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Morlais Project

Document MOR/RHDHV/DOC/0067: Information to Support Habitats Regulations Assessment

Applicant: Menter Môn Morlais Limited

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Author: Royal HaskoningDHV and MarineSpace

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GLOSSARY OF ABBREVIATIONS

AA	Appropriate Assessment
ADDs	Acoustic Deterrent Devices
CIA	Cumulative Impact Assessment
CIS	Celtic and Irish Sea
cSAC	candidate Special Area of Conservation
EMF	Electromagnetic Fields
EPS	European Protected Species
ES	Environmental Statement
EU	European Union
GBS	Gravity Base Structure
HRA	Habitat Regulations Assessment
IAMMWG	Inter-Agency Marine Mammal Working Group
IMARES	Institute for Marine Resources and Ecosystem Studies
IoACC	Isle of Anglesey County Council
JCP	Joint Cetacean Protocol
JNCC	Joint Nature Conservation Committee
kg	Kilogram
km	Kilometre
km2	Kilometre squared
LSE	Likely Significant Effect
m	Meter
m/s	Metres per second
MCA	Maritime and Coastguard Agency
MMMP	Marine Mammal Mitigation Plan
MU	Management Units
MW	Megawatts
nm	Nautical miles
NRW	Natural Resources Wales
O&M	Operational and Maintenance
OSPAR	Oslo and Paris Convention for the Protection of the Marine Environment
PINS	Planning Inspectorate
PTS	Permanent Threshold Shift
SAC	Special Area of Conservation
SCANS	Small Cetaceans in the European Atlantic and North Sea
SCI	Site of Community Importance
SCOS	Special Committee on Seals
SD	Standard Deviation
SEL	Sound Exposure Level
SMP	Seabird Monitoring Programme

SMRU	Sea Mammal Research Unit
SNCBs	Statutory Nature Conservation Bodies
SoCG	Statement of Common Ground
SPL	Sound Pressure Level
TTS	Temporary Threshold Shift
TWG	Technical Working Group
UK	United Kingdom of Great Britain and Northern Ireland
WG	Welsh Government

GLOSSARY OF TERMINOLOGY

Applicant	Menter Môn Morlais Limited.
Array	A group of tidal devices connected to each other and to a common export cable.
Array Area	The area taken up by an array, including spaces between devices.
Array Export Cable	Export cable connecting an array of tidal devices to an export cable tail, and from there to grid via permanent infrastructure.
Berth	Discrete area of the Morlais Demonstration Zone identified for a specific tenant's array project demonstration.
Cable Protection	Protective materials strategically placed on sections of the export cable, export cable tails and inter-array cables, to hold them in place on the seabed.
Code of Construction Practice	A document detailing the overarching principles of construction, contractor protocols, construction-related environmental management measures, pollution prevention measures, the selection of appropriate construction techniques and monitoring processes.
Cumulative effects	The combined effect of the Morlais Project in combination with the effects from a number of projects, on the same single receptor / resource.
Cumulative impact	Impacts that result from changes caused by other past, present or reasonably foreseeable actions together with the Morlais Project.
Device Area	Plan view surface area occupied by a tidal device.
Device Type	A grouping of tidal devices, with similar characteristics. For example, grouping on the basis of the nature of the Tidal Energy Converter (TEC) technology or grouping on the basis of the location and scale of the tidal device during operation, without consideration of the type of TEC deployed.
Effect	Term used to express the consequence of an impact. The significance of an effect is determined by correlating the magnitude of the impact with the importance, or sensitivity, of the receptor or resource in accordance with defined significance criteria.

Environmental Impact Assessment (EIA)	A statutory process by which certain planned projects must be assessed before a formal decision to proceed can be made. It involves the collection and consideration of environmental information, which fulfils the assessment requirements of the EIA Directive and EIA Regulations, including the publication of an EIA Report.
Export Cables	Up to nine lengths of cable from arrays within the Morlais Demonstration Zone (MDZ), connected to the export cable tails.
Export Cable Corridor	The corridor within which the export cables and export cable tails will be routed from the Morlais Demonstration Zone site to the landfall location at Abraham's Bosom.
Export Cable Tails	Up to nine lengths of cable installed from the transition pit in the landfall area, to a point in the nearshore offshore seabed via Horizontal Directional Drilling (HDD) or trenching.
Footprint	The surface area of a tidal device that is in physical contact with the seabed.
Grid Connection Substation	Grid connection substation at Orthios.
Horizontal Directional Drilling (HDD)	A method of cable installation where the cable is drilled beneath a feature without the need for trenching.
Hub	Electrical infrastructure used to connect two or more tidal devices within an array.
Inter-Array Cables	Offshore cables which link the arrays to each other and the offshore electrical platforms, these cables will include fibre optic cables.
Joint Pits	Underground structures constructed at regular intervals along the onshore cable route to join sections of cable and facilitate installation of the cables into buried ducts within the road.
Landfall	The area (from Mean Low Water Springs) where the offshore export cables would make contact with land and connect to the onshore cables.
Landfall Substation	Landfall substation at Ty-Mawr.
Morlais Demonstration Zone (MDZ)	Defined by The Crown Estate Lease boundary, the area within which the tidal devices/arrays will be deployed along with associated infrastructure such as inter-array cables, export cables, marker buoys, site monitoring equipment and electrical connections to the export cables. An offshore area of 35km2 within which the Project will deploy arrays of tidal devices and associated infrastructure.
Offshore Development Area (OfDA)	The combined area of the Morlais Demonstration Zone and the Export Cable Corridor.
Offshore Infrastructure	All offshore infrastructure including tidal devices, foundations or anchors, inter array cables, hubs, export cables, export cable tails and cable protection.
Onshore cables	The cables which take the electricity from the landfall transition pit to the grid connection substation.

Onshore Cable Corridor	The area within which the onshore cables and associated infrastructure such as joint bays, will be located.
Onshore Development Area (ODA)	The area including the intertidal landfall location at Abraham's Bosom, the short onshore cable route between landfall and the landfall substation infrastructure (up to and including landfall substation/control room), and the onshore cable route to the grid connection substation.
Offshore Development Area (OfDA)	
Project Design chaEnvelope (PDE)	The parameters within which the potential maximum extent of the project in terms of materials, scale, time and location can be described. Sometimes referred to as the 'Rochdale envelope'.
Repowering	The removal of a tenant's infrastructure at the end of a demonstration period and replacement with new tenant infrastructure.
Safety Zones	A marine area declared for the purposes of safety around a renewable energy, installation or works / construction area under the Energy Act 2004, the Electricity (Offshore Generating Stations) (Safety Zones) (Application Procedures and Control of Access) Regulations 2007 and the Transport and Works Act 1992.
Substation	A compound containing electrical equipment to enable connection to the existing electricity network. This also contains equipment to help maintain stable grid voltage.
Subzone	A part of the Morlais Demonstration Zone, within which defined types of tidal device may be deployed.
Swept Area	The cross-sectional area of the Tidal Energy Convertor perpendicular to the current flow.
Switchgear Building	Switchgear building at Parc Cybi.
Tenant / developer	A company or organisation which reaches agreement with Menter Mon to deploy tidal devices within the Morlais Demonstration Zone.
Tenant infrastructure	Tidal devices, hubs, inter array cables, cable protection, monitoring platforms / buoys and marker buoys. May also include export cables.
Tidal Device	One complete unit including: Tidal Energy Convertor(s) (; i.e. rotors and nacelle), foundations, support structure.
Tidal Energy Convertor (TEC)	A device that convert kinetic and potential energy contained within moving tidal water into electricity.
Transition Pit	Underground structures at the landfall and grid substation that house the joints between trenched and trenchless export cable sections.
Under-keel clearance	The vertical distance between the deepest underwater point of a vessels hull and the shallowest point of seabed or of an underwater structure

1. INTRODUCTION

1.1. BACKGROUND AND PURPOSE OF DOCUMENT

1. This document forms the Shadow Habitats Regulations Assessment (HRA) for the proposed Morlais Project, hereafter referred to as 'the Project'. The Project is being developed by Menter Môn Morlais Limited (Menter Môn) and will have a tidal generating capacity of up to 240MW within the Morlais Demonstration Zone (MDZ).

2. This document considers designated sites for birds, marine mammals, migratory fish and terrestrial ecology.

3. This HRA is produced in support of an application for a Marine Licence under the Marine and Coastal Access Act 2009, a Transport and Works Act Order under the Transport and Works Act 1992 and deemed planning permission for the project. **Chapter 2, Policy and Legislation** (**Volume I** of the ES) provides further detail on the requirements of each permission.

4. This document should be read in conjunction with the relevant chapters of the Morlais Project Environmental Statement (ES).

1.2. OVERVIEW OF THE PROJECT

5. The Project is located within one of several marine energy demonstration zones located around the United Kingdom (UK) coast, which have been leased out by The Crown Estate in a bid to encourage and accelerate the marine energy industry. The Project is located within the West Anglesey Demonstration Zone (WADZ), a zone primarily selected for its tidal resource. Menter Môn has been appointed as the manager of the WADZ by The Crown Estate. In this ES, the WADZ is referred to as the MDZ.

6. The Project will provide a fully consented demonstration zone for tidal technology, specifically designed for the installation and commercial demonstration of multiple arrays of tidal energy devices. The Project will comprise an offshore development area including the MDZ covering an area of 35 km^2, combined with an export cable corridor (ECC) with an area of 4.75 km^2, plus associated onshore infrastructure contained within an onshore development area (ODA) of 1 km^2.

7. The offshore and onshore development areas of the Morlais Project are shown in **Figure 1-1** and **Figure 1-2**, respectively.

8. As a pre-consented and grid connected demonstration zone, a number of different tidal devices and array configurations may be deployed within the MDZ over its lifetime. The Project aims to secure a broad consented project design envelope (PDE), which will encompass a range of tidal device types and technologies with the potential to be installed and operated as part of the project. This approach allows for deployment of a variety of currently available technologies, whilst also allowing for evolution of the designs of tidal devices over time.

9. However, the range and flexibility sought within the consent application has been limited by careful consideration of development scenarios designed to rationalise the likely approach to development and to set workable limits on potential impacts. The PDE approach used in this

ES, has been tested in planning law and is often referred to as the ‘Rochdale Envelope’ approach

10. The details of tidal technologies and infrastructure to be installed post consent, and methods to be used, will be reviewed with regulators prior to deployment and their compliance with the PDE confirmed. The types of devices that have been used to define the Project Design Envelope for the project are discussed in **Chapter 4, Project Description** (**Volume I** of the ES)**.**

11. The key components of the offshore works associated with the Project include tidal devices deployed in multiple arrays within the MDZ, to a maximum installed capacity of 240 MW.

12. Each single array will be comprised of the same type of tidal device (technology type) and located within a discrete location, or berth, within the MDZ. The installed capacity per array is expected to be up to 30 MW but may in practice be greater of smaller than this, being determined by a number of factors including the individual capacity of the export cables supporting each array, the installed capacity of the Project in full, and the requirements of the tidal devices. The installed capacity of individual arrays is not a parameter of bearing upon the HRA, and all installed arrays, when summed, will fall within the total installed capacity for the Project of 240 MW.

13. For deployment of arrays, the MDZ may be spilt into a series of subzones, with the zones allowing the demarcation of different technology types. Eight indicative subzones within the MDZ are presented through the ES, however, these indicative zones may be modified to meet the requirements of tenants and regulators. Water depths and tidal resource vary across the MDZ (average depth across the MDZ is approximately 40 m), and the subzones are likely to be located in areas of stronger tidal resource, while offering a range of depth parameters.

14. A phased approach to deployment of the project may be taken, with scale and timeframe of potential phasing determined by assessments and consideration of mitigation and management undertaken within the ES.

15. Dependent on the type of tidal device, full deployment to 240 MW could comprise up to a maximum of up to a maximum of 620[1] tidal devices supporting up to 1,648 Tidal Energy Convertors (TECS) and up to 740 inter-array cables within the MDZ. This represents the worst-case scenario as outlined in **Chapter 4, Project Description** (**Volume I** of the ES)**.**

16. The MDZ and Export Cable Corridor (ECC) will also contain the following ancillary infrastructure;

- Up to nine export cables;
- Up to nine export cable tails (shared with onshore components);

[1] Based on an indicative worst case maximum deployment scenario of 8 x 30MW arrays and limited to 620 tidal devices max. Comprising 480 Schottel TECs on SME PLATO devices; 480 Instream TECs; 300 Schottel TECs (on QED Naval); 150 Nova TECs; 100 Tocardo TECs on UFS; 78 Verdant TECs on Triframes; 30 Aquantis TECs; and 30 Sabella TECs

- Navigation and environmental monitoring equipment;
- Mooring and foundation structures; and
- Offshore electrical infrastructure, including submerged, floating or surface emergent hubs.

17. The key components of the onshore works associated with the Project include:

- Landfall works, including:
  - Up to nine Horizontal Directional Drilling (HDD) ducts or trenched equivalents
  - Up to nine transition pits
  - Up to nine export cable tails (shared with offshore components);
- A landfall substation at Ty-Mawr (hereafter referred to as 'Landfall Substation');
- A switchgear building at Parc Cybi (hereafter referred to as 'Switchgear Building');
- A grid connection substation at the existing Orthios Eco-Park to the east of Holyhead (the site of the former Anglesey Aluminium works) (hereafter referred to as 'Grid Connection Substation');
- Onshore cable route installed between Landfall Substation, Switchgear Building and Grid Connection Substation; and,

18. The expected life of the project is 37 years, including time required for construction, operation, repowering and decommissioning. Each stage of the Project is considered and assessed, as relevant, within this HRA.

19. Following consent award, tidal device developers will be allocated locations or "berths" within the MDZ, within which they will be able to deploy anything from one device to arrays of multiple tidal devices. A repowering of a device/array is defined as the end of a berth/array demonstration cycle, at which time the device, device foundations, support structures, electrical hubs, tenant monitoring equipment, and inter-array cabling will be removed, in line with procedures adopted during decommissioning. Once all developer owned assets listed above have been removed, the Project will then have capacity for 'repowering' and the berth would then be available for where new devices may be installed to utilise the vacated berth or be installed at a new berth for further demonstration.

20. The Project will also provide communal electrical infrastructure, including the aforementioned Landfall and Grid Connection Substations and onshore electrical cable route. Following construction, the onshore infrastructure will not be subject to repowering, impacts will be limited to O&M and decommissioning.

1.3. MITIGATION

21. In respect of Stage 1 Screening, a recent ruling (April 2018) by the Court of Justice of the European Union (CJEU) referred to as People Over Wind and Sweetman v Coillte Teoranta (C-323/17) provided a judgement that "…*it is not appropriate, at the screening stage, to take account of the measures intended to avoid or reduce the harmful effects of the plan or project on that site*". As such, no mitigation measures have been taken into account when undertaking

the LSE Screening exercise set out with **Section 6** and **Section 7** of this document. In this respect, it should be noted that the proposed location of the construction works within the Onshore Development Boundary (ODA) and Offshore Development Boundary (OfDA), shown in **Figure 1-1** and **Figure 1-2**, respectively, are driven by practical or engineering considerations (e.g. ease of site access). Consequently, these measures form part of fundamental characteristics of the works and are not "*measures intended to avoid or reduce the harmful effects of the plan or project on that site*".

22. Where appropriate, further topic specific additional mitigation measures would be adopted, and these are detailed where relevant and presented in full in **Chapter 27, Summary** (**Volume I** of the ES), however, these are only considered within the Appropriate Assessment stage in **Section 8** of the document. It is expected that the mitigation measures will form part of the eventual consent and licence conditions, many of which will require management, monitoring and mitigation plans to be produced as part of the overarching Construction Environmental Management Plan (CEMP), supported by an Environmental Mitigation and Monitoring Plan (EMMP) for marine aspects, with a Code of Construction Practice (CoCP) established for onshore aspects. See Document **MOR/RHDHV/DOC/0072, Outline EMMP**, **Document MOR/RHDHV/DOC/0073, Outline CEMP**, and **Document MOR/RHDHV/DOC/0076, Outline CoCP,** for further detail.

23. The CEMP, CoCP and EMMP will be the principle vehicles through which mitigation measures are implemented to ensure that appropriate actions are taken to prevent, reduce and offset potential impacts which have been described in the ES or identified through subsequent consultation and monitoring.

1.4. STUDY AREA AND ZONE OF INFLUENCE

24. The initial identification of European and Ramsar sites for inclusion in the Stage 1 HRA Screening is primarily based on the location of the site relative to the Project. The approach for each site interest feature, marine ornithology, marine mammals, fish and onshore ecology (including onshore ornithology) is outlined in **Sections 6.2**, **6.3**, **295** and **6.5** respectively, as each receptor has different range and therefore different potential for connectivity.

2. CONSULTATION

25. Formal consultation has been undertaken with Natural Resources Wales (NRW) and the Isle of Anglesey County Council (IoACC) during the EIA scoping phase, and also directly with NRW as part of a Technical Working Group and the Royal Society for the Protection of Birds (RSPB) to discuss the majority of the topics covered within the HRA.

26. Two scoping reports were previously submitted to Natural Resources Wales (NRW), the Marine Management Organisation (MMO) and the Isle of Anglesey County Council (IoACC) in support of earlier (lower capacity) versions of the Project. However, since those reports were submitted the proposed installed capacity of the Project has been increased and the Project is now seeking consent for up to 240 MW capacity.

27. A further request for scoping opinion, for the current 240 MW capacity Project, was submitted to the Welsh Government and NRW in April 2018, superseding the earlier scoping requests.

The Welsh Government and NRW provided a detailed scoping opinion, which has been the starting point for consultation on the project. Consultation with the Welsh Government and NRW has been ongoing throughout the EIA to discuss developments in the Project, scope and design parameters, and to agree methodologies and approaches used for environmental surveys and assessments during the EIA process.

28. Opinions that were received within the scoping response and further consultation, that are relevant to the HRA are presented in **Table 2-1**.

Table 2-1 Consultation Responses

Consultee	Date/Document	Comment	Response
Scoping Comments			
NRW (for PINS)	11/07/18	The Conservation of Habitats and Species Regulations 2010 and Offshore Marine Conservation (Natural Habitats &c.) Regulations 2007 have been consolidated and replaced by the Conservation of Habitats and Species Regulations 2017 and the Conservation of Offshore Marine Habitats and Species Regulations 2017 respectively. References to earlier regulations should be avoided in the ES. The proposal is relevant to sites designated under the provisions of the above regulations. In due course the proposal will require special consideration by the competent authority under Regulation 63 in the form of a Habitats Regulations Assessment (HRA) which will take the conservation objectives of the designated sites concerned into account.	Noted, see **Section 3** of this HRA for up to date legislative context
NRW (for PINS)	11/07/18	It is important that there is distinction between the EIA and HRA processes; however, the information contained within the ES may be of relevance and may be used within the HRA. We therefore recommend that the ES should include a section containing ‘information to inform the HRA’.	Noted. This document contains information to inform HRA and accompanies the ES and application. This document draws upon information from the ES, and wider sources as appropriate.
NRW (for PINS)	11/07/18	Without wishing to prejudice the HRA or consenting process, a package of measures that would avoid or mitigate the effects of the proposal and avoid adverse effects on the integrity of European protected sites would appear challenging to achieve in this instance. If this is the case it may be necessary to consider the proposal under Regulation 64 of the above regulations, where the possibility of alternatives to the proposal that would not give rise to adverse effects on the integrity of European protected sites are considered.	Adverse effects are not expected. However, a phased deployment of the project is proposed, with an initial phase of deployment at a level agreed with regulators as acceptable without adverse effects on European site integrity. A mitigation and monitoring plan will provide information to inform

Consultee	Date/Document	Comment	Response
			decisions regarding further deployment and provide options for mitigation of adverse effects if become apparent. The outline Environmental Mitigation and Monitoring Plan is presented in **Document MOR/RHDHV/DOC/0072, Outline EMMP**. This will be agreed with the relevant stakeholders prior to implementation.
NRW (for PINS)	11/07/18	We encourage the applicant to refer to the Crown Estate Technical Report: Wave and tidal enabling action: consolidation of wave and tidal EIA / HRA issues and research priorities (2014). This will provide guidance to addressing the key strategic EIA / HRA issues associated with wave and tidal stream arrays and identify strategic research priorities which individual developers may plan to undertake, or which could be addressed through a coordinated programme.	Noted. The report has been considered during the EIA process, from survey design described in key chapters, in particular **Chapter 11, Marine Ornithology** (**Volume I** of the ES) and **Chapter 12, Marine Mammals** (**Volume I** of the ES), to the development of proposals for mitigation and monitoring in the outline EMMP which accompanies consent applications for the Project (**Document MOR/RHDHV/DOC/0072, Outline EMMP**).
IACC 2017	09/06/18	The Applicant's intention to screen the Proposed Development under the Conservation of Habitats and Species Regulations 2010 (Habitat Regulations) (paragraph 5.3.1) is welcomed and the applicant should liaise with statutory and other material consultees as regards the information to be submitted as part of this screening process and the timing of this submission relative to the planning application. Other material consultees could include for instance, Royal Society for the Protection of Birds "RSPB" and the North Wales Wildlife Trust "NWWT".	Statutory consultation with NRW during Technical Working Group (TWG) meetings have taken place to discuss EIA/HRA issues. Contact with other material consultees has also taken place, including key consultee RSPB (see Section 11.3, **Chapter 11, Marine Ornithology, Volume I** of the ES).
NRW	11/07/18	Guidance provided to the applicant by NRW Technical Experts (TE) to assist with scoping the proposal and EIA does not appear to have been fully used to inform all aspects of the EIA scoping report. We also note that the scoping report has not drawn upon information collated within the Crown	Noted, as above, TWG have been established and information shared within the forum for the HRA and EIA. See **Section 3.3** for further detail on the use of the

Consultee	Date/Document	Comment	Response
		Estate's plan level Habitats Regulation Appraisal for their 2013/14 wave and tidal leasing round, which culminated in the leasing of the six UK demonstration zones, including Morlais. NRW TE has previously provided a guidance note to you on how we considered that this information could be used at an individual demonstration zone level. We strongly recommend that the ES makes full use of these sources of information.	Crown Estate's plan level HRA for further details. The sources of information for the Marine Mammals and Marine Ornithology assessment have been confirmed by NRW within the TWG meetings. **Chapter 12, Marine Mammals** utilises the NRW Guidance notes by Sparling et al., 2015 and Sparling and Smith, 2019.
Technical Working Group Meeting Minutes: Ornithology			
NRW	13/12/18	We agree in general with the preliminary findings of the HRA screening, however, would need to see the raw survey data before providing a definitive answer	Species to be included within HRA Screening: ▪ Kittiwake; ▪ Guillemot; ▪ Razorbill; ▪ Puffin; ▪ Manx Shearwater; and ▪ Gannet.
NRW	13/12/18	We believe that the mean-maximum distances provided in Thaxter *et al*. (2012) should be used as a coarse screening filter for sites in the breeding season and that data from papers and Future of the Atlantic Marine Environment (FAME) and Seabird Tracking and Research (STAR) projects should then be used to provide a more detailed look at where the birds come from. Furness (2015) should be used where applicable to try and allocate birds in non-breeding months.	This approach has been taken. Additionally, mean animal density is taken from two years of boat-based survey data, distance corrected where number of records allowed (razorbill and guillemot), non-speciated birds added to totals where relevant (razorbill and guillemot)
NRW	13/12/18	In combination: We advise that the applicant needs to look at foraging ranges from available data for the breeding season, as well as the Furness 2015 Biologically Defined Minimum Population Scales (DBMPS) report for the non-breeding season before determining which projects would need to be included.	Noted, the relevant sources of information for the HRA Screening are outlined in **Section 6.2**.
NRW	13/12/18	NRW does not agree with the different groupings and would like to see more groups which may well have a similarity in the collision risk models. When grouping tidal device parameters, consideration should be focused on whether there is an ecologically meaningful way to categorise in terms of potential	The grouping of tidal devices has been given further consideration and is presented in **Chapter 4, Project Description** (**Volume I** of the ES). In summary, tidal devices are categorised into

Consultee	Date/Document	Comment	Response
		encounter rates for birds, for example using depth.	groupings based upon their position within the water column. Those groupings are then further subdivided based on characteristics of the tidal energy convertors within each device. The groupings reflect in differences in seabed footprint, foundations / moorings / anchors, and location within the water column, all of which have potential to affect the significance of impacts upon ecological receptors.
NRW	13/12/18	Due to the many unknowns with tidal devices, NRW recommend presenting all qualitative evidence possible. Therefore, the assessment should include all suggested by SNH (2016) Guidance (0%, 50%, 90%, 95%, 98% and 99%).	Noted. This document contains information to inform HRA and accompanies the ES while draws upon information from the ES. The ES Chapter 11, Ornithology, considers a range of avoidance %, with relevant elements referenced in this document.
NRW	19/02/19	NRW suggests that the array results should be additive as the Project will have all of these devices in at the one time, as worst-case scenario.	Full deployment has been considered in both HRA and EIA, with a worst-case scenario of 240MW. However, it is also acknowledged that the project will be deployed in a number of intermediate phases before full capacity is achieved. Phasing of deployment allows the level of potential impact to be managed carefully, and impacts assessed through monitoring, prior to further deployment.
NRW	Third TWG Meeting May 2019	NRW advise that the applicant needs to look not just at Minesto but all other plans or projects that could have an additive effect on a site.	All appropriate plans and projects have been presented in **Section 7.1** and taken into consideration throughout the Appropriate Assessment in **Section 8.2**.

Consultee	Date/Document	Comment	Response
NRW	Third TWG Meeting May 2019	Avoidance rates will be presented using the range outlined in SNH (2016). Outcomes of Population Viability Analysis (PVA) indicate that avoidance of 99% and higher will be important based upon PVA results for guillemot and razorbill. For other species lower values are indicated.	Noted, the results of the ERM and CRM have been presented against this range of avoidance rates Full details of the PVA is included in **Appendix 11.3** (**Volume III** of the ES).
NRW	Third TWG Meeting May 2019	NRW requested that all sites should be screened in initially and taken through to AA.	All sites have been screened in, except where apportioning showed that only <1% of the site population could potentially be present within the OfDA.
NRW	Third TWG Meeting May 2019	NRW raised the potential for active sonar to be used and advise that the applicant needs to consider whether other monitoring could also be available to be used.	A deployment and monitoring strategy will be produced for consultation with the SNCBs. An outline Environmental Mitigation and Monitoring Plan is presented in **Document MOR/RHDHV/DOC/0072, Outline EMMP**.
NRW	Third TWG Meeting May 2019	Royal HaskoningDHV, on behalf of Menter Môn, confirmed that an AA will be carried out for chough.	The outcomes of the AA for chough is presented in **Section 8.4.2**.
Technical Working Group Meeting Minutes: Marine Mammals			
NRW	27/11/18	NRW noted that in addition to the sites listed in the discussion paper, there are further sites within the MU that are not covered in the list and are within the jurisdiction of other administrations. For example, 15 SACs have harbour porpoise listed as part of their designation within the MU.	It can be seen that all sites have been listed and considered in the HRA. Details of the HRA screening with justification for the sites screened in and out are provided in **Section 5.2.2**.
NRW	27/11/18	NRW note that there are 21 sites for grey seal in this MU. The ones listed are the most appropriate ones. Closest sites and the sites with the largest population (Pembrokeshire) should be included in the assessment	It can be seen that all relevant sites have been listed and considered in the HRA including closest sites and those with the largest populations. Full details of the HRA screening with justification for the sites screened in and out are provided in **Section 5.2.2**
NRW	27/11/18	NRW note there are 19 sites for harbour seal in the MU. There are no Welsh sites so NRW have no further comment.	All relevant sites have been listed and considered in the HRA, with full details of the HRA screening including

Consultee	Date/Document	Comment	Response
			justification for the sites screened in and out provided in **Section 5.2.2**
NRW	10/05/19	NRW wish to ensure that other SACs, such as harbour porpoise from French sites and sites from the west coast of Ireland, are considered.	Other SACs have been considered, including French and Irish sites. Full details of the HRA screening with justification for the sites screened in and out are provided in **Section 5.2.2**

3. POLICY, LEGISLATION AND GUIDANCE

3.1. INTRODUCTION

29. The HRA process covers features designated under the European Council Directive 12.2009/147/EC on the conservation of wild birds (the ‘Birds Directive’) and Council Directive 92/43/EEC on the Conservation of natural habitats and of wild fauna and flora (the ‘Habitats Directive’). These are implemented into UK legislation by the Conservation of Habitats and Species Regulations 2017.

30. European Union (EU) obligations in respect of habitats and species are met through Council Directive 92/43/EEC (the Habitats Directive) on the conservation of natural habitats and of wild fauna and flora, which requires Member States to schedule important wildlife sites through the European Community as Special Areas of Conservation (SACs) and to give protection to habitats and species listed in the Directive as being threatened or of Community Interest.

31. The EU meets its obligations for birds through Directive 2009/147/EC (Birds Directive) on the conservation of wild birds. This provides a framework for the conservation and management of wild birds in Europe. Of particular relevance is the requirement to identify and designate Special Protection Areas (SPAs) for rare or vulnerable species listed in Annex I of the Directive, as well as for all regularly occurring migratory species, paying particular attention to the protection of wetlands of international importance. Together with SACs, SPAs form a network of protected areas known as Natura 2000 sites or ‘European sites’.

32. The Habitats Directive is transposed into English and Welsh legislation by the Conservation of Habitats and Species Regulations 2010 (as amended) and the Offshore Marine Conservation (Natural Habitats & c.) Regulations 2007 (as amended); here after referred to as the ‘Habitats Regulations’. The Habitats Regulations incorporate all SPAs into the definition of European sites and, consequently, the protections afforded to European sites under the Habitats Directive apply to SPAs designated under the Birds Directive.

3.2. LEGISLATIVE CONTEXT

3.2.1. The Birds Directive

33. The EU Directive on the Conservation of Wild Birds (2009/147/EC) (hereafter called the Birds Directive) provides a framework for the conservation and management of wild birds in Europe. The relevant provisions of the Directive are the identification and classification of Special Protection Areas (SPAs) for rare or vulnerable species listed in Annex I of the Directive and for all regularly occurring migratory species (required by Article 4). The Directive requires national Governments to establish SPAs and to have in place mechanisms to protect and manage them. The SPA protection procedures originally set out in Article 4 of the Birds Directive have been replaced by the Article 6 provisions of the Habitats Directive.

3.2.2. The Habitats Directive

34. The EU Directive on the Conservation of Natural Habitats and of Wild Fauna and Flora (92/43/EEC) (hereafter called the Habitats Directive) provides a framework for the conservation and management of natural habitats, wild fauna (except birds) and flora in Europe. Its aim is to maintain or restore natural habitats and wild species at a favourable conservation status. The relevant provisions of the Directive are the identification and classification of Special Areas of Conservation (SAC) (Article 4) and procedures for the protection of SACs and SPAs (Article 6). SACs are identified based on the presence of natural habitat types listed in Annex I and populations of the species listed in Annex II. The Directive requires national Governments to establish SACs and to have in place mechanisms to protect and manage them.

35. The HRA process is a requirement of Directive 92/43/EEC on the conservation of on the conservation of natural habitats and of wild flora and fauna (the Habitats Directive). Together with the Birds Directive (2009/147/EC), the Habitats Directive establishes a network of European important sites designated for their ecological status, referred to as the Natura 2000 network. SACs and Sites of Community Importance (SCIs) are designated under the Habitats Directive and promote the protection of flora, fauna and habitats. SPAs are designated under the Birds Directive in order to protect rare, vulnerable and migratory birds.

36. The Habitats Directive is transposed into UK law by means of The Conservation of Habitats and Species Regulations 2017 (the ‘Habitats Regulations’). The Habitats Regulations incorporate all SPAs into the definition of European sites and, consequently, the protections afforded to European sites under the Habitats Directive also apply to SPAs designated under the Birds Directive. In addition, SPAs, possible PSAs (pSPA), possible SACs (pSACs) and Ramsar sites are also to be considered (DCLG, 2012).

37. In accordance with Regulation 63 of the Habitats Regulations, HRA is required for any plan or project, not connected with the management of a European site, which is likely to have a significant effect (LSE) on the site either alone or in-combination with other plans or projects.

38. Annex II of the Habitats Directive lists species for which member states are expected to establish a “consistent network of special areas of conservation” and designate sites, identified as being key areas for their life and reproduction.

3.2.3. The Conservation of Habitats and Species Regulations 2017

39. In November 2017, the Conservation of Habitats and Species Regulations 2010 and the Offshore Marine Conservation (Natural Habitats, &c.) Regulations 2007 were consolidated into the Conservation of Habitats and Species Regulations 2017 ('the Habitats Regulations 2017').

40. The Habitats Regulations 2017 transpose the Birds Directive and the Habitats Directive into UK law. The Habitats Regulations place an obligation on 'competent authorities' to carry out an appropriate assessment of any proposal likely to affect a Natura 2000 site, to seek advice from Natural Resources Wales (NRW) and not to approve an application that would have an adverse effect on a Natura 2000 site except under very tightly constrained conditions that involve decisions by the Secretary of State. The competent authority in the case of the Project is the Welsh Government for consenting the project under the Transport and Works Act 1992; and NRW for determination of the Marine Licence application.

3.3. POLICY AND GUIDANCE

41. In preparing this report, consideration has been given to relevant guidance issued by a number of Governmental, statutory and industry bodies. In relation to guidance from Government bodies, this includes:

- European Commission: Assessment of Plans and Projects Significantly Affecting Natura 2000 Sites.
- European Commission: EU Guidance on wind energy development in accordance with EU nature directives.
- Department of Communities and Local Government: Guidance on 'Planning for the Protection of European Sites: Appropriate Assessment'.
- The Planning Inspectorate Advice Note Nine: Rochdale Envelope.
- The Planning Inspectorate Advice Note Ten: Habitat Regulations Assessment relevant to nationally significant infrastructure projects.
- Department of Energy and Climate Change: Guidelines on the Assessment of Transboundary Impacts of Energy Developments on Natura 2000 Sites outside the UK.

42. In relation to guidance from Statutory Nature Conservation Bodies (SNCBs) this includes:

- English Nature: Habitats Regulations Guidance Note (HRGN 1): The Appropriate Assessment (Regulation 48) The Conservation (Natural Habitats &c) Regulations, 1994.
- English Nature: Habitats Regulations Guidance Note (HRGN 3): The Determination of Likely Significant Effect under the Conservation (Natural Habitats &c) Regulations, 1994.
- English Nature: Habitats Regulations Guidance Note (HRGN 4): Alone or in-combination.
- Planning Policy Wales Technical Advice Note 5: Nature Conservation and Planning
- National Assembly for Wales: The Planning Series: 16 – Habitats Regulations Assessment
- Natural England and JNCC: Interim advice on HRA screening for seabirds in the non-breeding season.

- Natural England and JNCC: Advice on HRA screening for seabirds in the breeding season.
- Natural England and JNCC: Interim Advice Note – Presenting information to inform assessment of the potential magnitude and consequences of displacement of seabirds in relation to Offshore Windfarm Developments.
- UK SNCBs, 2017. Joint SNCB Interim Displacement Advice Note: Advice on how to present assessment information on the extent and potential consequences of seabird displacement from offshore wind farm developments (UK SNCBs, 2017).
- Assessing collision risk between underwater turbines and marine wildlife. Scottish Natural Heritage (SNH) (2016) guidance note.

43. In relation to guidance from industry this includes:

- CIEEM, 2018. Guidelines for Ecological Impact Assessment in the UK and Ireland. CIEEM, Winchester (CIEEM, 2018);
- Crown Estate Technical Report: Wave and tidal enabling action: consolidation of wave and tidal EIA / HRA issues and research priorities.
- Developing Guidance on Ornithological Cumulative Impact Assessment for Offshore Wind Farm Developers (King *et al*. 2009).
- Cumulative Impact Assessment Guidelines – Guiding Principles for Cumulative Impacts Assessment in Offshore Wind Farms (RenewableUK 2013).
- Approaches to Marine Mammal Monitoring at Marine Renewable Energy Developments Final Report (Sea Mammal Research Unit Ltd (SMRU Ltd) on behalf of The Crown Estate, 2010).
- Guidelines for Data Acquisition to Support Marine Environmental Assessments of Offshore Renewable Energy Projects (Centre for the Environment and Fisheries and Aquaculture Science (Cefas), 2012).
- Guidance to inform marine mammal site characterisation requirements at wave and tidal stream energy sites in Wales (Sparling *et al*., 2015).
- Defining Project Envelopes for Marine Energy Projects: Review and Tidal Energy Test Facility and Marine Mammals Case Study (Sparling and Smith, 2019, unpublished).

44. In May 2013, The Crown Estate (TCE) announced plans to invite applicants to run a series of managed 'demonstration zones' for wave and tidal stream energy projects across the UK. The locations of these zone were identified by TCE with input from stakeholders. The locations of the demonstration zone were finalised in September 2013. At that point a further leasing process was launched, enabling organisations to apply for management of these zones. TCE undertook a HRA of this wave and tidal further leasing plan, to assess the effects of the plan on the protected European/Ramsar sites (ABPMer, 2014).

45. The document could not conclude there would be no Adverse Effect on Integrity (AEOI) of any European/Ramsar sites because of the inherent uncertainties which existed about future development and the lack of guarantee that there will be no evidence/analysis gaps. In addition,

uncertainty existed with respect to the in-combination effect that might arise with other plans or projects and especially for mobile interest feature species (marine mammals, seabirds and fish).

46. However, assurance that there would be no AEOI was provided by the in-built flexibility to allow for changes to be made at the project level to avoid this. Additionally, the report explains that the comparatively limited scale of the projects and the small spatial footprint provided further assurances that adverse effects would be avoided. The plan level HRA recommended two formal mitigation measures to be implemented by each development:

- The completion of project-level HRA with project-level mitigation measures where required; and,
- The application and continuation of evidence gathering measures.

47. The current document, the Shadow HRA for the Morlais Project demonstrates the adherence to these recommendations. The summary of key measures proposed by ABPMer (2014) have been considered and implemented as embedded mitigation measures where feasible for the Project. Consultation with NRW through the use of TWGs has covered the key topic groups for HRA, marine mammals, marine ornithology and terrestrial ornithology.

4. THE HRA PROCESS

4.1. OVERVIEW OF THE HRA STAGES

48. The HRA process typically follows a four staged approach:

- Stage 1: Screening;
  - European and Ramsar sites are screened for Likely Significant Effect (LSE), both from the project alone and in combination with other projects. For projects where no LSE is predicted, the Stage 2 assessment is not carried out.
- Stage 2: Appropriate Assessment;
  - For those sites where LSE on a European or Ramsar site cannot be excluded in Stage 1, then further information to inform the assessment will be prepared and the test applied to determine whether the project alone or in-combination could adversely affect the integrity of the site in view of its conservation objectives. This assessment stage will be reported in the form of a HRA Appropriate Assessment Report and the results of the assessment summarised in the form of a series of matrices. A decision is made by the competent authority with regard to the integrity of the European site, either alone or in combination with other plans and projects. Where there are adverse impacts, an assessment of mitigation options is carried out to determine adverse effect on the integrity of the site. If these mitigation options cannot avoid adverse effects on site integrity, then development consent can only be given if subsequent tests (see Stages 3 and 4 below) can be satisfied.

49. In those cases where the conclusion of the HRA Report is that an adverse effect on the integrity of a European or Ramsar site has been identified then the assessment proceeds to two further stages.

- Stage 3: Assessment of Alternatives;
  - Alternative ways of achieving the objectives of the project are assessed to establish whether there are solutions to avoid, or have a lesser effect, on European sites. Alternative solutions can include a proposal of a different scale, a different location and an option of not having the scheme at all (the ‘do nothing’ approach).
- Stage 4: Assessment of Imperative Reasons of Overriding Public Interest (IROPI);
  - If it is demonstrated that there are no alternative solutions to the proposal that would have a lesser effect or avoid an adverse effect on the integrity of the site(s), then a justified case will be prepared that the scheme must be carried out for IROPI.

50. If the conclusion of Stages 3 and 4 is that there is no alternative and that the project has demonstrated IROPI then the project may proceed with a requirement that appropriate and sufficient compensatory measures are delivered to maintain the overall coherence of the Natura 2000 network.

51. All four stages of the process are referred to collectively as the HRA, to clearly distinguish the whole process from the stage within it referred to as the ‘Appropriate Assessment’.

52. It is NRW’s responsibility, in its SNCB role, to advise the competent authority on the potential significance of effects on European sites. This report is intended to present all of the information necessary to assist NRW (and the competent authority) in reaching a conclusion.

53. In respect of Stage 1, a recent ruling (April 2018) by the Court of Justice of the European Union (CJEU) referred to as *People Over Wind and Sweetman v Coillte Teoranta* (C-323/17) has provided a judgement that *"…it is not appropriate, at the screening stage, to take account of the measures intended to avoid or reduce the harmful effects of the plan or project on that site”*. As such, no such mitigation measures have been taken into account when undertaking the LSE screening exercise.

54. The HRA process helps meet the requirements of Article 6(3) of the Habitats Directive (replicated in Regulation 61(1)) which states that any plan or project, that is not directly connected with or necessary to the management of an European site, but would be likely to have a significant effect on such a site, either on its own or in-combination with other plans or projects, will be subject to an ‘appropriate assessment’ of its implications for the European site in view of its conservation objectives. In light of the conclusions of that assessment and subject to the provisions of Article 6(4) of the Habitats Directive, the ‘competent authority’ will agree to the plan or project only having ascertained (beyond reasonable scientific doubt) that it will not adversely affect the integrity of the site(s) concerned.

55. Article 6(4) provides that if, in spite of a negative assessment of the implications for the site, and in the absence of alternative solutions, the plan or project must nevertheless be undertaken for IROPI, the Member State will take all compensatory measures necessary to ensure that the overall Natura 2000 sites are protected.

56. As a matter of policy, the UK Government also applies the HRA process to designated Ramsar sites. These are sites which are regarded as being wetlands of international importance as

defined following the Convention on Wetlands (Ramsar, Iran, 1971), which is an intergovernmental treaty that embodies the commitments of its member countries to maintain the ecological character of their internationally important wetland habitats.

57. There is no explicit definition of LSE in the legislation and in the context of HRA it is typically taken as any effect that reasonably may be predicted as a consequence of the project that may significantly adversely affect the conservation or management objectives of the features for which a site was designated, excluding trivial or inconsequential effects (English Nature, 1999). That is, the term “likely” infers the presence of a risk that a significant effect could occur. By definition, this assessment is based on the consideration of a number of factors, for example, the spatial extent and duration of an identified effect, and other considerations such as the availability of appropriate mitigation. When considering such effects, a precautionary approach is adopted.

58. The conservation status of a natural habitat, as defined in the Habitats Directive, means the “sum of the influences acting on a natural habitat and its typical species that may affect its long-term natural distribution, structure and functions as well as the long-term survival of its typical species within the territory referred to in Article 2”. The conservation objectives for a SAC or SPA are considered when identifying LSE. The conservation status of a natural habitat is taken as ‘favourable’ when:

- Its natural range and area it covers within that range are stable or increasing;
- The specific structure and functions which are necessary for its long-term maintenance exist and are likely to continue to exist for the foreseeable future; and
- The conservation status of its typical species is favourable.

59. The project has the potential to affect sites designated pursuant to the Habitats Directive and Wild Birds Directive, comprising sites designated as SACs and SPAs. The project also has the potential to affect sites that are in the process of designation as SACs and SPAs (proposed SACs and proposed SPAs) and Ramsar sites. As a consequence of this, Menter Môn is required to provide the ‘competent authorities’ (in this case the Welsh Government and NRW) with the information they require to undertake an assessment of what those effects are and whether they are predicted to have an adverse effect on the integrity of the European sites in question; this information is to be provided in this case through relevant HRA Reports.

4.2. HRA METHODOLOGY

4.2.1. Scoping the HRA

4.2.1.1. Source-Pathway-Receptor

60. Menter Môn has adopted a ‘source-pathway-receptor’ approach to identifying likely environmental impacts resulting from the proposed construction, operation and maintenance (O&M) and decommissioning of the Project. The parameters are defined as follows:

- Source: the origin of a potential impact (noting that one source may have several pathways and receptors);

- Pathway: the means by which the effect of the activity could impact a receptor; and
- Receptor: the element of the receiving environment that is impacted.

61. The 'source-pathway-receptor' method sought to understand the mechanisms (source and pathways) by which activities arising from the project might affect qualifying interest features of European sites (the receptors). Until the temporal and spatial limits of the project are well defined, however, a precautionary approach remains appropriate.

62. The approach identified potential sources of effects and then mapped how the effect might progress along a migration pathway. An understanding of the nature of the receiving environment is fundamental to determining the risk of exposure for a given receptor. An understanding of the receptor, its behavioural traits and specific vulnerability to the anticipated level and nature of the effect is similarly important.

63. Where there is no pathway, or the pathway is so long that the effect from the source has dissipated to a negligible level before reaching the receptor, there is justification for the screening out of that particular receptor.

64. The potential 'zone of influence' of the project was used to identify a geographical study area over which effects could occur, based on known or modelled information about the transmission of these effects. European sites within the zone of influence were then taken forward into the Screening process.

65. Relevant 'buffers' for each different receptor type were then defined and compared with the likely influence of various effects from the project. For mobile species, buffers were determined based on known or expected foraging ranges or migration routes (i.e. the potential capacity of a mobile qualifying feature from a distant European site to enter the area over which direct effects might occur). This was also qualified by information about the receptor, including records of presence and known distribution.

66. The lack of any records within the zone of influence was considered to represent good evidence that a species is either absent or present in such low numbers or regularity that any effect to it would pose no significant risk to the population and so no LSE would arise. Potential connectivity (of features found within or using the study area) to designated sites outside the study area was also determined by considering foraging and home range distances for individual species and other functional linkages, identified in consultation with NRW.

4.2.1.2. Birds

67. To identify SPAs with the potential to be affected by the project, the assessment focused on the bird species listed in Annex I of the Birds Directive that use the coastal resources in and around the Project area (based on survey records, see **Section 5.2.1** below).

68. To identify SPAs with potential connectivity to the qualifying interest species, the capacity and propensity of a species to enter the study area, typically indicated by any combination of the mean-maximum breeding season foraging ranges and known migratory passage routes and wintering concentrations, was determined. All European sites with potential connections to mobile bird features were taken through to the Screening assessment.

69. The European site selection process for sea birds is undertaken on the basis of the species' occurrence in breeding and/or winter periods or their migratory passage. Given the well-defined and predictable ecological traits and specific vulnerabilities of species at particular times, connectivity was therefore determined on the basis of the species designated occurrence; during the breeding season, over winter or during migratory passage.

4.2.1.2.1. Breeding Birds

70. Where breeding birds are the qualifying interest, connectivity was assumed on the basis that the SPA where the species is a qualifying interest feature, is within the mean/maximum foraging range of the nest.

71. The study area for sea bird interest features in the offshore environment was principally informed by the work of Thaxter *et al*. (2012) to systematically compile all available information on seabird foraging ranges (e.g. 30km was taken to be the maximum foraging range of Arctic tern, based on the maximum breeding season foraging range). The information provided by Scottish National Heritage (SNH) on dispersal and foraging distances for a range of bird species which are qualifying interests of SPAs (Pendlebury *et al*. 2011) also aided the identification of 'connectivity' between development proposals and SPAs. Other peer-reviewed studies were applied where appropriate.

4.2.1.2.2. Overwintering and Migratory Birds

72. Outside the breeding season (and for non-breeding birds within the breeding season) birds can disperse from distant SPAs. In particular, in autumn, birds can disburse widely over large distances and prediction of their dispersal patterns is difficult. For SPAs designated for wintering foraging for seabirds, however, the SPA population is within those SPAs (therefore the additional wintering range is not a factor in the extent of sensitivity of these species).

73. For some species, whilst an individual could plausibly enter the study area outside the breeding season, it is expected that this presence would only amount to a small number of individuals and, therefore, population effects on the source SPA have been deemed to be unlikely.

74. Important migration routes will be taken into account during the scoping process.

4.2.1.3. Marine Mammals

4.2.1.3.1. Cetaceans

75. Species Management Units (MUs) provide an indication of the spatial scales at which effects need to be assessed for cetaceans in UK waters (IAMMWG, 2015). In accordance with advice from statutory consultees, based on the extensive range of marine mammals and the connectivity between SAC populations, European sites were included for consideration in the Screening phase according to the relevant species MUs detailed in **Table 4-1**.

Table 4-1 MUs for cetaceans and OSPAR region for pinnipeds

Qualifying Feature - Cetaceans	**Relevant Species MUs (IAMMWG, 2015)**
Harbour porpoise *Phocoena phocoena*	Celtic and Irish Seas (CIS) comprising ICES areas VI and VII, except VIId
Bottlenose dolphin *Tursiops truncates*	Irish Sea comprising ICES Division VIIa
Qualifying Feature - Pinnipeds	**Relevant OSPAR region**
Grey seal *Halichoerus grypus*	Celtic Seas OSPAR region
Harbour seal *Phoca vitulina*	Celtic Seas OSPAR region

4.2.1.3.2. Pinnipeds

76. The HRA has considered the potential for functional linkage between the marine zone potentially affected by the Project and SAC seal colonies in the Celtic Seas OSPAR region (**Table 4-1**).

4.2.1.4. Migratory Fish

4.2.1.5. For migratory fish, all European sites which discharge into the western English and Welsh coastlines were included for consideration in the Screening stage based on information on migratory behaviour in coastal waters.

4.2.1.6. Terrestrial Ecology

77. For terrestrial ecology, all European sites which overlap with the proposed project or could which habitats and species of interest could be indirectly impacted by the project were included for consideration in the Screening stage.

4.2.2. Screening for Likely Significant Effect (LSE)

78. The screening process comprises an assessment of the capacity for the likely effects of the proposed scheme to influence the qualifying interest features of the relevant European and Ramsar sites, such that a LSE could arise. There is no specific definition of what constitutes LSE; however, guidance produced by Natural England (English Nature, 1999), Planning Policy Wales TAN:5 (2009) and Planning Series 16 (2017) outline the factors that should be considered and criteria that should be applied when determining LSE.

79. The guidance states that: “likely significant effect is, in this context, any effect that may reasonably be predicted as a consequence of a plan or project that may affect the conservation objectives of the features for which the site was designated, excluding trivial or inconsequential effects. Proposals having no, or *de minimis*, effects can be progressed without further consideration under the Habitats Regulations (i.e. there is no requirement to undertake appropriate assessment), although reasons for reaching this decision must be justified and recorded”.

80. The following criteria are cited as potential types of effects that are likely to be significant:

- Causing change to the coherence of the site or the Natura 2000 series (e.g. presenting a barrier between isolated fragments, or reducing the ability of the site to act as a source of new colonisers);
- Causing reduction in the area of habitat or of the site;
- Causing direct or indirect change to the physical quality of the environment (including the hydrology) or habitat within the site;
- Causing ongoing disturbance to species or habitats for which the site is notified;
- Altering community structure (species composition);
- Causing direct or indirect damage to the size, characteristics or reproductive ability of populations on the site;
- Altering the vulnerability of populations to other impacts;
- Causing a reduction in the resilience of the feature against external change (for example its ability to respond to extremes of environmental conditions); and
- Affecting restoration of a feature where this is a conservation objective.

81. The types of effects associated with a proposed scheme, particularly their spatial extent and duration, are of particular importance in identifying the European and Ramsar sites and associated designated interest features that may be influenced.

4.2.3. Implications of the Scheme In-Combination with Other Plans or Projects

82. When assessing the implications of a plan or project in light of the conservation objectives of the European site in question (i.e. assessing the potential for LSE and ascertaining the potential for effect on site integrity), it is necessary to consider the potential for in-combination effects, as well as effects due to the project in isolation. Natural England's Habitats Regulations Guidance Note 4 (English Nature, 2001) provides guidance on in-combination effects and, at paragraph 2.3, states that other plans or projects should include:

- Approved but as yet uncompleted plans or projects;
- Permitted on-going activities such as discharge consents or abstraction licenses; and
- Plans and projects for which an application has been made and which are currently under consideration but not yet approved by competent authorities.

83. It is also noted that in some circumstances it may be appropriate to include plans and projects not yet submitted to a competent authority for consideration but for which sufficient detail exists on which to make judgements on their effect on the European site.

84. In undertaking an in-combination assessment, it is important to consider the potential for each plan or project to influence the site. In order for an in-combination effect to arise, the nature of two effects does not necessarily have to be the same. The in-combination effects assessment, therefore, focusses on the overall implications for the site's conservation objectives, regardless of the type of effect.

85. A scoping and screening exercise was undertaken to identify other plans and projects whose effects have the potential to interact with the effects of the Project and result in likely significant in-combination effects (LSIE). The results of the in-combination screening assessment are provided in **Section 7**.

5. DATA SOURCES TO SUPPORT SCREENING/LSE ASSESSMENT

5.1. DESK STUDY

5.1.1. Summary of Desk-based Chough Data

86. For chough, data were requested from the Royal Society for the Protection of Birds (RSPB) and the Cross and Stratford Welsh Chough Project, both of whom monitor and hold data for chough in the Project area.

87. RSPB provided summary data from the 2014 national chough survey, indicating whether breeding was confirmed, probable or possible within 1 km squares in the vicinity of the consultation boundary, or whether no breeding was recorded. They also provided data from transect surveys of chough feeding in fields within the RSPB South Stack Reserve and off-reserve feeding areas for the period January 2013 until May 2017. The data are the numbers of chough recorded per land parcel unit for each survey along with habitat characteristics and the presence of domestic stock. Surveys were carried out fortnightly throughout the year. The data therefore indicate the relative use by chough of land parcels within the survey area. RSPB also provided data regarding the locations of known chough nest sites, including 'live' sites, sites which haven't been occupied since 2015 but are good successful sites and 'likely' to be used again, and sites were attempts were made but a successful brood was not raised.

88. The Cross and Stratford Welsh Chough Project provided details of chough nest sites and occupancy for the period 2014 to 2018 for the area within the scoping consultation boundary for the cable landfall, landfall substation location and onshore cable route. They also provided records on feeding chough from 1 km squares within or partially overlapping the consultation boundary. These records were collected on an ad-hoc basis, not as part of a systematic survey of the area. It was therefore noted that, while the presence of feeding choughs may indicate the relative importance of an area to this species, a lack of records cannot be interpreted as an area being unsuitable for them. In addition, information was provided on the location of chough roost sites in the vicinity of the consultation boundary.

5.1.1. Summary of Desk-based Onshore Ecology Data

89. A detailed desk study has been undertaken of the area within the Desk Study Area (**Appendix 19.1, Volume III** of the ES). This has involved:

- A review of aerial photographs (Google Earth and Bing Maps, accessed during April and November 2018), and Google Street View imagery was used to help identify and accurately map habitats and to identify ponds within the GCN Study Area.
- A detailed review of 1:25000 Ordnance Survey Maps, to identify ponds and public rights of way within the GCN Study Area.

- The UK Government's MAGIC website (www.magic.gov.uk) has been used to identify statutory designated sites within 2km of the Onshore Development Area.
- Cofnod (the local biological record centre for North Wales) was contacted to supply data within 2km of the Onshore Development Area on any protected/notable species records or non-statutory sites of conservation value, including Local Wildlife Sites (LWS) and ancient woodland sites (AWS). Data were supplied on 19 April 2018. Cofnod supplied further data on 19 July 2018 which extended coverage into the Trearddur Bay area as the route options were refined.

5.1.2. Summary of Desk-based Migratory Fish Data

5.1.2.1. Baseline Environment

90. The Welsh coastline contains important and valued fish stocks that are vital to the ecosystem and fishing. Some fish species have been assessed as requiring additional legal protection under the EU Habitats Directive due to their scarcity at a national or international level. The requisite protective measures depend on the Annex the species is listed on. Annex II species require the designation of SACs, Annex IV species are in need of strict protection, and Annex V species are subject to management measures with regards to taken them in the wild.

91. There are 12 species of fish protected under the EU Habitats Directive. Of these, five species are diadromous, in that they occur within both the marine and freshwater environment at different stages of their life cycle. These are the sea lamprey *Petromyzon marinus*, river lamprey *Lampetra fluviatilis*, allis shad *Alosa*, twaite shad *Alosa fallax*, and Atlantic salmon *Salmo salar*.

92. Lamprey spawn in clean gravel rivers around the UK. The larvae spend 3 to 4 years in the river before metamorphosing and migrating downstream during the spring to estuarine and coastal waters where they feed parasitically on marine species. Both lamprey species feed on small fish as juveniles. River lamprey remain on this diet throughout their life, taking mostly herring, sprat and flounder. Sea lamprey select larger prey as they increase in size, including cetaceans and sharks. River lamprey remain in the coastal environment. Sea lamprey have been recorded up to 400 km from shore and at depths up to 1000 m, though it's thought that they prefer demersal species and sheltered locations. Once they reach adulthood lampreys migrate upriver to spawn and complete their life cycle. Lampreys do not return to their natal river; therefore, each river's population comes from a wider marine population and is as such interconnected. River lamprey move from the marine environment when water temperatures reach the threshold of 10 to 18˚C.

93. Shad are the only members of the herring family that occur in the freshwater as well as marine environment. The two species of shad are easily confused and regularly hybridise. Due to this the relative populations size of the two species is poorly known, though it is thought that allis shad are far rarer than twaite shad. Individuals migrate into rivers or upper estuaries in early summer to spawn. The main spawning rivers include the Tywi, Usk, Wye and Severn. Migration begins when water temperature reaches 10 to 12˚C, usually in March May. Juveniles will move downstream to estuaries in August to October to feed. The majority overwinter in the marine environment, though a small proportion are thought to stay in the estuary. Juveniles spend their first spring in inshore waters, though older individuals remain at sea, at distances of up to 1000 km. Shad are pelagic fish that typically remain in the surface of the water column during all life

stages, though they have been recorded at depths up to 150 m. The presence of bycaught subadults off Cornwall and Devon indicate this may be an important marine feeding ground. Shads begin feeding on zooplankton and move onto small crustaceans, particularly mysids, as they grow. Most individuals complete their life cycle after spawning though some survive and presumably return to the sea in June to July.

94. Atlantic salmon are a migratory species that move from the marine to freshwater environment in order to spawn. Atlantic salmon spawn in clean, shallow gravelly rivers. Juveniles will spend 1 to 6 years in the river, following which they move into the marine environment. After 1 to 3 years at sea they return to their natal river to spawn. There are inter- and even intra-river genetic distinction between populations. Whilst at sea the Atlantic salmon performs long distance migrations, moving to waters in the latitudes north of the Arctic circle. Atlantic salmon display pelagic behaviour and spend the majority of their time in the upper 10 m of the water column though they also perform deep dives. At sea Atlantic salmon eat a variety of marine species, from small crustaceans to larger fish including herring, capelin, sand lace, and small cod and mackerel. Atlantic salmon do not eat as they enter their birth river to spawn.

95. Lamprey are a basal vertebrate; they have very basic auditory structure and also a basic behavioural repertoire, therefore it is considered that sound may not be relevant to them at all (Popper, 2005). Atlantic salmon are classified as hearing generalists, unable to hear high frequencies but are able to hear low frequency sound below 380 Hz (Hawkins and Johnstone, 1978), thought to be most sensitive to frequencies below 160 Hz (Nedwell *et al*., 2007). Shads, as part of the clupeid family, are classified as hearing specialists, having a greater hearing range than most fish and being able to detect ultrasound (up to 180 kHz) (Popper *et al*., 2004).

96. According to the JNCC species fact sheets, all five species of migratory fish listed on Annex II have known occurrence in Wales. Atlantic salmon, twaite shad, and river lamprey have a distribution range that covers the isle of Anglesey; whereas allis shad and sea lamprey do not. However, due to the potential for migratory pathways through the area, all five species have been considered for inclusion in Stage 1 (Screening) of the HRA.

97. There is very limited data available on the marine aspect of diadromous fish migrations, highlighted by the MMO (2017). Migratory fish have the potential to be present in areas considerable distances from their origin site. Therefore, as a precautionary measure, it is considered that a species may occur in the MDZ if they have a known population in a freshwater body that leads into the Irish Sea and adjacent south-western and north-western approaches. Accordingly, all SACs from Ardnamurchan point, Scotland, through to Land’s End, Cornwall, for which migratory fish are a designated feature, have been taken into consideration.

5.1.2.2. Site Selection Criteria

98. Annex II migratory fish species may be directly or indirectly affected by activities during the lifecycle of the MDZ, be it construction, operation, repowering or decommissioning. Potential effects include loss of habitat, disturbance and displacement.

99. This Appropriate Assessment screening exercise considers sites which meet the following criteria:

- Primary screening: the MDZ area (and offshore development zone) directly overlaps a site whose interest features includes an Annex II migratory fish species; and
- Secondary screening: the likelihood that a migratory route occurs overlaps with the MDZ area.

100. **Table 5-1** presents details of the migratory fish species and associated SACs included in Stage 1 (Screening) of the HRA. A figure of the location of these SACs is presented in **Figure 5-1**.

Table 5-1 Migratory fish species and SACs screened into Stage 1 of the HRA

Species	Sites Screened into Stage 1 of HRA	
	Primary screening	**Secondary screening**
Atlantic salmon	None	Afon Gwyrfai a Llyn Cwellyn* Afon Teifi/River Teifi* River Bladnoch* River Dee and Bala Lake/ Afon Dyfrdwy a Llyn Tegid* River Derwent and Bassenthwaite Lake* River Eden* River Usk/ Afon Wysg* River Wye/ Afon Gwy* Afon Eden - Cors Goch Trawsfynydd** Endrick Water** River Camel** River Ehen**
Twaite shad	None	River Usk/ Afon Wysg* River Wye/ Afon Gwy* Afon Tywi/ River Tywi* Carmarthen Bay and Estuaries/ Bae Caerfyrddin ac Aberoedd* Severn Estuary/ Môr Hafren* Pembrokeshire Marine/ Sir Benfro Forol**
Allis shad	None	Afon Tywi/ River Tywi** Carmarthen Bay and Estuaries/ Bae Caerfyrddin ac Aberoedd** Pembrokeshire Marine/ Sir Benfro Forol** River Usk/ Afon Wysg** River Wye/ Afon Gwy**
Sea lamprey	None	River Derwent and Bassenthwaite Lake* River Eden* River Usk/ Afon Wysg* River Wye/ Afon Gwy* Severn Estuary/ Môr Hafren* Solway Firth* Afon Tywi/ River Tywi** Carmarthen Bay and Estuaries/ Bae Caerfyrddin ac Aberoedd** Pembrokeshire Marine/ Sir Benfro Forol** Afonydd Cleddau/ Cleddau Rivers** Cardigan Bay/ Bae Ceredigion** Dee Estuary/ Aber Dyfrdwy** Afon Teifi/River Teifi** River Dee and Bala Lake/ Afon Dyfrdwy a Llyn Tegid**
River lamprey	None	Afon Teifi/River Teifi*

Species	Sites Screened into Stage 1 of HRA	
	Primary screening	Secondary screening
		Endrick Water* River Derwent and Bassenthwaite Lake* River Eden* River Usk/ Afon Wysg* River Wye/ Afon Gwy* River Teith* Solway Firth* Afonydd Cleddau/ Cleddau Rivers* Severn Estuary/ Môr Hafren* River Dee and Bala Lake/ Afon Dyfrdwy a Llyn Tegid** Afon Tywi/ River Tywi** Carmarthen Bay and Estuaries/ Bae Caerfyrddin ac Aberoedd** Pembrokeshire Marine/ Sir Benfro Forol** Cardigan Bay/ Bae Ceredigion** Dee Estuary/ Aber Dyfrdwy**
* = primary feature, ** = qualifying feature		

101. Reference to **Table 5-1** shows that there are no direct spatial overlaps of any impact pathways with any of the SACs with designated Annex II migratory fish species. Therefore, these impact pathways of effects at the SACs are screened out of the Stage 1 Screening process.

102. Only effect pathways associated with the passage of designated populations of Annex II migratory fish through the MDZ are considered as part of the Stage 1 Screening process.

103. The Habitats Directive is given effect in the UK largely through the Conservation of Habitats and Species Regulations (2017) (Habitats Regulation). Regulation 37 of the Habitats Regulations requires the UK statutory bodies to advise the relevant authorities on the conservation objectives and advice on operations for each European site.

104. An example of the conservation objectives, specifically for river lamprey in the Severn Estuary/ Môr Hafren, has been listed below as an indication of objectives for a typical site:

105. “The conservation objective for the river lamprey Lampetra fluviatilis feature of the Severn Estuary SAC is to maintain the feature in a favourable condition, as defined below:

106. The feature will be considered to be in favourable condition when, subject to natural processes, each of the following conditions are met:

- i. the migratory passage of both adult and juvenile river lamprey through the Severn Estuary between the Bristol Channel and any of their spawning rivers is not obstructed or impeded by physical barriers, changes in flows, or poor water quality;
- ii the size of the river lamprey population in the Severn Estuary and the rivers which drain into it, is at least maintained and is at a level that is sustainable in the long term;
- iii. the abundance of prey species forming the river lamprey’s food resource within the estuary, is maintained.

- iv. Toxic contaminants in the water column and sediment are below levels which would pose a risk to the ecological objectives described above."

107. The above conservation objectives will be used as the basis of identifying potential LSE within this screening exercise.

108. An example of Advice on Operations for migratory fish features, specifically here shad and lamprey features of the Severn Estuary / Môr Hafren SAC, is given as an example of advice on typical sites.

109. Migratory fish species are considered sensitive to: physical damage of their supporting habitats; non-physical disturbance; toxic contamination; non-toxic contamination; and biological disturbance. These result from a range of activities known to occur within the SAC and are expanded within the advice section.

110. Migratory fish and their supporting habitats are moderately to highly exposed to: noise; toxic contamination (introduction of synthetic & non-synthetic compounds); changes in nutrient loading; changes in thermal regime; changes in turbidity; changes in salinity; changes in oxygenation; and introduction of microbial pathogens.

111. The values of sensitivity and exposure are combined to create a vulnerability score. Any category of operation to which the feature has a moderate-high or unknown vulnerability should be assessed.

5.2. SITE SPECIFIC SURVEYS

112. Two years of baseline seabird and marine mammal surveys of the MDZ were undertaken between November 2016 and October 2018. This comprised of 24 surveys which provided coverage of all ecological seasons.

113. Surveys were undertaken by means of boat-based visual surveys, using a transect method. Thirteen parallel transects were followed on all surveys, covering the MDZ plus a 2 km buffer. The survey methodology was based on published guidance (Camphuysen *et al*., 2004).

114. Full details of the survey programme, the data collected, and the calculation of density estimates from this data, are available in **Appendix 11.1** (**Volume III** of the ES).

115. Marine mammal data for the Morlais site has also been collected by SEACAMS boat surveys (visual and acoustic data) during 18 boat surveys from January 2015 to December 2016 (**Appendix 11.2, Volume III** of the ES).

116. Initial onshore ecology field surveys were undertaken in April/early May 2018. A more detailed Extended Phase 1 Habitat Survey (EP1HS) was carried out between September and November 2018, when full survey access had been arranged (**Appendix 19.1, Volume III** of the ES).

5.2.1. Summary of Seabird Data

117. In total, 34 species of bird were recorded within the survey area during the boat-based surveys, of which 16 were seabirds recorded on the sea and in flight. These were Arctic tern (Sterna

paradisaea), Atlantic puffin (*Fratercula arctica*) ("puffin"), black-headed gull (*Chroicocephalus ridibundus*), black-legged kittiwake (*Rissa tridactyla*) ("kittiwake"), common gull (*Larus canus*), common tern (*Sterna hirundo*), great black-backed gull (*Larus marinus*), common guillemot (*Uria aalge*) ("guillemot"), herring gull (*Larus argentatus*), lesser black-backed gull (*Larus fuscus*), Manx shearwater (*Puffinus puffinus*), northern fulmar (*Fulmarus glacialis*) ("fulmar"), northern gannet (*Morus bassanus*) ("gannet"), razorbill (*Alca torda*), red-throated diver (*Gavia stellata*) and shag (*Phalacrocorax aristotelis*). In addition, one seaduck species was recorded on the sea and in flight; eider (*Somateria mollissima*). All of these species are considered for inclusion in Stage 1 (Screening) of the HRA.

118. There were a further five species of seabird recorded in flight only that are considered for inclusion in Stage 1 of the HRA. These are cormorant (*Phalacrocorax carbo*), Mediterranean gull (*Larus melanocephalus*), great skua (*Stercorarius skua*), sooty shearwater (*Puffinus griseus*) and Sandwich tern (*Thalasseus sandvicensis*), along with a single species of seaduck; common scoter (*Melanitta nigra*).

119. There are 17 bird species recorded during the boat-based surveys that have not been included in Stage 1 of the HRA by virtue of the fact that they were recorded in flight only, irregularly, and are not species that would be routinely expected to utilise the subtidal habitat within the MDZ and/or in the course of their normal behaviour. These are seven species of passerine (house martin (*Delichon urbicum*), meadow pipit (*Anthus pratensis*), pied wagtail (*Motacilla alba*), redwing (*Turdus iliacus*), starling (*Sturnus vulgaris*), swallow (*Hirundo rustica*) and sand martin (*Riparia riparia*), one species of swan (whooper swan (*Cygnus cygnus*)), one species of raptor (peregrine (*Falcus peregrinus*)) and two species of wader (dunlin (*Calidris alpina*) and whimbrel (*Numenius phaeopus*)).

120. **Table 5-2** presents the bird species and associated SPAs and/or Biologically Defined Minimum Population Scale (BDMPS) included in Stage 1 of the HRA by virtue of the birds recorded either being members of colonies that are designated as SPAs, or not. **Chapter 11, Marine Ornithology** (**Volume I** of the ES) contains detailed justification and evidence supporting the selection of species included in Stage 1 of the HRA.

Table 5-2 Birds species and SPAs/relevant BDMPS populations screened into Stage 1 of HRA

Species	Sites Screened into Stage 1 of HRA (breeding season)	Populations Screened into Stage 1 of HRA (non-breeding season)
Arctic tern	Anglesey Terns SPA	None
Black-headed gull	None	None
Common gull	None	None
Common scoter	None	None
Common tern	Anglesey Terns SPA	None
Cormorant	None	None
Eider	None	None
Fulmar	Lambay Island SPA, Saltee Islands SPA	UK Western Waters and Channel BDMPS
Great black-backed gull	None	None
Guillemot	Lambay Island SPA, Ireland's Eye SPA	UK Western Waters BDMPS

Species	Sites Screened into Stage 1 of HRA (breeding season)	Populations Screened into Stage 1 of HRA (non-breeding season)
Gannet	Grassholm SPA, Ailsa Craig SPA, Great Saltee Island SPA	UK Western Waters BDMPS
Great skua	None	None
Herring gull	None	None
Kittiwake	Lambay Island SPA, Ireland's Eye SPA, Howth Head Coast SPA	UK Western Waters plus Channel BDMPS
Lesser black-backed gull	Lambay Island SPA, Morecambe Bay and Duddon Estuary SPA, Ribble and Alt Estuaries SPA	None
Manx shearwater	Skomer, Skokholm and the Seas off Pembrokeshire SPA, Aberdaron Coast and Bardsey Island SPA, Copeland Islands SPA	None
Mediterranean gull	None	None
Puffin	Lambay Island SPA	UK Western Waters BDMPS
Razorbill	None	UK Western Waters BDMPS
Red-throated diver	None	None
Sandwich tern	Anglesey Terns SPA	None
Shag	None	None
Sooty shearwater	None	None

5.2.1.1. Auks

5.2.1.1.1. Records in MDZ and 2 km Buffer

121. Records of guillemot, razorbill and puffin were made during boat-based surveys carried out during the breeding and non-breeding seasons. The breeding and non-breeding seasons for guillemot are March to July and August to February (Furness, 2015). For razorbill, the breeding and non-breeding seasons are April to July and August to March (Furness, 2015). The breeding and non-breeding seasons for puffin are April to early August and mid-August to March (Furness, 2015).

