North (Table 8.17), assessed cumulatively with MHPGC Project. **Scenario 2** MDS as described for Morven North (Table 8.17), assessed cumulatively with MBAGC Project. **Scenario 4** MDS as described for Morven North (Table 8.17), assessed cumulatively with the following other projects and plans: **Tier 1** • Offshore Wind Farm Projects: – Ossian Offshore Wind Farm; – Morven South; – Seagreen 1. **Tier 2** • Offshore Wind Farm Projects: – Bowdun Offshore Wind Farm. • Wind Cable Agreements: – Ossian OWF Export Cable; – MHPGC Project.	The potential for and extent of likely significant cumulative effects will be greatest when the highest number of other projects and plans are considered in combination. The projects and plans within the Morven North and Morven South Benthic Cumulative Study Area are considered to capture the potential overlap of impacts during the construction, O&M and decommissioning phases. Activities from projects and plans that potentially increase SSCs during the temporal overlap with the Morven North phases have been included as these may create a cumulative impact and likely significant effect on physical features or receptors. Intermittent operations, such as the repair or reburial of offshore cables from potential upcoming projects, have been

Potential Impact	Phase			Maximum Design Scenario	Justification
	C	O	D		
				Tier 3 • Wind Cable Agreements: – MBAGC Project.	included in the cumulative assessment. These activities, although potentially in their O&M phase, are not included within the background assessment as they are not continual and therefore do not contribute to background conditions in a consistent manner.
	×	✓	×	**Scenario 1** MDS as described for Morven North (Table 8.17), assessed cumulatively with MHPGC Project. **Scenario 2** MDS as described for Morven North (Table 8.17), assessed cumulatively with MBAGC Project. **Scenario 4** MDS as described for Morven North (Table 8.17), assessed cumulatively with the following other projects and plans: **Tier 1** • Offshore Wind Farm Projects: – Ossian Offshore Wind Farm; – Morven South. **Tier 2** • Wind Cable Agreements: – Ossian OWF Export Cable; – MHPGC Project. **Tier 3** • Wind Cable Agreements: – MBAGC Project.	

Potential Impact	Phase			Maximum Design Scenario	Justification
	C	O	D		
	×	×	✓	**Scenario 1** MDS as described for Morven North (Table 8.17), assessed cumulatively with MHPGC Project. **Scenario 2** MDS as described for Morven North (Table 8.17), assessed cumulatively with MBAGC Project. **Scenario 4** MDS as described for Morven North (Table 8.17), assessed cumulatively with the following other projects and plans: **Tier 1** • Offshore Wind Farm Projects: – Ossian Offshore Wind Farm; – Morven South. **Tier 2** • Wind Cable Agreements: – Bowdun Offshore Wind Project; – Ossian OWF Export Cable. **Tier 3** • Wind Cable Agreements: – MBAGC Project.	
Long-term habitat loss	✓	✓	×	**Scenario 1** MDS as described for Morven North (Table 8.17), assessed cumulatively with MHPGC Project.	These projects will all result in the installation of hard structures on the seabed which will lead to long-term

Potential Impact	Phase			Maximum Design Scenario	Justification
	C	O	D		
				Scenario 2 MDS as described for Morven North (Table 8.17), assessed cumulatively with MBAGC Project. **Scenario 4** MDS as described for Morven North (Table 8.17), assessed cumulatively with the following other projects and plans: **Tier 1** • Offshore Wind Farm Projects: – Morven South – Ossian Offshore Wind Farm – Muir Mhor Offshore Wind Farm – INTOG: Cenos Offshore Wind Farm - Export Cable Corridor **Tier 2** • Offshore Wind Farm Projects: – Bowdun Offshore Wind Farm • Wind Cable Agreements: – Ossian Offshore Wind Farm Cable Cables: – Eastern Link 3 – Eastern Link 4 – Eastern Link 5 – MHPGC Project **Tier 3** • Offshore Wind Farm Projects:	habitat loss within the Regional Benthic Subtidal Study Area meaning they may also affect habitats that Morven North will also affect.

Potential Impact	Phase			Maximum Design Scenario	Justification
	C	O	D		
				– INTOG: Flora Offshore Wind Farm • Wind Cable Agreements: – MBAGC Project	
	×	×	✓	**Scenario 1** MDS as described for Morven North (Table 8.17), assessed cumulatively with MHPGC Project. **Scenario 2** MDS as described for Morven North (Table 8.17), assessed cumulatively with MBAGC Project. **Scenario 4** No Tier 1, 2 or 3 projects have been identified which may install new infrastructure at the time of Morven North's decommissioning.	
Increased risk of introduction and spread of INNS	✓	✓	✓	**Scenario 1** MDS as described for Morven North (Table 8.17), assessed cumulatively with MHPGC Project. **Scenario 2** MDS as described for Morven North (Table 8.17), assessed cumulatively with MBAGC Project. **Scenario 4** MDS as described for Morven North (Table 8.17), assessed cumulatively	These projects will all result in the installation of hard structures on the seabed which could be colonised by new communities composed of INNS within the Regional Benthic Subtidal Study Area meaning they may also affect habitats that Morven North will also affect.

Potential Impact	Phase			Maximum Design Scenario	Justification
	C	O	D		
				with the following other projects and plans: **Tier 1** • Offshore Wind Farm Projects: – Morven South; – Ossian Offshore Wind Farm; – Muir Mhor Offshore Wind Farm; – INTOG: Cenos Offshore Wind Farm - Export Cable Corridor. **Tier 2** • Offshore Wind Farm Projects: – Bowdun Offshore Wind Farm; • Wind Cable Agreements; – Ossian Offshore Wind Farm Cables; – Eastern Link 3; – Eastern Link 4; – Eastern Link 5; – MHPGC Project. **Tier 3** • Offshore Wind Farm Projects: – INTOG: Flora Offshore Wind Farm. • Wind Cable Agreements: – MBAGC Project.	
Colonisation of hard structures	×	✓	×	**Scenario 1**	These projects will all result in the installation of hard

Potential Impact	Phase			Maximum Design Scenario	Justification
	C	O	D		
				MDS as described for Morven North (Table 8.17), assessed cumulatively with MHPGC Project. **Scenario 2** MDS as described for Morven North (Table 8.17), assessed cumulatively with MBAGC Project. **Scenario 4** MDS as described for Morven North (Table 8.17), assessed cumulatively with the following other projects and plans: **Tier 1** • Offshore Wind Farm Projects: – Morven South – Ossian Offshore Wind Farm – Muir Mhor Offshore Wind Farm – INTOG: Cenos Offshore Wind Farm - Export Cable Corridor **Tier 2** • Offshore Wind Farm Projects: – Bowdun Offshore Wind Farm • Wind Cable Agreements – Ossian Offshore Wind Farm Cables – Eastern Link 3 – Eastern Link 4 – Eastern Link 5	structures on the seabed which could be colonised by new communities within the Regional Benthic Subtidal Study Area meaning they may also affect habitats that Morven North will also affect.

Potential Impact	Phase			Maximum Design Scenario	Justification
	C	O	D		
				– MHPGC Project **Tier 3** • Offshore Wind Farm Projects: – INTOG: Flora Offshore Wind Farm • Wind Cable Agreements: – MBAGC Project	
Changes in physical processes	×	✓	×	**Scenario 1** MDS as described for Morven North (Table 8.17), assessed cumulatively with MHPGC Project. **Scenario 2** MDS as described for Morven North (Table 8.17), assessed cumulatively with MBAGC Project. **Scenario 4** MDS as described for Morven North (Table 8.17), assessed cumulatively with the following other projects and plans: **Tier 1** • Offshore Wind Farm Projects: – Morven South – Ossian Offshore Wind Farm – Seagreen 1 **Tier 2** • Offshore Wind Farm Projects: – Bowdun Offshore Wind Farm	Infrastructure, such as foundations, scour protection, cable protection and cable crossings from other projects during the O&M phase may contribute to the magnitude of this impact and therefore likely significant effects when considered in combination with Morven North within the Morven North and Morven South Benthic Cumulative Study Area.

Potential Impact	Phase			Maximum Design Scenario	Justification
	C	O	D		
				• Wind Cable Agreements: – Ossian OWF Export Cable – MHPGC Project **Tier 3** • Wind Cable Agreements: – MBAGC Project	
Removal of hard substrates	×	×	✓	**Scenario 1** MDS as described for Morven North (Table 8.17), assessed cumulatively with MHPGC Project. **Scenario 2** MDS as described for Morven North (Table 8.17), assessed cumulatively with MBAGC Project. **Scenario 4** MDS as described for Morven North (Table 8.17), assessed cumulatively with the following other projects and plans: **Tier 1** • Offshore Wind Farm Projects: – Morven South; – Ossian Offshore Wind Farm; – Muir Mhor Offshore Wind Farm; – INTOG: Cenos Offshore Wind Farm - Export Cable Corridor. **Tier 2** • Offshore Wind Farm Projects:	These projects will also undergo the removal of hard substrate within the period of decommissioning for Morven North within the Regional Benthic Subtidal Study Area.

Potential Impact	Phase			Maximum Design Scenario	Justification
	C	O	D		
				– Bowdun Offshore Wind Farm; • Wind Cable Agreements; – Ossian Offshore Wind Farm Cables; – Eastern Link 3; – Eastern Link 4; – Eastern Link 5. **Tier 3** • Offshore Wind Farm Projects: – INTOG: Flora Offshore Wind Farm. • Wind Cable Agreements: – MBAGC Project.	
Impacts to benthic invertebrates due to EMF	×	✓	×	**Scenario 1** MDS as described for Morven South (Table 8.17), assessed cumulatively with MHPGC Project. **Scenario 2** MDS as described for Morven South (Table 8.17), assessed cumulatively with MBAGC Project. **Scenario 4** MDS as described for Morven South (Table 8.17), assessed cumulatively with the following other projects and plans: **Tier 1** • Offshore Wind Farm Projects:	These projects will have the potential to generate EMFs which could have a cumulative effect alongside Morven North within the Regional Benthic Subtidal Study Area.

Potential Impact	Phase			Maximum Design Scenario	Justification
	C	O	D		
				– Morven South; – Ossian Offshore Wind Farm; – Muir Mhor Offshore Wind Farm; – INTOG: Cenos Offshore Wind Farm - Export Cable Corridor. **Tier 2** • Offshore Wind Farm Projects: – Bowdun Offshore Wind Farm. • Wind Cable Agreements: – Ossian Offshore Wind Farm Cable Cables; – Eastern Link 3; – Eastern Link 4; – Eastern Link 5; – MHPGC Project. **Tier 3** • Offshore Wind Farm Projects: – INTOG: Flora Offshore Wind Farm • Wind Cable Agreements: – MBAGC Project	

8.13 Whole Project assessment and cumulative effects assessment

8.13.1 Overview

8.13.1.1 A description of the significance of Whole Project and cumulative effects upon benthic subtidal ecology receptors arising from each identified impact is given below. The Whole Project assessment and CEA for Morven North are presented in Table 8.26 to Table 8.44.

8.13.1.2 The Regional Benthic Subtidal Study Area encompasses an area extending from Peterhead, north of Morven North, down to south of Berwick-Upon-Tweed in the south. The area is the same as the Regional Benthic Subtidal Ecology Study Area as described in Section 8.2. Two CEA study areas are defined for benthic subtidal ecology, as presented in Paragraph 8.2.1.4.

8.13.2 Temporary habitat loss/disturbance

8.13.2.1 There is potential for temporary habitat loss/disturbance as a result of the Morven North construction, O&M and decommissioning activities alongside other offshore wind farms, cables and pipelines within the Regional Benthic Subtidal Study Area. The activities include seabed preparation, anchor placement, cable burial, and O&M activities.

8.13.2.2 Temporary habitat loss/disturbance may occur as a result of Morven North. Additionally, there are 20 offshore wind farm projects, seven cables, one CCS, and five pipeline projects which could contribute cumulatively.

8.13.2.3 The summary of the Whole Project assessment for temporary habitat loss/disturbance is presented in Table 8.26. A breakdown of the temporary habitat disturbance/loss associated with each project is presented in Table 8.27 to Table 8.29.

8.13.2.4 These are used to inform the cumulative effects assessment for temporary habitat loss/disturbance alongside other tiers as presented in Table 8.30.

Table 8.26: Morven North Whole Project assessment for temporary habitat loss/disturbance

	Whole Project assessment	
	Scenario 1: Morven North + MHPGC Project	**Scenario 2: Morven North + MBAGC Project**
Construction phase		
Magnitude of impact	The Whole Project assessment for Scenario 1 considers Morven North together with MHPGC Project. The O&M phase of the MHPGC Project may occur simultaneously with the construction phase of Morven North and includes cable repair and reburial events. The MHPGC Project Export Cable repair and reburial activities will be undertaken in close proximity to Morven North using similar parameters and techniques to those associated with the inter-array and interconnector cable installation for Morven North (Section 8.11.2). The impacts are expected to be minimal, with much smaller areas of disturbance expected than during the construction and decommissioning phases, and therefore the overall increase in magnitude will be minimal. The Whole Project impact is predicted to be of local spatial extent, medium term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be low.	The Whole Project assessment for Scenario 2 considers Morven North together with MBAGC Project. The construction phase of the MBAGC Project may occur simultaneously with the construction phase of Morven North. Currently no scoping report has been published for the MBAGC Project, however the site preparation and offshore export cable installation will likely be undertaken in close proximity to Morven North using similar parameters and techniques to those associated with the inter-array and interconnector cable installation (Section 8.11.2), and therefore the overall increase in magnitude will be minimal. The O&M phase of the MBAGC Project may also occur simultaneously with the construction phase of Morven North and includes repair and reburial events, similar to the MHPGC Project but with a lesser impact compared to the construction phase. The Whole Project impact is predicted to be of local spatial extent, medium term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be low.
Sensitivity of receptor	The sensitivity of the benthic subtidal ecology IEFs to temporary habitat loss/disturbance is as described previously for the construction phase assessment for Morven North alone in Paragraphs 8.11.2.10 to 8.11.2.14. The offshore subtidal sands and gravels IEF is deemed to be of medium vulnerability, medium to high recoverability and national value. The sensitivity of the receptor is therefore, considered to be medium. The ocean quahog IEF is deemed to be of high vulnerability, low recoverability, and international value. The sensitivity of the receptor is therefore, considered to be high.	
Significance of effect	Overall, for the offshore subtidal sands and gravels IEF, the magnitude of the Whole Project impact is deemed to be low and the sensitivity of the receptor is considered to be medium. The Whole	Overall, for the offshore subtidal sands and gravels IEF, the magnitude of the Whole Project impact is deemed to be low and the sensitivity of the receptor is considered to be medium. The Whole

	Whole Project assessment	
	Project effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms. Overall, for the ocean quahog IEF, the magnitude of the Whole Project impact is deemed to be low and the sensitivity of the receptor is considered to be high. The Whole Project effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms. This minor adverse conclusion is due to the low numbers of ocean quahog recorded from the site specific survey, therefore limiting the significance of effect.	Project effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms. Overall, for the ocean quahog IEF, the magnitude of the Whole Project impact is deemed to be low and the sensitivity of the receptor is considered to be high. The Whole Project effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms. This minor adverse conclusion is due to the low numbers of ocean quahog recorded from the site specific survey, therefore limiting the significance of effect.
Operations and maintenance phase		
Magnitude of impact	The Whole Project assessment for Scenario 1 considers Morven North together with MHPGC Project. The O&M phase of the MHPGC Project may occur simultaneously with the O&M phase of Morven North and includes cable repair and reburial events. The MHPGC Project Export Cable repair and reburial activities will be undertaken in close proximity to Morven North using similar parameters and techniques to those associated with the inter-array and inter-connector cable maintenance activities for Morven North (Section 8.11.2). The maintenance activities, therefore, are likely to result in a similar level of temporary habitat loss/disturbance, with a limited and localised spatial extent and as well occurring highly intermittently across the operational lifetime of the project, and therefore the overall magnitude would be unlikely to increase above that assessed for Morven North alone at any one time. The Whole Project impact is predicted to be of local spatial extent, medium term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be low.	The Whole Project assessment for Scenario 2 considers Morven North together with MBAGC Project. The assessment can be considered to be the same as Scenario 1 for this impact and phase, as discussed in the column to the left. The Whole Project impact is predicted to be of local spatial extent, medium term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be low.
Sensitivity of receptor	The sensitivity of the benthic subtidal ecology IEFs to temporary habitat loss/disturbance is as described previously for the construction phase assessment for Morven North alone in Paragraphs 8.11.2.10 to 8.11.2.14.	

	Whole Project assessment	
	The offshore subtidal sands and gravels IEF is deemed to be of medium vulnerability, medium to high recoverability and national value. The sensitivity of the receptor is therefore, considered to be medium. The ocean quahog IEF is deemed to be of high vulnerability, low recoverability, and international value. The sensitivity of the receptor is therefore, considered to be high.	
Significance of effect	Overall, for the offshore subtidal sands and gravels IEF, the magnitude of the Whole Project impact is deemed to be low and the sensitivity of the receptor is considered to be medium. The Whole Project effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms. Overall, for the ocean quahog IEF, the magnitude of the Whole Project impact is deemed to be low and the sensitivity of the receptor is considered to be high. The Whole Project effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms. This minor adverse conclusion is due to the low numbers of ocean quahog recorded from the site specific survey, therefore limiting the significance of effect.	Overall, for the offshore subtidal sands and gravels IEF, the magnitude of the Whole Project impact is deemed to be low and the sensitivity of the receptor is considered to be medium. The Whole Project effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms. Overall, for the ocean quahog IEF, the magnitude of the Whole Project impact is deemed to be low and the sensitivity of the receptor is considered to be high. The Whole Project effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms. This minor adverse conclusion is due to the low numbers of ocean quahog recorded from the site specific survey, therefore limiting the significance of effect.
Decommissioning phase		
Magnitude of impact	The Whole Project assessment for Scenario 1 considers Morven North together with MHPGC Project. The decommissioning phase of the MHPGC Project may occur simultaneously with the decommissioning phase of Morven North. Due to the relationship of the projects, it is assumed the O&M phase of the MHPGC Project will not occur during the decommissioning phase of Morven North. There is the potential for MHPGC Project decommissioning activities to include cable removal, although it is anticipated that offshore cables and any offshore cable protection may be left in-situ. Any direct impacts from jack-up vessels and anchor placements will be similar to the construction phase, with similar recovery periods (Section 8.11.2), and therefore the overall magnitude would not be expected to significantly increase compared to just Morven North.	The Whole Project assessment for Scenario 2 considers Morven North together with MBAGC Project. The assessment can be considered to be the same as Scenario 1 for this impact and phase, as discussed in the column to the left. The Whole Project impact is predicted to be of local spatial extent, medium term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be low.