5.2.1.1.2. Breeding Season

122. During the breeding season, the best available evidence concerning the at-sea distributions of guillemot and razorbill indicates that the overwhelming majority of birds present in the MDZ are likely to originate from colonies located at South Stack (Cleasby *et al*., 2018; Wakefield *et al*., 2017). This has been confirmed by the theoretical method of apportioning (SNH, 2018). Whilst this colony lies within the Holy Island Coast SPA, neither guillemot or razorbill are qualifying features.

123. Based on the mean maximum foraging ranges of 84.2 km for guillemot and 48.5 km for razorbill (Thaxter *et al*., 2012), there are two SPAs for guillemot which are within foraging range of the MDZ (Lambay Island SPA and Ireland's Eye SPA, which are located on the east coast of Ireland approximately 80 km from the MDZ), and none for razorbill. The mean maximum foraging distance of 105.4 km for puffin (Thaxter *et al*., 2012), means that birds from the Lambay Island SPA are within foraging range of the MDZ.

5.2.1.1.3. Non-breeding Season

124. During the non-breeding season, guillemots exhibit behaviour that is dispersive rather than migratory (Wernham *et al*., 2002). A proportion of guillemots present in the MDZ during the non-breeding season will therefore originate from colonies located at South Stack; birds are sometimes recorded on breeding ledges in winter (Jones and Whalley, 2004). The remainder of birds present during the non-breeding season will consist of birds from the UK Western Waters BDMPS (Furness, 2015). This population originates from a mixture of colonies, of which approximately 97% are UK-based birds, which move generally south in autumn from colonies on the west coast of northern Britain, and a reverse direction in spring (Furness, 2015). The UK Western Waters BDMPS consists of 1,139,220 birds originating from approximately 26 SPAs. Approximately 76% of the population are from SPAs where guillemot is a qualifying feature.

125. Fledged young and adult razorbills are likely to be found at-sea close to their colonies until around September, whilst other immature birds may leave earlier (Wernham *et al*., 2002). Movements are generally in a southerly direction, with spring migration occurring in the reverse direction (Furness, 2015). The birds present in the MDZ during the migration and non-breeding seasons will consist of birds from the UK Western Waters BDMPS, though like guillemot, some individuals that breed in the local area may sometimes be resident (Jones and Whalley, 2004). In the migration season the UK Western Waters BDMPS population consists of 606,914 birds, the majority of which originate either from three countries, Iceland, Norway and Russia that are not within the Natura 2000 network (approximately 66%), or non-SPA colonies in the UK (approximately 5%). The non-breeding season population consists of 341,222 birds, of which approximately 81% of birds are from colonies in countries outside the Natura 2000 network or from non-SPA colonies within the UK (2%).

126. Puffins leave UK colonies and the areas around them by approximately late August (Harris and Wanless, 2011; Wernham *et al*., 2002), and appear to migrate rapidly away from breeding areas, when they disperse over very large areas of sea at low densities (Furness, 2015). The birds present in the MDZ during the non-breeding season will largely consist of birds from the UK Western Waters BDMPS. This population consists of 304,577 birds, of which approximately 92% are thought to originate from SPAs for which puffin is a designated feature.

5.2.1.1.4. Conclusion

127. On the basis that small numbers of guillemot from the Lambay Island SPA and Ireland's Eye SPA, and small numbers of puffin from the Lambay Island SPA could be present in the MDZ during the breeding season, these sites are included in Stage 1 of the HRA for these species (see **Section 6**). No SPAs for breeding razorbill are included, as the mean maximum foraging range for this species suggests that no birds from SPAs designated for this species will be present in the MDZ. The UK Western Waters BDMPS for all three of the auk species will be included in Stage 1 of the HRA.

5.2.1.1.5. Relevant Species Densities by Season

128. The relevant on-sea and in-flight densities for Guillemot, Razorbill and Puffin from baseline surveys in the breeding and non-breeding season where relevant, are presented in **Table 5-3**.

Table 5-3 Relevant Densities for Guillemot, Razorbill and Puffin for HRA Screening

Species (season)	MDZ birds per km^2		2km Buffer from MDZ birds per km^2	
	On-sea Density	**In-flight Density**	**On-sea Density**	**In-flight Density**
Guillemot (breeding)	15.385 (90% Confidence Interval (CI) 7.876 to 22.893)	8.733 (90% CI 6.230 to 11.235)	8.834 (90% CI 4.742 to 12.926)	5.264 (90% CI 4.034 to 6.494)
Guillemot (non-breeding)	3.506 (90% CI 2.400 to 4.611)	2.144 (90% CI 1.002 to 3.226)	4.188 (90% CI 2.521 to 5.855)	1.947 (90% CI 0.684 to 3.210)
Razorbill (non-breeding)	1.584 (90% CI 0.547 to 2.621)	0.625 (90% CI 0.362 to 0.887)	1.320 (90% CI 0.327 to 2.313)	0.313 (90% CI 0.148 to 0.477)
Puffin (breeding)	0.074 (90% CI 0.011 to 0.136)	8.733 (90% CI 6.230 to 11.235)	0.112 (90% CI 0.044 to 0.180)	5.264 (90% CI 4.034 to 6.494)
Puffin (non-breeding)	0	0.007 (90% CI -0.004 to 0.018)	0.006 (90% CI -0.004 to 0.015)	0

5.2.1.2. Cormorant and Shag

5.2.1.2.1. Records in MDZ and 2 km Buffer

129. Cormorant was recorded during the boat-based surveys in the breeding season, defined as April to August, and the non-breeding season, defined as and September to March (Furness, 2015). Shag was recorded during the boat-based surveys in the breeding season, defined as February to August, and the non-breeding season, defined as September to January (Furness, 2015).

5.2.1.2.2. Breeding Season

130. The nearest SPA for which cormorant is a designated species is the Puffin Island SPA (Stroud *et al*., 2016), located approximately 60 km from the centroid of the MDZ, by the most direct at-sea route. The mean maximum foraging distance for cormorant is 25 km (Thaxter *et al*., 2012).

131. There are no breeding SPAs for shag in Wales (Stroud *et al*., 2016). Shag is known to have a short mean maximum foraging distance (14.5 km) (Thaxter *et al*., 2012), supported by more recent similar work (Oppel *et al*., 2018), and modelled at-sea distributions for this species (Cleasby *et al*., 2018; Wakefield *et al*., 2017). Ringed birds at Puffin Island have been recaptured 15 years after ringing on several occasions (Jones and Whalley, 2004).

5.2.1.2.3. Non-breeding Season

132. Most cormorants that breed at coastal colonies in Great Britain spend the non-breeding season near to their breeding sites (Wernham *et al*., 2002), though no substantial aggregations of birds have been reported around Anglesey during the non-breeding season (Jones and Whalley,

2004). Relative to birds in other locations, cormorants from Wales are most likely to winter inland, predominantly moving to freshwater sites in England (Furness, 2015).

133. During the non-breeding season, shags are also relatively sedentary, particularly in the west of the UK (Furness, 2015). Whilst the SW England and Wales BDMPS does contain birds originating from the Isles of Scilly SPA (Furness, 2015), this SPA is located >350 km from the MDZ.

5.2.1.2.4. Conclusion

134. It is concluded that all cormorants and shags recorded in the MDZ throughout the year originate from local colonies that are not designated as SPAs for either cormorant or shag. These species are therefore not included in Stage 1 of the HRA.

5.2.1.3. Fulmar

5.2.1.3.1. Records in MDZ and 2 km Buffer

135. Fulmar was recorded during the boat-based surveys in the breeding season, defined as January to August, and the non-breeding season, defined as and September to December (Furness, 2015).

5.2.1.3.2. Breeding Season

136. Breeding fulmars attend nest sites from early winter through to chick fledging in August-September and can travel hundreds of kilometres during foraging trips while breeding. The mean maximum foraging distance for fulmar is 400 km (Thaxter *et al*., 2012), whilst a more recent study suggested a median maximum distance from the colony of 135 km during chick rearing foraging trips (Oppel *et al*., 2018).

137. Several SPAs for which this species is a qualifying species occur with the mean maximum foraging range; Saltee Islands SPA and Lambay Island SPA in Ireland. However, in the local area fulmar is a widespread breeding species which is not confined to large colonies (Jones and Whalley, 2004).

5.2.1.3.3. Non-breeding Season

138. The general pattern of movement for this species during the non-breeding season indicates that birds breeding at colonies on the west coast of Great Britain move predominantly in a westerly direction out to sea at the end of the breeding season (Furness, 2015). During both the migration and non-breeding periods, approximately half of the UK Western Waters and Channel BDMPS are birds originating from >20 SPAs (Furness, 2015). This population consists of >500,000 birds during the non-breeding season and >800,000 birds during the migration seasons.

5.2.1.3.4. Conclusion

139. The Lambay Island SPA and Saltee Islands SPA are included in Stage 1 of the HRA for fulmar during the breeding season (see **Section 6**). On a precautionary basis, the non-breeding UK

Western Waters and Channel BDMPS population of fulmar is also included in Stage 1 of the HRA.

5.2.1.3.5. Densities by Season

140. The relevant on-sea and in-flight densities for Fulmar from baseline surveys in the breeding and non-breeding season, are presented in **Table 5-4**.

Table 5-4 Relevant Densities for Fulmar for HRA Screening

Species (season)	MDZ birds per km^2		2km Buffer from MDZ birds per km^2	
	On-sea Density	**In-flight Density**	**On-sea Density**	**In-flight Density**
Fulmar (breeding)	0.035 (90% CI 0.013 to 0.057)	0.064 (90% CI 0.029 to 0.098)	0.010 (90% CI 0.003 to 0.018)	0.076 (90% CI 0.045 to 0.107)
Fulmar (non-breeding)	0	0.034 (90% CI 0.013 to 0.054)	0	0.032 (90% CI 0.008 to 0.057)

5.2.1.4. Gannet

5.2.1.4.1. Records in MDZ and 2 km Buffer

141. Gannet was recorded during the boat-based surveys in the breeding season, defined as March to September, and the non-breeding season, defined as October to February (Furness, 2015).

5.2.1.4.2. Breeding Season

142. A wide-ranging seabird during the breeding season, the mean maximum foraging range for gannet is 229.4 km (Thaxter *et al*., 2012), with a median maximum distance from the colony during foraging in the chick-rearing period of 154 km (Oppel *et al*., 2018). Within the mean maximum foraging distance of the MDZ, there are three SPAs for which gannet is a breeding qualifying feature: Grassholm SPA, Great Saltee Island SPA and Ailsa Craig SPA.

5.2.1.4.3. Non-breeding Season

143. Gannets leave their colonies between August and October. Upon leaving the colony chicks are flightless and migrate by swimming initially (Wernham *et al*., 2002), though are thought to be able to fly quite soon after leaving colonies (Wanless and Okill, 1994). Adults may move to areas with abundant food in late summer before moving towards their wintering area (Furness, 2015). General known patterns of movement suggest that birds travel south from their colonies following the breeding season, making the return journey in the spring (Furness, 2015). The birds present in the MDZ during the non-breeding season will largely consist of birds from the UK Western Waters BDMPS. This population consists of >500,000 birds, of which >90% originate from SPAs (Furness, 2015).

5.2.1.4.4. Conclusion

144. The Grassholm SPA, Ailsa Craig SPA, and Great Saltee Island SPA are included in Stage 1 of the HRA for breeding gannet, which does not breed in the local area (Jones and Whalley, 2004).

The UK Western Waters BDMPS for gannet will also be included in Stage 1 of the HRA for birds present during the non-breeding season (see **Section 6**).

5.2.1.4.5. Densities by Season

145. The relevant on-sea and in-flight densities for gannet from baseline surveys in the breeding and non-breeding season, are presented in **Table 5-5.**

Table 5-5 Relevant Densities for Gannet for HRA Screening

Species (season)	MDZ birds per km^2		2km Buffer from MDZ birds per km^2	
	On-sea Density	In-flight Density	On-sea Density	In-flight Density
Gannet (breeding)	0.019 (90% CI -0.004 to 0.042)	0.234 (90% CI 0.162 to 0.306)	0.048 (90% CI 0.008 to 0.087)	0.224 (90% CI 0.151 to 0.296)
Gannet (non-breeding)	0	0.071 (90% CI -0.015 to 0.157)	0	0.056 (90% CI 0.006 to 0.106)

5.2.1.5. Great skua

5.2.1.5.1. Records in MDZ and 2 km Buffer

146. A single great skua was recorded during the boat-based surveys in the breeding season, defined as May to August (Furness, 2015). This occurred on 18/05/2018.

147. A comparison of published foraging range of great skua (86.4 km) (Thaxter *et al*., 2012) and the nearest SPA for which this species is a qualifying feature is located in excess of 500 km from the MDZ (Stroud *et al*., 2016). Based on the observation data, and previous reports of great skua in the Anglesey area (Jones and Whalley, 2004) it is assumed that this bird was a passage migrant.

5.2.1.5.2. Conclusion

148. As it is assumed the single record was a passage migrant, great skua is not included in Stage 1 of the HRA.

5.2.1.6. Gulls

5.2.1.6.1. Records in MDZ and 2 km Buffer

149. Seven species of gull were recorded in the MDZ and buffer zone during the boat-based surveys.

150. Records of black-headed gull, common gull, great black-backed gull, herring gull, kittiwake, lesser black-backed gull and Mediterranean gull were made during the breeding and non-breeding seasons. The breeding and non-breeding seasons for black-headed gull, common gull and lesser black-backed gull are April to August and September to March (Furness, 2015). For great black-backed gull, the breeding and non-breeding seasons are late March to August and September to mid-March April to July and August to March (Furness, 2015). The breeding and non-breeding seasons for kittiwake are March to August and September to February (Furness,

2015). The breeding season for Mediterranean gull in the UK is assumed to be April to August, with the non-breeding season presumed to occur between September to March.

5.2.1.6.2. Breeding Season

151. **Table 5-6** compares the mean maximum foraging distances (Thaxter *et al*., 2012), for seven species of gull present in the MDZ during the breeding season to the distance between the centroid of the MDZ and the nearest SPA for which the species is a named qualifying feature during the breeding season. For five of these species (black-headed gull, common gull, great black-backed gull, herring gull and Mediterranean gull), individuals recorded in the MDZ during the breeding season are likely to originate from breeding sites which are not SPAs containing these species as a designated feature.

152. There are no SPAs in the UK for which black-headed gull is a named breeding qualifying feature, though it does occur as an assemblage feature at several locations (Stroud *et al*., 2016). The nearest from the MDZ centroid is >100 km to the east (Ribble and Alt Estuaries SPA).

Table 5-6 Comparison of breeding gull foraging ranges and approximate distances between MDZ and nearest breeding SPAs

Species	Foraging Range km (Thaxter *et al.*, (2012) Mean Maximum unless otherwise stated)	Nearest Breeding SPA and Approximate Distance by Sea to MDZ km
Black-headed gull	25.5	No UK SPAs where species named as a qualifying feature
Common gull	50	>450 (Tips of Corsemaul and Tom Mor)
Great black-backed gull	<40 (mean) (Langston, 2010)	>350 (Isles of Scilly)
Herring gull	61.1	>100 (Morecambe Bay)
Kittiwake	60	>80 (Howth Head Coast, Ireland's Eye, Lambay Island)
Lesser black-backed gull	141	>80 (Lambay Island)
Mediterranean gull	Unknown	>700 (Poole Harbour)

153. There are no SPAs for which breeding kittiwake is a qualifying species within the mean maximum foraging range (Thaxter *et al*., 2012) of the MDZ for this species. However, there are three SPAs for which breeding kittiwake is a named qualifying species between 80-90 km from the centroid of the MDZ on the eastern coast of Ireland: Howth Head Coast SPA, Ireland's Eye SPA and Lambay Island SPA.

154. There are several SPAs within the mean maximum foraging range of lesser black-backed gull (Thaxter *et al*., 2012) to the MDZ for which it is a qualifying feature during the breeding season. These are Lambay Island SPA, Morecambe Bay and Duddon Estuary SPA and Ribble and Alt Estuaries SPA located in northwest England. A third SPA in northwest England, Bowland Fells SPA, is located just outside the mean maximum foraging range, but tracking data indicates that it is unlikely that birds from this site will occur at the MDZ (Clewley *et al*., 2017). It should also be noted that lesser black-backed gull is widespread breeding species that can be seen throughout Anglesey during the breeding season (Jones and Whalley, 2004).

5.2.1.6.3. Non-breeding Season

155. Whilst there is extensive migration from mainland Europe to Great Britain during the non-breeding season (Banks *et al*., 2007), there are no wintering SPAs for black-headed gull species within the UK

156. There are no SPAs for non-breeding common gull in England and Wales, and whilst birds are known to occur throughout England and Wales, they generally do so at low density (Stroud et al., 2016).

157. During the non-breeding season, adult great black-backed gulls are largely sedentary, or may travel short distances from their breeding sites (Furness, 2015). Immature birds may disperse slightly further than adults. The median distance between colony and wintering area has been estimated to be 54 km for adults but 115 km for immatures ringed in Britain and Ireland (Wernham *et al*., 2002). Whilst the UK South-west and Channel Waters BDMPS does contain birds originating from the Isles of Scilly SPA (Furness, 2015), it is implausible that birds from this SPA would occur in the MDZ during the non-breeding season as this SPA is located >350 km from the MDZ.

158. Herring gulls in Britain and Ireland show only limited dispersal during the non-breeding season (Furness, 2015). Young birds move further than adults, but the median distance between ringing site and recovery site for all UK ringed herring gulls was only around 15 km (Wernham *et al*., 2002). The nearest breeding SPA for herring gull is located >100 km from the MDZ.

159. During the autumn migration, immature and juvenile kittiwakes travel either west across the Atlantic Ocean or south (Wernham *et al*., 2002). Adults depart from colonies in late July or early August (Furness, 2015). Further south, this may occur later and substantial variation in the timing of migration between colonies has been noted (Frederiksen *et al*., 2012). Kittiwakes in winter may be distributed all across the North Atlantic and North Sea (Coulson, 2011), with birds from western parts of the UK apparently favouring areas on the eastern side of the Atlantic (Frederiksen *et al*., 2012). In spring, young birds may move north, with birds on the west side of the Atlantic visiting seas around Greenland, and birds on the east side possibly moving north but not as far as their breeding colony (Coulson, 2011; Furness, 2015). Between August and December, data from Furness (2015) suggests that approximately 40% of kittiwakes present at the MDZ are likely to originate from a combination of >30 SPAs. Between January to April, this increases to 47% (Furness, 2015).

160. A single flying lesser black-backed gull was recorded in the non-breeding season during two years of surveys. For this reason, it will not be considered further for inclusion in Stage 1 of the HRA.

161. There is a modest population of non-breeding Mediterranean gull present in north Wales (Frost *et al*., 2018). In the UK, the highest numbers of this species occur in southern England, and closer to the MDZ, in southern Wales (Frost *et al*., 2018; Musgrove *et al*., 2011). It is not clear whether the birds present around the Anglesey area are resident, however; based on the distance between the MDZ and the nearest breeding SPA (**Table 5-6**), it is considered highly unlikely that birds originating from an SPA could be present.

5.2.1.6.4. Conclusion

162. On the precautionary basis that small numbers of kittiwake from the Howth Head Coast SPA, Ireland's Eye SPA and Lambay Island SPA could be present in the MDZ during the breeding season, these sites are included in Stage 1 of the HRA for this species (see **Section 6** below). The UK Western Waters plus Channel BDMPS for kittiwake will also be included in Stage 1 of the HRA. Several SPAs for lesser black-backed gull will also be included in Stage of 1 of the HRA (see **Section 6** below). These are Lambay Island SPA, Morecambe Bay and Duddon Estuary SPA and Ribble and Alt Estuaries SPA.

5.2.1.6.5. Densities by Season

163. The relevant on-sea and in-flight densities for kittiwake and lesser black-backed gull from baseline surveys in the breeding and non-breeding season where relevant, are presented in **Table 5-7.**

Table 5-7 Relevant Densities for Kittiwake and Lesser black-backed gulls for HRA Screening

Species (season)	MDZ birds per km^2		2km Buffer from MDZ birds per km^2	
	On-sea Density	In-flight Density	On-sea Density	In-flight Density
Kittiwake (breeding)	0.510 (90% CI -0.263 to 1.283)	0.432 (90% CI 0.240 to 0.623)	0.500 (90% CI 0.072 to 0.928)	of 0.273 (90% CI 0.102 to 0.443)
Kittiwake (non-breeding	0.067 (90% CI -0.043 to 0.177)	0.478 (90% CI 0.057 to 0.899)	0.007 (90% CI -0.004 to 0.018)	0.332 (90% CI -0.112 to 0.776)
Lesser black-backed gull (breeding)	0.156 (90% CI -0.025 to 0.337)	0.120 (90% CI 0.026 to 0.213)	0.066 (90% CI -0.031 to 0.164)	0.062 (90% CI 0.006 to 0.117)

5.2.1.7. Manx shearwater

5.2.1.7.1. Records in MDZ and 2 km Buffer

164. Manx shearwater was recorded during the boat-based surveys predominantly in the breeding season, defined as April to August (Furness, 2015). Five records of individual birds in flight were made during boat-based surveys conducted outside the breeding season.

5.2.1.7.2. Breeding Season

165. Manx shearwater are capable of foraging over large distances, with a mean maximum foraging range of 330 km (Thaxter *et al*., 2012). The use of the theoretical method for apportioning seabirds (SNH, 2018) indicates that 55.88%, 41.56%, and 1.34% of Manx shearwater present in the MDZ during the breeding season may originate from the Skomer, Skokholm and the Seas off Pembrokeshire SPA, Aberdaron Coast and Bardsey Island SPA and Copeland Islands SPA respectively.

5.2.1.7.3. Conclusion

166. On this basis, the three SPAs named above will all be included in Stage 1 of the HRA (see **Section 6**). Also considered in Stage 1 of the HRA is the Irish Front SPA; which is an important feeding area for Manx shearwater during the breeding season but does not contain a breeding colony. As Manx shearwater were only recorded in the MDZ and buffer zone very infrequently (a total of five occasions) outside of the breeding season, and only as single birds in flight, non-breeding birds are not considered further in this assessment.

5.2.1.7.4. Densities by Season

167. The relevant on-sea and in-flight densities for Manx shearwater from baseline surveys in the breeding season, are presented in **Table 5-8**.

Table 5-8 Relevant Densities for Manx shearwater for HRA Screening

Species (season)	MDZ birds per km^2		2km Buffer from MDZ birds per km^2	
	On-sea Density	In-flight Density	On-sea Density	In-flight Density
Manx shearwater (breeding)	1.928 (90% CI -0.648 to 4.503)	2.201 (90% CI 0.534 to 3.868)	2.890 (90% CI -0.690 to 6.469)	2.095 (90% CI 0.191 to 3.998)

5.2.1.8. Red-throated diver

5.2.1.8.1. Records in MDZ and 2 km Buffer

168. Red-throated diver was recorded during the boat-based surveys in the breeding season, defined as March to August, and the non-breeding season. This is split into post-breeding migration (September to November), migration free winter season (December to January) and return migration (February to April) (Furness, 2015).

5.2.1.8.2. Breeding Season

169. In the UK, the breeding range of the red-throated diver is restricted to the north and west of Scotland (O'Brien *et al*., 2010). As a result, the small number of records made during boat-based surveys within the breeding season between March and May are considered to be either non-breeding birds or late migrants.

5.2.1.8.3. Non-breeding Season

170. Non-breeding red-throated diver is designated as a qualifying feature of the Northern Cardigan Bay SPA, the nearest boundary of which is located approximately 45 km to the south from the centroid of the MDZ, and the Liverpool Bay SPA, the nearest boundary of which is located approximately 35 km to the east from the centroid of the MDZ. Both SPAs are designated for concentrations of red-throated diver. The boundaries for the SPAs were defined following kernel density estimation and maximum curvature analysis (Natural England and Countryside Council for Wales, 2010; NRW, 2015a). As such, the SPA boundaries represent a defined and justifiable cut-off point for their respective populations.

5.2.1.8.4. Conclusion

171. As the SPA boundaries also represent a defined population boundary, red-throated diver is not included in Stage 1 of the HRA.

5.2.1.9. Seaducks

5.2.1.9.1. Records in MDZ and 2 km Buffer

172. Common scoter was recorded during the boat-based surveys in the breeding season and the non-breeding season, and is a species that can be seen around most of the Anglesey coast in most winter months (Jones and Whalley, 2004). As it is known that common scoter breeding is restricted to a handful of areas in Scotland in the UK (Stroud *et al*., 2016), it is considered that all birds recorded during the boat-based surveys were non-breeding birds. Birds that can be found in wintering areas during the breeding season are either immature birds or non-breeders (Natural England and Countryside Council for Wales, 2010).

173. Non-breeding common scoter is designated as a qualifying feature of the Liverpool Bay SPA, the nearest boundary of which is located approximately 35 km to the east from the centroid of the MDZ. The SPA boundary was defined following kernel density estimation and maximum curvature analysis (Natural England and Countryside Council for Wales, 2010). As such, the SPA boundary represents a defined and justifiable cut-off point for the SPA population.

174. Eider was recorded during the boat-based surveys on a single date; 15/10/2018.

175. The only date on which a record of a single sooty shearwater was made during boat-based surveys was 30/08/2018. Two records were made within an hour and a quarter of each other. It is considered likely that the records are the same bird.

5.2.1.9.2. Conclusion

176. As the SPA boundaries also represent a population boundary common scoter is not included in Stage 1 of the HRA. As a result of the single record, eider is not included in Stage 1 of the HRA. Due to the isolated nature of this species occurring during the surveys, and the lack of breeding SPAs in the UK (Stroud *et al*., 2016), sooty shearwater is also excluded from Stage 1 of the HRA.

5.2.1.10. Terns

5.2.1.10.1. Records in MDZ and 2 km Buffer

177. Three species of tern were recorded during the boat-based surveys; Arctic tern, common tern and Sandwich tern. All records of these species were made during the breeding season, which is defined as May to August for Arctic tern and common tern, and April to August for Sandwich tern (Furness, 2015).

178. The mean maximum foraging ranges for these species (Thaxter *et al*., 2012) are 24.2 km for Arctic tern, 15.2 km for common tern and 49 km for Sandwich tern. No SPAs for these species are located within these distances from the centroid of the MDZ other than the Anglesey Terns

SPA. The MDZ is located within the boundary of this SPA, which includes foraging areas for terns as well as the colonies themselves (NRW, 2015b).

5.2.1.10.2. Conclusion

179. Arctic tern, common tern and Sandwich tern recorded in the MDZ and buffer zone during the breeding season are assumed to be members of the Anglesey Terns SPA population, which is therefore included in Stage 1 of the HRA (see **Section 6**). As no terns were recorded in the MDZ or buffer zone outside of the breeding season, non-breeding birds are not considered further in this assessment.

5.2.1.10.3. Relevant Species Densities

180. The relevant on-sea and in-flight densities for Arctic, common and Sandwich terns from baseline surveys in the breeding season, are presented in **Table 5-9**.

Table 5-9 Relevant Densities for Terns for HRA Screening

Species (season)	MDZ birds per km^2		2km Buffer from MDZ birds per km^2	
	On-sea Density	In-flight Density	On-sea Density	In-flight Density
Arctic terns (breeding)	0.281 (90% CI -0.151 to 0.714)	0.157 (90% CI -0.066 to 0.380)	0.138 (90% CI -0.072 to 0.348)	0.316 (90% CI 0.033 to 0.599)
Common terns (breeding)	0	of 0.108 (90% CI -0.000 to 0.215)	0.040 (90% CI -0.011 to 0.090)	0.067 (90% CI -0.033 to 0.166)
Sandwich terns (breeding)	0	0.025 (90% CI -0.004 to 0.053)	0	0.024 (90% CI -0.015 to 0.063)

5.2.2. Summary of Marine Mammal Data

181. During 24 monthly surveys, conducted by Natural Power, of the MDZ between November 2016 and October 2018, four species of marine mammal were recorded in the survey area: harbour porpoise, Risso's dolphin[2] *Grampus griseus*, bottlenose dolphin and grey seal.

182. Harbour porpoise was the most frequently sighted marine mammal species and comprised 93% of all marine mammals recorded. This species was recorded in all months of the year, with the highest count being recorded in January 2017. The greatest abundance of harbour porpoise were typically in the north of the survey area. The data suggest that the greatest number of porpoises within the survey area were present mid-tide, as the tide was rising.

183. One group of bottlenose dolphin, consisting of an estimated 12 individuals, were recorded during the February 2018 survey (accounting for less than 1% of the total marine mammal sightings).

[2] Risso's dolphin is not an Annex II species and is therefore not considered further in the shadow HRA, but is included in the EIA and ES.

184. A relatively small number of grey seals were recorded (3% of total sightings) throughout the survey period, with two individuals were present within the Morlais Demonstration Zone. In addition, five unidentified seal species were recorded (1% of the total marine mammal sightings), however, as no harbour seal were identified, it is considered likely that these were also grey seal.

185. During the 18 SEACAMS surveys conducted between January 2015 and December 2016, four species of marine mammal were also recorded in the survey area: harbour porpoise (88% of 142 sightings), bottlenose dolphin (2% of sightings), Risso's dolphin (3% of sightings) and grey seal (7% of sightings).

186. In addition to the site-specific surveys, a range of other relevant data sources and information has been reviewed to provide information on the marine mammal species that could be present in and around the project, this includes, but is not limited to:

- Small Cetaceans in the European Atlantic and North Sea (SCANS-III) data (Hammond *et al*., 2017);
- ObSERVE aerial surveys (Rogan *et al*., 2018);
- Sea Watch Foundation sightings (Sea Watch Foundation, 2019);
- Management Units (MUs) for cetaceans in UK waters (Inter-Agency Marine Mammal Working Group (IAMMWG), 2015);
- The identification of discrete and persistent areas of relatively high harbour porpoise density in the wider UK marine area (Heinänen and Skov, 2015);
- Revised Phase III data analysis of Joint Cetacean Protocol (JCP) data resources (Paxton *et al*., 2016);
- UK seal at sea density estimates and usage maps (Russell *et al*., 2017);
- Special Committee on Seals (SCOS) annual reporting of scientific advice on matters related to the management of seal populations (SCOS, 2017);
- All relevant NRW reports;
- Minesto Deep Green Holyhead Deep Project Environmental Statement and Habitats Regulations Assessment Report;
- Horizon Wylfa Newydd Power Station baseline information, Environmental Statement and information for Habitats Regulations Assessment;
- Atlas of the Marine Mammals of Wales. CCW Monitoring Report No. 68 (Baines and Evans, 2012); and
- UK Offshore Energy Strategic Environmental Assessment. OWESEA3 March 2016 (DECC, 2016).

187. Based on the site-specific surveys and additional data and information, the marine mammal species to be considered in the HRA screening are:

- Harbour porpoise;

- Bottlenose dolphin;
- Grey seal; and
- Harbour seal (although very few sightings in the Morlais area, the potential for connectivity with European Designated Sites will be considered further).

5.2.3. Summary of Onshore Ecology Site-specific Surveys

188. A number of dedicated field surveys were commissioned to characterise the ecology of the Survey Study Area and to ascertain presence of protected or other notable species or habitats. The Survey Study Area was established and surveyed prior to the Onshore Development Area being finalised, when multiple route options were under consideration and therefore encompasses a larger area. The findings of the field surveys informed the decisions made to finalise the Onshore Development Area, avoiding sensitive ecology features (including designated sites, and heath habitat) where possible. Details on the Survey Study Area are provided in **Appendix 19.1 (Volume III** of the ES**)**.

189. The field survey work was carried out over multiple visits between April and November 2018. Initial Phase 1 habitat survey work (not 'extended') was carried out in April and May. This was followed by an Extended Phase 1 Habitat Survey (EP1HS) as the route became more refined and access to the various areas requiring survey was agreed. Methodologies of the relevant surveys are detailed in the following sections.

5.2.3.1. Initial Phase 1 Habitat Survey

190. Principal Ecologist Guy Miller CEcol CIEEM and Ecologist Emily Moore Grad CIEEM undertook the initial field survey over four days in late April/early May 2018 (26-27 April, 30 April-1 May 2018). This was not considered to be an EP1HS.

191. The review of aerial photographs and mapping was used to inform the field survey and identify habitats which required ground truthing.

192. During the survey the proposed onshore cabling routes within the Survey Study Area were driven in a slow-moving car with regular stops to record vegetation in habitats in the adjacent land. Public rights of way (PRoW) were used to obtain vantage points and view adjacent habitats. The habitats were described using the Joint Nature Conservation Committee (JNCC) Phase 1 habitat survey methodology (JNCC, 2010).

193. Habitats within the Survey Study Area were subject to an initial assessment for their suitability for protected species, including otter *Lutra lutra*. Otter are considered further in **Section 6.3.6.**

194. The Survey Study Area was also searched for the presence of invasive non-native plants including, but not limited to, Japanese knotweed *Fallopia japonica*.

5.2.3.2. Extended Phase 1 Habitat Survey (EP1HS)

195. A detailed Extended Phase 1 Habitat Survey (EP1HS) was carried out between September and November 2018, with full access to the survey area. The survey was carried out by Emily Moore, Guy Miller and Sophie Olejnik. The purpose of the survey was to carry out more detailed survey

of vegetation, to confirm the assessment made during the initial Phase 1 Habitat survey where full access was not previously granted, and to carry out survey for evidence of use by protected species.

196. A variety of grassland types was recorded within the onshore ecology survey area. Based on the site-specific surveys and additional data and information, the terrestrial ecology habitats to be considered in the HRA screening are:

- Unimproved grassland - character of maritime grassland, supporting cock's-foot (*Dactylis glomerata)*, Yorkshire fog (*Holcus lanatus)* and red fescue (*Festuca rubra)*, with occasional sorrel (*Rumex acetosa)*, bladder campion (*Silene vulgaris)*, spring squill (*Scilla verna)*, primrose (*Primula vulgaris),* common scurvy grass **(***Cochlearia officinalis),* and wild carrot (*Daucus carota)*;
- Heathland - dominated by heather (*Calluna vulgaris)* and western gorse (*Ulex gallii)* with occasional cross-leaved heath (*Erica tetralix)*, bilberry (*Vaccinium myrtillus),* purple moor-grass, spring squill, and deer grass (*Trichophorum cespitosum)*;
- Heathland / scrub - dominated by gorse, with patches of bracken (*Pteridium aquilinum)* and bramble (*Rubus fruticosus* agg.); and
- Cliff vegetation - diverse vegetation community including thrift (*Armeria maritima)*, primrose, sea beat, sea squill common scurvy grass, bladder campion, kidney vetch (*Anthyllis vulneraria),* buck's-horn plantain (*Plantago coronopus)*, western gorse, and blackthorn (*Prunus spinosa)* scrub.

6. STAGE 1: SCREENING (ALONE)

6.1. INTRODUCTION

197. Stage 1 (Screening) of the HRA for the European Protected Sites under consideration in this assessment is presented in the following sections. These are split into different ecological themes for marine ornithology, marine mammals, migratory fish and terrestrial ecology.

198. Evidence to assist the competent authority in reaching a conclusion on whether this project will have a LSE on European designated sites is detailed within the tables and corresponding footnotes that follow. The evidence itself draws upon the various assessments undertaken to inform the potential impacts of the proposed development.

199. The matrices that are provided below set out whether LSE is considered likely and are based upon an approach set out within the Planning Inspectorate's Advice Note 10 on Habitats Regulations Assessment[3] relating to Nationally Significant Infrastructure Projects (NSIP). Although this project is not an NSIP, the matrix approach used for such developments is

[3] The Planning Inspectorate (2017). Advice Note 10: Habitats Regulations Assessment relevant to nationally significant infrastructure projects. Version 8. November 2017

considered to be a convenient and helpful way in which information can be drawn together and conclusions presented.

200. The key for reading the matrices is as follows:

- ✓ = A likely significant effect cannot be excluded
- X = A likely significant effect can be excluded
- C = Construction
- O = Operation
- D = Decommissioning

201. Note that repowering is covered under ‘Construction’ for the purposes of the assessment as the impacts of removing and re-installing infrastructure is expected to be similar in nature during this phase.

202. Those boxes that are greyed out mean that either a feature, impact pathway, project phase, or combination is not applicable. For example, collision risk with tidal energy convertors would not be applicable during the construction or decommissioning phases).

203. Explanatory text for each of the potential effects on a feature are provided in subsequent paragraphs.

6.2. MARINE ORNITHOLOGY

6.2.1. Introduction

204. As described in **Section 4.2.1.1**, a source-pathway-receptor approach was adopted to understand the mechanisms by which the project might affect seabird qualifying interest features of SPAs.

205. SPAs are presented in ascending distance from the MDZ. Unless otherwise stated, all SPA citations are from the JNCC’s website (JNCC, 2019).

206. The potential impacts identified for seabirds are:

- Disturbance at sea by airborne noise;
- Visual disturbance at sea;
- Disturbance at breeding sites by airborne noise and/or visual disturbance;
- Changes in water quality;
- Changes in prey availability;
- Collision with devices.
- In-combination effects.

207. The designated nature conservation sites relevant to Marine Ornithology are illustrated in **Figure 6-1**.

6.2.2. Anglesey Terns SPA

6.2.2.1. Screening Overview

208. **Table 6-1** presents the LSE assessment of the project on the designated features of the Anglesey Terns SPA (NRW, 2015b), of which all are marine ornithology receptors.

209. With the exception of collision risk during the construction and decommissioning phases (which is not possible as tidal devices will not be active during this time), LSEs upon all site features of this SPA cannot be excluded without further analysis.

Table 6-1 Summary of LSE for qualifying features of the Anglesey Terns SPA

Anglesey Terns SPA																		
Distance to project: Overlap of MDZ with areas of SPA designated as foraging areas for qualifying species																		
European site features	Impact pathways during construction (C), operation (O) and decomissioning (D). ✓ = potential for LSE; X = no potential																	
	Disturb. at sea by airb. noise			Vis. disturb. at sea			Disturb. at breeding sites by airb. noise and/or vis. disturb.			Changes in water quality			Changes in prey availability			Collision with devices		
	C	O	D	C	O	D	C	O	D	C	O	D	C	O	D	C	O	D
Arctic tern	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	x	✓	x
Common tern	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	x	✓	x
Roseate tern	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	x	✓	x
Sandwich tern	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	x	✓	x

6.2.3. Irish Sea Front SPA

6.2.3.1. Screening Overview

210. **Table 6-2** presents the LSE assessment of the project on the designated features of the Irish Sea Front SPA.

211. With the exception of collision risk during the construction and decommissioning phases (which is not possible as tidal devices will not be active during this time), and disturbance at breeding sites (which is not possible as this SPA does not support any breeding sites), LSEs upon all site features of this SPA cannot be excluded without further analysis.

Table 6-2 Summary of LSE for qualifying features of the Irish Sea Front SPA

Irish Sea Front SPA																		
Distance to project: Approximately 30 km between northern extent of MDZ and southern extent of SPA																		
European site features	Impact pathways during construction (C), operation (O) and decomissioning (D). ✓ = potential for LSE; X = no potential																	
	Disturb. at sea by airb. noise			Vis. disturb. at sea			Disturb. at breeding sites by airb. noise and/or vis. disturb.			Changes in water quality			Changes in prey availability			Collision with devices		
	C	O	D	C	O	D	C	O	D	C	O	D	C	O	D	C	O	D
Manx shearwater	✓	✓	✓	✓	✓	✓	x	x	x	✓	✓	✓	✓	✓	✓	x	✓	x

6.2.4. Aberdaron Coast and Bardsey Island SPA

6.2.4.1. Screening Overview

212. **Table 6-3** presents the LSE assessment of the project on the designated features of the Aberdaron Coast and Bardsey Island SPA that are also marine ornithology receptors.

213. The theoretical method of apportioning (SNH, 2018) indicates that approximately 42% of the Manx shearwaters present in the MDZ and ECC are likely to originate from this SPA.

214. With the exception of collision risk during the construction and decommissioning phases (which is not possible as tidal devices will not be active during this time), LSEs upon Manx shearwater from this SPA cannot be excluded without further analysis.

Table 6-3 Summary of LSE for qualifying features of the Aberdaron Coast and Bardsey Island SPA

Aberdaron Coast and Bardsey Island SPA																		
Distance to project: Approximately 45 km between southern extent of MDZ and northern extent of SPA																		
European site features	Impact pathways during construction (C), operation (O) and decomissioning (D). ✓ = potential for LSE; X = no potential																	
	Disturb. at sea by airb. noise			Vis. disturb. at sea			Disturb. at breeding sites by airb. noise and/or vis. disturb.			Changes in water quality			Changes in prey availability			Collision with devices		
	C	O	D	C	O	D	C	O	D	C	O	D	C	O	D	C	O	D
Manx shearwater	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	x	✓	x

6.2.5. Howth Head Coast SPA

6.2.5.1. Screening Overview

215. **Table 6-4** presents the LSE assessment of the project on the designated features of the Howth Head Coast SPA (NPWS, 2017a) that are also marine ornithology receptors.

216. Theoretical method apportioning (SNH, 2018) indicates that approximately 13% of the kittiwakes present in the MDZ and ECC are likely to originate from this SPA.

217. With the exception of collision risk during the construction and decommissioning phases (which is not possible as tidal devices will not be active during this time), LSEs upon kittiwake from this SPA cannot be excluded without further analysis.

Table 6-4 Summary of LSE for qualifying features of the Howth Head Coast SPA

Howth Head Coast SPA																		
Distance to project: Approximately 80 km between western extent of MDZ and eastern extent of SPA																		
European site features	Impact pathways during construction (C), operation (O) and decomissioning (D). ✓ = potential for LSE; X = no potential																	
	Disturb. at sea by airb. noise			Vis. disturb. at sea			Disturb. at breeding sites by airb. noise and/or vis. disturb.			Changes in water quality			Changes in prey availability			Collision with devices		
	C	O	D	C	O	D	C	O	D	C	O	D	C	O	D	C	O	D
Kittiwake	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	x	✓	x

6.2.6. Ireland's Eye SPA

6.2.6.1. Screening Overview

218. **Table 6-5** presents the LSE assessment of the project on the designated features of the Ireland's Eye SPA (NPWS, 2017b) that are also marine ornithology receptors. Of these features, cormorant, herring gull and razorbill are screened out of further assessment, because published information on foraging distances (Thaxter et al., 2012) indicates that individuals from this SPA belonging to these species will not occur in the vicinity of the project.

219. The theoretical method of apportioning (SNH, 2018) indicates that <1% of the kittiwakes and guillemots present in the MDZ and ECC are likely to originate from this SPA.

220. As <1% of kittiwakes and guillemots present in the MDZ and ECC will originate from this SPA, LSE can be ruled out for all impact pathways on the basis that impacts on this SPA, if they occur, are not likely to be significant. This SPA is therefore screened out of Stage 2 (Appropriate Assessment) of the HRA.

Table 6-5 Summary of LSE for qualifying features of the Ireland's Eye SPA

Ireland's Eye SPA																		
Distance to project: Approximately 80 km between western extent of MDZ and eastern extent of SPA																		
European site features	Impact pathways during construction (C), operation (O) and decomissioning (D). ✓ = potential for LSE; X = no potential																	
	Disturb. at sea by airb. noise			Vis. disturb. at sea			Disturb. at breeding sites by airb. noise and/or vis. disturb.			Changes in water quality			Changes in prey availability			Collision with devices		
	C	O	D	C	O	D	C	O	D	C	O	D	C	O	D	C	O	D
Cormorant	*			*			*			*			*			*		
Herring gull	*			*			*			*			*			*		

Ireland's Eye SPA																		
Distance to project: Approximately 80 km between western extent of MDZ and eastern extent of SPA																		
European site features	Impact pathways during construction (C), operation (O) and decomissioning (D). ✓ = potential for LSE; X = no potential																	
	Disturb. at sea by airb. noise			Vis. disturb. at sea			Disturb. at breeding sites by airb. noise and/or vis. disturb.			Changes in water quality			Changes in prey availability			Collision with devices		
	C	O	D	C	O	D	C	O	D	C	O	D	C	O	D	C	O	D
Kittiwake	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Guillemot	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Razorbill	*			*			*			*			*			*		
Notes * impact pathway not applicable to this qualifying feature; mean maximum foraging distance (Thaxter *et al*., 2012) indicates that individuals from this SPA will not be present in the vicinity of the project																		

6.2.7. Lambay Island SPA

6.2.7.1. Screening Overview

221. **Table 6-6** presents the LSE assessment of the project on the designated features of the Lambay Island SPA (NPWS, 2017c) that are marine ornithology receptors. Of these features, cormorant, herring gull, razorbill and shag are screened out of further assessment, because published information on foraging distances (Thaxter et al., 2012) indicates that individuals from this SPA belonging to these species will not occur in the vicinity of the project.

222. Theoretical method apportioning (SNH, 2018) indicates that approximately <1% of fulmars, 16% of kittiwakes, <1% of guillemots, 2% of lesser black-backed gulls and 2% of puffins present in the MDZ and ECC are likely to originate from this SPA.

223. Due to the low numbers of fulmar, guillemot, lesser black-backed gull and puffins present in the MDZ and ECC that will be from this SPA, LSE can be ruled out for all impact pathways for these species on the basis that impacts on this SPA, if they occur, are not likely to be significant.

224. With the exception of collision risk during the construction and decommissioning phases (which is not possible as tidal devices will not be active during this time), LSEs upon kittiwake from this SPA cannot be excluded without further analysis.

Table 6-6 Summary of LSE for qualifying features of the Lambay Island SPA

Lambay Island SPA																		
Distance to project: Approximately 80 km between western extent of MDZ and eastern extent of SPA																		
European site features	Impact pathways during construction (C), operation (O) and decomissioning (D). ✓ = potential for LSE; X = no potential																	
	Disturb. at sea by airb. noise			Vis. disturb. at sea			Disturb. at breeding sites by airb. noise and/or vis. disturb.			Changes in water quality			Changes in prey availability			Collision with devices		
	C	O	D	C	O	D	C	O	D	C	O	D	C	O	D	C	O	D
Cormorant	*			*			*			*			*			*		
Fulmar	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Guillemot	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Herring gull	*			*			*			*			*			*		
Kittiwake	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	x	✓	x
Lesser black-backed gull	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Puffin	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Razorbill	*			*			*			*			*			*		
Shag	*			*			*			*			*			*		
Notes * impact pathway not applicable to this qualifying feature; mean maximum foraging distance (Thaxter *et al*., 2012) indicates that individuals from this SPA will not be present in the vicinity of the project																		

6.2.8. Ribble and Alt Estuaries SPA

6.2.8.1. Screening Overview

225. **Table 6-7** presents the LSE assessment of the project on the designated breeding features of the Ribble and Alt Estuaries SPA that are marine ornithology receptors. The non-breeding designated features, which are wintering waterbirds, are not marine ornithology receptors; they are therefore screened out of the assessment.

226. The theoretical method of apportioning (SNH, 2018) indicates that approximately 12% of the lesser black-backed gulls present in the MDZ and ECC are likely to originate from this SPA.

227. With the exception of collision risk during the construction and decommissioning phases (which is not possible as tidal devices will not be active during this time), LSEs upon lesser black-backed gull from this SPA cannot be excluded without further analysis.

Table 6-7 Summary of LSE for qualifying features of the Ribble and Alt Estuaries SPA (breeding)

Ribble and Alt Estuaries SPA (breeding)																		
Distance to project: Approximately 120 km between northern extent of MDZ and southwestern extent of SPA																		
European site features	Impact pathways during construction (C), operation (O) and decomissioning (D). ✓ = potential for LSE; X = no potential																	
	Disturb. at sea by airb. noise			Vis. disturb. at sea			Disturb. at breeding sites by airb. noise and/or vis. disturb.			Changes in water quality			Changes in prey availability			Collision with devices		
	C	O	D	C	O	D	C	O	D	C	O	D	C	O	D	C	O	D
Common tern	*			*			*			*			*			*		
Lesser black-backed gull	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	x	✓	x
Breeding seabird assemblage	*			*			*			*			*			*		
Notes * impact pathway not applicable to this qualifying feature; mean maximum foraging distance (Thaxter *et al*., 2012) indicates that individuals from this SPA will not be present in the vicinity of the project																		

6.2.9. Morecambe Bay and Duddon Estuary SPA

6.2.9.1. Screening Overview

228. **Table 6-8** presents the LSE assessment of the project on the designated breeding features of the Morecambe Bay and Duddon Estuary SPA that are also marine ornithology receptors. The non-breeding designated features, which are wintering waterbirds, are not marine ornithology receptors; they are therefore screened out of the assessment.

229. The theoretical method of apportioning (SNH, 2018) indicates that approximately 6% of the lesser black-backed gulls present in the MDZ and ECC are likely to originate from this SPA.

230. With the exception of collision risk during the construction and decommissioning phases (which is not possible as tidal devices will not be active during this time), LSEs upon lesser black-backed gull from this SPA cannot be excluded without further analysis.

Table 6-8 Summary of LSE for qualifying features of the Morecambe Bay and Duddon Estuary SPA (breeding)

Morecambe Bay and Duddon Estuary SPA (breeding)																		
Distance to project: Approximately 120 km between northern extent of MDZ and southwestern extent of SPA																		
European site features	Impact pathways during construction (C), operation (O) and decomissioning (D). ✓ = potential for LSE; X = no potential																	
	Disturb. at sea by airb. noise			Vis. disturb. at sea			Disturb. at breeding sites by airb. noise and/or vis. disturb.			Changes in water quality			Changes in prey availability			Collision with devices		
	C	O	D	C	O	D	C	O	D	C	O	D	C	O	D	C	O	D
Common tern		*			*			*			*			*			*	
Herring gull		*			*			*			*			*			*	
Lesser black-backed gull	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	x	✓	x
Little tern		*			*			*			*			*			*	
Sandwich tern		*			*			*			*			*			*	
Breeding seabird assemblage		*			*			*			*			*			*	
Notes * impact pathway not applicable to this qualifying feature; mean maximum foraging distance (Thaxter *et al*., 2012) indicates that individuals from this SPA will not be present in the vicinity of the project																		

6.2.10. Skomer, Skokholm and the Seas off Pembrokeshire SPA

6.2.10.1. Screening Overview

231. **Table 6-9** presents the LSE assessment of the project on the designated breeding features of the Skomer, Skokholm and the Seas off Pembrokeshire SPA that are also marine ornithology receptors.

232. The theoretical method of apportioning (SNH, 2018) indicates that approximately 56% of the Manx shearwaters present in the MDZ and ECC are likely to originate from this SPA.

233. With the exception of collision risk during the construction and decommissioning phases (which is not possible as tidal devices will not be active during this time), LSEs upon Manx shearwater from this SPA cannot be excluded without further analysis.

Table 6-9 Summary of LSE for qualifying features of the Skomer, Skokholm and the Seas off Pembrokeshire SPA

Skomer, Skokholm and the Seas off Pembrokeshire SPA																		
Distance to project: Approximately 160 km between southern extent of MDZ and northern extent of SPA																		
European site features	Impact pathways during construction (C), operation (O) and decomissioning (D). ✓ = potential for LSE; X = no potential																	
	Disturb. at sea by airb. noise			Vis. disturb. at sea			Disturb. at breeding sites by airb. noise and/or vis. disturb.			Changes in water quality			Changes in prey availability			Collision with devices		
	C	O	D	C	O	D	C	O	D	C	O	D	C	O	D	C	O	D
Lesser black-backed gull		*			*			*			*			*			*	
Manx shearwater	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	x	✓	x
Puffin		*			*			*			*			*			*	
Breeding seabird assemblage		*			*			*			*			*			*	
Notes * impact pathway not applicable to this qualifying feature; mean maximum foraging distance (Thaxter *et al*., 2012) indicates that individuals from this SPA will not be present in the vicinity of the project																		

6.2.11. Copeland Islands SPA

6.2.11.1. Screening Overview

234. **Table 6-10** presents the LSE assessment of the project on the designated features of the Copeland Islands SPA.

235. The theoretical method of apportioning (SNH, 2018) indicates that approximately <1% of the Manx shearwaters present in the MDZ and ECC are likely to originate from this SPA.

236. As <1% of Manx shearwater present in the MDZ and ECC will originate from this SPA, and the densities of birds recorded suggest that this is not an important subtidal area for this species in general (**Section 5.2.1.7**), LSE can be ruled out for all impact pathways on the basis that impacts on this SPA, if they occur, are not likely to be significant. This SPA is therefore screened out of Stage 2 (Appropriate Assessment) of the HRA.

Table 6-10 Summary of LSE for qualifying features of the Copeland Islands SPA

Copeland Islands SPA																		
Distance to project: Approximately 160 km between northern extent of MDZ and southern extent of SPA																		
European site features	Impact pathways during construction (C), operation (O) and decomissioning (D). ✓ = potential for LSE; X = no potential																	
	Disturb. at sea by airb. noise			Vis. disturb. at sea			Disturb. at breeding sites by airb. noise and/or vis. disturb.			Changes in water quality			Changes in prey availability			Collision with devices		
	C	O	D	C	O	D	C	O	D	C	O	D	C	O	D	C	O	D
Arctic tern		*			*			*			*			*			*	

Copeland Islands SPA																		
Distance to project: Approximately 160 km between northern extent of MDZ and southern extent of SPA																		
European site features	Impact pathways during construction (C), operation (O) and decomissioning (D). ✓ = potential for LSE; X = no potential																	
	Disturb. at sea by airb. noise			Vis. disturb. at sea			Disturb. at breeding sites by airb. noise and/or vis. disturb.			Changes in water quality			Changes in prey availability			Collision with devices		
	C	O	D	C	O	D	C	O	D	C	O	D	C	O	D	C	O	D
Manx shearwater	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Notes * impact pathway not applicable to this qualifying feature; mean maximum foraging distance (Thaxter *et al*., 2012) indicates that individuals from this SPA will not be present in the vicinity of the proposed development																		

6.2.12. Grassholm SPA

6.2.12.1. Screening Overview

237. **Table 6-11** presents the LSE assessment of the project on the designated features of the Grassholm SPA.

238. Theoretical method apportioning (SNH, 2018) indicates that approximately 54% of the gannets present in the MDZ and buffer zone are likely to originate from this SPA.

239. With the exception of collision risk during the construction and decommissioning phases (which is not possible as tidal devices will not be active during this time), LSEs upon gannet from this SPA cannot be excluded without further analysis.

Table 6-11 Summary of LSE for qualifying features of the Grassholm SPA

Grassholm SPA																		
Distance to project: Approximately 170 km between southern extent of MDZ and northern extent of SPA																		
European site features	Impact pathways during construction (C), operation (O) and decomissioning (D). ✓ = potential for LSE; X = no potential																	
	Disturb. at sea by airb. noise			Vis. disturb. at sea			Disturb. at breeding sites by airb. noise and/or vis. disturb.			Changes in water quality			Changes in prey availability			Collision with devices		
	C	O	D	C	O	D	C	O	D	C	O	D	C	O	D	C	O	D
Gannet	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	x	✓	x

6.2.13. Saltee Islands SPA

6.2.13.1. Screening Overview

240. **Table 6-12** presents the LSE assessment of the project on the designated features of the Saltee Islands SPA (NPWS, 2017d).

241. Theoretical method apportioning (SNH, 2018) indicates that approximately 4% of the gannets and <1% of the fulmars present in the MDZ and buffer zone are likely to originate from this SPA.

242. As <1% of fulmars and <5% of gannets present in the MDZ and ECC will originate from this SPA, and the densities of birds recorded suggest that this is not an important subtidal area for this species in general, LSE can be ruled out for all impact pathways on the basis that impacts on this SPA, if they occur, are not likely to be significant. This SPA is therefore screened out of Stage 2 (Appropriate Assessment) of the HRA.

Table 6-12 Summary of LSE for qualifying features of the Saltee Islands SPA

Saltee Islands SPA																		
Distance to project: Approximately 170 km between southern extent of MDZ and northern extent of SPA																		
European site features	Impact pathways during construction (C), operation (O) and decomissioning (D). ✓ = potential for LSE; X = no potential																	
	Disturb. at sea by airb. noise			Vis. disturb. at sea			Disturb. at breeding sites by airb. noise and/or vis. disturb.			Changes in water quality			Changes in prey availability			Collision with devices		
	C	O	D	C	O	D	C	O	D	C	O	D	C	O	D	C	O	D
Fulmar	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Gannet	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Cormorant	*			*			*			*			*			*		
Shag	*			*			*			*			*			*		
Lesser black-backed gull	*			*			*			*			*			*		
Herring gull	*			*			*			*			*			*		
Kittiwake	*			*			*			*			*			*		
Guillemot	*			*			*			*			*			*		
Razorbill	*			*			*			*			*			*		
Puffin	*			*			*			*			*			*		
Notes * impact pathway not applicable to this qualifying feature; mean maximum foraging distance (Thaxter *et al*., 2012) indicates that individuals from this SPA will not be present in the vicinity of the project																		

6.2.14. Ailsa Craig SPA

6.2.14.1. Screening Overview

243. **Table 6-13** presents the LSE assessment of the proposed development on the designated features of the Ailsa Craig SPA.

244. Theoretical method apportioning (SNH, 2018) indicates that approximately 34% of the gannets present in the MDZ and buffer zone are likely to originate from this SPA.

245. With the exception of collision risk during the construction and decommissioning phases (which is not possible as tidal devices will not be active during this time), LSEs upon gannet from this SPA cannot be excluded without further analysis.

Table 6-13 Summary of LSE for qualifying features of the Ailsa Craig SPA

Ailsa Craig SPA																		
Distance to project: Approximately 210 km between northern extent of MDZ and southern extent of SPA																		
European site features	Impact pathways during construction (C), operation (O) and decomissioning (D). ✓ = potential for LSE; X = no potential																	
	Disturb. at sea by airb. noise			Vis. disturb. at sea			Disturb. at breeding sites by airb. noise and/or vis. disturb.			Changes in water quality			Changes in prey availability			Collision with devices		
	C	O	D	C	O	D	C	O	D	C	O	D	C	O	D	C	O	D
Gannet	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	x	✓	x
Breeding seabird assemblage	*			*			*			*			*			*	*	*
Notes * impact pathway not applicable to this qualifying feature; mean maximum foraging distance (Thaxter *et al*., 2012) indicates that individuals from this SPA will not be present in the vicinity of the project																		

6.2.15. Non-breeding BDMPS Populations

6.2.15.1. Screening Overview

246. **Table 6-14** presents the LSE assessment of the proposed development on the relevant BDMPS populations identified in **Section 5.2.1**.

247. Approximately 50% of the fulmars in the UK Western Waters BDMPS that are present in the MDZ and 2 km buffer zone during the non-breeding season may originate from one of 20 SPAs (Furness, 2015). During the non-breeding season, fulmar are present at very low density on the sea in the MDZ and ECC; <0.05 birds/km^2 (**Section 5.2.1.3.5**). As only half of a very small number of birds present are from a relatively large number of SPAs, LSE due to all impact pathways can be ruled out because any impacts, if they occur, are not likely to be significant for any of the SPAs in question.

248. The UK Western Waters BDMPS for guillemot consists of 1,139,220 birds originating from approximately 26 SPAs. Approximately 76% of the population are from SPAs where guillemot is a qualifying feature (Furness, 2015). The density of birds on the sea within the MDZ during the non-breeding season is 3.506 birds/km^2 (**Section 5.2.1.1**). It is possible that due to the relatively close proximity of the MDZ and ECC to a non-designated breeding site, that lower numbers of SPA-qualifying birds are present than suggested by Furness (2015). Due to this, and the fact that a relatively small number of birds present are from a relatively large number of SPAs, LSE due to all impact pathways can be ruled out because any impacts, if they occur, are not likely to be significant for any of the SPAs in question.

249. The gannets present in the MDZ during the non-breeding season will largely consist of birds from the UK Western Waters BDMPS. This population consists of >500,000 birds, of which >90% originate from SPAs (Furness, 2015). Gannet densities on the sea in the MDZ during the non-breeding are low; <0.1 birds/km^2 (**Section 5.2.1.4.5**). Despite the relatively low number of SPAs represented in this population, and the high proportion of birds from those SPAs within it,

the low number of gannets present during the non-breeding season means that LSE due to all impact pathways can be ruled out because any impacts, if they occur, are not likely to be significant for any of the SPAs in question.

250. Approximately 40-50% of kittiwakes present in the MDZ and 2 km buffer are likely to originate from a combination of >30 SPAs during the non-breeding season (Furness, 2015). During migration the population of the UK Western Waters plus Channel BDMPS is >900,000 birds, whilst during the winter period it is >600,000 birds. On-sea densities of this species were low outside the breeding season; <0.1 birds/ km^2 (**Section 5.2.1.1.5**). As only half of a very small number of birds present are from a large number of SPAs, LSE due to all impact pathways can be ruled out because any impacts, if they occur, are not likely to be significant for any of the SPAs in question.

251. Puffins present in the MDZ and ECC during the non-breeding season will largely consist of birds from the UK Western Waters BDMPS. This population consists of 304,577 birds, of which approximately 92% are thought to originate from around 20 SPAs for which puffin is a designated feature. Puffin were absent on the sea in the MDZ at very low densities during the non-breeding season; and recorded at densities of <0.01 birds/km^2 in the 2 km buffer (**Section 5.2.1.1.5**). As only half of a very small number of birds present are from a relatively large number of SPAs, LSE due to all impact pathways can be ruled out because any impacts, if they occur, are not likely to be significant for any of the SPAs in question.

252. In the migration season the razorbill UK Western Waters BDMPS population consists of 606,914 birds, of which 71% originate from non-designated breeding sites. The non-breeding season population consists of 341,222 birds, of which approximately 81% of birds are from colonies in countries outside the Natura 2000 network or from non-SPA colonies within the UK (2%). The density of birds on the sea within the MDZ during the non-breeding season is 1.586 birds/km^2 (**Section 5.2.1.1.5**). As relatively small number of birds present are from a relatively large number of non-designated populations, LSE due to all impact pathways can be ruled out because any impacts, if they occur, are not likely to be significant for any SPAs represented in this population.

Table 6-14 Summary of LSE for relevant non-breeding BDMPSs

Relevant BDMPS Populations																		
Distance to project: MDZ lies within BDMPS locations																		
BDMPS Feature	Impact pathways during construction (C), operation (O) and decomissioning (D). ✓ = potential for LSE; X = no potential																	
	Disturb. at sea by airb. noise			Vis. disturb. at sea			Disturb. at breeding sites by airb. noise and/or vis. disturb.			Changes in water quality			Changes in prey availability			Collision with devices		
	C	O	D	C	O	D	C	O	D	C	O	D	C	O	D	C	O	D
Fulmar UK Western Waters BDMPS	x	x	x	x	x	x	*			x	x	x	x	x	x	x	x	x

Relevant BDMPS Populations																		
Distance to project: MDZ lies within BDMPS locations																		
BDMPS Feature	Impact pathways during construction (C), operation (O) and decomissioning (D). ✓ = potential for LSE; X = no potential																	
	Disturb. at sea by airb. noise			Vis. disturb. at sea			Disturb. at breeding sites by airb. noise and/or vis. disturb.			Changes in water quality			Changes in prey availability			Collision with devices		
	C	O	D	C	O	D	C	O	D	C	O	D	C	O	D	C	O	D
Guillemot UK Western Waters BDMPS	x	x	x	x	x	x	*			x	x	x	x	x	x	x	x	x
Gannet UK Western Waters BDMPS	x	x	x	x	x	x	*			x	x	x	x	x	x	x	x	x
Kittiwake UK Western Waters plus Channel BDMPS	x	x	x	x	x	x	*			x	x	x	x	x	x	x	x	x
Puffin UK Western Waters BDMPS	x	x	x	x	x	x	*			x	x	x	x	x	x	x	x	x
Razorbill UK Western Waters BDMPS	x	x	x	x	x	x	*			x	x	x	x	x	x	x	x	x
Notes * these are populations outside the breeding season; therefore, there are no breeding sites and this impact pathway does not apply																		

6.3. MARINE MAMMALS

6.3.1. Introduction

253. Stage 1 (Screening) of the HRA has been conducted to identify the relevant marine European Designated Sites, where harbour porpoise, bottlenose dolphin, grey seal, harbour seal and otter are a qualifying feature and determine if the project is likely to have a LSE on the interest features of the sites either alone or in-combination with other plans and projects.

254. A source-pathway-receptor approach (as described in **Section 4.2.1.1**) was adopted to understand the mechanisms by which the project might affect qualifying interest features of European Designated Sites where marine mammals are a qualifying feature.

255. For marine mammals, the European Designated Sites applicable for each species were identified, this included:

- Determining if the project area overlaps with any European Designated Sites for marine mammal species.

- Identifying a list of sites for each species that has potential connectivity for potential effects relevant to marine mammals based on:
  - qualifying interest features identified as being present in the area; and
  - the foraging ranges of the different qualifying interest features.

256. The key factor was the potential for connectivity between individual marine mammals from European Designated Sites and potential effects from the project (i.e. demonstration of a clear source-pathway-receptor relationship).

257. To determine the potential for LSE, further consideration of the ecology of each marine mammal species was undertaken. This identified where there is a realistic pathway for a potential effect on European Designated Sites for marine mammals.

6.3.2. Harbour porpoise

258. For harbour porpoise, initially connectivity was determined to be possible between the project and any European Designated Site within the Celtic and Irish Seas Management Unit (MU) (IAMMWG, 2015), where the species is a grade A, B or C feature. Grade D indicates a non-significant population and these European Designated Sites were not, therefore, considered further. This approach to site grade applies to all marine mammal species.

259. The harbour porpoise population of the Celtic and Irish Seas MU is the most likely population to interact with the project. European Designated Sites outside this MU were not considered further[4].

260. **Table 6-15** summarises the outcome of the Stage 1 HRA Screening for harbour porpoise. The locations of the European Designated Sites screened in for harbour porpoise are indicated in **Figure 6-2**.

[4] IAMMWG (2015) states that *"The MUs provide an indication of the spatial scales at which impacts of plans and projects alone, cumulatively and in-combination, need to be assessed for the key cetacean species in UK waters, with consistency across the UK*".

Table 6-15 Summary of the HRA screening for harbour porpoise

European Designated Sites	Distance from the proposed Morlais project	Potential for LSE (✓ = potential for LSE; X = no potential for LSE; a or b = relevant explanatory text)									
		Underwater noise	Collision risk with tidal devices	Potential collision risk with vessels	Potential for entanglement	Potential barrier effects	Potential EMF effects	Potential disturbance at haul out sites	Potential changes in water quality	Potential changes in prey availability	In-combination effects
North Anglesey Marine SAC Wales, UK	0km	✓a	✓a	✓a	✓a	✓a	✓a	N/A	✓a	✓a	✓a
West Wales Marine SAC Wales, UK	32km	✓a	✓a	✓a	✓a	✓a	✓a	N/A	✓a	✓a	✓a
Bristol Channel Approaches SAC Wales/England, UK	222km	✓a	✓a	✓a	✓a	✓a	✓a	N/A	✓a	✓a	✓a
North Channel SAC Northern Ireland, UK	98km	✓a	✓a	✓a	✓a	✓a	✓a	N/A	✓a	✓a	✓a
Rockabill to Dalkey Island SAC Ireland	81km	✓a	✓a	✓a	✓a	✓a	✓a	N/A	✓a	✓a	✓a
Blasket Islands SAC Ireland	518km	Xb	Xb	Xb	Xb	Xb	Xb	N/A	Xb	Xb	Xb
Roaringwater Bay and Islands SAC Ireland	409km	Xb	Xb	Xb	Xb	Xb	Xb	N/A	Xb	Xb	Xb

European Designated Sites	Distance from the proposed Morlais project	Potential for LSE (✓ = potential for LSE; X = no potential for LSE; a or b = relevant explanatory text)									
		Underwater noise	Collision risk with tidal devices	Potential collision risk with vessels	Potential for entanglement	Potential barrier effects	Potential EMF effects	Potential disturbance at haul out sites	Potential changes in water quality	Potential changes in prey availability	In-combination effects
Chaussee de Sein SAC France	559km	Xb	Xb	Xb	Xb	Xb	Xb	N/A	Xb	Xb	Xb
Ouessant-Molène SAC France	540km	Xb	Xb	Xb	Xb	Xb	Xb	N/A	Xb	Xb	Xb
Abers - Côtes des Légendes SAC France	544km	Xb	Xb	Xb	Xb	Xb	Xb	N/A	Xb	Xb	Xb
Cap d'Erquy-Cap Frehel SAC France	640km	Xb	Xb	Xb	Xb	Xb	Xb	N/A	Xb	Xb	Xb
Baie de Morlaix SAC France	553km	Xb	Xb	Xb	Xb	Xb	Xb	N/A	Xb	Xb	Xb
Côte de Granit Rose-Sept-Iles SAC France	551km	Xb	Xb	Xb	Xb	Xb	Xb	N/A	Xb	Xb	Xb
Tregor Goëlo SAC France	578km	Xb	Xb	Xb	Xb	Xb	Xb	N/A	Xb	Xb	Xb

6.3.2.1. Explanatory Text

6.3.2.1.1. Table 6-15 (a)

261. For all European Designated Sites for harbour porpoise within 400 km of the project, there could be the potential for a LSE to arise based on a precautionary approach and these sites are therefore screened into Stage 2 (Appropriate Assessment) of the HRA.

6.3.2.1.2. Table 6-15 (b)

262. For any European Designated Sites for harbour porpoise located more the 400 km from the project, it was determined that the potential did not exist for a LSE to arise and are therefore screened out of further assessment.

263. Harbour porpoise are highly mobile. However, they have relatively high daily energy demands and it has been estimated that they can only rely on stored energy (primarily blubber) for three to five days, depending on body condition (Kastelein *et al*., 1997). Based on a swimming speed of approximately 1.5 m/s (Otani *et al*., 2000), it is estimated that harbour porpoise could cover a distance of approximately 400 km in three days. In light of the above, it is highly unlikely that harbour porpoise from European Designated Sites located 400 km or more from the project are dependent on the area. Although harbour porpoise from European Designated Sites more than 400 km away could have foraging ranges that overlap the MDZ, any potential indirect effects on prey are highly unlikely to have a significant effect on harbour porpoise from that European Designated Site.

6.3.3. Bottlenose dolphin

264. For bottlenose dolphin, initially connectivity was considered possible between the project and any European Designated Site within the Irish Sea MU (IAMMWG, 2015), where the species is a grade A, B or C feature. Table 6-16 summarises the outcome of the Stage 1 HRA Screening for bottlenose dolphin and the locations of the European Designated Sites screened in for bottlenose dolphin are indicated in **Figure 6-3**.