	Whole Project assessment	
	The Whole Project impact is predicted to be of local spatial extent, medium term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is, therefore, considered to be low.	
Sensitivity of receptor	The sensitivity of the benthic subtidal ecology IEFs to temporary habitat loss/disturbance is as described previously for the construction phase assessment for Morven North alone in Paragraphs 8.11.2.10 to 8.11.2.14. The offshore subtidal sands and gravels IEF is deemed to be of medium vulnerability, medium to high recoverability and national value. The sensitivity of the receptor is therefore, considered to be medium. The ocean quahog IEF is deemed to be of high vulnerability, low recoverability, and international value. The sensitivity of the receptor is therefore, considered to be high.	
Significance of effect	Overall, for the offshore subtidal sands and gravels IEF, the magnitude of the Whole Project impact is deemed to be low and the sensitivity of the receptor is considered to be medium. The Whole Project effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms. Overall, for the ocean quahog IEF, the magnitude of the Whole Project impact is deemed to be low and the sensitivity of the receptor is considered to be high. The Whole Project effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms. This minor adverse conclusion is due to the low numbers of ocean quahog recorded from the site specific survey, therefore limiting the significance of effect.	Overall, for the offshore subtidal sands and gravels IEF, the magnitude of the Whole Project impact is deemed to be low and the sensitivity of the receptor is considered to be medium. The Whole Project effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms. Overall, for the ocean quahog IEF, the magnitude of the Whole Project impact is deemed to be low and the sensitivity of the receptor is considered to be high. The Whole Project effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms. This minor adverse conclusion is due to the low numbers of ocean quahog recorded from the site specific survey, therefore limiting the significance of effect.

Table 8.27 Scenario 4: Cumulative temporary habitat loss for the Morven North construction phase and relevant Tier 1 plans ,projects and activities

Project	MDS	Reference
Morven North	74,055,400m^2	See Table 8.17
Offshore Wind Farms		
Morven South	62,596,300m^2	Morven Offshore Wind Ltd, 2026
Ossian Offshore Wind Farm (in the construction and O&M phases)	Up to 49,948,548m^2 during construction and up to 51,411,500m^2 from O&M activities.	Ossian Offshore Wind Farm Limited, 2025
Seagreen Offshore Windfarm (O&M phase)	An unquantified area of temporary habitat disturbance could occur in the O&M phase of the project due to anchor and jack-up vessel placements.	Seagreen Wind Energy, 2012
Berwick Bank Offshore Windfarm (O&M phase)	Up to 989,000m^2 from O&M activities.	SSE Renewables, 2022
Seagreen 1A Offshore Windfarm (O&M phase)	An unquantified temporary habitat disturbance footprint associated with the O&M phase.	Seagreen Wind Energy, 2021
Kincardine Offshore Wind Farm (O&M phase)	An unquantified temporary habitat disturbance footprint associated with the O&M phase.	Kincardine Offshore Windfarm Limited, 2016
Muir Mhor Offshore Wind Farm (Construction and O&M phases)	Up to 7,731,870m^2 of temporary habitat disturbance from construction activities. Up to 1,930,600m^2 from O&M activities.	Muir Mhòr Offshore Wind Farm Limited, 2024
Inch Cape Offshore Wind Farm (O&M phase)	Up to 3,675,000m^2 from O&M activities.	Inch Cape Offshore Limited, 2018
Aberdeen Offshore Wind Farm (O&M phase)	An unquantified temporary habitat disturbance footprint associated with the O&M phase.	European Offshore Wind Deployment Centre, 2011
Hywind Offshore Wind Farm (O&M and decommissioning phases)	An unquantified temporary habitat disturbance footprint associated with the O&M and decommissioning phases.	Statoil, 2025
INTOG: Salamander Offshore Wind Farm (O&M phase)	Up to 6,194,800m^2 from O&M activities.	Salamander Wind Project Company Limited, 2024
INTOG: Aspen Export Cable (O&M phase)	Up to 1,939,000m^2 from O&M activities.	(Cerulean Winds, 2025)Cerulean Winds (2025)

Project	MDS	Reference
Neart Na Gaoithe Offshore Wind Farm (O&M phase)	Up to 50,000m^2 from O&M activities.	Mainstream Renewable Power, 2019
Green Volt Floating Offshore Wind Farm (O&M phase)	An unquantified temporary habitat disturbance footprint associated with the O&M phase.	GreenVolt, 2022
Forthwind Demo Offshore Wind Farm (O&M phase)	An unquantified temporary habitat disturbance footprint associated with the O&M phase.	Forthwind Ltd, 2022
INTOG: Cenos Offshore Wind Farm - Export Cable Corridor (O&M and decommissioning phases)	An unquantified temporary habitat disturbance footprint associated with the O&M phase. Up to 10,630,000m^2 from decommissioning activities.	Cenos Offshore Windfarm Limited, 2024
Wind Cable Agreements		
Cambois Connection Offshore Wind Farm Cable (O&M phase)	An unquantified temporary habitat disturbance footprint associated with the O&M phase.	SSE Renewables (2024)
Buchan OWF Export Cable (O&M phase)	An unquantified temporary habitat disturbance footprint associated with the O&M phase.	Buchan Offshore Wind (2025)
Acorn – CCS pipeline	No information is available on phases or quantities.	N/A
Forties C To Cruden Bay Pipeline	No information is available on phases or quantities.	N/A
20" Gas Fulmar A - St. Fergus Pipeline	No information is available on phases or quantities.	N/A
Buzzard (P) To Forties Hot Tap Pipeline	No information is available on phases or quantities.	N/A
Hfc To St. Fergus South Pipeline	No information is available on phases or quantities.	N/A
Sage Pipeline	No information is available on phases or quantities.	N/A
Spittal to Peterhead HDVC link (O&M phase)	No information is available on phases or quantities.	ERM (2025)
Total	**271,152,018m^2**	

Table 8.28: Scenario 4: Cumulative temporary habitat loss for the Morven North Operation and Maintenance phase and relevant Tier 1 plans/projects/activities

Project	MDS	Reference
Morven North	9,221,800m^2	See Table 8.17
Offshore Wind Farms		
Morven South	7,967,400m^2	Morven Offshore Wind Ltd, 2026
Ossian Offshore Wind Farm (O&M phase)	Up to 51,411,500m^2 from O&M activities.	Ossian Offshore Wind Farm Limited, 2025
Seagreen Offshore Windfarm (O&M and decommissioning phases)	An unquantified temporary habitat disturbance footprint associated with the O&M and decommissioning phases.	Seagreen Wind Energy, 2012
Berwick Bank Offshore Windfarm (O&M and decommissioning phases)	Up to 989,000m^2 from O&M activities and up to 34,571,200m^2 from decommissioning activities.	SSE Renewables, 2022
Seagreen 1A Offshore Windfarm (O&M and decommissioning phases)	An unquantified temporary habitat disturbance footprint associated with the O&M and decommissioning phases.	Seagreen Wind Energy, 2021
Kincardine Offshore Wind Farm (O&M and decommissioning phases)	An unquantified temporary habitat disturbance footprint associated with the O&M and decommissioning phases.	Kincardine Offshore Windfarm Limited, 2016
Muir Mhor Offshore Wind Farm (O&M phase)	Up to 1,930,600m^2 from O&M activities.	Muir Mhòr Offshore Wind Farm Limited, 2024
Inch Cape Offshore Wind Farm (O&M phase)	Up to 3,675,000m^2 from O&M activities.	Inch Cape Offshore Limited, 2018
Aberdeen Offshore Wind Farm (O&M and Decommissioning phase)	An unquantified temporary habitat disturbance footprint associated with the O&M phase. The decommissioning phase was not assessed.	European Offshore Wind Deployment Centre, 2011
INTOG: Salamander Offshore Wind Farm (O&M phase)	Up to 6,194,800m^2 from O&M activities.	Salamander Wind Project Company Limited, 2024

Project	MDS	Reference
Neart Na Gaoithe Offshore Wind Farm (O&M and decommissioning phases)	Up to 50,000m^2 from O&M activities. Not assessed for the decommissioning phase.	(Mainstream Renewable Power, 2019)
Green Volt Floating Offshore Wind Farm (O&M and decommissioning phases)	An unquantified temporary habitat disturbance footprint associated with the O&M and decommissioning phases.	GreenVolt, 2022
Forthwind Demo Offshore Wind Farm (O&M and decommissioning phases)	An unquantified temporary habitat disturbance footprint associated with the O&M and decommissioning phases.	Forthwind Ltd, 2022
INTOG: Cenos Offshore Wind Farm - Export Cable Corridor (O&M phase)	An unquantified temporary habitat disturbance footprint associated with the O&M phase.	Cenos Offshore Windfarm Limited, 2024
Cables and Pipelines		
Cambois Connection Offshore Wind Farm Cable (O&M phase)	An unquantified temporary habitat disturbance footprint associated with the O&M phase.	SSE Renewables (2024)
Acorn – CCS pipeline	No information is available on phases or quantities.	N/A
Total	**137,690,034m^2**	

Table 8.29: Scenario 4: Cumulative temporary habitat loss for the Morven North decommissioning phase and relevant Tier 1 plans/projects/activities

Project	MDS	Reference
Morven North	Similar to construction	See Table 8.17
Offshore Wind Farms		
Morven South	Footprint not calculated, but assumed to be lesser than or similar to that of the construction phase	Morven Offshore Wind Ltd, 2026
Ossian Offshore Wind Farm (O&M phase)	Up to 51,411,500m^2 from O&M activities.	Ossian Offshore Wind Farm Limited, 2025
Muir Mhor Offshore Wind Farm (O&M activities)	Up to 1,930,600m^2 from O&M activities.	Muir Mhòr Offshore Wind Farm Limited, 2024
Inch Cape Offshore Wind Farm (O&M activities)	Up to 3,675,000m^2 from O&M activities.	Inch Cape Offshore Limited, 2018
INTOG: Salamander Offshore Wind Farm (O&M phase)	Up to 6,194,800m^2 from O&M activities.	Salamander Wind Project Company Limited, 2024
INTOG: Cenos Offshore Wind Farm - Export Cable Corridor (O&M phase)	An unquantified temporary habitat disturbance footprint associated with the O&M phase.	Cenos Offshore Windfarm Limited, 2024
Cambois Connection Offshore Wind Farm Cable (O&M phase)	An unquantified temporary habitat disturbance footprint associated with the O&M phase.	SSE Renewables (2024)
Total	**63,211,900m^2**	

Table 8.30: Morven North cumulative effects assessment for temporary habitat loss/disturbance

	Cumulative effects assessment
	Scenario 4: Morven North and Tier 1, Tier 2 and Tier 3 Projects
Construction phase	
Magnitude of impact	The cumulative effects assessment for Scenario 4 considers Morven North together with the Tier 1, Tier 2 and Tier 3 projects below. Tier 1 Tier 1 includes the following offshore wind farm projects: • Ossian Offshore Wind Farm (Construction and O&M phases); • Morven South (Construction phase); • Seagreen 1 Offshore Wind Farm (O&M phase); • Berwick Bank Offshore Wind Farm (O&M phase); • Berwick Bank Export Cable – Branxton Connection (O&M phase); • Seagreen 1A Offshore Wind Farm (O&M phase); • Kincardine Offshore Wind Farm (O&M phase); • Muir Mhor Offshore Wind Farm (Construction and O&M phases); • Inch Cape Offshore Wind Farm (O&M phase); • Aberdeen Offshore Wind Farm (O&M phase); • Hywind Offshore Wind Farm (O&M and Decommissioning phases); • INTOG: Salamander Offshore Wind Farm (O&M phase); • INTOG: Aspen Offshore Wind Farm Export Cable (O&M phase); • Neart Na Gaoithe Offshore Wind Farm (O&M phase); • Green Volt Floating Offshore Wind Farm (O&M phase); • Forthwind Demo Offshore Wind Farm (O&M phase); • INTOG: Cenos Offshore Wind Farm - Export Cable Corridor (O&M phase). These projects are in various stages of development, the majority however will be in their O&M phase when Morven North is in construction, which will result in temporary habitat loss/disturbance as a result of cable and turbine foundation maintenance (similar to the activities described in the O&M phase of the project alone assessment, Section 8.11.2). The projects with the greatest contribution to cumulative

	Cumulative effects assessment
	temporary habitat loss/disturbance will be those in the construction phase when Morven North is also in the construction phase (Ossian Offshore Wind Farm and Muir Mhor). Overall, these projects will contribute 123,870,318m^2 to the cumulative temporary habitat disturbance/loss, however, a number of projects do not quantify this impact in regard to the O&M phase. Tier 1 includes the following cable and pipeline projects: • Cambois Connection Offshore Wind Farm Cable (O&M phase); • Salamander OWF Export Cable (O&M phase); • Buchan OWF Export Cable (O&M phase); • Acorn - CCS pipeline (O&M phase); • Forties C To Cruden Bay (O&M and Decommissioning phases); • 20" Gas Fulmar A - St. Fergus (Decommissioning phase); • Buzzard (P) To Forties Hot Tap (O&M and Decommissioning phases); • Spittal to Peterhead HDVC link (O&M phase); • Hfc To St. Fergus South (O&M and Decommissioning phases); • Sage Pipeline (O&M and Decommissioning phases). These projects are also primarily in their O&M phase and therefore may result in low levels of temporary habitat loss/disturbance due to maintenance. Due to the spatially limited and intermittent nature of this work, these projects have not quantified this impact and therefore have not contributed to the overall cumulative temporary habitat loss/disturbance value. In total, cumulative temporary habitat loss associated with Morven North and Tier 1 projects is up to 260,522,018m^2, however, this represents only 0.93% of the Regional Benthic Subtidal Ecology Study Area. The cumulative effect is predicted to be of regional spatial extent, short-term duration, intermittent and medium reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be low adverse. Tier 2 Tier 2 includes the following offshore wind farm projects: • Bowdun Offshore Wind Farm (Construction and O&M phases); • Bellrock Offshore Wind Farm (O&M phase); • MarramWind Offshore Wind Farm Export Cable (O&M phase). Tier 2 includes the following cable projects: • Ossian Offshore Wind Farm Cable (phase unknown);

	Cumulative effects assessment
	• Eastern Link 3 (Construction and O&M phases); • Eastern Link 4 (Construction and O&M phases); • Eastern Link 5 (Construction and O&M phases); • MHPGC Project. These projects are in their scoping phase so there is limited information regarding their quantitative impact however the activities associated with the construction and O&M phases of the offshore wind farm projects and cable projects will likely be similar to same phases of Morven North (Section 8.11.2), and therefore the overall magnitude would not be expected to significantly increase compared to just Morven North. The cumulative effect is predicted to be of regional spatial extent, short-term duration, intermittent and medium reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be low adverse. Tier 3 Tier 3 includes the following offshore wind farm project and the following cable project: • INTOG: Flora Offshore Wind Farm (phase unknown); • MBAGC Project. These projects are yet to submit any documents as part of an application therefore the scale and specific impact of these projects is unknown but is likely to be similar, if not much smaller than Morven North (Section 8.11.2). The cumulative effect of all projects in Scenario 4 is predicted to be of regional spatial extent, medium term duration, intermittent and medium reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is, therefore, considered to be low.
Sensitivity of receptor	The sensitivity of the benthic subtidal ecology IEFs to temporary habitat loss/disturbance is as described previously for the construction phase assessment for Morven North alone in Paragraphs 8.11.2.10 to 8.11.2.14. The offshore subtidal sands and gravels IEF is deemed to be of medium vulnerability, medium to high recoverability and national value. The sensitivity of the receptor is therefore, considered to be medium. The ocean quahog IEF is deemed to be of high vulnerability, low recoverability, and international value. The sensitivity of the receptor is therefore, considered to be high.
Significance of effect	Tier 1 Overall, for the offshore subtidal sands and gravels IEF, the magnitude of the cumulative impact is deemed to be low and the sensitivity of the receptor is considered to be medium. The cumulative effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms. Overall, for the ocean quahog IEF, the magnitude of the cumulative impact is deemed to be low and the sensitivity of the receptor is considered to be high. The cumulative effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms. This

	Cumulative effects assessment
	minor adverse conclusion is due to the low numbers of ocean quahog recorded from the site specific survey, therefore limiting the significance of effect. Tier 2 Overall, for the offshore subtidal sands and gravels IEF, the magnitude of the cumulative impact is deemed to be low and the sensitivity of the receptor is considered to be medium. The cumulative effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms. Overall, for the ocean quahog IEF, the magnitude of the cumulative impact is deemed to be low and the sensitivity of the receptor is considered to be high. The cumulative effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms. This minor adverse conclusion is due to the low numbers of ocean quahog recorded from the site specific survey, therefore limiting the significance of effect. Tier 3 and all of Scenario 4 Overall, for the offshore subtidal sands and gravels IEF, the magnitude of the cumulative impact is deemed to be low and the sensitivity of the receptor is considered to be medium. The cumulative effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms. Overall, for the ocean quahog IEF, the magnitude of the cumulative impact is deemed to be low and the sensitivity of the receptor is considered to be high. The cumulative effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms. This minor adverse conclusion is due to the low numbers of ocean quahog recorded from the site specific survey, therefore limiting the significance of effect.
O&M phase	
Magnitude of impact	The cumulative effects assessment for Scenario 4 considers Morven North together with the Tier 1, Tier 2 and Tier 3 projects below. Tier 1 Tier 1 includes the following offshore wind farm projects: • Morven South (O&M phase); • Ossian Offshore Wind Farm (O&M phase); • Seagreen 1 Offshore Wind Farm (O&M and Decommissioning phases); • Berwick Bank Offshore Wind Farm (O&M and Decommissioning phases); • Berwick Bank Export Cable – Branxton Connection (O&M and Decommissioning phases); • Seagreen 1A Offshore Wind Farm (O&M and Decommissioning phases); • Kincardine Offshore Wind Farm (O&M and Decommissioning phases);

	Cumulative effects assessment
	• Muir Mhor Offshore Wind Farm (O&M phase); • Inch Cape Offshore Wind Farm (O&M phase); • Aberdeen Offshore Wind Farm (O&M and Decommissioning phase); • INTOG: Salamander Offshore Wind Farm (O&M phase); • INTOG: Aspen Offshore Wind Farm Export Cable (O&M phase); • Neart Na Gaoithe Offshore Wind Farm (O&M and Decommissioning phases); • Green Volt Floating Offshore Wind Farm (O&M and Decommissioning phases); • Forthwind Demo Offshore Wind Farm (O&M and Decommissioning phases); • INTOG: Cenos Offshore Wind Farm - Export Cable Corridor (O&M phase). These projects are in various stages of development, the majority, however, are in their O&M and decommissioning phases when Morven North is in its O&M phase, which will result in temporary habitat loss/disturbance as a result of cable and turbine foundation maintenance as well as the removal of infrastructure such as turbine foundations. Overall, these projects will contribute 122,439,834m^2 to the cumulative temporary habitat disturbance/loss. Tier 1 includes the following cable and pipeline projects: • Cambois Connection Offshore Wind Farm Cable (O&M phase); • Salamander OWF Export Cable (OM and Decommissioning phases); • Buchan OWF Export Cable (O&M and Decommissioning phases); • Acorn - CCS pipeline (O&M and Decommissioning phases) • Spittal to Peterhead HVDC Link (O&M phase). These projects are also primarily in their O&M phase and therefore may result in low levels of temporary habitat loss/disturbance due to maintenance as well as the Acorn CCS project being in its decommissioning phase. Due to the spatially limited and intermittent nature of the work associated with these phases these projects have not quantified this impact and therefore have not contributed to the overall cumulative temporary habitat loss/disturbance value. In total cumulative temporary habitat loss associated with Morven North and Tier 1 projects is up to 139,629,034m^2, however, this represents only 0.50% of the Regional Benthic Subtidal Ecology Study Area. The cumulative effect is predicted to be of regional spatial extent, long-term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is, therefore, considered to be low. Tier 2 Tier 2 includes the following offshore wind farm projects:

	Cumulative effects assessment
	• Bowdun Offshore Wind Farm (O&M and Decommissioning phases); • Bellrock Offshore Wind Farm (O&M phase); • MarramWind Offshore Wind Farm Export Cable (O&M and Decommissioning phases). Tier 2 includes the following cable projects: • MHPGC Project (O&M phase); • Ossian Offshore Wind Farm Cable (phase unknown); • Eastern Link 3 (O&M phase); • Eastern Link 4 (O&M phase); • Eastern Link 5 (O&M phase). These projects are in their scoping phase so there is limited information regarding their quantitative impact however the activities associated with the O&M and decommissioning phases of the offshore wind farm projects and cable projects will likely be similar to same phases of Morven North (Section 8.11.2), and due to the intermittency of activities the overall magnitude would not be expected to significantly increase compared to just Morven North. The cumulative effect is predicted to be of regional spatial extent, long-term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be low. Tier 3 Tier 3 includes the following offshore wind farm project and cable project: • INTOG: Flora Offshore Wind Farm (phase unknown); • MBAGC Project (phase unknown). These projects are yet to submit any documents as part of an application therefore the scale and specific impact of these projects is unknown but is likely to be similar, if not much smaller than Morven North (Section 8.11.2). The cumulative effect of all projects in Scenario 4 is predicted to be of regional spatial extent, long-term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be low.
Sensitivity of receptor	The sensitivity of the benthic subtidal ecology IEFs to temporary habitat loss/disturbance is as described previously for the construction phase assessment for Morven North alone in Paragraphs 8.11.2.10 to 8.11.2.14. The offshore subtidal sands and gravels IEF is deemed to be of medium vulnerability, medium to high recoverability and national value. The sensitivity of the receptor is, therefore, considered to be medium. The ocean quahog IEF is deemed to be of high vulnerability, low recoverability, and international value. The sensitivity of the receptor is, therefore, considered to be high.

	Cumulative effects assessment
Significance of effect	Tier 1 Overall, for the offshore subtidal sands and gravels IEF, the magnitude of the cumulative impact is deemed to be low and the sensitivity of the receptor is considered to be medium. The cumulative effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms. Overall, for the ocean quahog IEF, the magnitude of the cumulative impact is deemed to be low and the sensitivity of the receptor is considered to be high. The cumulative effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms. This minor adverse conclusion is due to the low numbers of ocean quahog recorded from the site specific survey, therefore limiting the significance of effect. Tier 2 Overall, for the offshore subtidal sands and gravels IEF, the magnitude of the cumulative impact is deemed to be low and the sensitivity of the receptor is considered to be medium. The cumulative effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms. Overall, for the ocean quahog IEF, the magnitude of the cumulative impact is deemed to be low and the sensitivity of the receptor is considered to be high. The cumulative effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms. This minor adverse conclusion is due to the low numbers of ocean quahog recorded from the site specific survey, therefore limiting the significance of effect. Tier 3 and all of Scenario 4 Overall, for the offshore subtidal sands and gravels IEF, the magnitude of the cumulative impact is deemed to be low and the sensitivity of the receptor is considered to be medium. The cumulative effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms. Overall, for the ocean quahog IEF, the magnitude of the cumulative impact is deemed to be low and the sensitivity of the receptor is considered to be high. The cumulative effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms. This minor adverse conclusion is due to the low numbers of ocean quahog recorded from the site specific survey, therefore limiting the significance of effect.
Decommissioning phase	
Magnitude of impact	The cumulative effects assessment for Scenario 4 considers Morven North together with the Tier 1, Tier 2 and Tier 3 projects below. Tier 1 Tier 1 includes the following offshore wind farm projects: • Morven South (Decommissioning phase); • Ossian Offshore Wind Farm (O&M phase);

	Cumulative effects assessment
	• Muir Mhor Offshore Wind Farm (O&M phase); • Inch Cape Offshore Wind Farm (O&M phase); • INTOG: Salamander Offshore Wind Farm (O&M phase); • INTOG: Aspen Offshore Wind Farm Export Cable (O&M phase); • INTOG: Cenos Offshore Wind Farm - Export Cable Corridor (O&M phase). These projects are all in their O&M phase while Morven North is in its decommissioning phase, which will result in temporary habitat loss/disturbance as a result of cable and turbine foundation maintenance. Overall these projects will contribute 65,150,900m^2 to the cumulative temporary habitat disturbance/loss. Tier 1 includes the following cable project: • Cambois Connection Offshore Wind Farm Cable (O&M phase) This project is also in its O&M phase and therefore may result in low levels of temporary habitat loss/disturbance due to maintenance. Due to the spatially limited and intermittent nature of the work associated with this phase this project has not quantified this impact and therefore has not contributed to the overall cumulative temporary habitat loss/disturbance value. In total cumulative temporary habitat loss associated with Morven North and Tier 1 projects is up to 65,150,900m2 however this represents only 0.23% of the Regional Benthic Subtidal Ecology Study Area. The cumulative effect is predicted to be of regional spatial extent, medium term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be low. Tier 2 Tier 2 includes the following offshore wind farm project: • Bellrock Offshore Wind Farm (O&M phase) Tier 2 includes the following cable projects: • Ossian Offshore Wind Farm Cable (phase unknown); • Eastern Link 3 (O&M phase); • Eastern Link 4 (O&M phase); • Eastern Link 5 (O&M phase). These projects are in their scoping phase so there is limited information regarding their quantitative impact however the activities associated with the O&M phase of the offshore wind farm project and cable projects will likely be similar to the same phases of Morven North (Section 8.11.2) and due to the intermittency of activities the overall magnitude would not be expected to significantly increase compared to just Morven North.

	Cumulative effects assessment
	The cumulative effect is predicted to be of regional spatial extent, medium term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be low. Tier 3 Tier 3 includes the following offshore wind farm project and cable projects: • INTOG: Flora Offshore Wind Farm (phase unknown); • MBAGC Project. These projects are yet to submit any documents as part of an application therefore the magnitude of this impact for these projects is unknown but is likely to be similar, if not much smaller than the Morven North O&M phase (Section 8.11.2). The cumulative effect of all projects in Scenario 4 is predicted to be of regional spatial extent, medium term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is, therefore, considered to be low.
Sensitivity of receptor	The sensitivity of the benthic subtidal ecology IEFs to temporary habitat loss/disturbance is as described previously for the construction phase assessment for Morven North alone in Paragraphs 8.11.2.10 to 8.11.2.14. The offshore subtidal sands and gravels IEF is deemed to be of medium vulnerability, medium to high recoverability and national value. The sensitivity of the receptor is, therefore, considered to be medium. The ocean quahog IEF is deemed to be of high vulnerability, low recoverability, and international value. The sensitivity of the receptor is therefore, considered to be high.
Significance of effect	Tier 1 Overall, for the offshore subtidal sands and gravels IEF, the magnitude of the cumulative impact is deemed to be low and the sensitivity of the receptor is considered to be medium. The cumulative effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms. Overall, for the ocean quahog IEF, the magnitude of the cumulative impact is deemed to be low and the sensitivity of the receptor is considered to be high. The cumulative effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms. This minor adverse conclusion is due to the low numbers of ocean quahog recorded from the site specific survey, therefore limiting the significance of effect. Tier 2 Overall, for the offshore subtidal sands and gravels IEF, the magnitude of the cumulative impact is deemed to be low and the sensitivity of the receptor is considered to be medium. The cumulative effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms. Overall, for the ocean quahog IEF, the magnitude of the cumulative impact is deemed to be low and the sensitivity of the receptor is considered to be high. The cumulative effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms. This

	Cumulative effects assessment
	minor adverse conclusion is due to the low numbers of ocean quahog recorded from the site specific survey, therefore limiting the significance of effect. Tier 3 and all of Scenario 4 Overall, for the offshore subtidal sands and gravels IEF, the magnitude of the cumulative impact is deemed to be low and the sensitivity of the receptor is considered to be medium. The cumulative effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms. Overall, for the ocean quahog IEF, the magnitude of the cumulative impact is deemed to be low and the sensitivity of the receptor is considered to be high. The cumulative effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms. This minor adverse conclusion is due to the low numbers of ocean quahog recorded from the site specific survey, therefore limiting the significance of effect.

8.13.3 Increased suspended sediment concentrations and associated deposition

8.13.3.1 There is potential for increased SSCs and associated deposition as a result of the Morven North construction, O&M, and decommissioning activities alongside other offshore wind farm and cables within the Morven North and Morven South Benthic Cumulative Study Area. These activities include seabed preparation, anchor placement, cable burial, and O&M activities.

8.13.3.2 Increased SSCs and associated deposition may occur as a result of Morven North. Additionally, there are five offshore wind farm projects and two wind cable agreements which could contribute cumulatively.

8.13.3.3 The summary of the Whole Project assessment for increased SSCs and associated deposition is presented in Table 8.31, and cumulative effects assessment for increased SSCs and associated deposition is presented in Table 8.32.

Table 8.31: Morven North Whole Project assessment for increased Suspended Sediment Concentrations and associated deposition

	Whole Project assessment	
	Scenario 1: Morven North + MHPGC Project	**Scenario 2: Morven North + MBAGC Project**
Construction phase		
Magnitude of impact	The Whole Project assessment for Scenario 1 considers Morven North together with MHPGC Project. The O&M phase of the MHPGC Project may occur simultaneously with the construction phase of Morven North and includes cable repair and reburial events. The MHPGC Project Export Cable repair and reburial activities will be undertaken in close proximity to Morven North, using similar parameters and techniques to those associated with the inter-array and interconnector cable installation activities for Morven North (Section 8.11.3). The impacts are expected to be minimal, with much smaller areas of disturbance and therefore smaller increases in SSCs and associated deposition then during the construction and decommissioning phases, and the overall magnitude is therefore unlikely to be significantly greater than the alone assessment at any one point. The Whole Project impact is predicted to be of local spatial extent, medium term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is, therefore, considered to be low.	The Whole Project assessment for Scenario 2 considers Morven North together with MBAGC Project. The construction of the MBAGC Project may occur simultaneously with the construction phase of Morven North. Currently no scoping report has been published for the MBAGC Project, however the MBAGC Project site preparation and offshore cable installation will be undertaken in close proximity to Morven North, likely using similar parameters and techniques to those associated with the inter-array and interconnector cable installation for Morven North (Section 8.11.3). The O&M phase of the MBAGC Project may also occur simultaneously with the construction phase of Morven North, and will include repair and reburial events, similar to the MHPGC Project, and with a reduced impact compared to the construction phase. The Whole Project impact is predicted to be of local spatial extent, medium term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is, therefore, considered to be low.
Sensitivity of receptor	The sensitivity of the benthic subtidal ecology IEFs to increased SSC and associated deposition is as described in Paragraphs 8.11.3.9 to 8.11.3.13. The offshore subtidal sands and gravels IEF was deemed to be of low to medium vulnerability, high recoverability and national value. The sensitivity of the receptor was therefore considered to be medium. The ocean quahog IEF was deemed to be of no vulnerability, high recoverability and international value. The sensitivity of the receptor was therefore considered to be negligible.	

	Whole Project assessment	
Significance of effect	Overall, for the offshore subtidal sands and gravels IEF, the magnitude of the Whole Project impact is deemed to be low and the sensitivity of the receptor is considered to be medium. The Whole Project effect will, therefore, be of **minor adverse** significance, due to the large areas of similar unimpacted habitat within the Regional Benthic Subtidal Ecology Study Area, which is not significant in EIA terms. Overall, for the ocean quahog IEF, the magnitude of the Whole Project impact is deemed to be low and the sensitivity of the receptor is considered to be negligible. The Whole Project effect will, therefore, be of negligible to minor adverse significance, with an overall **minor adverse** significance, due to the international importance of this species and classification as a PMF, which is not significant in EIA terms.	Overall, for the offshore subtidal sands and gravels IEF, the magnitude of the Whole Project impact is deemed to be low and the sensitivity of the receptor is considered to be medium. The Whole Project effect will, therefore, be of **minor adverse** significance, due to the large areas of similar unimpacted habitat within the Regional Benthic Subtidal Ecology Study Area, which is not significant in EIA terms. Overall, for the ocean quahog IEF, the magnitude of the Whole Project impact is deemed to be low and the sensitivity of the receptor is considered to be negligible. The Whole Project effect will, therefore, be of negligible to minor adverse significance, with an overall **minor adverse** significance, due to the international importance of this species and classification as a PMF, which is not significant in EIA terms.
O&M phase		
Magnitude of impact	The Whole Project assessment for Scenario 1 considers Morven North together with MHPGC Project. The O&M phase of the MHPGC Project may occur simultaneously with the O&M phase of Morven North and includes cable repair and reburial events. The MHPGC Project Export Cable repair and reburial activities will be undertaken in close proximity to Morven North, using similar parameters and techniques to those associated with the inter-array and interconnector cable installation activities for Morven North (Section 8.11.3). The maintenance activities, therefore, are likely to result in a similar level of increased SSCs and associated deposition, with a limited and localised spatial extent, with the impact only occurring intermittently across the operational lifetime of Morven North, therefore not significantly increasing the magnitude. The Whole Project impact is predicted to be of local spatial extent, long-term duration, intermittent and high reversibility. It is predicted	The Whole Project assessment for Scenario 2 considers Morven North together with MBAGC Project. The assessment can be considered to be the same as Scenario 1 for this impact and phase, as discussed in the column to the left. The Whole Project impact is predicted to be of local spatial extent, long-term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be low.

	Whole Project assessment	
	that the impact will affect the receptor directly. The magnitude is therefore, considered to be low.	
Sensitivity of receptor	The sensitivity of the benthic subtidal ecology IEFs to increased SSC and associated deposition is as described in Paragraphs 8.11.3.9 to 8.11.3.13. The offshore subtidal sands and gravels IEF was deemed to be of low to medium vulnerability, high recoverability and national value. The sensitivity of the receptor was therefore considered to be medium. The ocean quahog IEF was deemed to be of no vulnerability, high recoverability and international value. The sensitivity of the receptor was therefore considered to be negligible.	
Significance of effect	Overall, for the offshore subtidal sands and gravels IEF, the magnitude of the Whole Project impact is deemed to be low and the sensitivity of the receptor is considered to be medium. The Whole Project effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms. Overall, for the ocean quahog IEF, the magnitude of the Whole Project impact is deemed to be low and the sensitivity of the receptor is considered to be negligible. The Whole Project effect will, therefore, be of negligible to minor adverse significance, with an overall **minor adverse** significance, due to the international importance of this species and classification as a PMF, which is not significant in EIA terms.	Overall, for the offshore subtidal sands and gravels IEF, the magnitude of the Whole Project impact is deemed to be low and the sensitivity of the receptor is considered to be medium. The Whole Project effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms. Overall, for the ocean quahog IEF, the magnitude of the Whole Project impact is deemed to be low and the sensitivity of the receptor is considered to be negligible. The Whole Project effect will, therefore, be of negligible to minor adverse significance, with an overall **minor adverse** significance, due to the international importance of this species and classification as a PMF, which is not significant in EIA terms.
Decommissioning phase		
Magnitude of impact	The Whole Project assessment for Scenario 1 considers Morven North together with MHPGC Project. The decommissioning phase of the MHPGC Project may occur simultaneously with the decommissioning phase of Morven North. Due to the relationship of the projects, it is assumed the O&M phase of the MHPGC Project will not occur during the decommissioning phase of Morven North. There is the potential for the MHPGC Project decommissioning activities to include cable removal, although it is anticipated that offshore cables and any offshore cable protection may be left in-situ.	The Whole Project assessment for Scenario 2 considers Morven North together with MBAGC Project. The assessment can be considered to be the same as Scenario 1 for this impact and phase, as discussed in the column to the left. The Whole Project impact is predicted to be of local spatial extent, long-term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be low.

	Whole Project assessment	
	Any direct impacts from jack-up vessels and anchor placements will be similar to the construction phase, with similar recovery periods (Section 8.11.3), and therefore the magnitude is unlikely to significantly increase. The Whole Project impact is predicted to be of local spatial extent, long-term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore considered to be low.	
Sensitivity of receptor	The sensitivity of the benthic subtidal ecology IEFs to increased SSC and associated deposition is as described in Paragraphs 8.11.3.9 to 8.11.3.13. The offshore subtidal sands and gravels IEF was deemed to be of low to medium vulnerability, high recoverability and national value. The sensitivity of the receptor was therefore considered to be medium. The ocean quahog IEF was deemed to be of no vulnerability, high recoverability and international value. The sensitivity of the receptor was therefore considered to be negligible.	
Significance of effect	Overall, for the offshore subtidal sands and gravels IEF, the magnitude of the Whole Project impact is deemed to be low and the sensitivity of the receptor is considered to be medium. The Whole Project effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms. Overall, for the ocean quahog IEF, the magnitude of the Whole Project impact is deemed to be low and the sensitivity of the receptor is considered to be negligible. The Whole Project effect will, therefore, be of negligible to minor adverse significance, with an overall **minor adverse** significance, due to the international importance of this species and classification as a PMF, which is not significant in EIA terms.	Overall, for the offshore subtidal sands and gravels IEF, the magnitude of the Whole Project impact is deemed to be low and the sensitivity of the receptor is considered to be medium. The Whole Project effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms. Overall, for the ocean quahog IEF, the magnitude of the Whole Project impact is deemed to be low and the sensitivity of the receptor is considered to be negligible. The Whole Project effect will, therefore, be of negligible to minor adverse significance, with an overall **minor adverse** significance, due to the international importance of this species and classification as a PMF, which is not significant in EIA terms.