Table 6-16 Summary of the HRA screening for bottlenose dolphin

European Designated Sites	Distance from the proposed Morlais project	Potential for LSE (✓ = potential for LSE; X = no potential for LSE; a = relevant explanatory text)									
		Underwater noise	Collision risk with tidal devices	Potential collision risk with vessels	Potential for entanglement	Potential barrier effects	Potential EMF effects	Potential disturbance at haul out sites	Potential changes in water quality	Potential changes in prey availability	In-combination effects
Lleyn Peninsula and the Sarnau SAC Wales, UK	34km	✓a	✓a	✓a	✓a	✓a	✓a	N/A	✓a	✓a	✓a
Cardigan Bay SAC Wales, UK	101km	✓a	✓a	✓a	✓a	✓a	✓a	N/A	✓a	✓a	✓a

6.3.3.1. Explanatory Text

6.3.3.1.1. Table 6-16 (a)

265. For bottlenose dolphin the potential exists for LSE to arise for all European Designated Sites that were initially assessed, as there is known connectivity between the two SACs for bottlenose dolphin (Bae Ceredigion/Cardigan Bay SAC and the Pen Lleyn a'r Sarnau/Llyn Peninsula and the Sarnau SAC) and the north coast of Anglesey.

266. Photo identification studies completed by the Sea Watch Foundation (Veneruso and Evans, 2012 a,b) have revealed that of 221 bottlenose dolphins recorded between 2007 and 2012 off the north coast of Anglesey, 141 (64%) had been previously recorded within the Bae Ceredigion/ Cardigan Bay SAC, as well as north of the Lleyn Peninsula, and many had additionally been recorded within the Pen Llyn a'r Sarnau/Lleyn Peninsula and the Sarnau SAC (Veneruso and Evans, 2012 a,b). This indicates that the majority of the Cardigan Bay population of bottlenose dolphin move between the two sites.

267. Within the same study, bottlenose dolphin encountered from the north coast of Anglesey (n=28) were investigated to determine the seasonal movements of bottlenose dolphin. It was revealed that of the dolphins recorded in the winter surveys (December to February), 95% had previously been recorded within Cardigan Bay, supporting the theory that there is a seasonal movement of dolphins from Cardigan Bay to the north coast of Anglesey within the winter months (Veneruso and Evans, 2012 a,b). During spring (March to May), 62% of the individuals recorded along the north coast of Anglesey had previously been recorded in Cardigan Bay, 38% were recorded in the summer (June to August) and 98% in the autumn (September to November). This pattern gives a clear indication of the movement of bottlenose dolphins from Cardigan Bay in summer to the north coast of Anglesey and the Lleyn Peninsula in the autumn and winter (Veneruso and Evans, 2012 a,b).

268. A review of the field research (2011-13) conducted by the Sea Watch Foundation for bottlenose dolphin in the Cardigan Bay and Pen Llŷn a’r Sarnau SACs (Feingold and Evans, 2014), indicates that the entire coastal area from Aberaeron to Cardigan appears to be of particular significance. Bottlenose dolphin sightings have also been regularly reported in North Wales, particularly around the Isle of Anglesey but extending east into Liverpool Bay and north to at least the Isle of Man (Feingold and Evans, 2014).

269. Photo-identification surveys off the coast of Anglesey, along with data provided from the Isle of Man and Liverpool Bay, indicate that individuals from Cardigan Bay extend their home ranges, particularly in winter, to the northern Irish Sea at least as far as the Isle of Man (Feingold and Evans, 2014). In addition to winter sightings of the species in the northern Irish Sea, bottlenose dolphins have also been recorded off the North Wales coast and across to Liverpool Bay in summer (Feingold and Evans, 2014; Veneruso and Evans, 2012 a,b).

6.3.4. Grey seal

270. For grey seal, initially connectivity was considered possible between the project and any European Designated Site where this species is a grade A, B or C feature within the Celtic Seas OSPAR region.

271. To identify European Designated Sites for grey seal that have potential connectivity with the project, the foraging ranges and telemetry studies for grey seal were assessed.

272. **Table 6-17** summarises the outcome of the Stage 1 HRA Screening for grey seal and the locations of the European Designated Sites screened in for grey seal are indicated in **Figure 6-4**.

Table 6-17 Summary of the HRA screening for grey seal

European Designated Sites	Distance from the proposed Morlais project	Potential for LSE (✓ = potential for LSE; X = no potential for LSE; a, b or c = relevant explanatory text)									
		Underwater noise	Collision risk with tidal devices	Potential collision risk with vessels	Potential for entanglement	Potential barrier effects	Potential EMF effects	Potential disturbance at haul out sites	Potential changes in water quality	Potential changes in prey availability	In-combination effects
Lleyn Peninsula and the Sarnau SAC Wales, UK	34km	✓a	✓a	✓a	✓a	✓a	✓a	✓a	✓a	✓a	✓a
Cardigan Bay SAC Wales, UK	101km	✓a	✓a	✓a	✓a	✓a	✓a	✓a	✓a	✓a	✓a
Pembrokeshire Marine SAC Wales, UK	152km	✓a	✓a	✓a	✓a	✓a	✓a	Xb	✓a	✓a	✓a
The Maidens SAC Northern Ireland, UK	185km	✓a	✓a	✓a	✓a	✓a	✓a	Xb	✓a	✓a	✓a
Lambay Island SAC Ireland	85km	✓a	✓a	✓a	✓a	✓a	✓a	Xb	✓a	✓a	✓a
Saltee Islands SAC Ireland	176km	✓a	✓a	✓a	✓a	✓a	✓a	Xb	✓a	✓a	✓a
Blasket Islands SAC Ireland	518km	Xc	Xc	Xc	Xc	Xc	Xc	Xb	Xc	Xc	Xc

European Designated Sites	Distance from the proposed Morlais project	Potential for LSE (✓ = potential for LSE; X = no potential for LSE; a, b or c = relevant explanatory text)									
		Underwater noise	Collision risk with tidal devices	Potential collision risk with vessels	Potential for entanglement	Potential barrier effects	Potential EMF effects	Potential disturbance at haul out sites	Potential changes in water quality	Potential changes in prey availability	In-combination effects
Roaringwater Bay and Islands SAC Ireland	409km	Xc	Xc	Xc	Xc	Xc	Xc	Xb	Xc	Xc	Xc
Chaussee de Sein SAC France	559km	Xc	Xc	Xc	Xc	Xc	Xc	Xb	Xc	Xc	Xc
Ouessant-Molène SAC France	540km	Xc	Xc	Xc	Xc	Xc	Xc	Xb	Xc	Xc	Xc
Abers - Côtes des Légendes SAC France	544km	Xc	Xc	Xc	Xc	Xc	Xc	Xb	Xc	Xc	Xc
Baie de Morlaix SAC France	553km	Xc	Xc	Xc	Xc	Xc	Xc	Xb	Xc	Xc	Xc
Côte de Granit Rose-Sept-Iles SAC France	551km	Xc	Xc	Xc	Xc	Xc	Xc	Xb	Xc	Xc	Xc
Tregor Goëlo SAC France	578km	Xc	Xc	Xc	Xc	Xc	Xc	Xb	Xc	Xc	Xc

6.3.4.1. Explanatory Text

6.3.4.1.1. Table 6-17 (a)

273. Based on the foraging ranges for grey seal and the assessment of the telemetry data in and around the Irish Sea, it was determined that there was potentially connectivity for any European Designated Site for grey seal up to 200km from the project. Consequently, for all European Designated Sites for grey seal within 200km of the project, there could be the potential for a LSE to arise and these sites are therefore screened into Stage 2 (Appropriate Assessment) of the HRA. For any European Designated Sites for grey seal located more the 200km from the project, it was determined that the potential did not exist for a LSE to arise and are therefore screened out of further assessment.

274. Grey seals forage in the open sea and they may range widely to forage and frequently travel over 100km between haul-out sites (SCOS, 2017). Foraging trips can last anywhere between one and 30 days. Tracking of individual grey seals has shown that most foraging probably occurs within 100km of a haul-out site, although they can feed up to several hundred kilometres offshore (SCOS, 2017).

275. Telemetry data show much individual variability in the movement patterns of grey seals (Matthiopoulos *et al*., 2004; McConnell *et al*., 1999), with some animals ranging widely and spending time in a variety of locations; while others remain in one limited area for most of the time they were tagged.

276. Data from tagging studies in the Irish Sea were examined in order to describe the extent of ‘forging trips’ of grey seals in the Irish Sea (SCOS, 2014). The telemetry data included in this study were from adult grey seals tagged at Ramsey (n=7), Bardsey (n=4), and Hilbre island (n=7) in 2004 and from pups tagged at Anglesey in 2009 and 2010 (n= 3 and 5), Bardsey in 2009 (n=2) and Ramsey in 2010 (n=7). Over the lifetime of the tags, pups made an average of 58 trips per seal (over the average tag duration of 151 days) with a median trip duration of 0.92 days (95% CI = 0.12-7.89) between haul-out locations and covered an average distance of 19.47km. Grey seal adults made less trips with an average of 41 trips per seal (over the average tag duration of 131 days) and covered less distance (average maximum of 16.94km), with trips between haul-out locations lasting on average 0.75 days (as a median, 95% CI = 0.12-5.61). The greatest distance travelled by one adult was 172.6km. The tag data showed that seals often move between haul out locations, in particular between the Lleyn Peninsula, Cardigan Bay and haul out locations around the Isle of Anglesey.

277. SCOS (2014) described telemetry studies that have been undertaken by tagging grey seals at five SACs across the UK (Pembrokeshire Marine, Lleyn Peninsula and the Sarnau, Monach Islands, Isle of May, and Berwickshire and North Northumberland Coast). The results indicate that grey seal travel between Sir Benfro Forol/Pembrokeshire Marine SAC, Pen Llyn a'r Sarnau/Lleyn Peninsula and the Sarnau SAC and the Saltee Islands SAC (Ireland).

278. Tagging data of grey seals from haul-out sites in Liverpool Bay, Wales and southeast Ireland, indicates that most movement from these sites was contained within the Irish Sea (Hammond *et al*., 2005).

6.3.4.1.2. Table 6-17 (b)

279. Studies on the distance of disturbance, on land or in the water, from hauled-out seals have found that the closer the disturbance, the more likely seals are to move into the water. For the grey seal, mothers responded by moving into the water more due to boat speed rather than as a result of the distance, although movement into the water was generally observed to occur at distances of between 20 and 70m, with no detectable disturbance at 150m (Wilson, 2014; Strong and Morris, 2010). However, grey seals have also been reported to move into the water when vessels are at a distance of approximately 200m to 300m (Wilson, 2014).

280. There are no grey seal haul-out sites within European Designated Sites located 500m or less from the project. Beyond the project site and any harbour locations, vessels would not be moving within 500m of the coast.

281. Taking into account that the tracking of individual grey seals has shown that most foraging probably occurs within 100km of a haul-out site, it was determined that for any European Designated Sites for grey seal located more the 100km from the project, that the potential did not exist for a LSE to arise and are therefore screened out of further assessment.

6.3.4.1.3. Table 6-17 (c)

282. Based on the foraging ranges for grey seal and the assessment of the telemetry data in and around the Irish Sea, it was determined that for any European Designated Sites for grey seal located more the 200km from the project, that the potential did not exist for a LSE to arise and are therefore screened out of further assessment.

283. Grey seals from telemetry studies off western Scotland and off northern France indicate that the tagged grey seals from these areas did not enter the Irish Sea (Matthiopoulos *et al*., 2004).

6.3.5. Harbour seal

284. For harbour seal, initially connectivity was considered possible between the project and any European Designated Site where harbour seal is a grade A, B or C feature within the Celtic Seas OSPAR region.

285. To identify European Designated Sites for harbour seal that have potential connectivity with the project, the foraging ranges and telemetry studies for harbour seal were assessed.

286. **Table 6-18** summarises the outcome of the Stage 1 HRA Screening for harbour seal and the locations of the European Designated Sites screened in for harbour seal are indicated in **Figure 6-5**.

Table 6-18 Summary of the HRA screening for harbour seal

European Designated Sites	Distance from the proposed Morlais project	Potential for LSE (✓ = potential for LSE; X = no potential for LSE; a, b or c = relevant explanatory text)									
		Underwater noise	Collision risk with tidal devices	Potential collision risk with vessels	Potential for entanglement	Potential barrier effects	Potential EMF effects	Potential disturbance at haul out sites	Potential changes in water quality	Potential changes in prey availability	In-combination effects
Lambay Island SAC Ireland	85km	✓a	✓a	✓a	✓a	✓a	✓a	Xb	✓a	✓a	✓a
Murlough SAC Northern Ireland, UK	116km	Xc	Xc	Xc	Xc	Xc	Xc	Xb	Xc	Xc	Xc
Strangford Lough SAC Northern Ireland, UK	121km	Xc	Xc	Xc	Xc	Xc	Xc	Xb	Xc	Xc	Xc
Slaney River Valley SAC Ireland	148km	Xc	Xc	Xc	Xc	Xc	Xc	Xb	Xc	Xc	Xc

6.3.5.1. Expanatory Text

6.3.5.1.1. Table 6-18 (a)

287. Based on the foraging ranges for harbour seal, it was determined that there was potential connectivity for any European Designated Sites for harbour seal up to 100km of the project. Consequently, for all European Designated Sites for harbour seal within 100km of the project, there could be the potential for a LSE to arise and these sites are therefore screened into Stage 2 (Appropriate Assessment) of the HRA.

288. Harbour seal exhibit relatively short foraging trips from their haul out sites. The range of these trips varies depending on the location and surrounding marine habitat. For example, 25km on the west of Scotland (Cunningham *et al*., 2009) and 30 km-45 km in the Moray Firth (Thompson *et al*., 1996). Data from telemetry studies in The Wash (2003- 2005) suggest that harbour seal travel further, and repeatedly forage between 75 km and 120 km offshore, with one seal travelling 220 km (Sharples *et al*., 2008; 2012). Information on harbour seal at-sea movements and habitat use in southwest Ireland suggests a limited range, generally staying within 20 km of their haul-out site (Cronin *et al*., 2008). Although occasional longer trips do occur, these are often associated with young animals dispersing from sites, and are not, therefore, considered to indicate repeated connectivity between European Designated Sites and the project.

6.3.5.1.2. Table 6-18 (b)

289. Studies on the distance of disturbance, on land or in the water, from hauled-out seals have found that the closer the disturbance, the more likely seals are to move into the water. Research has shown that harbour seals will flee from their haul-out sites if a vessel comes within 560 - 850m of their location, or if a pedestrian comes within 200 – 425 m (Anderson *et al*., 2012). However, a study was carried out by SMRU (Paterson *et al*., 2015) using a series of controlled disturbance tests at harbour seal haul-out sites, consisted of regular (every three days) disturbance through direct approaches by vessel and effectively ‘chasing’ the seals into the water. The seal behaviour was recorded via GPS tags and found that even intense levels of disturbance did not cause seals to abandon their haul-out sites more than would be considered normal (for example seals travelling between sites) and were found to haul-out again or to undertake a foraging trip in response to the disturbance but would later return.

290. There are no seal harbour seal haul-out sites within European Designated Sites located 850m or less from the project. Given the very low number of harbour seal in the area of the project, it was determined that the potential did not exist for a LSE to arise and was therefore screened out of further assessment.

6.3.5.1.3. Table 6-18 (c)

291. Based on the foraging ranges for harbour seal, it was determined that for any European Designated Sites for harbour seal located more the 200 km from the project, that the potential did not exist for a LSE to arise and are therefore screened out of further assessment.

6.3.6. Otter

292. For otters, marine European Designated Sites were identified. Although the maximum potential home range for otters can be up to 40km on land (Green *et al*., 1984; Roche *et al*., 1995), it was deemed more appropriate to focus on those marine European Designated Sites within the potential area of effect for the project because, while coastal otters can hunt as far as 100m offshore in water over 10m deep, most feeding is done close to the shore in water less than 3m deep (NRW, 2017).

293. The nearest European Designated Sites for otters to the project (**Figure 6-6**), including possible cable landfall location at the closest point are:

- Afon Gwyrfai a Llyn Cwellyn SAC (33 km from MDZ; 33 km from potential cable corridor area);
- Pen Llyn a'r Sarnau/Lleyn Peninsula and the Sarnau SAC (34 km from MDZ; 35 km from potential cable corridor area); and
- Afon Eden – Cors Goch Trawsfynydd SAC (115 km from MDZ; 115 km from potential cable corridor area).

294. Taking into account the distance between the European Designated Sites for otters, the distance to the project, it has been determined that there is a lack of a reasonable functional linkage. On this basis, it is concluded that the project would not:

- Result in the contaminant burdens in otters at the SACs that may cause physiological damage, or immune or reproductive suppression;
- Significantly affect the range or food resources of otters within the SACs and adjacent inter-connected areas;
- Result in any disturbance by human activity that could suppress reproductive success, physiological health or long-term behaviour of the otters in the site; or
- Significantly affect sources within the SACs and beyond of high-quality freshwater for drinking and bathing by otters from the SACs.

295. Therefore, all marine European Designated Sites for otters were screened out from further assessment.

6.4. MIGRATORY FISH

6.4.1. Introduction

296. It was identified in the Scoping Document that potential impacts that may arise from the activities at MDZ are:

- Effects of Electromagnetic Fields;
- Effects of underwater noise;
- Barriers to migration routes;
- Collision risk with devices;

- Effects of habitat loss; and
- Indirect effects such as changes to habitat or availability/distribution of prey species.

297. **Table 6-19** was compiled to illustrate the potential impact pathways that might arise as a result of different phases of the project. The categories of operations were taken from the Regulation 33 advice for the Severn Estuary / Môr Hafren SAC and supplemented with project-specific operations that may be missing from the published advice package.

298. Where there is no potential for a particular impact pathway to arise from the project, these have automatically been screened out of assessment and are greyed out.

299. Where there is a potential for the impact pathway to arise only in the case of a direct spatial overlap between the MDZ and the European site, which is not possible, these were screened out of assessment and recorded as N in **Table 6-19** (N = no pathway).

Table 6-19 Summary of Impact Pathways for the Morlais Development Zone

Categories of operations which may cause deterioration or disturbance		**Does phase lead to such a category of operations?**		
		Construction	**Operation**	**Decommissioning**
Physical Loss	Removal / substratum loss	N	N	N
	Smothering	N	N	N
Physical Damage	Changes in suspended sediment	Y – migration route only	Y – migration route only	Y – migration route only
	Desiccation & changes in emergence regime			
	Changes in water flow rate	N	N	N
	Changes in wave exposure	N	N	N
	Abrasion / physical disturbance (of habitats)	N	N	N
	Changes in grazing management			
Non-physical disturbance	Noise and visual presence	Y – migration route only	Y – migration route only	Y – migration route only
Toxic contamination	Introduction of synthetic compounds			
	Introduction of non-synthetic compounds[1]			
	Introduction of radionuclides			
Non-toxic contamination	Changes in nutrient loading			
	Changes in thermal regime		N	
	Changes in turbidity (light penetration)	Y – migration route only	Y – migration route only	Y – migration route only
	Changes in salinity		N	
	Changes in oxygenation			
Biological disturbance	Introduction of microbial pathogens			
	Introduction of non-native species	N		N

Categories of operations which may cause deterioration or disturbance		Does phase lead to such a category of operations?		
		Construction	**Operation**	**Decommissioning**
	Selective extraction of species			
Additional mechanisms	Collision risk		Y	
	Effects of electromagnetic field		Y	
	Non-selective extraction of species		Y	
[1] Introduction of non-synthetic compounds such as oil is considered a force majeure i.e. an unforeseeable catastrophic event. It is considered that the likelihood of occurrence is negligible, therefore it has not been considered as part of the assessment.				

300. The impact pathways that have not been screened out in **Table 6-19** have been carried forward and assessed for LSE against the migratory fish features of European sites screened into assessment.

301. It should be noted that both Annex II species of lamprey: sea lamprey *Petromyzon marinus*; and river lamprey *Lampetra fluviatilis* have been screened out of impact pathways arising from underwater noise. Research presented in the Moray West Offshore Wind Farm HRA screening report indicates that sea lamprey respond to sound at frequencies of between 20 Hz and 100 Hz. However, they do not possess a swim bladder and are less sensitive to sound than fish that do possess a swim bladder (Moray Offshore Windfarm (West) Ltd, 2017). Both species are considered not sensitive to the effects of underwater sound emissions for this shadow HRA and are screened out of assessment.

302. In the case of SACs for Annex II migratory fish, they are listed in **Table 6-20** in order of increasing distance from the MDZ.

6.4.2. Designated sites

6.4.2.1. Screening Overview

303. **Table 6-20** presents the LSE assessment of the proposed scheme on the designated features of the designated sites for migratory fish. There are no LSE predicted on the qualifying species of any of the designated sites, which are therefore screened out of further assessment.

Table 6-20 Summary of LSE for Afon Gwyrfai a Llyn Cwellyn SAC

Name of site	Distance to project (between nearest extent of MDZ and outer extent of site) (km)	European site features	Impact pathways during construction (C), operation (O) and decomissioning (D). (✓ = potential for LSE; X = no potential for LSE; a, b, c, d, e, f = relevant explanatory text)																	
			Disturb. Of migratory routes by u/water noise.			Changes in water quality of migratory routes			Changes in prey availability of migratory routes			Barrier to migration routes			Collision with devices			EMF		
			C	O	D	C	O	D	C	O	D	C	O	D	C	O	D	C	O	D
Afon Gwyrfai a Llyn Cwellyn SAC	31	Atlantic salmon	Xa	Xa	Xa	Xb	Xb	Xb	Xc	Xc	Xc		Xd			Xe			Xf	
Afon Eden - Cors Goch Trawsfynydd SAC	65	Atlantic salmon	Xa	Xa	Xa	Xb	Xb	Xb	Xc	Xc	Xc		Xd			Xe			Xf	
River Dee and Bala Lake/ Afon Dyfrdwy a Llyn Tegid SAC	77	Sea lamprey				Xb	Xb	Xb	Xc	Xc	Xc		Xd			Xe			Xf	
		River lamprey				Xb	Xb	Xb	Xc	Xc	Xc		Xd			Xe			Xf	
		Atlantic salmon	Xa	Xa	Xa	Xb	Xb	Xb	Xc	Xc	Xc		Xd			Xe			Xf	
Dee Estuary/ Aber Dyfrdwy SAC	86	Sea lamprey				Xb	Xb	Xb	Xc	Xc	Xc		Xd			Xe			Xf	
		River lamprey				Xb	Xb	Xb	Xc	Xc	Xc		Xd			Xe			Xf	
		Atlantic salmon	Xa	Xa	Xa	Xb	Xb	Xb	Xc	Xc	Xc		Xd			Xe			Xf	
Cardigan Bay/ Bae Ceredigion SAC	97	Sea lamprey				Xb	Xb	Xb	Xc	Xc	Xc		Xd			Xe			Xf	
		River lamprey				Xb	Xb	Xb	Xc	Xc	Xc		Xd			Xe			Xf	

Name of site	Distance to project (between nearest extent of MDZ and outer extent of site) (km)	European site features	Impact pathways during construction (C), operation (O) and decomissioning (D). (✓ = potential for LSE; X = no potential for LSE; a, b, c, d, e, f = relevant explanatory text)																	
			Disturb. Of migratory routes by u/water noise.			Changes in water quality of migratory routes			Changes in prey availability of migratory routes			Barrier to migration routes			Collision with devices			EMF		
			C	O	D	C	O	D	C	O	D	C	O	D	C	O	D	C	O	D
River Wye/ Afon Gwy SAC	114	Sea lamprey				Xb	Xb	Xb	Xc	Xc	Xc		Xd			Xe			Xf	
River Wye/ Afon Gwy SAC	114	River lamprey				Xb	Xb	Xb	Xc	Xc	Xc		Xd			Xe			Xf	
		Atlantic salmon	Xa	Xa	Xa	Xb	Xb	Xb	Xc	Xc	Xc		Xd			Xe			Xf	
		Twaite shad	Xa	Xa	Xa	Xb	Xb	Xb	Xc	Xc	Xc		Xd			Xe			Xf	
Afon Teifi/ River Teifi SAC	121	Sea lamprey				Xb	Xb	Xb	Xc	Xc	Xc		Xd			Xe			Xf	
		River lamprey				Xb	Xb	Xb	Xc	Xc	Xc		Xd			Xe			Xf	
		Atlantic salmon	Xa	Xa	Xa	Xb	Xb	Xb	Xc	Xc	Xc		Xd			Xe			Xf	
		Allis shad	Xa	Xa	Xa	Xb	Xb	Xb	Xc	Xc	Xc		Xd			Xe			Xf	
		Twaite shad	Xa	Xa	Xa	Xb	Xb	Xb	Xc	Xc	Xc		Xd			Xe			Xf	
Afonydd Cleddau/ Cleddau Rivers SAC	143	Sea lamprey				Xb	Xb	Xb	Xc	Xc	Xc		Xd			Xe			Xf	
		River lamprey				Xb	Xb	Xb	Xc	Xc	Xc		Xd			Xe			Xf	
Pembrokeshire Marine/ Sir	149	Sea lamprey				Xb	Xb	Xb	Xc	Xc	Xc		Xd			Xe			Xf	

Name of site	Distance to project (between nearest extent of MDZ and outer extent of site) (km)	European site features	Impact pathways during construction (C), operation (O) and decomissioning (D). (✓ = potential for LSE; X = no potential for LSE; a, b, c, d, e, f = relevant explanatory text)																	
			Disturb. Of migratory routes by u/water noise.			Changes in water quality of migratory routes			Changes in prey availability of migratory routes			Barrier to migration routes			Collision with devices			EMF		
			C	O	D	C	O	D	C	O	D	C	O	D	C	O	D	C	O	D
Benfro Forol SAC		River lamprey				Xb	Xb	Xb	Xc	Xc	Xc		Xd			Xe			Xf	
		Allis shad	Xa	Xa	Xa	Xb	Xb	Xb	Xc	Xc	Xc		Xd			Xe			Xf	
Pembrokeshire Marine/ Sir Benfro Forol SAC	149	Twaite shad	Xa	Xa	Xa	Xb	Xb	Xb	Xc	Xc	Xc		Xd			Xe			Xf	
River Ehen SAC	151	Atlantic salmon	Xa	Xa	Xa	Xb	Xb	Xb	Xc	Xc	Xc		Xd			Xe			Xf	
Afon Tywi/ River Tywi SAC	153	Sea lamprey				Xb	Xb	Xb	Xc	Xc	Xc		Xd			Xe			Xf	
		River lamprey				Xb	Xb	Xb	Xc	Xc	Xc		Xd			Xe			Xf	
		Allis shad	Xa	Xa	Xa	Xb	Xb	Xb	Xc	Xc	Xc		Xd			Xe			Xf	
		Twaite shad	Xa	Xa	Xa	Xb	Xb	Xb	Xc	Xc	Xc		Xd			Xe			Xf	
River Usk SAC	155	Sea lamprey				Xb	Xb	Xb	Xc	Xc	Xc		Xd			Xe			Xf	
		River lamprey				Xb	Xb	Xb	Xc	Xc	Xc		Xd			Xe			Xf	
		Atlantic salmon	Xa	Xa	Xa	Xb	Xb	Xb	Xc	Xc	Xc		Xd			Xe			Xf	
		Twaite shad	Xa	Xa	Xa	Xb	Xb	Xb	Xc	Xc	Xc		Xd			Xe			Xf	

Name of site	Distance to project (between nearest extent of MDZ and outer extent of site) (km)	European site features	Impact pathways during construction (C), operation (O) and decomissioning (D). (✓ = potential for LSE; X = no potential for LSE; a, b, c, d, e, f = relevant explanatory text)																	
			Disturb. Of migratory routes by u/water noise.			Changes in water quality of migratory routes			Changes in prey availability of migratory routes			Barrier to migration routes			Collision with devices			EMF		
			C	O	D	C	O	D	C	O	D	C	O	D	C	O	D	C	O	D
River Derwent and Bassenthwaite Lake SAC	160	Sea lamprey				Xb	Xb	Xb	Xc	Xc	Xc		Xd			Xe			Xf	
River Derwent and Bassenthwaite Lake SAC	160	River lamprey				Xb	Xb	Xb	Xc	Xc	Xc		Xd			Xe			Xf	
		Atlantic salmon	Xa	Xa	Xa	Xb	Xb	Xb	Xc	Xc	Xc		Xd			Xe			Xf	
Carmarthen Bay and Estuaries/ Bae Caerfyrddin ac Aberoedd SAC	162	Sea lamprey				Xb	Xb	Xb	Xc	Xc	Xc		Xd			Xe			Xf	
		River lamprey				Xb	Xb	Xb	Xc	Xc	Xc		Xd			Xe			Xf	
		Allis shad	Xa	Xa	Xa	Xb	Xb	Xb	Xc	Xc	Xc		Xd			Xe			Xf	
		Twaite shad	Xa	Xa	Xa	Xb	Xb	Xb	Xc	Xc	Xc		Xd			Xe			Xf	
River Bladnoch SAC	167	Atlantic salmon	Xa	Xa	Xa	Xb	Xb	Xb	Xc	Xc	Xc		Xd			Xe			Xf	
River Eden SAC	175	Sea lamprey				Xb	Xb	Xb	Xc	Xc	Xc		Xd			Xe			Xf	
		River lamprey				Xb	Xb	Xb	Xc	Xc	Xc		Xd			Xe			Xf	
		Atlantic salmon	Xa	Xa	Xa	Xb	Xb	Xb	Xc	Xc	Xc		Xd			Xe			Xf	

Name of site	Distance to project (between nearest extent of MDZ and outer extent of site) (km)	European site features	Impact pathways during construction (C), operation (O) and decomissioning (D). (✓ = potential for LSE; X = no potential for LSE; a, b, c, d, e, f = relevant explanatory text)																	
			Disturb. Of migratory routes by u/water noise.			Changes in water quality of migratory routes			Changes in prey availability of migratory routes			Barrier to migration routes			Collision with devices			EMF		
			C	O	D	C	O	D	C	O	D	C	O	D	C	O	D	C	O	D
Solway Firth SAC	178	Sea lamprey				Xb	Xb	Xb	Xc	Xc	Xc		Xd			Xe			Xf	
		River lamprey				Xb	Xb	Xb	Xc	Xc	Xc		Xd			Xe			Xf	
Severn Estuary / Môr Hafren SAC	222	Sea lamprey				Xb	Xb	Xb	Xc	Xc	Xc		Xd			Xe			Xf	
	222	River lamprey				Xb	Xb	Xb	Xc	Xc	Xc		Xd			Xe			Xf	
		Twaite shad	Xa	Xa	Xa	Xb	Xb	Xb	Xc	Xc	Xc		Xd			Xe			Xf	
River Camel SAC	289	Atlantic salmon	Xa	Xa	Xa	Xb	Xb	Xb	Xc	Xc	Xc		Xd			Xe			Xf	
Endrick Water SAC	302	River lamprey				Xb	Xb	Xb	Xc	Xc	Xc		Xd			Xe			Xf	
		Atlantic salmon	Xa	Xa	Xa	Xb	Xb	Xb	Xc	Xc	Xc		Xd			Xe			Xf	

6.4.2.1. Explanatory Text

6.4.2.1.1. Table 6-20 (a)

304. Sensitivity to underwater noise is dependent upon the specific hearing abilities of the species. The potential effects are:

- Lethal effects and physical injury;
- Auditory injury (Permanent Threshold Shift (PTS) and Temporary Threshold Shift (TTS)); and
- Behavioural response.

305. Nedwell et al. (2008) discuss injury and fatality from underwater transient pressure waves related to both the peak pressure, and the duration that the peak pressure acts upon the body of the fish. In terms of a peak pressure level exposure it is indicated that:

- Lethal effects occur at incident peak underwater sound levels of ≥260 dB re 1μPa @ 1 m;
- There is increasing likelihood of death or severe injury leading to death in a short time at incident peak underwater sound levels of ≥240 dB re 1μPa @ 1 m; and
- Direct physical injury to gas-containing structures and auditory organs may occur, particularly from repeat exposures at incident peak underwater sound levels of ≥220 dB re 1μPa @ 1 m.

306. Atlantic salmon can detect and respond to underwater sound emissions. They are classified as hearing generalists, unable to hear high frequencies but are able to hear low frequency sound and infrasound (SSE, 2011). Nedwell *et al.* (2008) postulate that Atlantic salmon is most sensitive to underwater sound at a frequency of 160 Hz, where the threshold Sound Pressure Level is 95 dB re 1 μPa @ 1 m. Based on these data, underwater noise might cause tissue damage to the auditory system (PTS) of the salmon following 1 hour exposure at a level of 215 dB re 1 μPa @ 1 m. Hearing impairment (TTS) might occur following exposure at a level of 195 dB re 1 μPa @ 1 m (for a period of 1 hour).

307. Atlantic salmon have a dBht *Salmo salar* metric of 90dBht (SSE, 2011). This is postulated as the threshold for significant avoidance reaction, meaning virtually all individuals will take avoidance action when exposed to that sound level.

308. Allis and twaite shad are clupeids (herring family). Clupeids are known as underwater sound emission sensitive species as they are classified as hearing specialists. Clupeids have a greater hearing range than most fish and being able to detect ultrasound (up to 180 kHz) (Popper *et al.*, 2004). In the absence of shad-specific sonograms those of Atlantic herring have been used.

309. Doksætera *et al.* (2009) demonstrated that transmissions of 1–2kHz nor 6–7kHz6 have any significant negative influence on Atlantic herring on the received sound pressure level tested (127–197 and 139–209 dB139–209 dB re 1μPa @ 1 m, respectively). Military sonars of such frequencies and source levels were determined to have no adverse effects in areas of overwintering Atlantic herring including not substantially affecting their behaviour.

6.4.2.1.1.1. Construction and Decomissioning

310. The worst-case scenario for underwater sound and pressure emissions during the project will arise during the construction phase (and therefore, by extension, also assumed as likely to occur during the decommissioning phase). Sound emissions will be associated with the drilling/drill-drive-drill sub-activity during installation.

311. Nedwell *et al.* (2003) assessed the noise from rock socket drilling, comprising drilling into hard rock that may be considered comparable to the operations that may occur as part of construction of MDZ. Drill noise was predominantly low in frequency, with a strong fundamental component at 125 Hz and harmonics up to 1 kHz. Drill noise therefore falls within the frequency ranges produced by shipping noise (<1 kHz). The drill noise could be detected above background levels up to 7 km from the source. Unfortunately, the source level could not be determined from the data.

312. MeyGen (2012) reviewed published noise level records of drilling in order to inform their assessment for tidal turbine development. McCauley (1998) measured drilling from an oil drilling rig and indicated that broadband source levels were around 144 dB re 1 µPa @ 1 m. Analysis of the drilling noise showed that dominant tones were produced in the 31 Hz and 62 Hz 1/3 octave bands. Nedwell *et al.* (2010) reported that noise levels produced during foundation socket drilling were 178 dB re 1 µPa @ 1 m. These measurements were taken in an area of sandstone bedrock, not dissimilar to the MDZ. MeyGen (2012) reported that it was uncertain which of these two noise level measurements would be more representative of the noise levels produced during construction of the tidal device due to the overall lack of data on noise measurements.

313. PTEC (2014) modelled the underwater noise levels of drilling operations in support of a tidal energy project. Noise propagation modelling was undertaken for a series of scenarios of drilling operations, for which the worst-case scenario was a 4 m diameter pile and a 333 kW drill power. It was determined that the maximum noise level modelled (160 dB re 1 µPa) was detectable at a maximum range of 18 m from the source. This noise level is considerably lower (35 dB) than the threshold which can result in disturbance (TTS) to Atlantic salmon. Unfortunately, the source level could not be determined from the data. It is not known at what distance the threshold noise levels for impact would be reached. However, it can be inferred that noise levels which could lead to disturbance levels would only occur in the immediate vicinity (i.e. <18 m) of drilling operations.

314. In line with the precautionary principle the worst-case scenario for noise production has been used to inform the screening exercise. The worst-case noise levels are below the threshold for onset of TTS in the most sensitive Annex II migratory fish species; therefore, even at 1 m from the drilling noise source, the noise levels will be below the threshold for detection by the individual.

315. Assessment associated with installation for the MeyGen project (MeyGen, 2012), which assessed the use of foundation socket drilling into the seabed to install pin-piled tripods, determined no likely significant effects on fish species.

316. MeyGen (2012) indicated that there was one available measurement for operational noise produced by a tidal turbine, that of a 300 kW horizontal axis turbine in the Bristol Channel, which was modelled to produce a source level of 165.7 dB re 1 μPa @ 1m. Following the application of an uplift factor, MeyGen (2012) determined that source level for a 1 MW and 2.4 MW would be 171 dB re 1 μPa @ 1m and 177 dB re 1 μPa @ 1m, respectively.

317. Using these measurements, MeyGen (2012) found that, under a worst-case deployment scenario of 36 x 2.4 MW turbine, operational noise from turbines would not cause mortality or injury and a behavioural reaction of strong avoidance would occur at 18 m and mild avoidance at 68 m (for the most sensitive hearing specialists such as herring).

6.4.2.1.1.2. Operation

318. Studies such as Frid *et al.* (2012), state that operational noise of tidal energy convertors is unlikely to be ecologically significant.

319. There is very little information on the operational noise produced by tidal devices. However, the information available has informed a number of preceding EIA studies, including the recently consented PTEC project. The results from the noise modelling conducted for the PTEC project (2014) and MeyGen (Kongsberg, 2012) have been applied to this project. Information from the Technical Note produced by Subacoustech (2019) for this project is also used.

320. Subacoustech (2019) reviewed the noise outputs of a suite of tidal devices. It was reported that predicted source noise levels ranged from 145 to 175 dB re 1 uPa @ 1 m. The corresponding frequency range was rarely reported. One turbine design with the most information available, OpenHydro, has a predicted source noise level of 152 dB SPL_{RMS}, with the majority of the energy centred on the 125 Hz 1/3 octave frequency band. This low frequency noise is within the typical frequency range of the predominant component of ambient noise (Subacoustech, 2019) as well as fish hearing ability (e.g. salmon; Harding *et al.,* 2016). The noise emitted from OpenHydro was reported to reach background noise levels within 1-1.5 km from the source.

321. Four underwater noise monitoring stations were installed in the MDZ by SEACAMS (University of Bangor) to record background noise and assess variation on a daily and tidal cycle basis (Subacoustech, 2019). Underwater noise measurements were taken over periods of 15-30 days in 2016, 2017 and 2018. Analysis of the records revealed that noise levels were highly consistent between sites and years; all were between 89 dB to 107 dB SPL_{RMS} re 1 μPa. As expected there was variation in the noise levels with the position of the tide, and when marine traffic was present.

322. PTEC (2014) modelled the propagation of operational noise of a tidal turbine of maximum rotor diameter of 24 m. They reported that a level of 160 dB re 1 μPa would be reached at a maximum of 6 m from the turbine. Note that this is smaller than the maximum rotor size potentially proposed for the Project, 27 m, however, the scale of potential effect on fish species associated with the noise of tidal turbines from PTEC and MeyGen shows range to be limited to the low 10s of metres at greatest, and this is expected for other tidal turbines of a similar scale.

323. For the MeyGen project, the behavioural impact ranges of fish were modelled for the operational noise predicted to be emitted from a 1 MW and 2.4 MW turbine. Operational noise was predicted

to be up to 177 dB SPL_{RMS} for a 2.4 MW turbine, with peak energy content below 100 Hz but also significant peaks in the 1,500 Hz and 5,000 Hz bands (Subacoustech, 2019).

324. The findings of MeyGen (2012) and PTEC (2014) show that any impacts of underwater noise from construction and operation will be limited to the area immediately surrounding the device and is unlikely to extend beyond the boundaries of the MDZ. The worst-case scenario of complete avoidance of the MDZ due to underwater noise is not considered to have an ecologically significant effect on the migratory routes of Annex II migratory fish as the area is very small in comparison to the total available habitat for migration and so can be avoided at minimal cost to the individual, particularly as there are no natal rivers inshore of the MDZ. Therefore, the pressure pathway from noise during the construction and operation phase of the project is not considered significant.

325. No LSE will arise from disturbance of the designated Annex II migratory fish populations using migratory routes in association with underwater noise.

6.4.2.1.2. Table 6-20 (b)

326. There may be a localised decrease in water quality associated with potential increases in suspended sediment concentrations/increase in turbidity arising from resuspension of sediments.

327. Resuspension may arise from excavation of seabed material and dumping *in situ* for the emplacement of structures (construction and decommissioning phase). However, as the site comprises mostly rock, no significant amounts of sediment are expected to be resuspended.

328. Sediment plumes are not expected to be generated during the project at any phase.

329. Resuspension due to changes in the hydrodynamic regime around the structures (operational phase) is anticipated to be extremely localised and contained to the site only. Therefore, the exposure pathway for any small increases in turbidity at certain restricted times are not likely to result in any significant effects with any migratory fish features of SACs assessed. This is especially the case when considering the context of the migratory ‘space’ associated with the Irish Sea and the Southwest Approaches.

330. No LSE will arise from changes in water quality of migratory routes for the designated Annex II migratory fish populations associated with any SACs.

6.4.2.1.3. Table 6-20 (c)

331. The project may potentially indirectly affect prey availability in the area through a variety of mechanisms including, but not limited to, removal/loss of habitat supporting prey species, increased turbidity, underwater sound emissions, and changes in hydrodynamics.

332. The MDZ is not known to be a key feeding ground for any of the Annex II migratory fish species at any of their life stages. Nonetheless, it cannot be ruled out that some species may opportunistically feed in the area as they pass through.

333. Assessments associated with MeyGen determined that no significant effects would result concerning habitat supporting prey species or prey species themselves. The project EIA of fish ecology and populations relevant to the MDZ also indicate no LSE is expected to occur. Habitat loss at the seabed and increases in turbidity are not determined to be significant, nor are effects of underwater emissions, associated with construction or operation of the tidal energy convertors.

334. The MDZ represents a very small portion of the overall area transited by migratory fish in the context of the total available habitat space of the Irish Sea and Southwest Approaches. The results from MeyGen (2012) and PTEC (2014) demonstrate that the area within which there would be an impact of underwater noise would not exceed the boundary of the MDZ. Nedwell *et al.* (2003) demonstrated that drilling noise may be detectable above background noise at a distance of up to 7 km. Although larger than the boundary of the MDZ, the potential zone of impact from noise around the MDZ is also not a significant proportion of the total habitat available. As such, it can be assessed that no LSE will arise on any designated Annex II migratory fish population features of SACs as a result of effect of changes in prey species.

6.4.2.1.4. Table 6-20 (d)

335. The physical structures of the MDZ, including the tidal energy convertors and seabed foundations may pose a barrier to the migratory route of Annex II fish populations.

336. The physical structures of the MDZ will be contained within the consent area, delineated by the red line boundary. The potential distribution of infrastructure and convertors within the MDZ is unlikely to present a complete barrier to the passage of migrating fish. However, the maximum additional distance that would be added to a migration (if any individual had to go around the edge of the consent area instead of along the coast) would be approximately 25 km.

337. The MDZ will be unlikely to form a barrier to any key migration routes that are unavoidable. There are no SACs designated inshore of the MDZ.

338. The MDZ represents a very small portion of the overall area passed through by migratory fish in the context of the Irish Sea and the Southwest Approaches. As such, it can be assessed that no LSE will arise on any migratory fish features of SACs as a result of physical barrier to migration.

6.4.2.1.5. Table 6-20 (e)

339. For the purposes of this assessment is assumed as a worst case that tidal energy convertors pose the risk of collision to species that occupy the water column, such as migratory fish. In a worst-case scenario, it can be assumed that any interaction will result in the fatality of the animal involved. It should be noted however, that this assumption may be incorrect.

340. ABPmer (2010) state that the opportunity for fish to engage in long range avoidance is likely to be a function of:

- The source levels of underwater noise associated with tidal devices (particularly during operation);

- Background noise levels (the extent to which device noise levels might be masked by ambient background noise); and
- The particular hearing sensitivities of different species of fish.

341. The analysis conducted by ABPmer (2010) suggests that hearing sensitive fish (such as clupeids (including shad species)) may be able to detect and avoid individual operational tidal energy convertors at distances between approximately 120-300 m (depending on the depth of the water). This is even when background noise levels are comparatively high.

342. The MDZ represents a very small portion of the habitat available to migratory fish throughout the Irish Sea. Although it is not possible to quantify the portion of each SAC’s population that may use the site, it can be assumed that it would be low enough that any entrainment/removal of individuals would not impact at a population level. As a result, it is assessed that no LSE will arise from collision by tidal energy convertors on designated Annex II migratory fish features of SACs.

6.4.2.1.6. Table 6-20 (f)

343. EMF emissions can arise in the immediate area around cables that would be used as part of the MDZ project. Assessments of EMF have indicated that electrical fields reach background levels at a distance of 20 m (Frid *et al.*, 2012).

344. There is generally a lack of understanding on the potential impacts of EMF on marine species. EMF can have a disorientating effect on migratory fish species as they use electromagnetic fields for navigation purposes, though the extent to which this is used is species-specific. EMF could therefore result in exclusion of use of the zone or cause loss of the individual from the population.

345. As stated before, the MDZ represents a very small part of the total habitat available to migratory fish throughout the Irish Sea. Exclusion from the area, or loss of the individuals that use the area, is unlikely to result in a likely significant effect on the population of designated Annex II migratory fish species of a SAC in relation to EMF.

6.5. ONSHORE ECOLOGY

6.5.1. Introduction

346. The relevant SPAs/SACs for onshore ecology (including onshore ornithology) receptors are illustrated on **Figure 6-7**. Unless otherwise stated, all SPA and SAC citations are from the JNCC’s website (JNCC, 2019).

6.5.2. Glannau Ynys Gybi/ Holy Island Coast SAC

6.5.2.1. Screening Overview

347. The Annex I habitats that are a primary reason for selection of this site are 1230 Vegetated sea cliffs of the Atlantic and Baltic Coasts and 4030 European dry heaths.

348. Holy Island, off the north-west coast of Wales, has hard rock acidic cliffs and supports important examples of coastal cliff heathland vegetation. In addition to maritime heath with several rare species such as spotted rock-rose *Tuberaria guttata*, there are extensive maritime cliff-crevice and grassland communities. The maritime influence is not as extreme as in north Scotland, and this site represents an important part of the range of variation on the mid-west coast of the UK.

349. Glannau Ynys Gybi/Holy Island Coast SAC is the most important site in north Wales for maritime forms of European dry heaths. The main NVC types are H7 *Calluna vulgaris – Scilla verna* heath and H8 *Calluna vulgaris – Ulex gallii* heath. The dry heathland is associated with small areas of wet heath and forms part of a complete zonation from maritime grassland through maritime heath to inland heath to inland heath with bracken *Pteridium aquilinum* to bramble *Rubus fruticosus* scrub. The heath is an important locus for spotted rock-rose.

350. **Table 6-21** presents the LSE assessment of the proposed scheme on the designated features of the Glannau Ynys Gybi/ Holy Island Coast SAC. There is no LSE predicted on the habitats that are a primary reason for selection of this SAC, which is therefore screened out of further assessment.

Table 6-21 Summary of LSE for qualifying features of the Glannau Ynys Gybi/ Holy Island Coast SAC

Glannau Ynys Gybi/ Holy Island Coast SAC						
Distance to project:						
European site features	Impact pathways during construction (C), operation (O) and decomissioning (D). (✓ = potential for LSE; X = no potential for LSE; a, b or c = relevant explanatory text)					
	Habitat loss			Pollution/contamination of habitat		
	C	O	D	C	O	D
1230 Vegetated sea cliffs of the Atlantic and Baltic Coasts	✓a	✓a	✓a	✓b	✓b	✓b
4030 European dry heaths	Xc	Xc	Xc	Xc	Xc	Xc

6.5.2.2. Explanatory Text

6.5.2.2.1. Table 6-21(a)

351. The preferred option of transporting the cables ashore at landfall is to use Horizontal Directional Drilling (HDD). This will avoid any interaction with the intertidal environment, vegetated sea cliffs and coastal fringe habitat, instead utilising the grasslands set further back from the coast. Should HDD be used as the landfall methodology, the designated site and its qualifying features will be avoided entirely and therefore no LSE associated with habitat loss screened out of further assessment under this option.

352. However, under the worst-case scenario where HDD at landfall is not possible for technical / engineering reasons, landfall activities will involve trenching the cable, with resulting disturbance, and temporary habitat loss within the Glannau Ynys Gybi/ Holy Island Coast SAC. Therefore, under the worst case scenario LSE for disturbance to 1230 Vegetated sea cliffs as a qualifying feature of the Glannau Ynys Gybi/ Holy Island Coast SAC cannot be ruled out. This

impact pathway for this qualifying feature at this site will be screened into Stage 2 (Appropriate Assessment) of the HRA.

6.5.2.2.2. Table 6-21(b)

353. Construction, operation and decommissioning activities may result in the release of pollutants or contaminants which may adversely affect 1230 Vegetated sea cliffs.

354. The preferred construction option is for cables to be installed by HDD and no work to occur within the boundary of the SAC. Construction activity will only take place within the SAC under the worst-case scenario if the cable is installed through the landfall by trenching, or during operation if the cable requires excavation.

355. A water resources assessment has been undertaken and is presented in **Chapter 17, Water Resources and Flood Risk** (**Volume I** of the ES). The assessment concluded no significant impacts for all but one receptor, natural streams. There is a natural stream to the south of the landfall point, which runs through the SAC. However, there is no direct hydrological connection between the proposed works and this feature, as due to nature of geomorphology in the area of the natural stream, it would not be technically feasible for cable trenching works to take place close to the stream. Therefore no direct impact pathway exists and due to the limited nature of the works, any indirect effects will be restricted to the working corridor. As such, there is not anticipated to be any hydrological impacts which may affect the features of the designated vegetated sea cliffs.

356. Air quality impacts on designated ecological sites are considered in **Chapter 22, Air Quality** (**Volume I** of the ES). Impacts on designated sites relating to construction phase dust and particulate matter emissions were considered. Risk of dust impacts to ecological receptors, including the designated sites, were assessed to be high during earthworks, low during construction activities and medium from trackout from Heavy Goods Vehicles (HGV) movements.

357. There are not anticipated to be any significant impacts on designated sites associated with road traffic emissions due to the expected low number of vehicle movements in the construction, operational and decommissioning phases. Although not expected to be a significant impact due to the features present on the cliffs at landfall, due to the potential for pathway for dust settlement on vegetation during trenching activities, under the worst case scenario at the landfall, LSE for this impact cannot be excluded. This impact is screened in to the Appropriate Assessment.

358. Water-borne pollution from trenching activities, under the worst case scenario at the landfall, are not expected to affect to 1230 Vegetated sea cliffs. As a result LSE for this impact are screened out from further assessment as there is no impact pathway.

359. Table 6-21(c)

360. As no heath habitat is present within this location (avoided through design), there will be no LSE to the 4030 European Dry Heath designated feature and this is screened out from further assessment (see **Figure 19.5**, **Chapter 19, Onshore Ecology** (**Volume II** of the ES)).

6.5.3. Glannau Ynys Gybi/ Holy Island Coast SPA

6.5.3.1. Screening Overview

361. **Table 6-22** presents the LSE assessment of the proposed development on the designated features of the Holy Island Coast SPA.

362. LSE cannot be ruled out due to potential disturbance of chough at nesting sites, foraging habitat and roosting locations, habitat loss, and potential pollution/contamination incidents during the construction, operation and decommissioning phases of the project. This SPA is therefore screened into Stage 2 (Appropriate Assessment) of the HRA.

Table 6-22 Summary of LSE for qualifying features of the Holy Island Coast SPA

Holy Island Coast SPA									
Distance to project:									
European site features	Impact pathways during construction (C), operation (O) and decomissioning (D). (✓ = potential for LSE; X = no potential for LSE; a, b or c = relevant explanatory text)								
	Disturb. at nesting, foraging and roosting sites by airborne noise and/or vis. disturb.			Habitat loss during construction and operation			Pollution/contamination of habitat during construction and operation		
	C	O	D	C	O	D	C	O	D
Chough	✓	✓	✓	✓	✓	✓	✓	✓	✓
Notes * collision risk is not an applicable impact pathway to the construction, operation and decommissioning phases									

7. STAGE 1: SCREENING (IN-COMBINATION)

7.1. SCREENING OF RELEVANT PROJECTS AND PLANS

363. A scoping and screening exercise was undertaken to identify other plans and projects whose effects have the potential to interact with the effects of the Project and result in likely significant in-combination effects (LSIE). A list of other potentially relevant plans and projects for the in-combination assessment was compiled using the three sources of information:

- The list of projects and plans developed for the Project's Environmental Impact Assessment (EIA) cumulative impact assessment (CIA);
- A search of national registers of marine licences and foreshore licences; and
- A search of projects on the National Infrastructure Planning register (i.e. NSIPs).

364. For all other projects 'scoped into' the assessment (i.e. where the potential for interaction existed) it was assumed, on a precautionary basis, that the potential existed for a LSIE to arise.

365. The results of the in-combination screening assessment are provided in **Table 7-1**.

Table 7-1 Screening of projects to the in-combination HRA

ID[5]	Project	Location	Developer	Description	Current Status	[6]Distance from OfDA (km)
1	Holyhead Deep Phase I	Wales	Minesto	10 MW Tidal kite installation off the coast of Holyhead, plus on land elements and grid connection. The Environmental Statement for this proposed project has been obtained. Minesto plans to start the installation of a 10MW marine energy array in 2017, subject to planning permission and Marine Licences. At this stage, it is known that onshore infrastructure and further turbines will be proposed for construction, but the details are not known (Minesto, 2016). The site will be located in the southern half of the former 'Holyhead Deep' licenced dredge disposal site. ES and HRA available: http://minesto.com/projects/holyhead-deep	Permitted application, not yet under construction	2
1	Holyhead Deep - 80MW project	Wales	Minesto	The Project includes construction, installation, commissioning, operation and maintenance, and decommissioning activities for an array of up to 160 DGUs (80 MW). The DGUs will be installed in clusters of between six and seven DGUs, with each DGU linked to a Deep Green Connection Hub (DGCH) via a subsea umbilical. Energy generated by the DGUs will be transmitted to the DGCH, before being 'stepped-up' on its way to the transmission infrastructure, a process whereby the voltage of the electricity is modified to reduce transmission losses. Each of the DGUs will require its own subsea foundation, utilising one of three options: a concrete gravity base structure, a monopile, or a mud mat foundation. Onshore aspects not discussed, intention to develop transmission infrastructure with Morlais Project.	Pre-application	2

[5] Reference relates to project ID on **Figure 26-1** (**Volume II of the ES**)
[6] Shortest distance between the considered project and Morlais Offshore Development Area (OfDA). The OdDA encompasses the Morlais Demonstration Zone and the Export Cable Corridor

ID[5]	Project	Location	Developer	Description	Current Status	[6]Distance from OfDA (km)
2	Reclamation adjacent to Terminal 4 of the Port of Holyhead	Wales	Stena Line	Reclamation of approximately 0.62ha of land adjacent to Terminal 4 of the Port of Holyhead for the purpose of facilitating port development.	Pre-application	2
3	Holyhead Waterfront Redevelopment	Wales	Conygar Stena Line Ltd	A comprehensive mixed-use development on 1.2km of Holyhead waterfront at Newry Beach and Porth y Felin. This development will include 326 homes, a 500 berth marina and 50,000 sq.ft of marine related retail, leisure, restaurants hotel and office space. A Town or Village Green Public Inquiry was held in October 2016. Subsequently awaiting the outcome of a 'village green' application which may prevent the development from proceeding. An Environmental Statement is believed to have accompanied the Planning Application. At the time of writing the Environmental Statement was not available online.	Pre-application	2
4	Holyhead Harbour Maintenance Dredging	Wales	Stena Line Ports Ltd	Limited information currently available. Marine Licences non EIA – licence issued and valid until 22/12/2019.	Permitted application, not yet under construction	2
5	Holy Island Resort	Wales	Land and Lakes. Bluestone Development	Construction of a luxury holiday destination on the Penrhos Estate, including 500 lodges, restaurants, a spa and water park. The project aims to open in 2021. The need for an HRA for this project was scoped out at the start of the application process as the development did not have an adverse impact on any European designated sites.	Permitted application, not yet under construction	2.5
6	Sirius SBC	Wales	SIRIUS SBC RENEWABLES LLP	This project is for the installation of generators and associated infrastructure to provide a Short-Term Operating Reserve (STOR) facility with an anticipated capacity of approximately 48MW at Caergeiliog on Anglesey. It is not known whether an HRA will be undertaken for this project at this stage.	Pre-application	4

ID[5]	Project	Location	Developer	Description	Current Status	[6]Distance from OfDA (km)
7	Anglesey Eco Park Power Station	Wales	Orthios Group	Anglesey Eco Park 299MW biomass power station within the existing consented scheme, aquaculture facility, large soil-less indoor vegetable growing facility (hydroponics), home compostable food packaging facility, the CFP Centre of Excellence, research and development, and a deep-water jetty for bulk import. An application was made in August 2016 for the demolition of buildings on the site; these works commenced in October 2016. Currently two proposals are being put forward for the project, a Polymer Processing Centre and a Biomass Processing Centre. The Polymer Processing Centre will be fuelled by UK polymers and waste forestry products. The Biomass Processing Centre will process waste wood chippings to produce power and heat.	Permitted application, not yet under construction	5
8	Wind Turbine	Wales	Energy Consultants Wales	Erection of one 100kw wind turbine with a maximum hub height of up to 36m, rotor diameter of up to 24m and a maximum upright vertical tip height of up to 48m together with the construction of an access track on land near Ty'n Rallt, Bodorgan. EIA screening opinion requested from Isle of Anglesey County Council Planning Application Ref: 15C75G/SCR	Permitted application, not yet under construction	17
9	North Wales Connection Project	Wales	National Grid	A new connection for new energy generation in North Wales. Potential new generation includes the proposed Wylfa Newydd Project as well as a number of renewable energy projects. National Grid has a preferred corridor for a new electrical connection between the Wylfa substation and the Pentir substation. Environmental information is expected to be available as National Grid progress with defining their route alignment. An Environmental Statement is not expected to be available prior to Horizon's submission of the DCO application. National Grid have submitted an application to the Planning Inspectorate for a new, second line of pylons mostly in parallel to the existing line from Wylfa in Anglesey to Pentir in North Gwynedd. Where the connection crosses the Menai Strait, it is proposed that the connection is placed in a tunnel. There is also the need to make changes to the existing substations at Wylfa and Pentir (National Grid, 2018).	Withdrawn	2

ID[5]	Project	Location	Developer	Description	Current Status	[6]Distance from OfDA (km)
9	Wylfa Decommissioning	Wales	Magnox Limited	Decommissioning of the Existing Power Station (Wylfa) including care and maintenance of the existing facilities followed by decommissioning and final site clearance.	Decomissioning ongoing	17.5
9	Wylfa Nuclear Power Plant	Wales	Horizon Nuclear Power	Construction of new nuclear power station. The site is on land beside the former Magnox Wylfa Power Station, which is now being decommissioned.	Project Suspended	17.5
10	Rhyd-y-groes Repower	Wales	TPG Wind Limited (a joint venture between E.ON and Eurus Energy UK Ltd)	The current wind Rhyd-y-groes Wind Farm, located near the northern shores of Anglesey in Wales, has 24 turbines with a maximum total power output of 6.6MW. Proposals are to replace the current turbines with up to 11 modern turbines, which could produce up to 9.9MW of renewable energy. The Environmental Statement is available online - https://www.eonenergy.com/Abouteon/ourcompany/generation/planning-forthe-future/wind/onshore/rhyd-ygroes-repower/project-information The construction period for the proposed development is forecast to last 12 months and the proposed decommissioning of the existing windfarm could take up to six months. There is scope for decommissioning and construction timetables to overlap. Although construction phasing is known, a start date for construction has not been set.	Permitted application, not yet under construction	18
11	Coleg Menai Llangefni	Wales	Grŵp Llandrillo Menai	This development includes proposals for a new Engineering Centre, a Scaffolding training centre and proposals for housing, restaurants and a hotel.	Permitted application, not yet under construction	20
12	M-SParc	Wales	Bangor University	M-SParc is Wales' first science park with and estimated investment of £20 million. Construction began in 2016 and the first building is now open and operational. It comprises of meeting spaces, hot desking facilities and lab/workshop space with a café for hosting larger events.	Operational	23
13	Third bridge across the Menai Straits	Wales	Welsh Government	The Welsh Government is developing this project. Meetings have been held with the Welsh Government and information has been requested. Preferred route announced. https://www.bbc.co.uk/news/uk-wales-45822960	Pre-application	27.5
14	Hafan y Mor Holiday Park	Wales		Screening and Scoping SC1814. Issued Feb 2019.	Pre-application	45

ID[5]	Project	Location	Developer	Description	Current Status	[6]Distance from OfDA (km)
15	West shore, Llandudno	Wales	Conwy County Borough Council	Limited information available. Wind-blown sand – licence issued and valid until 14/06/21.	Permitted application, construction status unknown	50
16	Victoria Pier	Wales	Conwy County Borough Council	Limited information available Marine Licences – Non-EIA – licence issued and valid until 08/03/21.	Permitted application, construction status unknown	57
17	East Rhyl Coastal Defence Scheme	Wales	Denbighshire County Council – East Rhyl Coastal Defence	The East Rhyl Coastal Defence Scheme will reduce the risk of coastal flooding in the Garford Road area of East Rhyl. The East Rhyl Coastal Defence Scheme is led by Denbighshire County Council, with support from the Welsh Government. Balfour Beatty has been appointed as the main contractor to deliver the Coastal Defence Scheme, and is currently working with Denbighshire County Council, and the Environmental and Engineering Consultancy JBA Consulting through early design and development works. The project will involve the construction of a rock revetment structure immediately in front of the existing sea wall, with improvements to the existing wall over a length of around four hundred metres, from Splash Point heading East. The East Rhyl Project will expand upon the recently completed flood storage works completed by Denbighshire County Council since the coastal flood event in 2013	Submitted application, not yet determined	73
18	Inspection and maintenance of Barmouth Viaduct	Wales	Network Rail Infrastructure Ltd	Limited information currently available. Marine Licences non-EIA.	Permitted application, construction status unknown	75
19	Codling Wind Park II	Ireland	Fred Olsen Renewable s and Hazel Shore	Codling Bank Wind Park is a consented 220 turbine offshore wind farm. A second phase has been submitted for planning for a further 200 turbines. ES not available	Submitted application, not yet determined	75

ID[5]	Project	Location	Developer	Description	Current Status	[6]Distance from OfDA (km)
20	North Hoyle Offshore Windfarm, North Wales	Wales	NWP Offshore Limited	Application to carry out operation and maintenance activities at North Hoyle Offshore Wind Farm. This includes routine inspections and maintenance of wind turbine generators, foundations and transition pieces and cables of the already constructed windfarm. Parts, labour, plant for operations and maintenance will be delivered by sea from the Port of Mostyn to Rhyl Flats Wind Farm by crew transfer vessel, jack up barge or other. The operations are identified as potentially having an impact on the Liverpool Bay SPA.	Operational	81
21	Proposed New Cruise Berth	Ireland	Dun Laoghaire Harbour Company (Ireland)	Proposed New Cruise Berth For Large Cruise Ships at Dun Laoghaire Harbour Dun Laoghaire Harbour Company is seeking permission for an €18m cruise berth facility to cater for jumbo cruise ships. Planning application submitted. The accompanying Environmental Impact Statement was not obtained at the time of writing. The expected construction duration is 15 to 18 months. Although construction phasing is known the scheduled start date is unknown. Strategic Environmental Assessment statements are available online – http://dlharbour.ie/masterplan/seastatement/	Permitted application, construction status unknown	91

ID[5]	Project	Location	Developer	Description	Current Status	[6]Distance from OfDA (km)
22	Isle of Man Ferry Terminal	England		The works associated with the proposed development requiring a marine licence include: 1. Infilling the south-west corner of West Waterloo Dock & two small compartments of the Princes Half-Tide Dock (further info is in the 'Dock Infilling Report' Appendix 12.3 ES) 2. Capital Dredging works to River Mersey to provide a berthing pocket and approach channel 3. Disposal of dredged material to sea (Site Z (IS140), Y (IS150) or Mid-River if & as agreed with MMO during consenting process) 4. Steel linkspan bridge & floating pontoon (inc. piles) to provide vehicle & pedestrian access to the rear of the vessels 5. Hydraulic movable passenger access system (PAS) 6. Berthing dolphin (including access walkway & pile), mooring buoy, fenders, floating bollards & ladders 7. Precast 'L shaped' retaining wall structure at former West Waterloo Dock entrance. 8. Removal of upper part of West Waterloo Gate 9. Possible repairs / maintenance to dock walls (all round site) 10. Temporary pontoon during construction period	Submitted application, not yet determined	92
23	Greater Dublin Drainage	Ireland	Irish Water	Outfall pipeline for treated material from Sewer. Located off North County Dublin, between Maynetown and Ireland's Eye extending across the following townlands in Fingal – Maynetown and Burrow. Natura Impact Statement completed	Submitted application, not yet determined	92
24	Burbo Bank Extension O&M Facility.	England	Burbo Bank	Burbo Bank Extension O&M facility Kings Wharf. Proposal to develop an operations and maintenance base for the Burbo Bank OWF extension. The Proposed Development will comprise onshore land-based development (small warehouse, office and car park). An EIA screening opinion was provided by the MMO and the MMO has confirmed that an EIA is not required for this project. The Environmental Report shows no LSE on Liverpool Bay SPA.	Permitted application, not yet under construction	95

ID[5]	Project	Location	Developer	Description	Current Status	[6]Distance from OfDA (km)
25	Alexandra Basin Redevelopment Project	Ireland	Dublin Port Company	Extension of infrastructure to open up Dublin Port to larger cruise and cargo ships. The port will dredge the river Liffey to increase the depth of its berths and the entrance channel from 7m to at least 10m. This will eliminate access issues caused by tides and enable large cruise and cargo ships to turn in Alexandra Basin and dock at East Link Bridge, rather than reversing up the Liffey to their berth as they do now. The project has consent. The Environmental Impact Statement is available online – http://dublinportabr.ie/eis	Permitted application, construction status unknown	96
26	West of Duddon Sands Offshore Wind Farm O&M Marine Licence	England	Ørsted West of Duddon Sands (UK) Limit	Application - Maintenance of existing works required for the operational life of the constructed windfarm. An Environmental Statement is available on the MMO public register. The Environmental Assessment concludes a negligible impact on Liverpool Bay, Liverpool Bay extension and Morecambe and Duddon Estuary SPA	Operational	114
27	Rhyl Flats Windfarm, North Wales	Wales	Rhyl Flats Wind Farm Limited	Application for operations and maintenance activities at the Rhyl Flats windfarm. This includes routine inspections and maintenance of wind turbine generators, foundations and transition pieces and cables of the already constructed windfarm. Parts, labour, plant for operations and maintenance will be delivered by sea from the Port of Mostyn to Rhyl Flats Wind Farm by crew transfer vessel, jack up barge or other. The operations are identified as potentially having an impact on the Liverpool Bay SPA.	Operational	58.8
28	Gwynt y Môr Offshore Wind Farm	Wales	Gwynt y Môr Offshore Wind Farm Ltd	Offshore Wind Farm Limited information available	Operational	65
29	Walney Extension Offshore Wind Farm Operations and Maintenance (O&M) Facilities	England		Marine licence has been granted for the maintenance of facilities for the operational life of the offshore windfarm. A HRA is available for this project on the MMO public register. The HRA states that there is no potential LSE of the works on the Morecambe Bay SPA or Duddon Estuary SPA and Ramsar site.	Operational	114

ID[5]	Project	Location	Developer	Description	Current Status	[6]Distance from OfDA (km)
30	Barrow Offshore Wind Farm O&M Marine Licence	England	Barrow Offshore Wind Farm Ltd	Application - Maintenance of existing works required for the operational life of the constructed windfarm. An Environmental Statement is available on the MMO public register. The Environmental Assessment concludes a negligible impact on Liverpool Bay, Liverpool Bay extension and Morecambe and Duddon Estuary SPA	Operational	116
31	New Quay Harbour and associated Beach	Wales	Ceredigion County Council	Annual harbour maintenance dredging works, involving dredging of sand to the south side of the main pier at New Quay harbour and the disposal of the dredged material for use as beach nourishment at Traeth y Dolau, within the harbour area. The sand bank is only dredged up to a maximum depth of 1 metre by means of a land based mechanical excavator and it is loaded into tractors and trailers for disposal on to another beach (Traeth y Dolau; New Quay) within the Harbour area. The works are programmed to coincide with low water to ensure that no plant need to physically enter the water.	Permitted application, construction status unknown	118.5
32	Fairhaven Lake and Church Scar Coastal Defence Scheme	England	Fylde Council	The proposed scheme is located at two discrete, but adjacent, locations; Fairhaven Lake and Church Scar, on the north bank of the Ribble estuary at Lytham St Annes, Lancashire NGR 333580, 427300 to 335710, 426870. A screening opinion has been submitted to the MMO and the project will require an EIA. The MMO Screening Opinion States that there will be a temporary disturbance (visual, noise, vibration) to bird populations during construction, in particular overwintering species designated as part of the adjacent Ribble and Alt Estuaries SPA. https://marinelicensing.marinemana gement.org.uk/mmofox5/fox/live/	Pre-application	120
33	Hesketh Out Marsh Managed Realignment Scheme	England	Environment Agency	This project is to refurbish the remaining section of flood embankment at Hesketh Out Marsh (approximately 2km) and breach the outer embankment to allow land inbetween to revert back to intertidal habitat. The project will be delivered in partnership with RSPB and Natural England. An EIA has been undertaken for the scheme. The current stage of the works is unknown. Details are on the MMO Public Register: https://marinelicensing.marineman agement.org.uk/mmofox5/fox/live/ ES submitted to the MMO who has approved the content.	Permitted application, construction status unknown	128

ID[5]	Project	Location	Developer	Description	Current Status	[6]Distance from OfDA (km)
34	Tidal Turbine Testing (TTT) project - Strangford Lough	Northern Ireland	Queen's University Belfast	Two 1.5m diameter tidal turbines have been installed on the research platform. A range of acoustic Doppler instruments (ADP and ADVs) have also been deployed on the platform which enables the turbines to be located within a working area enabling up to 2.5D in-plane spacing and 4D in-line spacing.	Operational	138
35	Fishguard port linkspan replacement	Wales	Stena Line	linkspan replacement Limited information available. Screening opinion – licence not yet applied for.	Permitted application, construction status unknown	140
36	Dredge of channel at D3	Northern Ireland	Belfast Harbour Commissioners	Maintenance channel dredging at D3 Terminal, Belfast Reference: ML 149_16	Submitted application, not yet determined	163
37	D3 terminal cruise ship facility	Northern Ireland	Belfast Harbour Commissioners	Construction of Cruise Ship Facility at D3 Terminal, Belfast. Reference: ML 122_15	Submitted application, not yet determined	163
38	Linkspan replacement and civil works	Northern Ireland	Doran Consulting	VT2 Victoria Channel. Belfast Lough. ML 16_17	Withdrawn	166
39	Neyland Yacht Haven	Wales	Neyland Yacht Haven Ltd	Limited information currently available. Marine licences non- EIA – licence issued and valid until 20/11/2019	Permitted application, construction status unknown	174