Table 8.32: Morven North cumulative effects assessment for increased Suspended Sediment Concentrations and associated deposition

	Cumulative effects assessment
	Scenario 4: Morven North and Tier 1, Tier 2 and Tier 3 Projects
Construction phase	
Magnitude of impact	The cumulative effects assessment for Scenario 4 considers Morven North together with the Tier 1, Tier 2 and Tier 3 projects below. Tier 1 Tier 1 includes Ossian Offshore Wind Farm, Seagreen 1 Offshore Wind Project, and Morven South. The O&M phase of Ossian Offshore Wind Farm, and Seagreen 1, in addition to Morven South may occur simultaneously with the construction phase of Morven North and includes cable repair and reburial events. The construction phase of Ossian Offshore Wind Farm may also occur simultaneously with the construction phase of Morven North and includes activities such as site preparation/sandwave clearance, and export cable trenching, which will give rise to increased SSCs. Morven South is located directly to the southeast of Morven North, with the Morven North Boundary and Morven South Boundary positioned adjacent to each other. Therefore, construction activities for Morven South may be undertaken in close proximity to Morven North, and should they be undertaken concurrently, there is potential for plumes to interact, however these activities would be of limited spatial extent and frequency and plume interactions likely of a low magnitude and short duration. The majority of sedimentation would occur within close proximity to each activity due to the low sediment transport rates in the area. Ossian Offshore Wind Farm is located 9km from the Morven North Boundary directly to the east and southeast and is proposed for up to 265 wind turbines. There will be limited opportunity for the amalgamation of sediment plumes from these projects, given the orientation of the tides in a predominantly north northeast to south southwest direction. Seagreen 1 is located to the west of the Morven North Boundary at a distance of 25km (114 wind turbines), with negligible opportunity for the amalgamation of plumes given the orientation of the tides, as evidenced from modelling of sediment plumes in Volume 2, Chapter 7: Physical Processes, of the EIA Report. The cumulative effect is predicted to be of local spatial extent, short-term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is, therefore, considered to be low. Tier 2 Tier 2 includes Bowdun Offshore Wind Project, Ossian OWF Export Cable, and the MHPGC Project. The O&M phase of Bowdun Offshore Wind Project, Ossian OWF Export Cable, and the MHPGC Project may occur simultaneously with the construction phase of Morven North and includes cable repair and reburial events. The construction phase of Bowdun Offshore Wind Project and Ossian OWF Export Cable may also occur simultaneously with the construction phase of Morven North and includes activities such as site preparation/sandwave clearance, foundation installation, and export cable trenching, which will give rise to increased SSCs. Bowdun Offshore Wind Project is located 10km to the northwest of the Morven North Boundary (67 wind turbines) and is unlikely to have potential for the amalgamation of plumes from Morven North construction activities, due to the orientation of the tides. Construction or

	Cumulative effects assessment
	O&M activities from Ossian OWF Export Cable may be undertaken in close proximity to Morven North and should they be undertaken concurrently, there is potential for the amalgamation of plumes, increased deposition and a negligible amount of remobilised and redistributed material, as evidenced from modelling of sediment plumes in Volume 2, Chapter 7: Physical Processes, of the EIA Report. These activities would be of limited spatial extent and frequency and plume interactions likely of a low magnitude and short duration. The majority of sedimentation would occur within close proximity to each activity due to the low sediment transport rates in the area. The cumulative effect is predicted to be of local spatial extent, short-term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is, therefore, considered to be low. Tier 3 Tier 3 involves the MBAGC Project. This project is yet to submit any documents as part of an application therefore the scale and specific impact of this project is unknown but is likely to be similar, if not much smaller than Morven North (Section 8.11.2). The cumulative effect of all projects in Scenario 4 is predicted to be of local spatial extent, short-term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be low.
Sensitivity of receptor	The sensitivity of the benthic subtidal ecology IEFs to increased SSC and associated deposition is as described in Paragraphs 8.11.3.9 to 8.11.3.13. The offshore subtidal sands and gravels IEF was deemed to be of low to medium vulnerability, high recoverability and national value. The sensitivity of the receptor was therefore considered to be medium. The ocean quahog IEF was deemed to be of no vulnerability, high recoverability and international value. The sensitivity of the receptor was therefore considered to be negligible.
Significance of effect	Tier 1 Overall, for the offshore subtidal sands and gravels IEF, the magnitude of the cumulative impact is deemed to be low and the sensitivity of the receptor is considered to be medium. The cumulative effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms. Overall, for the ocean quahog IEF, the magnitude of the cumulative impact is deemed to be low and the sensitivity of the receptor is considered to be negligible. The cumulative effect will, therefore, be of negligible to minor adverse significance, with an overall **minor adverse** significance, due to the international importance of this species and classification as a PMF, which is not significant in EIA terms. Tier 2 Overall, for the offshore subtidal sands and gravels IEF, the magnitude of the cumulative impact is deemed to be low and the sensitivity of the receptor is considered to be medium. The cumulative effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.

	Cumulative effects assessment
	Overall, for the ocean quahog IEF, the magnitude of the cumulative impact is deemed to be low and the sensitivity of the receptor is considered to be negligible. The cumulative effect will, therefore, be of negligible to minor adverse significance, with an overall **minor adverse** significance, due to the international importance of this species and classification as a PMF, which is not significant in EIA terms. Tier 3 Overall, for the offshore subtidal sands and gravels IEF, the magnitude of the cumulative impact is deemed to be low and the sensitivity of the receptor is considered to be medium. The cumulative effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms. Overall, for the ocean quahog IEF, the magnitude of the cumulative impact is deemed to be low and the sensitivity of the receptor is considered to be negligible. The cumulative effect will, therefore, be of negligible to minor adverse significance, with an overall **minor adverse** significance, due to the international importance of this species and classification as a PMF, which is not significant in EIA terms.
O&M phase	
Magnitude of impact	The cumulative effects assessment for Scenario 4 considers Morven North together with the Tier 1, Tier 2 and Tier 3 projects below. Tier 1 Tier 1 includes Ossian Offshore Wind Farm, Seagreen 1 Offshore Wind Project, and Morven South. The O&M phase of Ossian Offshore Wind Farm, Seagreen 1, and Morven South may occur simultaneously with the O&M phase of Morven North and includes cable repair and reburial events. The construction phase of Morven South may also occur simultaneously with the O&M phase of Morven North and includes activities such as site preparation/sandwave clearance, foundation installation and export cable trenching, which will give rise to increased SSCs. The decommissioning phases of Morven South, Seagreen 1 and Ossian Offshore Wind Farm also may align with the O&M phase of Morven North and may include cable removal. Ossian Offshore Wind Farm is located 9km from the Morven North Boundary directly to the east and southeast. There will be limited opportunity for the amalgamation of sediment plumes from these projects, given the orientation of the tides in a predominantly north northeast to south southwest direction. It is noted that a limited increases in SSCs may occur due to the mooring lines interacting with the seabed as part of the Ossian Offshore Wind Farm, however, plumes are not expected to amalgamate with Morven North. Seagreen 1 is located to the west of the Morven North Boundary at a distance of 25km, with negligible opportunity for the amalgamation of plumes given the orientation of the tides as evidenced from modelling of sediment plumes in Volume 2, Chapter 7: Physical Processes, of the EIA Report. Project activities for Morven South would be undertaken in close proximity to Morven North, and should they be undertaken concurrently, there is potential for plumes to interact, however these activities would be of limited spatial extent and frequency and plume interactions likely of a low magnitude and short duration. The majority of sedimentation would occur within close proximity to each activity due to the low sediment transport rates in the area. Given that the magnitude of the O&M activities will be negligible for Morven North alone, or Morven South alone, it is not anticipated that the cumulative magnitude of Morven South construction activities during the O&M phase of Morven North will be measurably higher than for Morven North or Morven South alone.

	Cumulative effects assessment
	The magnitude of the impact is not anticipated to be measurably larger than Scenarios 1 and 2 for this impact with the addition of Tier 1 projects, with the construction phase of Morven South the most critical to the potential increase in SSCs and associated deposition, but the intermittent nature of activities will reduce temporal overlap and therefore prevent significant increases to the magnitude. The cumulative effect is predicted to be of local spatial extent, short-term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be low. Tier 2 Tier 2 includes Bowdun Offshore Wind Project, the Ossian OWF Export Cable, and the MHPGC Project. The O&M phase of Bowdun Offshore Wind Project, Ossian OWF Export Cable, and the MHPGC Project may occur simultaneously with the O&M phase of Morven North and includes cable repair and reburial events. The construction phase of the Ossian OWF Export Cable may also occur simultaneously with the O&M phase of Morven North and includes activities such as site preparation/sandwave clearance, foundation installation, and export cable trenching, which will give rise to increased SSCs. The decommissioning phases of Bowdun Offshore Wind Project and Ossian OWF Export Cable also may align with the O&M phase of Morven North and may include cable and foundation removal. Bowdun Offshore Wind Project is located 10km to the northwest of the Morven North Boundary and is unlikely to have potential for the amalgamation of plumes from Morven North activities, due to the orientation of the tides. Activities from Ossian OWF Export Cable may be undertaken in close proximity to Morven North and should they be undertaken concurrently, there is potential for the amalgamation of plumes, increased deposition and a negligible amount of remobilised and redistributed material. These activities would be of limited spatial extent and frequency and plume interactions likely of a low magnitude and short duration. The majority of sedimentation would occur within close proximity to each activity due to the low sediment transport rates in the area, thereby reducing the potential for significant increases in magnitude. The cumulative effect is predicted to be of local spatial extent, short-term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be low. Tier 3 Tier 3 involves the MBAGC Project. This project is yet to submit any documents as part of an application therefore the scale and specific impact of this project is unknown but is likely to be similar, if not much smaller than Morven North (Section 8.11.2). The cumulative effect of all projects in Scenario 4 is predicted to be of local spatial extent, short-term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be low.
Sensitivity of receptor	The sensitivity of the benthic subtidal ecology IEFs to increased SSC and associated deposition is as described in Paragraphs 8.11.3.9 to 8.11.3.13.

	Cumulative effects assessment
	The offshore subtidal sands and gravels IEF was deemed to be of low to medium vulnerability, high recoverability and national value. The sensitivity of the receptor was therefore considered to be medium. The ocean quahog IEF was deemed to be of no vulnerability, high recoverability and international value. The sensitivity of the receptor was therefore considered to be negligible.
Significance of effect	Tier 1 Overall, for the offshore subtidal sands and gravels IEF, the magnitude of the cumulative impact is deemed to be low and the sensitivity of the receptor is considered to be medium. The cumulative effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms. Overall, for the ocean quahog IEF, the magnitude of the cumulative impact is deemed to be low and the sensitivity of the receptor is considered to be negligible. The cumulative effect will, therefore, be of negligible to minor adverse significance, with an overall **minor adverse** significance, due to the international importance of this species and classification as a PMF, which is not significant in EIA terms. Tier 2 Overall, for the offshore subtidal sands and gravels IEF, the magnitude of the cumulative impact is deemed to be low and the sensitivity of the receptor is considered to be medium. The cumulative effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms. Overall, for the ocean quahog IEF, the magnitude of the cumulative impact is deemed to be low and the sensitivity of the receptor is considered to be negligible. The cumulative effect will, therefore, be of negligible to minor adverse significance, with an overall **minor adverse** significance, due to the international importance of this species and classification as a PMF, which is not significant in EIA terms. Tier 3 and all of Scenario 4 Overall, for the offshore subtidal sands and gravels IEF, the magnitude of the cumulative impact is deemed to be low and the sensitivity of the receptor is considered to be medium. The cumulative effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms. Overall, for the ocean quahog IEF, the magnitude of the cumulative impact is deemed to be low and the sensitivity of the receptor is considered to be negligible. The cumulative effect will, therefore, be of negligible to minor adverse significance, with an overall **minor adverse** significance, due to the international importance of this species and classification as a PMF, which is not significant in EIA terms.
Decommissioning phase	
Magnitude of impact	The cumulative effects assessment for Scenario 4 considers Morven North together with the Tier 1, Tier 2 and Tier 3 projects below. Tier 1 Tier 1 includes Ossian Offshore Wind Farm and Morven South.

	Cumulative effects assessment
	The O&M phase of Ossian Offshore Wind Farm and Morven South may occur simultaneously with the decommissioning phase of Morven North and includes cable repair and reburial events. The decommissioning phase of Ossian Offshore Wind Farm and Morven South may also occur simultaneously with the decommissioning phase of Morven North and includes cable and foundation removal. Ossian Offshore Wind Farm is located 9km from the Morven North Boundary directly to the east and southeast. There will be limited opportunity for the amalgamation of sediment plumes from these projects, given the orientation of the tides in a predominantly north northeast to south southwest direction. It is noted that a limited increases in SSCs may occur due to the mooring lines interacting with the seabed as part of the Ossian Offshore Wind Farm, however, plumes are not expected to amalgamate with Morven North as evidenced from modelling of sediment plumes in Volume 2, Chapter 7: Physical Processes, of the EIA Report. Project activities from Morven South would be undertaken in close proximity to Morven North and should they be undertaken concurrently, there is potential for plumes to interact, however these activities would be of limited spatial extent and frequency and plume interactions likely of a low magnitude and short duration. The majority of sedimentation would occur within close proximity to each activity due to the low sediment transport rates in the area. Any changes to SSC would be reversible following cessation of the activities within a few tidal cycles, with deposited material returning to equilibrium over time. The magnitude of the impact is not anticipated to be larger than Scenarios 1 and 2 for this impact as it is unlikely concurrent activities will be undertaken in the same location, thereby reducing the potential for significant increases in magnitude. The cumulative effect is predicted to be of local spatial extent, short-term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be low. Tier 2 Tier 2 includes Bowdun Offshore Wind Project and Ossian OWF Export Cable. The O&M phase of Bowdun Offshore Wind Project and Ossian OWF Export Cable may occur simultaneously with the decommissioning phase of Morven North and includes cable repair and reburial events. The decommissioning phase of Bowdun Offshore Wind Project and Ossian OWF Export Cable may also occur simultaneously with the decommissioning phase of Morven North and includes cable and foundation removal. Bowdun Offshore Wind Project is located 10km to the northwest of the Morven North Boundary and is unlikely to have potential for the amalgamation of plumes from Morven North activities, due to the orientation of the tides. Activities from Ossian OWF Export Cable may be undertaken in close proximity to Morven North and should they be undertaken concurrently, there is potential for the amalgamation of plumes, increased deposition and a negligible amount of remobilised and redistributed material. These activities would be of limited spatial extent and frequency and plume interactions likely of a low magnitude and short duration. The majority of sedimentation would occur within close proximity to each activity due to the low sediment transport rates in the area, reducing the potential for significant increases in magnitude. With no construction activities to consider under this phase, the additional cumulative magnitude of the impact during decommissioning is likely to be less than during the Morven North construction or O&M phases.

	Cumulative effects assessment
	The cumulative effect is predicted to be of local spatial extent, short-term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is, therefore, considered to be low. Tier 3 Tier 3 involves the MBAGC Project. This project is yet to submit any documents as part of an application therefore the scale and specific impact of this project is unknown but is likely to be similar, if not much smaller than Morven North (Section 8.11.2). The cumulative effect of all projects in Scenario 4 is predicted to be of local spatial extent, short-term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be low.
Sensitivity of receptor	The sensitivity of the benthic subtidal ecology IEFs to increased SSC and associated deposition is as described in Paragraphs 8.11.3.9 to 8.11.3.13. The offshore subtidal sands and gravels IEF was deemed to be of low to medium vulnerability, high recoverability and national value. The sensitivity of the receptor was therefore considered to be medium. The ocean quahog IEF was deemed to be of no vulnerability, high recoverability and international value. The sensitivity of the receptor was therefore considered to be negligible.
Significance of effect	Tier 1 Overall, for the offshore subtidal sands and gravels IEF, the magnitude of the cumulative impact is deemed to be low and the sensitivity of the receptor is considered to be medium. The cumulative effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms. Overall, for the ocean quahog IEF, the magnitude of the cumulative impact is deemed to be low and the sensitivity of the receptor is considered to be negligible. The cumulative effect will, therefore, be of negligible to minor adverse significance, with an overall **minor adverse** significance, due to the international importance of this species and classification as a PMF, which is not significant in EIA terms. Tier 2 Overall, for the offshore subtidal sands and gravels IEF, the magnitude of the cumulative impact is deemed to be low and the sensitivity of the receptor is considered to be medium. The cumulative effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms. Overall, for the ocean quahog IEF, the magnitude of the cumulative impact is deemed to be low and the sensitivity of the receptor is considered to be negligible. The cumulative effect will, therefore, be of negligible to minor adverse significance, with an overall **minor adverse** significance, due to the international importance of this species and classification as a PMF, which is not significant in EIA terms. Tier 3 and all of Scenario 4

	Cumulative effects assessment
	Overall, for the offshore subtidal sands and gravels IEF, the magnitude of the cumulative impact is deemed to be low and the sensitivity of the receptor is considered to be medium. The cumulative effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms. Overall, for the ocean quahog IEF, the magnitude of the cumulative impact is deemed to be low and the sensitivity of the receptor is considered to be negligible. The cumulative effect will, therefore, be of negligible to minor adverse significance, with an overall **minor adverse** significance, due to the international importance of this species and classification as a PMF, which is not significant in EIA terms.

8.13.4 Long-term habitat loss

8.13.4.1 There is potential for long-term habitat loss as a result of Morven North's construction, O&M and decommissioning activities alongside other offshore wind farms, cables, and pipelines within the Regional Benthic Subtidal Study Area. Long-term habitat loss may result from the installation of turbine foundations, scour protection, cable protection, and cable crossings.

8.13.4.2 Long-term habitat loss may occur as a result of Morven North. Additionally, there are five offshore wind farm projects and five cable projects which could contribute cumulatively.

8.13.4.3 The summary of the Whole Project assessment for long-term habitat loss is presented in Table 8.33, and cumulative effects assessment for long-term habitat loss is presented in Table 8.34.

Table 8.33: Morven North Whole Project assessment for long-term habitat loss

	Whole Project assessment	
	Scenario 1: Morven North + MHPGC Project	**Scenario 2: Morven North + MBAGC Project**
Construction and O&M phases		
Magnitude of impact	The Whole Project assessment for Scenario 1 considers Morven North together with MHPGC Project. The MHPGC Project may install cable protection along its Export Cable Corridor during the Morven North construction and O&M phase. As this project is only in its scoping stage, the amount of long-term habitat loss from this project is not currently quantified. Cable protection for the MHPGC Project will likely have a similar or smaller footprint than Morven North (Section 8.11.4), however the total long-term habitat loss is unknown. The impacts are expected to be minimal and highly localised along the Export Cable Corridor. The overall magnitude of this impact represents approximately 0.01% of the Regional Benthic Subtidal Study Area, which is a very low proportion of sediment lost to long-term habitat loss. The Whole Project impact is predicted to be of local spatial extent, long-term duration, continuous and low reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is, therefore, considered to be low adverse.	The Whole Project assessment for Scenario 2 considers Morven North together with MBAGC Project. The assessment can be considered to be the same as Scenario 1 for this impact and phase, as discussed in the column to the left. The Whole Project impact is predicted to be of local spatial extent, long-term duration, continuous and low reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is, therefore, considered to be low adverse.
Sensitivity of receptor	The sensitivity of the benthic subtidal ecology IEFs to long-term habitat loss is as described previously for the construction phase assessment for Morven North alone in Paragraphs 8.11.4.6 to 8.11.4.10. The offshore subtidal sands and gravels and ocean quahog IEFs are deemed to be of high vulnerability, low recoverability, and national to international value. The sensitivity of these receptors is, therefore, considered to be high.	
Significance of effect	Overall, for the subtidal sands and gravels and ocean quahog IEFs, the magnitude of the Whole Project impact is deemed to be low and the sensitivity of the receptor is considered to be high. The Whole Project effect will, therefore, be of minor to moderate significance, with an overall conclusion for both IEFs of **minor adverse**	Overall, for the subtidal sands and gravels and ocean quahog IEFs, the magnitude of the Whole Project impact is deemed to be low and the sensitivity of the receptor is considered to be high. The Whole Project effect will, therefore, be of minor to moderate significance, with an overall conclusion for both IEFs of **minor adverse**

	Whole Project assessment	
	significance, which is not significant in EIA terms. This is due to the relatively low area impacted by long-term habitat loss compared to the large areas of unimpacted similar habitat regionally and due to the low numbers of ocean quahog recorded across the Regional Benthic Subtidal Ecology Study Area lowering the overall significance from moderate to minor.	significance, which is not significant in EIA terms. This is due to the relatively low area impacted by long-term habitat loss compared to the large areas of unimpacted similar habitat regionally and due to the low numbers of ocean quahog recorded across the Regional Benthic Subtidal Ecology Study Area lowering the overall significance from moderate to minor.
Decommissioning phase		
Magnitude of impact	The Whole Project assessment for Scenario 1 considers Morven North together with MHPGC Project. The decommissioning phase of the MHPGC Project may occur simultaneously with the decommissioning phase of Morven North. Due to the relationship of the projects, it is assumed the O&M phase of the MHPGC Project will not occur during the decommissioning phase of Morven North. The overall magnitude of this impact represents approximately 0.01% of the Regional Benthic Subtidal Study Area, which is a very low proportion of sediment lost to long-term habitat loss. Permanent habitat loss from the MHPGC Project decommissioning phase may occur as a result of infrastructure such as cable protection being left in situ. Any cable protection left on the seabed will likely have a highly localised impacts on the surrounding communities, as described for Morven North, and will likely become buried over time (Section 8.11.4). Any cable protection remaining unburied will provide an ongoing substrate for colonisation by benthic communities, which has been assessed separately in Table 8.37 and Table 8.38. The Whole Project impact is predicted to be of local spatial extent, long-term duration, continuous and low reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is, therefore, considered to be low adverse.	The Whole Project assessment for Scenario 2 considers Morven North together with MBAGC Project. The assessment can be considered to be the same as Scenario 1 for this impact and phase, as discussed in the column to the left. The Whole Project impact is predicted to be of local spatial extent, long-term duration, continuous and low reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is, therefore, considered to be low adverse.
Sensitivity of receptor	The sensitivity of the benthic subtidal ecology IEFs to long-term habitat loss is as described previously for the construction phase assessment for Morven North alone in Paragraphs 8.11.4.6 to 8.11.4.10.	

	Whole Project assessment	
	The offshore subtidal sands and gravels and ocean quahog IEFs are deemed to be of high vulnerability, low recoverability, and national to international value. The sensitivity of these receptors was, therefore, considered to be high.	
Significance of effect	Overall, for the subtidal sands and gravels and ocean quahog IEFs, the magnitude of the Whole Project impact is deemed to be low and the sensitivity of the receptor is considered to be high. The Whole Project effect will, therefore, be of minor to moderate significance, with an overall conclusion for both IEFs of **minor adverse** significance, which is not significant in EIA terms. This is due to the relatively low area impacted by long-term habitat loss compared to the large areas of unimpacted similar habitat regionally and due to the low numbers of ocean quahog recorded across the Regional Benthic Subtidal Ecology Study Area lowering the overall significance from moderate to minor.	Overall, for the subtidal sands and gravels and ocean quahog IEFs, the magnitude of the Whole Project impact is deemed to be low and the sensitivity of the receptor is considered to be high. The Whole Project effect will, therefore, be of minor to moderate significance, with an overall conclusion for both IEFs of **minor adverse** significance, which is not significant in EIA terms. This is due to the relatively low area impacted by long-term habitat loss compared to the large areas of unimpacted similar habitat regionally and due to the low numbers of ocean quahog recorded across the Regional Benthic Subtidal Ecology Study Area lowering the overall significance from moderate to minor.

Table 8.34: Morven North cumulative effects assessment for long-term habitat loss

	Cumulative effects assessment
	Scenario 4: Morven North and Tier 1, Tier 2 and Tier 3 Projects
Construction and O&M phases	
Magnitude of impact	The cumulative effects assessment for Scenario 4 considers Morven North together with the Tier 1, Tier 2 and Tier 3 projects below. Tier 1 Tier 1 includes the following offshore wind farm projects which have construction phases overlapping with the construction of Morven North, with all other projects considered part of the existing baseline and therefore not requiring a separate assessment: • Morven South; • Ossian Offshore Wind Farm; • Muir Mhor Offshore Wind Farm. Morven South may result in up to 1,820,664m^2 of long-term habitat loss as a result of wind turbine foundations, OSP foundations, cable protection, cable crossings, and scour protection.

	Cumulative effects assessment
	The Ossian Offshore Wind Farm may result in up to 19,270,958m^2 of hard substrate as a result of moorings and anchors, OSP foundations, cable protection, cable crossings, subsea junction boxes and scour protection (Ossian OWFL, 2024). Muir Mhor Offshore Wind Farm may result in up to 5,530,120m^2 of hard substrate as a result of moorings, anchors, junction boxes offshore electrical platform foundations, dynamic cables, cable protection, cable crossings and scour protection (Muir Mhòr Offshore Wind Farm, 2024). In total cumulative colonisation of hard structures associated with Morven North during the construction and O&M phases and Tier 1 projects is up to 31,014,679m^2 however this represents 0.11% of the Regional Benthic Subtidal Ecology Study Area. The cumulative effect is predicted to be of regional spatial extent, long-term duration, continuous, and low reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is, therefore, considered to be low adverse. Tier 2 Tier 2 includes the following offshore wind farm project: • Bowdun Offshore Wind Farm. Tier 2 includes the following cable projects: • Ossian Offshore Wind Farm Cable; • Eastern Link 3; • Eastern Link 4; • Eastern Link 5; • MHPGC Project. These projects are in their scoping phase so there is limited information regarding their quantitative impact, however the Bowdun Offshore Wind Farm is likely to install a similar magnitude of hard substrate to Morven North (Section 8.11.4). The cable projects are also likely to install hard structures such as cable protection and cable crossings. The distances separating projects and lack of connectivity between the long-term habitat loss introduced for each project reduces the potential of this increasing the magnitude overall. The cumulative effect is predicted to be of regional spatial extent, long-term duration, continuous, and low reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore considered to be low adverse. Tier 3 Tier 3 includes the following offshore wind farm project and the following cable project: • INTOG: Flora Offshore Wind Farm (phase unknown); • MBAGC Project.

	Cumulative effects assessment
	The programme for the Flora Offshore Wind Farm is unknown and therefore there is potential for the project to install hard substrate within the Morven North O&M phase. It is currently not possible to quantify this impact but it is likely to be of a similar or reduced magnitude compared to Morven North (Section 8.11.4). The cumulative effect of all projects in Scenario 4 is predicted to be of regional spatial extent, long-term duration, continuous, and low reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is, therefore, considered to be low adverse.
Sensitivity of receptor	The sensitivity of the benthic subtidal ecology IEFs to long-term habitat loss is as described previously for the construction phase assessment for Morven North alone in Paragraphs 8.11.4.6 to 8.11.4.10. The offshore subtidal sands and gravels and ocean quahog IEFs are deemed to be of high vulnerability, low recoverability, and national to international value. The sensitivity of these receptors was, therefore, considered to be high.
Significance of effect	Tier 1 Overall, for the subtidal sands and gravels and ocean quahog IEFs, the magnitude of the cumulative impact is deemed to be low and the sensitivity of the receptor is considered to be high. The cumulative effect will, therefore, be of minor to moderate significance, with an overall conclusion for both IEFs of **minor adverse** significance, which is not significant in EIA terms. This is due to the relatively low area impacted by long-term habitat loss compared to the large areas of unimpacted similar habitat regionally and due to the low numbers of ocean quahog recorded across the Regional Benthic Subtidal Ecology Study Area lowering the overall significance from moderate to minor. Tier 2 Overall, for the subtidal sands and gravels and ocean quahog IEFs, the magnitude of the cumulative impact is deemed to be low and the sensitivity of the receptor is considered to be high. The cumulative effect will, therefore, be of minor to moderate significance, with an overall conclusion for both IEFs of **minor adverse** significance, which is not significant in EIA terms. This is due to the relatively low area impacted by long-term habitat loss compared to the large areas of unimpacted similar habitat regionally and due to the low numbers of ocean quahog recorded across the Regional Benthic Subtidal Ecology Study Area lowering the overall significance from moderate to minor. Tier 3 and all of Scenario 4 Overall, for the subtidal sands and gravels and ocean quahog IEFs, the magnitude of the cumulative impact is deemed to be low and the sensitivity of the receptor is considered to be high. The cumulative effect will, therefore, be of minor to moderate significance, with an overall conclusion for both IEFs of **minor adverse** significance, which is not significant in EIA terms. This is due to the relatively low area impacted by long-term habitat loss compared to the large areas of unimpacted similar habitat regionally and due to the low numbers of ocean quahog recorded across the Regional Benthic Subtidal Ecology Study Area lowering the overall significance from moderate to minor.
Decommissioning phase	
Magnitude of impact	No Tier 1, 2 or 3 projects have been identified which may install new infrastructure at the time of the decommissioning of Morven North. Therefore, the cumulative magnitude will be no greater than during the construction and O&M phases of Scenario 4.

	Cumulative effects assessment
	The cumulative effect is predicted to be of regional spatial extent, long-term duration, continuous, and low reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is, therefore, considered to be low adverse.
Sensitivity of receptor	The sensitivity of the benthic subtidal ecology IEFs to long-term habitat loss is as described previously for the construction phase assessment for Morven North alone in Paragraphs 8.11.4.6 to 8.11.4.10. The offshore subtidal sands and gravels and ocean quahog IEFs are deemed to be of high vulnerability, low recoverability, and national to international value. The sensitivity of these receptors is, therefore, considered to be high.
Significance of effect	Tier 1 Overall, for the subtidal sands and gravels and ocean quahog IEFs, the magnitude of the cumulative impact is deemed to be low and the sensitivity of the receptor is considered to be high. The cumulative effect will, therefore, be of minor to moderate significance, with an overall conclusion for both IEFs of **minor adverse** significance, which is not significant in EIA terms. This is due to the relatively low area of long-term habitat loss removed and due to the low numbers of ocean quahog recorded across the Regional Benthic Subtidal Ecology Study Area lowering the overall significance from moderate to minor. Tier 2 Overall, for the subtidal sands and gravels and ocean quahog IEFs, the magnitude of the cumulative impact is deemed to be low and the sensitivity of the receptor is considered to be high. The cumulative effect will, therefore, be of minor to moderate significance, with an overall conclusion for both IEFs of **minor adverse** significance, which is not significant in EIA terms. This is due to the relatively low area of long-term habitat loss removed and due to the low numbers of ocean quahog recorded across the Regional Benthic Subtidal Ecology Study Area lowering the overall significance from moderate to minor. Tier 3 and all of Scenario 4 Overall, for the subtidal sands and gravels and ocean quahog IEFs, the magnitude of the cumulative impact is deemed to be low and the sensitivity of the receptor is considered to be high. The cumulative effect will, therefore, be of minor to moderate significance, with an overall conclusion for both IEFs of **minor adverse** significance, which is not significant in EIA terms. This is due to the relatively low area of long-term habitat loss removed and due to the low numbers of ocean quahog recorded across the Regional Benthic Subtidal Ecology Study Area lowering the overall significance from moderate to minor.

8.13.5 Increased risk of introduction and spread of invasive non-native species

8.13.5.1 There is potential for increased risk of introduction and spread of INNS as a result of the Morven North construction, O&M and decommissioning activities alongside other offshore wind farms, cables and pipelines within the Regional Benthic Subtidal Study Area. Increased risk of introduction and spread of INNS may result from the installation of hard structures and increased vessel activity in the region.

8.13.5.2 Increased risk of introduction and spread of INNS may occur as a result of Morven North. Additionally, there are six offshore wind farm projects and five cable projects which could contribute cumulatively.

8.13.5.3 The summary of the Whole Project assessment for increased risk of introduction and spread of INNS is presented in Table 8.35, and cumulative effects assessment for increased risk of introduction and spread of INNS is presented in Table 8.36.

Table 8.35: Morven North Whole Project assessment for increased risk of introduction and spread of Invasive Non-Native Species

	Whole Project assessment	
	Scenario 1: Morven North + MHPGC Project	**Scenario 2: Morven North + MBAGC Project**
Construction, O&M and Decommissioning phases		
Magnitude of impact	The Whole Project assessment for Scenario 1 considers Morven North together with MHPGC Project. The construction, O&M and decommissioning phases of the MHPGC Project may occur simultaneously with the construction, O&M and decommissioning phases of Morven North. This may contribute to an increased risk of introduction and spread of INNS through the installation of hard structures, such as cable protection, as well as vessel movement which may occur in all phases of the MHPGC Project. As this project is currently in its scoping stage, this impact is not quantified, however it is likely to be similar to the impact associated with the inter-array and interconnector cables for Morven North in terms of vessel movements and introduction of hard structures (Section 8.11.5). This reduces the potential of the magnitude increasing significantly, due to the intermittent nature of these activities and vessel movements. The Whole Project impact is predicted to be of local spatial extent, long-term duration (across all phases), intermittent and low reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be low adverse. This is due to the implementation of an INNSMP which will reduce the risk of this impact occurring.	The Whole Project assessment for Scenario 2 considers Morven North together with MBAGC Project. The assessment can be considered to be the same as Scenario 1 for this impact and phase, as discussed in the column to the left. The Whole Project impact is predicted to be of local spatial extent, long-term duration (across all phases), intermittent and low reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be low adverse. This is due to the implementation of an INNSMP which will reduce the risk of this impact occurring.
Sensitivity of receptor	The sensitivity of the benthic subtidal ecology IEFs to increased risk of introduction and spread of INNS is as described previously for the construction phase assessment for Morven North alone in Paragraphs 8.11.5.9 to 8.11.5.12. The offshore subtidal sands and gravels and ocean quahog IEFs are deemed to be of high vulnerability, low recoverability and national to international value. The sensitivity of the receptors is, therefore, considered to be high.	

	Whole Project assessment	
Significance of effect	Overall, for the offshore subtidal sands and gravels and ocean quahog IEFs, the magnitude of the Whole Project impact is deemed to be low and the sensitivity of the receptors is considered to be high. The Whole Project effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.	Overall, for the offshore subtidal sands and gravels and ocean quahog IEFs, the magnitude of the Whole Project impact is deemed to be low and the sensitivity of the receptors is considered to be high. The Whole Project effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.

Table 8.36: Morven North cumulative effects assessment for increased risk of introduction and spread of Invasive Non-Native Species

	Cumulative effects assessment
	Scenario 4: Morven North and Tier 1, Tier 2 and Tier 3 Projects
Construction, O&M and Decommissioning phase	
Magnitude of impact	The cumulative effects assessment for Scenario 4 considers Morven North together with the Tier 1, Tier 2 and Tier 3 projects below. Tier 1 Tier 1 includes the following offshore wind farm projects: • Morven South; • Ossian Offshore Wind Farm; • Muir Mhor Offshore Wind Farm; • INTOG: Cenos Offshore Wind Farm - Export Cable Corridor (O&M phase). Morven South may install up to 3,074,239m^2 of hard structures as a result of cable protection, scour protection, cable crossings, turbine and OSP foundations. Additionally, the maintenance activities associated with Morven South may result in up to 293 vessel round trips in the O&M phase. The vessel return trips associated within the Morven South decommissioning has not been quantified however it is likely to be similar to the construction phase (2,979 return trips). The Ossian Offshore Wind Farm may result in up to 19,270,958m^2 of hard substrate as a result of moorings and anchors, OSP foundations, cable protection, cable crossings, subsea junction boxes and scour protection (Ossian OWFL, 2024). Additionally, Ossian Offshore Wind Farm may result in up to 7,902 vessel round trips due to site preparation and the construction phase of Ossian Offshore Wind Farm, as well as up to 17,780 vessel round trips over the 35 year lifecycle of Morven North (Ossian OWFL, 2024). Muir Mhor Offshore Wind Farm may result in up to 5,530,120m^2 of hard substrate as a result of moorings, anchors, junction boxes offshore electrical platform foundations, dynamic cables, cable protection, cable crossings and scour protection (Muir Mhòr Offshore Wind Farm,

	Cumulative effects assessment
	2024). Additionally, there may be up to up to 17,780 vessel round trips over the 35 year lifecycle of Morven North. No quantification is provided regarding vessel movement in the construction phase (Muir Mhòr Offshore Wind Farm, 2024). Cenos Offshore Wind Farm - Export Cable Corridor may result in up to 349,100m^2 (likely much smaller due to only a small proportion of the Cenos Export Cable overlapping with the Regional Benthic Subtidal Study Area) of hard substrate as a result of export cable protection and cable crossings (Cenos Offshore Windfarm Limited, 2024). Additionally there may be up to 27 different vessels used across the construction period, as well as up to 10 vessels operating simultaneously during O&M phase (Cenos Offshore Windfarm Limited, 2024). In total cumulative hard substrate associated with the Morven North construction, O&M, and decommissioning phases and Tier 1 projects is up to 31,363,779m^2, however, this represents only 0.11% of the Regional Benthic Subtidal Ecology Study Area. The cumulative effect is predicted to be of regional spatial extent, long-term duration (across all phases), intermittent and low reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be low adverse. This is also due to the implementation of an INNSMP which will reduce the risk of this impact occurring. Tier 2 Tier 2 includes the following offshore wind farm project: • Bowdun Offshore Wind Farm; Tier 2 includes the following cable projects: • Ossian Offshore Wind Farm Cable; • Eastern Link 3; • Eastern Link 4; • Eastern Link 5; • MHPGC Project. These projects are in their scoping phase so there is limited information regarding their quantitative impact however Bowdun Offshore Wind Farm is likely to install a similar magnitude of hard substrate to Morven North (Section 8.11.5). The cable projects are also likely to install hard substrate such as cable protection and cable crossings. The associated vessel movements will be intermittent and involve a low number of vessels at any one time, and the long-term habitat loss would have low physical connectivity, reducing the potential of the magnitude increasing significantly. The cumulative impact is predicted to be of regional spatial extent, long-term duration (across all phases), intermittent, and low reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore considered to be low adverse. This is also due to the implementation of an INNSMP which will reduce the risk of this impact occurring. Tier 3 Tier 3 includes the following offshore wind farm project and the following cable project:

	Cumulative effects assessment
	• INTOG: Flora Offshore Wind Farm (phase unknown); • MBAGC Project. The programme for both the Flora Offshore Wind Farm and MBAGC Project is unknown and therefore there is potential for the projects to install hard substrate within the Morven North construction and O&M phases. It is currently not possible to quantify this impact but it is likely to be of a similar or reduced magnitude compared to Morven North (Section 8.11.5). The cumulative effect of all projects in Scenario 4 is predicted to be of regional spatial extent, long-term duration (across all phases), intermittent and low reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is, therefore, considered to be low adverse. This is also due to the implementation of an INNSMP which will reduce the risk of this impact occurring.
Sensitivity of receptor	The sensitivity of the benthic subtidal ecology IEFs to increased risk of introduction and spread of INNS is as described previously for the construction phase assessment for Morven North alone in Paragraphs 8.11.5.9 to 8.11.5.12. The offshore subtidal sands and gravels and ocean quahog IEFs are deemed to be of high vulnerability, low recoverability and national to international value. The sensitivity of the receptors is therefore considered to be high.
Significance of effect	Tier 1 Overall, for the offshore subtidal sands and gravels and ocean quahog IEFs, the magnitude of the cumulative impact is deemed to be low and the sensitivity of the receptors is considered to be high. The cumulative effect will, therefore, be of minor to moderate significance, with an overall conclusion for both IEFs of **minor adverse** significance, which is not significant in EIA terms. This was based on the mitigation measures within the INNSMP reducing the potential of introduction and spread of INNS, and the large areas of otherwise unimpacted habitats within the Regional Benthic Subtidal Ecology Study Area, as well as the low numbers of ocean quahog which could be impacted by INNS within the Regional Benthic Subtidal Ecology Study Area lowering the overall significance from moderate to minor. Tier 2 Overall, for the offshore subtidal sands and gravels and ocean quahog IEFs, the magnitude of the cumulative impact is deemed to be low and the sensitivity of the receptors is considered to be high. The cumulative effect will, therefore, be of minor to moderate significance, with an overall conclusion for both IEFs of **minor adverse** significance, which is not significant in EIA terms. This was based on the mitigation measures within the INNSMP reducing the potential of introduction and spread of INNS, and the large areas of otherwise unimpacted habitats within the Regional Benthic Subtidal Ecology Study Area, as well as the low numbers of ocean quahog which could be impacted by INNS within the Regional Benthic Subtidal Ecology Study Area lowering the overall significance from moderate to minor. Tier 3 and all of Scenario 4 Overall, for the offshore subtidal sands and gravels and ocean quahog IEFs, the magnitude of the cumulative impact is deemed to be low and the sensitivity of the receptors is considered to be high. The cumulative effect will, therefore, be of minor to moderate significance, with an overall conclusion for both IEFs of **minor adverse** significance, which is not significant in EIA terms. This was based on the mitigation measures within the INNSMP reducing the potential of introduction and spread of INNS, and the large areas of otherwise unimpacted

	Cumulative effects assessment
	habitats within the Regional Benthic Subtidal Ecology Study Area, as well as the low numbers of ocean quahog which could be impacted by INNS within the Regional Benthic Subtidal Ecology Study Area lowering the overall significance from moderate to minor.