ID[5]	Project	Location	Developer	Description	Current Status	[6]Distance from OfDA (km)
40	Marine Energy Testing Area (META), Pembroke Dock	Wales	Marine Energy Wales (Pembrokeshire Coastal Forum)	The META project consists of eight test sites where marine energy testing activities will be permitted. Five are in META Phase 1 and Three are in META Phase 2. The proposed sites have been chosen as they are accessible, yet still representative of real sea environments. The aim is to make it easier to test marine energy equipment to make sure it is working as expected. The sites are for testing only and so will not be connected to the National Grid, and devices will be in the water for between 1 – 12 months maximum. These areas will not be permanent exclusion zones. During installation and operational activity there may be buffers around devices within the areas but only in the vicinity of the test activity. https://www.marineenergywales.co.uk/meta-sites/	Pre-application	175
41	Milford Haven, Maintenance Dredge Pembrokeshire	Wales	Milford Haven Port Authority	The removal of maintenance dredge material from berths and channels within the limits of Milford Haven Port Authority, Pembrokeshire. An annual tonnage of 365,000 tonnes is being applied for. The licence is valid until 08/03/2022. A HRA has been undertaken for the works and is available from NRW.	Operational	175
42	Gas storage project	Northern Ireland	Islandmagee Storage Ltd.	Marine infrastructure for seawater abstraction and brine discharge. Islandmagee Energy Limited completed the Front End Engineering and Design (FEED) phase of the underground facility during Q4 2018 27/02/19, applicant supplied report concerning brine dispersion modelling, which included figures on rock salt sampling taken from Islandmagee. DEFRA to consider implications of this new data on updated environmental assessments (still to be presented).	Pre-application	175
43	Swansea Inner West Pier Works	Wales	Associated British Ports	Swansea West Pier is located near to the Tawe Barrage in Swansea Bay and is owned by Associated British Ports (ABP). ABP is currently exploring the option of repairing Swansea Inner West Pier by constructing a new retaining wall aligned immediately in front (seaward) of the existing pier structure. Following an appraisal of all the potential repair options for the Swansea Inner West Pier, the preferred design option is that the new structure is fronted by a driven combination pile wall.	Submitted application, not yet determined	190

ID[5]	Project	Location	Developer	Description	Current Status	[6]Distance from OfDA (km)
45	ABP Port Talbot Dredge and Disposal	Wales	ABP	Limited information currently available. Marine Licences non EIA – licence issued and valid until 22/12/2019.	Operational	194
46	M4 Corridor around Newport (M4CaN)	Wales	Welsh Government (Economy and Transport)	M4 Corridor around Newport (M4CaN). The proposals for the M4CaN Scheme include a new bridge crossing of the River Usk which has several commercially operated wharfs. The bridge and approach viaducts also cross the Newport Docks, owned and operated by Associated British Ports (ABP), between North and South Dock. ABP is a Statutory Undertaker and has objected to the Scheme to the Secretary of State under section 16 of the Acquisition of Land Act 1981, alleging that the scheme would cause serious detriment to the carrying on of the undertaking. The Welsh Government are proposing to provide the following works to overcome the impact of the proposed Scheme on Newport Docks: a) The phased creation of approximately 303m of new quay on the north side of South Dock; b) Refurbishment of 250m of quay on the south side of South Dock (at the eastern end of the Coal Terminal); c) Provision of a moveable bridge to facilitate mobile harbour cranes, other port equipment and HGVs to cross the extended junction cut from west to east (and vice versa) of South Dock; and d) Preparation of areas of land and provision of premises to facilitate the relocation of ABP, tenants and occupiers of the port that are affected temporarily and permanently by the scheme, including site preparation, new buildings, hardstandings and infrastructure	Permitted application, construction status unknown	220
47	Marine Renewable Tidal Array	Northern Ireland	Fair Head Tidal Energy Park Ltd	Construction of offshore tidal array: Phase 1 - 10MW offshore tidal development to be connected via an export cable to landfall at Ballycastle or in the vicinity of Murlough Bay. Phase 2 - 90MW offshore tidal development with multiple export cables to landfall.	Permitted application, construction status unknown	228
48	Oldbury	England	Horizon Nuclear Power	Oldbury Construction, operation and decommissioning of a new nuclear power station using UK ABWR technology	Project Suspended	230

ID[5]	Project	Location	Developer	Description	Current Status	[6]Distance from OfDA (km)
49	Argyll Tidal Demonstration	England	Argyll Tidal Ltd	Argyll Tidal Demonstration Array – Mull of Kintyre, Argyll & Bute. Proposal to build a single 500kW demonstration device Argyll Tidal Array – deployment of up to 6 of the 500kW devices. Environmental Appraisal Report submitted with the marine licence application for the Argyll Tidal Demonstration Array. Documents can be found here: http://www.gov.scot/Topics/marine/ licensing/marine/scoping/ArgyllTidalArray. Scoping Report and Scoping Opinion available for the Argyll Tidal Array	Permitted application, construction status unknown	225
50	Sound of Islay Demonstration Site	Scotland	Scottish Power Renewables (UK) Ltd	Sound of Islay – West Coast of Scotland. Scottish Power Renewables has received consent to develop a Demonstration Tidal Array in the Sound of Islay, between the islands of Islay and Jura on the west coast of Scotland. The tidal array will consist of ten tidal stream generating devices that will be fully submerged on the seabed just south of Port Askaig. Environmental Assessment available this includes an Appropriate Assessment of potential impacts on European designated sites. http://www.gov.scot/Topics/marine/ Licensing/marine/scoping/SoundofIslay	Permitted application, construction status unknown	270
51	Kinsale Head / Ballycotton gas fields and Seven Heads gas field	Ireland	PSE Kinsale Energy & PSE Seven Heads Limited	Decommissioning of certain facilities within the Kinsale Head and Seven Heads Petroleum Lease areas. https://www.dccae.gov.ie/en-ie/natural-resources/consultations/Pages/Further-consultation-for-the-decommissioning-of-certain-facilities-within-the-Kinsale-Head-and-Seven-Heads-Petroleum-Lease.aspx	Submitted application, not yet determined	290
52	Construction of intake/outlet pipe	Ireland	Gaelectric Energy Storage (GEAS)	Construction of intake/outlet pipe to support Gas Storage project. Reference: ML 49_13	Submitted application, not yet determined	175
53	Aberystwyth Water injection dredging	Wales	The Cardiff Marine Group	Limited information available. Marine Licence non-EIA DML1554	Operational	102

ID[5]	Project	Location	Developer	Description	Current Status	[6]Distance from OfDA (km)
54	Liverpool Channel and River disposal licence	England	Mersey Docks Harbour Company Limited	Variation requested - The variation that is being sought would allow Site Y to accept an additional 7.95 million wet tonnes (4.2 million cubic metres) of sand from the Approach Channel over the licence period, in line with that previously assessed and requested and which is necessary to meet Peel Ports' dredge requirements. MLA/2016/00317/2.	Operational	105
55	East Lytham Flood Alleviation scheme	England	Environment Agency	Environmental impact assessment - Construction, Deposits, Dredging. A screening opinion provided by the MMO has stated that an EIA is not required for this project. Natural England has provided a comfort letter dated 21/01/2017 which states that they believe that there will be no LSE on the Ribble and Alt Estuaries sites from these works.	Permitted application, construction status unknown	114
56	Afon Dysynni outfall gravel removal and relocation	Wales	Natural Resources Wales	Removal of accumulated stone river channel material via excavation and deposit of material on right river bank on the north shore. The maximum excavation depth will be to 1.5 m below the existing bed level and a maximum quantity to be removed is 6000 m³. The channel would need to be excavated back to around the position of the old training camp sewage pipe crossing. That would be approximately 150 to 200m river reach. Channel width opened to approximately 20m, at depth 1.5m. An HRA has been undertaken and is available from NRW.	Permitted application, construction status unknown	81
57	Ceredigion	Wales	Afon Teifi Fairways Ltd	Management of Moorings & Navigation to the River Teifi. – licence issued and valid until 16/06/21	Permitted application, construction status unknown	128
59	Swansea Maintenance Dredging disposal	Wales	Associated British Ports	Limited information currently available. Marine Licences non-EIA – licence issued and valid until 22/12/2019	Operational	189
59	Swansea Marina Maintenance Dredging	Wales	Swansea City Council	Limited information currently available. Marine licences non- EIA – licence issued and valid until 03/11/2019.	Operational	189

ID[5]	Project	Location	Developer	Description	Current Status	[6]Distance from OfDA (km)
60	Amlwch LNG	Wales	Amlwch LNG (previously Cantaxx)	Amlwch LNG (Liquified Natural Gas) Tankers would import liquid gas to a mooring 3km from the Amlwch coast. The gas would then be transferred by an undersea pipeline from the mooring platform to the site near the town of Amlwch, where it would be converted back to natural gas and sent into the UK gas network. The planning application is expected to have had an accompanying Environmental Statement. At the time of writing the Environmental Statement was not available online.	Permitted application, not yet under construction	20.5
61	Visitor and Media Reception Centre	Wales	HNP	A planning application is to be submitted following completion of the construction of the Wylfa Newydd Project. No environmental information is currently available.	Project Suspended	15
62 and 63	Ireland – United Kingdom electricity interconnection	Wales	Greenlink Interconnect or Limited	Ireland – United Kingdom electricity interconnection, which aims to deliver additional transmission capacity between Ireland and United Kingdom. The Greenwire Interconnector would connect between Great Island, Wexford County and Pembrokeshire	Permitted application, not yet under construction	178
64	West of Islay Tidal Energy Park	Scotland	DP Marine Energy Ltd and DEME Blue Energy	The project aims to install a 30 MW array off the West Coast of Islay, covering approximately 2km2 of seabed. The development site lies approximately 6km off the Rinns of Islay. The long term goal is to expand the array, eventually producing a project providing up to 400 MW. The design envelope considers two device types, the first being a twin rotor system with blades capable of 180 degree rotation to optimise on flood and ebb tidal streams. The rotor diameter would be typically up to 20m. The second system is a bi-directional ducted tidal turbine with direct drive to a permanent magnet generator.	Permitted application, construction status unknown	280
65	Enlli Tidal Energy Scheme, Bardsey Island	Wales	Nova Innovation and YnNi Llŷn	An Agreement for Lease was awarded in summer 2017. The project would include up to 20 100 kW turbines. A full EIA will be carried out as part of the consenting process. An EIA Scoping opinion was issued by NRW in November 2018.	Pre-application	53

ID[5]	Project	Location	Developer	Description	Current Status	[6]Distance from OfDA (km)
NA	Welsh National Marine Plan	Wales	Welsh Government	The Welsh National Marine Plan (WNMP) is currently being prepared by the Welsh Government in accordance with the Marine and Coastal Access Act 2009 (MCAA)1. The purpose of marine planning under the MCAA is to help achieve sustainable development in the marine area. Welsh Ministers are the Marine Planning Authority under the MCAA, responsible for creating marine plans for both the inshore region (0-12 nautical miles) and offshore region (beyond 12 nautical miles) of Wales.	In draft	0

7.1. SCREENING OF POTENTIAL IN-COMBINATION EFFECTS FOR MARINE ORNITHOLOGY

366. The following proposed plans and projects are considered to have the potential to have 'in-combination' effects for marine mammals with the currently proposed Morlais project. The assessments for any potential in-combination effects will take into account the distance, location and the potential for connectivity between the bird species outlined in **Section 6.2** given foraging ranges.

- Holyhead Deep Phase I (Aberdaron Coast and Bardsey Island SPA, Ireland's Eye SPA, Lambay Island SPA, Skomer, Skokholm and the Seas off Pembrokeshire SPA, Copeland Islands SPA, Grassholm SPA, Saltee Islands SPA);
- Argyll Tidal Demonstration (Ailsa Craig SPA);
- Wylfa Nuclear Power Plant (Anglesey Terns SPA, Aberdaron Coast and Bardsey Island SPA);
- Alexandra Basin Redevelopment Project (Ireland's Eye SPA, Lambay Island SPA, Howth Head); and
- Greater Dublin Drainage (Ireland's Eye SPA, Lambay Island SPA)

367. For a number of projects listed in **Table 7-1**, insufficient information is currently available to assess the potential for an in-combination LSE. However, if the project overlaps or lies within foraging distance to a site(s) screened in to the Project alone assessment, these are assumed to have the potential for an in-combination LSE as a precautionary measure. The following projects will therefore be reviewed throughout the HRA and process and will be further assessed upon the receipt of more detailed information, if available at the time of application:

- Anglesey Eco Park Power Station (Anglesey Terns SPA);
- Marine Energy Wales Marine Testing Area (Grassholm SPA, Skomer, Skokholm and the Seas off Pembrokeshire SPA);
- Enlli Tidal Energy Scheme, Bardsey Island (Aberdaron Coast and Bardsey Island (SPA);
- East Rhyl Coastal Defence Scheme;
- Sound of Islay Tidal Demonstration Site (Ailsa Craig SPA);
- West of Islay Tidal Energy Park (Ailsa Craig SPA);
- Sirius SBC Renewables (Anglesey Terns SPA);
- Almwch LNG (Anglesey Terns SPA);
- Greenlink Interconnector (Grassholm SPA, Skomer, Skokholm and the Seas off Pembrokeshire SPA);
- Milford Haven Maintenance Dredge (Grassholm SPA, Skomer, Skokholm and the Seas off Pembrokeshire SPA);
- Proposed New Cruise Berth Dun Laoghaire (Ireland's Eye SPA, Lambay Island SPA);
- Codling Wind Park II (Aberdaron Coast and Bardsey Island SPA, Ireland's Eye SPA, Lambay Island SPA, Grassholm SPA, Irish Sea Front SPA, Howth Head Coast SPA);

- Kinsale Head / Ballycotton gas fields and Seven Heads gas field (Grassholm SPA, Skomer, Skokholm and the Seas off Pembrokeshire SPA);
- Gas Storage Project Islandmagee (Copeland Island SPA, Ailsa Craig SPA); and
- Fair Head Tidal Energy Park (Copeland Island SPA, Ailsa Craig SPA).

7.2. SCREENING OF POTENTIAL IN-COMBINATION EFFECTS FOR MARINE MAMMALS

368. The following proposed plans and projects are considered to have the potential to have 'in-combination' effects for marine mammals with the currently proposed Morlais project. The assessments for any potential in-combination effects will take into account the distance, location and the potential for connectivity between individual marine mammals from the European Designated Sites and the potential in-combination effects from the proposed Project and the other projects.

369. The list of projects screened in below is therefore based on the MUs for harbour porpoise and bottlenose dolphin and the foraging ranges for grey and harbour seal, relative to the European Designated Sites screened into the HRA:

- Marine Energy Wales marine testing area due to underwater noise and disturbance. (Pen Llyn a'r Sarnau/Lleyn Peninsula and the Sarnau SAC, Bae Ceredigion/Cardigan Bay SAC, North Anglesey Marine SAC);
- Holyhead Deep Tidal Array (Minesto) due to the potential for collision risk, underwater noise and disturbance;
- Holyhead Port Expansion due to underwater noise and disturbance. (Pen Llyn a'r Sarnau/Lleyn Peninsula and the Sarnau SAC, Bae Ceredigion/Cardigan Bay SAC, North Anglesey Marine SAC);
- Holyhead Waterfront Regeneration due to underwater noise and disturbance. (Pen Llyn a'r Sarnau/Lleyn Peninsula and the Sarnau SAC, Bae Ceredigion/Cardigan Bay SAC, North Anglesey Marine SAC);
- Wylfa Nuclear Power Plant due to underwater noise and disturbance, increased vessel collision risk and changes in prey availability (Pen Llyn a'r Sarnau/Lleyn Peninsula and the Sarnau SAC, Bae Ceredigion/Cardigan Bay SAC, North Anglesey Marine SAC);
- Wylfa Decommissioning due to underwater noise and disturbance (Pen Llyn a'r Sarnau/Lleyn Peninsula and the Sarnau SAC, Bae Ceredigion/Cardigan Bay SAC, North Anglesey Marine SAC);
- Amlwch LNG due to increased vessel noise and collision risk. (Pen Llyn a'r Sarnau/Lleyn Peninsula and the Sarnau SAC, Bae Ceredigion/Cardigan Bay SAC, North Anglesey Marine SAC);
- North Hoyle Offshore Windfarm operation and maintenance activities, due to increased underwater noise from vessels and maintenance activity. (Pen Llyn a'r Sarnau/Lleyn Peninsula and the Sarnau SAC, Bae Ceredigion/Cardigan Bay SAC, North Anglesey Marine SAC);

- Rhyl Flats Offshore Windfarm, operation and maintenance activities due to increased underwater noise from vessels and maintenance activity. (Pen Llyn a'r Sarnau/Lleyn Peninsula and the Sarnau SAC, Bae Ceredigion/Cardigan Bay SAC, North Anglesey Marine SAC);
- Gwynt y Môr Offshore Wind Farm operation and maintenance activities due to increased underwater noise from vessels and maintenance activity. (Pen Llyn a'r Sarnau/Lleyn Peninsula and the Sarnau SAC, Bae Ceredigion/Cardigan Bay SAC, North Anglesey Marine SAC);
- Barrow Offshore Wind Farm - operation and maintenance activities due to increased underwater noise from vessels and maintenance activity. (Pen Llyn a'r Sarnau/Lleyn Peninsula and the Sarnau SAC, Bae Ceredigion/Cardigan Bay SAC, North Anglesey Marine SAC);
- West of Duddon Sands Offshore Wind Farm operation and maintenance activities due to increased underwater noise from vessels and maintenance activity. (Pen Llyn a'r Sarnau/Lleyn Peninsula and the Sarnau SAC, Bae Ceredigion/Cardigan Bay SAC, North Anglesey Marine SAC);
- Walney Extension Offshore Wind Farm – operation and maintenance activities due to increased underwater noise from vessels and maintenance activity. (Pen Llyn a'r Sarnau/Lleyn Peninsula and the Sarnau SAC, Bae Ceredigion/Cardigan Bay SAC, North Anglesey Marine SAC);
- Burbo Bank Extension Offshore Wind Farm – operation and maintenance activities due to increased underwater noise from vessels and maintenance activity. (Pen Llyn a'r Sarnau/Lleyn Peninsula and the Sarnau SAC, Bae Ceredigion/Cardigan Bay SAC, North Anglesey Marine SAC);
- Codling Wind Park due to increased underwater noise from construction activities, as well as vessels and maintenance activity. (Pen Llyn a'r Sarnau/Lleyn Peninsula and the Sarnau SAC);
- Isle of Man Ferry Terminal due to increased underwater noise from construction activities, as well as vessel activity. (Pen Llyn a'r Sarnau/Lleyn Peninsula and the Sarnau SAC, Bae Ceredigion/Cardigan Bay SAC, North Anglesey Marine SAC, North Channel SAC);
- Milford Haven Maintenance Dredge due to increased underwater noise from vessels and dredging activity, and changes in water quality. (West Wales Marine SAC);
- Afon Dysynni outfall gravel removal and relocation – due to increase in suspended sediment concentration and contaminant remobilisation during dredging. There could also be the potential for increased vessel movements. West Wales Marine SAC);
- Belfast Harbour D3 terminal cruise ship facility due to potential sources of underwater noise include piling, dredging, general construction activity and vessels. (North Channel SAC);
- Disposal of dredge material from the D3 approach channel due to potential sources of underwater noise include dredging, disposal of dredge material and vessels. There is also the potential for increase in suspended sediment concentration and contaminant remobilisation during dredging and disposal. (North Channel SAC);

- Alexandra Basin Redevelopment Project. There is the potential for increased underwater noise from vessels and dredging activity. There is the potential for increase in suspended sediment concentration and contaminant remobilisation during dredging. There could be the potential for increased vessel movements. (Lambay Island SAC);
- New Cruise Berth for Large Cruise Ships at Dun Laoghaire Harbour. There is the potential for increase in suspended sediment concentration and contaminant remobilisation during dredging. There could be the potential for increased vessel movements. (Lambay Island SAC);
- Argyll Tidal Demonstration Array due to collision risk (North Channel SAC);
- Sound of Islay Tidal Demonstration Site due to collision risk (North Channel SAC); and
- West of Islay Tidal Energy Park due to collision risk (North Channel SAC).

7.3. SCREENING OF POTENTIAL IN-COMBINATION EFFECTS FOR MIGRATORY FISH

370. The following European sites were screened into Stage 2 of the HRA in relation to their designated populations of Annex II migratory fish, and/ or for freshwater pearl mussel designated features (which are dependent on Atlantic salmon designated features as part of their life-strategy/cycle):

- Afon Gwyrfai a Llyn Cwellyn SAC;
- Afon Eden - Cors Goch Trawsfynydd SAC;
- River Dee and Bala Lake/ Afon Dyfrdwy a Llyn Tegid SAC;
- Dee Estuary/ Aber Dyfrdwy SAC;
- Cardigan Bay/ Bae Ceredigion SAC;
- River Wye/ Afon Gwy SAC;
- Afon Teifi/ River Teifi;
- Afonydd Cleddau/ Cleddau Rivers SAC;
- Pembrokeshire Marine/ Sir Benfro Forol SAC;
- River Ehen SAC;
- Afon Tywi/ River Tywi SAC;
- River Usk/ Afon Wysg SAC;
- River Derwent and Bassenthwaite Lake Carmarthen Bay and Estuaries/ Bae Caerfyrddin ac Aberoedd SAC;
- River Eden SAC;
- Solway Firth SAC;
- Severn Estuary/ Môr Hafren SAC;
- River Camel SAC; and
- Endrick Water SAC.

371. The pressures that were assessed for Annex II migratory fish are:

- Disturbance of migratory routes by underwater noise;
- Changes in water quality of migratory routes;
- Changes in prey availability of migratory routes;
- Barrier to migration routes;
- Collision / entrainment with devices; and
- EMF.

372. This in-combination assessment is conducted in the context of consideration of the extent of migratory habitat available to the designated populations of Annex II migratory fish (from Ardnamurchan Point, through the Celtic and Irish seas and down through the Southwest Approaches).

373. Of the European sites assessed, only the Severn Estuary/ Môr Hafren SAC and the Pembrokeshire Marine/ Sir Benfro Forol SAC directly spatially overlap with reasonably foreseeable plans or projects being screened for in-combination effects i.e. there is no direct overlap between a project and any other SAC) and any combined secondary effect will be whilst the fish are outside of their SAC boundary and migrating/fulfilling their marine life-stages. Those projects screened in are as follows:

- Greenlink Interconnector;
- Marine aggregate dredging area 531 – Tarmac and Hanson Aggregates;
- M4 Corridor around Newport (M4CaN); and
- Newport Relocation Proposals.

374. Secondary effects from underwater sound emissions and disturbance effects from other plans and projects are only considered for the sensitive clupeid species; twaite shad and allis shad. Displacement and entrainment are considered in relation to reasonably foreseeable tidal energy park/demo sites.

375. All reasonably foreseeable plans and projects (and associated pressure envelopes) are so spatially distant from the MDZ that any possible combined effects are likely to be absent (or temporally unlikely to combine given the foreseeable timing of some projects), or of such small magnitude (for secondary effects) as to be undetectable/*de minimus* at the designated population level (as per conservation objectives). Therefore, no significant effects are expected and no adverse effects on the integrity of all of the SACs listed above (for their designated populations of Annex II migratory fish and/or freshwater pearl mussel designated features) is determined in-combination.

7.4. SCREENING OF POTENTIAL IN-COMBINATION EFFECTS FOR ONSHORE BIRDS

376. The following proposed plans and projects are considered to have the potential to have ‘in-combination’ effects for Chough, screened in to AA for the Holy Island Coast SPA due to potential noise and visual disturbance:

- Anglesey Eco Park Power Station;
- Holyhead Waterfront Redevelopment;
- Holy Island Resort; and
- Reclamation adjacent to Terminal 4 of the Port of Holyhead.

7.5. SCREENING OF POTENTIAL IN-COMBINATION EFFECTS FOR ONSHORE ECOLOGY

377. No potential for cumulative impacts arising between the proposed onshore elements of the Project and other proposed onshore developments in the study area for onshore ecology was identified.

8. STAGE 2: APPROPRIATE ASSESSMENT

8.1. INTRODUCTION

378. This section of the HRA provides the information required for AA of the proposed scheme. With reference to the information presented in **Section 7** of this HRA document and the relevant ES chapters as follows; **Chapter 10, Fish and Shellfish Ecology** (**Volume I** of the ES), **Chapter 11, Marine Ornithology** (**Volume I** of the ES)**, Chapter 12, Marine Mammals** (**Volume I** of the ES), **Chapter 19, Onshore Ecology** (**Volume I** of the ES); this section describes the potential effects of the proposed scheme insofar as they are relevant to the qualifying interest features / criteria of the designated sites screened into the assessment.

379. The potential effects identified are then considered in the context of the defined conservation objectives for the designated sites and a view is given on whether or not the proposed scheme (alone or in-combination with relevant plans/projects) would have an adverse effect on the integrity of the European site.

8.1.1. Approach to assessment of potential adverse effects

380. Determining whether, in view of a European site's conservation objectives, the plan or project, either alone or in-combination with other plans and projects would have an adverse effect (or risk of this) on the integrity of the site has been assessed in light of:

- site-specific information obtained from surveys and studies undertaken to inform this Appropriate Assessment;
- the advice of statutory bodies; and,
- professional judgement.

381. The following definitions and approach were used to determine whether the proposed scheme would result in an adverse effect on the European sites screened into the assessment.

8.1.2. Site integrity

382. The assessment of adverse effects on the integrity of a site is undertaken in light of the conservation objectives for each site. The integrity of a site is defined as the "*coherence of the site's ecological structure and function, across its whole area, which enables it to sustain the*

habitat, complex of habitats and/or populations of species for which the site has been designated" (ODPM Circular, 06/2005).

383. EC guidance (European Commission, 2000) emphasis that site integrity involves its ecological functions and that the assessment of adverse effect should focus on and be limited to the site's conservation objectives.

8.1.3. Adverse effect

384. The potential effects of the proposed scheme during the construction and operational phases have been considered in the context of their effects on the qualifying interest features and criteria (the species and their supporting habitats) of the European sites. An adverse effect on integrity is likely to be one which prevents the site from making the same contribution to favourable conservation status for the relevant feature as it did at the time of designation. In addition, an adverse effect would be one which caused a detectable reduction in the species for which the sites are designated, at the scale of the site rather than the scale of the impact.

385. Article 1 of the Habitats Directive defines the conservation status of a natural habitat as 'favourable' when "the specific structure and functions which are necessary for its long-term maintenance exist and are likely to continue to exist for the foreseeable future". An adverse effect on site integrity will not occur if it can be shown that, in the long term, the habitat or population of the species in question as a viable component of the site will be maintained despite potential impacts.

386. 'Long term' is considered to be a period of at least five years. This is considered to be an appropriate timescale for the assessment of adverse effect on integrity, because, for example, SPAs are usually designated in the UK on the basis of five year population estimates. A five year rolling mean is used because it is considered to take account of sufficient data to demonstrate that birds use sites regularly, smoothing out any short term peaks and troughs in numbers.

387. Using the same argument, it is, therefore, logical to continue to review populations over the same timescale in order to demonstrate that observed use or 'non-use' of habitat is typical, and not a chance event. In addition, bird breeding performance and productivity varies between species and between years, and many species have long life spans. Population dynamics data therefore need to take into account the possible short-term fluctuations in the numbers of any species. European Commission (2000) also recommends that, when considering the 'integrity of the site', it is important to take into account a range of factors, including the possibility of effects manifesting themselves in the short, medium and long term.

8.2. MARINE ORNITHOLOGY

8.2.1. Anglesey Terns SPA

8.2.1.1. Conservation Objectives

388. The Anglesey Terns SPA has four qualifying species which are considered by this assessment; Arctic tern, common tern, roseate tern and Sandwich tern. Details of the conservation objectives (NRW, 2015c) for each of these features are presented in **Table 8-1**.

Table 8-1 Conservation objectives for Anglesey Terns SPA

Conservation Objective	Arctic tern	Common tern	Roseate tern	Sandwich tern
The size of the population should be stable or increasing, allowing for natural variability, and sustainable in the long term	The breeding population of Arctic tern should be stable or increasing. The site was designated for 1,290 pairs across the SPA.	The breeding population of common tern should be stable or increasing. The site was designated for 189 pairs across the SPA.	The breeding population of roseate tern should be stable or increasing. The site was designated for 3 pairs across the SPA.	The breeding population of Sandwich tern should be stable or increasing. The site was designated for 460 pairs across the SPA.
The distribution of the population should be being maintained, or where appropriate increasing	▪ The range and distribution of terns within the SPA and beyond is not constrained or hindered			
There should be sufficient habitat, of sufficient quality, to support the population in the long term	▪ The extent of supporting habitats used by terns is stable or increasing ▪ Supporting habitats are of sufficient quality to support the requirements of terns ▪ There are appropriate and sufficient food sources for terns within access of the SPA			
Factors affecting the population, or its habitat should be under appropriate control	▪ The number of chicks successfully fledged in the SPA and beyond is sufficient to help sustain the population ▪ Actions or events likely to impinge on the sustainability of the population are under control ▪ There should be no mammalian land predators present in the SPA, and control measures should be in place to ensure that accidental introduction does not take place			

8.2.1.2. Assessment of Impact Pathways

8.2.1.2.1. Disturbance at Sea by Airborne Noise and Visual Disturbance

389. In a literature review examining the likely sensitivity of seabirds to tidal and wave energy development (Furness *et al*., 2012), all four of the tern species listed on the citation for the Anglesey Terns SPA were given a score of two out of five for disturbance by vessels, where a score of one is the least sensitive. Disturbance response of these species was described as

slight avoidance of vessels at short range. The same score for the same parameter was also issued by a similar earlier study relating to offshore wind development (Garthe and Hüppop, 2004). More recently, a wide-ranging review of displacement and habituation of seabirds did not identify terns as being sensitive to disturbance or displacement in response to a range of marine activities (MMO, 2018). A review of offshore wind farm ornithology studies concluded that effects on common tern and Arctic tern (which often could not be separated during such studies) were generally weak or not detectable. Sandwich terns were described as a species displaying weak avoidance to offshore wind farms (Dierschke *et al*., 2016).

390. At the Sheringham Shoal offshore wind farm, avoidance of areas of construction activity and installed monopiles by Sandwich terns was recorded, which strengthened during turbine assembly (Harwood *et al*., 2017). Approximately 30% fewer birds entered the wind farm during the construction phase relative to the pre-construction baseline. Navigational buoys within 2 km of the site were used extensively by resting and socialising birds, especially early in the breeding season. Flight lines of birds that did enter the site were generally along the centre of rows between turbines. Whilst feeding activity was lower in the wind farm site than the buffer areas, the overall abundance within the site was not significantly reduced as the site remained permeable to terns flying to and from foraging grounds further offshore. Due to the obvious difference in physical characteristics, it is not anticipated that this pattern of behaviour would be observed during the operation of the proposed development.

391. Terns are generally not thought to be active at night (Garthe and Hüppop, 2004), and there is no evidence that they are affected by the presence of artificial lighting at sea.

392. It is considered that due to airborne noise and visual disturbance during the construction, operational and decommissioning phases of the project, some disturbance to terns at sea may occur within the MDZ and ECC. Based on the recorded reactions of birds elsewhere at other developments where comparable marine activities have been undertaken, disturbance events will be spatially restricted to areas within close proximity to construction, operational or decommissioning activity (likely to be in the order of tens to hundreds of metres based on the apparent relative insensitivity of the qualifying species to this impact pathway), last only for as long as the activity itself, and be reversible once the activity has concluded. Rather than resulting in harm to the bird or loss from the population, disturbance by airborne noise and visual disturbance will generally result in affected birds temporarily redistributing at sea and moving to an area where they are undisturbed. The Anglesey Terns SPA consists of a large amount of foraging habitat (approximately 100,000 hectares (NRW, 2015b)), so it is considered that ample alternative foraging habitat for any disturbed birds is available.

393. Based on the relatively low observed densities of birds during the baseline surveys (**Section 5.2.1.10.3**), individual disturbance events are likely to be infrequent, and when they do occur will involve very small numbers of birds. The low recorded densities of all tern species in the MDZ and 2 km buffer during the baseline surveys indicates that this area of sea is not an important area for these species, which is not unexpected when the findings of related studies are reviewed (Perrow *et al.*, 2011; Wilson *et al.*, 2014).

394. On the basis of the available information, the possibility of an adverse effect on site integrity due to disturbance at sea by airborne noise and visual disturbance can be excluded for the Anglesey

Terns SPA due to the predicted low magnitude of any potential impact, the relative insensitivity of the qualifying features of the SPA to this impact pathway, and the low density of qualifying features across the area in which this impact pathway could occur. These factors, combined with the location and distances of other projects (Section 7.1) from the MDZ and ECC mean that there is no potential for in-combination effects with other projects due to this impact pathway.

8.2.1.2.2. Disturbance at Breeding Sites by Airborne Noise and Visual Disturbance

395. The population of the Anglesey Terns SPA is made up of species breeding principally at three locations. These are Ynys Feurig, The Skerries and Cemlyn Lagoon. These colonies are located approximately 14, 16 and 19 km respectively from the nearest boundary of the MDZ and ECC (NRW, 2015b). There is no project-related activity planned at substantially closer distances to these colonies during any of the project phases. Whilst habituation to anthropogenic activities near a breeding colony is a key factor in understanding the likely response of the colony to that activity, flight initiation distances for birds at breeding colonies are generally in the order of hundreds of metres or less (Burger, 1998; Erwin, 1989; Livezey *et al*., 2016; Rodgers Jr. and Schwikert, 2002; Rodgers Jr. and Smith, 1995).

396. The possibility of an adverse effect on site integrity due to disturbance at breeding colonies can be excluded for the Anglesey Terns SPA, as no effect is predicted. This is due to the distances between activities relating to the proposed development and breeding colonies associated with this SPA. Because no effect is predicted there is no possibility of in-combination effects with other projects (Section 7.1) due to this impact pathway.

8.2.1.2.3. Changes in Water Quality

397. Pollution incidents, which are considered unlikely to occur, would result in the contamination of a small area (likely no more than several hundreds of metres) of subtidal habitat with a small amount of pollution. Measures will be in place to rapidly collect or disperse any such contamination, meaning that its presence will be temporary and reversible. Because of the overlap between the project and the SPA, it is possible that such an event could result in the temporary non-availability of a small area of subtidal habitat to the qualifying features of the SPA.

398. The foraging capabilities of the qualifying species of this SPA (Thaxter *et al.,* 2012; Wilson *et al.*, 2014) are such that whilst temporary habitat loss of a small area of subtidal foraging habitat within the SPA boundary could occur, the temporary non-availability of a section of subtidal habitat of this size would represent a very small percentage of the total available to the qualifying species of this SPA. Combined with the large amount of alternative habitat available locally, and the fact that the project does not appear to represent prime foraging habitat based on reported species densities (**Section 5.2.1.10**), such an event would therefore not be expected to substantially impact the species concerned.

399. The possibility of an adverse effect on site integrity due to changes in water quality as a result of the construction, operation and decommissioning of the project can be excluded for the Anglesey Terns SPA for these reasons. Combined with the location and distances of other

projects (Section 7.1) from the MDZ and ECC, these factors mean that there is no potential for in-combination effects with other projects due to this impact pathway.

8.2.1.2.4. Changes in Prey Availability

400. For prey items of the qualifying features of this SPA, no effect due to underwater noise (either due to physical injury or behavioural changes) or habitat loss is predicted.

401. The maximum envisaged effect associated with sediment plumes arising as a result of construction, operation and decommissioning of the project are very minor increases in suspended sediment concentration; less than 1 mg/l a short distance from the release point, over a distance of several hundred metres. The effects will be temporary and reversible, with a return to very low background concentrations occurring rapidly upon cessation of activities. Other than at the immediate release point, such a change would be immeasurable. No effects on the prey species of the qualifying features of this SPA are therefore predicted.

402. On the basis of the available information, the possibility of an adverse effect on site integrity due to changes in prey availability can be excluded for the Anglesey Terns SPA, as no effect on prey species is predicted. Because no effect is predicted there is no possibility of in-combination effects with other projects (Section 7.1) due to this impact pathway.

8.2.1.2.5. Collision with Tidal Devices

403. Whilst tern species are plunge diving birds (Cramp, 1985), they are limited to shallow depths; in the order of 1 m for Arctic tern, common tern and roseate tern, and 2 m for Sandwich tern (Haney and Stone, 1988). Moving elements of tidal devices which will be operated at the project are not expected to occur less than approximately 5 m from the surface of the sea.

404. An adverse effect on site integrity due to this impact pathway can therefore be excluded for the Anglesey Terns SPA as no effect is predicted. This is due to the fact that qualifying species do not occur in the ‘at risk’ depths of the water column where collision with moving parts of tidal devices is a possibility. Because no effect is predicted there is no possibility of in-combination effects with other projects (Section 7.1) due to this impact pathway.

8.2.1.3. Conclusion

405. On the basis of the information presented above, none of the impact pathways screened into Stage 2 of the HRA have the potential individually or when considered together to either compromise the conservation objectives or cause an adverse effect on site integrity of this SPA, both for the Morlais project alone and in-combination with other projects.

8.2.2. Irish Sea Front SPA

8.2.2.1. Conservation Objectives

406. The Irish Sea Front SPA has a single qualifying feature; Manx shearwater, which has been screened into this assessment.

407. There is a single conservation objective for this species (JNCC, 2016b), which is *"to avoid significant deterioration* of *the habitats of the qualifying species or significant disturbance to the qualifying species, subject to natural change, thus ensuring that the integrity of the site is maintained in the long term and makes an appropriate contribution to achieving the aims of the Birds Directive for each of the qualifying species"*. This would be achieved by delivering the following objectives:

- Avoid significant mortality, injury and disturbance of the qualifying features, so that the distribution of the species and ability to use the site are maintained in the long-term;
- Maintain the habitats and food resources of the qualifying features in favourable condition; and
- Ensure access to the site from linked breeding colonies.

408. The Irish Sea Front SPA is unique amongst the SPAs considered in this assessment in that it consists entirely of subtidal habitat that is known to be of high importance for foraging of Manx shearwater during the breeding season, and no breeding colony is present. Given that almost 100% of UK-based Manx shearwater breed in SPAs (Furness, 2015), the birds in this SPA will also be qualifying features of other SPAs. The density of foraging birds within this SPA varies between 27 to 136 birds/km^2, although there is evidence for strong annual variability; densities of up to 2,035 birds/km^2 have previously been recorded (JNCC, 2016a).

8.2.2.2. Assessment of Impact Pathways

8.2.2.2.1. Disturbance at Sea by Airborne Noise and Visual Disturbance

409. In two literature reviews examining the likely sensitivity of seabirds to tidal and wave energy development (Furness *et al*., 2012) and offshore wind development (Furness and Wade, 2012), Manx shearwater was given a score of one out of five for disturbance by vessels (where a score of one is the least sensitive). More recently, a wide-ranging review of displacement and habituation of seabirds did not identify Manx shearwater as being sensitive to disturbance or displacement in response to a range of marine activities (MMO, 2018). A review of offshore wind farm studies stated that in general, Manx shearwater displayed weak avoidance of offshore wind farms, though it has been recorded in developments in the Celtic Sea (Dierschke *et al.*, 2016). Due to the obvious visual differences between an offshore wind farm and a tidal energy development it is currently thought that displacement for this species will not occur during the operational phase of the proposed development. Manx shearwaters are active at night, though most nights away from the colony are spent roosting on the water rather than foraging (Dean, 2012; Dean *et al.*, 2012).

410. The Irish Sea Front is located >30 km from the nearest extent of the MDZ, and it is unlikely that any activities will occur much closer to the Irish Sea Front SPA than this. Due to this spatial separation it is inconceivable that birds within the SPA boundary could be impacted by visual disturbance or airborne noise disturbance during any project phase.

411. The possibility of an adverse effect on site integrity due to disturbance at sea by airborne noise and visual disturbance can be excluded for the Irish Sea Front SPA due to the predicted low

magnitude of impact, the insensitivity of the qualifying features to this impact pathway, and the absence of qualifying features of this SPA across the area in which this impact pathway could occur. These factors mean that there is no potential for in-combination effects with other projects (Section 7.1) due to this impact pathway.

8.2.2.2.2. Changes in Water Quality

412. Any pollution incidents, which are considered to be unlikely to occur, will result in the contamination of a small area (likely no more than several hundreds of metres) of subtidal habitat with a small amount of pollution. Measures will be in place to rapidly collect or disperse any such contamination, meaning that its presence will be temporary and reversible. Because this SPA is located >30 km from the MDZ and ECC, it is inconceivable that this impact pathway could affect habitats within this SPA.

413. On the basis of the available information, the possibility of an adverse effect on site integrity due to changes in prey availability can be excluded for the Irish Sea Front SPA, as no effect on water quality is predicted. Because no effect is predicted there is no possibility of in-combination effects with other projects (Section 7.1) due to this impact pathway.

8.2.2.2.3. Changes in Prey Availability

414. For prey items of the qualifying features of this SPA, no effect due to underwater noise (either due to physical injury or behavioural changes) and habitat loss is predicted.

415. The maximum envisaged effect associated with sediment plumes arising as a result of construction, operation and decommissioning of the project are very minor increases in suspended sediment concentration; less than 1 mg/l a short distance from the release point, over a distance of several hundred metres. The effects will be temporary and reversible, with a return to very low background concentrations occurring rapidly upon cessation of activities. Other than at the immediate release point, such a change would be immeasurable. No effects on the prey species of the qualifying features of this SPA are therefore predicted.

416. On the basis of the available information, the possibility of an adverse effect on site integrity due to changes in prey availability can be excluded for the Irish Sea Front SPA, as no effect on prey species is predicted. Because no effect is predicted there is no possibility of in-combination effects with other projects (**Section 7.1**) due to this impact pathway.

8.2.2.2.4. Collision with Tidal Devices

417. Manx shearwater is known to possess substantial diving capabilities, meaning that there is a theoretical risk of collision with tidal devices. At an indicative 240 MW array, approximately 0-2 or 0-9 birds per season may collide with tidal devices, of which the vast majority will breed at either the Skomer, Skokholm and the Seas off Pembrokeshire SPA or the Aberdaron Coast and Bardsey Island SPA (SNH, 2018). This assumes an avoidance rate of at least 95%. Compared with the 12,000 birds estimated to occur at the Irish Sea Front SPA, this is <0.1% of the total, and is therefore considered an impact so small it will not result in an adverse effect on site integrity. Due to the very low magnitude of this impact pathway, these factors mean that there

is no potential for in-combination effects with other projects (**Section 7.1**) due to this impact pathway.

8.2.2.3. Conclusion

418. On the basis of the information presented above, none of the impact pathways screened into Stage 2 of the HRA have the potential individually or when considered together to either compromise the conservation objectives or cause an adverse effect on site integrity of this SPA, both for the Morlais project alone and in-combination with other projects.

8.2.3. Aberdaron Coast and Bardsey Island SPA

8.2.3.1. Conservation Objectives

419. A single species from this SPA, Manx shearwater, is considered by this assessment. The vision for Manx shearwater at this SPA (CCW, 2008a) is for it to be of favourable conservation status, where all of the following conditions are satisfied:

- Breeding population of Manx shearwater (confined to Ynys Enlli) is stable or increasing;
- Reproductive rates remain stable;
- Deaths from the lighthouse attractions, fencing and other infrastructure are minimal;
- No ground predators are introduced;
- Nesting birds are not disturbed by restoration works on boundary walls or recreational activities; and
- All factors affecting the achievement of these conditions are under control.

8.2.3.2. Assessment of Impact Pathways

8.2.3.2.1. Disturbance at Sea by Airborne Noise and Visual Disturbance

420. In two literature reviews examining the likely sensitivity of seabirds to tidal and wave energy development (Furness *et al*., 2012) and offshore wind development (Furness and Wade, 2012), Manx shearwater was given a score of one out of five for disturbance by vessels (where a score of one is the least sensitive). More recently, a wide-ranging review of displacement and habituation of seabirds did not identify Manx shearwater as being sensitive to disturbance or displacement in response to a range of marine activities (MMO, 2018). A review of offshore wind farm studies stated that in general, Manx shearwater displayed weak avoidance of offshore wind farms, though it has been recorded in developments in the Celtic Sea (Dierschke *et al.*, 2016). Due to the obvious visual differences between an offshore wind farm and a tidal energy development it is currently thought that displacement for this species will not occur during the operational phase of the proposed development. Manx shearwaters are active at night, though most nights away from the colony are spent roosting on the water rather than foraging (Dean, 2012; Dean *et al.*, 2012).

421. Fledging shearwaters, along with other members of the Procellariiformes order of seabirds are known to be vulnerable to grounding by attraction to artificial lighting (Deppe *et al.*, 2017; Laguna

et al., 2014; Rodríguez *et al.*, 2017, 2015, 2014). This grounding seems to occur at relatively close range to the colony (within 20 km), so is not considered to be an issue for the proposed development requiring further consideration given that this SPA is situated >40 km from the nearest part of the MDZ.

422. Of the Manx shearwater in the MDZ and ECC, approximately 42% are predicted to originate from this SPA (SNH, 2018). It is considered that due to airborne noise and visual disturbance during the construction, operational and decommissioning phases of the proposed development, some disturbance to Manx shearwaters at sea that are from this SPA may occasionally occur within the MDZ and ECC as a result of these activities but is not likely on a regular basis. Based on the available information, disturbance events will be spatially restricted to areas within close proximity to construction, operational or decommissioning activity (likely to be in the order of tens of metres or less due to the apparent insensitivity of this qualifying feature to this impact pathway), last only for as long as the activity itself, and be reversible once the activity has concluded. Rather than resulting in harm to the bird or loss from the population, disturbance by airborne noise and visual disturbance will generally result in affected birds temporarily redistributing at sea and moving to an area where they are undisturbed. The relatively low recorded densities of Manx shearwater in the MDZ and 2 km buffer during the baseline surveys (**Section 5.2.1.7.4**) indicates that the area of sea occupied by the MDZ and ECC are not an important foraging area for these species. The preferred foraging grounds of Manx shearwater for birds breeding in UK western waters have been shown to occur away from the MDZ and ECC (Dean, 2012; Dean et al., 2012; Guilford et al., 2008; Shoji et al., 2016).

423. On the basis of this information, the possibility of an adverse effect on site integrity due to disturbance at sea by airborne noise and visual disturbance can be excluded for the Aberdaron Coast and Bardsey Island SPA due to the predicted low impact magnitude, the insensitivity of the qualifying features to this impact pathway, and the absence of high densities of qualifying features across the area in which this impact pathway could occur. These factors mean that there is no potential for in-combination effects with other projects (Section 7.1) due to this impact pathway.

8.2.3.2.2. Disturbance at Breeding Sites by Airborne Noise and Visual Disturbance

424. The Manx shearwater population of the Aberdaron Coast and Bardsey Island SPA consists of birds breeding at Bardsey Island. This is located approximately 47 km from the nearest boundary of the MDZ. There is no project-related activity planned at substantially closer distances to these colonies during any of the project phases. Whilst habituation to anthropogenic activities near a breeding colony is a key factor in understanding the likely response of the colony to that activity, flight initiation distances for birds at breeding colonies are generally in the order of hundreds of metres or less (Burger, 1998; Erwin, 1989; Livezey *et al.*, 2016; Rodgers Jr. and Schwikert, 2002; Rodgers Jr. and Smith, 1995).

425. The possibility of an adverse effect on site integrity due to disturbance at breeding colonies can be excluded for the Aberdaron Coast and Bardsey Island SPA, as no effect is predicted. This is due to the distances between activities relating to the proposed development and breeding colony associated with this SPA. Because no effect is predicted there is no possibility of in-combination effects with other projects (Section 7.1) due to this impact pathway.

8.2.3.2.3. Changes in Water Quality

426. Any pollution incidents, which are considered to be unlikely to occur, will result in the contamination of a small area (likely no more than several hundreds of metres) of subtidal habitat with a small amount of pollution. Measures will be in place to rapidly collect or disperse any such contamination, meaning that its presence will be temporary and reversible. Because this SPA is located >40 km from the MDZ and ECC, it is inconceivable that this impact pathway could affect habitats within this SPA.

427. The foraging capabilities of the qualifying species of this SPA (Oppel *et al.*, 2018; Thaxter *et al.*, 2012) are such that whilst temporary habitat loss of a small area of subtidal foraging habitat outside the SPA boundary could occur, the temporary non-availability of a section of subtidal habitat of this size would represent a very small percentage of the total available to the qualifying species of this SPA. Combined with the large amount of alternative habitat available locally, and the fact that the project does not appear to represent prime foraging habitat based on reported species densities (**Section 5.2.1.10**), such an event would therefore not be expected to substantially impact the species concerned.

428. The possibility of an adverse effect on site integrity due to changes in water quality as a result of the construction, operation and decommissioning of the project can be excluded for the Aberdaron Coast and Bardsey Island SPA for these reasons. Combined with the location and distances of other projects (Section 7.1) from the MDZ and ECC, these factors mean that there is no potential for in-combination effects with other projects due to this impact pathway.

8.2.3.2.4. Changes in Prey Availability

429. For prey items of the qualifying features of this SPA, no effect due to underwater noise (either due to physical injury or behavioural changes) and habitat loss is predicted.

430. The maximum envisaged effect associated with sediment plumes arising as a result of construction, operation and decommissioning of the project are very minor increases in suspended sediment concentration; less than 1 mg/l a short distance from the release point, over a distance of several hundred metres. The effects will be temporary and reversible, with a return to very low background concentrations occurring rapidly upon cessation of activities. Other than at the immediate release point, such a change would be immeasurable. No effects on the prey species of the qualifying features of this SPA are therefore predicted.

431. On the basis of the available information, the possibility of an adverse effect on site integrity due to changes in prey availability can be excluded for the Aberdaron Coast and Bardsey Island SPA, as no effect on prey species is predicted. Because no effect is predicted there is no possibility of in-combination effects with other projects (Section 7.1) due to this impact pathway.

8.2.3.2.5. Collision with Tidal Devices

432. Dean (2012) reported that approximately 50% of all Manx shearwater diving activity occurs at depths of less than 5.3 m, though birds were recorded diving as deep as 55.5 m. Using the same raw data, Shoji et al., (2016) reported that mean dive depth was 9.6 m, and mean dive duration was 13.49 seconds. Whilst this information suggests that the majority of Manx shearwater diving

behaviour occurs in relatively shallow parts of the water column, there is potential for this species to interact with the moving parts of tidal energy convertors during the operational phase of the project.

433. At an indicative 240 MW array, approximately 0-2 or 0-9 birds respectively per season may collide with tidal devices (assuming an avoidance rate of at least 95%). The theoretical method of apportioning (SNH, 2018) indicates that approximately 42% of the Manx shearwaters present in the MDZ and buffer zone are likely to originate from this SPA. On this basis, between 0-4 birds from this SPA may collide annually with tidal devices. On the basis that this represents 0.03% of the 13,860 birds that breed at this SPA. The predicted magnitude of this impact means that it is considered that the project will not result in an adverse effect on site integrity through this impact pathway. Due to the very low magnitude of this impact pathway, these factors mean that there is no potential for in-combination effects with other projects (Section 7.1) due to this impact pathway.

8.2.3.3. Conclusion

434. On the basis of the information presented above, none of the impact pathways screened into Stage 2 of the HRA have the potential individually or when considered together to either compromise the conservation objectives or cause an adverse effect on site integrity of this SPA, both for the Morlais project alone and in-combination with other projects.

8.2.4. Howth Head Coast SPA

8.2.4.1. Conservation Objectives

435. The conservation objective of this SPA (NPWS, 2017a) is to maintain or restore the favourable conservation status of species of special conservation interests, which for the purposes of this assessment covers a single species; kittiwake. This is achieved when:

- Population dynamics data on the species concerned indicate that it is maintaining itself on a long-term basis as a viable component of its natural habitats;
- The natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future; and
- There is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis.

8.2.4.2. Assessment of Impact Pathways

8.2.4.2.1. Disturbance at Sea by Airborne Noise and Visual Disturbance

436. In three literature reviews examining the likely sensitivity of seabirds to tidal and wave energy development (Furness *et al*., 2012) and offshore wind development (Furness and Wade, 2012; Garthe and Hüppop, 2004), kittiwake was given a score of two out of five for disturbance by vessels (where a score of one is the least sensitive), with avoidance behaviour described as slight avoidance at short range. More recently, a wide-ranging review of displacement and habituation of seabirds did not identify kittiwake as being sensitive to disturbance or displacement in response to a wide range of marine activities (MMO, 2018).

437. During a review of offshore wind farm studies, kittiwake was described as a species which is hardly affected by offshore wind farms or with attraction and avoidance approximately equal over all studies (Dierschke *et al.*, 2016). Single site studies showed attraction during construction only (indicating possible attraction to vessels) (Gill *et al.*, 2018), mixed avoidance at two sites in Dutch waters (including attraction into a vessel anchorage zone) (Leopold *et al.*, 2013), no evidence of any such effects (APEM, 2017) and possible, but not significant, attraction effects (Vanermen *et al.*, 2015).

438. Kittiwake is thought to be fairly active during nocturnal conditions (Garthe and Hüppop, 2004), but there is no evidence that artificial lighting during the night causes issues for this species.

439. It is considered that due to airborne noise and visual disturbance during the construction, operational and decommissioning phases of the proposed development, some disturbance to breeding kittiwakes at sea that are from this SPA may occasionally occur within the MDZ as a result of these activities but is not likely on a regular basis. Based on the available information, disturbance events will not be particularly common, and be spatially restricted to areas within close proximity to construction, operational or decommissioning activity (likely to be in the order of tens or hundreds of metres due to the apparent insensitivity of this qualifying feature to this impact pathway), last only for as long as the activity itself, and be completely reversible once the activity has concluded. Rather than resulting in harm to the bird or loss from the population, disturbance by airborne noise and visual disturbance will generally result in affected birds temporarily redistributing at sea and moving to an area where they are undisturbed. The low recorded densities of kittiwake in the MDZ and 2 km buffer during the baseline surveys (**Section 5.2.1.6.5**) indicates that this area of sea is not an important area for these species; and only 13% of birds in the MDZ and ECC are thought to originate from this colony. The low on-site kittiwake density reflects models of at-sea distribution for kittiwake throughout UK waters, which do not consider the MDZ, ECC and surrounding subtidal habitats to be part of the core foraging range for this species (Cleasby *et al.*, 2018; Wakefield *et al.*, 2017).

440. The possibility of an adverse effect on site integrity due to disturbance at sea by airborne noise and visual disturbance at sea can be excluded for the Howth Head Coast SPA due to the very low density of birds from this SPA in the area in which this impact pathway could occur, the low precited magnitude of the impact pathway, and the relative insensitivity of the qualifying species present from this SPA. These factors mean that there is no potential for in-combination effects with other projects (Section 7.1) due to this impact pathway.

8.2.4.2.2. Disturbance at Breeding Sites by Airborne Noise and Visual Disturbance

441. Within this SPA, breeding kittiwake sites are located in excess of 80 km from the MDZ. There is no project-related activity planned at substantially closer distances to these colonies during any of the project phases. Whilst habituation to anthropogenic activities near a breeding colony is a key factor in understanding the likely response of the colony to that activity, flight initiation distances for birds at breeding colonies are generally in the order of hundreds of metres or less (Burger, 1998; Erwin, 1989; Livezey *et al.*, 2016; Rodgers Jr. and Schwikert, 2002; Rodgers Jr. and Smith, 1995).

442. The possibility of an adverse effect on site integrity due to disturbance at breeding sites by airborne noise and visual disturbance at sea can be excluded for the Howth Head Coast SPA as no effects are predicted. This is due to the distances between activities relating to the proposed development and breeding colonies associated with this SPA. Because no effect is predicted there is no possibility of in-combination effects with other projects (Section 7.1) due to this impact pathway.

8.2.4.2.3. Changes in Water Quality

443. Any pollution incidents, which are considered to be unlikely to occur, will result in the contamination of a small area (likely no more than several hundreds of metres) of subtidal habitat with a small amount of pollution. Measures will be in place to rapidly collect or disperse any such contamination, meaning that its presence will be temporary and reversible. Because this SPA is located >80 km from the MDZ and ECC, it is inconceivable that this impact pathway could affect habitats within this SPA.

444. The foraging capabilities of the qualifying species of this SPA (Cleasby *et al.*, 2018; Oppel *et al.*, 2018; Thaxter *et al.*, 2012; Wakefield *et al.*, 2017) are such that whilst temporary habitat loss of a small area of subtidal foraging habitat outside the SPA boundary could occur, the temporary non-availability of a section of subtidal habitat of this size would represent a very small percentage of the total available to the qualifying species of this SPA. Combined with the large amount of alternative habitat available locally, and the fact that the project does not appear to represent prime foraging habitat based on reported species densities (**Section 5.2.1.10**), such an event would therefore not be expected to substantially impact the species concerned.

445. The possibility of an adverse effect on site integrity due to changes in water quality as a result of the construction, operation and decommissioning of the project can be excluded for the Howth Head Coast SPA for these reasons. Combined with the location and distances of other projects (Section 7.1) from the MDZ and ECC, these factors mean that there is no potential for in-combination effects with other projects due to this impact pathway.

8.2.4.2.4. Changes in Prey Availability

446. For prey items of the qualifying features of this SPA, no effect due to underwater noise (either due to physical injury or behavioural changes) and habitat loss is predicted.

447. The maximum envisaged effect associated with sediment plumes arising as a result of construction, operation and decommissioning of the project are very minor increases in suspended sediment concentration; less than 1 mg/l a short distance from the release point, over a distance of several hundred metres. The effects will be temporary and reversible, with a return to very low background concentrations occurring rapidly upon cessation of activities. Other than at the immediate release point, such a change would be immeasurable. No effects on the prey species of the qualifying features of this SPA are therefore predicted.

448. On the basis of the available information, the possibility of an adverse effect on site integrity due to changes in prey availability can be excluded for the Howth Head Coast SPA, as no effect on prey species is predicted. Because no effect is predicted there is no possibility of in-combination effects with other projects (Section 7.1) due to this impact pathway.

8.2.4.2.5. Collision with Tidal Devices

449. Like other gull species, kittiwake are surface feeding birds. The maximum depth at which kittiwakes are likely to feed is approximately 1 m (Cramp and Simmons, 1983). Moving elements of tidal devices which will be operated at the project are not expected to occur less than 5 m from the surface of the sea.

450. The possibility of an adverse effect on site integrity due to this impact pathway can therefore be excluded for the kittiwakes of the Howth Head Coast SPA. This is due to the fact that qualifying species do not occur in the 'at risk' depths of the water column where collision with moving parts of tidal devices is a possibility. Because no effect is predicted there is no possibility of in-combination effects with other projects (Section 7.1) due to this impact pathway.

8.2.4.3. Conclusion

451. On the basis of the information presented above, none of the impact pathways screened into Stage 2 of the HRA have the potential individually or when considered together to either compromise the conservation objectives or cause an adverse effect on site integrity of this SPA, both for the Morlais project alone and in-combination with other projects.

8.2.5. Lambay Island SPA

8.2.5.1. Conservation Objectives

452. A single species from this site (kittiwake) is included in this assessment. The conservation objective of this SPA (NPWS, 2017c) is to maintain or restore the favourable conservation status of species of special conservation interest. This is achieved when:

- Population dynamics data on the species concerned indicate that it is maintaining itself on a long-term basis as a viable component of its natural habitats;
- The natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future; and
- There is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis.

8.2.5.2. Assessment of Impact Pathways

8.2.5.2.1. Disturbance at Sea by Airborne Noise and Visual Disturbance

453. In three literature reviews examining the likely sensitivity of seabirds to tidal and wave energy development (Furness *et al.*, 2012) and offshore wind development (Furness and Wade, 2012; Garthe and Hüppop, 2004), kittiwake was given a score of two out of five for disturbance by vessels (where a score of one is the least sensitive), with avoidance behaviour described as slight avoidance at short range. More recently, a wide-ranging review of displacement and habituation of seabirds did not identify kittiwake as being sensitive to disturbance or displacement in response to a wide range of marine activities (MMO, 2018).

454. During a review of offshore wind farm studies, kittiwake was described as a species which is hardly affected by offshore wind farms or with attraction and avoidance approximately equal over all studies (Dierschke *et al.*, 2016). Single site studies showed attraction during construction only (indicating possible attraction to vessels) (Gill *et al.*, 2018), mixed avoidance at two sites in Dutch waters (including attraction into a vessel anchorage zone) (Leopold *et al.*, 2013), no evidence of any such effects (APEM, 2017) and possible, but not significant, attraction effects (Vanermen *et al.*, 2015).

455. Kittiwake is thought to be fairly active during nocturnal conditions (Garthe and Hüppop, 2004), but there is no evidence that artificial lighting during the night causes issues for this species.

456. It is considered that due to airborne noise and visual disturbance during the construction, operational and decommissioning phases of the proposed development, some disturbance to breeding kittiwakes at sea that are from this SPA may occasionally occur within the MDZ as a result of these activities but is not likely on a regular basis. Based on the available information, disturbance events will not be particularly common, and be spatially restricted to areas within close proximity to construction, operational or decommissioning activity (likely to be in the order of tens or hundreds of metres due to the apparent insensitivity of this qualifying feature to this impact pathway), last only for as long as the activity itself, and be completely reversible once the activity has concluded. Rather than resulting in harm to the bird or loss from the population, disturbance by airborne noise and visual disturbance will generally result in affected birds temporarily redistributing at sea and moving to an area where they are undisturbed. The low recorded densities of kittiwake in the MDZ and 2 km buffer during the baseline surveys (**Section 5.2.1.6.5**) indicates that this area of sea is not an important area for these species; and only 13% of birds in the MDZ and ECC are thought to originate from this colony. The low on-site kittiwake density reflects models of at-sea distribution for kittiwake throughout UK waters, which do not consider the MDZ, ECC and surrounding subtidal habitats to be part of the core foraging range for this species (Cleasby *et al.*, 2018; Wakefield *et al.*, 2017).

457. The possibility of an adverse effect on site integrity due to disturbance at sea by airborne noise and visual disturbance at sea can be excluded for the Lambay Island SPA due to the very low density of birds from this SPA in the area in which this impact pathway could occur, the low precited magnitude of the impact pathway, and the relative insensitivity of the qualifying species present from this SPA. These factors mean that there is no potential for in-combination effects with other projects (Section 7.1) due to this impact pathway.

8.2.5.2.2. Disturbance at Breeding Sites by Airborne Noise and Visual Disturbance

458. Within this SPA, breeding kittiwake sites are located in excess of 80 km from the MDZ. There is no project-related activity planned at substantially closer distances to these colonies during any of the project phases. Whilst habituation to anthropogenic activities near a breeding colony is a key factor in understanding the likely response of the colony to that activity, flight initiation distances for birds at breeding colonies are generally in the order of hundreds of metres or less (Burger, 1998; Erwin, 1989; Livezey *et al.*, 2016; Rodgers Jr. and Schwikert, 2002; Rodgers Jr. and Smith, 1995).

459. The possibility of an adverse effect on site integrity due to disturbance at breeding sites by airborne noise and visual disturbance at sea can be excluded for the Lambay Island SPA as no effects are predicted. This is due to the distances between activities relating to the proposed development and breeding colonies associated with this SPA. Because no effect is predicted there is no possibility of in-combination effects with other projects (Section 7.1) due to this impact pathway.

8.2.5.2.3. Changes in Water Quality

460. Any pollution incidents, which are considered to be unlikely to occur, will result in the contamination of a small area (likely no more than several hundreds of metres) of subtidal habitat with a small amount of pollution. Measures will be in place to rapidly collect or disperse any such contamination, meaning that its presence will be temporary and reversible. Because this SPA is located >80 km from the MDZ and ECC, it is inconceivable that this impact pathway could affect habitats within this SPA.

461. The foraging capabilities of the qualifying species of this SPA (Cleasby *et al.*, 2018; Oppel *et al.*, 2018; Thaxter *et al.*, 2012; Wakefield *et al.*, 2017) are such that whilst temporary habitat loss of a small area of subtidal foraging habitat outside the SPA boundary could occur, the temporary non-availability of a section of subtidal habitat of this size would represent a very small percentage of the total available to the qualifying species of this SPA. Combined with the large amount of alternative habitat available locally, and the fact that the project does not appear to represent prime foraging habitat based on reported species densities (**Section 5.2.1.10**), such an event would therefore not be expected to substantially impact the species concerned.

462. The possibility of an adverse effect on site integrity due to changes in water quality as a result of the construction, operation and decommissioning of the project can be excluded for the Lambay Island SPA for these reasons. Combined with the location and distances of other projects (Section 7.1) from the MDZ and ECC, these factors mean that there is no potential for in-combination effects with other projects due to this impact pathway.

8.2.5.2.4. Changes in Prey Availability

463. For prey items of the qualifying features of this SPA, no effect due to underwater noise (either due to physical injury or behavioural changes) and habitat loss is predicted.

464. The maximum envisaged effect associated with sediment plumes arising as a result of construction, operation and decommissioning of the project are very minor increases in suspended sediment concentration; less than 1 mg/l a short distance from the release point, over a distance of several hundred metres. The effects will be temporary and reversible, with a return to very low background concentrations occurring rapidly upon cessation of activities. Other than at the immediate release point, such a change would be immeasurable. No effects on the prey species of the qualifying features of this SPA are therefore predicted.

465. On the basis of the available information, the possibility of an adverse effect on site integrity due to changes in prey availability can be excluded for the Lambay Island SPA, as no effect on prey species is predicted. Because no effect is predicted there is no possibility of in-combination effects with other projects (Section 7.1) due to this impact pathway.

8.2.5.2.5. Collision with Tidal Devices

466. Like other gull species, kittiwake are surface feeding birds. The maximum depth at which kittiwakes are likely to feed is approximately 1 m (Cramp and Simmons, 1983). Moving elements of tidal devices which will be operated at the project are not expected to occur less than approximately 5 m from the surface of the sea.

467. The possibility of an adverse effect on site integrity due to this impact pathway can therefore be excluded for the kittiwakes of the Lambay Island SPA. This is due to the fact that qualifying species do not occur in the 'at risk' depths of the water column where collision with moving parts of tidal devices is a possibility. Because no effect is predicted there is no possibility of in-combination effects with other projects (Section 7.1) due to this impact pathway.

8.2.5.3. Conclusion

468. On the basis of the information presented above, none of the impact pathways screened into Stage 2 of the HRA have the potential individually or when considered together to either compromise the conservation objectives, or cause an adverse effect on site integrity of this SPA, both for the Morlais project alone and in-combination with other projects.

8.2.6. Ribble and Allt Estuaries SPA

8.2.6.1. Conservation Objectives

469. A single species from this SPA, lesser black-backed gull, is included in this assessment.

470. The conservation objective of this SPA (Natural England, 2019a) is, subject to natural change, to ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the
site contributes to achieving the aims of the Wild Birds Directive, by maintaining or restoring:

- The extent and distribution of the habitats of the qualifying features;
- The structure and function of the habitats of the qualifying features;
- The supporting processes on which the habitats of the qualifying features rely;
- The population of each of the qualifying features; and
- The distribution of the qualifying features within the site.

8.2.6.2. Assessment of Impact Pathways

8.2.6.2.1. Disturbance at Sea by Airborne Noise and Visual Disturbance

471. In three literature reviews examining the likely sensitivity of seabirds to tidal and wave energy development (Furness *et al*., 2012) and offshore wind development (Furness and Wade, 2012; Garthe and Hüppop, 2004), lesser black-backed gull was given a score of two out of five for disturbance by vessels (where a score of one is the least sensitive), with avoidance behaviour described as slight avoidance at short range. More recently, a wide-ranging review of displacement and habituation of seabirds did not identify lesser black-backed gull as being

sensitive to disturbance or displacement in response to a wide range of marine activities (MMO, 2018).

472. Whilst some evidence does exist of lesser black-backed gull displacement by offshore wind farms (Leopold *et al.*, 2013), it is suggested that the prohibition of fishing vessels within operational offshore wind farms may be responsible for this observation, as opposed to a genuine disturbance and displacement effect. More recent work at another site no change in numbers during any stage of an offshore wind farm's development (Gill *et al.*, 2018). A review into the findings of ornithological studies at offshore wind farms suggested that single site studies usually concluded weak attraction for lesser black-backed gull; this was attributed to the species being regularly recorded roosting on wind farm infrastructure (Dierschke *et al.*, 2016).

473. Lesser black-backed gull are thought to be fairly active during nocturnal conditions (Garthe and Hüppop, 2004), but there is no evidence that artificial lighting during the night causes issues for this species.

474. It is considered that due to airborne noise and visual disturbance during the construction, operational and decommissioning phases of the proposed development, some disturbance to breeding lesser black-backed gull at sea that are from this SPA may occasionally occur within the MDZ and ECC as a result of these activities but is not likely on a regular basis. Based on the available information, disturbance events will not be particularly common, and be spatially restricted to areas within close proximity to construction, operational or decommissioning activity (likely to be in the order of tens or hundreds of metres due to the apparent relative insensitivity of this qualifying feature to this impact pathway), last only for as long as the activity itself, and be reversible once the activity has concluded. Rather than resulting in harm to the bird or loss from the population, disturbance by airborne noise and visual disturbance will generally result in affected birds temporarily redistributing at sea and moving to an area where they are undisturbed. The low recorded densities of lesser black-backed gull (**Section 5.2.1.6.5**) in the MDZ and 2 km buffer during the baseline surveys indicates that this area of sea is not an important area for these species; even less so for birds from this SPA with approximately 12% of lesser black-backed gulls recorded in the MDZ and ECC thought to originate from this SPA.

475. The possibility of an adverse effect on site integrity due to disturbance at sea by airborne noise and visual disturbance at sea can be excluded for the Ribble and Allt Estuaries SPA due to the very low density of birds from this SPA in the area in which this impact pathway could occur, the low predicted magnitude of the impact pathway, and the relative insensitivity of the qualifying species present from this SPA.

8.2.6.2.2. Disturbance at Breeding Sites by Airborne Noise and Visual Disturbance

476. Within this SPA, lesser black-backed gull breeding sites are located in excess of 100 km from the nearest boundary of the MDZ. There is no project-related activity planned at substantially closer distances to these colonies during any of the project phases. Whilst habituation to anthropogenic activities near a breeding colony is a key factor in understanding the likely response of the colony to that activity, flight initiation distances for birds at breeding colonies are generally in the order of hundreds of metres or less (Burger, 1998; Erwin, 1989; Livezey *et al.*, 2016; Rodgers Jr. and Schwikert, 2002; Rodgers Jr. and Smith, 1995).

477. The possibility of an adverse effect on site integrity due to disturbance at breeding colonies can be excluded for the Ribble and Allt Estuaries SPA, as no effect is predicted. This is due to the distances between activities relating to the proposed development and breeding colony associated with this SPA. These factors mean that there is no potential for in-combination effects with other projects (Section 7.1) due to this impact pathway.

8.2.6.2.3. Changes in Water Quality

478. Any pollution incidents, which are considered to be unlikely to occur, will result in the contamination of a small area (likely no more than several hundreds of metres) of subtidal habitat with a small amount of pollution. Measures will be in place to rapidly collect or disperse any such contamination, meaning that its presence will be temporary and reversible. Because this SPA is located >100 km from the MDZ and ECC, it is inconceivable that this impact pathway could affect habitats within this SPA.

479. The foraging capabilities of lesser black-backed gull (Thaxter *et al.*, 2012) are such that whilst temporary habitat loss of a small area of subtidal foraging habitat outside the SPA boundary could occur, the temporary non-availability of a section of subtidal habitat of this size would represent a very small percentage of the total available to the qualifying species of this SPA. Combined with the large amount of alternative habitat available locally, and the fact that the project does not appear to represent prime foraging habitat based on reported species densities (**Section 5.2.1.10**), such an event would therefore not be expected to substantially impact the species concerned.