8.13.6 Colonisation of hard structures

8.13.6.1 There is potential for colonisation of hard structures as a result of the Morven North O&M activities alongside other offshore wind farms, cables and pipelines within the Regional Benthic Subtidal Study Area. Colonisation of hard structures may result from the installation of hard structures in the region.

8.13.6.2 Colonisation of hard structures may occur as a result of Morven North. Additionally, there are six offshore wind farm projects and five cable projects which could contribute cumulatively.

8.13.6.3 The summary of the Whole Project assessment for colonisation of hard structures is presented in Table 8.37, and cumulative effects assessment for colonisation of hard structures is presented in Table 8.38.

Table 8.37: Morven North Whole Project assessment for colonisation of hard structures

	Whole Project assessment	
	Scenario 1: Morven North + MHPGC Project	**Scenario 2: Morven North + MBAGC Project**
O&M phase		
Magnitude of impact	The Whole Project assessment for Scenario 1 considers Morven North together with MHPGC Project. The O&M phase of the MHPGC Project may occur simultaneously with the O&M phase of Morven North. The MHPGC Project may contribute to the colonisation of hard structures through the installation of hard structures, such as cable protection. As this project is currently in its scoping stage, this impact in not quantified. However, it is likely to be similar to the impact associated with the inter-array and interconnector cables for Morven North (Section 8.11.6), and the overall magnitude is unlikely to significantly increase due to the introduced hard substrate only representing a small overall increase compared to the Regional Benthic Subtidal Study Area. The Whole Project impact is predicted to be of local spatial extent, long-term duration, continuous and low reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be low adverse.	The Whole Project assessment for Scenario 2 considers Morven North together with MBAGC Project. The assessment can be considered to be the same as Scenario 1 for this impact and phase, as discussed in the column to the left. The Whole Project impact is predicted to be of local spatial extent, long-term duration, continuous and low reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be low adverse.
Sensitivity of receptor	The sensitivity of the benthic subtidal ecology IEFs to colonisation of hard structures is as described previously for the O&M phase assessment for the Morven North alone in Paragraphs 8.11.6.7 to 8.11.6.11.	

	Whole Project assessment	
	The offshore subtidal sands and gravels and the ocean quahog IEFs are deemed to be of high vulnerability, low recoverability, and national to international value. The sensitivities of both receptors was, therefore, considered to be high.	
Significance of effect	Overall, the magnitude of the Whole Project impact is deemed to be low and the sensitivity of the receptor is considered to be high. The Whole Project effect will, therefore, be of minor to moderate significance, with an overall conclusion for both IEFs of **minor adverse** significance, which is not significant in EIA terms. This is based on the wide availability of other sandy and gravelly habitats in the Regional Benthic Ecology Study Area, and the low number of ocean quahog individuals lowering the overall significance from moderate to minor.	Overall, the magnitude of the Whole Project impact is deemed to be low and the sensitivity of the receptor is considered to be high. The Whole Project effect will, therefore, be of minor to moderate significance, with an overall conclusion for both IEFs of **minor adverse** significance, which is not significant in EIA terms. This is based on the wide availability of other sandy and gravelly habitats in the Regional Benthic Ecology Study Area, and the low number of ocean quahog individuals lowering the overall significance from moderate to minor.

Table 8.38: Morven North cumulative effects assessment for colonisation of hard structures

	Cumulative effects assessment
	Scenario 4: Morven North and Tier 1, Tier 2 and Tier 3 Projects
O&M phase	
Magnitude of impact	The cumulative effects assessment for Scenario 4 considers Morven North together with the Tier 1, Tier 2 and Tier 3 projects below. Tier 1 Tier 1 includes the following offshore wind farm projects: • Morven South; • Ossian Offshore Wind Farm; • Muir Mhor Offshore Wind Farm; • INTOG: Cenos Offshore Wind Farm - Export Cable Corridor (O&M phase)

	Cumulative effects assessment
	Morven South may install up to 3,074,239m^2 of hard structures as a result of cable protection, scour protection, cable crossings, turbines and OSP foundations. The Ossian Offshore Wind Farm may result in up to 19,270,958m^2 of hard substrate as a result of moorings and anchors, OSP foundations, cable protection, cable crossings, subsea junction boxes and scour protection (Ossian OWFL, 2024). Muir Mhor Offshore Wind Farm may result in up to 5,530,120m^2 of hard substrate as a result of moorings, anchors, junction boxes offshore electrical platform foundations, dynamic cables, cable protection, cable crossings and scour protection (Muir Mhòr Offshore Wind Farm, 2024). Cenos Offshore Wind Farm - Export Cable Corridor may result in up to 349,100m^2 of hard substrate as a result of export cable protection and cable crossings (Cenos Offshore Windfarm Limited, 2024). In total cumulative colonisation of hard structures associated with the Morven North O&M phase and Tier 1 projects is up to 31,363,779m^2 however this represents 0.11% of the Regional Benthic Subtidal Ecology Study Area. The cumulative effect is predicted to be of regional spatial extent, long-term duration, continuous, and low reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore considered to be low adverse. Tier 2 Tier 2 includes the following offshore wind farm project: • Bowdun Offshore Wind Farm Tier 2 includes the following cable projects: • Ossian Offshore Wind Farm Cable; • Eastern Link 3; • Eastern Link 4; • Eastern Link 5; • MHPGC Project. These projects are in their scoping phase so there is limited information regarding their quantitative impact, however the Bowdun Offshore Wind Farm is likely to install a similar magnitude of hard substrate to Morven North (Section 8.11.6). The cable projects are also likely to install hard structures such as cable protection and cable crossings, and the overall magnitude is unlikely to significantly increase due to the introduced hard substrate only representing a small overall increase compared to the Regional Benthic Subtidal Study Area. The cumulative effect is predicted to be of regional spatial extent, long-term duration, continuous, and low reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore considered to be low adverse. Tier 3

	Cumulative effects assessment
	Tier 3 includes the following offshore wind farm project and the following cable project: • INTOG: Flora Offshore Wind Farm (phase unknown); • MBAGC Project. The programme for both the Flora Offshore Wind Farm and MBAGC Project is unknown and therefore there is potential for the projects to install hard substrate and structures within the Morven North O&M phase. It is currently not possible to quantify this impact but it is likely to be of a similar or reduced magnitude compared to Morven North (Section 8.11.6). The cumulative effect of all projects in Scenario 4 is predicted to be of regional spatial extent, long-term duration, continuous, and low reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore considered to be low adverse.
Sensitivity of receptor	The sensitivity of the benthic subtidal ecology IEFs to colonisation of hard structures is as described previously for the O&M phase assessment for the Morven North alone in Paragraphs 8.11.6.7 to 8.11.6.11. The offshore subtidal sands and gravels and the ocean quahog IEFs are deemed to be of high vulnerability, low recoverability, and national to international value. The sensitivities of both receptors was, therefore, considered to be high.
Significance of effect	Tier 1 Overall, the magnitude of the cumulative impact is deemed to be low and the sensitivity of the receptor is considered to be high. The cumulative effect will, therefore, be of minor to moderate significance, with an overall conclusion for both IEFs of **minor adverse** significance, which is not significant in EIA terms. This is based on the wide availability of other sandy and gravelly habitats in the Regional Benthic Ecology Study Area, and the low number of ocean quahog individuals lowering the overall significance from moderate to minor. Tier 2 Overall, the magnitude of the cumulative impact is deemed to be low and the sensitivity of the receptor is considered to be high. The cumulative effect will, therefore, be of minor to moderate significance, with an overall conclusion for both IEFs of **minor adverse** significance, which is not significant in EIA terms. This is based on the wide availability of other sandy and gravelly habitats in the Regional Benthic Ecology Study Area, and the low number of ocean quahog individuals lowering the overall significance from moderate to minor. Tier 3 and all of Scenario 4 Overall, the magnitude of the cumulative impact is deemed to be low and the sensitivity of the receptor is considered to be high. The cumulative effect will, therefore, be of minor to moderate significance, with an overall conclusion for both IEFs of **minor adverse** significance, which is not significant in EIA terms. This is based on the wide availability of other sandy and gravelly habitats in the Regional Benthic Ecology Study Area, and the low number of ocean quahog individuals lowering the overall significance from moderate to minor.

8.13.7 Changes in physical processes

8.13.7.1 There is potential for changes in physical processes as a result of the Morven North O&M activities alongside other offshore wind farms and cables within the Morven North and Morven South Benthic Cumulative Study Area. These activities include the installation of infrastructure causing changes in wave and tidal regimes.

8.13.7.2 Changes in physical processes may occur as a result of Morven North. Additionally, there are five additional offshore wind farm projects and three wind cable agreements which could contribute cumulatively.

8.13.7.3 The summary of the Whole Project assessment for changes in physical processes is presented in Table 8.39, and cumulative effects assessment for changes in physical processes is presented in Table 8.40.

Table 8.39: Morven North Whole Project assessment for changes in physical processes

	Whole Project assessment	
	Scenario 1: Morven North + MHPGC Project	**Scenario 2: Morven North + MBAGC Project**
O&M phase		
Magnitude of impact	The Whole Project assessment for Scenario 1 considers Morven North together with MHPGC Project. The O&M phase of the MHPGC Project may occur simultaneously with the O&M phase of Morven North and involves the presence of cable protection and foundations, and associated repairs and reburials where required. Morven North and the MHPGC Project are in close proximity to each other, however due to the deepwater location of Morven North, the impact of cable protection in this area on wave climate or tidal regime has been shown to be negligible in the physical processes modelling (Volume 3, Annex 7.1: Physical Processes Shared Technical Report, of the EIA Report). Due to the similarly deepwater location of the MHPGC Project, there is not anticipated to be any greater impact than the scenario of Morven North alone (presented in Section 8.11.7) from Morven North cumulatively with MHPGC. The Whole Project impact is predicted to be of local spatial extent, long-term duration, continuous and low reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be low.	The Whole Project assessment for Scenario 2 considers Morven North together with MBAGC Project. The assessment can be considered to be the same as Scenario 1 for this impact and phase, as discussed in the column to the left. The Whole Project impact is predicted to be of local spatial extent, long-term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be low.
Sensitivity of receptor	The sensitivity of the benthic subtidal ecology IEFs to changes in physical processes is as described in Paragraphs 8.11.7.10 to 8.11.7.12. The offshore subtidal sands and gravels IEF was deemed to be of no vulnerability, high recoverability, and national value. The sensitivity of the receptor was therefore considered to be negligible The ocean quahog IEF was deemed to be of medium vulnerability, high recoverability, and international value. The sensitivity of the receptor was therefore considered to be medium.	
Significance of effect	Overall, for the offshore subtidal sands and gravels IEF, the magnitude of the Whole Project impact is deemed to be low and the sensitivity of the receptor is considered to be negligible. The Whole	Overall, for the offshore subtidal sands and gravels IEF, the magnitude of the Whole Project impact is deemed to be low and the sensitivity of the receptor is considered to be negligible. The Whole

	Whole Project assessment	
	Project effect will, therefore, be of negligible to minor adverse significance, with an overall **negligible adverse** significance, due to the large areas of similar unimpacted habitat within the Regional Benthic Subtidal Ecology Study Area, which is not significant in EIA terms. Overall, for the ocean quahog IEF, the magnitude of the Whole Project impact is deemed to be low and the sensitivity of the receptor is considered to be medium. The Morven North and MHPGC Projects effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.	Project effect will, therefore, be of negligible to minor adverse significance, with an overall **negligible adverse** significance due to the large areas of similar unimpacted habitat within the Regional Benthic Subtidal Ecology Study Area, which is not significant in EIA terms. Overall, for the ocean quahog IEF, the magnitude of the Whole Project impact is deemed to be low and the sensitivity of the receptor is considered to be medium. The Morven North and MBAGC Projects effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.

Table 8.40: Morven North cumulative effects assessment for changes in physical processes

	Cumulative effects assessment
	Scenario 4: Morven North and Tier 1, Tier 2 and Tier 3 Projects
O&M phase	
Magnitude of impact	The cumulative effects assessment for Scenario 4 considers Morven North together with the Tier 1, Tier 2 and Tier 3 projects below. Tier 1 Tier 1 includes Ossian Offshore Wind Farm, Morven South, and Seagreen 1 Offshore Wind Project. The O&M phase of Ossian Offshore Wind Farm, Seagreen 1, and Morven South may occur simultaneously with the O&M phase of Morven North and includes the presence of foundations and associated scour protection, cable protection and cable crossings on the seabed. Ossian Offshore Wind Farm is located 9km from the Morven North Boundary directly to the east and southeast, with a greater number of wind turbines (265 floating foundations) compared to Morven North, however, will employ the same minimum wind turbine separation of 1km. It is anticipated that waves from the northeast through to the southeast may induce more widespread reductions in the wave height within the Morven North Boundary, although it can be inferred from the results of the physical processes modelling (Volume 2, Chapter 7: Physical Processes, of the EIA Report) that peak changes in wave height within the Morven North Boundary will not be affected. There is potential to increase the wake within the Firth of Forth Banks Complex MPA from this direction, although the decreases in wave height are expected to be small.

	Cumulative effects assessment
	A similar wake effect may be created due to the presence of the Seagreen 1 foundations, which is located 25km to the west of the Morven North Boundary. Seagreen 1 has 114 wind turbines and is of a smaller scale than Morven North and Morven South in combination. The most critical waves would arise from the west and southwest which have the potential to impact receptors within the Morven North Boundary. Also, drawing on the conclusions from the physical processes modelling of the combined presence of Morven North and Morven South, there would be no evident increase in the change in current speeds when considering Tier 1 Offshore Wind Projects, due to the changes being limited to the locality of the structures. It is also noted that the floating infrastructure of Ossian Offshore Wind Farm would have a lesser tidal regime than fixed infrastructure as the foundations will not occupy the entire water column. Therefore, this impact has been scoped out for Ossian Offshore Wind Farm. The cumulative effect is predicted to be of local spatial extent, long-term duration, continuous and high reversibility. It is predicted that the impact will affect the receptor directly and indirectly. The magnitude is therefore, considered to be low. Tier 2 Tier 2 includes Bowdun Offshore Wind Project, the Ossian OWF Export Cable, and the MHPGC Project. The O&M phase of Bowdun Offshore Wind Project, Ossian OWF Export Cable, and MHPGC Project may occur simultaneously with the O&M phase of Morven North and includes the presence of foundations and associated scour protection, cable protection and cable crossings on the seabed. Bowdun is located 10km to the northwest of the Morven North Boundary and is of a smaller scale (67 wind turbines) than Morven North. The distance from Morven North and the size of the project would not increase the magnitude of the change to tidal regime. Waves from the northwest are the most critical to the combined impact within the Morven North Boundary. The physical processes modelling indicated that peak changes in wave height within the Morven North Boundary will not be affected, although the wave shadow may be more widespread. As inferred from the physical processes modelling, cable protection and crossings associated with the Ossian OWF Export Cable will have a negligible impact on wave climate and tidal regime. The cumulative effect of all projects in Scenario 4 is predicted to be of local spatial extent, long-term duration, continuous and high reversibility. It is predicted that the impact will affect the receptor directly and indirectly. The magnitude is therefore, considered to be low.
Sensitivity of receptor	The sensitivity of the benthic subtidal ecology IEFs to changes in physical processes is as described in Paragraphs 8.11.7.10 to 8.11.7.12. The offshore subtidal sands and gravels IEF was deemed to be of no vulnerability, high recoverability, and national value. The sensitivity of the receptor was therefore considered to be negligible. The ocean quahog IEF was deemed to be of medium vulnerability, high recoverability, and international value. The sensitivity of the receptor was therefore considered to be medium.

	Cumulative effects assessment
Significance of effect	Tier 1 Overall, for the offshore subtidal sands and gravels IEF, the magnitude of the cumulative impact is deemed to be low and the sensitivity of the receptor is considered to be negligible. The cumulative effect will, therefore, be of negligible to minor adverse significance, with an overall **negligible adverse** significance due to the large areas of similar unimpacted habitat within the Regional Benthic Subtidal Ecology Study Area, which is not significant in EIA terms. Overall, for the ocean quahog IEF, the magnitude of the cumulative impact is deemed to be low and the sensitivity of the receptor is considered to be medium. The cumulative effects will, therefore, be of **minor adverse** significance, which is not significant in EIA terms. Tier 2 and all of Scenario 4 Overall, for the offshore subtidal sands and gravels IEF, the magnitude of the cumulative impact is deemed to be low and the sensitivity of the receptor is considered to be negligible. The cumulative effect will, therefore, be of negligible to minor adverse significance, with an overall **negligible adverse** significance due to the large areas of similar unimpacted habitat within the Regional Benthic Subtidal Ecology Study Area, which is not significant in EIA terms. Overall, for the ocean quahog IEF, the magnitude of the cumulative impact is deemed to be low and the sensitivity of the receptor is considered to be negligible. The cumulative effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.

8.13.8 Removal of hard substrates

8.13.8.1 There is potential for the removal of hard substrates as a result of the Morven North decommissioning activities alongside other offshore wind farms and cables within the Regional Benthic Subtidal Study Area.

8.13.8.2 Removal of hard substrate may occur for Morven North. Additionally, there are six offshore wind farm projects and five cable projects which could contribute cumulatively.

8.13.8.3 The summary of the Whole Project assessment for removal of hard substrates is presented in Table 8.41, and cumulative effects assessment for removal of hard substrates is presented in Table 8.42.