480. The possibility of an adverse effect on site integrity due to changes in water quality as a result of the construction, operation and decommissioning of the project can be excluded for Ribble and Allt Estuaries SPA for these reasons. Combined with the location and distances of other projects (Section 7.1) from the MDZ and ECC, these factors mean that there is no potential for in-combination effects with other projects due to this impact pathway.

8.2.6.2.4. Changes in Prey Availability

481. For prey items of the qualifying features of this SPA, no effect due to underwater noise (either due to physical injury or behavioural changes) and habitat loss is predicted.

482. The maximum envisaged effect associated with sediment plumes arising as a result of construction, operation and decommissioning of the project are very minor increases in suspended sediment concentration; less than 1 mg/l a short distance from the release point, over a distance of several hundred metres. The effects will be temporary and reversible, with a return to very low background concentrations occurring rapidly upon cessation of activities. Other than at the immediate release point, such a change would be immeasurable. No effects on the prey species of the qualifying features of this SPA are therefore predicted.

483. On the basis of the available information, the possibility of an adverse effect on site integrity due to changes in prey availability can be excluded for the Ribble and Allt Estuaries SPA, as no effect on prey species is predicted. Because no effect is predicted there is no possibility of in-combination effects with other projects (Section 7.1) due to this impact pathway.

8.2.6.2.5. Collision with Tidal Devices

484. Lesser black-backed gull is a surface feeding species. The maximum depth at which they are likely to feed is approximately 1 m or less (Cramp and Simmons, 1983; Schwemmer and Garthe, 2008). The moving elements of tidal energy convertors which will be operated at the proposed development are not expected to occur less than 5 m from the surface of the sea.

485. The possibility of an adverse effect on site integrity due to this impact pathway can therefore be excluded for the lesser black-backed gulls of the Ribble and Allt Estuaries SPA. This is due to the fact that qualifying species do not occur in the ‘at risk’ depths of the water column where collision with moving parts of tidal devices is a possibility. Because no effect is predicted there is no possibility of in-combination effects with other projects (Section 7.1) due to this impact pathway.

8.2.6.3. Conclusion

486. On the basis of the information presented above, none of the impact pathways screened into Stage 2 of the HRA have the potential individually or when considered together to either compromise the conservation objectives or cause an adverse effect on site integrity of this SPA, both for the Morlais project alone and in-combination with other projects.

8.2.7. Morecambe Bay and Duddon Estuary SPA

8.2.7.1. Conservation Objectives

487. A single species from this SPA, lesser black-backed gull, is included in this assessment.

488. The conservation objective of this SPA (Natural England, 2019b) is, subject to natural change, to ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the
site contributes to achieving the aims of the Wild Birds Directive, by maintaining or restoring:

- The extent and distribution of the habitats of the qualifying features;
- The structure and function of the habitats of the qualifying features;
- The supporting processes on which the habitats of the qualifying features rely;
- The population of each of the qualifying features; and
- The distribution of the qualifying features within the site.

8.2.7.2. Assessment of Impact Pathways

8.2.7.2.1. Disturbance at Sea by Airborne Noise and Visual Disturbance

489. In three literature reviews examining the likely sensitivity of seabirds to tidal and wave energy development (Furness *et al*., 2012) and offshore wind development (Furness and Wade, 2012; Garthe and Hüppop, 2004), lesser black-backed gull was given a score of two out of five for disturbance by vessels (where a score of one is the least sensitive), with avoidance behaviour described as slight avoidance at short range. More recently, a wide-ranging review of

displacement and habituation of seabirds did not identify lesser black-backed gull as being sensitive to disturbance or displacement in response to a wide range of marine activities (MMO, 2018).

490. Whilst some evidence does exist of lesser black-backed gull displacement by offshore wind farms (Leopold *et al*., 2013), it is suggested that the prohibition of fishing vessels within operational offshore wind farms may be responsible for this observation, as opposed to a genuine disturbance and displacement effect. More recent work at another site no change in numbers during any stage of an offshore wind farm's development (Gill et al., 2018). A review into the findings of ornithological studies at offshore wind farms suggested that single site studies usually concluded weak attraction for lesser black-backed gull; this was attributed to the species being regularly recorded roosting on wind farm infrastructure (Dierschke et al., 2016).

491. Lesser black-backed gull are thought to be fairly active during nocturnal conditions (Garthe and Hüppop, 2004), but there is no evidence that artificial lighting during the night causes issues for this species.

492. It is considered that due to airborne noise and visual disturbance during the construction, operational and decommissioning phases of the proposed development, some disturbance to breeding lesser black-backed gull at sea that are from this SPA may occasionally occur within the MDZ and ECC as a result of these activities but is not likely on a regular basis. Based on the available information, disturbance events will not be particularly common, and be spatially restricted to areas within close proximity to construction, operational or decommissioning activity (likely to be in the order of tens or hundreds of metres due to the apparent relative insensitivity of this qualifying feature to this impact pathway), last only for as long as the activity itself, and be reversible once the activity has concluded. Rather than resulting in harm to the bird or loss from the population, disturbance by airborne noise and visual disturbance will generally result in affected birds temporarily redistributing at sea and moving to an area where they are undisturbed. The low recorded densities of lesser black-backed gull (**Section 5.2.1.6.5**) in the MDZ and 2 km buffer during the baseline surveys indicates that this area of sea is not an important area for these species; even less so for birds from this SPA with approximately 12% of lesser black-backed gulls recorded in the MDZ and ECC thought to originate from this SPA.

493. The possibility of an adverse effect on site integrity due to disturbance at sea by airborne noise and visual disturbance at sea can be excluded for the Morecambe Bay and Duddon Estuary SPA due to the very low density of birds from this SPA in the area in which this impact pathway could occur, the low precited magnitude of the impact pathway, and the relative insensitivity of the qualifying species present from this SPA. These factors mean that there is no potential for in-combination effects with other projects (Section 7.1) due to this impact pathway.

8.2.7.2.2. Disturbance at Breeding Sites by Airborne Noise and Visual Disturbance

494. Within this SPA, lesser black-backed gull breeding sites are located in excess of 100 km from the nearest boundary of the MDZ. There is no project-related activity planned at substantially closer distances to these colonies during any of the project phases. Whilst habituation to anthropogenic activities near a breeding colony is a key factor in understanding the likely response of the colony to that activity, flight initiation distances for birds at breeding colonies are

generally in the order of hundreds of metres or less (Burger, 1998; Erwin, 1989; Livezey et al., 2016; Rodgers Jr. and Schwikert, 2002; Rodgers Jr. and Smith, 1995).

495. The possibility of an adverse effect on site integrity due to disturbance at breeding colonies can be excluded for the Morecambe Bay and Duddon Estuary SPA, as no effect is predicted. This is due to the distances between activities relating to the proposed development and breeding colony associated with this SPA. Because no effect is predicted there is no possibility of in-combination effects with other projects (Section 7.1) due to this impact pathway.

8.2.7.2.3. Changes in Water Quality

496. Any pollution incidents, which are considered to be unlikely to occur, will result in the contamination of a small area (likely no more than several hundreds of metres) of subtidal habitat with a small amount of pollution. Measures will be in place to rapidly collect or disperse any such contamination, meaning that its presence will be temporary and reversible. Because this SPA is located >100 km from the MDZ and ECC, it is inconceivable that this impact pathway could affect habitats within this SPA.

497. The foraging capabilities of lesser black-backed gull (Thaxter et al., 2012) are such that whilst temporary habitat loss of a small area of subtidal foraging habitat outside the SPA boundary could occur, the temporary non-availability of a section of subtidal habitat of this size would represent a very small percentage of the total available to the qualifying species of this SPA. Combined with the large amount of alternative habitat available locally, and the fact that the project does not appear to represent prime foraging habitat based on reported species densities (**Section 5.2.1.10**), such an event would therefore not be expected to substantially impact the species concerned.

498. The possibility of an adverse effect on site integrity due to changes in water quality as a result of the construction, operation and decommissioning of the project can be excluded for Morecambe Bay and Duddon Estuary SPA for these reasons. Combined with the location and distances of other projects (Section 7.1) from the MDZ and ECC, these factors mean that there is no potential for in-combination effects with other projects due to this impact pathway.

8.2.7.2.4. Changes in Prey Availability

499. For prey items of the qualifying features of this SPA, no effect due to underwater noise (either due to physical injury or behavioural changes) and habitat loss is predicted.

500. The maximum envisaged effect associated with sediment plumes arising as a result of construction, operation and decommissioning of the project are very minor increases in suspended sediment concentration; less than 1 mg/l a short distance from the release point, over a distance of several hundred metres. The effects will be temporary and reversible, with a return to very low background concentrations occurring rapidly upon cessation of activities. Other than at the immediate release point, such a change would be immeasurable. No effects on the prey species of the qualifying features of this SPA are therefore predicted.

501. On the basis of the available information, the possibility of an adverse effect on site integrity due to changes in prey availability can be excluded for the Morecambe Bay and Duddon Estuary

SPA, as no effect on prey species is predicted. Because no effect is predicted there is no possibility of in-combination effects with other projects (Section 7.1) due to this impact pathway.

8.2.7.2.5. Collision with Tidal Devices

502. Lesser black-backed gull is a surface feeding species. The maximum depth at which they are likely to feed is approximately 1 m or less (Cramp and Simmons, 1983; Schwemmer and Garthe, 2008). The moving elements of tidal energy convertors which will be operated at the proposed development are not expected to occur less than 5 m from the surface of the sea.

503. The possibility of an adverse effect on site integrity due to this impact pathway can therefore be excluded for the lesser black-backed gulls of the Morecambe Bay and Duddon Estuary SPA. This is due to the fact that qualifying species do not occur in the ‘at risk’ depths of the water column where collision with moving parts of tidal devices is a possibility. Because no effect is predicted there is no possibility of in-combination effects with other projects (Section 7.1) due to this impact pathway.

8.2.7.3. Conclusion

504. On the basis of the information presented above, none of the impact pathways screened into Stage 2 of the HRA have the potential individually or when considered together to either compromise the conservation objectives or cause an adverse effect on site integrity of this SPA, both for the Morlais project alone and in-combination with other projects.

8.2.8. Skomer, Skokholm and the Seas off Pembrokeshire SPA

8.2.8.1. Conservation Objectives

505. For this SPA, only Manx shearwater was screened into Stage 2 (Appropriate Assessment). The conservation objectives for this species (NRW, 2015d) at this SPA are presented in **Table 8-2**.

Table 8-2 Conservation objectives for Skomer, Skokholm and the Seas off Pembrokeshire SPA for Manx shearwater

Conservation Objective	Species-specific Guidance
The size of the population should be stable or increasing, allowing for natural variability, and sustainable in the long term	The breeding population of Manx shearwater should be stable or increasing with no measured decrease in numbers (based on a population count of 150,968), based on annual study plots
The distribution of the population should be being maintained, or where appropriate increasing	The distribution of this species within the site should not be constrained by anthropogenic factors, including disturbance of nesting sites by the public and activities leading to possible loss of suitable nesting sites
There should be sufficient habitat, of sufficient quality, to support the population in the long term	The breeding and foraging habitat of this species should be stable or increasing in terms of its area, and its quality should remain unaffected by anthropogenic factors
Factors affecting the population or its habitat should be under appropriate control	Rafting birds should remain unaffected by boat use and other anthropogenic factors; appropriate codes of conduct must be followed by all visitors and craft surrounding the islands. Factors affecting the species within the site should be under control

8.2.8.2. Assessment of Impact Pathways

8.2.8.2.1. Disturbance at Sea by Airborne Noise and Visual Disturbance

506. In two literature reviews examining the likely sensitivity of seabirds to tidal and wave energy development (Furness et al., 2012) and offshore wind development (Furness and Wade, 2012), Manx shearwater was given a score of one out of five for disturbance by vessels (where a score of one is the least sensitive). More recently, a wide-ranging review of displacement and habituation of seabirds did not identify Manx shearwater as being sensitive to disturbance or displacement in response to a range of marine activities (MMO, 2018). A review of offshore wind farm studies stated that in general, Manx shearwater displayed weak avoidance of offshore wind farms, though it has been recorded in developments in the Celtic Sea (Dierschke et al., 2016). Due to the obvious visual differences between an offshore wind farm and a tidal energy development it is currently thought that displacement for this species will not occur during the operational phase of the proposed development. Manx shearwaters are active at night, though most nights away from the colony are spent roosting on the water rather than foraging (Dean, 2012; Dean et al., 2012).

507. Fledging shearwaters, along with other members of the Procellariiformes order of seabirds are known to be vulnerable to grounding by attraction to artificial lighting (Deppe et al., 2017; Laguna et al., 2014; Rodríguez et al., 2017, 2015, 2014). This grounding seems to occur at relatively close range to the colony (within 20 km), so is not considered to be an issue for the proposed development requiring further consideration given that this SPA is situated >160 km from the nearest part of the MDZ.

508. Of the Manx shearwater in the MDZ and ECC, approximately 56% are predicted to originate from this SPA (SNH, 2018). It is considered that due to airborne noise and visual disturbance during the construction, operational and decommissioning phases of the proposed development, some disturbance to Manx shearwaters at sea that are from this SPA may occasionally occur within the MDZ and ECC as a result of these activities but is not likely on a regular basis. Based on the available information, disturbance events will be spatially restricted to areas within close proximity to construction, operational or decommissioning activity (likely to be in the order of tens of metres or less due to the apparent insensitivity of this qualifying feature to this impact pathway), last only for as long as the activity itself, and be reversible once the activity has concluded. Rather than resulting in harm to the bird or loss from the population, disturbance by airborne noise and visual disturbance will generally result in affected birds temporarily redistributing at sea and moving to an area where they are undisturbed. The relatively low recorded densities of Manx shearwater in the MDZ and 2 km buffer during the baseline surveys (**Section 5.2.1.7.4**) indicates that the area of sea occupied by the MDZ and ECC are not an important foraging area for these species. The preferred foraging grounds of Manx shearwater for birds breeding in UK western waters have been shown to occur away from the MDZ and ECC (Dean, 2012; Dean et al., 2012; Guilford et al., 2008; Shoji et al., 2016).

509. On the basis of this information, the possibility of an adverse effect on site integrity due to disturbance at sea by airborne noise and visual disturbance can be excluded for the Skomer, Skokholm and the Seas off Pembrokeshire SPA due to the predicted low impact magnitude, the insensitivity of the qualifying features to this impact pathway, and the absence of high densities

of qualifying features across the area in which this impact pathway could occur. These factors mean that there is no potential for in-combination effects with other projects (Section 7.1) due to this impact pathway.

8.2.8.2.2. Disturbance at Breeding Sites by Airborne Noise and Visual Disturbance

510. The Manx shearwater population of the Skomer, Skokholm and the Seas off Pembrokeshire SPA consists of birds breeding on Skokholm, Skomer and Middleholm Islands (Perrins et al., 2012). These are located approximately 160 km from the nearest boundary of the MDZ. There is no project-related activity planned at substantially closer distances to these colonies during any of the project phases. Whilst habituation to anthropogenic activities near a breeding colony is a key factor in understanding the likely response of the colony to that activity, flight initiation distances for birds at breeding colonies are generally in the order of hundreds of metres or less (Burger, 1998; Erwin, 1989; Livezey et al., 2016; Rodgers Jr. and Schwikert, 2002; Rodgers Jr. and Smith, 1995).

511. The possibility of an adverse effect on site integrity due to disturbance at breeding colonies can be excluded for the Skomer, Skokholm and the Seas off Pembrokeshire SPA, as no effect is predicted. This is due to the distances between activities relating to the proposed development and breeding colony associated with this SPA. Because no effect is predicted there is no possibility of in-combination effects with other projects (Section 7.1) due to this impact pathway.

8.2.8.2.3. Changes in Water Quality

512. Any pollution incidents, which are considered to be unlikely to occur, will result in the contamination of a small area (likely no more than several hundreds of metres) of subtidal habitat with a small amount of pollution. Measures will be in place to rapidly collect or disperse any such contamination, meaning that its presence will be temporary and reversible. Because this SPA is located >160 km from the MDZ and ECC, it is inconceivable that this impact pathway could affect habitats within this SPA.

513. The foraging capabilities of the qualifying species of this SPA (Oppel et al., 2018; Thaxter et al., 2012) are such that whilst temporary habitat loss of a small area of subtidal foraging habitat outside the SPA boundary could occur, the temporary non-availability of a section of subtidal habitat of this size would represent a very small percentage of the total available to the qualifying species of this SPA. Combined with the large amount of alternative habitat available locally, and the fact that the project does not appear to represent prime foraging habitat based on reported species densities (**Section 5.2.1.10**), such an event would therefore not be expected to substantially impact the species concerned.

514. The possibility of an adverse effect on site integrity due to changes in water quality as a result of the construction, operation and decommissioning of the project can be excluded for the Skomer, Skokholm and the Seas off Pembrokeshire SPA for these reasons. Combined with the location and distances of other projects (Section 7.1) from the MDZ and ECC, these factors mean that there is no potential for in-combination effects with other projects due to this impact pathway.

8.2.8.2.4. Changes in Prey Availability

515. For prey items of the qualifying features of this SPA, no effect due to underwater noise (either due to physical injury or behavioural changes) and habitat loss is predicted.

516. The maximum envisaged effect associated with sediment plumes arising as a result of construction, operation and decommissioning of the project are very minor increases in suspended sediment concentration; less than 1 mg/l a short distance from the release point, over a distance of several hundred metres. The effects will be temporary and reversible, with a return to very low background concentrations occurring rapidly upon cessation of activities. Other than at the immediate release point, such a change would be immeasurable. No effects on the prey species of the qualifying features of this SPA are therefore predicted.

517. On the basis of the available information, the possibility of an adverse effect on site integrity due to changes in prey availability can be excluded for the Skomer, Skokholm and the Seas off Pembrokeshire SPA, as no effect on prey species is predicted. Because no effect is predicted there is no possibility of in-combination effects with other projects (Section 7.1) due to this impact pathway.

8.2.8.2.5. Collision with Tidal Devices

518. Dean (2012) reported that approximately 50% of all Manx shearwater diving activity occurs at depths of less than 5.3 m, though birds were recorded diving as deep as 55.5 m. Using the same raw data, Shoji et al., (2016) reported that mean dive depth was 9.6 m, and mean dive duration was 13.49 seconds. Whilst this information suggests that the majority of Manx shearwater diving behaviour occurs in relatively shallow parts of the water column, there is potential for this species to interact with the moving parts of tidal energy convertors during the operational phase of the project.

519. At an indicative 240 MW array, approximately 0-9 birds respectively per season may collide with tidal devices (assuming an avoidance rate of at least 95%). The theoretical method of apportioning (SNH, 2018) indicates that approximately 56% of the Manx shearwaters present in the MDZ and buffer zone are likely to originate from this SPA. On this basis, between 0-5 birds from this SPA may collide annually with tidal devices. On the basis that this represents 0.0008% of the 600,000+ birds that breed at this SPA. The predicted magnitude of this impact means that it is considered that the project will not result in an adverse effect on site integrity through this impact pathway. Due to the very low magnitude of this impact pathway, these factors mean that there is no potential for in-combination effects with other projects (Section 7.1) due to this impact pathway.

8.2.8.3. Conclusion

520. On the basis of the information presented above, none of the impact pathways screened into Stage 2 of the HRA have the potential individually or when considered together to either compromise the conservation objectives or cause an adverse effect on site integrity of this SPA, both for the Morlais project alone and in-combination with other projects.

8.2.9. Grassholm SPA

8.2.9.1. Conservation Objectives

521. A single qualifying feature (gannet) is considered by this assessment. The vision for this feature (CCW, 2008b) is for it to be in a favourable conservation status, where all of the following conditions are satisfied:

- The population will not fall below 30,000 pairs in three consecutive years;
- It will not drop by more than 25% of the previous year's figures in any one year; and
- There will be no decline in this population significantly greater than any decline in the North Atlantic population as a whole.

8.2.9.2. Assessment of Impact Pathways

8.2.9.2.1. Disturbance at Sea by Airborne Noise and Visual Disturbance

522. In three literature reviews examining the likely sensitivity of seabirds to tidal and wave energy development (Furness et al., 2012) and offshore wind development (Furness and Wade, 2012; Garthe and Hüppop, 2004), gannet was given a score of two out of five for disturbance by vessels (where a score of one is the least sensitive), and assigned the descriptor slight avoidance at short range. More recently, a wide-ranging review of displacement and habituation of seabirds in response to marine activities did not identify gannet as being sensitive to disturbance or displacement, with exception of displacement effects noted at offshore wind farms (MMO, 2018). This has been observed in several single site studies (Dierschke et al., 2016; Gill et al., 2018; Leopold et al., 2013; Vanermen et al., 2015). Rather than displacement occurring as a result of vessel activity (which generally attracts gannets (Leopold et al., 2013)), the presence of the wind farm itself is what seems to cause the effect. Due to the obvious visual differences between an offshore wind farm and a tidal energy development it is currently thought that displacement for this species will not occur during the operational phase of the proposed development.

523. With respect to artificial light, gannet are not known to be particularly sensitive to the presence of artificial light at sea, particularly as nocturnal activity for this species is around 8% of activity levels during daytime (Furness et al., 2018).

524. It is considered that due to airborne noise and visual disturbance during the construction, operational and decommissioning phases of the proposed development, some disturbance to gannets at sea that are from this SPA may occasionally occur within the MDZ as a result of these activities but is not likely on a regular basis. Based on the available information, disturbance events will be spatially restricted to areas within close proximity to construction, operation or decommissioning activity (likely to be in the order of tens to hundreds of metres due to the apparent relative insensitivity of this qualifying feature to this impact pathway), last only for as long as the activity itself, and be reversible once the activity has concluded. Rather than resulting in harm to the bird or loss from the population, disturbance by airborne noise and visual disturbance will generally result in affected birds temporarily redistributing at sea and moving to an area where they are undisturbed. The relatively low recorded densities of gannet

in the MDZ and 2 km buffer during the baseline surveys (**Section 5.2.1.4.5**) indicates that the area of sea occupied by the MDZ is not an important foraging area for these species and that subtidal habitats favoured for foraging by gannets from this SPA lie elsewhere. This position is supported by two recent tracking studies concerning this species (Cox et al., 2016; Wakefield et al., 2013).

525. On the basis of this information, the possibility of an adverse effect on site integrity due to disturbance at sea by airborne noise and visual disturbance can be excluded for the Grassholm SPA due to the predicted low impact magnitude, the insensitivity of the qualifying features to this impact pathway, and the absence of high densities of qualifying features across the area in which this impact pathway could occur (noting that approximately 54% of the gannets present in the MDZ and 2 km buffer zone will originate from this SPA). These factors mean that there is no potential for in-combination effects with other projects (Section 7.1) due to this impact pathway.

8.2.9.2.2. Disturbance at Breeding Sites by Airborne Noise and Visual Disturbance

526. Within this SPA, breeding gannet sites are located in excess of 170 km from the MDZ. There is no project-related activity planned at substantially closer distances to these colonies during any of the project phases. Whilst habituation to anthropogenic activities near a breeding colony is a key factor in understanding the likely response of the colony to that activity, flight initiation distances for birds at breeding colonies are generally in the order of hundreds of metres (Burger, 1998; Erwin, 1989; Livezey et al., 2016; Rodgers Jr. and Schwikert, 2002; Rodgers Jr. and Smith, 1995).

527. The possibility of an adverse effect on site integrity due to disturbance at breeding colonies can be excluded for the Grassholm SPA, as no effect is predicted. This is due to the distances between activities relating to the proposed development and breeding colony associated with this SPA. Because no effect is predicted there is no possibility of in-combination effects with other projects (Section 7.1) due to this impact pathway.

8.2.9.2.3. Changes in Water Quality

528. Any pollution incidents, which are considered to be unlikely to occur, will result in the contamination of a small area (likely no more than several hundreds of metres) of subtidal habitat with a small amount of pollution. Measures will be in place to rapidly collect or disperse any such contamination, meaning that its presence will be temporary and reversible. Because this SPA is located >160 km from the MDZ and ECC, it is inconceivable that this impact pathway could affect habitats within this SPA.

529. The foraging capabilities of the qualifying species of this SPA (Oppel et al., 2018; Thaxter et al., 2012) are such that whilst temporary habitat loss of a small area of subtidal foraging habitat outside the SPA boundary could occur, the temporary non-availability of a section of subtidal habitat of this size would represent a very small percentage of the total available to the qualifying species of this SPA. Combined with the large amount of alternative habitat available locally, and the fact that the project does not appear to represent prime foraging habitat based on reported

species densities (**Section 5.2.1.10**), such an event would therefore not be expected to substantially impact the species concerned.

530. The possibility of an adverse effect on site integrity due to changes in water quality as a result of the construction, operation and decommissioning of the project can be excluded for the Grassholm SPA for these reasons. Combined with the location and distances of other projects (Section 7.1) from the MDZ and ECC, these factors mean that there is no potential for in-combination effects with other projects due to this impact pathway.

8.2.9.2.4. Changes in Prey Availability

531. For prey items of the qualifying features of this SPA, no effect due to underwater noise (either due to physical injury or behavioural changes) and habitat loss is predicted.

532. The maximum envisaged effect associated with sediment plumes arising as a result of construction, operation and decommissioning of the project are very minor increases in suspended sediment concentration; less than 1 mg/l a short distance from the release point, over a distance of several hundred metres. The effects will be temporary and reversible, with a return to very low background concentrations occurring rapidly upon cessation of activities. Other than at the immediate release point, such a change would be immeasurable. No effects on the prey species of the qualifying features of this SPA are therefore predicted.

533. On the basis of the available information, the possibility of an adverse effect on site integrity due to changes in prey availability can be excluded for the Grassholm SPA, as no effect on prey species is predicted. Because no effect is predicted there is no possibility of in-combination effects with other projects (Section 7.1) due to this impact pathway.

8.2.9.2.5. Collision with Tidal Devices

534. Gannets have an average diving depth and time of 8 m (+/- 7.8 m) and 7.3 seconds respectively, and a maximum reported dive depth of 34 m (Robbins, 2017). Whilst the majority of gannet diving behaviour occurs in the shallower parts of the water column, there is potential for this species to interact with the moving parts of tidal energy convertors during the operational phase of the project. Whilst this information suggests that the majority of gannet diving behaviour occurs in relatively shallow parts of the water column, there is potential for this species to interact with the moving parts of tidal energy convertors during the operational phase of the project, which may occur at depths as shallow as 5 m.

535. At an indicative 240 MW array respectively, approximately 0-1 gannets per season may collide with tidal devices (assuming an avoidance rate of at least 95%). The theoretical method of apportioning (SNH, 2018) indicates that approximately 54% of the Manx shearwaters present in the MDZ and buffer zone are likely to originate from this SPA. On the basis that this represents 0.002% of the 66,000 birds that breed at this SPA, the predicted magnitude of this impact means that it is considered that the project will not result in an adverse effect on site integrity through this impact pathway. Due to the very low magnitude of this impact pathway, these factors mean that there is no potential for in-combination effects with other projects (Section 7.1) due to this impact pathway.

8.2.9.3. Conclusion

536. On the basis of the information presented above, none of the impact pathways screened into Stage 2 of the HRA have the potential individually or when considered together to either compromise the conservation objectives or cause an adverse effect on site integrity of this SPA, both for the Morlais project alone and in-combination with other projects.

8.2.10. Ailsa Craig SPA

8.2.10.1. Conservation Objectives

537. A single qualifying feature (gannet) is considered by this assessment. The conservation objectives are to avoid deterioration of the habitats of the qualifying species, or significant disturbance to the qualifying species, thus ensuring that the integrity of the site is maintained, and to ensure for the qualifying species that the following are maintained in the long term:

- Population of the species as a viable component of the site;
- Distribution of the species within site;
- Distribution and extent of habitats supporting the species;
- Structure, function and supporting processes of habitats supporting the species; and
- No significant disturbance of the species.

8.2.10.2. Assessment of Impact Pathways

8.2.10.2.1. Disturbance at Sea by Airborne Noise and Visual Disturbance

538. In three literature reviews examining the likely sensitivity of seabirds to tidal and wave energy development (Furness *et al*., 2012) and offshore wind development (Furness and Wade, 2012; Garthe and Hüppop, 2004), gannet was given a score of two out of five for disturbance by vessels (where a score of one is the least sensitive), and assigned the descriptor slight avoidance at short range. More recently, a wide-ranging review of displacement and habituation of seabirds in response to marine activities did not identify gannet as being sensitive to disturbance or displacement, with exception of displacement effects noted at offshore wind farms (MMO, 2018). This has been observed in several single site studies (Dierschke *et al*., 2016; Gill *et al*., 2018; Leopold *et al*., 2013; Vanermen *et al*., 2015). Rather than displacement occurring as a result of vessel activity (which generally attracts gannets (Leopold *et al*., 2013)), the presence of the wind farm itself is what seems to cause the effect. Due to the obvious visual differences between an offshore wind farm and a tidal energy development it is currently thought that displacement for this species will not occur during the operational phase of the proposed development.

539. With respect to artificial light, gannet are not known to be particularly sensitive to the presence of artificial light at sea, particularly as nocturnal activity for this species is around 8% of activity levels during daytime (Furness et al., 2018).

540. It is considered that due to airborne noise and visual disturbance during the construction, operational and decommissioning phases of the proposed development, some disturbance to

gannets at sea that are from this SPA may occasionally occur within the MDZ as a result of these activities but is not likely on a regular basis. Based on the available information, disturbance events will be spatially restricted to areas within close proximity to construction, operation or decommissioning activity (likely to be in the order of tens to hundreds of metres due to the apparent relative insensitivity of this qualifying feature to this impact pathway), last only for as long as the activity itself, and be reversible once the activity has concluded. Rather than resulting in harm to the bird or loss from the population, disturbance by airborne noise and visual disturbance will generally result in affected birds temporarily redistributing at sea and moving to an area where they are undisturbed. The relatively low recorded densities of gannet in the MDZ and 2 km buffer during the baseline surveys (**Section 5.2.1.4.5**) indicates that the area of sea occupied by the MDZ is not an important foraging area for these species and that subtidal habitats favoured for foraging by gannets from this SPA lie elsewhere. This position is supported by two recent tracking studies concerning this species (Cox et al., 2016; Wakefield et al., 2013).

541. On the basis of this information, the possibility of an adverse effect on site integrity due to disturbance at sea by airborne noise and visual disturbance can be excluded for the Ailsa Craig SPA due to the predicted low impact magnitude, the insensitivity of the qualifying features to this impact pathway, and the absence of high densities of qualifying features across the area in which this impact pathway could occur (noting that approximately 34% of the gannets present in the MDZ and 2 km buffer zone will originate from this SPA). These factors mean that there is no potential for in-combination effects with other projects (Section 7.1) due to this impact pathway.

8.2.10.2.2. Disturbance at Breeding Sites by Airborne Noise and Visual Disturbance

542. Within this SPA, breeding gannet sites are located in excess of 210 km from the MDZ. There is no project-related activity planned at substantially closer distances to these colonies during any of the project phases. Whilst habituation to anthropogenic activities near a breeding colony is a key factor in understanding the likely response of the colony to that activity, flight initiation distances for birds at breeding colonies are generally in the order of hundreds of metres (Burger, 1998; Erwin, 1989; Livezey et al., 2016; Rodgers Jr. and Schwikert, 2002; Rodgers Jr. and Smith, 1995).

543. The possibility of an adverse effect on site integrity due to disturbance at breeding colonies can be excluded for the Ailsa Craig SPA, as no effect is predicted. This is due to the distances between activities relating to the proposed development and breeding colony associated with this SPA. Because no effect is predicted there is no possibility of in-combination effects with other projects (Section 7.1) due to this impact pathway.

8.2.10.2.3. Changes in Water Quality

544. Any pollution incidents, which are considered to be unlikely to occur, will result in the contamination of a small area (likely no more than several hundreds of metres) of subtidal habitat with a small amount of pollution. Measures will be in place to rapidly collect or disperse any such contamination, meaning that its presence will be temporary and reversible. Because this SPA is

located >210 km from the MDZ and ECC, it is inconceivable that this impact pathway could affect habitats within this SPA.

545. The foraging capabilities of the qualifying species of this SPA (Oppel et al., 2018; Thaxter et al., 2012) are such that whilst temporary habitat loss of a small area of subtidal foraging habitat outside the SPA boundary could occur, the temporary non-availability of a section of subtidal habitat of this size would represent a very small percentage of the total available to the qualifying species of this SPA. Combined with the large amount of alternative habitat available locally, and the fact that the project does not appear to represent prime foraging habitat based on reported species densities (**Section 5.2.1.10**), such an event would therefore not be expected to substantially impact the species concerned.

546. The possibility of an adverse effect on site integrity due to changes in water quality as a result of the construction, operation and decommissioning of the project can be excluded for the Ailsa Craig SPA for these reasons. Combined with the location and distances of other projects (Section 7.1) from the MDZ and ECC, these factors mean that there is no potential for in-combination effects with other projects due to this impact pathway.

8.2.10.2.4. Changes in Prey Availability

547. For prey items of the qualifying features of this SPA, no effect due to underwater noise (either due to physical injury or behavioural changes) and habitat loss is predicted.

548. The maximum envisaged effect associated with sediment plumes arising as a result of construction, operation and decommissioning of the project are very minor increases in suspended sediment concentration; less than 1 mg/l a short distance from the release point, over a distance of several hundred metres. The effects will be temporary and reversible, with a return to very low background concentrations occurring rapidly upon cessation of activities. Other than at the immediate release point, such a change would be immeasurable. No effects on the prey species of the qualifying features of this SPA are therefore predicted.

549. On the basis of the available information, the possibility of an adverse effect on site integrity due to changes in prey availability can be excluded for the Ailsa Craig SPA, as no effect on prey species is predicted. Because no effect is predicted there is no possibility of in-combination effects with other projects (Section 7.1) due to this impact pathway.

8.2.10.2.5. Collision with Tidal Devices

550. Gannets have an average diving depth and time of 8 m (+/- 7.8 m) and 7.3 seconds respectively, and a maximum reported dive depth of 34 m (Robbins, 2017). Whilst the majority of gannet diving behaviour occurs in the shallower parts of the water column, there is potential for this species to interact with the moving parts of tidal energy convertors during the operational phase of the project. Whilst this information suggests that the majority of gannet diving behaviour occurs in relatively shallow parts of the water column, there is potential for this species to interact with the moving parts of tidal energy convertors during the operational phase of the project, which may occur at depths as shallow as 5 m.

551. At an indicative 240 MW array, approximately 0-1 gannets per season may collide with tidal devices (assuming an avoidance rate of at least 95%). The theoretical method of apportioning (SNH, 2018) indicates that approximately 54% of the Manx shearwaters present in the MDZ and buffer zone are likely to originate from this SPA. On the basis that this represents 0.002% of the 64,920 birds that breed at this SPA, the predicted magnitude of this impact means that it is considered that the project will not result in an adverse effect on site integrity through this impact pathway. Due to the very low magnitude of this impact pathway, these factors mean that there is no potential for in-combination effects with other projects (Section 7.1) due to this impact pathway.

8.2.10.3. Conclusion

552. On the basis of the information presented above, none of the impact pathways screened into Stage 2 of the HRA have the potential individually or when considered together to either compromise the conservation objectives or cause an adverse effect on site integrity of this SPA, both for the Morlais project alone and in-combination with other projects.

8.3. MARINE MAMMALS

8.3.1. Introduction

553. As outlined in **Section 6.3**, the European Designated Sites screened in for marine mammals are:

- Gogledd Môn Forol/North Anglesey Marine SAC (harbour porpoise)
- Gorllewin Cymru Forol/West Wales Marine SAC (harbour porpoise)
- Dynesfeydd Môr Hafren/ Bristol Channel Approaches SAC (harbour porpoise)
- North Channel SAC (harbour porpoise)
- Rockabill to Dalkey Island SAC (harbour porpoise)
- Pen Llŷn a'r Sarnau/ Lleyn Peninsula and the Sarnau SAC (bottlenose dolphin and grey seal)
- Bae Ceredigion/ Cardigan Bay SAC (bottlenose dolphin and grey seal)
- Pembrokeshire Marine SAC (grey seal)
- The Maidens SAC (grey seal)
- Lambay Island SAC (grey and harbour seal)
- Saltee Islands SAC (grey seal)

554. However, it should be noted that all assessments based on the cetacean MUs and OSPAR region for seals are relevant for all the designated sites within these areas and that the sites screened in are those where the potential connectivity and a realistic pathway for a potential effect has been determined.

555. Details on the baseline information for each relevant marine mammal species is provided in **Chapter 12, Marine Mammals** of the ES.

8.3.2. Gogledd Môn Forol/North Anglesey Marine SAC

556. The Gogledd Môn Forol/North Anglesey Marine SAC site covers an area of 3,249km^2, reaching north-west from Anglesey into the Irish Sea. It sits at the northern end of St George's Channel, extending approximately half way across to the Republic of Ireland, skirting the national waters of the Isle of Man. The water depths within the site range between the Mean Low Water Tide (MLWT) level and 100m. Away from coastal areas, the depths largely fall within the range of between 40m and 50m. The site contains a mixture of hard substrate and sediments, including rock, coarse sediment, and mud (Joint Nature Conservation Committee (JNCC) and Natural Resources Wales (NRW), 2016a, 2017).

557. The Gogledd Môn Forol/North Anglesey Marine SAC has been recognised as an area with predicted persistent high densities of harbour porpoise. The area included within the site covers important summer habitat for porpoises, which was identified as part of the top 10% persistent high density areas for the summer seasons within the UK (JNCC and NRW, 2016a, 2017).

558. The qualifying feature of the site is the Habitats Directive Annex II species the harbour porpoise. North Anglesey Marine / Gogledd Môn Forol SAC has been designated because of its importance to harbour porpoises in the summer months (April to September) (JNCC *et al*., 2019a). The MDZ is located within the North Anglesey Marine / Gogledd Môn Forol SAC (**Figure 6-2**).

559. Harbour porpoise within the eastern North Atlantic are generally considered to be part of a continuous biological population that extends from the French coastline of the Bay of Biscay to northern Norway and Iceland (Tolley and Rosel, 2006; Fontaine *et al*., 2007, 2014; IAMMWG, 2015). However, for conservation and management purposes, it is necessary to consider this population as smaller Management Units (MUs). MUs provide an indication of the spatial scales at which effects of plans and projects alone, and in-combination, need to be assessed for the key cetacean species in UK waters, with consistency across the UK (IAMMWG, 2015).

560. The Inter-Agency Marine Mammal Working Group (IAMMWG) defined three MUs for harbour porpoise: The North Sea (NS); West Scotland (WS) and the Celtic and Irish Sea (CIS) (comprising ICES area VI and VII, except VIId). The North Anglesey Marine / Gogledd Môn Forol SAC and MDZ are located in the Celtic and Irish Seas MU, which has an estimated harbour porpoise abundance of 104,695 (CV = 0.32; 95% CI = 56,774-193,065; IAMMWG, 2015), this was based on the SCANS-II survey (Hammond *et al*., 2013) and CODA surveys (Macleod *et al*., 2009).

561. The Gogledd Môn Forol/North Anglesey Marine SAC has been selected primarily based on the long-term, relatively higher densities of porpoise in contrast to other areas of the Celtic and Irish Seas MU. The implication is that the SAC provides relatively good foraging habitat and may also be used for breeding and calving. However, because the number of harbour porpoise using the site naturally varies (e.g. between seasons), there is no exact number of animals within the site. As harbour porpoise are also considered part of a wider European population and the highly mobile nature of this species, therefore the concept of a 'site population' is not considered an appropriate basis for expressing Conservation Objectives for this species (JNCC *et al*., 2019a).

562. Therefore, the potential effects of the proposed project have been assessed for the Celtic and Irish Seas MU reference population for harbour porpoise (104,695 individuals). This follows the current advice which states that, the reference population for assessments against Conservation Objectives is the MU population in which the SAC is situated (JNCC *et al.*, 2019a). This approach was agreed with NRW at the at the marine mammal technical working group (TWG) meetings.

563. In addition, the assessment also includes a spatial and temporal assessment of the potential disturbance effects in relation to the area of the SAC. Following the current advice (JNCC *et al.*, 2019a), disturbance within a SAC from a plan/project individually or in combination is significant if it excludes harbour porpoises from more than:

I. 20% of the relevant area (3,249km^2) of the site in any given day, and

II. an average of 10% of the relevant area of the site over a season (summer is defined as April to September inclusive and winter as October to March inclusive)[7].

564. The current conservation status of the harbour porpoise, as assessed in the 3rd UK report on implementation of the Habitats Directive (submitted to the European Commission in 2013), is ‘Favourable’ (JNCC, 2013).

8.3.2.1. Conservation Objectives

565. The Conservation Objectives are designed to help ensure that the obligations of the Habitats Directive can be met. Article 6(2) of the Directive requires that there should be no deterioration or significant disturbance of the qualifying species or to the habitats upon which they rely. Therefore, the focus of the Conservation Objectives for harbour porpoise sites is on addressing pressures that affect site integrity and would include:

- killing or injuring harbour porpoise (directly or indirectly);
- preventing their use of significant parts of the site (disturbance / displacement);
- significantly damaging relevant habitats; or
- significantly reducing the availability of prey.

566. The Conservation Objectives for harbour porpoise at the Gogledd Môn Forol/North Anglesey Marine SAC are summarised in **Table 8-3**.

[7] For example, a daily footprint of 19% for 95 days would result in an average of 19x95/183 days (summer) =9.86%

Table 8-3 Conservation Objectives for harbour porpoise at Gogledd Môn Forol / North Anglesey Marine SAC

Site	**Site Area (km^2)**	**Conservation Objectives**
Gogledd Môn Forol / North Anglesey Marine SAC	3,249	To ensure that the integrity of the site is maintained and that it makes the best possible contribution to maintaining Favourable Conservation Status (FCS) for Harbour Porpoise in UK waters. In the context of natural change, this will be achieved by ensuring that: 1. Harbour porpoise is a viable component of the site; 2. There is no significant disturbance of the species; and 3. The condition of supporting habitats and processes, and the availability of prey is maintained. (JNCC *et al*., 2019a)

8.3.2.1.1. Conservation Objective 1: Harbour porpoise is a viable component of the site

567. “This SAC has been selected primarily based on the long-term, relatively higher densities of porpoise in contrast to other areas of the MU. The implication is that the SAC provides relatively good foraging habitat and may also be used for breeding and calving. However, because the number of harbour porpoise using the site naturally varies (e.g. between seasons), there is no exact number of animals within the site.

568. The intent of this objective is to minimise the risk of injury and killing or other factors that could restrict the survivability and reproductive potential of harbour porpoise using the site. Specifically, this objective is primarily concerned with operations that would result in unacceptable levels of those impacts on harbour porpoises using the site. Unacceptable levels can be defined as those having an impact on the FCS of the populations of the species in their natural range. The reference population for assessments against this objective is the MU population in which the SAC is situated (IAMMWG, 2015).

569. Harbour porpoise is a European Protected Species (EPS) listed on Annex IV of the Habitats Directive and as such is protected under the Habitats Directive Article 12 and transposing regulations from deliberate killing (or injury), capture and disturbance throughout its range. In addition, Article 12 (4) of the Habitats Directive is concerned with incidental capture and killing. It states that Member States ‘shall establish a system to monitor the incidental capture and killing of the species listed on Annex IV (all cetaceans). In the light of the information gathered, Member States shall take further research or conservation measures as required to ensure that incidental capture and killing does not have a significant negative impact on the species concerned’. Site based measures should therefore be aligned with the existing strict protection measures in place throughout UK waters. Significant disturbance within or affecting the site is considered in the second Conservation Objective (JNCC *et al*., 2019a)”.

8.3.2.1.2. Conservation Objective 2: There is no significant disturbance of the species

570. “Disturbance is primarily a behavioural response to noise and may, for example, lead to harbour porpoises being displaced from the affected area.

571. This SAC was identified as having persistently higher densities of harbour porpoises (Heinänen and Skov, 2015) compared to other areas of the MU. This is likely linked to the habitats within the site providing good feeding opportunities. Therefore, operations within or affecting the site should be managed to ensure that the animals’ potential usage of the site is maintained. Disturbance is considered significant if it leads to the exclusion of harbour porpoise from a significant portion of the site. Specifically, draft SNCB advice / guidance for assessing the significance of noise disturbance to a site suggests, noise disturbance within an SAC from a plan/project individually or in combination is significant if it excludes harbour porpoises from more than:

1. 20% of the relevant area of the site in any given day, and

2. an average of 10% of the relevant area of the site over a season (JNCC *et al*., 2019a).”

8.3.2.1.3. Conservation Objective 3: The condition of supporting habitats and processes, and the availability of prey is maintained

572. “Supporting habitats, in this context, means the characteristics of the seabed and water column. Processes encompass the movements and physical properties of the habitat. The maintenance of supporting habitats and processes contributes to ensuring that prey is maintained within the site and is available to harbour porpoises using the site (JNCC *et al*., 2019a).”

8.3.2.2. Assessment of Potential Effects

573. The HRA screening (Table 6-15) identified that the following effects during construction, operation, maintenance, repowering and decommissioning could have the potential to have an adverse effect on the integrity of the Gogledd Môn Forol/North Anglesey Marine SAC in relation to the Conservation Objectives for harbour porpoise:

- Underwater noise and the risk of auditory injury;
- Underwater noise and disturbance;
- Collision risk with tidal devices
- Increased collision risk with vessels;
- Entanglement with mooring lines;
- Barrier effects;
- EMF effects;
- Changes in water quality;
- Changes in prey availability; and
- In-combination effects.

574. Assessment of the potential effects on the Gogledd Môn Forol/North Anglesey Marine SAC for harbour porpoise, is based on the current draft SNCB advice / guidance that:

- Displacement of harbour porpoise should not exceed 20% of the seasonal component of the SAC area in any given day; and / or on average exceed 10% of the seasonal component of the SAC area over the duration of that season.

575. The Gogledd Môn Forol/North Anglesey Marine SAC site covers an area of 3,249km^2 has been designated because of its importance to harbour porpoises in the summer months (April to September; 183 days) (JNCC *et al*., 2019a).

576. The potential effects have also been assessed and put into the context of the harbour porpoise abundance estimate for the Celtic and Irish Sea MU of 104,695 (CV = 0.32; 95% CI = 56,774-193,065; IAMMWG, 2015), based on the SCANS-II survey (Hammond *et al*., 2013) and CODA surveys (Macleod *et al*., 2009). An abundance estimate for the Celtic and Irish Sea MU based on the SCANS-III surveys in summer 2016 (Hammond *et al*., 2017) and ObSERVE surveys in 2015 and 2016 (Rogan *et al*., 2018) was not available at the time of writing.

577. As outlined in the Conservation Objectives for the Gogledd Môn Forol/North Anglesey Marine SAC (**Section 8.3.2.1.1**), the reference population for assessments against objective 1 is the MU population in which the SAC is situated. The reference population of 104,695 harbour porpoise for the MU to be used in the assessments was agreed with NRW at the Marine Mammal Technical Working Group Meetings (November 2018, February 2019 and May 2019).

578. The harbour porpoise density estimate used in the assessments is 0.783 harbour porpoise per km^2 based on the SEACAMS data (see **Chapter 12, Marine Mammals, Volume I** of the ES). This was agreed with NRW at the Marine Mammal Technical Working Group Meetings.

8.3.2.2.1. Assessment of Potential Effects of Underwater Noise and Risk of Auditory Injury

579. High exposure levels from underwater noise sources can cause auditory injury or hearing impairment taking the form of a permanent loss of hearing sensitivity (Permanent Threshold Shift (PTS)). The potential for any permanent auditory injury is not just related to the level of the underwater sound and its frequency relative to the hearing bandwidth of the animal but is also influenced by the duration of exposure. The level of effect on an individual is a function of the Sound Exposure Level (SEL) that an individual receives as a result of underwater noise.

580. The potential sources of underwater noise during the construction, operation, maintenance, repowering and decommissioning of the Project are:

- Drilling to install the tidal device and hub foundations;
- Cable laying;
- Cable protection;
- Vessels;
- Operational turbines; and
- Acoustic Deterrent Devices (ADDs).

581. As outlined in **Chapter 12, Marine Mammals** (**Volume I** of the ES), underwater noise modelling has not currently been conducted for the MDZ, however, A series of underwater noise monitoring stations were installed by SEACAMS (University of Bangor) to sample the background noise levels in and around the MDZ over periods of between 15 and 30 days in 2016, 2017 and 2018. Four of these datasets from different time periods and locations have been analysed by Subacoustech (**Appendix 12.4, Volume III** of the ES) to provide a range of noise levels to define a baseline over a daily (high-low) and fortnightly (springs-neaps) tidal cycle. All measurements analysed were taken with a 48 kHz sample rate and with contiguous 10-minute samples, except the June 2017 sample period which used a finer 1-minute sample period throughout.

582. The results of the background noise monitoring in these locations in and around the MDZ show a remarkable degree of consistency in all locations and time periods, and noise levels varying with position of the tide. There were occasional, rare outliers expected to be associated with passing vessel traffic. All locations show a range of noise levels of 89 dB to 107 dB SPLRMS re 1 µPa (as either 1-minute or 10-minute samples).

583. An overview of the noise levels sampled at each location is given in **Table 8-4** (excluding outliers).

Table 8-4 Summary of background noise levels in and around the MDZ

Period	Overall average noise level	Tide cycle: Springs		Tide cycle: Neaps	
		Max SPL_{RMS}	Min SPL_{RMS}	Max SPL_{RMS}	Min SPL_{RMS}
April 2017	98.3 dB SPL_{RMS}	103.0 dB	91.9 dB	99.7 dB	90.7 dB
June 2017	96.9 dB SPL_{RMS}	104.1 dB	89.1 dB	97.5 dB	89.7 dB
July 2017	98.9 dB SPL_{RMS}	106.4 dB	92.7 dB	100.2 dB	95.2 dB
July 2018	98.0 dB SPL_{RMS}	106.6 dB	89.9 dB	99.8 dB	92.6 dB

584. The assessments within the HRA have been based on the worst-case scenario for similar activities at similar sites the nearby Wylfa Newydd Development Area, the Perpetuus Tidal Energy Centre (PTEC) off the coast of the Isle of Wight, MeyGen in the Inner Sound of the Pentland Firth and offshore wind farms in the Southern North Sea (further details of the underwater noise modelling undertaken for these sites is provided in **Chapter 12, Marine Mammals, Volume I** of the ES).

585. The maximum predicted ranges for the risk of PTS for drilling is for two percussive drilling rigs at the Wylfa Newydd Development Area using the non-impulsive National Marine Fisheries Service (NMFS) (2018) criteria (173 dB re 1 µPa^{2}s Weighted SEL_{cum} for harbour porpoise), assuming a stationary animal remaining in the vicinity over a 24-hour period (**Table 8-5**).

586. The maximum predicted ranges for the risk of PTS for cable laying and cable protection (rock placement) are based on modelling for Southern North Sea offshore wind farm sites using the impulsive NMFS (2018) criteria (155 dB re 1 µPa^{2}s Weighted SEL_{cum} for harbour porpoise). This assessment uses a fleeing animal model, which is more realistic as it assumes that the animal exposed to high noise levels will swim away from the noise source. For this a constant fleeing speed of 1.5m/s has been assumed, which is an average swimming speed for a harbour

porpoise (Otani *et al*., 2000). This is considered 'worst-case' as marine mammals are expected to be able to swim much faster under stress conditions. For example, Kastelein *et al*. (2018) recorded harbour porpoise swimming speeds of 1.97m/s during playbacks of pile driving sounds. The modelling ranges smaller than 100m (cumulative) were not been presented for the Southern North Sea sites and could therefore be a lot less then 100m, however, as a worst-case scenario, ranges of up to 100m have been assumed (**Table 8-5**).

587. The maximum predicted ranges for the risk of PTS from vessels is for large vessels at the Wylfa Newydd Development Area using the non-impulsive NMFS (2018) criteria (173 dB re 1 µPa^{2}s Weighted SEL_{cum} for harbour porpoise), assuming a stationary animal remaining in the vicinity over a 24-hour period (**Table 8-5**).

588. The noise measurements and modelling for a range of different operational tidal devices, indicates that the noise levels would not be sufficient to result in any auditory injury (see **Chapter 12, Marine Mammals, Volume I** of the ES). Therefore, there is no risk of PTS from the underwater noise of operational turbine devices and it has not been included in this assessment.

589. A review of ADDs in **Chapter 12, Marine Mammals** (**Volume I** of the ES), indicates that the noise levels would not be sufficient to result in any auditory injury. Therefore, there is no risk of PTS and they have not been included in this assessment.

590. As a worst-case scenario, based on two percussive drilling rigs, two cable laying activities, two rock placement activities and up to 16 large vessels in the MDZ, the maximum area for potential risk of auditory injury in harbour porpoise, without any mitigation, is 0.12km^2, which could affect up to 0.09 individuals (0.00009% for the MU). This represents up to 0.004% of the Gogledd Môn Forol/North Anglesey Marine SAC area (**Table 8-5**).

Table 8-5 Summary of the maximum predicted PTS ranges (and areas) for harbour porpoise in the Gogledd Môn Forol/North Anglesey Marine SAC

Potential Effect	Two percussive drilling rigs	Cable laying	Rock placement	Large vessels	Worst-Case Total
Range (and area) for PTS in harbour porpoise	10m (0.0003km^2)	<100m (0.03km^2) Up to 0.06 km^2 for two activities	<100m (0.03km^2) Up to 0.06 km^2 for two activities	4m (0.00005km^2) Up to 0.0008km^2 for 16 vessels	0.12km^2
Maximum number of individuals and % of MU	0.00024 individuals (0.00000023% of the MU)	0.024 individuals (0.000023% of the MU) for one activity. 0.04 individuals (0.00004% of the MU) for two activities.	0.024 individuals (0.000023% of the MU) for one activity. 0.04 individuals (0.00004% of the MU) for two activities.	0.00004 individuals (0.0000004% of the MU) for one large vessel. 0.0006 individuals (0.0000006% of the MU) for up to 16 large vessels	0.09 individuals (0.00009% of MU)
Area of Gogledd Môn Forol/North Anglesey Marine SAC	0.00009% of 3,249km^2 SAC area	Up to 0.002% of 3,249km^2 SAC area	Up to 0.002% of 3,249km^2 SAC area	Up to 0.00025% of 3,249km^2 SAC area	Up to 0.004% of 3,249km^2 SAC area

Potential Effect	Two percussive drilling rigs	Cable laying	Rock placement	Large vessels	Worst-Case Total
Maximum duration of 183 days in summer season	Seasonal average = 0.00009%	Seasonal average = 0.002%	Seasonal average = 0.0029%	Seasonal average = 0.00025%	Seasonal average = 0.004%

8.3.2.2.1.1. Mitigation

591. As outlined in **Chapter 12, Marine Mammals** (**Volume I** of the ES), Marine Mammal Mitigation Protocols (MMMPs) will be prepared to reduce the risk of any permanent auditory injury (PTS) to marine mammals as a result of underwater noise during construction. The MMMP(s) will be developed in the pre-construction period and based upon best available information, methodologies, industry best practice, latest scientific understanding, current guidance and detailed project design.

592. It is currently proposed, that MMMPs for drilling activity and for cable installation and cable protection activities would be prepared prior to construction, for example with the option of having Marine Mammal Observers (MMOs) on site during these activities to ensure marine mammals do not enter a predetermined mitigation zone (for example, 500m).

593. The MMMP(s) will reduce the risk of permanent auditory injury to harbour porpoise as a result of underwater noise at the MDZ, therefore, there would be **no adverse effect on the integrity of the Gogledd Môn Forol/North Anglesey Marine SAC in relation to the Conservation Objectives for harbour porpoise (i.e. Conservation Objective 1: harbour porpoise is a viable component of the site)**.

8.3.2.2.2. Assessment of Potential Effects of Underwater Noise and Disturbance

594. As a precautionary approach the maximum area of potential disturbance has been assessed for underwater water noise from operational turbines for the full deployment (240MW) at the same time as underwater water noise from any construction activities, maintenance and repowering activities and vessels, based on the worst-case scenarios and maximum potential ranges for two drilling activities, two cable laying activities, two cable protection activities and up to 16 vessels (**Table 8-6**). It has been assumed that these activities could be undertaken throughout the summer period.

595. The underwater noise modelling for PTEC predicted that the largest ranges for harbour porpoise with a maximum range for 90 dB_{ht}(*Species*) level where a strong behavioural avoidance reaction is likely of 450m and a maximum range for 75 dB_{ht}(*Species*) of 7km where some avoidance reaction could occur; both of these impact ranges are estimated for the largest 20m rotor diameter. The estimated impact ranges for the 24m diameter rotor were expected to extend to a maximum 90 dB_{ht} impact range out to 610m and a 75 dB_{ht} impact range out to 9.1km (Subacoustech, 2014).

596. For full deployment (240MW) the assessment has been based on the possible strong avoidance (90 dB_{ht}(*Species*) range from the modelling for PTEC. The assessment for the full deployment has been based on arrays rather than individual tidal devices, as individual marine mammals would be more likely to be disturbed by the closest turbine they approach rather than all

individual turbines within the array. As an indicative precautionary worst-case, the assessment has been based on up to 10 arrays, however the maximum number of arrays at the MDZ is likely to be eight. The areas are based on an area of a circle and assessment also assumes no overlap in disturbance areas between arrays / groups of turbines. For harbour porpoise the maximum predicted area of disturbance has been estimated at up to 11.7km^2. This is based on the area of a circle for the 610m impact range from the PTEC noise modelling for one device, multiplied by 10 for the 10 arrays.

597. The maximum predicted range of 320m (0.32km^2) for disturbance (based on the TTS/ fleeing response) during drilling is based on the example of two percussive drilling rigs at the Wylfa Newydd Development Area using the non-impulsive NMFS (2018) criteria (153 dB re 1 µPa^{2}s Weighted SEL$_{cum}$ for harbour porpoise), assuming a stationary animal remaining in the vicinity over a 24-hour period.

598. As outlined in **Chapter 12, Marine Mammals** (**Volume I** of the ES), using the predicted ranges for Temporary Threshold Shift (TTS) / fleeing response, based on the NMFS (2018) thresholds and criteria represents a good indication of the potential disturbance ranges.

599. The maximum predicted impact ranges for TTS / fleeing response using the non- impulsive NMFS (2018) criteria (153 dB re 1 µPa^{2}s Weighted SEL$_{cum}$ for harbour porpoise) and the fleeing animal model for cable laying and rock placement in the Southern North Sea sites was assessed as less than 100m (0.03km^2) and up to 990m (3.08km^2), respectively, and has been used as an example. For two cable laying activities and two cable protection activities the maximum area of potential disturbance would be 6.22km^2.

600. The maximum predicted range of 140m (0.062km^2) for disturbance (based on the TTS/ fleeing response) from vessels is for large vessels at the Wylfa Newydd Development Area using the non-impulsive NMFS (2018) criteria, assuming a stationary animal remaining in the vicinity over a 24-hour period, has been used as an example. For up to 16 vessels in the MDZ the maximum area of potential disturbance would be up to 1km^2.

601. It is estimated that there could be up to 14 construction vessels in the MDZ and export cable corridor (ECC) at any one time, however, as a precautionary worst-case scenario the assessment has been based on 16 vessels, to allow for additional guard vessels.

602. Modelling by Heinänen and Skov (2015) indicates that the number of ships represents a relatively important factor determining the density of harbour porpoise in the Celtic and Irish Sea MU during summer, with markedly lower densities with increasing levels of traffic. A threshold level in terms of impact seems to be approximately 15,000 ships per year (approximately 50 vessels per day within a 5km^2 area).

603. The number of construction vessels within the MDZ array area (35km^2) and ECC area (4.75km^2) would be well below this threshold with an estimated two vessels per 5km^2. If all the vessels were within one development area (e.g. indicative smallest area of 1.85km^2) and the ECC area (4.75km^2) at any one time, there could be up to 11.5 vessels per 5km^2.

604. The maximum area of potential disturbance for underwater water noise from operational turbines for the full deployment (240MW) at the same time as underwater water noise from any

construction activities, maintenance and repowering activities and vessels, based on the worst-case scenarios and maximum potential ranges for two drilling activities, two cable laying activities, two cable protection activities and up to 16 vessels is up to 19.24km^2, which could affect up to 15 individuals (0.014% of the MU) (**Table 8-6**).

605. At any one time the maximum area of potential disturbance could be up to 0.6% of the Gogledd Môn Forol/North Anglesey Marine SAC area. Assuming that these activities, as a worst-case scenario, would be undertaken throughout the summer period (183 days), the maximum seasonal average would be 0.6% (**Table 8-6**). Any displacement of harbour porpoise would not exceed 20% of the seasonal component of the SAC area in any given day or on average exceed 10% of the seasonal component of the SAC area over the duration of that season.

606. Therefore, there would be no adverse effect on the integrity of the Gogledd Môn Forol/North Anglesey Marine SAC in relation to the Conservation Objectives for harbour porpoise (i.e. Conservation Objective 2: there is no significant disturbance of harbour porpoise).

607. No mitigation is proposed.

Table 8-6 Summary of the maximum predicted disturbance of harbour porpoise in the Gogledd Môn Forol/North Anglesey Marine SAC

Potential Effect	Operational turbines	Drilling x 2	Cable laying x2 and cable protection x2	Up to 16 large vessels	Total
Maximum area of disturbance for harbour porpoise	11.7km^2	0.32km^2	6.22km^2	1km^2	19.24km^2
Maximum number of individuals and % of MU	9.2 individuals (0.009% of the MU)	0.25 individuals (0.0002% of the MU)	5 individuals (0.005% of the MU)	0.78 individuals (0.00075% of the MU)	15 individuals (0.014% of the MU)
Area of Gogledd Môn Forol/North Anglesey Marine SAC	0.36% of 3,249km^2 SAC area	0.01% of 3,249km^2 SAC area	0.2% of 3,249km^2 SAC area	0.03% of 3,249km^2 SAC area	0.6% of 3,249km^2 SAC area
Maximum duration of 183 days in summer season	Seasonal average = 0.36%	Seasonal average = 0.01%	Seasonal average = 0.3%	Seasonal average = 0.03%	Seasonal average = 0.6%

8.3.2.2.3. Assessment of Potential Effects of Disturbance from ADDs

608. Acoustic deterrent devices (ADDs) may be used as part of the mitigation plan to deter marine mammals for coming too close to operational turbines and to reduce the potential collisions risk.

609. As a precautionary approach, the assessment has been based on a potential average disturbance range of approximately 1km (3.14km^2) for a range of ADD devices, based on the JNCC guide for the selection and deployment of acoustic deterrent devices (McGarry *et al*., 2018) (see **Chapter 12, Marine Mammals**, **Volume I** of the ES).

610. The requirements for ADD use has still to be determined during the development of the mitigation plan. Therefore, for this assessment a precautionary indicative example has been assumed in that there could be four ADDs at each of the arrays with a worst-case scenario of

up to ten arrays, although the maximum of eight arrays are proposed for the MDZ. It is proposed that the ADDs would only be activated when marine mammals are in close proximity to the arrays and therefore not all 40 ADDs would ever be activated at the same time. Therefore, the assessment has been based on a very precautionary scenario of a maximum of 10 ADDs activated at the same time, with a potential disturbance area of up to 31.4km^2 (assuming no overlap in the disturbance areas for the 10 ADDs or land).

611. The duration of the ADD activation has also still to be determined, therefore as a precautionary approach an assessment has been based on possible 20 minute activation and the distance marine mammals could be disturbed based on them swimming away for the ADD during this activation time. For harbour porpoise an average swimming speed of 1.5m/s (Otani *et al*., 2000) has been assumed. Therefore, for a 20 minute ADD activation a harbour porpoise could cover 1.8km, an approximate area of 10.18km^2. Assuming a precautionary, although unlikely scenario of up to 10 ADDs activated at the same time, the potential disturbance area could be up to 101.8km^2 (assuming no overlap in the disturbance areas for the 10 ADDs or land).

612. The overall maximum area of possible disturbance during ADD activation in-combination with the underwater noise from the operational turbines or other activities and vessels would be the same area as assessed for ADDs, as the ADD areas of disturbance (e.g. 31.4km^2 or 101.8km^2) would be greater than the area of potential disturbance for underwater noise from operational turbines of up to 11.7km^2 and the maximum potential area of disturbance for operational turbines and other activities and vessels (e.g. up to 19.24km^2; **Table 8-6**) for harbour porpoise.

613. As a worst-case scenario, it has been assumed that ADDs could be activated on every day in the summer period. This is highly unlikely as the ADDs would only be activated for 10 or 20 minutes when marine mammals come in close proximity to the tidal devices or arrays.

614. The maximum number of harbour porpoise that could be disturbed, based on the worst-case scenario for ADD activation is up to 80 individuals (0.08% of the MU). At any one time the maximum area of potential disturbance could be up to 3% of the Gogledd Môn Forol/North Anglesey Marine SAC area. Assuming that these activities, as a worst-case scenario, would be undertaken throughout the summer period (183 days), the maximum seasonal average would be 3% (**Table 8-7**). Any displacement of harbour porpoise would not exceed 20% of the seasonal component of the SAC area in any given day or on average exceed 10% of the seasonal component of the SAC area over the duration of that season.

615. Therefore, there would be no adverse effect on the integrity of the Gogledd Môn Forol/North Anglesey Marine SAC in relation to the Conservation Objectives for harbour porpoise (i.e. Conservation Objective 2: there is no significant disturbance of harbour porpoise).

616. No mitigation, other than restricting the ADD activation time to the minimum required to displace marine mammals and reduce the risk of collisions with tidal devices and that ADDs are only activated when marine mammals come within close proximity of the tidal devices and arrays, are proposed.

Table 8-7 Summary of the maximum predicted ADD disturbance of harbour porpoise in the Gogledd Môn Forol/North Anglesey Marine SAC

Potential Effect	Up to 10 ADDs (1km range)	Up to 20 minute ADD activation for up to 10 ADDs
Maximum area of disturbance for harbour porpoise	31.4km^2	101.8km^2
Maximum number of individuals and % of MU	24.6 individuals (0.02% of the MU)	80 individuals (0.08% of the MU)
Area of Gogledd Môn Forol/North Anglesey Marine SAC	1% of 3,249km^2 SAC area	3% of 3,249km^2 SAC area
Maximum duration of 183 days in summer season	Seasonal average = 1%	Seasonal average = 3%

8.3.2.2.4. Assessment of Potential Effects of Collision Risk with Tidal Devices

617. Full details of the collision risk assessments are provided in **Chapter 12, Marine Mammals** (**Volume I** of the ES).

618. There is considerable uncertainty regarding the collision risk of marine mammals with all tidal turbine types. The moving rotors of tidal energy devices may pose a potential collision risk for marine mammals. However, there is currently limited understanding and empirical data relating interactions between marine mammals with tidal devices and there have been no recorded incidents at any operational tidal turbines.

619. Scenarios and assessments have been conducted for the maximum number of each type of device combined where the predicted collision risk is less than one bottlenose dolphin, using the Encounter Rate Model (ERM) and Collision Risk Model (CRM) with 98% avoidance.

620. The assessment for harbour porpoise has been based on the scenarios for the combination of different types of devices where the collision risk is predicted to be less than one bottlenose dolphin (based on the scenarios with the current maximum MW). Each stage of deployment would only progress based on these scenarios and that the regular reviewing of the monitoring and mitigation indicated that there was no increased collision risk.

621. The approach will be to deploy to a level where the risk is less than one bottlenose dolphin (e.g. **Table 8-8** and **Table 8-9**). This deployment will then be monitored with the potential for application of mitigation, such as the use of ADDs if animals demonstrate behaviours that come too close to the tidal devices and arrays. The next phase of deployment, again based on the collision risk of less than one bottlenose dolphin, would only proceed when a review of the monitoring and requirements for mitigation (e.g. how often ADDs were activated), indicates that there is no increased collisions risk. This would be done in consultation with NRW. Therefore, the assessments, including the in-combination assessment is based on the scenarios for less than on bottlenose dolphin, as this would be the worst-case scenario.

622. The ERM assessment indicates that for an indicative deployment, based on 98% avoidance, the potential collision risk for harbour porpoise, without mitigation, could be up to 23 individuals per year (0.02% of the MU) (**Table 8-8**).

623. The CRM assessment indicates that for an indicative deployment, based on 98% avoidance, the potential collision risk for harbour porpoise, without mitigation, could be up to 20 individuals per year (0.02% of the MU) (**Table 8-9**).

624. Indicative assessments for 30MW and 40MW of each type of device and an indicative 240MW scenario are also presented in **Appendix 12.2** (**Volume III**) of the ES, however, these would only be developed once the monitoring and mitigation indicates that the modelled collision risk associated with the arrays would be less than one bottlenose dolphin. As a worst-case, the assessment for the indicative 240MW scenario indicates that up to 0.4% of the harbour porpoise MU could be at risk, based on 98% avoidance without mitigation.

625. The number of animals that can be 'removed' from a population varies, but is largely dependent on the growth rate of the population. Populations with low growth rates can sustain the removal of a smaller proportion of the population. The JNCC *et al*. (2010) draft EPS guidance provides some indication on how many animals may be removed from a population without causing detrimental effects to the population at FCS.

626. JNCC *et al*. (2010) draft EPS guidance considered 4% as the maximum potential growth rate in harbour porpoise, and the 'default' rate for cetaceans. Therefore, beyond natural mortality, up to 4% of the population could theoretically be permanently removed before population growth would be halted.

627. A threshold of 1.7% of the relevant harbour porpoise population above which a population decline is inevitable has been agreed with Parties to the Agreement on the Conservation of Small Cetaceans of the Baltic and North Seas (ASCOBANS), with an intermediate precautionary objective of reducing the impact to less than 1% of the population (Defra, 2003; ASCOBANS, 2015). This threshold relates to impacts from fisheries by-catch on harbour porpoise where the impact on the harbour porpoise is permanent, i.e. up to 1.7% of the population may be caught as by-catch before a population decline is inevitable.

628. The collision risk assessments have been based on the worst-case scenarios, does not take into account the proposed phased deployment, monitoring and mitigation measures and assumes that all encounter or collisions would be fatal.

629. Taking this into account, along with the JNCC *et al*. (2010) draft EPS guidance and ASCOBANS by-catch threshold, it is therefore unlikely that the potential collision risk of up to 0.02% of the MU would result in any significant population effects.

630. Therefore, there would be no adverse effect on the integrity of the Gogledd Môn Forol/North Anglesey Marine SAC in relation to the Conservation Objectives for harbour porpoise (i.e. Conservation Objective 1: harbour porpoise is a viable component of the site).

631. The potential population level effects of collision risk with operational tidal turbines on marine mammals have been assessed in **Appendix 12.2** (**Volume III**) of the ES.