Table 8.41: Morven North Whole Project assessment for removal of removal of hard substrates

	Whole Project assessment	
	Scenario 1: Morven North + MHPGC Project	**Scenario 2: Morven North + MBAGC Project**
Decommissioning phase		
Magnitude of impact	The Whole Project assessment for Scenario 1 considers Morven North together with MHPGC Project. The MHPGC Project may contribute to the cumulative effect of hard substrate removal through the removal of artificial structures, such as cable protection. As this project is currently in its scoping stage this impact is not quantified however it is likely to be similar to the impact associated with the inter-array and interconnector cables for Morven North (Section 8.11.8), and this will not significantly increase the magnitude due to the hard substrates being removed only representing a small proportion of the Regional Benthic Subtidal Study Area. The Whole Project impact is predicted to be of local spatial extent, long-term duration, continuous and low reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is, therefore, considered to be low adverse.	The Whole Project assessment for Scenario 2 considers Morven North together with MBAGC Project. The assessment can be considered the same as Scenario 1 for this impact and phase, as discussed in the column to the left. The Whole Project impact is predicted to be of local spatial extent, long-term duration, continuous and low reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is, therefore, considered to be low adverse.
Sensitivity of receptor	The sensitivity of the benthic subtidal ecology IEFs to removal of hard substrate is as described previously for the decommissioning phase assessment for the Morven North alone assessment in Paragraphs 8.11.8.4 to 8.11.8.5. Both the offshore subtidal sands and gravels and ocean quahog IEFs are deemed to be of low vulnerability, high recoverability, and national to international value. The sensitivities of both receptors were, therefore, considered to be low.	

	Whole Project assessment	
Significance of effect	Overall, for both the offshore subtidal sands and gravels and ocean quahog IEFs, the magnitude of the Whole Project impact is deemed to be low and the sensitivity of the receptor is considered to be low. The Whole Project effect will, therefore, be of negligible to minor significance, with an overall conclusion for both IEFs of **minor adverse** significance, which is not significant in EIA terms. This minor adverse conclusion is due to the potential removal of benthic habitats as well as international importance of ocean quahog and classification as a PMF.	Overall, for both the offshore subtidal sands and gravels and ocean quahog IEFs, the magnitude of the Whole Project impact is deemed to be low and the sensitivity of the receptor is considered to be low. The Whole Project effect will, therefore, be of negligible to minor significance, with an overall conclusion for both IEFs of **minor adverse** significance, which is not significant in EIA terms. This minor adverse conclusion is due to the potential removal of benthic habitats as well as international importance of ocean quahog and classification as a PMF.

Table 8.42: Morven North cumulative effects assessment for removal of removal of hard substrates

	Cumulative effects assessment
	Scenario 4: Morven North and Tier 1, Tier 2 and Tier 3 Projects
Decommissioning phase	
Magnitude of impact	The cumulative effects assessment for Scenario 4 considers Morven North together with the Tier 1, Tier 2 and Tier 3 projects below. Tier 1 Tier 1 includes the following offshore wind farm projects: • Morven South; • Ossian Offshore Wind Farm; • Muir Mhor Offshore Wind Farm; • INTOG: Cenos Offshore Wind Farm - Export Cable Corridor (O&M phases). Morven South may remove up to 3,074,239m^2 of hard substrate as a result of cable protection, scour protection, cable crossings, turbines and OSP foundations. The approach for decommissioning however is yet to be determined, the exact programme for decommissioning will be submitted to MD-LOT for consultation and approval by the Scottish Ministers. The Ossian Offshore Wind Farm may result in the removal up to 19,270,958m^2 of hard substrate including moorings and anchors, OSP foundations, cable protection, cable crossings, subsea junction boxes and scour protection (Ossian OWFL, 2024). The decommissioning strategy is not yet defined, and cable protection, cable crossing protection, and scour protection may potentially be left in situ. Anchors will also be removed or cut on or at the seabed and left in situ, however, are considered unlikely to contribute to this impact as they will be a significant depth below the seabed (Ossian OWFL, 2024). Muir Mhor Offshore Wind Farm may result in the removal of up to 5,530,120m^2 of hard substrate including moorings, anchors, junction boxes offshore electrical platform foundations, dynamic cables, cable protection, cable crossings and scour protection (Muir Mhòr Offshore Wind Farm, 2024). The Maximum Design Scenario assumes complete removal of all infrastructure, including cables and cable protection where it is possible and appropriate to do so. If any infrastructure is left in situ this will result in a reduced area of hard substrate being removed during decommissioning (Muir Mhòr Offshore Wind Farm, 2024). Cenos Offshore Wind Farm - Export Cable Corridor does not assess this impact however it is likely that its decommissioning may result in the removal of up to 349,100m^2 of hard substrate including export cable protection and cable crossings (Cenos Offshore Windfarm Limited, 2024). In total cumulative removal of hard substrate associated with the Morven North decommissioning phase and Tier 1 projects is up to 31,363,779m^2 however this represents only 0.11% of the Regional Benthic Subtidal Ecology Study Area.

	Cumulative effects assessment
	The cumulative effect is predicted to be of regional spatial extent, long-term duration, continuous and low reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be low adverse. Tier 2 Tier 2 includes the following offshore wind farm project: • Bowdun Offshore Wind Farm; Tier 2 includes the following cable projects: • Ossian Offshore Wind Farm Cable; • Eastern Link 3; • Eastern Link 4; • Eastern Link 5. These projects are in their scoping phase so there is limited information regarding their quantitative impact however Bowdun Offshore Wind Farm is likely to remove infrastructure at a similar magnitude to Morven North (Section 8.11.8). The cable projects are also likely to remove hard substrate such as cable protection and cable crossings, and this will not significantly increase the magnitude due to the hard substrates being removed only representing a small proportion of the Regional Benthic Subtidal Study Area. The cumulative effect is predicted to be of regional spatial extent, long-term duration, continuous and low reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be low adverse. Tier 3 Tier 3 includes the following offshore wind farm project and the following cable project: • INTOG: Flora Offshore Wind Farm (phase unknown); • MBAGC Project. The programme for both the Flora Offshore Wind Farm and MBAGC Project is unknown and therefore there is potential for the projects to remove hard substrate within the Morven North decommissioning phase. It is currently not possible to quantify this impact but it is likely to be of a similar or reduced magnitude compared to Morven North (Section 8.11.8). The cumulative effect of all projects in Scenario 4 is predicted to be of regional spatial extent, long-term duration, continuous and low reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is, therefore, considered to be low adverse.
Sensitivity of receptor	The sensitivity of the benthic subtidal ecology IEFs to removal of hard substrate is as described previously for the decommissioning phase assessment for the Morven North alone assessment in Paragraphs 8.11.8.4 to 8.11.8.5. Both the offshore subtidal sands and gravels and ocean quahog IEFs are deemed to be of low vulnerability, high recoverability, and national to international value. The sensitivities of both receptors were therefore considered to be low.

	Cumulative effects assessment
Significance of effect	Tier 1 For both the offshore subtidal sands and gravels and ocean quahog IEFs, the cumulative magnitude of the cumulative impact and cumulative impact is deemed to be low and the sensitivity of the receptors was, deemed to be low. The effect will, therefore, be of negligible to minor significance, with an overall conclusion for both IEFs of **minor adverse** significance, which is not significant in EIA terms. This minor adverse conclusion is due to the potential removal of benthic habitats as well as international importance of ocean quahog and classification as a PMF. Tier 2 For both the offshore subtidal sands and gravels and ocean quahog IEFs, the cumulative magnitude of the cumulative impact and cumulative impact is deemed to be low and the sensitivity of the receptors was deemed to be low. The effect will, therefore, be of negligible to minor significance, with an overall conclusion for both IEFs of **minor adverse** significance, which is not significant in EIA terms. This minor adverse conclusion is due to the potential removal of benthic habitats as well as international importance of ocean quahog and classification as a PMF. Tier 3 and all of Scenario 4 For both the offshore subtidal sands and gravels and ocean quahog IEFs, the cumulative magnitude of the cumulative impact and cumulative impact is deemed to be low and the sensitivity of the receptors was deemed to be low. The effect will, therefore, be of negligible to minor significance, with an overall conclusion for both IEFs of **minor adverse** significance, which is not significant in EIA terms. This minor adverse conclusion is due to the potential removal of benthic habitats as well as international importance of ocean quahog and classification as a PMF.

8.13.9 Impacts to benthic invertebrates due to electromagnetic fields

8.13.9.1 There may be impacts to benthic invertebrates due to EMF as a result of the Morven North O&M activities alongside other offshore wind farms and cables within the Regional Benthic Subtidal Study Area. Impacts to benthic invertebrates due to EMF may arise due to the presence and operation of active electrical cables.

8.13.9.2 Impacts to benthic invertebrates due to EMF may occur as a result of Morven North. Additionally, there are six offshore wind farm projects and five cable projects which could contribute cumulatively.

8.13.9.3 The summary of the Whole Project assessment for impacts to benthic invertebrates due to EMF is presented in Table 8.43, and cumulative effects assessment for impacts to benthic invertebrates due to EMF is presented in Table 8.44.

Table 8.43: Morven North Whole Project assessment for impacts to benthic invertebrates due to Electromagnetic Fields

	Whole Project assessment	
	Scenario 1: Morven North + MHPGC Project	**Scenario 2: Morven North + MBAGC Project**
O&M phase		
Magnitude of impact	The Whole Project assessment for Scenario 1 considers Morven North together with MHPGC Project. The O&M phase of the MHPGC Project may occur simultaneously with the OM phase of Morven North. The MHPGC Project may contribute to the impacts to benthic invertebrates due to EMF through the operation of electrical cables. As this project is currently in its scoping stage this impact is not quantified however it is likely to be similar to the impact associated with the inter-array and interconnector cables for Morven North, although the length of the cable may be greater than Morven North (Section 8.11.9). The magnitude is however unlikely to significantly increase due to the rapid attenuation of EMFs to background levels within a few metres of the cable source. The Whole Project impact is predicted to be of local spatial extent, long-term duration, continuous and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be low adverse.	The Whole Project assessment for Scenario 2 considers Morven North together with MBAGC Project. The assessment can be considered the same as Scenario 1 for this impact and phase, as discussed in the column to the left. The Whole Project impact is predicted to be of local spatial extent, long-term duration, continuous and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be low.
Sensitivity of receptor	The sensitivity of the benthic subtidal ecology IEFs to impacts to benthic invertebrates due to EMF is as described previously for the O&M phase assessment for Morven North alone in Paragraphs 8.11.9.10 to 8.11.9.13.	

	Whole Project assessment	
	The offshore subtidal sands and gravels and the ocean quahog IEFs are deemed to be of medium vulnerability, medium recoverability, and national to international value. The sensitivities of both receptors was, therefore, considered to be medium.	
Significance of effect	Overall, for the offshore subtidal sands and gravels and ocean quahog IEFs, the magnitude of the Whole Project impact is deemed to be low and the sensitivity of the receptor is considered to be medium. The Whole Project effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.	Overall, for the offshore subtidal sands and gravels and ocean quahog IEFs, the magnitude of the Whole Project impact is deemed to be low and the sensitivity of the receptor is considered to be medium. The Whole Project effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.

Table 8.44: Morven North cumulative effects assessment for impacts to benthic invertebrates due to Electromagnetic Fields

	Cumulative effects assessment
	Scenario 4: Morven North and Tier 1, Tier 2 and Tier 3 Projects
O&M phase	
Magnitude of impact	The cumulative effects assessment for Scenario 4 considers Morven North together with the Tier 1, Tier 2 and Tier 3 projects below. Tier 1 Tier 1 includes the following offshore wind farm projects: • Morven South; • Ossian Offshore Wind Farm; • Muir Mhor Offshore Wind Farm; • INTOG: Cenos Offshore Wind Farm - Export Cable Corridor (O&M phase). Morven South may install up to 420km of inter-array cables and up to 264 of interconnector cables which will be operational for up to 35 years.

	Cumulative effects assessment
	The Ossian Offshore Wind Farm may result in up to 1,261km of 66kV inter-array cables, with up to 116km within the water column (i.e. 'dynamic cables') and the rest buried at a minimum target depth of 0.4m (Ossian OWFL, 2024). There will also be up to 236km of interconnector cables buried to a minimum target depth of 0.4m (Ossian OWFL, 2024). Muir Mhor Offshore Wind Farm may result in up to 250km of up to 132kV inter-array cables, up to 3km of up to 275kV export cables and up to 270km of up to 275kV export cables buried at a minimum cable burial depth of 1m (Muir Mhòr Offshore Wind Farm, 2024). Cenos Offshore Wind Farm - Export Cable Corridor may result in up to 359km of up to 132kV inter-array cables (280km of static cable and 70km of dynamic cables), up to 230km of up to 525kV export cables at a minimum cable burial depth of 0.4m (Cenos Offshore Windfarm Limited, 2024). In total the cumulative length of operational electrical cables associated with the Morven North O&M phase and Tier 1 projects may be up to 4,737km however these cables will have a very localised impact and are spread widely across the Regional Benthic Subtidal Ecology Study Area. The cumulative effect is predicted to be of regional spatial extent, long-term duration, continuous, and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore considered to be low adverse. Tier 2 Tier 2 includes the following offshore wind farm project: • Bowdun Offshore Wind Farm; Tier 2 includes the following cable projects: • Ossian Offshore Wind Farm Cable; • Eastern Link 3; • Eastern Link 4; • Eastern Link 5; • MHPGC Project. These projects are in their scoping phase so there is limited information regarding their quantitative impact however Bowdun Offshore Wind Farm is likely to install a similar if not greater length of cable to Morven Noth (Section 8.11.9). The cable protections are also likely to have a similar level of impact however it is currently not possible to quantify the length of cable that will be installed. The magnitude is however unlikely to significantly increase due to the rapid attenuation of EMFs to background levels within a few metres of the cable source. The cumulative effect is predicted to be of regional spatial extent, long-term duration, continuous, and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore considered to be low adverse. Tier 3

	Cumulative effects assessment
	Tier 3 includes the following offshore wind farm project and the following cable project: • INTOG: Flora Offshore Wind Farm (phase unknown); • MBAGC Project. There is little information available regarding either the Flora Offshore Wind Farm or MBAGC Project and therefore the length of electrical cable installed is not known, however, it is likely to be of a similar or greater magnitude compared to Morven North (Section 8.11.9). The cumulative effect of all projects in Scenario 4 impact is predicted to be of regional spatial extent, long-term duration, continuous, and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore considered to be low adverse.
Sensitivity of receptor	The sensitivity of the benthic subtidal ecology IEFs to impacts to benthic invertebrates due to EMF is as described previously for the O&M phase assessment for Morven North alone in Paragraphs 8.11.9.10 to 8.11.9.13. The offshore subtidal sands and gravels and the ocean quahog IEFs are deemed to be of medium vulnerability, medium recoverability, and national to international value. The sensitivities of both receptors was, therefore, considered to be medium.
Significance of effect	Overall, for the offshore subtidal sands and gravels and ocean quahog IEFs, the magnitude of the cumulative impact is deemed to be low and the sensitivity of the receptor is considered to be medium. The cumulative effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.

8.13.10 Proposed monitoring

8.13.10.1 Site-specific monitoring is not proposed because the assessment concluded that Morven North would not give rise to significant effects on benthic subtidal ecology, either alone or when considered cumulatively with other plans, projects, or activities. The Applicant will, however, continue to liaise with MD-LOT, NatureScot, and other key stakeholders to help identify opportunities for proportionate, evidence-led regional or strategic monitoring that can improve the understanding of the environmental implications of offshore wind, particularly where recognized evidence gaps exist. This may include contributing to, or participating in, relevant ongoing initiatives under the ScotMER programme (Scottish Government, 2024).

8.14 Transboundary effects

8.14.1.1 A screening of transboundary impacts has been carried out (see Volume 3, Annex 6.2: Transboundary Effects Screening). This has identified that no likely significant transboundary effects with regard to benthic subtidal ecology would result from Morven North upon the interests of other European Economic Area (EEA) States. This scoping out of transboundary effects overall was agreed with MD-LOT (Section 8.4).

8.15 Inter-related effects

8.15.1.1 Inter-relationships are considered to be the impacts and associated effects of different aspects of Morven North on the same receptor. Inter-related effects are considered to be either:

- Lifetime effects: Assessment of the scope for effects that occur throughout more than one phase of Morven North (construction, O&M and decommissioning), to interact to potentially create a more significant effect on a receptor than if just assessed in isolation in these three project stages (e.g. subsea noise effects from piling, operational turbines, vessels and decommissioning); or
- Receptor-led effects: Assessment of the scope for all effects to interact, spatially and temporally, to create inter-related effects on a receptor. As an example, all effects on benthic subtidal ecology, such as direct habitat loss or disturbance or increased concentrations of suspended sediments may interact to produce a different, or greater effect on this receptor than when the effects are considered in isolation. Receptor-led effects may be short-term, temporary or transient effects, or incorporate longer-term effects.

8.15.1.2 A description of the likely inter-related effects arising from Morven North on benthic subtidal ecology is provided in Volume 2, Chapter 21: Inter-related and Ecosystem Effects.

8.15.1.3 For benthic subtidal ecology, the following potential impacts have been considered within the inter-related effects assessment:

- Temporary habitat loss/disturbance;
- Increased SSCs and associated deposition;
- Long-term habitat loss;
- Increased risk of introduction and spread of INNS;
- Colonisation of hard structures;
- Changes in physical processes;
- Removal of hard substrate;
- Impacts to benthic invertebrates due to EMF.

8.15.1.4 Table 8.45 lists the inter-related effects (Morven North lifetime effects) that are predicted to arise during the construction, O&M and decommissioning of Morven North and the inter-related effects (receptor-led effects) that are predicted to arise for benthic subtidal ecology receptors.

8.15.1.5 Effects on benthic subtidal ecology also have the potential to have secondary effects on other receptors and these effects are fully considered in the respective topic-specific chapters. These receptors and effects are:

- Fish and shellfish ecology:
  - Temporary habitat loss and disturbance;
  - Long-term habitat loss;
  - Colonisation of hard structures and associated fish aggregation;
- Marine mammals:
  - Effects on marine mammals due to changes in prey availability
- Offshore Ornithology:
  - Changes in prey availability.

Table 8.45: Summary of likely significant inter-related effects on the environment from individual effects occurring across the construction, Operation and Maintenance and decommissioning phases of Morven North (project lifetime effects) and from multiple effects interacting across all phases (receptor-led effects)

C= Construction, O= Operations and Maintenance, D= Decommissioning phases

Description of impact	Phase			Inter-related effect	Significance
	C	O	D		
Morven North lifetime effects					
Temporary habitat loss/disturbance	✓	✓	✓	The total area of habitat potentially affected, when disturbance and loss are considered additively across all phases is greater than for each individual phase (e.g., just the construction phase). However, temporary habitat loss/disturbance arising during each phase of Morven North will be highly localised to the vicinity of the activities being undertaken (i.e., limited to the immediate footprints) during each phase (i.e., construction, operation and maintenance, and decommissioning). Individual activities (e.g., cable installation and repairs, and sandwave clearance) will each cause temporary habitat loss/disturbance intermittently with only a small proportion of the total area of habitat being impacted at any one time. The sandy sediment habitats present within the Morven North Benthic Subtidal Ecology Study Area are typical of, and widespread throughout, the northern North Sea. All sediments and associated benthic communities are predicted to recover. Whilst there is the potential for repeat disturbance to occur during the operation and maintenance phase to habitats previously disturbed during the construction phase (e.g. during cable repair and reburial events), it is predicted that the benthic communities will have fully recovered from construction impacts by this time. Across the project lifetime, the effects on benthic ecology receptors were not anticipated to interact in such a way as	Effects are anticipated to interact in such a way as to result in combined effects of minor to moderate adverse significance across all phases (i.e. not of greater significance than the assessments presented for each individual phase), with an overall minor adverse significance, which is not significant in EIA terms. This is due to only a small proportion of the total area for any IEFs or habitats being impacted at any one time.