Table 8-8 ERM assessment for harbour porpoise (number of individuals / year and % of MU) with 98% avoidance for maximum number (and MW) of each type of device combined for collision risk scenario of less than one bottlenose dolphin

Tidal device category	Twin-rotor floating	Multiple-rotor buoyant platform	Multi-rotor buoyant mid water	Multiple-rotor buoyant platform	Spar buoy	Seabed mounted single rotor	Seabed mounted single rotor	Seabed mounted single rotor	Three-rotor seabed mounted platform	Cross-flow multi-rotor floating	Total
Number (MW)	**4 (8MW)**	**1 (1.5MW)**	**1 (1.25MW)**	**0**	**1 (1MW)**	**2 (2MW)**	**1 (1.5MW)**	**1 (0.3MW)**	**1 (1.2MW)**	**0**	**12 (16.75MW)**
Bottlenose dolphin	0.39	0.10	0.10	0	0.07	0.11	0.08	0.02	0.11		0.99 (0.25%)
Harbour porpoise	13.7	2.8	2.3	0	1.6	0.4	1.0	0.1	0.37		22.76 (0.02%)

Table 8-9 CRM assessment for harbour porpoise (number of individuals / year and % of MU) with 98% avoidance for maximum number (and MW) of each type of device combined for collision risk scenario of less than one bottlenose dolphin

Tidal device category	Twin-rotor floating	Multiple-rotor buoyant platform	Multi-rotor buoyant mid water	Multiple-rotor buoyant platform	Spar buoy	Seabed mounted single rotor	Seabed mounted single rotor	Seabed mounted single rotor	Three-rotor seabed mounted platform	Cross-flow multi-rotor floating*	Total
Number (MW)	**3 (6MW)**	**1 (1.5MW)**	**1 (1.25MW)**	**0**	**1 (1MW)**	**1 (1MW)**	**1 (1.5MW)**	**2 (0.6MW)**	**3 (3.6MW)**	**0**	**13 (16.45MW)**
Bottlenose dolphin	0.37	0.09	0.09	0	0.11	0.04	0.10	0.04	0.16		0.99 (0.25%)
Harbour porpoise	11.28	2.37	1.96	0	2.12	0.25	1.22	0.15	0.35		19.69 (0.02%)

*CRM not applicable for vertical blade of cross-flow multi-rotor floating type device, therefore ERM results included

8.3.2.2.4.1. Mitigation

632. As outlined in **Chapter 12, Marine Mammals** (**Volume I** of the ES), an Environmental Mitigation and Monitoring Plan (EMMP) (**Document MOR/RHDHV/DOC/0072**) will be developed in the pre-construction period and based upon best available information, methodologies, industry best practice, latest scientific understanding, current guidance and detailed project design.

633. This plan will consider the most suitable and effective monitoring and mitigation measures to, detect marine mammals in and around the arrays (for example, using remotely monitored Passive Acoustic Monitoring (PAM), underwater cameras, autonomous recorders, and / or high definition (HD) and thermal imaging camera systems). There would also be the use of active sonar to detect marine mammals in close proximity to the arrays / devices to trigger mitigation measures, such as the automatic activation of ADDs to deter marine mammals from a predetermined mitigation zone around the arrays / devices.

634. The approach would be based on deployment, monitoring and adaptive management, with regular reviews of the installation at appropriate increments directly related to collision risk to marine mammals, specially bottlenose dolphin, to ensure that in that no more than one bottlenose dolphin could be at risk.

635. The proposed mitigation would significantly reduce the potential collision risk, therefore, there would be no adverse effect on the integrity of the Gogledd Môn Forol/North Anglesey Marine SAC in relation to the Conservation Objectives for harbour porpoise (i.e. Conservation Objective 1: harbour porpoise is a viable component of the site).

8.3.2.2.5. Assessment of Potential Effects of Collision Risk with Vessels

636. The potential for increased collision risk with vessels has been based on up to 16 vessels on site at any one time, with up to 16 vessel movements to and from the site per day. The maximum area of potential risk has been estimated based on construction vessels in indicative examples of the two largest potential deployment areas (3 km^2 and 3 km^2); plus, vessels in ECC area (4.75 km^2). In addition, increased collision risk has also been estimated based on the potential vessel route area to and from Holyhead Harbour, based on a precautionary 250 m buffer either side of the vessels (4.34 km^2).

637. Harbour porpoise are small and highly mobile and given their responses to vessel noise (e.g. Thomsen *et al*., 2006; Evans *et al*.,1993; Polacheck and Thorpe, 1990), are expected to largely avoid vessel collisions. The Heinänen and Skov (2015) report indicates a negative relationship between the number of ships and the distribution of harbour porpoise in the Celtic and Irish Seas, suggesting that the species could exhibit avoidance behaviour which reduces the risk of strikes.

638. Of the 274 reported harbour porpoise strandings in 2015 (latest UK Cetacean Stranding's Investigation Programme (CSIP) Report currently available), 53 were investigated at post mortem (27 were conducted in England, 13 in Scotland and 13 in Wales). A cause of death was established in 51 examined individuals (approximately 96% of examined cases). Of these, four (8%) had died from physical trauma of unknown cause, which could have been vessel strikes

(CSIP, 2015). Approximately 4% of all harbour porpoise post mortem examinations from the Baltic, North East Atlantic, Irish and North Seas (ASCOBANS area) are thought to have evidence of interaction with vessels (Evans *et al*., 2011).

639. There is limited information on which to quantity the collision risk of marine mammals with vessels. Although the risk of collision is likely to be low, as a precautionary worse-case scenario, the number of harbour porpoise that could be at increased collision risk with vessels has been assessed based on precautionary 5% to 10% of the number of individuals, based on the strandings data, that could be present in the area potentially being at increased collision risk.

640. As a worst-case scenario 0.59-1.18 harbour porpoise could be at increased collision risk with vessels in the MDZ and moving between the MDZ and Holyhead Port. This represents 0.0006-0.0011% of the MU (**Table 8-10**).

641. Therefore, there would be no adverse effect on the integrity of the Gogledd Môn Forol/North Anglesey Marine SAC in relation to the Conservation Objectives for harbour porpoise (i.e. Conservation Objective 1: harbour porpoise is a viable component of the site).

642. No mitigation is proposed.

Table 8-10 Estimated number of harbour porpoise (and % of MU) that could be at increased collision risk with vessels at MDZ

Species	Increased collision risk (5-10% of individuals in area at increased risk)		
	Two indicative deployment areas and cable corridor (10.75km^2) area.	**Vessel route to Holyhead Port (4.34km^2)**	**Number of individuals (% of MU) at potential increased risk in total area (15.09km^2)**
Harbour porpoise	0.42-0.84 individuals (0.0004-0.008% of the MU)	0.17-0.34 individuals (0.0002-0.0003% of the MU)	0.59-1.18 individuals (0.0006-0.0011% of MU)

8.3.2.2.6. Assessment of Potential Effects of Collision Risk with Tidal Devices and Vessels

643. As a precautionary approach the number of harbour porpoise (and percentage of the MU) has been assessed for the potential collision risk with operational turbines (**Section 8.3.2.2.4**) and possible increased collision risk with vessels (**Section 8.3.2.2.5**).

644. The assessment has been based on the worst-case scenario that there could be up to 16 vessels on site at the same time as the deployment of the less than one bottlenose dolphin at collision risk scenario (**Table 8-11**). However, it is highly unlikely that 16 vessels would be on site during operation, also when vessels are on site during operation this is likely to be for maintenance and repowering activities, which would result in a number of devices to be non-operational during these activities.

645. As a worst-case scenario, with no mitigation, up to 25 harbour porpoise could be at increased collision risk with tidal devices and vessels. This represents 0.024% of the MU (**Table 8-11**).

646. The estimated collision risk per year would be significantly less than 4% of the MU, therefore based on the JNCC *et al*. (2010) draft EPS guidance, it is unlikely that the potential collision risk would result in any significant population effects.

647. Taking into account the EMMP outlined in **Section 8.3.2.2.4.1**, reduces the potential collision risk with tidal devices, there would be no adverse effect on the integrity of the Gogledd Môn Forol/North Anglesey Marine SAC in relation to the Conservation Objectives for harbour porpoise (i.e. Conservation Objective 1: harbour porpoise is a viable component of the site).

Table 8-11 Estimated number of harbour porpoise (and % of MU) that could be at increased collision risk with vessels and full deployment of operational tidal devices at MDZ

Species	Number of individuals (% of reference population)		
	Increased collision risk with vessels (5-10% of individuals in total area; 15.09km^2)	Collision risk for one dolphin scenario (ERM and CRM)	Total (maximum based on worst-case scenario)
Harbour porpoise	0.59-1.18 individuals (0.0006-0.0011% of MU)	20-23 individuals (0.02% of MU)	Up to 25 individuals (0.024%)

8.3.2.2.7. Assessment of Potential Effects of Entanglement with Mooring Lines

648. To date, there have been no recorded instances of marine mammal entanglement from mooring systems of renewable devices (Sparling *et al*., 2013; Isaacman and Daborn, 2011), or for anchored floating production, storage and offloading (FPSO) vessels in the oil and gas industry (Benjamins *et al*., 2014) with similar mooring lines.

649. Benjamins *et al*. (2014) provides a qualitative assessment of relative entanglement risk across different marine megafauna groups, taking into account both biological risk factors such as animal size, sensory capabilities and foraging methods, and physical risk factors such as mooring flexibility, pre-tension and footprint. For the mooring scenarios which most represent those likely to be used at MDZ (i.e. catenary & chain or tension mooring, with or without accessory buoy), the risk to harbour porpoise is low.

650. Taking into account that there have been no recorded instances of harbour porpoise entanglement from mooring systems of renewable devices or similar mooring lines, it is highly unlikely that there is any risk of entanglement at the MDZ.

651. In addition, the tidal devices and moorings would be regular checked (approximately 15 times annually for both planned and unplanned maintenance activities), this would ensure that there was no material such as discarded nets, ropes or other debris which could increase the risk of entanglement for marine mammals or interfere with the optimal operation of the tidal devices.

652. The mitigation and monitoring measures to reduce the risk of collision with operational turbines would also reduce the risk of entablement with mooring lines.

653. Therefore, there would be no adverse effect on the integrity of the Gogledd Môn Forol/North Anglesey Marine SAC in relation to the Conservation Objectives for harbour porpoise (i.e. Conservation Objective 1: harbour porpoise is a viable component of the site).

8.3.2.2.8. Assessment of Potential Barrier Effects

654. Underwater noise could have the potential to create a barrier effect, preventing movement or migration of marine mammals between important feeding and / or breeding areas, or potentially increasing swimming distances if marine mammals avoid the site and go around it.

655. The worst-case scenario in relation to barrier effects as a result of underwater noise is based on the maximum spatial and temporal (i.e. longest duration) scenarios. This assumes the maximum potential disturbance and possible barrier effects that there could be at any one time. This has been assessed in **Section 8.3.2.2.2**, for the maximum area of potential disturbance for underwater water noise from operational turbines for the full deployment (240MW) at the same time as underwater water noise from any construction activities, maintenance and repowering activities and vessels, based on the worst-case scenarios and maximum potential ranges for two drilling activities, two cable laying activities, two cable protection activities and up to 16 vessels (**Table 8-6**). It has been assumed that these activities could be undertaken throughout the summer period.

656. As a worst-case scenario, up to 15 individuals could be affected (0.014% of the MU) (**Table 8-6**). At any one time the maximum area of potential disturbance and any barrier effects from underwater noise could be up to 0.6% of the Gogledd Môn Forol/North Anglesey Marine SAC area. Assuming that these activities, as a worst-case scenario, would be undertaken throughout the summer period (183 days), the maximum seasonal average would be 0.6% (**Table 8-6**). Any displacement of harbour porpoise would not exceed 20% of the seasonal component of the SAC area in any given day or on average exceed 10% of the seasonal component of the SAC area over the duration of that season.

657. Therefore, there would be no adverse effect on the integrity of the Gogledd Môn Forol/North Anglesey Marine SAC in relation to the Conservation Objectives for harbour porpoise (i.e. Conservation Objective 2: there is no significant disturbance of harbour porpoise).

658. The physical presence of the tidal array could have the potential to create a physical barrier. As outlined in **Chapter 12, Marine Mammals** (**Volume I** of the ES), the final array layout will be identified post consent, following the berth selection and allocation process. The final detailed device locations will be developed based on further site investigation works conducted post-consent to determine detailed construction constraints. However, the assessment has been based on indicative spacings and potential area of the tidal arrays. The estimated maximum area taken up by all arrays, including spaces between devices (i.e. not the seabed footprint) of up to 12.5km^2 for the full 240MW capacity project.

659. The number of harbour porpoise that could be at risk of potential barrier effects based on the maximum area of 12.5km^2 is 10 individuals (0.01% of the MU).

660. At any one time the maximum area of potential disturbance as a result of potential physical barrier effects could be up to 0.4% of the Gogledd Môn Forol/North Anglesey Marine SAC area. Based on the effects throughout the summer period (183 days), the maximum seasonal average would be 0.4%. Any displacement of harbour porpoise would not exceed 20% of the seasonal component of the SAC area in any given day or on average exceed 10% of the seasonal component of the SAC area over the duration of that season.

661. Therefore, there would be no adverse effect on the integrity of the Gogledd Môn Forol/North Anglesey Marine SAC in relation to the Conservation Objectives for harbour porpoise (i.e. Conservation Objective 2: there is no significant disturbance of harbour porpoise).

8.3.2.2.9. Assessment of Potential EMF Effects

662. Potential pathways for effects from electromagnetic fields (EMF) would be from the presence of cables within the MDZ and ECC.

663. Modelling of expected magnetic fields by Normandeau *et al*. (2011) indicates that the predicted fields were strongest directly over the cables and decreased rapidly with vertical and horizontal distance from the cables.

664. Currently there is no evidence to suggest that existing subsea cables have influenced harbour porpoise movements. For example, harbour porpoise move in and out of the Baltic Sea with several crossings over operating subsea HVDC cables in the Skagerrak and western Baltic Sea without any apparent effect on their migration pattern (Gill *et al*., 2005). In addition, data from operational windfarms show no evidence of exclusion of harbour porpoise.

665. As a precautionary approach, the number of harbour porpoise that could be affected by any potential EMF effects is up to 0.03 individuals (0.00003% of the MU) based on the maximum cable area (0.042km^2) in the MDZ and ECC.

666. At any one time the maximum area of potential disturbance as a result of potential physical barrier effects could be up to 0.0013% of the Gogledd Môn Forol/North Anglesey Marine SAC area. Based on the effects throughout the summer period (183 days), the maximum seasonal average would be 0.0013%. Any displacement of harbour porpoise would not exceed 20% of the seasonal component of the SAC area in any given day or on average exceed 10% of the seasonal component of the SAC area over the duration of that season.

667. Therefore, there would be no adverse effect on the integrity of the Gogledd Môn Forol/North Anglesey Marine SAC in relation to the Conservation Objectives for harbour porpoise (i.e. Conservation Objective 2: there is no significant disturbance of harbour porpoise).

668. It should be noted that any displacement of harbour porpoise as a result of EMF effects is not an additional effect as the area of displacement would be covered by the maximum area assessed for potential disturbance as a result of underwater noise.

8.3.2.2.10. Assessment of Potential Effects of Any Changes in Water Quality

669. During construction, maintenance and repowering activities and decommissioning there is the potential for disturbance and re-suspension of sediments, either directly from the seabed, or from sub-seabed cuttings, and for these re-suspended sediments to be dispersed through the water column as a plume. This has the potential to increase the suspended sediment concentrations and potentially increase turbidity around the MDZ.

670. The maximum envisaged effect associated with sediment plumes arising from the foundation installation activities will cause a small increase in suspended sediment concentration (typically less than 1mg/l a short distance from the release point) over only a small geographical area (a few hundred metres). The effects will be temporary, with a return to very low background concentrations occurring rapidly upon cessation of installation activities (i.e. the effect is temporary only). Other than at the immediate release point, such a change would be

immeasurable and has been assessed as negligible in **Chapter 8, Marine Water and Sediment Quality** (**Volume I** of the ES), with no mitigation required.

671. The free-laying of cables and the placement of cable protection would not cause plumes along the offshore sections of the cable corridor because the sea bed is characterised by bedrock or, where sparse sediment cover does exist, by sediments with a particle size that cannot be suspended in the water column.

672. In the nearshore, the bedrock is overlain by sand which has the potential to be disturbed. The assessment in **Chapter 8, Marine Water and Sediment Quality** (**Volume I** of the ES), indicates that there could be a minor adverse (not significant) impact via increased suspended sediments in the area around the sandwave field and close to shore. However, the likely increase in suspended sediment concentration in areas with sand cover nearer to shore (including at the landfall) will remain within the natural variation that are governed by storm waves and surge effects. Any increase in suspended sediments would reduce rapidly with distance from the point of disturbance to a few mg/l over a small geographical area (within a few hundred metres, along the axis of tidal currents). Furthermore, these effects will be one-off and temporary in duration, with a return to the very low background concentrations occurring rapidly upon cessation of installation.

673. The re-suspension of sediments during construction activities could also lead to the release of any contaminants that may be present within them. However, as outlined in **Chapter 8, Marine Water and Sediment Quality** (**Volume I** of the ES), sediment contamination within the MDZ is low, due to the dynamic hydrological regime and generally low level of industrial activity in this region. The low proportion of fine sediments within the MDZ is another factor that indicates low sediment contamination levels. Therefore, the assessment determined a negligible impact on general water quality in the MDZ via release of contaminated sediments, as even though mobilisation of the relatively limited amount of sediments in the MDZ will occur via construction works, none of these sediments are known to have high levels of contaminants.

674. During construction there is the potential for changes in water quality as a result of accidental discharge and spillage of oils, fuels and materials. However, Menter Môn is committed to the use of best practice and pollution prevention guidelines at all times. A Marine Pollution Contingency Plan (MPCP) would be in place and agreed with NRW in line with the Integrated Pollution Prevention and Control (IPPC) Directive such that any potential risk is minimised. Any permitted discharges would be small volumes, intermittent and dilute and disperse quickly.

675. If any such substances were accidentally released/leaked, quantities would likely be small due to relatively small amounts being present in individual devices. Due to the dynamic nature of the tidal and wave regime in and around the MDZ, lateral and vertical dispersion rates of any spilled substances would be expected to be high.

676. Any potential in changes in marine water quality as a result of sediment re-suspension caused by seabed disturbance; mobilisation of contaminants adsorbed onto potentially re-suspended seabed sediments; and accidental discharge and spillage of oils, fuels and materials are likely to be localised, dispersed quickly, temporary and would have a negligible effect.

677. Therefore, there would be no adverse effect on the integrity of the Gogledd Môn Forol/North Anglesey Marine SAC in relation to the Conservation Objectives for harbour porpoise (i.e. Conservation Objective 3: the condition of supporting habitats and processes, and the availability of prey is maintained).

8.3.2.2.11. Assessment of Potential Effects of Any Changes in Prey Availability

678. Potential effects on marine mammal prey species during construction, maintenance and repowering activities and decommissioning which could result in changes to prey availability include: underwater noise; barrier effects; collision risk; electromagnetic fields; increased suspended sediment concentrations and sediment re-deposition; physical disturbance and temporary loss of seabed habitat during construction; and long-term habitat loss via placement of project infrastructure.

679. As outlined in in **Chapter 12, Marine Mammals** (**Volume I** of the ES), underwater noise modelling was conducted for fish at the nearby Wylfa Newydd Development Area for drilling into a hard substrate, cutter-suction dredging as a proxy for cable installation and cable protection, and for large vessels, based on the Popper *et al*. (2014) thresholds and criteria. The results indicated that the potential disturbance of harbour porpoise as a result of underwater noise (**Section 8.3.2.2.2**) is greater than the maximum area (0.034km^2) of potential changes in prey availability, therefore there would be no further effect as harbour porpoise would already be disturbed from the area of potential prey displacement.

680. The assessment of underwater noise from operational turbines, in **Chapter 10, Fish and Shellfish Ecology** (**Volume I** of the ES), was based on the modelling conducted for operational noise for the PTEC project. The largest range at which a behavioural reaction was predicted (i.e. levels of 75dB$_{ht}$ are reached) was 36m, for cod species. The largest range at which a startle response was predicted (i.e. levels of 90dB$_{ht}$ are reached) was 3m, also for cod. Again, these ranges are less than those predicted for harbour porpoise, therefore there will be no further effect as a result of any changes in prey availability due to underwater noise from operational turbines, as harbour porpoise will be disturbed from the area that any changes in prey distribution could occur.

681. The assessment in **Chapter 10, Fish and Shellfish Ecology** (**Volume I** of the ES), found it unlikely that the presence of the tidal devices and infrastructure, including mooring chains and catenaries, would represent a complete barrier to fish due to the separation distance (70m distance in the shortest dimension) and the space available above and below tidal devices in the water column. The assessment also determined that any loss of individuals as a result of collisions with tidal devices, in the context of the total loss of individuals for a population, are considered to be within the natural levels of mortality due to other factors, therefore the magnitude of the effect at a population was considered to be very low/negligible.

682. The assessment in **Chapter 10, Fish and Shellfish Ecology** (**Volume I** of the ES), would have a low, if any effect, on marine mammal prey species. The potential effect of EMF on prey would be the same as those assessed in **Section 8.3.2.2.9**, therefore there would be no further effect on harbour porpoise as a result of any changes in prey availability due to EMF effects.

683. As outlined in **Section 8.3.2.2.10**, any changes in water quality will be negligible. The assessment in **Chapter 10, Fish and Shellfish Ecology** (**Volume I** of the ES), also determined that the potential effects of increased suspended sediment concentrations and sediment deposition on prey species would be low. The potential area of effect for any changes in water quality would be the same for harbour porpoise and their prey, therefore there would be no further effect on harbour porpoise as a result of any changes in prey availability due to changes in water quality.

684. As outlined in **Chapter 10, Fish and Shellfish Ecology** (**Volume I** of the ES), the worst-case scenario for temporary habitat loss during construction could be up to 0.42km^2, based on area for post-lay burial of cables (27,259m^2), deployment of anchor blocks by barges during cable installation (100,240m^2), deployment of anchor blocks by barges during TEC device installation (248,000m^2) and deployment of anchor blocks by barges during hub installation(48,000m^2).

685. As a worst-case scenario, up to 0.33 individuals could be temporarily affected (0.0003% of the MU) (**Table 8-12**). At any one time the maximum area of potential displacement of harbour porpoise as a result for changes in prey availability and temporary habitat loss could be up to 0.013% of the Gogledd Môn Forol/North Anglesey Marine SAC area. Assuming a worst-case scenario, that this would be throughout the summer period (183 days), the maximum seasonal average would be 0.013% (**Table 8-12**). Any displacement of harbour porpoise would not exceed 20% of the seasonal component of the SAC area in any given day or on average exceed 10% of the seasonal component of the SAC area over the duration of that season.

686. Therefore, there would be no adverse effect on the integrity of Gogledd Môn Forol/North Anglesey Marine SAC in relation to the Conservation Objectives for harbour porpoise (i.e. Conservation Objective 3: the condition of supporting habitats and processes, and the availability of prey is maintained).

687. As outlined in **Chapter 10, Fish and Shellfish Ecology** (**Volume I** of the ES), the worst-case scenario for permanent habitat loss as a result of project infrastructure could be up to 2.18km^2, based on area for Gravity Base Structures (GBS) (74,790m^2), swept area of catenary cables (2,055,000m^2), export cable footprint (cables and protection systems; 11,745m^2), array cable footprint (cables and protection systems; 30,040m^2), additional cable protection material (4,860m^2), cable tails (120m^2), trench for 9 x landfall cables (7,400m^2), footprint of navigation marker buoys (540m^2), footprint of Acoustic Doppler Current Profiler (ADCP) moorings (280m^2), footprint of seabed mounted environmental monitoring units (112m^2) and footprint of mooring for floating environmental monitoring units (45m^2).

688. As a worst-case scenario, up to 1.7 individuals could be affected (0.0016% of the MU) (**Table 8-12**). At any one time the maximum area of potential displacement of harbour porpoise as a result for changes in prey availability and permanent habitat loss could be up to 0.07% of the Gogledd Môn Forol/North Anglesey Marine SAC area. Assuming a worst-case scenario, that this would be throughout the summer period (183 days), the maximum seasonal average would be 0.07% (**Table 8-12**). Any displacement of harbour porpoise would not exceed 20% of the seasonal component of the SAC area in any given day or on average exceed 10% of the seasonal component of the SAC area over the duration of that season.

689. Therefore, there would be no adverse effect on the integrity of Gogledd Môn Forol/North Anglesey Marine SAC in relation to the Conservation Objectives for harbour porpoise (i.e. Conservation Objective 3: the condition of supporting habitats and processes, and the availability of prey is maintained).

Table 8-12 Summary of the maximum areas of possible displacement of harbour porpoise due to changes in prey availability as a result of temporary and permanent habitat loss in the Gogledd Môn Forol/North Anglesey Marine SAC

Potential Effect	Temporary habitat loss during construction	Permanent habitat loss
Maximum area of displacement for harbour porpoise	0.42km^2	2.18km^2
Maximum number of individuals and % of MU	0.33 individuals (0.0003% of the MU)	1.7 individuals (0.0016% of the MU)
Area of Gogledd Môn Forol/North Anglesey Marine SAC	0.013% of 3,249km^2 SAC area	0.07% of 3,249km^2 SAC area
Maximum duration of 183 days in summer season	Seasonal average = 0.013%	Seasonal average = 0.07%

8.3.2.2.12. Assessment of Potential In-Combination Effects

690. The screening of potential in-combination effects for marine mammals identified a number of plans and projects that were considered to have the potential to have ‘in-combination’ effects for marine mammals with the currently proposed Morlais project (**Table 8-13**).

691. A number of in-combination effects have been identified to have the potential to adversely effect the integrity of SACs in relation to the Conservation Objectives for harbour porpoise, these include:

- Underwater noise and disturbance (**Table 8-14**);
- Collision risk with tidal devices and vessels (**Table 8-15**); and
- Any changes in prey availability as a result of habitat loss (**Table 8-16**).

692. Any risk of potential auditory injury as a result of underwater noise would be mitigated, as outlined in **Section 8.3.2.2.1**, therefore there would be no potential for any in-combination effects.

693. As outlined in **Section 8.3.2.2.11**, any changes in prey availability as a result of any potential disturbance from underwater noise would be less that areas of potential impact assessed for harbour porpoise and would therefore have no further potential in-combination effects.

694. There is the no potential for in-combination barrier effects with other projects, based on the location and distances of the projects.

695. There is no potential for any changes to water quality to impact on marine mammal species in and around the MDZ and ECC, therefore there is no potential for any in-combination effects with other projects.

696. There is also no potential for EMF effects to marine mammal species or their prey, so there is no potential for any in-combination effects.

697. As no instances of entanglement with the mooring systems of renewable energy have been recorded, and the constant tension of the mooring line for the Holyhead Deep Phase I, the impact was concluded to be negligible for harbour porpoise. Taking into account the assessment of potential entanglement at MDZ and the proposed regular maintenance inspections of the lines as well as the ongoing monitoring and mitigation to reduce any collision risk, there is no predicted in-combination effects.

Table 8-13 Summary of projects considered for potential in combination effects impacts

Project	Status	Distance from Nearest Part of Project (km)	Potential for In-Combination Effects			
			Underwater noise and disturbance	Collision risk from vessels	Collision risk from tidal devices	Changes to prey availability
Holyhead Deep Phase I	In April 2017, a Marine Licence was granted for the first 0.5MW installation.	2	Yes	Yes	Yes	No
Holyhead Deep Tidal Array	In 2017, scoping report submitted for an 80MW extension to the Holyhead Deep tidal array.	2	Yes	Yes	Yes	Yes
Holyhead Port Expansion	ES currently being prepared	2	Yes	Yes	N/A	Yes
Holyhead Waterfront Regeneration	Awarded Outline Planning Permission in 2014, with Reserved Matters.	2	Yes	Yes	N/A	No
Wylfa Nuclear Power Plant	Project Suspended	17	Yes	Yes	N/A	Yes
Wylfa Decommissioning	Ongoing (with most work on land)	17	Yes	Yes	N/A	Yes
Amlwch LNG	The existing consent was renewed in 2013, but future plans are unclear and timescales undefined.	20.5	Yes	Yes	N/A	No
North Hoyle Offshore Wind Farm	Operation and Maintenance Activities only.	81	Yes	No	N/A	No
Rhyl Flats Offshore Windfarm	Operation and Maintenance Activities only.	59	Yes	Yes	N/A	No
Gwynt y Môr Offshore Wind Farm	Operations and Maintenance activities only.	65	Yes	Yes	N/A	No
Barrow Offshore Wind Farm	Operations and Maintenance activities only.	116	Yes	Yes	N/A	No
West of Duddon Sands Offshore Wind Farm	Operations and Maintenance activities only.	114	Yes	Yes	N/A	No
Ormonde Offshore Wind Farm	Operations and Maintenance activities only.	117	Yes	Yes	N/A	No

Project	Status	Distance from Nearest Part of Project (km)	Potential for In-Combination Effects			
			Underwater noise and disturbance	Collision risk from vessels	Collision risk from tidal devices	Changes to prey availability
Walney Extension Offshore Wind Farm	Operations and Maintenance activities only.	114	Yes	No	N/A	No
Burbo Bank Extension Offshore Wind Farm	Operations and Maintenance activities only.	95	Yes	Yes	N/A	No
Codling Wind Park	Consented.	75	Yes	Yes	N/A	No
Codling Wind Park Extension.	Application submitted.	75	Yes	Yes	N/A	No
Alexandra Basin Redevelopment.	Current status unknown, but the project has been consented.	96	Yes	No	N/A	No
Isle of Man Ferry Terminal.	MLA/2018/00536. Marine Licence App submitted Dec 2018.	92	Yes	Yes	N/A	No
Milford Haven, Maintenance Dredge Pembrokeshire	Application submitted.	175	Yes	Yes	N/A	Yes
Afon Dysynni outfall gravel removal and relocation	Marine Licences issued and valid until 17/10/2021.	81	Yes	Yes	N/A	Yes
Belfast Harbour D3 terminal cruise ship facility	Application submitted, awaiting a decision.	163	Yes	Yes	N/A	No
Disposal of dredge material from the D3 approach channel	Application submitted, awaiting a decision.	163	Yes	Yes	N/A	No
Marine Energy Wales marine testing area	Scoping – Issued Nov 2018	175	Yes	Yes	Yes	No
Enlli Tidal Energy Scheme, Bardsey Island	Pre-application. An Agreement for Lease was awarded pre-May 2018. The project would include up to 20 100 kW turbines	50	Yes	Yes	Yes	Yes

Table 8-14 Assessment of potential in-combination effects for disturbance of harbour porpoise from underwater noise (N/A = not available)

Project	Potential in-combination effect	Notes	Maximum number of harbour porpoise potentially disturbed	Area of disturbance (km^2) in SAC
Morlais	Underwater noise and disturbance from installation of tidal devices and hubs (two drilling rigs), two cable laying activities, two cable protection activities and up to 16 vessels, plus operational turbine noise for full deployment (240MW).	See **Section 8.3.2.2.2**	15.4	$19.24km^2$
Holyhead Deep Phase I[8]	Underwater noise and potential disturbance from vessels during operation and maintenance	Based on assessment in ES for estimated number of animals experiencing behavioural change as a result of the LARS support vessel noise during operation.	17	$50.7km^2$
	Underwater noise and potential disturbance from operational turbine	For operational noise impacts, the ES concluded that the disturbance range would be less 1m as a result of noise from the turbines.	0	0
Holyhead Deep Tidal Array – 80MW	Underwater noise and disturbance during installation	Assumed to be the same as assessment in ES for single device that disturbance area could extend out to 375m for pile drilling and out to a maximum of 10,000m for the vibro-hammering. For the installation of one DGU piling activities are likely to be limited to approximately 5 days, the ES concluded that there is likely to be very limited interaction between the piling noise and mammals; any changes would likely be undetectable against natural variation and would have no residual impact at the population level. However, as a worst-case scenario the number of marine mammals in the 10km range ($314km^2$ area) has been estimated, based on $0.335/km^2$	105.2	$314km^2$

[8] https://www.minesto.com/sites/default/files/documents/l100194-s14-eias-001-a01_es_compressed.pdf

Project	Potential in-combination effect	Notes	Maximum number of harbour porpoise potentially disturbed	Area of disturbance (km^2) in SAC
		density estimate and this area would include construction vessels.		
Holyhead Deep Tidal Array – 80MW	Underwater noise and potential disturbance from construction vessels	Assumed to be the same as assessment in ES for single device that disturbance ranges for marine mammals from vessel noise could be 14km for installation / construction vessel (using DP) and up to 4km for support vessels. No numbers of individuals provided in the ES. However, the ES concluded that whilst a small number of individual animals may exhibit some form of change in behaviour for the period in which they encounter sound from the installation or support vessels, this number is likely to be small and the main noise sources present for such a short time that any changes would likely be undetectable against natural variation.	0	0
Holyhead Port Expansion	Underwater noise and disturbance	ES not available at time of writing, therefore, no information available to inform cumulative assessment.	N/A	N/A
Holyhead Waterfront Regeneration	Underwater noise and disturbance	No information available to inform cumulative assessment.	N/A	N/A
Wylfa Nuclear Power Plant	Underwater noise and disturbance during construction	When the predicted effects of the construction works (e.g. two percussive drilling rigs, the disposal of dredged material and disturbance from vessels) are considered together, on a very precautionary basis, is $1.26km^2$ for harbour porpoise.	3	$1.26km^2$
Wylfa Decommissioning	Underwater noise and disturbance	No key significant adverse impacts were identified by the ecological assessment	0	0
Amlwch LNG	Underwater noise and disturbance	No information available to inform cumulative assessment.	N/A	N/A

Project	Potential in-combination effect	Notes	Maximum number of harbour porpoise potentially disturbed	Area of disturbance (km^2) in SAC
North Hoyle Offshore Wind Farm[9]	Underwater noise and disturbance during operation and maintenance activities	Due to the low incidence of individuals in the area, and the pre-existing noisy environment, impacts from underwater noise are not considered to be significant.	0	0
Rhyl Flats Offshore Windfarm	Underwater noise and disturbance during operation and maintenance activities	No information available to inform cumulative assessment.	N/A	N/A
Gwynt y Môr Offshore Wind Farm[10]	Underwater noise and disturbance during operation and maintenance activities	During the operation and maintenance of the Gwynt y Môr Offshore Wind Farm, there is the potential for disturbance as a result of underwater noise from maintenance activities such as cable re-burial and vessels. However, it is likely to be limited to the wind farm site, short-term and temporary, and therefore there would be a negligible impact only.	0	0
Barrow Offshore Wind Farm Operation & Maintenance Activities[11]	Underwater noise and disturbance during operation and maintenance activities	Disturbance and masking effects could occur over the short-term but would be temporary effects only. Given the baseline level of vessel activity in the area, marine mammals will, to some degree, be sensitised to noise from vessels. Therefore, the effects are predicted to be short-term and reversible, with marine mammal activity returning to baseline levels after the vessel has passed / activity ceases. It is considered that there would no additional	0	0

[9] https://www.innogy.com/web/cms/mediablob/en/3170702/data/3170690/1/rwe-innogy/rwe-innogy-uk/sites/wind-offshore/in-operation/north-hoyle/environmental-statement/chapter5.pdf
[10] https://tethys.pnnl.gov/sites/default/files/publications/Gwynt-y-Mor-Offshore-Wind-Farm-Technical-Report.pdf
[11] https://marinelicensing.marinemanagement.org.uk/mmofox5/download/parcel/6gbevdvpjrtve9km9ch4j9ldtss4nd3hapikrj14ukv072rkpk7c1ea2bprufqttfcvbog6qmil4obfptgae6k2c7h4rc8972b5f/cb08835002ff0877454187bec6de5ad5/EOR0680_Barrow+O%2526M+Marine+Licence_Assessment_Rev02_FINAL.pdf?

Project	Potential in-combination effect	Notes	Maximum number of harbour porpoise potentially disturbed	Area of disturbance (km^2) in SAC
		impacts to marine mammals over and above normal shipping activities.		
West of Duddon Sands Offshore Wind Farm Operation & Maintenance Activities[12, 13]	Underwater noise and disturbance during operation and maintenance activities	As above, it is considered that there would no additional impacts to marine mammals over and above normal shipping activities.	0	0
Ormonde Offshore Wind Farm[14]	Underwater noise and disturbance during operation and maintenance activities	As above, it is considered that there would no additional impacts to marine mammals over and above normal shipping activities.	0	0
Walney Extension Offshore Wind Farm[15]	Underwater noise and disturbance during operation and maintenance activities	As noise associated with the WTGs through operation are temporary, of a low level and area localised in nature, the impact was assessed to be negligible. Due to the low level of noise associated with maintenance vessels, and the low level of activity required compared to existing baseline levels, it is considered that there would no additional impacts to marine mammals.	0	0

[12] https://marinelicensing.marinemanagement.org.uk/mmofox5/download/parcel/6jpplqea6tc3ulc2c9vb8fm5hqsnjdfc553ajog293hg31acbv426tip6g6gkcanjc2nsjrn9mimli32hb71o5tdu6481e0cgeeq/553dd5a2fac017a8ea96bd524488df58/EOR0680_West+of+Duddon+Sands+O%2526M+Marine+Licence_Assessment_Rev02_FINAL.pdf?

[13] https://marinelicensing.marinemanagement.org.uk/mmofox5/download/parcel/i0ft2qro0mii4uff5o4j377070dp4n6c9bmqu14gd2bqfnfodbv5oibvjarpscvnn3n94632mbsu97jkhnsjenuirkgqkv66k9m4/0fc03a8dc4bf2a5f7a97cb89855f8a53/EOR0709_WDS+OFTO+O%2526M+Marine+Licence_Assessment_Rev02.pdf?

[14] https://marinelicensing.marinemanagement.org.uk/mmofox5/download/parcel/ejvk69u43qab71irh09f3373dah9h9cd4bhiqa44ts4k2v9bh3jp2ure0m31ng39i57jbdd8172dpmmk4k9egn262qtaroedqfc4/6b6d14cb74d569561df1a3e0b74a882c/EOR0682_Ormonde+O%2526M+Marine+Licence_Assessment_Rev02_FINAL.pdf?

[15] https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010027/EN010027-000266-10.1.12%20ES%20Ch%2012%20Marine%20Mammals.pdf

Project	Potential in-combination effect	Notes	Maximum number of harbour porpoise potentially disturbed	Area of disturbance (km^2) in SAC
Burbo Bank Extension Offshore Wind Farm[16]	Underwater noise and disturbance during operation and maintenance activities	Impacts associated with turbine operating noise are considered to be direct and continuous. It is predicted that marine mammals will quickly habituate to the presence of turbines in the water, and that there will be sufficient distance between turbines to allow movement between foundations. The impact is therefore considered to be of neutral significance.	0	0
Codling Wind Park	Underwater noise and disturbance	No information available to inform assessment.	N/A	N/A
Codling Wind Park Extension.	Underwater noise and disturbance	No information available to inform assessment.	N/A	N/A
Alexandra Basin Redevelopment Project[17]	Underwater noise and disturbance	The proposed piling and dredging in Dublin Port; dredging works within Dublin bay; and dumping of dredged material the west of the Burford Bank has been assessed to be unlikely to have an effect on marine mammals. It is likely that individual marine mammals entering the works area will be affected by acoustic disturbance resulting from noise and boat activity associated with demolition works, piling, dredging, and dumping. With mitigation measures, it was concluded that there will be no significant impacts of the proposed development on marine mammals.	0	0
Isle of Man Ferry Terminal[18]	Underwater noise and disturbance	Underwater noise from the construction of the ferry terminal (from piling) could cause	0	0

16 https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010026/EN010026-000365-5.1.2.14%20Marine%20Mammals.pdf
17 http://dublinportabr.ie/wp-content/uploads/2014/03/ABR-Project-March-2014-EIS-Volume-1.pdf
18 https://marinelicensing.marinemanagement.org.uk/mmofox5/download/parcel/fl5r1i6hjphn6nupqhk05gb2l5s7dn77nl89bcpusov36jrpqouns7uq9el2o111je4vkmu1ep7kvpc553h8qv8kmiein9gtjh4i/7f19880e35eb2a9216475d2b17aae95e/Isle+of+Man+Ferry+Terminal+ES+-+Vol+1+-+Main+Text+Part+2+%2528Jan+2019%2529.pdf?

Project	Potential in-combination effect	Notes	Maximum number of harbour porpoise potentially disturbed	Area of disturbance (km^2) in SAC
		behavioural effects in seals, harbour porpoise and dolphin species. It is expected that these noise levels would attenuate quickly from source. Given that only three piles are to be installed, the rapid attenuation of the noise, and therefore the impact is considered to be temporary, local and of minor significance. The only additional vessel movements through the operational phase would be the occasional maintenance dredging vessel. No additional vessel movements are expected at the new ferry terminal above current levels. Based on these considerations, the impact is expected to be temporary, local and of negligible significance.		
Milford Haven, Maintenance Dredge Pembrokeshire	Underwater noise and disturbance	No information available to inform assessment.	N/A	N/A
Afon Dysynni outfall gravel removal and relocation	Underwater noise and disturbance	No information available to inform assessment.	N/A	N/A
Belfast Harbour D3 terminal cruise ship facility[19]	Underwater noise and disturbance	Only grey and harbour seal were considered within this assessment and this project is within a different MU. Therefore, no potential for cumulative impacts.	N/A	N/A
Disposal of dredge material from the D3 approach channel	Underwater noise and disturbance	No information available to inform assessment.	N/A	N/A
Marine Energy Wales marine testing area	Underwater noise and disturbance	No information available to inform assessment.	N/A	N/A

[19] Available for download from: http://epicpublic.planningni.gov.uk/publicaccess/applicationDetails.do?activeTab=summary&keyVal=O3IS1ISV30000

Project	Potential in-combination effect	Notes	Maximum number of harbour porpoise potentially disturbed	Area of disturbance (km^2) in SAC
Enlli Tidal Energy Scheme, Bardsey Island	Underwater noise and disturbance	No information available to inform assessment.	N/A	N/A
Overall In-Combination Effects (maximum number of individuals potentially disturbed and maximum area in SAC)			**Up to 141**	**Up to 385.2km^2**
Percentage of MU and percentage of SAC			**0.14%**	**11.86%**

Table 8-15 Assessment for potential in-combination effects for collision risk of harbour porpoise with tidal devices and vessels (N/A = not available)

Project	Potential In-Combination Effect	Notes	Maximum number of harbour porpoise at increased collision risk
Morlais	Collision risk with tidal devices	Collision risk for less than one dolphin scenario (ERM and CRM) – see **Table 8-8** and **Table 8-9**	23
	Collision risk with vessels	Increased collision risk with vessels (5-10% of individuals in total area; 15.09km^2) - see **Table 8-11**	0.59-1.18
Holyhead Deep Phase I	Collision risk with tidal devices	In the ES for a single device, physical interaction with the DGU was considered low on the basis that the number of passages of animals through the area required to bring about population level effects is beyond that which the baseline data suggests is feasible. No values for the collision risk of individuals for each species was provided, just passage rates through swept area for the device.	N/A
	Collision risk from vessels	The operation and maintenance activities will not involve significant numbers of vessels and therefore it is not considered that there would be any additional impacts to marine mammals over and above normal shipping activities and extremely unlikely that vessel collision will occur.	0
Holyhead Deep Tidal Array – 80MW	Collision risk with tidal devices	Scoping report only, therefore no assessments currently available. However, if assume same approach as used for Morlais that 1st phase would be used to monitor any collision risk and that development of next phases would be based on adequate mitigation and therefore no increased collision risk.	N/A 0
	Collision risk with vessels	Scoping report only, therefore no assessments currently available. However, estimate has been based on AfL area of 9.1km^2, 0.335/km^2 density estimate for harbour porpoise and increased collision risk of 5-10% of individuals in total area.	N/A 0.15-0.3

Project	Potential In-Combination Effect	Notes	Maximum number of harbour porpoise at increased collision risk
Holyhead Port Expansion	Collision risk with vessels	ES not available at time of writing, therefore, no information available to inform cumulative assessment.	N/A
Holyhead Waterfront Regeneration	Collision risk with vessels	No information available to inform cumulative assessment.	N/A
Wylfa Nuclear Power Plant	Collision risk with vessels	Very precautionary assessment based on the Wylfa Newydd Development Area, the Disposal Site plus 100m buffer and 1km wide vessel route between the two sites.	5.5
Wylfa Decommissioning	Collision risk with vessels	No key significant adverse impacts were identified by the ecological assessment, most of work would be done on land.	0
Amlwch LNG	Collision risk with vessels	No information available to inform cumulative assessment.	N/A
Rhyl Flats Offshore Windfarm	Collision risk with vessels	No information available to inform cumulative assessment.	N/A
Gwynt y Môr Offshore Wind Farm	Collision risk with vessels	Due to the existing high levels of vessel traffic in the area, and the natural avoidance behaviours of marine mammals, the impact of increased collision risk is low. Therefore, it is not considered that there would be any additional impacts to marine mammals over and above normal shipping activities and extremely unlikely that any vessel collision will occur.	0
Barrow Offshore Wind Farm Operation & Maintenance Activities	Collision risk with vessels	Collision risk could occur over short-term events, however the risk will be reduced immediately after a vessel has passed by the marine mammal receptor. Marine mammals will, to some extent, be sensitised to vessel movements due to the existing levels in the area. Therefore, it is not considered that there would be any additional impacts to marine mammals over and above normal shipping activities and extremely unlikely that any vessel collision will occur.	0
West of Duddon Sands Offshore Wind Farm Operation & Maintenance Activities	Collision risk with vessels	As above, therefore, it is not considered that there would be any additional impacts to marine mammals over and above normal shipping activities and extremely unlikely that any vessel collision will occur.	0
Ormonde Offshore Wind Farm	Collision risk with vessels	As above, therefore, it is not considered that there would be any additional impacts to marine mammals over and above normal shipping activities and extremely unlikely that any vessel collision will occur.	0
Walney Extension Offshore Wind Farm	Collision risk with vessels	As above, therefore, it is not considered that there would be any additional impacts to marine mammals over and above normal shipping activities and extremely unlikely that any vessel collision will occur.	0
Burbo Bank Extension Offshore Wind Farm	Collision risk with vessels	It is considered unlikely that vessel use during the operational phase of the wind farm for maintenance activities will significantly increase the number of vessels already utilising the Liverpool Bay area. Impacts associated with maintenance vessels are considered to be direct and intermittent. The impact of increased vessel traffic during operation of the offshore wind farm on marine mammals is considered	0

Project	Potential In-Combination Effect	Notes	Maximum number of harbour porpoise at increased collision risk
		to be probable, of short duration (i.e. only when vessel is present). Therefore, it is not considered that there would be any additional impacts to marine mammals over and above normal shipping activities and extremely unlikely that any vessel collision will occur.	
Codling Wind Park	Collision risk with vessels	No information available to inform assessment.	N/A
Codling Bank Extension	Collision risk with vessels	No information available to inform assessment.	N/A
Isle of Man Ferry Terminal	Collision risk with vessels	The vessels involved in the construction phase would be small and once on site are expected to remain relatively stationary. The risk of a collision with marine mammals is considered to be extremely small. As the only increase in vessels at the site is expected to be from occasional maintenance dredging, the potential for increased collision risk through the operation of the Ferry terminal is not expected to be any greater than current shipping activities and it is extremely unlikely that any vessel collision will occur.	0
Milford Haven, Maintenance Dredge Pembrokeshire	Collision risk with vessels	No information available to inform assessment.	N/A
Afon Dysynni outfall gravel removal and relocation	Collision risk with vessels	No information available to inform assessment.	N/A
Belfast Harbour D3 terminal cruise ship facility	Collision risk with vessels	The probability of a collision occurring is considered to be low as, while collision incidents have been recorded in the UK and Ireland, they are generally considered to be a rare occurrence. In addition, construction activities are only short term and temporary. The conclusion is that there would be a negligible impact on marine mammal species.	0
Marine Energy Wales marine testing area	Collision risk with tidal devices	Scoping. No information available to inform assessment.	N/A
	Collision risk with vessels		N/A
Enlli Tidal Energy Scheme, Bardsey Island	Collision risk with tidal devices	No information available to inform assessment.	N/A
	Collision risk with vessels	No information available to inform assessment.	N/A
Overall In-Combination Effect (maximum number of individuals at possible risk)			**Up to 30**
Percentage of MU			**0.03%**

Table 8-16 Assessment of potential in-combination effects for displacement of harbour porpoise as a result of changes in prey availability from habitat loss (N/A = not available)

Project	Notes	Maximum number of harbour porpoise potentially displaced	Maximum area of potential displacement in SAC
Morlais	The worst-case scenario for permanent habitat loss would be up to 2.18km^2 (see **Section 8.3.2.2.11**).	1.7	2.18km^2
Holyhead Deep Tidal Array – 80MW	Scoping report only, therefore no assessments currently available. However, the Holyhead Deep tidal development area is 9.1km^2, therefore this area has been used as a worst-case scenario with the density estimates for the MDZ.	7	9.1km^2
Holyhead Port Expansion	ES not available at time of writing, therefore, no information available to inform cumulative assessment.	N/A	N/A
Holyhead Waterfront Regeneration	No information available to inform cumulative assessment.	N/A	N/A
Wylfa Nuclear Power Plant	Based on a precautionary approach, the marine area of the Wylfa Newydd Development Area (approximately 0.35km^2) and Disposal Site including a 100m buffer (approximately 0.65km^2), could experience a potential change or loss of habitat (1km^2).	2.09	1km^2
Milford Haven, Maintenance Dredge Pembrokeshire	No information available to inform assessment.	N/A	N/A
Afon Dysynni outfall gravel removal and relocation	No information available to inform assessment.	N/A	N/A
Enlli Tidal Energy Scheme, Bardsey Island	No information available to inform assessment.	N/A	N/A
Overall In-Combination Effects (maximum number of individuals potentially displaced and maximum area in SAC)		**Up to 11**	**12.3km^2**
Percentage of MU and percentage of SAC		**0.01%**	**0.4%**

698. As a worst-case scenario, up to 282 harbour porpoise could potentially be disturbed as a result of in-combination effects (0.3% of the MU; **Table 8-14**). At any one time the maximum area of potential displacement of harbour porpoise as a result disturbance from the in-combination effects of underwater noise could be up to 11.86% of the Gogledd Môn Forol/North Anglesey Marine SAC area. Assuming a worst-case scenario, that this would be throughout the summer period (183 days), the maximum seasonal average could be up to 11.86% (**Table 8-14**). However, it is highly unlikely that all these activities and potential disturbance would occur on every day throughout the summer season, it could therefore more realistic to assume that a number of days could be lost due to poor weather, technical issues or other delays, therefore the seasonal average is more likely to be 10% or less.

699. Any displacement of harbour porpoise would not exceed 20% of the seasonal component of the SAC area in any given day or on average exceed 10% of the seasonal component of the SAC area over the duration of that season.

700. Therefore, there would be no adverse effect on the integrity of Gogledd Môn Forol/North Anglesey Marine SAC in relation to the Conservation Objectives for harbour porpoise (i.e. Conservation Objective 2: there is no significant disturbance of harbour porpoise).

701. As a worst-case scenario the maximum potential collision risk has been estimated as up to 30 harbour porpoise per year (0.03% of MU).

702. The collision risk assessments have been based on the worst-case scenarios, they do not take into account the proposed mitigation measures and assumes that all encounter or collisions would be fatal. Taking this into account, along with the JNCC *et al*. (2010) draft EPS guidance, it is therefore unlikely that the potential collision risk would result in any significant population effects.

703. The potential population level effects of collision risk with operational tidal turbines on marine mammals have been assessed in **Appendix 12.2** (**Volume III**) of the ES.

704. Therefore, there would be no adverse effect on the integrity of Gogledd Môn Forol/North Anglesey Marine SAC in relation to the Conservation Objectives for harbour porpoise (i.e. Conservation Objective 1: harbour porpoise is a viable component of the site).

705. As a worst-case scenario, up to 11 harbour porpoise could potentially be displaced as a result of in-combination effects for any changes in prey availability as a result of habitat loss (0.01% of the MU; **Table 8-16**). At any one time the maximum area of potential displacement of harbour porpoise could be up to 0.4% of the Gogledd Môn Forol/North Anglesey Marine SAC area. Assuming a worst-case scenario, that this would be throughout the summer period (183 days), the maximum seasonal average could be up to 0.4% (**Table 8-16**).

706. Any displacement of harbour porpoise would not exceed 20% of the seasonal component of the SAC area in any given day or on average exceed 10% of the seasonal component of the SAC area over the duration of that season.

707. Therefore, there would be no adverse effect on the integrity of Gogledd Môn Forol/North Anglesey Marine SAC in relation to the Conservation Objectives for harbour porpoise (i.e. Conservation Objective 3: the condition of supporting habitats and processes, and the availability of prey is maintained).

8.3.3. The Gorllewin Cymru Forol/West Wales Marine SAC

708. The Gorllewin Cymru Forol/West Wales Marine SAC site covers an area of 7,376 km^2, covering the majority of Cardigan Bay and the Pembrokeshire coastline to the south to the tip of the Lleyn Peninsula in the north, extending almost to the mid-line between the Republic of Ireland and Welsh waters. The boundary includes the entirety of the Bae Ceredigion/Cardigan Bay SAC and part of both the Pen Llŷn a'r Sarnau/Lleyn Peninsula and the Sarnau SAC and Sir Benfro Forol/Pembrokeshire Marine SACs. The water depths within the site range between the MLWT level and 100 m. Away from coastal areas, the depths largely fall within the range of between 40 m and 50 m. The site contains a mixture of hard substrate and sediments, including rock, coarse sediment, sand and mud (JNCC and NRW, 2016b; NRW and JNCC, 2017).

709. The Gorllewin Cymru Forol/West Wales Marine SAC has been recognised as an area within the top 10% predicted persistent high densities of harbour porpoise. The area included within the site covers important summer habitat for porpoises, while parts of the Cardigan Bay area are also identified as important in the winter periods (JNCC and NRW, 2016b; NRW and JNCC, 2017).

710. The Gorllewin Cymru Forol/West Wales Marine SAC is located within the Celtic and Irish Seas harbour porpoise MU. Additionally, three other sites (North Channel SAC, Gogledd Môn Forol/North Anglesey Marine SAC and Dynesfeydd Môr Hafren/Bristol Channel Approaches SAC, make up a series of sites proposed for Annex II harbour porpoise within this MU.

711. The qualifying feature of the site is the Habitats Directive Annex II species the harbour porpoise. The Gorllewin Cymru Forol/West Wales Marine SAC has been designated because of its importance to harbour porpoises in the summer months (April to September) and winter months (October to March) (NRW and JNCC, 2019).

712. The MDZ is located 32 km from the Gorllewin Cymru Forol/West Wales Marine SAC. Therefore, there is no direct effect within the SAC area. However, there is the potential to affect harbour porpoise from the Gorllewin Cymru Forol/West Wales Marine SAC if they are foraging or moving through the MDZ.

713. As outlined in **Section 8.3.2**, harbour porpoise in UK waters are considered part of a wider European population and the highly mobile nature of this species means that the concept of a 'site population' is not considered an appropriate basis for expressing Conservation Objectives for this species. Therefore, the reference population for assessments is the MU population in which the SAC is situated (NRW and JNCC, 2019).

714. The Gorllewin Cymru Forol/West Wales Marine SAC and MDZ are located in the Celtic and Irish Seas MU, which has an estimated harbour porpoise abundance of 104,695 (CV = 0.32; 95% CI = 56,774-193,065; IAMMWG, 2015), this was based on the SCANS-II survey (Hammond *et al*., 2013) and CODA surveys (Macleod *et al*., 2009).

715. The potential effects of the proposed project have been assessed for the Celtic and Irish Seas MU reference population for harbour porpoise (104,695 individuals). This follows the current advice which states that, the reference population for assessments against conservation objectives is the MU population in which the SAC is situated (NRW and JNCC, 2019). This approach was agreed with NRW at the at the marine mammal technical working group (TWG) meetings.

716. As the MDZ is not located in the Gorllewin Cymru Forol/West Wales Marine SAC, there is no potential disturbance effects in relation to the area of the SAC.

717. The Conservation Objectives for harbour porpoise at the Gorllewin Cymru Forol/West Wales Marine SAC (NRW and JNCC, 2019) are the same as those for the Gogledd Môn Forol/North Anglesey Marine SAC (**Section 8.3.2.1**):

To ensure that the integrity of the site is maintained and that it makes the best possible contribution to maintaining Favourable Conservation Status (FCS) for Harbour Porpoise in UK waters

In the context of natural change, this will be achieved by ensuring that:

1. Harbour porpoise is a viable component of the site;

2. There is no significant disturbance of the species; and

3. The condition of supporting habitats and processes, and the availability of prey is maintained.

718. The current conservation status of the harbour porpoise, as assessed in the 3rd UK report on implementation of the Habitats Directive (submitted to the European Commission in 2013), is ‘Favourable’ (JNCC, 2013).

8.3.3.1. Assessment of Potential Effects

719. The assessment of the potential effects of the project alone for the Gogledd Môn Forol/North Anglesey Marine SAC (**Section 8.3.2.2**) in relation to the Celtic and Irish Seas MU are the same for the potential effects on the Gorllewin Cymru Forol/West Wales Marine SAC, as they are both located in the same MU for harbour porpoise. The potential effects of the project alone on harbour porpoise in the Celtic and Irish Seas MU are summarised and assessed in relation to the Conservation Objectives for the Gorllewin Cymru Forol/West Wales Marine SAC in **Table 8-17**.

720. Therefore, there would be no adverse effect on the integrity of the Gorllewin Cymru Forol/West Wales Marine SAC in relation to the Conservation Objectives for harbour porpoise (i.e. the integrity of the site is maintained and that it makes the best possible contribution to maintaining FCS for harbour porpoise in UK waters).

Table 8-17 Summary of the potential effects of the project alone on harbour porpoise in the Celtic and Irish Seas MU and assessment in relation to the Conservation Objectives for the Gorllewin Cymru Forol/West Wales Marine SAC

Potential Effect	Maximum number of harbour porpoise	Percentage of MU	Assessment in relation to the Conservation Objectives for the SAC
Underwater noise and risk of auditory injury (PTS) – see Section 8.3.2.2.1	0.09 individuals	0.00009%	The MMMP(s) will reduce the risk of permanent auditory injury to harbour porpoise as a result of underwater noise at the MDZ, therefore, there would be no adverse effect on the integrity of the SAC in relation to the conservation objectives for harbour porpoise (i.e. Conservation Objective 1: harbour porpoise is a viable component of the site).
Underwater noise and disturbance – see Section 8.3.2.2.2	15 individuals	0.014% of the MU	There would be no significant disturbance of harbour porpoise, therefore, there would be no adverse effect on the integrity of the SAC in relation to the conservation objectives for harbour porpoise (i.e. Conservation Objective 2: there is no significant disturbance of harbour porpoise).
Disturbance from ADDs – see Section 8.3.2.2.3	80 individuals	0.08% of the MU	There would be no significant disturbance of harbour porpoise, therefore, there would be no adverse effect on the integrity of the SAC in relation to the conservation objectives for harbour porpoise (i.e. Conservation Objective 2: there is no significant disturbance of harbour porpoise).
Collision risk with tidal devices and vessels – see Section 8.3.2.2.6	25 individuals	0.024% of MU	Taking into account the proposed phased deployment, monitoring and mitigation, along with the JNCC *et al*. (2010) draft EPS guidance, it is therefore unlikely that the potential collision risk would result in any significant population effects. Therefore, there would be no adverse effect on the integrity of SAC in relation to the conservation objectives for harbour porpoise (i.e. Conservation Objective 1: harbour porpoise is a viable component of the site).
Entanglement with Mooring Lines - see Section 8.3.2.2.7	0	0	To date, there have been no recorded instances of marine mammal entanglement from mooring systems of renewable devices. The tidal devices and moorings would be regular checked, this would ensure that there was no material such as discarded nets, ropes or other debris which could increase the risk of entanglement. The mitigation and monitoring measures to reduce the risk of collision with operational turbines would also reduce the risk of entablement with mooring lines. Therefore, there would be no adverse effect on the integrity of the SAC in relation to the conservation objectives for harbour porpoise (i.e. Conservation Objective 1: harbour porpoise is a viable component of the site).
Barrier effects - see Section 8.3.2.2.8	10 individuals	0.01% of the MU	There would be no adverse effect on the integrity of the SAC in relation to the conservation objectives for harbour porpoise (i.e. Conservation Objective 2: there is no significant disturbance of harbour porpoise).
EMF effects - see Section 8.3.2.2.9	0.03 individuals	0.00003% of the MU	There would be no adverse effect on the integrity of the SAC in relation to the conservation objectives for harbour porpoise (i.e. Conservation Objective 2: there is no significant disturbance of harbour porpoise).
Changes in water quality – see Section 8.3.2.2.10	0	0	Any potential in changes in marine water quality as a result of sediment re-suspension caused by seabed disturbance; mobilisation of contaminants adsorbed onto potentially re-suspended seabed sediments; and accidental discharge and spillage of oils, fuels and materials are likely to be localised, dispersed quickly,

Potential Effect	Maximum number of harbour porpoise	Percentage of MU	Assessment in relation to the Conservation Objectives for the SAC
			temporary and would have a negligible effect. Therefore, there would be no adverse effect on the integrity of the SAC in relation to the conservation objectives for harbour porpoise (i.e. Conservation Objective 3: the condition of supporting habitats and processes, and the availability of prey is maintained).
Changes in prey availability as a result of habitat loss – see Section 8.3.2.2.11	1.7 individuals	0.0016% of the MU	There would be no adverse effect on the integrity of the SAC in relation to the conservation objectives for harbour porpoise (i.e. Conservation Objective 3: the condition of supporting habitats and processes, and the availability of prey is maintained).

721. The assessment of the potential in-combination effects for the Gogledd Môn Forol/North Anglesey Marine SAC (**Section 8.3.2.2.12**) in relation to the Celtic and Irish Seas MU are the same for the potential effects on the Gorllewin Cymru Forol/West Wales Marine SAC, as they are both located in the same MU for harbour porpoise. The potential in-combination effects on harbour porpoise in the Celtic and Irish Seas MU are summarised and assessed in relation to the Conservation Objectives for the Gorllewin Cymru Forol/West Wales Marine SAC in **Table 8-18**.

722. Therefore, there would be no adverse effect on the integrity of the Gorllewin Cymru Forol/West Wales Marine SAC in relation to the Conservation Objectives for harbour porpoise (i.e. the integrity of the site is maintained and that it makes the best possible contribution to maintaining FCS for harbour porpoise in UK waters).

Table 8-18 Summary of the potential in-combination effects on harbour porpoise in the Celtic and Irish Seas MU and assessment in relation to the Conservation Objectives for the Gorllewin Cymru Forol/West Wales Marine SAC

Potential Effect	Maximum number of harbour porpoise	Percentage of MU	Assessment in relation to the Conservation Objectives for the SAC
Underwater noise and disturbance	141 individuals	0.14%	There would be no adverse effect on the integrity of the SAC in relation to the conservation objectives for harbour porpoise (i.e. Conservation Objective 2: there is no significant disturbance of harbour porpoise).
Collision risk with tidal devices and vessels	30 individuals	0.03%	Taking into account the proposed phased deployment, monitoring and mitigation, along with the JNCC *et al*. (2010) draft EPS guidance, it is therefore unlikely that the potential collision risk would result in any significant population effects. Therefore, there would be no adverse effect on the integrity of SAC in relation to the conservation objectives for harbour porpoise (i.e. Conservation Objective 1: harbour porpoise is a viable component of the site).
Changes in prey availability due to habitat loss	11 individuals	0.01%	There would be no adverse effect on the integrity of the SAC in relation to the conservation objectives for harbour porpoise (i.e. Conservation Objective 3: the condition of supporting habitats and processes, and the availability of prey is maintained).

8.3.4. Dynesfeydd Môr Hafren/ Bristol Channel Approaches SAC

723. The Dynesfeydd Môr Hafren/ Bristol Channel Approaches SAC site covers an area of 5,850km^2, covering the northern Cornwall and north Devon coastlines up to Carmarthen Bay along the south Wales coast and the marine area between, including Lundy Island, with 58% English inshore waters, 18% Welsh inshore and 24% offshore waters. The water depths within the site range between the MLWT level and 70m, with the majority of the site being 50m in depth, with steep slopes up to the shoreline towards the Cornish coast, and much shallower slopes up to Carmarthen Bay. The majority of the seabed is formed of sublittoral coarse sediments (Natural England *et al*., 2016). The Lundy SAC lies fully within the site, with parts of Sir Benfro Forol/Pembrokeshire Marine SAC also covered.

724. The Dynesfeydd Môr Hafren/Bristol Channel Approaches SAC has been recognised as an area within the top 10% predicted persistent high densities of harbour porpoise during the winter season (Natural England *et al*., 2016; JNCC, 2017).

725. The qualifying feature of the site is the Habitats Directive Annex II species the harbour porpoise. The Dynesfeydd Môr Hafren/Bristol Channel Approaches SAC has been designated because of its importance to harbour porpoises in the winter months (October to March) (JNCC *et al*., 2019b).

726. The MDZ is located 222km from the Dynesfeydd Môr Hafren/Bristol Channel Approaches SAC. Therefore, there is no direct effect within the SAC area. However, there is the potential to affect harbour porpoise from the Dynesfeydd Môr Hafren/Bristol Channel Approaches SAC if they are foraging or moving through the MDZ.

727. As outlined in **Section 8.3.2**, harbour porpoise in UK waters are considered part of a wider European population and the highly mobile nature of this species means that the concept of a ‘site population’ is not considered an appropriate basis for expressing Conservation Objectives for this species. Therefore, the reference population for assessments is the MU population in which the SAC is situated (JNCC *et al*., 2019b).

728. The Dynesfeydd Môr Hafren/Bristol Channel Approaches SAC and MDZ are located in the Celtic and Irish Seas MU, which has an estimated harbour porpoise abundance of 104,695 (CV = 0.32; 95% CI = 56,774-193,065; IAMMWG, 2015), this was based on the SCANS-II survey (Hammond *et al*., 2013) and CODA surveys (Macleod *et al*., 2009).

729. The potential effects of the proposed project have been assessed for the Celtic and Irish Seas MU reference population for harbour porpoise (104,695 individuals). This follows the current advice which states that, the reference population for assessments against Conservation Objectives is the MU population in which the SAC is situated (JNCC *et al*., 2019b). This approach was agreed with NRW at the at the marine mammal technical working group (TWG) meetings.

730. As the MDZ is not located in the Dynesfeydd Môr Hafren/Bristol Channel Approaches SAC, there is no potential disturbance effects in relation to the area of the SAC.

731. The Conservation Objectives for harbour porpoise at the Dynesfeydd Môr Hafren/Bristol Channel Approaches SAC (JNCC *et al*, 2019) are the same as those for the Gogledd Môn Forol/North Anglesey Marine SAC (**Section 8.3.2.1**):

To ensure that the integrity of the site is maintained and that it makes the best possible contribution to maintaining Favourable Conservation Status (FCS) for Harbour Porpoise in UK waters

In the context of natural change, this will be achieved by ensuring that:

1. Harbour porpoise is a viable component of the site;

2. There is no significant disturbance of the species; and

3. The condition of supporting habitats and processes, and the availability of prey is maintained.

732. The current conservation status of the harbour porpoise, as assessed in the 3rd UK report on implementation of the Habitats Directive (submitted to the European Commission in 2013), is 'Favourable' (JNCC, 2013).

8.3.4.1. Assessment of Potential Effects

733. The assessment of the potential effects of the project alone for the Gogledd Môn Forol/North Anglesey Marine SAC (**Section 8.3.2.2**) in relation to the Celtic and Irish Seas MU are the same for the potential effects on the Dynesfeydd Môr Hafren/Bristol Channel Approaches SAC, as they are both located in the same MU for harbour porpoise. The potential effects of the project alone on harbour porpoise in the Celtic and Irish Seas MU are summarised and assessed in relation to the Conservation Objectives for the Dynesfeydd Môr Hafren/Bristol Channel Approaches SAC in **Table 8-19**.

734. Therefore, there would be no adverse effect on the integrity of the Dynesfeydd Môr Hafren/Bristol Channel Approaches SAC in relation to the Conservation Objectives for harbour porpoise (i.e. the integrity of the site is maintained and that it makes the best possible contribution to maintaining FCS for harbour porpoise in UK waters).

Table 8-19 Summary of the potential effects of the project alone on harbour porpoise in the Celtic and Irish Seas MU and assessment in relation to the Conservation Objectives for the Dynesfeydd Môr Hafren/Bristol Channel Approaches SAC

Potential Effect	Maximum number of harbour porpoise	Percentage of MU	Assessment in relation to the Conservation Objectives for the SAC
Underwater noise and risk of auditory injury (PTS) – see Section 8.3.2.2.1	0.09 individuals	0.00009%	The MMMP(s) will reduce the risk of permanent auditory injury to harbour porpoise as a result of underwater noise at the MDZ, therefore, there would be no adverse effect on the integrity of the SAC in relation to the conservation objectives for harbour porpoise (i.e. Conservation Objective 1: harbour porpoise is a viable component of the site).

Potential Effect	Maximum number of harbour porpoise	Percentage of MU	Assessment in relation to the Conservation Objectives for the SAC
Underwater noise and disturbance – see Section 8.3.2.2.2	15 individuals	0.014% of the MU	There would be no significant disturbance of harbour porpoise, therefore, there would be no adverse effect on the integrity of the SAC in relation to the conservation objectives for harbour porpoise (i.e. Conservation Objective 2: there is no significant disturbance of harbour porpoise).
Disturbance from ADDs – see Section 8.3.2.2.3	80 individuals	0.08% of the MU	There would be no significant disturbance of harbour porpoise, therefore, there would be no adverse effect on the integrity of the SAC in relation to the conservation objectives for harbour porpoise (i.e. Conservation Objective 2: there is no significant disturbance of harbour porpoise).
Collision risk with tidal devices and vessels – see Section 8.3.2.2.6	25 individuals	0.024% of MU	Taking into account the proposed phased deployment, monitoring and mitigation, along with the JNCC *et al*. (2010) draft EPS guidance, it is therefore unlikely that the potential collision risk would result in any significant population effects. Therefore, there would be no adverse effect on the integrity of SAC in relation to the conservation objectives for harbour porpoise (i.e. Conservation Objective 1: harbour porpoise is a viable component of the site).
Entanglement with Mooring Lines - see Section 8.3.2.2.7	0	0	To date, there have been no recorded instances of marine mammal entanglement from mooring systems of renewable devices. The tidal devices and moorings would be regular checked, this would ensure that there was no material such as discarded nets, ropes or other debris which could increase the risk of entanglement. The mitigation and monitoring measures to reduce the risk of collision with operational turbines would also reduce the risk of entablement with mooring lines. Therefore, there would be no adverse effect on the integrity of the SAC in relation to the conservation objectives for harbour porpoise (i.e. Conservation Objective 1: harbour porpoise is a viable component of the site).
Barrier effects - see Section 8.3.2.2.8	10 individuals	0.01% of the MU	There would be no adverse effect on the integrity of the SAC in relation to the conservation objectives for harbour porpoise (i.e. Conservation Objective 2: there is no significant disturbance of harbour porpoise).
EMF effects - see Section 8.3.2.2.9	0.03 individuals	0.00003% of the MU	There would be no adverse effect on the integrity of the SAC in relation to the conservation objectives for harbour porpoise (i.e. Conservation Objective 2: there is no significant disturbance of harbour porpoise).
Changes in water quality – see Section 8.3.2.2.10	0	0	Any potential in changes in marine water quality as a result of sediment re-suspension caused by seabed disturbance; mobilisation of contaminants adsorbed onto potentially re-suspended seabed sediments; and accidental discharge and spillage of oils, fuels and materials are likely to be localised, dispersed quickly, temporary and would have a negligible effect. Therefore, there would be no adverse effect on the integrity of the SAC in relation to the conservation objectives for harbour porpoise (i.e. Conservation Objective 3: the condition of supporting habitats and processes, and the availability of prey is maintained).
Changes in prey availability as a result of habitat loss – see Section 8.3.2.2.11	1.7 individuals	0.0016% of the MU	There would be no adverse effect on the integrity of the SAC in relation to the conservation objectives for harbour porpoise (i.e. Conservation Objective 3: the

Potential Effect	Maximum number of harbour porpoise	Percentage of MU	Assessment in relation to the Conservation Objectives for the SAC
			condition of supporting habitats and processes, and the availability of prey is maintained).

735. The assessment of the potential in-combination effects for the Gogledd Môn Forol/North Anglesey Marine SAC (**Section 8.3.2.2.12**) in relation to the Celtic and Irish Seas MU are the same for the potential effects on the Dynesfeydd Môr Hafren/Bristol Channel Approaches SAC, as they are both located in the same MU for harbour porpoise. The potential in-combination effects on harbour porpoise in the Celtic and Irish Seas MU are summarised and assessed in relation to the Conservation Objectives for the Dynesfeydd Môr Hafren/Bristol Channel Approaches SAC in **Table 8-20**.

736. Therefore, there would be no adverse effect on the integrity of the Dynesfeydd Môr Hafren/Bristol Channel Approaches SAC in relation to the Conservation Objectives for harbour porpoise (i.e. the integrity of the site is maintained and that it makes the best possible contribution to maintaining FCS for harbour porpoise in UK waters).

Table 8-20 Summary of the potential in-combination effects on harbour porpoise in the Celtic and Irish Seas MU and assessment in relation to the Conservation Objectives for the Dynesfeydd Môr Hafren/Bristol Channel Approaches SAC

Potential Effect	Maximum number of harbour porpoise	Percentage of MU	Assessment in relation to the Conservation Objectives for the SAC
Underwater noise and disturbance	141 individuals	0.14%	There would be no adverse effect on the integrity of the SAC in relation to the conservation objectives for harbour porpoise (i.e. Conservation Objective 2: there is no significant disturbance of harbour porpoise).
Collision risk with tidal devices and vessels	30 individuals	0.03%	Taking into account the proposed phased deployment, monitoring and mitigation, along with the JNCC *et al*. (2010) draft EPS guidance, it is therefore unlikely that the potential collision risk would result in any significant population effects. Therefore, there would be no adverse effect on the integrity of SAC in relation to the conservation objectives for harbour porpoise (i.e. Conservation Objective 1: harbour porpoise is a viable component of the site).
Changes in prey availability due to habitat loss	11 individuals	0.01%	There would be no adverse effect on the integrity of the SAC in relation to the conservation objectives for harbour porpoise (i.e. Conservation Objective 3: the condition of supporting habitats and processes, and the availability of prey is maintained).

8.3.5. North Channel SAC

737. The North Channel SAC site covers an area of 1,604km^2, extending from the north-east coast of Northern Ireland from Island Magee to Cloughey towards the Isle of Man. The water depths within the site range between the MLWT level to 150m in the north and eastern parts of the site. Shallower areas occur near the coast with depths mostly between 10 and 40m. Beyond these shallower areas close to the coast, the water depth ranges between 50 and 130m. The site contains a mixture of coarse sediments and sand near the Irish coastlines, and increasing amounts of moderate and high energy circalittoral rock in more offshore waters, with an area of

mud in the south-west of the site (Department of Agriculture, Environment and Rural Affairs (DAERA) and JNCC, 2017).

738. The North Channel SAC has been recognised as an area within the top 10% predicted persistent high densities of harbour porpoise during the winter season (DAERA and JNCC, 2017).

739. The qualifying feature of the site is the Habitats Directive Annex II species the harbour porpoise. The North Channel SAC has been designated because of its importance to harbour porpoises in the winter months (October to March) (DAERA and JNCC, 2019).

740. The MDZ is located 98km from the North Channel SAC. Therefore, there is no direct effect within the SAC area. However, there is the potential to affect harbour porpoise from the North Channel SAC if they are foraging or moving through the MDZ.

741. As outlined in **Section 8.3.2**, harbour porpoise in UK waters are considered part of a wider European population and the highly mobile nature of this species means that the concept of a 'site population' is not considered an appropriate basis for expressing Conservation Objectives for this species. Therefore, the reference population for assessments is the MU population in which the SAC is situated (DAERA and JNCC, 2019).

742. The North Channel SAC and MDZ are located in the Celtic and Irish Seas MU, which has an estimated harbour porpoise abundance of 104,695 (CV = 0.32; 95% CI = 56,774-193,065; IAMMWG, 2015), this was based on the SCANS-II survey (Hammond *et al*., 2013) and CODA surveys (Macleod *et al*., 2009).

743. The potential effects of the proposed project have been assessed for the Celtic and Irish Seas MU reference population for harbour porpoise (104,695 individuals). This follows the current advice which states that, the reference population for assessments against Conservation Objectives is the MU population in which the SAC is situated (DAERA and JNCC, 2019). This approach was agreed with NRW at the at the marine mammal technical working group (TWG) meetings.

744. As the MDZ is not located in the North Channel SAC, there is no potential disturbance effects in relation to the area of the SAC.

745. The Conservation Objectives for harbour porpoise at the North Channel SAC (DAERA and JNCC, 2019) are the same as those for the Gogledd Môn Forol/North Anglesey Marine SAC (**Section 8.3.2.1**):

To ensure that the integrity of the site is maintained and that it makes the best possible contribution to maintaining Favourable Conservation Status (FCS) for Harbour Porpoise in UK waters

In the context of natural change, this will be achieved by ensuring that:

1. Harbour porpoise is a viable component of the site;

2. There is no significant disturbance of the species; and

3. The condition of supporting habitats and processes, and the availability of prey is maintained.

746. The current conservation status of the harbour porpoise, as assessed in the 3rd UK report on implementation of the Habitats Directive (submitted to the European Commission in 2013), is 'Favourable' (JNCC, 2013).

8.3.5.1. Assessment of Potential Effects

747. The assessment of the potential effects of the project alone for the Gogledd Môn Forol/North Anglesey Marine SAC (**Section 8.3.2.2**) in relation to the Celtic and Irish Seas MU are the same for the potential effects on the North Channel SAC, as they are both located in the same MU for harbour porpoise. The potential effects of the project alone on harbour porpoise in the Celtic and Irish Seas MU are summarised and assessed in relation to the Conservation Objectives for the North Channel SAC in **Table 8-21**.

748. Therefore, there would be no adverse effect on the integrity of the North Channel SAC in relation to the Conservation Objectives for harbour porpoise (i.e. the integrity of the site is maintained and that it makes the best possible contribution to maintaining FCS for harbour porpoise in UK waters).

Table 8-21 Summary of the potential effects of the project alone on harbour porpoise in the Celtic and Irish Seas MU and assessment in relation to the Conservation Objectives for the North Channel SAC

Potential Effect	Maximum number of harbour porpoise	Percentage of MU	Assessment in relation to the Conservation Objectives for the SAC
Underwater noise and risk of auditory injury (PTS) – see Section 8.3.2.2.1	0.09 individuals	0.00009%	The MMMP(s) will reduce the risk of permanent auditory injury to harbour porpoise as a result of underwater noise at the MDZ, therefore, there would be no adverse effect on the integrity of the SAC in relation to the conservation objectives for harbour porpoise (i.e. Conservation Objective 1: harbour porpoise is a viable component of the site).
Underwater noise and disturbance – see Section 8.3.2.2.2	15 individuals	0.014% of the MU	There would be no significant disturbance of harbour porpoise, therefore, there would be no adverse effect on the integrity of the SAC in relation to the conservation objectives for harbour porpoise (i.e. Conservation Objective 2: there is no significant disturbance of harbour porpoise).
Disturbance from ADDs – see Section 8.3.2.2.3	80 individuals	0.08% of the MU	There would be no significant disturbance of harbour porpoise, therefore, there would be no adverse effect on the integrity of the SAC in relation to the conservation objectives for harbour porpoise (i.e. Conservation Objective 2: there is no significant disturbance of harbour porpoise).
Collision risk with tidal devices and vessels – see Section 8.3.2.2.6	25 individuals	0.024% of MU	Taking into account the proposed phased deployment, monitoring and mitigation, along with the JNCC *et al*. (2010) draft EPS guidance, it is therefore unlikely that the potential collision would result in any significant population effects. Therefore, there would be no adverse effect on the integrity of SAC in relation to the conservation objectives for harbour porpoise (i.e. Conservation Objective 1: harbour porpoise is a viable component of the site).

Potential Effect	Maximum number of harbour porpoise	Percentage of MU	Assessment in relation to the Conservation Objectives for the SAC
Entanglement with Mooring Lines - see Section 8.3.2.2.7	0	0	To date, there have been no recorded instances of marine mammal entanglement from mooring systems of renewable devices. The tidal devices and moorings would be regular checked, this would ensure that there was no material such as discarded nets, ropes or other debris which could increase the risk of entanglement. The mitigation and monitoring measures to reduce the risk of collision with operational turbines would also reduce the risk of entablement with mooring lines. Therefore, there would be no adverse effect on the integrity of the SAC in relation to the conservation objectives for harbour porpoise (i.e. Conservation Objective 1: harbour porpoise is a viable component of the site).
Barrier effects - see Section 8.3.2.2.8	10 individuals	0.01% of the MU	There would be no adverse effect on the integrity of the SAC in relation to the conservation objectives for harbour porpoise (i.e. Conservation Objective 2: there is no significant disturbance of harbour porpoise).
EMF effects - see Section 8.3.2.2.9	0.03 individuals	0.00003% of the MU	There would be no adverse effect on the integrity of the SAC in relation to the conservation objectives for harbour porpoise (i.e. Conservation Objective 2: there is no significant disturbance of harbour porpoise).
Changes in water quality – see Section 8.3.2.2.10	0	0	Any potential in changes in marine water quality as a result of sediment re-suspension caused by seabed disturbance; mobilisation of contaminants adsorbed onto potentially re-suspended seabed sediments; and accidental discharge and spillage of oils, fuels and materials are likely to be localised, dispersed quickly, temporary and would have a negligible effect. Therefore, there would be no adverse effect on the integrity of the SAC in relation to the conservation objectives for harbour porpoise (i.e. Conservation Objective 3: the condition of supporting habitats and processes, and the availability of prey is maintained).
Changes in prey availability as a result of habitat loss – see Section 8.3.2.2.11	1.7 individuals	0.0016% of the MU	There would be no adverse effect on the integrity of the SAC in relation to the conservation objectives for harbour porpoise (i.e. Conservation Objective 3: the condition of supporting habitats and processes, and the availability of prey is maintained).

749. The assessment of the potential in-combination effects for the Gogledd Môn Forol/North Anglesey Marine SAC (**Section 8.3.2.2.12**) in relation to the Celtic and Irish Seas MU are the same for the potential effects on the North Channel SAC, as they are both located in the same MU for harbour porpoise. The potential in-combination effects on harbour porpoise in the Celtic and Irish Seas MU are summarised and assessed in relation to the Conservation Objectives for the North Channel SAC in **Table 8-22**.

750. Therefore, there would be no adverse effect on the integrity of the North Channel SAC in relation to the Conservation Objectives for harbour porpoise (i.e. the integrity of the site is maintained and that it makes the best possible contribution to maintaining FCS for harbour porpoise in UK waters).

Table 8-22 Summary of the potential in-combination effects on harbour porpoise in the Celtic and Irish Seas MU and assessment in relation to the Conservation Objectives for the North Channel SAC

Potential Effect	Maximum number of harbour porpoise	Percentage of MU	Assessment in relation to the Conservation Objectives for the SAC
Underwater noise and disturbance	141 individuals	0.14%	There would be no adverse effect on the integrity of the SAC in relation to the conservation objectives for harbour porpoise (i.e. Conservation Objective 2: there is no significant disturbance of harbour porpoise).
Collision risk with tidal devices and vessels	30 individuals	0.03%	Taking into account the proposed phased deployment, monitoring and mitigation, along with the JNCC *et al*. (2010) draft EPS guidance, it is therefore unlikely that the potential collision risk would result in any significant population effects. Therefore, there would be no adverse effect on the integrity of SAC in relation to the conservation objectives for harbour porpoise (i.e. Conservation Objective 1: harbour porpoise is a viable component of the site).
Changes in prey availability due to habitat loss	11 individuals	0.01%	There would be no adverse effect on the integrity of the SAC in relation to the conservation objectives for harbour porpoise (i.e. Conservation Objective 3: the condition of supporting habitats and processes, and the availability of prey is maintained).

8.3.6. Rockabill to Dalkey Island SAC

751. The Rockabill to Dalkey Island SAC is located on the eastern coastline of the Republic of Ireland covering an area of 273.26km^2. The site extends in a strip southwards from Rockabill to Frazer Bank, encompassing the islands of Dalkey, Muglins and Rockabill. Primary features of the site are listed as the Annex I habitat of reefs and the Annex II species harbour porpoise (National Parks and Wildlife Service (NPWS), 2013a).

752. The size, community structure and distribution or habitat use of harbour porpoise inhabiting Rockabill to Dalkey Island SAC are not fully understood (NPWS, 2013a). Survey effort in the 2008 summer-autumn season delivered initial estimates of between 0.54 and 6.93 animals per km^2 within the northern half of the site (overall estimate across four surveys: 2.03 individuals per km^2, N= 211 ± 47 individuals, 95% CI = 137 – 327; CV = 0.23) and between 0.48 and 2.05 animals per km^2 within the southern half of the site, including outer Dublin Bay (overall estimate across four surveys: 1.19 individuals per km^2, N= 138 ± 33 individuals, 95% CI = 86 – 221; CV = 0.24; (NPWS, 2013a). The species is present at the site in all seasons and newborn calves have also been recorded within the site, including during the calving/breeding season (NPWS, 2013a).

753. No detailed information is currently available on individual or group movements by harbour porpoise within or into and out of the site, nor is it known whether individuals or groups of the species demonstrate any faithfulness to the site (i.e. site fidelity or residency). Nevertheless, the consistent annual and seasonal occurrence of the species at the site, its occurrence during the calving/breeding period and density/population estimates available to date all indicate the importance of this coastal site for the species (NPWS, 2013a).

754. The MDZ is located 81km from the Rockabill to Dalkey Island SAC. Therefore, there is no direct effect within the SAC area. However, there is the potential to affect harbour porpoise from the Rockabill to Dalkey Island SAC if they are foraging or moving through the MDZ.

755. As outlined in **Section 8.3.2**, harbour porpoise in UK waters are considered part of a wider European population and the highly mobile nature of this species means that the concept of a 'site population' is not considered an appropriate basis for expressing Conservation Objectives for this species.

756. The Rockabill to Dalkey Island SAC and MDZ are located in the Celtic and Irish Seas MU, which has an estimated harbour porpoise abundance of 104,695 (CV = 0.32; 95% CI = 56,774-193,065; IAMMWG, 2015), this was based on the SCANS-II survey (Hammond *et al*., 2013) and CODA surveys (Macleod *et al*., 2009). The potential effects of the proposed project have been assessed for the Celtic and Irish Seas MU reference population for harbour porpoise (104,695 individuals).

757. The Conservation Objectives for harbour porpoise at the Rockabill to Dalkey Island SAC (NPWS, 2013a) are:

To maintain the favourable conservation condition of harbour porpoise in Rockabill to Dalkey Island SAC, which is defined by the following list of attributes and targets:

1. Access to suitable habitat: species range within the site should not be restricted by artificial barriers to site use.

2. Disturbance: human activities should occur at levels that do not adversely affect the harbour porpoise community at the site.

758. As the MDZ is not located in the Rockabill to Dalkey Island SAC, there is no potential barrier or disturbance effects within the SAC.

8.3.6.1. Assessment of Potential Effects

759. The assessment of the potential effects of the project alone for the Gogledd Môn Forol/North Anglesey Marine SAC (**Section 8.3.2.2**) in relation to the Celtic and Irish Seas MU are the same for the potential effects on the Rockabill to Dalkey Island SAC, as they are both located in the same MU for harbour porpoise. The potential effects of the project alone on harbour porpoise in the Celtic and Irish Seas MU are summarised and assessed in relation to the Conservation Objectives for the Rockabill to Dalkey Island SAC in **Table 8-23**.

760. Therefore, there would be no adverse effect on the integrity of the Rockabill to Dalkey Island SAC in relation to the Conservation Objectives for harbour porpoise (i.e. to maintain the favourable conservation condition of harbour porpoise).

Table 8-23 Summary of the potential effects of the project alone on harbour porpoise in the Celtic and Irish Seas MU and assessment in relation to the Conservation Objectives for the Rockabill to Dalkey Island SAC

Potential Effect	Maximum number of harbour porpoise	Percentage of MU	Assessment in relation to the Conservation Objectives for the SAC
Underwater noise and risk of auditory injury (PTS) – see Section 8.3.2.2.1	0.09 individuals	0.00009%	The MMMP(s) will reduce the risk of permanent auditory injury to harbour porpoise as a result of underwater noise at the MDZ, therefore, there would be no adverse effect on the integrity of the SAC in relation to the conservation objectives for harbour porpoise.
Underwater noise and disturbance – see Section 8.3.2.2.2	15 individuals	0.014% of the MU	There would be no significant disturbance of harbour porpoise, therefore, there would be no adverse effect on the integrity of the SAC in relation to the conservation objectives for harbour porpoise.
Disturbance from ADDs – see Section 8.3.2.2.3	80 individuals	0.08% of the MU	There would be no significant disturbance of harbour porpoise, therefore, there would be no adverse effect on the integrity of the SAC in relation to the conservation objectives for harbour porpoise.
Collision risk with tidal devices and vessels – see Section 8.3.2.2.6	25 individuals	0.024% of MU	Taking into account the proposed phased deployment, monitoring and mitigation, along with the JNCC *et al*. (2010) draft EPS guidance, it is therefore unlikely that the potential collision risk would result in any significant population effects. Therefore, there would be no adverse effect on the integrity of SAC in relation to the conservation objectives for harbour porpoise.
Entanglement with Mooring Lines - see Section 8.3.2.2.7	0	0	To date, there have been no recorded instances of marine mammal entanglement from mooring systems of renewable devices. The tidal devices and moorings would be regular checked, this would ensure that there was no material such as discarded nets, ropes or other debris which could increase the risk of entanglement. The mitigation and monitoring measures to reduce the risk of collision with operational turbines would also reduce the risk of entablement with mooring lines. Therefore, there would be no adverse effect on the integrity of the SAC in relation to the conservation objectives for harbour porpoise.
Barrier effects - see Section 8.3.2.2.8	10 individuals	0.01% of the MU	There would be no adverse effect on the integrity of the SAC in relation to the conservation objectives for harbour porpoise.
EMF effects - see Section 8.3.2.2.9	0.03 individuals	0.00003% of the MU	There would be no adverse effect on the integrity of the SAC in relation to the conservation objectives for harbour porpoise.
Changes in water quality – see Section 8.3.2.2.10	0	0	Any potential in changes in marine water quality as a result of sediment re-suspension caused by seabed disturbance; mobilisation of contaminants adsorbed onto potentially re-suspended seabed sediments; and accidental discharge and spillage of oils, fuels and materials are likely to be localised, dispersed quickly, temporary and would have a negligible effect. Therefore, there would be no adverse effect on the integrity of the SAC in relation to the conservation objectives for harbour porpoise.
Changes in prey availability as a result of habitat loss – see Section 8.3.2.2.11	1.7 individuals	0.0016% of the MU	There would be no adverse effect on the integrity of the SAC in relation to the conservation objectives for harbour porpoise.

761. The assessment of the potential in-combination effects for the Gogledd Môn Forol/North Anglesey Marine SAC (**Section 8.3.2.2.12**) in relation to the Celtic and Irish Seas MU are the

same for the potential effects on the Rockabill to Dalkey Island SAC, as they are both located in the same MU for harbour porpoise. The potential in-combination effects on harbour porpoise in the Celtic and Irish Seas MU are summarised and assessed in relation to the Conservation Objectives for the Rockabill to Dalkey Island SAC in **Table 8-24**.

762. Therefore, there would be no adverse effect on the integrity of the Rockabill to Dalkey Island SAC in relation to the Conservation Objectives for harbour porpoise (i.e. to maintain the favourable conservation condition of harbour porpoise).

Table 8-24 Summary of the potential in-combination effects on harbour porpoise in the Celtic and Irish Seas MU and assessment in relation to the Conservation Objectives for the Rockabill to Dalkey Island SAC

Potential Effect	Maximum number of harbour porpoise	Percentage of MU	Assessment in relation to the Conservation Objectives for the SAC
Underwater noise and disturbance	141 individuals	0.14%	There would be no adverse effect on the integrity of the SAC in relation to the conservation objectives for harbour porpoise.
Collision risk with tidal devices and vessels	30 individuals	0.03%	Taking into account the proposed phased deployment, monitoring and mitigation, along with the JNCC *et al*. (2010) draft EPS guidance, it is therefore unlikely that the potential collision risk would result in any significant population effects. Therefore, there would be no adverse effect on the integrity of SAC in relation to the conservation objectives for harbour porpoise.
Changes in prey availability due to habitat loss	11 individuals	0.01%	There would be no adverse effect on the integrity of the SAC in relation to the conservation objectives for harbour porpoise.

8.3.7. Other European Designated Sites for Harbour Porpoise

763. Other European Designated Sites (SACs) in the Celtic and Irish Seas MU where harbour porpoise is a qualifying feature are all located more than 400km from the MDZ and therefore were screened out for any potential connectivity and realistic pathway for a potential effect (**Section 6.3.2**). These sites are:

- Blasket Islands SAC (518km)
- Roaringwater Bay and Islands SAC (409km)
- Chaussee de Sein SAC (559km)
- Ouessant-Molène SAC (540km)
- Abers - Côtes des Légendes SAC (544km)
- Cap d'Erquy-Cap Frehel SAC (640km)
- Baie de Morlaix SAC (553km)
- Côte de Granit Rose-Sept-Iles SAC (551km)
- Tregor Goëlo SAC (578km)

764. The assessment of the potential effects of the project alone for the Gogledd Môn Forol/North Anglesey Marine SAC (**Section 8.3.2.2**) in relation to the Celtic and Irish Seas MU are the same

for the potential effects on these sites, as they are all located in the same MU for harbour porpoise.

765. Therefore, there would be no adverse effect on the integrity of the other European Designated Sites in relation to the Conservation Objectives for harbour porpoise (i.e. to maintain the favourable conservation status of harbour porpoise) for the Project alone or in-combination with other projects in Celtic and Irish Seas MU.

8.3.8. Pen Llŷn a'r Sarnau/Lleyn Peninsula and the Sarnau SAC

766. The Pen Llŷn a'r Sarnau/Lleyn Peninsula and the Sarnau SAC site covers an area of 1,460km^2, from the coastlines of the Lleyn Peninsula and the northern part of Cardigan Bay, and includes three tidal inlets. The water depths range from over 40m in depth off the north and south-west coast on the Lleyn Peninsula, to less than 10m around the Sarnau (Countryside Council for Wales (CCW), 2009a).

767. The Pen Llŷn a'r Sarnau/Lleyn Peninsula and the Sarnau SAC is designated for primarily Annex I habitats, including sandbanks, estuaries, coastal lagoons, large shallow inlets and bays and reefs; however, it also lists bottlenose dolphin and grey seal as qualifying features (CCW, 2009a). Bottlenose dolphin and grey seal are Annex II species present at this site as a qualifying feature, but not a primary reason for site selection.

768. Bottlenose dolphin are considered to be of significant importance within the Pen Llŷn a'r Sarnau/Lleyn Peninsula and the Sarnau SAC, however, they do not form a resident population but should be considered as part of the wider Wales population, including those of Cardigan Bay. Photo-identification studies have revealed that the dolphins present in this site travel between the Pen Llŷn a'r Sarnau/Lleyn Peninsula and the Sarnau SAC and Bae Ceredigion/Cardigan Bay SAC. Both these sites are within Cardigan Bay and their population should be considered together. It was estimated in 2007 that there were 397 individuals within the Bae Ceredigion/Cardigan Bay SAC for the period 2001- 2007 (CCW, 2009a). More recent population estimates for the wider Cardigan Bay vary between 254 and 330 animals (CV = 0.25 – 0.28) for the years 2011 and 2013 inclusive (Feingold and Evans, 2014).

769. The Pen Llŷn a'r Sarnau/Lleyn Peninsula and the Sarnau SAC and MDZ are located within the Irish Sea MU for bottlenose dolphin. The Irish Sea MU has an estimated bottlenose dolphin abundance of 397 (CV = 0.23; 95% CI = 362-414; IAMMWG, 2015).

770. Grey seals present at this site are thought to be a part of the wider north Wales population (between 700 and 750 in winter and up to 1,100 in summer) and that the persistent breeding individuals form part of the larger Irish Sea population. The Pen Llyn a'r Sarnau/Lleyn Peninsula and Sarnau SAC had an estimated population of 365 grey seals (in 2002) and has the largest breeding colony in north Wales with a number of important pupping sites, including Bardsey Island (CCW, 2009a).

771. It is believed that the persistent breeding individuals in the SAC are part of a wider population that extends to southwest Wales and to the southeast and eastern Irish coasts, and possibly extends beyond the Irish Sea. It is likely that there are occasional but as yet unquantified migrations to and from populations further afield. Recent tracking data (from a study using

satellite tags to track seal movements and diving behaviour) show that seals moved from haul out sites on Bardsey Island and West Hoyle Sandbank to the east coast of Ireland, Inner Hebrides, and Pembrokeshire (CCW, 2009a).

772. The Pen Llyn a'r Sarnau/Lleyn Peninsula and the Sarnau SAC and MDZ are located within the South and West England and Wales MU for grey seal (IAMMWG, 2013). The South and West England and the Wales MU for grey seal has an estimated summer population size of 6,000 (SCOS, 2017).

773. The MDZ is located 34km from the Pen Llyn a'r Sarnau/Lleyn Peninsula and the Sarnau SAC. Therefore, there is no direct effect within the SAC area. However, there is the potential to affect bottlenose dolphin and grey seal from the Pen Llyn a'r Sarnau/Lleyn Peninsula and the Sarnau SAC if they are foraging or moving through the MDZ.

8.3.8.1. Conservation Objectives

774. The conservation objectives for bottlenose dolphin is that the Pen Llyn a'r Sarnau/Lleyn Peninsula and the Sarnau SAC will "continue to provide a productive and supportive marine area for bottlenose dolphin. Bottlenose dolphin will continue to be widespread within the waters of the SAC and those frequenting the SAC will reflect a healthy population structure including immature and adult male and female dolphins. The bottlenose dolphins in the SAC will form an important component a larger population of this species present in Cardigan Bay and in the wider sea area around Wales and the north east Atlantic. The animals using the SAC will reflect good physiological health. The bottlenose dolphins will have access to and sufficient availability of prey, and they will have widespread availability and access to good quality essential habitats free from excessive disturbance. The quality and distribution of essential habitats (such as for feeding, calving, resting and travelling) within the site will be maintained or improved through appropriate management" (CWW, 2009a).

775. The conservation objectives for grey seal is that the Pen Llyn a'r Sarnau/Lleyn Peninsula and the Sarnau SAC will "continue to provide a productive and supportive marine area for grey seal. The population of grey seals frequenting the SAC will form and important component of a larger southwest UK population of grey seals. Grey seal will continue to be widespread throughout the SAC predominantly in areas of open coast and sea. Grey seal will have access to, and sufficient availability of prey, and they will have widespread availability and access to good quality essential habitats, including areas for hauling out and pupping, that are free from excessive disturbance. The quality and distribution of haul out and breeding sites for grey seal within the site will be maintained or improved through appropriate management" (CWW, 2009a).

776. The Conservation Objectives for bottlenose dolphin and grey seal at the Pen Llyn a'r Sarnau/Lleyn Peninsula and the Sarnau SAC are summarised in **Table 8-25**.

Table 8-25 Conservation Objectives for bottlenose dolphin and grey seal at the Pen Llyn a'r Sarnau/Lleyn Peninsula and the Sarnau SAC

Site	Conservation Objectives for Bottlenose Dolphin and Grey Seal
Pen Llŷn a'r Sarnau/Lleyn Peninsula SAC	**Population** The population is maintaining itself on a long-term basis as a viable component of its natural habitat. Important elements include: • Population size; • Structure; • Production; and • Condition of the species within the site. As part of this objective it should be noted that: • For bottlenose dolphin and grey seal: contaminant burdens derived from human activity are below levels that may cause physiological damage, or immune or reproductive suppression. • For grey seal: Populations should not be reduced as a consequence of human activity. **Range** The species population within the site is such that the natural range of the population is not being reduced or likely to be reduced for the foreseeable future: • Their range within the SAC and adjacent inter-connected areas is not constrained or hindered. • There are appropriate and sufficient food resources within the SAC and beyond. • The sites and amount of supporting habitat used by these species are accessible and their extent and quality is stable or increasing. **Supporting Habitats and Species** The presence, abundance, condition and diversity of habitats and species required to support these species is such that the distribution, abundance and populations dynamics of the species within the site and population beyond the site is stable or increasing. Important considerations include: • Distribution; • Extent; • Structure; • Function and quality of habitat; and • Prey availability and quality. As part of this objective it should be noted that: • The abundance of prey species subject to existing commercial fisheries needs to be equal to or greater than that required to achieve maximum sustainable yield and secure in the long term. • The management and control of activities or operations likely to adversely affect the species feature is appropriate for maintaining it in favourable condition and is secure in the long term. • Contamination of potential prey species should be below concentrations potentially harmful to their physiological health. • Disturbance by human activity is below levels that suppress reproductive success, physiological health or long-term behaviour **Restoration and recovery** As part of this objective it should be noted that for the bottlenose dolphin populations should be increasing.

8.3.8.2. Assessment of Potential Effects

777. The HRA screening for bottlenose dolphin (Table 6-16) and grey seal (**Table 6-17**) identified that the following effects during construction, operation, maintenance, repowering and decommissioning could have the potential to have an adverse effect on the integrity of the Pen Llŷn a'r Sarnau/Lleyn Peninsula and the Sarnau SAC in relation to the Conservation Objectives for bottlenose dolphin and grey seal:

- Underwater noise and the risk of auditory injury;
- Underwater noise and disturbance;
- Collision risk with tidal devices
- Increased collision risk with vessels;
- Entanglement with mooring lines;
- Barrier effects;
- EMF effects;
- Potential disturbance at haul out sites;
- Changes in water quality;
- Changes in prey availability; and
- In-combination effects.

778. The assessments for bottlenose dolphin have been put into the context of the Irish Sea MU and the population estimate of 330 dolphins for the Cardigan Bay area, which contains the Pen Llŷn a'r Sarnau/Lleyn Peninsula and the Sarnau SAC and Bae Ceredigion/Cardigan Bay SAC.

779. To take into account the range of bottlenose dolphin from Anglesey to Cardigan Bay, including the Cardigan Bay SAC and Lleyn Peninsula SAC, the density estimate has been based on 330 dolphins in an area of 16,098km^2 (see **Chapter 12, Marine Mammals**, **Volume I** of the ES). For the assessments, the density estimate of 0.02 bottlenose dolphin per km^2 has been used. This was agreed with NRW at the 2nd marine mammal TWG meeting on the 19th February 2019.

780. To take into account the movement of grey seal and that grey seal in the Pen Llyn a'r Sarnau/Lleyn Peninsula and Sarnau SAC are part of the wider population the assessments have been put into the context of the South and West England and the Wales MU of 6,000 grey seal (IAMMWG, 2013; SCOS, 2018).

781. SMRU has produced maps of grey seal distribution in UK waters (Russell *et al*., 2017). The grey seal density estimate of 0.155 per km^2 for the MDZ has been calculated from the seal density maps (see **Chapter 12, Marine Mammals**, **Volume I** of the ES), based on the highest density estimate for the grid squares within 2km of the area.

782. There is currently insufficient data from the site-specific surveys to provide robust density estimates, therefore the latest seal at sea density maps (Russell *et al*., 2017) have been used to estimate the density of grey seal for the MDZ. This was agreed with NRW at the 2nd marine mammal TWG meeting on the 19th February 2019.

8.3.8.2.1. Assessment of Potential Effects of Underwater Noise and Risk of Auditory Injury

783. As outlined in **Chapter 12, Marine Mammals** (**Volume I** of the ES), underwater noise modelling has not currently been conducted for the MDZ, however, the assessments have been based on the worst-case scenario for similar activities at similar sites the nearby Wylfa Newydd Development Area, PTEC off the coast of the Isle of Wight, MeyGen in the Inner Sound of the Pentland Firth and offshore wind farms in the Southern North Sea (further details of the underwater noise modelling undertaken for these sites is provided in **Chapter 12, Marine Mammals** (**Volume I** of the ES).

784. The maximum predicted ranges for the risk of PTS for drilling is for two percussive drilling rigs at the Wylfa Newydd Development Area using the non-impulsive NMFS (2018) criteria (198 and 201 dB re 1 µPa^{2}s Weighted SEL$_{cum}$ for bottlenose dolphin and grey seal, respectively), assuming a stationary animal remaining in the vicinity over a 24-hour period (**Table 8-26**).

785. The maximum predicted ranges for the risk of PTS for cable laying and cable protection (rock placement) are based on modelling for Southern North Sea offshore wind farm sites using the impulsive NMFS (2018) criteria (185 dB re 1 µPa^{2}s Weighted SEL$_{cum}$ for bottlenose dolphin and grey seal). This assessment uses a fleeing animal model, which is more realistic as it assumes that the animal exposed to high noise levels will swim away from the noise source. For this a constant fleeing speed of 1.5m/s has been assumed. This is considered 'worst-case' as marine mammals are expected to be able to swim much faster under stress conditions. The modelling ranges smaller than 100m (cumulative) were not been presented for the Southern North Sea sites and could therefore be a lot less then 100m, however, as a worst-case scenario, ranges of up to 100m have been assumed (**Table 8-26**).

786. The maximum predicted ranges for the risk of PTS from vessels is for large vessels at the Wylfa Newydd Development Area using the non-impulsive NMFS (2018) criteria (198 and 201 dB re 1 µPa^{2}s Weighted SEL$_{cum}$ for bottlenose dolphin and grey seal, respectively), assuming a stationary animal remaining in the vicinity over a 24-hour period (**Table 8-26**).

787. The noise measurements and modelling for a range of different operational tidal devices, indicates that the noise levels would not be sufficient to result in any auditory injury (see **Chapter 12, Marine Mammals, Volume I** of the ES). Therefore, there is no risk of PTS from the underwater noise of operational turbine devices and it has not been included in this assessment.

788. A review of ADDs in **Chapter 12, Marine Mammals** (**Volume I** of the ES), indicates that the noise levels would not be sufficient to result in any auditory injury. Therefore, there is no risk of PTS and they have not been included in this assessment.

789. As a worst-case scenario, based on two percussive drilling rigs, two cable laying activities, two rock placement activities and up to 16 large vessels in the MDZ, the maximum area for potential risk of auditory injury, without any mitigation, is 0.12km^2, which could affect up to 0.0024 bottlenose dolphin (0.0006% of the 397 dolphins in the MU; 0.0007% of the 330 dolphins in the two SACs) and up to 0.019 grey seal (0.0003% of the 6,000 seals in the MU) (**Table 8-26**).

Table 8-26 Summary of the maximum predicted PTS ranges (and areas) for bottlenose dolphin and grey seal

Potential Effect	Two percussive drilling rigs	Cable laying	Rock placement	Large vessels	Worst-Case Total
Range (and area) for PTS in bottlenose dolphin	1m (0.000003km^2)	<100m (0.03km^2) Up to 0.06 km^2 for two activities	<100m (0.03km^2) Up to 0.06 km^2 for two activities	<1m (0.000003km^2) Up to 0.00005km^2 for 16 vessels	0.12km^2
Maximum number of bottlenose dolphin and % of MU and SACs	0.00000006 individuals (0.000000015% of the MU; 0.00000018% of the SACs)	0.0006 individuals (0.00015% of the MU; 0.00018% of the SACs). 0.0012 individuals (0.0003% of the MU; 0.00036% of the SACs).	0.0006 individuals (0.00015% of the MU; 0.00018% of the SACs). 0.0012 individuals (0.0003% of the MU; 0.00036% of the SACs).	0.00000006 individuals (0.000000015% of the MU; 0.00000018% of the SACs). 0.000001 individuals (0.0000002% of the MU; 0.0000003% of the SACs).	0.0024 individuals (0.0006% of the MU; 0.0007% of the SACs).
Range (and area) for PTS in grey seal	10m (0.0003km^2)	<100m (0.03km^2) Up to 0.06 km^2 for two activities	<100m (0.03km^2) Up to 0.06 km^2 for two activities	<1m (0.000003km^2) Up to 0.00005km^2 for 16 vessels	0.12km^2
Maximum number of grey seal and % of MU	0.000049 individuals (0.0000008% of the MU).	0.005 individuals (0.00008% of the MU). 0.009 individuals (0.00015% of the MU).	0.005 individuals (0.00008% of the MU). 0.009 individuals (0.00015% of the MU).	0.0000005 individuals (0.000000008% of the MU). 0.000007 individuals (0.0000001% of the MU).	0.019 individuals 0.0003% of the MU).

8.3.8.2.1.1. Mitigation

790. As outlined in **Chapter 12, Marine Mammals** (**Volume I** of the ES), Marine Mammal Mitigation Protocols (MMMPs) will be prepared to reduce the risk of any permanent auditory injury (PTS) to marine mammals as a result of underwater noise during construction. The MMMP(s) will be developed in the pre-construction period and based upon best available information, methodologies, industry best practice, latest scientific understanding, current guidance and detailed project design.

791. It is currently proposed, that MMMPs for drilling activity and for cable installation and cable protection activities would be prepared prior to construction, for example with the option of having Marine Mammal Observers (MMOs) on site during these activities to ensure marine mammals do not enter a predetermined mitigation zone (for example, 500m).

792. The MMMP(s) will reduce the risk of permanent auditory injury to bottlenose dolphin and grey seal as a result of underwater noise at the MDZ, therefore, there would be **no adverse effect on the integrity of the Pen Llŷn a'r Sarnau/Lleyn Peninsula and the Sarnau SAC in relation to the Conservation Objectives for bottlenose dolphin and grey seal (i.e. Conservation Objective 1: the populations are maintained on a long-term basis as a viable component of its natural habitat)**.

8.3.8.2.2. Assessment of Potential Effects of Underwater Noise and Disturbance

793. As a precautionary approach the maximum area of potential disturbance has been assessed for underwater water noise from operational turbines for the full deployment (240MW) at the same time as underwater water noise from any construction activities, maintenance and repowering activities and vessels, based on the worst-case scenarios and maximum potential ranges for two drilling activities, two cable laying activities, two cable protection activities and up to 16 vessels (**Table 8-27**).

794. For full deployment (240MW) the assessment has been based on the possible strong avoidance (90 dB_{ht}(*Species*) range from the modelling for PTEC. The assessment for the full deployment has been based on arrays rather than individual tidal devices, as individual marine mammals would be more likely to be disturbed by the closest turbine they approach rather than all individual turbines within the array. As an indicative precautionary worst-case, the assessment has been based on up to 10 arrays, however the maximum number of arrays at the MDZ is likely to be eight. The areas are based on an area of a circle and assessment also assumes no overlap in disturbance areas between arrays / groups of turbines. For bottlenose dolphin and grey seal the maximum predicted area of disturbance has been estimated at up to 0.28km^2 and 0.18km^2, respectively (**Table 8-27**).

795. The maximum predicted range for disturbance (based on the TTS/ fleeing response) during drilling is for two percussive drilling rigs at the Wylfa Newydd Development Area using the non-impulsive NMFS (2018) criteria, assuming a stationary animal remaining in the vicinity over a 24-hour period.

796. As outlined in **Chapter 12, Marine Mammals** (**Volume I** of the ES), using the predicted ranges for Temporary Threshold Shift (TTS) / fleeing response, based on the NMFS (2018) thresholds and criteria represents a good indication of the potential disturbance ranges.

797. The maximum predicted impact ranges for TTS / fleeing response using the non- impulsive NMFS (2018) criteria and the fleeing animal model for cable laying and rock placement at the Southern North Sea sites was used as the worst-case scenario with the maximum predicted impact areas (**Table 8-27**).

798. The maximum predicted area of disturbance (based on the TTS/ fleeing response) from vessels was for large vessels at the Wylfa Newydd Development Area using the non-impulsive NMFS (2018) criteria, assuming a stationary animal remaining in the vicinity over a 24-hour period.

799. The maximum area of potential disturbance for underwater water noise from operational turbines for the full deployment (240MW) at the same time as underwater water noise from any construction activities, maintenance and repowering activities and vessels, based on the worst-case scenarios and maximum potential ranges for two drilling activities, two cable laying activities, two cable protection activities and up to 16 vessels is up to 0.4km^2 for bottlenose dolphin, which could affect up to 0.008 individuals (0.002% of the MU and the SACs) and up to 0.7km^2 for grey seal, which could affect up to 0.11 individuals (0.0018% of the MU) (**Table 8-27**).

800. Therefore, there would be no adverse effect on the integrity of the Pen Llŷn a'r Sarnau/Lleyn Peninsula and the Sarnau SAC in relation to the Conservation Objectives for bottlenose dolphin

and grey seal (i.e. Conservation Objective 2: the species population within the site is such that the natural range of the population is not being reduced or likely to be reduced for the foreseeable future).

801. No mitigation is proposed.

Table 8-27 Summary of the maximum predicted disturbance of bottlenose dolphin and grey seal

Potential Effect	Operational turbines	Drilling x 2	Cable laying x2 and cable protection x2	Up to 16 large vessels	Total
Maximum area of disturbance for bottlenose dolphin	0.28km^2	0.0013km^2	0.12km^2	0.0005km^2	0.4km^2
Maximum number of bottlenose dolphin and % of MU and SACs	0.006 individuals (0.0015% of the MU; 0.002% of the SACs)	0.0024 individuals (0.0006% of the MU; 0.0007% of the SACs).			0.008 individuals (0.002% of the MU and the SACs)
Maximum area of disturbance for grey seal	0.18km^2	0.32km^2	0.12km^2	0.08km^2	0.7km^2
Maximum number of grey seal and % of MU	0.03 individuals (0.0005% of the MU)	0.08 individuals (0.001% of the MU).			0.11 individuals (0.0018% of MU)

8.3.8.2.3. Assessment of Potential Effects of Disturbance from ADDs

802. Acoustic deterrent devices (ADDs) may be used as part of the mitigation plan to deter marine mammals for coming too close to operational turbines and to reduce the potential collisions risk.

803. As a precautionary approach, the assessment has been based on a potential average disturbance range of approximately 1km (3.14km^2) for a range of ADD devices, based on the JNCC guide for the selection and deployment of acoustic deterrent devices (McGarry *et al*., 2018) (see **Chapter 12, Marine Mammals**, **Volume I** of the ES).

804. The requirements for ADD use has still to be determined during the development of the mitigation plan. Therefore, for this assessment a precautionary indicative example has been assumed in that there could be four ADDs at each of the arrays with a worst-case scenario of up to ten arrays, although the maximum of eight arrays are proposed for the MDZ. It is proposed that the ADDs would only be activated when marine mammals are in close proximity to the arrays and therefore not all 40 ADDs would ever be activated at the same time. Therefore, the assessment has been based on a very precautionary scenario of a maximum of 10 ADDs activated at the same time, with a potential disturbance area of up to 31.4 km^2 (assuming no overlap in the disturbance areas for the 10 ADDs or land).

805. The duration of the ADD activation has also still to be determined, therefore as a precautionary approach an assessment has been based on possible 20 minute activation and the distance marine mammals could be disturbed based on them swimming away for the ADD during this activation time. For bottlenose dolphin and grey seal an average swimming speed of 1.5m/s has been assumed. Therefore, for a 20 minute ADD activation the distance covered could be 1.8km. Assuming a precautionary, although unlikely scenario of up to 10 ADDs activated at the

same time, the potential disturbance area could be up to 101.8km^2 (assuming no overlap in the disturbance areas for the 10 ADDs or land).

806. The overall maximum area of possible disturbance during ADD activation in-combination with the underwater noise from the operational turbines or other activities and vessels would be the same area as assessed for ADDs, as the ADD areas of disturbance (e.g. 31.4 km^2 or 101.8 km^2) would be greater than the area of potential disturbance for underwater noise from operational turbines and the maximum potential area of disturbance for operational turbines and other activities and vessels (**Table 8-27**).

807. The maximum number of individuals that could be temporary disturbed, based on the worst-case scenario for 20 minute activation of 10 ADDs is up to 5 bottlenose dolphin (0.5% of the MU; 0.6% of the SACs) and up to 16 grey seal (0.3% of the MU) (**Table 8-28**).

808. Therefore, there would be no adverse effect on the integrity of the Pen Llŷn a'r Sarnau/Lleyn Peninsula and the Sarnau SAC in relation to the Conservation Objectives for bottlenose dolphin and grey seal (i.e. Conservation Objective 2: the species population within the site is such that the natural range of the population is not being reduced or likely to be reduced for the foreseeable future).

809. No mitigation, other than restricting the ADD activation time to the minimum required to displace marine mammals and reduce the risk of collisions with tidal devices and that ADDs are only activated when marine mammals come within close proximity of the tidal devices and arrays, are proposed.

Table 8-28 Summary of the maximum predicted ADD disturbance of bottlenose dolphin and grey seal

Potential Effect	Up to 10 ADDs (1km range)	Up to 20 minute ADD activation for up to 10 ADDs
Maximum area of disturbance for bottlenose dolphin and grey seal	31.4km^2	101.8km^2
Maximum number of bottlenose dolphin and % of MU and SACs	0.6 individuals (0.15% of the MU; 0.18% of the SACs).	2 individuals (0.5% of the MU; 0.6% of the SACs).
Maximum number of grey seal and % of MU	5 individuals (0.08% of the MU).	16 individuals (0.3% of the MU).

8.3.8.2.4. Assessment of Potential Effects of Collision Risk with Tidal Devices

810. Full details of the collision risk assessments are provided in **Chapter 12, Marine Mammals** (**Volume I** of the ES).

811. There is considerable uncertainty regarding the collision risk of marine mammals with all tidal turbine types. The moving rotors of tidal energy devices pose a potential collision risk for marine mammals. However, there is currently limited understanding and empirical data relating interactions between marine mammals with tidal devices and there have been no recorded incidents at any operational tidal arrays.

812. Scenarios and assessments have been conducted in the ES for the maximum number of each type of device combined where the predicted collision risk is less than one bottlenose dolphin, using the Encounter Rate Model (ERM) and Collision Risk Model (CRM) with 98% avoidance.

813. The assessment for bottlenose dolphin and grey seal has been based on the scenarios for the combination of different types of devices where the collision risk is predicted to be less than one bottlenose dolphin (based on the scenarios with the current maximum MW). Each stage of deployment would only progress based on these scenarios and that the regular reviewing of the monitoring and mitigation indicated that there was no increased collision risk.

814. As previous outlined, the approach will be to deploy to a level where the risk is less than one bottlenose dolphin (e.g. **Table 8-29** and **Table 8-30**). This deployment will then be monitored with mitigation options, such as the use of ADDs, if animals come close to the tidal devices and arrays. The next phase of deployment, again based on the collision risk of less than one bottlenose dolphin, would only proceed when a review of the monitoring and requirements for mitigation (e.g. how often ADDs were activated), indicates that there is no increased collisions risk. This would be done in consultation with NRW. Therefore, the assessments, including the in-combination assessment is based on the scenarios for less than on bottlenose dolphin, as this would be the worst-case scenario.

815. The ERM assessment indicates that for an indicative deployment, based on 98% avoidance, the potential collision risk for bottlenose dolphin, without any mitigation, could be up to 0.99 individuals per year (0.25% of the MU; 0.3% of the SACs) and the number of grey seal could be up to 4.6 individuals (0.08% of the MU) (**Table 8-29**).

816. The CRM assessment indicates that for an indicative deployment, based on 98% avoidance, the potential collision risk for the potential collision risk for bottlenose dolphin, without any mitigation, could be up to 0.99 individuals per year (0.25% of the MU; 0.3% of the SACs) and the number of grey seal could be up to 4.3 individuals (0.07% of the MU) (**Table 8-30**).

817. Indicative assessments for 30MW and 40MW of each type of device and an indicative 240MW scenario are also presented in **Appendix 12.2** (**Volume III**) of the ES, however, these would only be developed once the monitoring and mitigation indicates that the modelled collision risk would be less than one bottlenose dolphin. As a worst-case, the assessment for the indicative 240MW scenario indicates that up to 4.6% of the bottlenose dolphin MU or up to 5.6% of the SACs could be at risk, based on 98% avoidance without mitigation or the planned phased deployment (as outlined above, in **Section 8.3.8.2.4.1** and in the EMMP (**Document MOR/RHDHV/DOC/0072**), which would have an adverse effect on the bottlenose dolphin population and conservation objectives for the SACs. For grey seal, up to 1.4% of the MU could be at risk, based on 98% avoidance without mitigation for the indicative 240MW scenario.

818. The number of animals that can be ‘removed’ from a population varies, but is largely dependent on the growth rate of the population; populations with low growth rates can sustain the removal of a smaller proportion of the population. The JNCC *et al*. (2010) draft EPS guidance provides some indication on how many animals may be removed from a population without causing detrimental effects to the population at FCS.

819. JNCC *et al*. (2010) draft EPS guidance considered 4% as the maximum potential growth rate in harbour porpoise, and the ‘default’ rate for cetaceans. Therefore, beyond natural mortality, up to 4% of the population could theoretically be permanently removed before population growth would be halted.

820. The collision risk assessments have been based on the worst-case scenarios, does not take into account the proposed phased deployment, monitoring and mitigation measures and assumes that all encounter or collisions would be fatal.

821. Taking this into account, along with the JNCC *et al*. (2010) draft EPS guidance, it is therefore unlikely that the potential collision risk for these scenarios would result in any significant population effects for bottlenose dolphin or grey seal.

822. The potential population level effects of collision risk with operational tidal turbines on marine mammals have been assessed in **Appendix 12.2** (**Volume III**) of the ES. The result of the PVA for bottlenose dolphin indicate that population trajectories of the baseline and collision risk scenarios of 1, 2 and 3 animals are very similar, with only a potential for a decline when more than three adults per year are removed from the population of 397 bottlenose dolphins in the Irish Sea MU or 330 bottlenose dolphin in the SACs. The result of the PVA for grey seal indicate that the population trajectories of the baseline and all modelled collision scenarios (2, 3, 14, 34, 81 and 85 individuals per year) are very similar, showing an increasing population with a stochastic growth rate of 0.05 for all for MU population of 6,000 grey seal.

823. Therefore, there would be no adverse effect on the integrity of the Pen Llŷn a'r Sarnau/Lleyn Peninsula and the Sarnau SAC in relation to the Conservation Objectives for bottlenose dolphin and grey seal (i.e. Conservation Objective 1: the populations are maintained on a long-term basis as a viable component of its natural habitat).

Table 8-29 ERM assessment for bottlenose dolphin and grey seal (number of individuals / year and % of MU) with 98% avoidance for maximum number (and MW) of each type of device combined for collision risk scenario of less than one bottlenose dolphin

Tidal device category	Twin-rotor floating	Multiple-rotor buoyant platform	Multi-rotor buoyant mid water	Multiple-rotor buoyant platform	Spar buoy	Seabed mounted single rotor	Seabed mounted single rotor	Seabed mounted single rotor	Three-rotor seabed mounted platform	Cross-flow multi-rotor floating	Total
Number (MW)	**4 (8MW)**	**1 (1.5MW)**	**1 (1.25MW)**	**0**	**1 (1MW)**	**2 (2MW)**	**1 (1.5MW)**	**1 (0.3MW)**	**1 (1.2MW)**	**0**	**12 (16.75MW)**
Bottlenose dolphin	0.39	0.10	0.10	0	0.07	0.11	0.08	0.02	0.11		0.99 (0.25% of MU; 0.3% of SACs)
Grey seal	2.17	0.47	0.47	0	0.34	0.4	0.32	0.08	0.35		4.6 (0.08% of MU)

Table 8-30 CRM assessment for bottlenose dolphin and grey seal (number of individuals / year and % of MU) with 98% avoidance for maximum number (and MW) of each type of device combined for collision risk scenario of less than one bottlenose dolphin

Tidal device category	Twin-rotor floating	Multiple-rotor buoyant platform	Multi-rotor buoyant mid water	Multiple-rotor buoyant platform	Spar buoy	Seabed mounted single rotor	Seabed mounted single rotor	Seabed mounted single rotor	Three-rotor seabed mounted platform	Cross-flow multi-rotor floating*	Total
Number (MW)	**3 (6MW)**	**1 (1.5MW)**	**1 (1.25MW)**	**0**	**1 (1MW)**	**1 (1MW)**	**1 (1.5MW)**	**2 (0.6MW)**	**3 (3.6MW)**	**0**	**13 (16.45MW)**
Bottlenose dolphin	0.37	0.09	0.09	0	0.11	0.04	0.10	0.04	0.16		0.99 (0.25% of MU; 0.3% of SACs)
Grey seal	1.89	0.39	0.39	0	0.47	0.12	0.39	0.11	0.5		4.3 (0.07% of MU)

*CRM not applicable for vertical blade of cross-flow multi-rotor floating type device, therefore ERM results included

8.3.8.2.4.1. Mitigation

824. As outlined in **Chapter 12, Marine Mammals** (**Volume I** of the ES), the deployment, monitoring and adaptive management plan will be developed in the pre-construction period and based upon best available information, methodologies, industry best practice, latest scientific understanding, current guidance and detailed project design.

825. This plan will consider the most suitable and effective monitoring and mitigation measures to, detect marine mammals in and around the arrays (for example, using remotely monitored Passive Acoustic Monitoring (PAM), underwater cameras, autonomous recorders, and / or high definition (HD) and thermal imaging camera systems). There would also be the use of active sonar to detect marine mammals in close proximity to the arrays / devices to trigger mitigation measures, such as the automatic activation of ADDs to deter marine mammals from a predetermined mitigation zone around the arrays / devices.

826. The approach would be based on deployment, monitoring and adaptive management, with regular reviews of the installation at appropriate increments directly related to collision risk to marine mammals, specially bottlenose dolphin, to ensure that in that no more than one bottlenose dolphin could be at risk.

827. The proposed mitigation would significantly reduce the potential collision risk, therefore, therefore, there would be no adverse effect on the integrity of the Pen Llŷn a'r Sarnau/Lleyn Peninsula and the Sarnau SAC in relation to the Conservation Objectives for bottlenose dolphin and grey seal (i.e. Conservation Objective 1: the populations are maintained on a long-term basis as a viable component of its natural habitat).

8.3.8.2.5. Assessment of Potential Effects of Collision Risk with Vessels

828. The potential for increased collision risk with vessels has been based on up to 16 vessels on site at any one time, with up to 16 vessel movements to and from the site per day. The maximum area of potential risk has been estimated based on construction vessels in indicative examples of the two largest potential deployment areas (3km^2 and 3km^2); plus, vessels in ECC area (4.75km^2). In addition, increased collision risk has also been estimated based on the potential vessel route area to and from Holyhead Harbour, based on a precautionary 250m buffer either side of the vessels (4.34km^2).

829. There is limited information on which to quantity the collision risk of marine mammals with vessels. Although the risk of collision is likely to be low, as a precautionary worse-case scenario, the number of bottlenose dolphin and grey seal that could be at increased collision risk with vessels has been assessed based on precautionary 5% to 10% of the number of individuals, that could be present in the area potentially being at increased collision risk.

830. As a worst-case scenario 0.015-0.031 bottlenose dolphin (0.0038-0.0076% of MU; 0.0045-0.009% of the SACs) and 0.117-0.237 grey seal (0.0019%-0.0039% of MU) could be at increased collision risk with vessels in the MDZ and moving between the MDZ and Holyhead Port (**Table 8-31**).

831. Therefore, therefore, therefore, there would be no adverse effect on the integrity of the Pen Llŷn a'r Sarnau/Lleyn Peninsula and the Sarnau SAC in relation to the Conservation Objectives for bottlenose dolphin and grey seal (i.e. Conservation Objective 1: the populations are maintained on a long-term basis as a viable component of its natural habitat).

832. No mitigation is proposed.

Table 8-31 Estimated number of bottlenose dolphin and grey seal (and % of MU) that could be at increased collision risk with vessels at MDZ

Species	**Increased collision risk (5-10% of individuals in area at increased risk)**
	Number of individuals (% of MU) at potential increased risk in total area of two deployment areas, ECC and route to and from Holyhead (15.09km^2)
Bottlenose dolphin	0.015-0.031 individuals (0.0038-0.0076% of MU; 0.0045-0.009% of the SACs)
Grey seal	0.117-0.237 individuals (0.0019%-0.0039% of MU)

8.3.8.2.6. Assessment of Potential Effects of Collision Risk with Tidal Devices and Vessels

833. As a precautionary approach the number of bottlenose dolphin and grey seal has been assessed for the potential collision risk with operational turbines (**Section 8.3.8.2.4**) and possible increased collision risk with vessels (**Section 8.3.8.2.5**).

834. The assessment has been based on the worst-case scenario that there could be up to 16 vessels on site at the same time as the collision risk scenario for less than one bottlenose dolphin. However, it is highly unlikely that 16 vessels would be on site during operation, also when vessels are on site during operation this is likely to be for maintenance and repowering activities, which would result in a number of devices or array likely to be non-operational during these activities.

835. As a worst-case scenario, with no mitigation, up to up to 1 bottlenose dolphin (0.25% of MU; 0.3% of the SACs) and up to 5 grey seal (0.08% of MU) could be at increased collision risk with tidal devices and vessels (**Table 8-32**).

836. The potential population level effects of collision risk with operational tidal turbines on marine mammals have been assessed in **Appendix 12.2** (**Volume III**) of the ES. The result of the PVA for bottlenose dolphin indicate that population trajectories of the baseline and collision risk scenarios of 1, 2 and 3 animals are very similar, with only a potential for a decline when more than three adults per year are removed from the population of 397 bottlenose dolphins in the Irish Sea MU or 330 bottlenose dolphin in the SACs. The result of the PVA for grey seal indicate that the population trajectories of the baseline and all modelled collision scenarios (2, 3, 14, 34, 81 and 85 individuals per year) are very similar, showing an increasing population with a stochastic growth rate of 0.05 for all for MU population of 6,000 grey seal.

837. Taking into account the proposed monitoring and mitigation plan, outlined in **Section 8.3.8.2.4.1**, reduce the potential collision risk with tidal devices, there would be no anticipated adverse effect on the integrity of the Pen Llŷn a'r Sarnau/Lleyn Peninsula and the Sarnau SAC in relation to the Conservation Objectives for bottlenose dolphin and grey seal (i.e. Conservation Objective

1: the populations are maintained on a long-term basis as a viable component of its natural habitat).

Table 8-32 Estimated number of bottlenose dolphin and grey seal (and % of MU) that could be at increased collision risk with vessels and full deployment of operational tidal devices at MDZ

Species	**Number of individuals (% of reference population)**		
	Increased collision risk with vessels (5-10% of individuals in total area; 15.09km^2)	**Collision risk for one dolphin scenario (ERM and CRM)**	**Total (maximum based on worst-case scenario)**
Bottlenose dolphin	0.015-0.031 individuals (0.0038-0.0076% of MU; 0.0045-0.009% of the SACs)	0.99 individuals (0.25% of MU; 0.3% of SACs)	Up to 1 individual (0.25% of MU; 0.3% of the SACs)
Grey seal	0.117-0.237 individuals (0.0019%-0.0039% of MU)	4-5 individuals (0.08% of MU)	Up to 5 grey seal (0.08% of MU).

8.3.8.2.7. Assessment of Potential Effects of Entanglement with Mooring Lines

838. To date, there have been no recorded instances of marine mammal entanglement from mooring systems of renewable devices (Sparling *et al*., 2013; Isaacman and Daborn, 2011), or for anchored floating production, storage and offloading (FPSO) vessels in the oil and gas industry (Benjamins *et al*., 2014) with similar mooring lines.

839. Benjamins *et al*. (2014) provides a qualitative assessment of relative entanglement risk across different marine megafauna groups, taking into account both biological risk factors such as animal size, sensory capabilities and foraging methods, and physical risk factors such as mooring flexibility, pre-tension and footprint. For the mooring scenarios which most represent those likely to be used at MDZ (i.e. catenary & chain and taut & accessory buoy), the risk bottlenose dolphin and grey seal is low.

840. Taking into account that there have been no recorded instances of bottlenose dolphin and grey seal entanglement from mooring systems of renewable devices or similar mooring lines, it is highly unlikely that there is any risk of entanglement at the MDZ.

841. In addition, the tidal devices and moorings would be regular checked (approximately 15 times annually for both planned and unplanned maintenance activities), this would ensure that there was no material such as discarded nets, ropes or other debris which could increase the risk of entanglement for marine mammals or interfere with the optimal operation of the tidal devices.

842. The mitigation and monitoring measures to reduce the risk of collision with operational turbines would also reduce the risk of entablement with mooring lines.

Therefore, there would be no adverse effect on the integrity of the Pen Llŷn a'r Sarnau/Lleyn Peninsula and the Sarnau SAC in relation to the Conservation Objectives for bottlenose dolphin and grey seal (i.e. Conservation Objective 1: the populations are maintained on a long-term basis as a viable component of its natural habitat).

8.3.8.2.8. Assessment of Potential Barrier Effects

843. Underwater noise could have the potential to create a barrier effect, preventing movement or migration of marine mammals between important feeding and / or breeding areas, or potentially increasing swimming distances if marine mammals avoid the site and go around it.

844. The worst-case scenario in relation to barrier effects as a result of underwater noise is based on the maximum spatial and temporal (i.e. longest duration) scenarios. This assumes the maximum potential disturbance and possible barrier effects that there could be at any one time. This has been assessed in **Section 8.3.8.2.2**, for the maximum area of potential disturbance for underwater water noise from operational turbines for the full deployment (240MW) at the same time as underwater water noise from any construction activities, maintenance and repowering activities and vessels, based on the worst-case scenarios and maximum potential ranges for two drilling activities, two cable laying activities, two cable protection activities and up to 16 vessels (**Table 8-27**).

845. As a worst-case scenario, up to 0.008 bottlenose dolphin individuals (0.002% of the MU and the SACs) and up to 0.11 grey seal (0.0018% of the MU) could be affected (**Table 8-27**).

846. Therefore, there would be no adverse effect on the integrity of the Pen Llŷn a'r Sarnau/Lleyn Peninsula and the Sarnau SAC in relation to the Conservation Objectives for bottlenose dolphin and grey seal (i.e. Conservation Objective 2: the species population within the site is such that the natural range of the population is not being reduced or likely to be reduced for the foreseeable future).

847. The physical presence of the tidal array could have the potential to create a physical barrier. As outlined in **Chapter 12, Marine Mammals** (**Volume I** of the ES), the final array layout will be identified post consent, following the berth selection and allocation process. The final detailed device locations will be developed based on further site investigation works conducted post-consent to determine detailed construction constraints. However, the assessment has been based on indicative spacings and potential area of the tidal arrays. The estimated maximum area taken up by all arrays, including spaces between devices (i.e. not the seabed footprint) of up to 12.5km^2 for the full 240MW capacity project.

848. As a worst-case scenario, up to 0.25 bottlenose dolphin (0.06% of the MU; 0.1% of the SACs) and up to 2 grey seal (0.03% of the MU) could be affected.

849. Therefore, there would be no adverse effect on the integrity of the Pen Llŷn a'r Sarnau/Lleyn Peninsula and the Sarnau SAC in relation to the Conservation Objectives for bottlenose dolphin and grey seal (i.e. Conservation Objective 2: the species population within the site is such that the natural range of the population is not being reduced or likely to be reduced for the foreseeable future).

8.3.8.2.9. Assessment of Potential EMF Effects

850. Potential pathways for effects from electromagnetic fields (EMF) would be from the presence of cables within the MDZ and ECC.

851. Modelling of expected magnetic fields by Normandeau *et al*. (2011) indicates that the predicted fields were strongest directly over the cables and decreased rapidly with vertical and horizontal distance from the cables.

852. Currently there is no evidence to suggest that existing subsea cables have influenced bottlenose dolphin or grey seal movements. In addition, data from operational windfarms show no evidence of exclusion of bottlenose dolphin or grey seal.

853. As a precautionary approach, the number bottlenose dolphin that could be affected by any potential EMF effects is up to 0.001 individuals (0.0002% of the MU; 0.0003% of the SACs) and the number of grey seal that could be affected is up to 0.01 individuals (0.0001% of the MU), based on the maximum cable area (0.042km^2) in the MDZ and ECC.

854. Therefore, there would be no adverse effect on the integrity of the Pen Llŷn a'r Sarnau/Lleyn Peninsula and the Sarnau SAC in relation to the Conservation Objectives for bottlenose dolphin and grey seal (i.e. Conservation Objective 2: the species population within the site is such that the natural range of the population is not being reduced or likely to be reduced for the foreseeable future).

8.3.8.2.10. Assessment of Potential Effects of Any Disturbance at Sea Haul-Out Sites

855. Hauled-out seals are sensitive to disturbance, particularly if they are in their breeding or moult periods. For grey seal, this is from August to December with a peak in October-November.

856. Although the MDZ is not located in the Pen Llŷn a'r Sarnau/Lleyn Peninsula and the Sarnau SAC there is the potential for grey seal from the site to be using haul-out sites in the vicinity of the MDZ,

857. Studies on the distance of disturbance, on land or in the water, from hauled-out seals have found that the closer the disturbance, the more likely seals are to move into the water. For the grey seal, mothers responded by moving into the water more due to boat speed rather than as a result of the distance, although movement into the water was generally observed to occur at distances of between 20 and 70m, with no detectable disturbance at 150m (Wilson, 2014; Strong and Morris, 2010). However, grey seals have also been reported to move into the water when vessels are at a distance of approximately 200m to 300m (Wilson, 2014).

858. The closest grey seal pupping sites (based on Clarke *et al*., 2018) are located at Arw Cleft, 69m from the nearest point of the MDZ cable corridor area, however, no pups were recorded at this site during the 2017 survey. The rest of the grey seal sites are beyond 200m from the nearest point of the MDZ cable area, with the closest located at Parliament House site 220m from the cable corridor area. There are no haul-out sites identified in the area for the proposed landfall at Abraham's Bosom on the west coast of Holy Island (see **Chapter 12, Marine Mammals**, **Volume I** of the ES).

859. Taking into account the distance of the proposed cable corridor area from the nearest grey seal pupping site (over 200m) and the proximity of current vessel movements to these sites (see **Chapter 15, Shipping and Navigation**, **Volume I** of the ES), there is unlikely to be any

increased disturbance at grey seal pupping sites as a result of vessels and any cable laying activity in the MDZ cable corridor area.

860. With the proximity of vessel movements, including current vessel routes to and from Holyhead Port, it is likely that seals hauled-out along these routes and in the area of the port would be habituated to the noise, movements and presence of vessels. Therefore, the sensitivity of grey seals at haul-out sites to disturbance from vessels during construction is likely to be negligible. As a very precautionary approach, it is proposed that sensitivity during the breeding season and annual moult could be slightly higher and has therefore been considered as low in this assessment for any activity in the cable corridor area at this time.

861. Vessel movements to the offshore project area would use direct routes and are unlikely to be close to the shore (i.e. within a few hundred metres) except when near the landfall site or port to avoid the risk of collision and grounding. No mitigation measures are required or proposed.

862. Therefore, there would be no adverse effect on the integrity of the Pen Llŷn a'r Sarnau/Lleyn Peninsula and the Sarnau SAC in relation to the Conservation Objectives for grey seal (i.e. Conservation Objective 2: the species population within the site is such that the natural range of the population is not being reduced or likely to be reduced for the foreseeable future).

8.3.8.2.11. Assessment of Potential Effects of Any Changes in Water Quality

863. During construction, maintenance and repowering activities and decommissioning there is the potential for disturbance and re-suspension of sediments, either directly from the sea bed, or from sub-seabed cuttings, and for these re-suspended sediments to be dispersed through the water column as a plume. This has the potential to increase the suspended sediment concentrations and potentially increase turbidity around the MDZ.

864. The maximum envisaged effect associated with sediment plumes arising from the foundation installation activities will cause a small increase in suspended sediment concentration (typically less than 1mg/l a short distance from the release point) over only a small geographical area (a few hundred metres). The effects will be temporary, with a return to very low background concentrations occurring rapidly upon cessation of installation activities (i.e. the effect is temporary only). Other than at the immediate release point, such a change would be immeasurable and has been assessed as negligible in **Chapter 8, Marine Water and Sediment Quality** (**Volume I** of the ES), with no mitigation required.

865. The free-laying of cables and the placement of cable protection would not cause plumes along the offshore sections of the cable corridor because the sea bed is characterised by bedrock or, where sparse sediment cover does exist, by sediments with a particle size that cannot be suspended in the water column.

866. In the nearshore, the bedrock is overlain by sand which has the potential to be disturbed. The assessment in **Chapter 8, Marine Water and Sediment Quality** (**Volume I** of the ES), indicates that there could be a minor adverse (not significant) impact via increased suspended sediments in the area around the sandwave field and close to shore. However, the likely increase in suspended sediment concentration in areas with sand cover nearer to shore (including at the landfall) will remain within the natural variation that are governed by storm waves and surge

effects. Any increase in suspended sediments would reduce rapidly with distance from the point of disturbance to a few mg/l over a small geographical area (within a few hundred metres, along the axis of tidal currents). Furthermore, these effects will be one-off and temporary in duration, with a return to the very low background concentrations occurring rapidly upon cessation of installation.

867. The re-suspension of sediments during construction activities could also lead to the release of any contaminants that may be present within them. However, as outlined in **Chapter 8, Marine Water and Sediment Quality** (**Volume I** of the ES), sediment contamination within the MDZ is low, due to the dynamic hydrological regime and generally low level of industrial activity in this region. The low proportion of fine sediments within the MDZ is another factor that indicates low sediment contamination levels. Therefore, the assessment determined a negligible impact on general water quality in the MDZ via release of contaminated sediments, as even though mobilisation of the relatively limited amount of sediments in the MDZ will occur via construction works, none of these sediments are known to have high levels of contaminants.

868. During construction there is the potential for changes in water quality as a result of accidental discharge and spillage of oils, fuels and materials. However, Menter Môn is committed to the use of best practice and pollution prevention guidelines at all times. An Marine Pollution Contingency Plan (MPCP) would be in place and agreed with NRW in line with the Integrated Pollution Prevention and Control (IPPC) Directive such that any potential risk is minimised. Any permitted discharges would be small volumes, intermittent and dilute and disperse quickly.

869. If any such substances were accidentally released/leaked, quantities would likely be small due to relatively small amounts being present in individual devices. Due to the dynamic nature of the tidal and wave regime in and around the MDZ, lateral and vertical dispersion rates of any spilled substances would be expected to be high.

870. Any potential in changes in marine water quality as a result of sediment re-suspension caused by seabed disturbance; mobilisation of contaminants adsorbed onto potentially re-suspended seabed sediments; and accidental discharge and spillage of oils, fuels and materials are likely to be localised, dispersed quickly, temporary and would have a negligible effect.

871. Therefore, there would be no adverse effect on the integrity of the Pen Llŷn a'r Sarnau/Lleyn Peninsula and the Sarnau SAC in relation to the Conservation Objectives for bottlenose dolphin and grey seal (i.e. Conservation Objective 3: the presence, abundance, condition and diversity of habitats and species required to support these species is such that the distribution, abundance and populations dynamics of the species within the site and population beyond the site is stable or increasing).