Description of impact	Phase			Inter-related effect	Significance
	C	O	D		
				to result in combined effects of greater significance than the assessments presented for each individual phase.	
Increased SSCs and associated deposition	✓	✓	✓	Activities with the potential to result in the greatest level of seabed disturbance and, therefore, highest increases in SSCs/deposition, will occur during the construction and decommissioning phases. Any effects on benthic communities during this time will be intermittent, temporary and short-term. The benthic subtidal ecology IEFs potentially affected by increased SSCs and deposition are predicted to have recovered in the intervening period between phases (i.e., prior to any localised increases in SSCs during maintenance activities in the operation and maintenance phase). Across the project lifetime, the effects on benthic subtidal ecology receptors were not anticipated to interact in such a way as to result in combined effects of greater significance than the assessments presented for each individual phase.	Effects are anticipated to interact in such a way as to result in combined effects of minor adverse significance across all phases (i.e. not of greater significance than the assessments presented for each individual phase), which is not significant in EIA terms.
Long-term habitat loss	✓	✓	✓	This impact will occur throughout the construction, O&M and decommissioning phases of Morven North. The communities that develop on the introduced hard structures will likely differ from the surrounding sedimentary biotopes but may be typical of areas of coarse and stony substrate in the area. Also, the amount of the hard infrastructure is expected to be consistent between the construction and O&M phases, with repair and replacement events not significantly increasing the overall magnitude of the long-term habitat loss, and this will provide long-term stability to any communities which form, and be unlikely to impact the IEFs significantly. There is potential for some infrastructure to remain *in situ* following decommissioning, but this will only represent a very small	Effects are anticipated to interact in such a way as to result in combined effects of minor to moderate adverse significance across all phases (i.e. not of greater significance than the assessments presented for each individual phase), with an overall minor adverse significance, which is not significant in EIA terms. This is due to the low overall area of sedimentary habitat which will be replaced by hard substrates compared to similar habitats present nearby.

Description of impact	Phase			Inter-related effect	Significance
	C	O	D		
				proportion of the habitats that the IEFs rely upon and therefore will not represent a significant impact. Across the lifetime of Morven North, the effects on benthic subtidal ecology receptors were not anticipated to interact in such a way as to result in combined effects of greater significance than the assessments presented for each individual phase.	
Increased risk of introduction and spread of INNS	✓	✓	✓	Although the presence and movement of construction, maintenance or decommissioning vessels in the area may facilitate the introduction and spread of INNS across all phases of Morven North, this effect will predominantly arise during the O&M phase, if an effect does occur. This is because, the presence of the hard structures associated with wind turbines and OSP foundations, scour protection, cable protection and cable crossings will be present in the O&M phase which may provide INNS with the necessary structures on which to settle. However, the measures adopted as part of Morven North include a commitment to produce an Offshore EMP (MM-5) with provisions for management of INNS to be set out in an INNSMP. This will ensure that the risk of potential introduction and spread of INNS will be reduced across all phases. As a result, any additional inter-related project lifetime effect is judged to be of minor to moderate adverse significance. Across the lifetime of Morven North, the effects on benthic subtidal ecology receptors were not anticipated to interact in such a way as to result in combined effects of greater significance than the assessments presented for each individual phase.	Effects are anticipated to interact in such a way as to result in combined effects of minor to moderate adverse significance across all phases (i.e. not of greater significance than the assessments presented for each individual phase), with an overall minor adverse significance, which is not significant in EIA terms. This is due to the low number of vessels which will be on site at any one time during any phase.
Receptor led effects					
There is the potential for spatial and temporal interactions between the effects arising from temporary habitat loss/disturbance, increased SSC and associated sediment deposition, long-term habitat loss, colonisation of hard structures, and impacts to benthic invertebrates due to EMF during the lifetime					

Description of impact	Phase			Inter-related effect	Significance
	C	O	D		
of Morven North. Any effects due to changes in the physical processes and removal of hard substrate are likely to be limited, both in extent and also in magnitude, with many benthic subtidal ecology receptors having low sensitivity or high recoverability to the scale of the changes predicted. Based on current understanding, and expert knowledge (as presented in Section 8.11), the greatest potential for inter-related impacts is predicted to arise through the interaction of direct (both temporary and long-term) habitat loss/disturbance from sandwave clearance and cable installation, and indirect habitat disturbance due to sediment deposition due mainly to the installation and also the presence of Morven North infrastructure. These individual impacts were assigned a significance of minor adverse as individual impacts and, although potential combined impacts may arise (i.e., spatial and temporal overlap of habitat disturbance), it is not predicted that this will result in effects of more significance than the individual impacts in isolation. This is because the combined extent of habitat potentially affected would be typically restricted to the Morven North Boundary, the habitats affected are widespread across the northern North Sea and, where temporary disturbance occurs, full recovery of the benthos is predicted. Across the lifetime of Morven North, the additive effects on benthic subtidal ecology receptors is not anticipated to interact in such a way as to result in combined effects of greater significance than the assessments presented for each individual phase and impact, or when considered in conjunction with other topics addressed in the EIA Report.					

8.16 Summary of impacts, mitigation, likely significant effects and monitoring

8.16.1.1 Information on benthic subtidal ecology within the Morven North Benthic Subtidal Ecology Study Area was collected through desktop review and site-specific surveys.

8.16.1.2 Table 8.46 presents a summary of the potential impacts, mitigation measures and the conclusion of likely significant effects on benthic subtidal ecology in EIA terms. The impacts assessed are:

- temporary habitat loss/disturbance;
- increases in SSCs and associated deposition;
- long-term habitat loss;
- increased risk of introduction and spread of INNS;
- colonisation of hard structures;
- changes in physical process;
- removal of hard substrate;
- impacts to benthic invertebrates due to EMF.

8.16.1.3 Overall, it is concluded that there will be no likely significant effects on benthic receptors arising from Morven North during the construction, O&M or decommissioning phases. Table 8.47 presents a summary of the potential cumulative impacts, mitigation measures and the conclusion of likely significant cumulative effects on benthic subtidal ecology in EIA terms. The impacts assessed are:

- temporary habitat loss/disturbance;
- increases in SSCs and associated deposition;
- long-term habitat loss;
- increased risk of introduction and spread of INNS;
- colonisation of hard structures;
- changes in physical process;
- removal of hard substrate;
- impacts to benthic invertebrates due to EMF.

8.16.1.4 Overall, it is concluded that there will be no likely significant cumulative effects on benthic receptors from Morven North cumulatively with other projects/plans.

8.16.1.5 No likely significant transboundary effects have been identified in regard to effects of Morven North.

Table 8.46: Summary of Likely Significant Effects, mitigation and monitoring

C= Construction, O= Operations and Maintenance, D= Decommissioning phases

Description of impact	Phase			Designed-in measures	Magnitude of impact	Sensitivity of receptor	Significance of effect	Additional mitigation measures	Significance of residual effect	Proposed monitoring
	C	O	D							
Temporary habitat disturbance/loss	✓	✓	✓	MM-1 MM-2 MM-32	C Low O Low D Low	Offshore subtidal sands and gravels IEF Medium Ocean Quahog IEF High	C Offshore subtidal sands and gravels IEF: Minor adverse Ocean Quahog IEF: Minor adverse O Offshore subtidal sands and gravels IEF: Minor adverse Ocean Quahog IEF: Minor adverse D Offshore subtidal sands and gravels IEF: Minor adverse Ocean Quahog IEF: Minor adverse	None proposed beyond existing commitments	Minor adverse	None
Increased SSCs and associated deposition	✓	✓	✓	MM-1 MM-2 MM-32	C Low O	Offshore subtidal	C Offshore subtidal sands	None proposed beyond	Minor adverse	None

Description of impact	Phase			Designed-in measures	Magnitude of impact	Sensitivity of receptor	Significance of effect	Additional mitigation measures	Significance of residual effect	Proposed monitoring
	C	O	D							
					Negligible D Negligible	sands and gravels IEF Medium Ocean Quahog IEF Negligible	and gravels IEF: Minor adverse Ocean Quahog IEF: Minor adverse O Offshore subtidal sands and gravels IEF: Minor adverse Ocean Quahog IEF: Negligible adverse D Offshore subtidal sands and gravels IEF: Minor adverse Ocean Quahog IEF: Negligible adverse	existing commitments		
Long-term habitat loss	✓	✓	✓	MM-1 MM-2 MM-32	C and O Low D Low	Offshore subtidal sands and gravels IEF High Ocean Quahog IEF High	C and O Offshore subtidal sands and gravels IEF: Minor adverse Ocean Quahog IEF: Minor adverse	None proposed beyond existing commitments	Minor adverse	None

Description of impact	Phase			Designed-in measures	Magnitude of impact	Sensitivity of receptor	Significance of effect	Additional mitigation measures	Significance of residual effect	Proposed monitoring
	C	O	D							
							D Offshore subtidal sands and gravels IEF: Minor adverse Ocean Quahog IEF: Minor adverse			
Increased risk of introduction and spread of INNS	✓	✓	✓	MM-5 MM-6 MM-32	C, O and D Low	Offshore subtidal sands and gravels IEF High Ocean Quahog IEF High	C, O and D Offshore subtidal sands and gravels IEF: Minor adverse Ocean Quahog IEF: Minor adverse	None proposed beyond existing commitments	Minor adverse	None
Colonisation of hard structures	×	✓	×	MM-1 MM-2 MM-32	O Low	Offshore subtidal sands and gravels IEF High Ocean Quahog IEF High	O Offshore subtidal sands and gravels IEF: Minor adverse Ocean Quahog IEF: Minor adverse	None proposed beyond existing commitments	Minor adverse	None
Changes in physical processes	×	✓	×	MM-1 MM-2 MM-32	O Low	Offshore subtidal sands and gravels IEF Negligible	Offshore subtidal sands and gravels IEF Negligible adverse	None proposed beyond existing commitments	Negligible to Minor adverse	None

Description of impact	Phase			Designed-in measures	Magnitude of impact	Sensitivity of receptor	Significance of effect	Additional mitigation measures	Significance of residual effect	Proposed monitoring
	C	O	D							
						Ocean Quahog IEF Medium	Ocean Quahog IEF Minor adverse			
Removal of hard substrates	×	×	✓	N/A	D Low	Offshore subtidal sands and gravels IEF Low Ocean Quahog IEF Low	D Offshore subtidal sands and gravels IEF: Minor adverse Ocean Quahog IEF: Minor adverse	None proposed beyond existing commitments	Minor adverse	None
Impacts to benthic invertebrates due to EMF	×	✓	×	MM-2 MM-32	O Low	Offshore subtidal sands and gravels IEF Medium Ocean Quahog IEF Medium	O Offshore subtidal sands and gravels IEF: Minor adverse Ocean Quahog IEF: Minor adverse	None proposed beyond existing commitments	Minor adverse	None

Table 8.47: Summary of likely significant cumulative environment effects, mitigation and monitoring

C= Construction, O= Operations and Maintenance, D= Decommissioning phases

Description of impact	Phase			Designed-in measures	Magnitude of impact	Sensitivity of receptor	Significance of effect	Additional measures	Significance of residual effect	Proposed monitoring
	C	O	D							
Scenarios 1 – 2 (Morven North + MHPGC Project and Morven North + MBAGC Project)										
Temporary habitat disturbance/loss	✓	✓	✓	MM-1 MM-2 MM-32	C Low O Low D Low	Offshore subtidal sands and gravels IEF Medium Ocean Quahog IEF High	C Offshore subtidal sands and gravels IEF: Minor adverse Ocean Quahog IEF: Minor adverse O Offshore subtidal sands and gravels IEF: Minor adverse Ocean Quahog IEF: Minor adverse D Offshore subtidal sands and gravels IEF: Minor adverse Ocean Quahog IEF: Minor adverse	None proposed beyond existing commitments.	Minor adverse	None

Description of impact	Phase			Designed-in measures	Magnitude of impact	Sensitivity of receptor	Significance of effect	Additional measures	Significance of residual effect	Proposed monitoring
	C	O	D							
Increased SSCs and associated deposition	✓	✓	✓	MM-1 MM-2 MM-32	C Low O Low D Low	Offshore subtidal sands and gravels IEF Medium Ocean Quahog IEF Negligible	C Offshore subtidal sands and gravels IEF: Minor adverse Ocean Quahog IEF: Minor adverse O Offshore subtidal sands and gravels IEF: Minor adverse Ocean Quahog IEF: Minor adverse D Offshore subtidal sands and gravels IEF: Minor adverse Ocean Quahog IEF: Minor adverse	None proposed beyond existing commitments.	Minor adverse	None
Long-term habitat loss	✓	✓	✓	MM-1 MM-2 MM-32	C and O Low D Low	Offshore subtidal sands and gravels IEF High Ocean Quahog IEF	C and O Offshore subtidal sands and gravels IEF: Minor adverse	None proposed beyond existing commitments.	Minor adverse	None

Description of impact	Phase			Designed-in measures	Magnitude of impact	Sensitivity of receptor	Significance of effect	Additional measures	Significance of residual effect	Proposed monitoring
	C	O	D							
						High	Ocean Quahog IEF: Minor adverse D Offshore subtidal sands and gravels IEF: Minor adverse Ocean Quahog IEF: Minor adverse			
Increased risk of introduction and spread of INNS	✓	✓	✓	MM-5 MM-6 MM-32	C, O and D Low	Offshore subtidal sands and gravels IEF High Ocean Quahog IEF High	C, O and D Offshore subtidal sands and gravels IEF: Minor adverse Ocean Quahog IEF: Minor adverse	None proposed beyond existing commitments.	Minor adverse	None
Colonisation of hard structures	×	✓	×	MM-1 MM-2 MM-32	O Low	Offshore subtidal sands and gravels IEF High Ocean Quahog IEF High	O Offshore subtidal sands and gravels IEF: Minor adverse Ocean Quahog IEF: Minor adverse	None proposed beyond existing commitments.	Minor adverse	None
Changes in physical processes	×	✓	×	MM-1 MM-2	O Low	Offshore subtidal sands and gravels IEF	O Offshore subtidal sands	None proposed beyond	Minor adverse	None

Description of impact	Phase			Designed-in measures	Magnitude of impact	Sensitivity of receptor	Significance of effect	Additional measures	Significance of residual effect	Proposed monitoring
	C	O	D							
				MM-32		Negligible Ocean Quahog IEF Medium	and gravels IEF: Negligible adverse Ocean Quahog IEF: Minor adverse	existing commitments.		
Removal of hard substrates	×	×	✓	N/A	D Low	Offshore subtidal sands and gravels IEF Low Ocean Quahog IEF Low	D Offshore subtidal sands and gravels IEF: Minor adverse Ocean Quahog IEF: Minor adverse	None proposed beyond existing commitments.	Minor adverse	None
Impacts to benthic invertebrates due to EMF	×	✓	×	MM-2 MM-32	O Low	Offshore subtidal sands and gravels IEF Medium Ocean Quahog IEF Medium	O Offshore subtidal sands and gravels IEF: Minor adverse Ocean Quahog IEF: Minor adverse	None proposed beyond existing commitments.	Minor adverse	None
Scenario 4 (Morven North and Tier 1, Tier 2 and Tier 3 Projects)										
Temporary habitat disturbance/loss	✓	✓	✓	MM-1 MM-2 MM-32	C Low O Low D Low	Offshore subtidal sands and gravels IEF Medium Ocean Quahog IEF	C Offshore subtidal sands and gravels IEF: Minor adverse	None proposed beyond existing commitments.	Minor adverse	None

Description of impact	Phase			Designed-in measures	Magnitude of impact	Sensitivity of receptor	Significance of effect	Additional measures	Significance of residual effect	Proposed monitoring
	C	O	D							
						High	Ocean Quahog IEF: Minor adverse O Offshore subtidal sands and gravels IEF: Minor adverse Ocean Quahog IEF: Minor adverse D Offshore subtidal sands and gravels IEF: Minor adverse Ocean Quahog IEF: Minor adverse			
Increased SSCs and associated deposition	✓	✓	✓	MM-1 MM-2 MM-32	C Low O Low D Low	Offshore subtidal sands and gravels IEF Medium Ocean Quahog IEF Negligible	C Offshore subtidal sands and gravels IEF: Minor adverse Ocean Quahog IEF: Minor adverse O Offshore subtidal sands	None proposed beyond existing commitments.	Minor adverse	None

Description of impact	Phase			Designed-in measures	Magnitude of impact	Sensitivity of receptor	Significance of effect	Additional measures	Significance of residual effect	Proposed monitoring
	C	O	D				and gravels IEF: Minor adverse Ocean Quahog IEF: Minor adverse D Offshore subtidal sands and gravels IEF: Minor adverse Ocean Quahog IEF: Minor adverse			
Long-term habitat loss	✓	✓	✓	MM-1 MM-2 MM-32	C and O Low D Low	Offshore subtidal sands and gravels IEF High Ocean Quahog IEF High	C and O Offshore subtidal sands and gravels IEF: Minor adverse Ocean Quahog IEF: Minor adverse D Offshore subtidal sands and gravels IEF: Minor adverse Ocean Quahog IEF: Minor adverse	None proposed beyond existing commitments.	Minor adverse	None

Description of impact	Phase			Designed-in measures	Magnitude of impact	Sensitivity of receptor	Significance of effect	Additional measures	Significance of residual effect	Proposed monitoring
	C	O	D							
Increased risk of introduction and spread of INNS	✓	✓	✓	MM-5 MM-6 MM-32	C, O and D Low	Offshore subtidal sands and gravels IEF High Ocean Quahog IEF High	C, O and D Offshore subtidal sands and gravels IEF: Minor adverse Ocean Quahog IEF: Minor adverse	None proposed beyond existing commitments.	Minor adverse	None
Colonisation of hard structures	×	✓	×	MM-1 MM-2 MM-32	O Low	Offshore subtidal sands and gravels IEF High Ocean Quahog IEF High	O Offshore subtidal sands and gravels IEF: Minor adverse Ocean Quahog IEF: Minor adverse	None proposed beyond existing commitments.	Minor adverse	None
Changes in physical processes	×	✓	×	MM-1 MM-2 MM-32	O Low	Offshore subtidal sands and gravels IEF Negligible Ocean Quahog IEF Medium	O Offshore subtidal sands and gravels IEF Negligible adverse Ocean Quahog IEF Minor adverse	None proposed beyond existing commitments.	Negligible to minor adverse	None
Removal of hard substrates	×	×	✓	N/A	D Low	Offshore subtidal sands and gravels IEF Low	D Offshore subtidal sands	None proposed beyond	Minor adverse	None

Description of impact	Phase			Designed-in measures	Magnitude of impact	Sensitivity of receptor	Significance of effect	Additional measures	Significance of residual effect	Proposed monitoring
	C	O	D							
						Ocean Quahog IEF Low	and gravels IEF: Minor adverse Ocean Quahog IEF: Minor adverse	existing commitments.		
Impacts to benthic invertebrates due to EMF	×	✓	×	MM-2 MM-32	O Low	Offshore subtidal sands and gravels IEF Medium Ocean Quahog IEF Medium	O Offshore subtidal sands and gravels IEF: Minor adverse Ocean Quahog IEF: Minor adverse	None proposed beyond existing commitments.	Minor adverse	None

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