8.3.8.2.12. Assessment of Potential Effects of Any Changes in Prey Availability

872. Potential effects on marine mammal prey species during construction, maintenance and repowering activities and decommissioning which could result in changes to prey availability include: underwater noise; barrier effects; collision risk; electromagnetic fields; increased suspended sediment concentrations and sediment re-deposition; physical disturbance and

temporary loss of seabed habitat during construction; and long-term habitat loss via placement of project infrastructure.

873. As outlined in in **Chapter 12, Marine Mammals** (**Volume I** of the ES), underwater noise modelling was conducted for fish at the nearby Wylfa Newydd Development Area for drilling into a hard substrate, cutter-suction dredging as a proxy for cable installation and cable protection, and for large vessels, based on the Popper *et al*. (2014) thresholds and criteria. The results indicated that the potential disturbance of bottlenose dolphin and grey seal as a result of underwater noise (**Section 8.3.8.2.2**) is greater than the maximum area (0.034km^2) of potential changes in prey availability, therefore there would be no further effect as bottlenose dolphin and grey seal would already be disturbed from the area of potential prey displacement.

874. The assessment of underwater noise from operational turbines, in **Chapter 10, Fish and Shellfish Ecology** (**Volume I** of the ES), was based on the modelling conducted for operational noise for the PTEC project. The largest range at which a behavioural reaction was predicted (i.e. levels of 75dB$_{ht}$ are reached) was 36m, for cod species. The largest range at which a startle response was predicted (i.e. levels of 90dB$_{ht}$ are reached) was 3m, also for cod. Again, these ranges are less than those predicted for bottlenose dolphin and grey seal, therefore there will be no further effect as a result of any changes in prey availability due to underwater noise from operational turbines, as bottlenose dolphin and grey seal will be disturbed from the area that any changes in prey distribution could occur.

875. The assessment in **Chapter 10, Fish and Shellfish Ecology** (**Volume I** of the ES), found it unlikely that the presence of the tidal devise and infrastructure, including mooring chains and catenaries, would represent a complete barrier to fish due to the separation distance (70m distance in the shortest dimension) and the space above and below tidal devices in the water column. The assessment also determined that any loss of individuals as a result of collisions with tidal devices, in the context of the total loss of individuals for a population, are considered to be within the natural levels of mortality due to other factors, therefore the magnitude of the effect at a population was considered to be very low/negligible.

876. The assessment in **Chapter 10, Fish and Shellfish Ecology** (**Volume I** of the ES), would have a low, if any effect, on marine mammal prey species. The potential effect of EMF on prey would be the same as those assessed in **Section 8.3.8.2.9**, therefore there would be no further effect on bottlenose dolphin and grey seal as a result of any changes in prey availability due to EMF effects.

877. As outlined in **Section 8.3.2.2.10**, any changes in water quality will be negligible. The assessment in **Chapter 10, Fish and Shellfish Ecology** (**Volume I** of the ES), also determined that the potential effects of increased suspended sediment concentrations and sediment deposition on prey species would be low. The potential area of effect for any changes in water quality would be the same for bottlenose dolphin and grey seal and their prey, therefore there would be no further effect on bottlenose dolphin and grey seal as a result of any changes in prey availability due to changes in water quality.

878. As outlined in **Chapter 10, Fish and Shellfish Ecology** (**Volume I** of the ES), the worst-case scenario for temporary habitat loss during construction could be up to 0.42km^2, based on area

for post-lay burial of cables (27,259m^2), deployment of anchor blocks by barges during cable installation (100,240m^2), deployment of anchor blocks by barges during TEC device installation (248,000m^2) and deployment of anchor blocks by barges during hub installation(48,000m^2).

879. As a worst-case scenario, up to 0.0084 bottlenose dolphin (0.002% of the MU; 0.0025% of the SACs) and 0.07 grey seal (0.0011% of the MU) could be temporarily affected (**Table 8-33**).

880. Therefore, there would be no adverse effect on the integrity of the Pen Llŷn a'r Sarnau/Lleyn Peninsula and the Sarnau SAC in relation to the Conservation Objectives for bottlenose dolphin and grey seal (i.e. Conservation Objective 3: the presence, abundance, condition and diversity of habitats and species required to support these species is such that the distribution, abundance and populations dynamics of the species within the site and population beyond the site is stable or increasing).

881. As outlined in **Chapter 10, Fish and Shellfish Ecology** (**Volume I** of the ES), the worst-case scenario for permanent habitat loss as a result of project infrastructure could be up to 2.18km^2, based on area for Gravity Base Structures (GBS) (74,790m^2), swept area of catenary cables (2,055,000m^2), export cable footprint (cables and protection systems; 11,745m^2), array cable footprint (cables and protection systems; 30,040m^2), additional cable protection material (4,860m^2), cable tails (120m^2), trench for 9 x landfall cables (7,400m^2), footprint of navigation marker buoys (540m^2), footprint of Acoustic Doppler Current Profiler (ADCP) moorings (280m^2), footprint of seabed mounted environmental monitoring units (112m^2) and footprint of mooring for floating environmental monitoring units (45m^2).

882. As a worst-case scenario, up to 0.04 bottlenose dolphin (0.011% of the MU; 0.012% of the SACs) and 0.34 grey seal (0.006% of the MU) could be affected (**Table 8-33**).

883. Therefore, there would be no adverse effect on the integrity of the Pen Llŷn a'r Sarnau/Lleyn Peninsula and the Sarnau SAC in relation to the Conservation Objectives for bottlenose dolphin and grey seal (i.e. Conservation Objective 3: the presence, abundance, condition and diversity of habitats and species required to support these species is such that the distribution, abundance and populations dynamics of the species within the site and population beyond the site is stable or increasing).

Table 8-33 Summary of the maximum areas of possible displacement of bottlenose dolphin and grey seal due to changes in prey availability as a result of temporary and permanent habitat loss

Potential Effect	Temporary habitat loss during construction	Permanent habitat loss
Maximum area of displacement for bottlenose dolphin and grey seal	0.42km^2	2.18km^2
Maximum number of bottlenose dolphin and % of MU and SACs	0.0084 individuals (0.002% of the MU; 0.0025% of the SACs).	0.04 individuals (0.011% of the MU; 0.012% of the SACs).
Maximum number of grey seal and % of MU and SACs	0.07 individuals (0.0011% of the MU).	0.34 individuals (0.006% of the MU).

8.3.8.2.13. Assessment of Potential In-Combination Effects

884. The screening of potential in-combination effects for marine mammals identified a number of plans and projects that were considered to have the potential to have ‘in-combination’ effects for marine mammals with the currently proposed Morlais project (**Table 8-13**).

885. A number of in-combination effects have been identified to have the potential to adversely effect the integrity of SACs in relation to the Conservation Objectives for bottlenose dolphin and grey seal, these include:

- Underwater noise and disturbance (**Table 8-34**);
- Collision risk with tidal devices and vessels (**Table 8-35**); and
- Any changes in prey availability as a result of habitat loss (**Table 8-36**).

886. Any risk of potential auditory injury as a result of underwater noise would be mitigated, as outlined in **Section 8.3.8.2.1**, therefore there would be no potential for any in-combination effects.

887. As outlined in **Section 8.3.8.2.12**, any changes in prey availability as a result of any potential disturbance from underwater noise would be less that areas of potential impact assessed for bottlenose dolphin and grey seal and would therefore have no further potential in-combination effects.

888. There is the no potential for in-combination barrier effects with other projects, based on the location and distances of the projects.

889. There is no potential for any changes to water quality to impact on marine mammal species in and around the MDZ and ECC, therefore there is no potential for any in-combination effects with other projects.

890. There is also no potential for EMF effects to marine mammal species or their prey, so there is no potential for any in-combination effects.

891. As no instances of entanglement with the mooring systems of renewable energy have been recorded, and the constant tension of the mooring line for the Holyhead Deep Phase I, the impact was concluded to be negligible for bottlenose dolphin and grey seal. Taking into account the assessment of potential entanglement at MDZ and the proposed regular maintenance inspections of the lines as well as the ongoing monitoring and mitigation to reduce any collision risk, there is no predicted in-combination effects.

892. To take into account the movement of grey seal and locations of the projects in the in-combination assessment (i.e. not all located in the South and West England and the Wales MU) the in-combination assessments have been put into the context of the 40,233 grey seal in the wider OSPAR region (based on Russell *et al*., 2017).

Table 8-34 Assessment of potential in-combination effects for disturbance of bottlenose dolphin and grey seal from underwater noise (N/A = not available)

Project	Potential in-combination effect	Notes	Maximum number of bottlenose dolphin potentially disturbed	Maximum number of grey seal potentially disturbed
Morlais	Underwater noise and disturbance from installation of tidal devices and hubs (two drilling rigs), two cable laying activities, two cable protection activities and up to 16 vessels, plus operational turbine noise for full deployment (240MW).	See **Section 8.3.8.2.2**	0.008	0.11
Holyhead Deep Phase I[20]	Underwater noise and potential disturbance from vessels during operation and maintenance	Based on assessment in ES for estimated number of animals experiencing behavioural change as a result of the LARS support vessel noise during operation.	0	15
	Underwater noise and potential disturbance from operational turbine	For operational noise impacts, the ES concluded that the disturbance range would be less 1m as a result of noise from the turbines.	0	0
Holyhead Deep Tidal Array – 80MW	Underwater noise and disturbance during installation	Assumed to be the same as assessment in ES for single device that disturbance area could extend out to 375m for pile drilling and out to a maximum of 10,000m for the vibro-hammering. For the installation of one DGU piling activities are likely to be limited to approximately 5 days, the ES concluded that there is likely to be very limited interaction between the piling noise and mammals; any changes would likely be undetectable against natural variation and would have no residual impact at the population level.	1.6	49

[20] https://www.minesto.com/sites/default/files/documents/l100194-s14-eias-001-a01_es_compressed.pdf

Project	Potential in-combination effect	Notes	Maximum number of bottlenose dolphin potentially disturbed	Maximum number of grey seal potentially disturbed
		However, as a worst-case scenario the number of marine mammals in the 10km range (314km² area) has been estimated, based on density estimate in the ES for BND and the MDZ density estimates for GS, and this area would include construction vessels.		
Holyhead Deep Tidal Array – 80MW	Underwater noise and potential disturbance from construction vessels	Assumed to be the same as assessment in ES for single device that disturbance ranges for marine mammals from vessel noise could be 14km for installation / construction vessel (using DP) and up to 4km for support vessels. No numbers of individuals provided in the ES. However, the ES concluded that whilst a small number of individual animals may exhibit some form of change in behaviour for the period in which they encounter sound from the installation or support vessels, this number is likely to be small and the main noise sources present for such a short time that any changes would likely be undetectable against natural variation.	0	0
Holyhead Port Expansion	Underwater noise and disturbance	ES not available at time of writing, therefore, no information available to inform cumulative assessment.	N/A	N/A
Holyhead Waterfront Regeneration	Underwater noise and disturbance	No information available to inform cumulative assessment.	N/A	N/A
Wylfa Nuclear Power Plant	Underwater noise and disturbance during construction	When the predicted effects of the construction works (e.g. two percussive drilling rigs, the disposal of dredged material and disturbance from vessels) are considered together, on a very precautionary basis.	1	4.5
Wylfa Decommissioning	Underwater noise and disturbance	No key significant adverse impacts were identified by the ecological assessment	0	0
Amlwch LNG	Underwater noise and disturbance	No information available to inform cumulative assessment.	N/A	N/A

Project	Potential in-combination effect	Notes	Maximum number of bottlenose dolphin potentially disturbed	Maximum number of grey seal potentially disturbed
North Hoyle Offshore Wind Farm[21]	Underwater noise and disturbance during operation and maintenance activities	Due to the low incidence of individuals in the area, and the pre-existing noisy environment, impacts from underwater noise are not considered to be significant.	0	0
Rhyl Flats Offshore Windfarm	Underwater noise and disturbance during operation and maintenance activities	No information available to inform cumulative assessment.	N/A	N/A
Gwynt y Môr Offshore Wind Farm[22]	Underwater noise and disturbance during operation and maintenance activities	During the operation and maintenance of the Gwynt y Môr Offshore Wind Farm, there is the potential for disturbance as a result of underwater noise from maintenance activities such as cable re-burial and vessels. However, it is likely to be limited to the wind farm site, short-term and temporary, and therefore there would be a negligible impact only.	0	0
Barrow Offshore Wind Farm Operation & Maintenance Activities[23]	Underwater noise and disturbance during operation and maintenance activities	Disturbance and masking effects could occur over the short-term but would be temporary effects only. Given the baseline level of vessel activity in the area, marine mammals will, to some degree, be sensitised to noise from vessels. Therefore, the effects are predicted to be short-term and reversible, with marine mammal activity returning to baseline levels after the vessel has passed / activity ceases. It is considered that there would no additional	0	0

21 https://www.innogy.com/web/cms/mediablob/en/3170702/data/3170690/1/rwe-innogy/rwe-innogy-uk/sites/wind-offshore/in-operation/north-hoyle/environmental-statement/chapter5.pdf

22 https://tethys.pnnl.gov/sites/default/files/publications/Gwynt-y-Mor-Offshore-Wind-Farm-Technical-Report.pdf

23 https://marinelicensing.marinemanagement.org.uk/mmofox5/download/parcel/6gbevdvpjrtve9km9ch4j9ldtss4nd3hapikrj14ukv072rkpk7c1ea2bprufqttfcvbog6qmil4obfptgae6k2c7h4rc8972b5f/cb08835002ff0877454187bec6de5ad5/EOR0680_Barrow+O%2526M+Marine+Licence_Assessment_Rev02_FINAL.pdf?

Project	Potential in-combination effect	Notes	Maximum number of bottlenose dolphin potentially disturbed	Maximum number of grey seal potentially disturbed
		impacts to marine mammals over and above normal shipping activities.		
West of Duddon Sands Offshore Wind Farm Operation & Maintenance Activities[24, 25]	Underwater noise and disturbance during operation and maintenance activities	As above, it is considered that there would no additional impacts to marine mammals over and above normal shipping activities.	0	0
Ormonde Offshore Wind Farm[26]	Underwater noise and disturbance during operation and maintenance activities	As above, it is considered that there would no additional impacts to marine mammals over and above normal shipping activities.	0	0
Walney Extension Offshore Wind Farm[27]	Underwater noise and disturbance during operation and maintenance activities	As noise associated with the WTGs through operation are temporary, of a low level and area localised in nature, the impact was assessed to be negligible. Due to the low level of noise associated with maintenance vessels, and the low level of activity required compared to existing baseline levels, it is considered that there would no additional impacts to marine mammals.	0	0

24 https://marinelicensing.marinemanagement.org.uk/mmofox5/download/parcel/6jpplqea6tc3ulc2c9vb8fm5hqsnjdfc553ajog293hg31acbv426tip6g6gkcanjc2nsjrn9mimli32hb71o5tdu6481e0cgeeg/553dd5a2fac017a8ea96bd524488df58/EOR0680_West+of+Duddon+Sands+O%2526M+Marine+Licence_Assessment_Rev02_FINAL.pdf?

25 https://marinelicensing.marinemanagement.org.uk/mmofox5/download/parcel/i0ft2qro0mii4uff5o4j377070dp4n6c9bmqu14gd2bqfnfodbv5oibvjarpscvnn3n94632mbsu97jkhnsjenuirkgqkv66k9m4/0fc03a8dc4bf2a5f7a97cb89855f8a53/EOR0709_WDS+OFTO+O%2526M+Marine+Licence_Assessment_Rev02.pdf?

26 https://marinelicensing.marinemanagement.org.uk/mmofox5/download/parcel/ejvk69u43qab71irh09f3373dah9h9cd4bhiqa44ts4k2v9bh3jp2ure0m31ng39i57jbdd8172dpmmk4k9egn262qtaroedqfc4/6b6d14cb74d569561df1a3e0b74a882c/EOR0682_Ormonde+O%2526M+Marine+Licence_Assessment_Rev02_FINAL.pdf?

27 https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010027/EN010027-000266-10.1.12%20ES%20Ch%2012%20Marine%20Mammals.pdf

Project	Potential in-combination effect	Notes	Maximum number of bottlenose dolphin potentially disturbed	Maximum number of grey seal potentially disturbed
Burbo Bank Extension Offshore Wind Farm[28]	Underwater noise and disturbance during operation and maintenance activities	Impacts associated with turbine operating noise are considered to be direct and continuous. It is predicted that marine mammals will quickly habituate to the presence of turbines in the water, and that there will be sufficient distance between turbines to allow movement between foundations. The impact is therefore considered to be of neutral significance.	0	0
Codling Wind Park	Underwater noise and disturbance	No information available to inform assessment.	N/A	N/A
Codling Wind Park Extension.	Underwater noise and disturbance	No information available to inform assessment.	N/A	N/A
Alexandra Basin Redevelopment Project[29]	Underwater noise and disturbance	The proposed piling and dredging in Dublin Port; dredging works within Dublin bay; and dumping of dredged material the west of the Burford Bank has been assessed to be unlikely to have an effect on marine mammals. It is likely that individual marine mammals entering the works area will be affected by acoustic disturbance resulting from noise and boat activity associated with demolition works, piling, dredging, and dumping. With mitigation measures, it was concluded that there will be no significant impacts of the proposed development on marine mammals.	0	0

[28] https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010026/EN010026-000365-5.1.2.14%20Marine%20Mammals.pdf
[29] http://dublinportabr.ie/wp-content/uploads/2014/03/ABR-Project-March-2014-EIS-Volume-1.pdf

Project	Potential in-combination effect	Notes	Maximum number of bottlenose dolphin potentially disturbed	Maximum number of grey seal potentially disturbed
Isle of Man Ferry Terminal[30]	Underwater noise and disturbance	Underwater noise from the construction of the ferry terminal (from piling) could cause behavioural effects in seals, harbour porpoise and dolphin species. It is expected that these noise levels would attenuate quickly from source. Given that only three piles are to be installed, the rapid attenuation of the noise, and therefore the impact is considered to be temporary, local and of minor significance. The only additional vessel movements through the operational phase would be the occasional maintenance dredging vessel. No additional vessel movements are expected at the new ferry terminal above current levels. Based on these considerations, the impact is expected to be temporary, local and of negligible significance.	0	0
Milford Haven, Maintenance Dredge Pembrokeshire	Underwater noise and disturbance	No information available to inform assessment.	N/A	N/A
Afon Dysynni outfall gravel removal and relocation	Underwater noise and disturbance	No information available to inform assessment.	N/A	N/A
Belfast Harbour D3 terminal cruise ship facility[31]	Underwater noise and disturbance	Only grey and harbour seal were considered within this assessment and this project is	N/A	N/A

30 https://marinelicensing.marinemanagement.org.uk/mmofox5/download/parcel/fl5r1i6hjphn6nupqhk05qb2l5s7dn77nl89bcpusov36jrpqouns7uq9el2o111je4vkmu1ep7kvpc553h8qv8kmiein9gtjh4i/7f19880e35eb2a9216475d2b17aae95e/Isle+of+Man+Ferry+Terminal+ES+-+Vol+1+-+Main+Text+Part+2+%2528Jan+2019%2529.pdf?
31 Available for download from: http://epicpublic.planningni.gov.uk/publicaccess/applicationDetails.do?activeTab=summary&keyVal=O3IS1ISV30000

Project	Potential in-combination effect	Notes	Maximum number of bottlenose dolphin potentially disturbed	Maximum number of grey seal potentially disturbed
		within a different MU. Therefore, no potential for cumulative impacts.		
Disposal of dredge material from the D3 approach channel	Underwater noise and disturbance	No information available to inform assessment.	N/A	N/A
Marine Energy Wales marine testing area	Underwater noise and disturbance	No information available to inform assessment.	N/A	N/A
Argyll Tidal Demonstration[32]	Underwater noise and disturbance	Not in bottlenose dolphin MU, but in grey seal OSPAR region. Disturbance during construction would be caused by vessels and drilling (if required) of foundations. Any drilling activities may cause avoidance behaviour if individuals are within a few metres of the drilling activity. Marine mammal numbers in the area are low and the site is predominantly used for transit. The overall impact of disturbance due to construction activity was assessed as being negligible to minor. Operational tidal devices can emit low levels of noise. However, considering that marine mammals have the capacity to avoid, adapt to, accommodate and recover from the impact of noise, and the indications of low levels of effect from the monitoring at Strangford Lough tidal turbine, the impact was assessed as negligible.	-	0

[32] http://www.nautricity.com/docs/014_036__argylltidal_environmentalappraisal_dec13_lores3_1392661149.pdf

Project	Potential in-combination effect	Notes	Maximum number of bottlenose dolphin potentially disturbed	Maximum number of grey seal potentially disturbed
Sound of Islay Demonstration Site[33]	Underwater noise and disturbance	Not in bottlenose dolphin MU, but in grey seal OSPAR region. Due to the number of vessels already using the area, and the limited duration over which increased levels of construction vessel activity will occur, as well as the existing levels of background noise, the impact is expected to be relatively low. A negligible magnitude is predicted for construction noise, with no measurable response or change anticipated. During operation, the Islands of Islay and Jura will have a shielding effect on noise levels and is not likely to travel out of the Sound. Data from other tidal projects has not shown any significant effect on the activity of marine mammals in the area. With regard to maintenance activities, it is expected that marine mammals in the area will be accustomed to vessel noise. Noise effects from maintenance vessels (if any) are expected to be both short term, limited in scale and transitory. Based on levels of existing noise and the limited scale of potential noise impacts, operational noise is predicted to be limited.	-	0
West of Islay Tidal Energy Park[34]	Underwater noise and disturbance	Not in bottlenose dolphin MU, but in grey seal OSPAR region. Disturbance from underwater noise was assessed as negligible or minor.	-	0

[33] http://marine.gov.scot/datafiles/lot/So_Islay_Tidal/2014_Application/Environmental%20Report/Volume%201_%202010%20Sound%20of%20Islay%20Environmental%20Statement.pdf
[34] https://www2.gov.scot/Topics/marine/Licensing/marine/scoping/DPMarineEnergy

Project	Potential in-combination effect	Notes	Maximum number of bottlenose dolphin potentially disturbed	Maximum number of grey seal potentially disturbed
Enlli Tidal Energy Scheme, Bardsey Island	Underwater noise and disturbance	No information available to inform assessment.	N/A	N/A
Overall In-Combination Effects (maximum number of individuals potentially disturbed)			**Up to 3**	**Up to 69**
Percentage of MU and percentage of SACs			**0.75% of MU 0.9% of SACs**	**0.2% of OSPAR MU**

Table 8-35 Assessment for potential in-combination effects for collision risk of bottlenose dolphin and grey seal with tidal devices and vessels (N/A = not available)

Project	Potential In-Combination Effect	Notes	Maximum number of bottlenose dolphin at increased collision risk	Maximum number of grey seal at increased collision risk
Morlais	Collision risk with tidal devices	Collision risk for one dolphin scenarios (ERM and CRM) – see **Table 8-29** and **Table 8-30**	0.99	5
	Collision risk with vessels	Increased collision risk with vessels (5-10% of individuals in total area; 15.09km^2) - see **Table 8-31**	0.015-0.031	0.117-0.237
Holyhead Deep Phase I	Collision risk with tidal devices	In the ES for a single device, physical interaction with the DGU was considered low on the basis that the number of passages of animals through the area required to bring about population level effects is beyond that which the baseline data suggests is feasible. No values for the collision risk of individuals for each species was provided, just passage rates through swept area for the device.	N/A	N/A
	Collision risk from vessels	The operation and maintenance activities will not involve significant numbers of vessels and therefore it is not considered that there would be any additional impacts to marine mammals over and above normal shipping activities and extremely unlikely that vessel collision will occur.	0	0
Holyhead Deep Tidal Array – 80MW	Collision risk with tidal devices	Scoping report only, therefore no assessments currently available. However, if assume same approach as used for Morlais that 1st phase would be used to monitor any collision risk and that development of next phases would be based on adequate mitigation and therefore no increased collision risk.	N/A 0	N/A 0

Project	Potential In-Combination Effect	Notes	Maximum number of bottlenose dolphin at increased collision risk	Maximum number of grey seal at increased collision risk
	Collision risk with vessels	Scoping report only, therefore no assessments currently available. However, estimate has been based on AfL area of 9.1km^2, 0.0052/km^2 density estimate for bottlenose dolphin based on ES and 0.155/km^2 for grey seal based on MDZ and increased collision risk of 5-10% of individuals in total area.	N/A 0.0025-0.05	N/A 0.65-1.3
Holyhead Port Expansion	Collision risk with vessels	ES not available at time of writing, therefore, no information available to inform cumulative assessment.	N/A	N/A
Holyhead Waterfront Regeneration	Collision risk with vessels	No information available to inform cumulative assessment.	N/A	N/A
Wylfa Nuclear Power Plant	Collision risk with vessels	Very precautionary assessment based on the Wylfa Newydd Development Area, the Disposal Site plus 100m buffer and 1km wide vessel route between the two sites.	0.75	0.3
Wylfa Decommissioning	Collision risk with vessels	No key significant adverse impacts were identified by the ecological assessment, most of work would be done on land.	0	0
Amlwch LNG	Collision risk with vessels	No information available to inform cumulative assessment.	N/A	N/A
Rhyl Flats Offshore Windfarm	Collision risk with vessels	No information available to inform cumulative assessment.	N/A	N/A
Gwynt y Môr Offshore Wind Farm	Collision risk with vessels	Due to the existing high levels of vessel traffic in the area, and the natural avoidance behaviours of marine mammals, the impact of increased collision risk is low. Therefore, it is not considered that there would be any additional impacts to marine mammals over and above normal shipping activities and extremely unlikely that any vessel collision will occur.	0	0
Barrow Offshore Wind Farm Operation & Maintenance Activities	Collision risk with vessels	Collision risk could occur over short-term events, however the risk will be reduced immediately after a vessel has passed by the marine mammal receptor. Marine mammals will, to some extent, be sensitised to vessel movements due to the existing levels in the area. Therefore, it is not considered that there would be any additional impacts to marine mammals over and above normal shipping activities and extremely unlikely that any vessel collision will occur.	0	0
West of Duddon Sands Offshore Wind Farm Operation &	Collision risk with vessels	As above, therefore, it is not considered that there would be any additional impacts to marine mammals over and above normal shipping activities and extremely unlikely that any vessel collision will occur.	0	0

Project	Potential In-Combination Effect	Notes	Maximum number of bottlenose dolphin at increased collision risk	Maximum number of grey seal at increased collision risk
Maintenance Activities				
Ormonde Offshore Wind Farm	Collision risk with vessels	As above, therefore, it is not considered that there would be any additional impacts to marine mammals over and above normal shipping activities and extremely unlikely that any vessel collision will occur.	0	0
Walney Extension Offshore Wind Farm	Collision risk with vessels	As above, therefore, it is not considered that there would be any additional impacts to marine mammals over and above normal shipping activities and extremely unlikely that any vessel collision will occur.	0	0
Burbo Bank Extension Offshore Wind Farm	Collision risk with vessels	It is considered unlikely that vessel use during the operational phase of the wind farm for maintenance activities will significantly increase the number of vessels already utilising the Liverpool Bay area. Impacts associated with maintenance vessels are considered to be direct and intermittent. The impact of increased vessel traffic during operation of the offshore wind farm on marine mammals is considered to be probable, of short duration (i.e. only when vessel is present). Therefore, it is not considered that there would be any additional impacts to marine mammals over and above normal shipping activities and extremely unlikely that any vessel collision will occur.	0	0
Codling Wind Park	Collision risk with vessels	No information available to inform assessment.	N/A	N/A
Codling Bank Extension	Collision risk with vessels	No information available to inform assessment.	N/A	N/A
Isle of Man Ferry Terminal	Collision risk with vessels	The vessels involved in the construction phase would be small and once on site are expected to remain relatively stationary. The risk of a collision with marine mammals is considered to be extremely small. As the only increase in vessels at the site is expected to be from occasional maintenance dredging, the potential for increased collision risk through the operation of the Ferry terminal is not expected to be any greater than current shipping activities and it is extremely unlikely that any vessel collision will occur.	0	0
Milford Haven, Maintenance Dredge Pembrokeshire	Collision risk with vessels	No information available to inform assessment.	N/A	N/A
Afon Dysynni outfall gravel removal and relocation	Collision risk with vessels	No information available to inform assessment.	N/A	N/A

Project	Potential In-Combination Effect	Notes	Maximum number of bottlenose dolphin at increased collision risk	Maximum number of grey seal at increased collision risk
Belfast Harbour D3 terminal cruise ship facility	Collision risk with vessels	The probability of a collision occurring is considered to be low as, while collision incidents have been recorded in the UK and Ireland, they are generally considered to be a rare occurrence. In addition, construction activities are only short term and temporary. The conclusion is that there would be a negligible impact on marine mammal species.	0	0
Marine Energy Wales marine testing area	Collision risk with tidal devices	Scoping. No information available to inform assessment.	N/A	N/A
	Collision risk with vessels		N/A	N/A
Argyll Tidal Demonstration	Collision risk with tidal devices	Not in bottlenose dolphin MU, but in grey seal OSPAR region. Based on a modelling of other tidal arrays which assessed the impact of collision risk to be negligible for cetaceans, the impact of collision on marine mammal populations can also be assessed as negligible for this project. No values for the collision risk of individuals for each species was provided. Common dolphin was the only species within the same MU as Morlais and assessed as part of this project.	-	-
	Collision risk with vessels	Not in bottlenose dolphin MU, but in grey seal OSPAR region. Construction vessels are likely to be moving slowly, indicating a lower collision risk than from other vessels already in the area. The risk of collision is considered to be low as numbers of individuals in the area are low, and construction activities would be expected to require only a short period of activity. Common dolphin was the only species within the same MU as Morlais and assessed as part of this project.	-	-
Sound of Islay Demonstration Site	Collision risk with tidal devices	Not in bottlenose dolphin MU, but in grey seal OSPAR region. The noise generated by the devices during operation could be detected up to a distance of between 20 and 400m and is expected to alert mammals to the presence of the devices when they are operating at full power and enable avoidance measures to be taken. This, along with the environmental awareness and manoeuvrability of marine mammals, the relatively slow movement of the rotors on each device, are all a factor in the impact assessment. No values for the collision risk of individuals for each species was provided.	-	-
	Collision risk with vessels	Not in bottlenose dolphin MU, but in grey seal OSPAR region.	-	-

Project	Potential In-Combination Effect	Notes	Maximum number of bottlenose dolphin at increased collision risk	Maximum number of grey seal at increased collision risk
		Based on existing levels of vessel activity in the area, the limited scale and timeframe for installation, as well as the lack of any evidence of collision risk from other tidal turbine installation works, impact is therefore predicted to be minor. No values for the collision risk of individuals for each species was provided.		
West of Islay Tidal Energy Park	Collision risk with tidal devices	Not in bottlenose dolphin MU, but in grey seal OSPAR region. Assessment of possible collision risk used a 3-dimensional model for estimating encounter rates between marine mammals and tidal turbines. Estimated number of collision for 30 rotors per year, based on 97% avoidance.	-	17
	Collision risk with vessels	Not in bottlenose dolphin MU, but in grey seal OSPAR region. Collision risk with vessels was assessed as negligible	-	0
Enlli Tidal Energy Scheme, Bardsey Island	Collision risk with tidal devices	No information available to inform assessment.	N/A	N/A
	Collision risk with vessels	No information available to inform assessment.	N/A	N/A
Overall In-Combination Effect (maximum number of individuals at possible risk)			**Up to 1.8**	**Up to 24**
Percentage of MU and percentage of SACs			**0.45% of MU 0.55% of SACs**	**0.06% of OSPAR MU**

Table 8-36 Assessment of potential in-combination effects for displacement of bottlenose dolphin and grey seal as a result of changes in prey availability from habitat loss (N/A = not available)

Project	Notes	Maximum number of bottlenose dolphin potentially displaced	Maximum number of grey seal potentially displaced
Morlais	The worst-case scenario for permanent habitat loss would be up to 2.18km^2 (see **Section 8.3.8.2.12**).	0.04	0.34
Holyhead Deep Tidal Array – 80MW	Scoping report only, therefore no assessments currently available. However, the Holyhead Deep tidal development area is 9.1km^2, therefore this area has been used as a worst-case scenario with the density estimates for the MDZ.	0.2	1.4
Holyhead Port Expansion	ES not available at time of writing, therefore, no information available to inform cumulative assessment.	N/A	N/A

Project	Notes	Maximum number of bottlenose dolphin potentially displaced	Maximum number of grey seal potentially displaced
Holyhead Waterfront Regeneration	No information available to inform cumulative assessment.	N/A	N/A
Wylfa Nuclear Power Plant	Based on a precautionary approach, the marine area of the Wylfa Newydd Development Area (approximately 0.35km^2) and Disposal Site including a 100m buffer (approximately 0.65km^2), could experience a potential change or loss of habitat (1km^2).	0.34	0.16
Milford Haven, Maintenance Dredge Pembrokeshire	No information available to inform assessment.	N/A	N/A
Afon Dysynni outfall gravel removal and relocation	No information available to inform assessment.	N/A	N/A
Enlli Tidal Energy Scheme, Bardsey Island	No information available to inform assessment.	N/A	N/A
Overall In-Combination Effects (maximum number of individuals potentially displaced and maximum area in SAC)		**Up to 0.6**	**Up to 2**
Percentage of MU and percentage of SACs		**0.15% of MU 0.18% of SACs**	**0.005% of OSPAR MU**

893. As a worst-case scenario, up to 3 bottlenose dolphin (0.75% of MU; 0.9% of SACs) and up to 69 grey seal (0.2% of OSPAR MU) could potentially be disturbed as a result of in-combination effects (**Table 8-34**).

894. Therefore, there would be no adverse effect on the integrity of the Pen Llŷn a'r Sarnau/Lleyn Peninsula and the Sarnau SAC in relation to the Conservation Objectives for bottlenose dolphin and grey seal (i.e. Conservation Objective 2: the species population within the site is such that the natural range of the population is not being reduced or likely to be reduced for the foreseeable future).

895. As a worst-case scenario the maximum potential collision risk has been estimated as up to 1.8 bottlenose dolphin (0.45% of the MU; 0.55% of the SACs) and up to 24 grey seal (0.06% of the OSPAR MU) (**Table 8-35**). However, the collision risk assessments have been based on the worst-case scenarios, assumes that all encounter or collisions would be fatal. Taking this into account, along with the proposed mitigation and monitoring (**Section 8.3.8.2.4.1**), it is therefore unlikely that the potential collision risk would result in any significant population effects.

896. The potential population level effects of collision risk with operational tidal turbines on marine mammals have been assessed in **Appendix 12.2** (**Volume III**) of the ES. The result of the PVA for bottlenose dolphin indicate that population trajectories of the baseline and collision risk scenarios of 1, 2 and 3 animals are very similar, with only a potential for a decline when more than three adults per year are removed from the population of 397 bottlenose dolphins in the Irish Sea MU or 330 bottlenose dolphin in the SACs. The result of the PVA for grey seal indicate that the population trajectories of the baseline and all modelled collision scenarios (2, 3, 14, 34, 81 and 85 individuals per year) are very similar, showing an increasing population with a stochastic growth rate of 0.05 for all for MU population of 6,000 grey seal.

897. The proposed mitigation would significantly reduce the potential collision risk, therefore, therefore, there would be no adverse effect on the integrity of the Pen Llŷn a'r Sarnau/Lleyn Peninsula and the Sarnau SAC in relation to the Conservation Objectives for bottlenose dolphin and grey seal (i.e. Conservation Objective 1: the populations are maintained on a long-term basis as a viable component of its natural habitat).

898. As a worst-case scenario, up to 0.6 bottlenose dolphin (0.15% of the MU; 0.18% of the SACs) and up to 2 grey seal (0.005% of the OSPAR MU) could potentially be displaced as a result of in-combination effects for any changes in prey availability as a result of habitat loss (**Table 8-36**).

899. Therefore, there would be no adverse effect on the integrity of the Pen Llŷn a'r Sarnau/Lleyn Peninsula and the Sarnau SAC in relation to the Conservation Objectives for bottlenose dolphin and grey seal (i.e. Conservation Objective 3: the presence, abundance, condition and diversity of habitats and species required to support these species is such that the distribution, abundance and populations dynamics of the species within the site and population beyond the site is stable or increasing).

8.3.9. Bae Ceredigion/Cardigan Bay SAC

900. The Bae Ceredigion/Cardigan Bay SAC site covers an area of 960km^2, covering an area to the southern extent of Cardigan Bay off the Ceredigion and north Pembrokeshire coastlines extending approximately 12 miles offshore, with 99.5% of the SAC comprising of marine areas and inlets, with a small area of shingle ridges and sea cliffs (CCW, 2009b; NRW, 2018a).

901. Sediments present at the site range from highly homogenous sands to well mixed muddy gravels, pebbles and cobble. The site is relatively shallow, only reaching water depths of 50m in the outer parts of the Bay towards St Georges Channel, with the majority of the SAC being less than 30m in depth. Mean spring tides range from 4-5m with generally low tidal currents of less than 0.9m/s (CCW, 2009b; NRW, 2018a).

902. The Bae Ceredigion/Cardigan Bay SAC site was primarily designated for the bottlenose dolphin, with grey seal listed as a qualifying feature, alongside river lamprey *Lampetra fluviatilis* and sea lamprey *Petromyzon marinus* and three Annex 1 habitats; sandbanks which are slightly covered by seawater all the time, reefs and submerged or partially submerged sea caves (NRW, 2018a).

903. Cardigan Bay forms one of the biggest resident populations of bottlenose dolphins in the UK, alongside the Moray Firth. Bottlenose dolphins are seen year-round within the Bae Ceredigion/Cardigan Bay SAC, numbers increase during summer months, peaking in late September and October when large groups can be seen. Calving of bottlenose dolphins is known to occur in the site, with very young calves reported in Cardigan Bay from April to September (NRW, 2018a).

904. Recent analysis shows that nearly 30% of individuals have been identified in both Cardigan Bay SAC and Pen Llŷn a'r Sarnau SAC as well as north of the Lleyn Peninsula around the Isle of Anglesey, indicating large home ranges that most probably extend to the northern Irish Sea and maybe beyond. However, a proportion of the population shows a more local residency pattern, with relatively small home ranges (NRW, 2018a).

905. The Bae Ceredigion/ Cardigan Bay SAC and Pen Llŷn a'r Sarnau/Lleyn Peninsula and the Sarnau SAC should be considered together due to the strong connectivity between the two. It was estimated in 2007 that there were 397 individuals within the Bae Ceredigion/Cardigan Bay SAC for the period 2001-2007 (CCW, 2009b). More recent population estimates for the wider Cardigan Bay vary between 254 and 330 animals (CV = 0.25 – 0.28) for the years 2011 and 2013 inclusive (Feingold and Evans, 2014).

906. Bae Ceredigion/Cardigan Bay SAC and the MDZ are located within the Irish Sea MU for bottlenose dolphin. The Irish Sea MU has an estimated bottlenose dolphin abundance of 397 (CV = 0.23; 95% CI = 362-414; IAMMWG, 2015).

907. Grey seals present within the Bae Ceredigion/Cardigan Bay SAC at any one time do not form a discrete population, but are centred (in terms of abundance) on Cardigan Bay and are considered part of the SW England and Wales management unit (IAMMWG, 2013; NRW, 2018a). This population itself is not isolated but extends from SW Scotland to SW England and SE Ireland (individuals have been photographically recaptured among these regions (e.g. Keily *et al*. (2000)) and there are movements and exchanges with more distant populations (for

example, satellite tracked individuals have been tracked to/from France, west coast of Scotland and Ireland (Cronin (2011)) (NRW, 2018a).

908. Bae Ceredigion/Cardigan Bay SAC is located within the West England and Wales MU for grey seal (IAMMWG, 2013). The South and West England and Wales MU has an estimated summer population size of 6,000 (SCOS, 2017).

909. The MDZ is located 100km from the Bae Ceredigion/Cardigan Bay SAC. Therefore, there is no direct effect within the SAC area. However, there is the potential to affect bottlenose dolphin and grey seal from the Bae Ceredigion/Cardigan Bay SAC if they are foraging or moving through the MDZ.

910. The Conservation Objectives for bottlenose dolphin and grey seal at the Bae Ceredigion/Cardigan Bay SAC (NRW, 2018a) are the same as those for the Pen Llŷn a'r Sarnau/Lleyn Peninsula and the Sarnau SAC (**Section 8.3.8.1** and **Table 8-25**). In summary the Conservation Objectives for bottlenose dolphin and grey seal at the Bae Ceredigion/Cardigan Bay SAC are:

1. The populations are maintained on a long-term basis as a viable component of its natural habitat.
2. The species population within the site is such that the natural range of the population is not being reduced or likely to be reduced for the foreseeable future.
3. The presence, abundance, condition and diversity of habitats and species required to support this species is such that the distribution, abundance and populations dynamics of the species within the site and population beyond the site is stable or increasing.

911. The assessments for bottlenose dolphin have been put into the context of the Irish Sea MU and the population estimate of 330 dolphins for the Cardigan Bay area, which contains the Pen Llŷn a'r Sarnau/Lleyn Peninsula and the Sarnau SAC and Bae Ceredigion/Cardigan Bay SAC.

912. To take into account the range of bottlenose dolphin from Anglesey to Cardigan Bay, including the Cardigan Bay SAC and Lleyn Peninsula SAC, the density estimate has been based on 330 dolphins in an area of 16,098km^2 (see **Chapter 12, Marine Mammals** of the ES. For the assessments, the density estimate of 0.02 bottlenose dolphin per km^2 has been used. This was agreed with NRW at the 2nd marine mammal TWG meeting on the 19th February 2019.

913. To take into account the movement of grey seal and that grey seal in the Pen Llyn a'r Sarnau/Lleyn Peninsula and Sarnau SAC and Bae Ceredigion/Cardigan Bay SAC are part of the wider population the assessments have been put into the context of the South and West England and the Wales MU of 6,000 grey seal (IAMMWG, 2013; SCOS, 2018).

914. SMRU has produced maps of grey seal distribution in UK waters (Russell *et al.*, 2017). The grey seal density estimate of 0.155 per km^2 for the MDZ has been calculated from the seal density maps (see **Chapter 12, Marine Mammals** of the ES, based on the highest density estimate for the grid squares within 2km of the area.

915. There is currently insufficient data from the site-specific surveys to provide robust density estimates, therefore the latest seal at sea density maps (Russell *et al*., 2017) have been used to estimate the density of grey seal for the MDZ. This was agreed with NRW at the 2nd marine mammal TWG meeting on the 19th February 2019.

8.3.9.1. Assessment of Potential Effects

916. The assessment of the potential effects of the project alone for the Pen Llyn a'r Sarnau/Lleyn Peninsula and Sarnau SAC (**Section 8.3.8**) are the same for the potential effects on the Bae Ceredigion/Cardigan Bay SAC. The potential effects of the project alone are summarised and assessed in relation to the Conservation Objectives for the Bae Ceredigion/Cardigan Bay SAC in **Table 8-37**.

917. Therefore, there would be no adverse effect on the integrity of the Bae Ceredigion/Cardigan Bay SAC in relation to the Conservation Objectives for bottlenose dolphin and grey seal (**Table 8-37**).

Table 8-37 Summary of the potential effects of the project alone on bottlenose dolphin and grey seal in relation to the Conservation Objectives for the Bae Ceredigion/Cardigan Bay SAC

Potential Effect	Maximum number of bottlenose dolphin (% of MU and SACs)	Maximum number of grey seal (% of MU)	Assessment in relation to the Conservation Objectives for the SAC
Underwater noise and risk of auditory injury (PTS) – see Section 8.3.8.2.1	0.0024 individuals (0.0006% of the MU; 0.0007% of the SACs).	0.019 individuals 0.0003% of the MU).	The MMMP(s) will reduce the risk of permanent auditory injury as a result of underwater noise at the MDZ, therefore, there would be no adverse effect on the integrity of the SAC in relation to the conservation objectives for bottlenose dolphin and grey seal (i.e. Conservation Objective 1: the populations are maintained on a long-term basis as a viable component of its natural habitat).
Underwater noise and disturbance – see Section 8.3.8.2.2	0.008 individuals (0.002% of the MU and the SACs)	0.11 individuals (0.0018% of MU)	There would be no significant disturbance, therefore, there would be no adverse effect on the integrity of the SAC in relation to the conservation objectives for bottlenose dolphin and grey seal (i.e. Conservation Objective 2: the species population within the site is such that the natural range of the population is not being reduced or likely to be reduced for the foreseeable future).
Disturbance from ADDs – see Section 8.3.8.2.3	2 individuals (0.5% of the MU; 0.6% of the SACs).	16 individuals (0.3% of the MU).	There would be no significant disturbance as ADD activation would be limited to 20 minutes and when needed, therefore, there would be no adverse effect on the integrity of the SAC in relation to the conservation objectives for bottlenose dolphin and grey seal (i.e. Conservation Objective 2: the species population within the site is such that the natural range of the population is not being reduced or likely to be reduced for the foreseeable future).
Collision risk with tidal devices and vessels – see Section 8.3.8.2.6	Up to 1 individual (0.25% of MU; 0.3% of the SACs)	Up to 5 grey seal (0.08% of MU).	Taking into account the proposed phased deployment, monitoring and mitigation, there would be no adverse effect on the integrity of SAC in relation to the conservation objectives for bottlenose dolphin and grey seal (i.e. Conservation Objective 1: the populations are maintained on a long-term basis as a viable component of its natural habitat).

Potential Effect	Maximum number of bottlenose dolphin (% of MU and SACs)	Maximum number of grey seal (% of MU)	Assessment in relation to the Conservation Objectives for the SAC
Entanglement with Mooring Lines - see Section 8.3.8.2.7	0	0	To date, there have been no recorded instances of marine mammal entanglement from mooring systems of renewable devices. The tidal devices and moorings would be regular checked, this would ensure that there was no material such as discarded nets, ropes or other debris which could increase the risk of entanglement. The mitigation and monitoring measures to reduce the risk of collision with operational turbines would also reduce the risk of entablement with mooring lines. Therefore, there would be no adverse effect on the integrity of the SAC in relation to the conservation objectives for bottlenose dolphin and grey seal (i.e. Conservation Objective 1: the populations are maintained on a long-term basis as a viable component of its natural habitat).
Barrier effects - see Section 8.3.8.2.8	0.25 individuals (0.06% of the MU; 0.1% of the SACs)	2 individuals (0.03% of the MU)	There would be no adverse effect on the integrity of the SAC in relation to the conservation objectives for bottlenose dolphin and grey seal (i.e. Conservation Objective 2: the species population within the site is such that the natural range of the population is not being reduced or likely to be reduced for the foreseeable future).
EMF effects - see Section 8.3.8.2.9	0.001 individuals (0.0002% of the MU; 0.0003% of the SACs)	0.01 individuals (0.0001% of the MU)	There would be no adverse effect on the integrity of the SAC in relation to the conservation objectives for bottlenose dolphin and grey seal (i.e. Conservation Objective 2: the species population within the site is such that the natural range of the population is not being reduced or likely to be reduced for the foreseeable future).
Disturbance at Sea Haul-Out Sites – see Section 8.3.8.2.10	-	0	There would be no adverse effect on the integrity of the SAC in relation to the conservation objectives for grey seal (i.e. Conservation Objective 2: the species population within the site is such that the natural range of the population is not being reduced or likely to be reduced for the foreseeable future).
Changes in water quality – see Section 8.3.8.2.11	0	0	Any potential in changes in marine water quality as a result of sediment re-suspension caused by seabed disturbance; mobilisation of contaminants adsorbed onto potentially re-suspended seabed sediments; and accidental discharge and spillage of oils, fuels and materials are likely to be localised, dispersed quickly, temporary and would have a negligible effect. Therefore, there would be no adverse effect on the integrity of the SAC in relation to the conservation objectives for bottlenose dolphin and grey seal (i.e. Conservation Objective 3: the presence, abundance, condition and diversity of habitats and species required to support these species is such that the distribution, abundance and populations dynamics of the species within the site and population beyond the site is stable or increasing).
Changes in prey availability as a result of habitat loss – see Section 8.3.8.2.12	0.04 individuals (0.011% of the MU; 0.012% of the SACs).	0.34 individuals (0.006% of the MU).	There would be no adverse effect on the integrity of the SAC in relation to the conservation objectives for bottlenose dolphin and grey seal (i.e. Conservation Objective 3: the presence, abundance, condition and diversity of habitats and species required to support these species is such that the distribution, abundance and populations dynamics of the species within the site and population beyond the site is stable or increasing).

918. The assessment of the potential in-combination effects for the Pen Llyn a'r Sarnau/Lleyn Peninsula and Sarnau SAC (**Section 8.3.8.2.13**) are the same for the potential effects on the Bae Ceredigion/Cardigan Bay SAC. The potential in-combination effects are summarised and assessed in relation to the Conservation Objectives for the Bae Ceredigion/Cardigan Bay SAC in **Table 8-38**).

Table 8-38 Summary of the potential in-combination effects on bottlenose dolphin and grey seal in relation to the Conservation Objectives for the Bae Ceredigion/Cardigan Bay SAC

Potential Effect	Maximum number of bottlenose dolphin (% of MU and SACs)	Maximum number of grey seal (% of MU)	Assessment in relation to the Conservation Objectives for the SAC
Underwater noise and disturbance	Up to 3 individuals (0.75% of MU; 0.9% of SACs)	Up to 69 individuals (0.2% of OSPAR MU)	There would be no adverse effect on the integrity of the SAC in relation to the conservation objectives for bottlenose dolphin and grey seal (i.e. Conservation Objective 2: the species population within the site is such that the natural range of the population is not being reduced or likely to be reduced for the foreseeable future).
Collision risk with tidal devices and vessels	Up to 1.8 individuals (0.45% of MU; 0.55% of SACs)	Up to 24 individuals (0.06% of OSPAR MU)	Taking into account the proposed phased deployment, monitoring and mitigation, there would be no adverse effect on the integrity of SAC in relation to the conservation objectives for bottlenose dolphin and grey seal (i.e. Conservation Objective 1: the populations are maintained on a long-term basis as a viable component of its natural habitat).
Changes in prey availability due to habitat loss	Up to 0.6 individuals (0.15% of MU; 0.18% of SACs)	Up to 2 individuals (0.005% of OSPAR MU)	There would be no adverse effect on the integrity of the SAC in relation to the conservation objectives for bottlenose dolphin and grey seal (i.e. Conservation Objective 3: the presence, abundance, condition and diversity of habitats and species required to support these species is such that the distribution, abundance and populations dynamics of the species within the site and population beyond the site is stable or increasing).

8.3.10. Sir Benfro Forol/Pembrokeshire Marine SAC

919. The Sir Benfro Forol/Pembrokeshire Marine SAC site covers an area of approximately 1,380m^2, including areas of the Pembrokeshire coastline and St Brides Bay and includes the islands of Ramsey, Skomer, Grassolm, Skokholm, The Bishops and Clerks and the Smalls, with 96% of the SAC comprising of marine areas and inlets, and 3.8% of tidal areas, estuaries, mud and sand flats and lagoons. Sediments present at the site are wide ranging, from very fine muds, sands and gravels to consolidated and unconsolidated pebbles and cobbles. Mean tides range from 7.8m at Milford Haven to 4.4m in Ramsey Sound with string tidal currents around the islands and islets of up to 10 knots (CCW, 2009c; NRW, 2018b).

920. The site was primarily designated for the Annex I habitats of estuaries, large shallow inlets and bays and reefs, and the Annex II species of grey seal and shore dock. Further, Annex I habitats listed as qualifying features include sandbanks, mud and sand flats, coastal lagoons, salt meadows and sea caves, with qualifying Annex II species listed as sea and river lamprey, allis and twaite shad and otter (CCW, 2009c).

921. Grey seals within the Sir Benfro Forol/Pembrokeshire Marine SAC are not part of a discrete population, but are centred (in terms of abundance) on the Pembrokeshire coast and are considered part of the SW England and Wales management unit (NRW, 2018b). This population itself is not isolated but extends from SW Scotland to SW England and SE Ireland (individuals have been photographically recaptured among these regions (e.g. Keily *et al*. 2000) and there are movements and exchanges with more distant populations (for example, satellite tracked individuals have been tracked to/from France, west coast of Scotland and Ireland (Cronin, 2011)(NRW, 2018b).

922. The Sir Benfro Forol/Pembrokeshire Marine SAC is located within the West England and Wales MU for grey seal (IAMMWG, 2013). The South and West England and Wales MU has an estimated summer population size of 6,000 (SCOS, 2017).

923. The MDZ is located 152km from the Sir Benfro Forol/Pembrokeshire Marine SAC. Therefore, there is no direct effect within the SAC area. However, there is the potential to affect grey seal from the Sir Benfro Forol/Pembrokeshire Marine SAC if they are foraging or moving through the MDZ.

924. The Conservation Objectives for grey seal at the Sir Benfro Forol/Pembrokeshire Marine SAC (NRW, 2018b) are the same as those for the Pen Llŷn a'r Sarnau/Lleyn Peninsula and the Sarnau SAC (**Section 8.3.8.1** and **Table 8-25**). In summary the Conservation Objectives for bottlenose dolphin and grey seal at the Sir Benfro Forol/Pembrokeshire Marine SAC are:

1. The populations are maintained on a long-term basis as a viable component of its natural habitat.
2. The species population within the site is such that the natural range of the population is not being reduced or likely to be reduced for the foreseeable future.
3. The presence, abundance, condition and diversity of habitats and species required to support this species is such that the distribution, abundance and populations dynamics of the species within the site and population beyond the site is stable or increasing.

925. To take into account the movement of grey seal and that grey seal in the Sir Benfro Forol/Pembrokeshire Marine SAC are part of the wider population the assessments have been put into the context of the South and West England and the Wales MU of 6,000 grey seal (IAMMWG, 2013; SCOS, 2018).

926. SMRU has produced maps of grey seal distribution in UK waters (Russell *et al*., 2017). The grey seal density estimate of 0.155 per km^2 for the MDZ has been calculated from the seal density maps (see **Chapter 12, Marine Mammals**, **Volume I** of the ES), based on the highest density estimate for the grid squares within 2km of the area.

927. There is currently insufficient data from the site-specific surveys to provide robust density estimates, therefore the latest seal at sea density maps (Russell *et al*., 2017) have been used to estimate the density of grey seal for the MDZ. This was agreed with NRW at the 2nd marine mammal TWG meeting on the 19th February 2019.

8.3.10.1. Assessment of Potential Effects

928. The assessment of the potential effects of the project alone for the Pen Llyn a'r Sarnau/Lleyn Peninsula and Sarnau SAC (**Section 8.3.8**) are the same for the potential effects on the Sir Benfro Forol/Pembrokeshire Marine SAC. The potential effects of the project alone are summarised and assessed in relation to the Conservation Objectives for the Sir Benfro Forol/Pembrokeshire Marine SAC in **Table 8-39**.

929. Therefore, there would be no adverse effect on the integrity of the Sir Benfro Forol/Pembrokeshire Marine SAC in relation to the Conservation Objectives for grey seal (**Table 8-39**).

Table 8-39 Summary of the potential effects of the project alone on grey seal in relation to the Conservation Objectives for the Sir Benfro Forol/Pembrokeshire Marine SAC

Potential Effect	Maximum number of grey seal (% of MU)	Assessment in relation to the Conservation Objectives for the SAC
Underwater noise and risk of auditory injury (PTS) – see Section 8.3.8.2.1	0.019 individuals 0.0003% of the MU).	The MMMP(s) will reduce the risk of permanent auditory injury as a result of underwater noise at the MDZ, therefore, there would be no adverse effect on the integrity of the SAC in relation to the conservation objectives for grey seal (i.e. Conservation Objective 1: the populations are maintained on a long-term basis as a viable component of its natural habitat).
Underwater noise and disturbance – see Section 8.3.8.2.2	0.11 individuals (0.0018% of MU)	There would be no significant disturbance, therefore, there would be no adverse effect on the integrity of the SAC in relation to the conservation objectives for grey seal (i.e. Conservation Objective 2: the species population within the site is such that the natural range of the population is not being reduced or likely to be reduced for the foreseeable future).
Disturbance from ADDs – see Section 8.3.8.2.3	16 individuals (0.3% of the MU).	There would be no significant disturbance as ADD activation would be limited to 20 minutes and when needed, therefore, there would be no adverse effect on the integrity of the SAC in relation to the conservation objectives for grey seal (i.e. Conservation Objective 2: the species population within the site is such that the natural range of the population is not being reduced or likely to be reduced for the foreseeable future).
Collision risk with tidal devices and vessels – see Section 8.3.8.2.6	Up to 5 grey seal (0.08% of MU).	Taking into account the proposed phased deployment, monitoring and mitigation, there would be no adverse effect on the integrity of SAC in relation to the conservation objectives for grey seal (i.e. Conservation Objective 1: the populations are maintained on a long-term basis as a viable component of its natural habitat).
Entanglement with Mooring Lines - see Section 8.3.8.2.7	0	To date, there have been no recorded instances of marine mammal entanglement from mooring systems of renewable devices. The tidal devices and moorings would be regular checked, this would ensure that there was no material such as discarded nets, ropes or other debris which could increase the risk of entanglement. The mitigation and monitoring measures to reduce the risk of collision with operational turbines would also reduce the risk of entablement with mooring lines. Therefore, there would be no adverse effect on the integrity of the SAC in relation to the conservation objectives for grey seal (i.e. Conservation Objective 1: the populations are maintained on a long-term basis as a viable component of its natural habitat).
Barrier effects - see Section 8.3.8.2.8	2 individuals (0.03% of the MU)	There would be no adverse effect on the integrity of the SAC in relation to the conservation objectives for grey seal (i.e. Conservation Objective 2: the species population within the site is such that the natural range of the population is not being reduced or likely to be reduced for the foreseeable future).
EMF effects - see Section 8.3.8.2.9	0.01 individuals (0.0001% of the MU)	There would be no adverse effect on the integrity of the SAC in relation to the conservation objectives for grey seal (i.e. Conservation Objective 2: the species population within the site is such that the natural range of the

Potential Effect	Maximum number of grey seal (% of MU)	Assessment in relation to the Conservation Objectives for the SAC
		population is not being reduced or likely to be reduced for the foreseeable future).
Disturbance at Sea Haul-Out Sites – see Section 8.3.8.2.10	0	There would be no adverse effect on the integrity of the SAC in relation to the conservation objectives for grey seal (i.e. Conservation Objective 2: the species population within the site is such that the natural range of the population is not being reduced or likely to be reduced for the foreseeable future).
Changes in water quality – see Section 8.3.8.2.11	0	Any potential in changes in marine water quality as a result of sediment re-suspension caused by seabed disturbance; mobilisation of contaminants adsorbed onto potentially re-suspended seabed sediments; and accidental discharge and spillage of oils, fuels and materials are likely to be localised, dispersed quickly, temporary and would have a negligible effect. Therefore, there would be no adverse effect on the integrity of the SAC in relation to the conservation objectives for grey seal (i.e. Conservation Objective 3: the presence, abundance, condition and diversity of habitats and species required to support these species is such that the distribution, abundance and populations dynamics of the species within the site and population beyond the site is stable or increasing).
Changes in prey availability as a result of habitat loss – see Section 8.3.8.2.12	0.34 individuals (0.006% of the MU).	There would be no adverse effect on the integrity of the SAC in relation to the conservation objectives for grey seal (i.e. Conservation Objective 3: the presence, abundance, condition and diversity of habitats and species required to support these species is such that the distribution, abundance and populations dynamics of the species within the site and population beyond the site is stable or increasing).

930. The assessment of the potential in-combination effects for the Pen Llyn a'r Sarnau/Lleyn Peninsula and Sarnau SAC (**Section 8.3.8.2.13**) are the same for the potential effects on the Sir Benfro Forol/Pembrokeshire Marine SAC. The potential in-combination effects are summarised and assessed in relation to the Conservation Objectives for the Sir Benfro Forol/Pembrokeshire Marine SAC in **Table 8-40**.

931. Therefore, there would be no adverse effect on the integrity of the Sir Benfro Forol/Pembrokeshire Marine SAC in relation to the Conservation Objectives for grey seal (**Table 8-40**).

Table 8-40 Summary of the potential in-combination effects on grey seal in relation to the Conservation Objectives for the Sir Benfro Forol/Pembrokeshire Marine SAC

Potential Effect	Maximum number of grey seal (% of MU)	Assessment in relation to the Conservation Objectives for the SAC
Underwater noise and disturbance	Up to 69 individuals (0.2% of OSPAR MU)	There would be no adverse effect on the integrity of the SAC in relation to the conservation objectives for grey seal (i.e. Conservation Objective 2: the species population within the site is such that the natural range of the population is not being reduced or likely to be reduced for the foreseeable future).
Collision risk with tidal devices and vessels	Up to 24 individuals (0.06% of OSPAR MU)	Taking into account the proposed phased deployment, monitoring and mitigation, there would be no adverse effect on the integrity of SAC in relation to the conservation objectives for grey seal (i.e. Conservation Objective 1: the populations are maintained on a long-term basis as a viable component of its natural habitat).
Changes in prey availability due to habitat loss	Up to 2 individuals (0.005% of OSPAR MU)	There would be no adverse effect on the integrity of the SAC in relation to the conservation objectives for grey seal (i.e. Conservation Objective 3: the presence, abundance, condition and diversity of habitats and species required to support these species is such that the distribution, abundance

Potential Effect	Maximum number of grey seal (% of MU)	Assessment in relation to the Conservation Objectives for the SAC
		and populations dynamics of the species within the site and population beyond the site is stable or increasing).

8.3.11. The Maidens SAC

932. The Maidens SAC is a group of rocky reefs detached from the coast, north east of Larne, Northern Ireland. The Maidens SAC covers an area of approximately 75km^2 and is located 185km from the MDZ (DAERA, 2017). The Maidens (or Hulin Rocks) are a group of small rocky reefs either awash or just emergent, two are large enough to be termed islands, East and West Maiden, there are also four other reef areas that form a part of the SAC (DAERA, 2017).

933. The primary reason for the designation of The Maidens as an SAC is for the Annex I Reef habitat; the site is also designated for Annex I Sandbanks slightly covered by sea water all of the time. Annex II Grey seals are not the primary feature of The Maidens SAC. However, these relatively remote rocks, islands and the waters surrounding them in the North Channel are important for providing haul-out sites, resting sites and foraging areas for grey seal. There is a permanent population of grey seal at this site with a population of estimate of between 51 and 100 individuals (DAERA, 2017), with an estimated count of 70 adults recorded in a July 2000 survey. Recent surveys in 2009 confirmed use of the site for both pupping and breeding (DAERA, 2017).

934. The Conservation Objectives for The Maidens SAC (DAERA, 2017) for grey seal are:

- To maintain (or restore where appropriate) the grey seal to favourable condition.
- To maintain (and if feasible enhance) population numbers and the distribution of grey seal.
- To maintain and enhance, as appropriate, physical features used by grey seal within the site.

935. The MDZ is located 185km from The Maidens SAC. Therefore, there is no direct effect within the SAC area. However, there is the potential to affect grey seal from The Maidens SAC if they are foraging or moving through the MDZ.

936. To take into account the movement of grey seal and that grey seal in The Maidens SAC are part of the wider population the assessments have been put into the context of the 40,233 grey seal in the wider OSPAR region (based on Russell *et al*., 2017). The Maidens SAC is not located in the South and West England and the Wales MU and it is highly unlikely that all grey seal in and around the MDZ would be from The Maidens SAC only.

8.3.11.1. Assessment of Potential Effects

937. The assessment of the potential effects of the project alone for the Pen Llyn a'r Sarnau/Lleyn Peninsula and Sarnau SAC (**Section 8.3.8**) are the same for the potential effects on The Maidens SAC. The potential effects of the project alone are summarised and assessed in relation to the Conservation Objectives for The Maidens SAC in **Table 8-41**.

938. Therefore, there would be no adverse effect on the integrity of The Maidens SAC in relation to the Conservation Objectives for grey seal (**Table 8-41**).

Table 8-41 Summary of the potential effects of the project alone on grey seal in relation to the Conservation Objectives for The Maidens SAC

Potential Effect	Maximum number of grey seal (% of OSPAR MU)	Assessment in relation to the Conservation Objectives for the SAC
Underwater noise and risk of auditory injury (PTS) – see Section 8.3.8.2.1	0.019 individuals 0.00005% of OSPAR MU).	The MMMP(s) will reduce the risk of permanent auditory injury as a result of underwater noise at the MDZ, therefore, there would be no adverse effect on the integrity of the SAC in relation to the conservation objectives for grey seal (i.e. to maintain (and if feasible enhance) population numbers and the distribution of grey seal).
Underwater noise and disturbance – see Section 8.3.8.2.2	0.11 individuals (0.0003% of OSPAR MU)	There would be no significant disturbance, therefore, there would be no adverse effect on the integrity of the SAC in relation to the conservation objectives for grey seal (i.e. to maintain (and if feasible enhance) population numbers and the distribution of grey seal).
Disturbance from ADDs – see Section 8.3.8.2.3	16 individuals (0.04% of OSPAR MU).	There would be no significant disturbance as ADD activation would be limited to 20 minutes and when needed, therefore, there would be no adverse effect on the integrity of the SAC in relation to the conservation objectives for grey seal (i.e. to maintain (and if feasible enhance) population numbers and the distribution of grey seal).
Collision risk with tidal devices and vessels – see Section 8.3.8.2.6	Up to 5 grey seal (0.012% of OSPAR MU).	Taking into account the proposed phased deployment, monitoring and mitigation, there would be no adverse effect on the integrity of SAC in relation to the conservation objectives for grey seal (i.e. to maintain (and if feasible enhance) population numbers and the distribution of grey seal).
Entanglement with Mooring Lines - see Section 8.3.8.2.7	0	To date, there have been no recorded instances of marine mammal entanglement from mooring systems of renewable devices. The tidal devices and moorings would be regular checked, this would ensure that there was no material such as discarded nets, ropes or other debris which could increase the risk of entanglement. The mitigation and monitoring measures to reduce the risk of collision with operational turbines would also reduce the risk of entablement with mooring lines. Therefore, there would be no adverse effect on the integrity of the SAC in relation to the conservation objectives for grey seal (i.e. to maintain (and if feasible enhance) population numbers and the distribution of grey seal).
Barrier effects - see Section 8.3.8.2.8	2 individuals (0.005% of OSPAR MU)	There would be no adverse effect on the integrity of the SAC in relation to the conservation objectives for grey seal (i.e. to maintain (and if feasible enhance) population numbers and the distribution of grey seal).
EMF effects - see Section 8.3.8.2.9	0.01 individuals (0.000025% of OSPAR MU)	There would be no adverse effect on the integrity of the SAC in relation to the conservation objectives for grey seal (i.e. to maintain (and if feasible enhance) population numbers and the distribution of grey seal).
Disturbance at Sea Haul-Out Sites – see Section 8.3.8.2.10	0	There would be no adverse effect on the integrity of the SAC in relation to the conservation objectives for grey seal (i.e. to maintain (and if feasible enhance) population numbers and the distribution of grey seal).
Changes in water quality – see Section 8.3.8.2.11	0	Any potential in changes in marine water quality as a result of sediment re-suspension caused by seabed disturbance; mobilisation of contaminants adsorbed onto potentially re-suspended seabed sediments; and accidental discharge and spillage of oils, fuels and materials are likely to be localised, dispersed quickly, temporary and would have a negligible effect. Therefore, there would be no adverse effect on the integrity of the SAC in relation to the conservation objectives for grey seal (i.e. to maintain (and if feasible enhance) population numbers and the distribution of grey seal).
Changes in prey availability as a result of habitat loss – see Section 8.3.8.2.12	0.34 individuals (0.00085% of OSPAR MU).	There would be no adverse effect on the integrity of the SAC in relation to the conservation objectives for grey seal (i.e. to maintain (and if feasible enhance) population numbers and the distribution of grey seal).

939. The assessment of the potential in-combination effects for the Pen Llyn a'r Sarnau/Lleyn Peninsula and Sarnau SAC (**Section 8.3.8.2.13**) are the same for the potential effects on The Maidens SAC. The potential in-combination effects are summarised and assessed in relation to the Conservation Objectives for The Maidens SAC in **Table 8-42**.

940. Therefore, there would be no adverse effect on the integrity of The Maidens SAC in relation to the Conservation Objectives for grey seal (**Table 8-42**).

Table 8-42 Summary of the potential in-combination effects on grey seal in relation to the Conservation Objectives for The Maidens SAC

Potential Effect	Maximum number of grey seal (% of OSPAR MU)	Assessment in relation to the Conservation Objectives for the SAC
Underwater noise and disturbance	Up to 69 individuals (0.2% of OSPAR MU)	There would be no adverse effect on the integrity of the SAC in relation to the conservation objectives for grey seal (i.e. to maintain (and if feasible enhance) population numbers and the distribution of grey seal).
Collision risk with tidal devices and vessels	Up to 24 individuals (0.06% of OSPAR MU)	Taking into account the proposed phased deployment, monitoring and mitigation, there would be no adverse effect on the integrity of SAC in relation to the conservation objectives for grey seal (i.e. to maintain (and if feasible enhance) population numbers and the distribution of grey seal).
Changes in prey availability due to habitat loss	Up to 2 individuals (0.005% of OSPAR MU)	There would be no adverse effect on the integrity of the SAC in relation to the conservation objectives for grey seal (i.e. to maintain (and if feasible enhance) population numbers and the distribution of grey seal).

8.3.12. Lambay Island SAC

941. Lambay Island SAC is located along the east coast of the Republic of Ireland, 85km from the MDZ and covers an area of 4.05km^2. The island is 127m high with steep cliffs to the north, east and south coasts, while the west shore is low-lying and gently slopes upwards (NPWS, 2012b).

942. The Lambay Island SAC is primarily designated for the Annex I habitats of reefs and vegetated sea cliffs, and the Annex II species of both grey and harbour seal (NPWS, 2013b).

943. Lambay Island supports the main breeding colony of grey seal along the east coast of Ireland, with a population of 196-252. There are additionally regionally significant numbers of harbour seal present at the site. Both species of seal occur year round at the site, along the intertidal coasts, coves and caves (NPWS, 2013b).

944. The Conservation Objectives for grey seal and harbour seal at the Lambay Island SAC (NPWS, 2013b) are:

To maintain the favourable conservation condition of grey seal and harbour seal in Lambay Island SAC, which is defined by the following list of attributes and targets:

1. Access to suitable habitat: species range within the site should not be restricted by artificial barriers to site use.

2. Breeding behaviour: The breeding sites should be maintained in a natural condition.

3. Moulting behaviour: The moult haul-out sites should be maintained in a natural condition.

4. Resting behaviour: The resting haul-out sites should be maintained in a natural condition

5. Disturbance: human activities should occur at levels that do not adversely affect the grey seal and harbour seal population at the site.

945. The MDZ is located 85km from the Lambay Island SAC. Therefore, there is no direct effect within the SAC area. However, there is the potential to affect grey and harbour seal from the Lambay Island SAC if they are foraging or moving through the MDZ.

946. To take into account the movement of grey seal and that grey seal in the Lambay Island SAC are part of the wider population the assessments have been put into the context of the 40,233 grey seal in the wider OSPAR region (based on Russell *et al*., 2017). The Maidens SAC is not located in the South and West England and the Wales MU and it is highly unlikely that all grey seal in and around the MDZ would be from the Lambay Island SAC only.

947. To take into account the movement of harbour seal and that harbour seal in the Lambay Island SAC are part of the wider population the assessments have been put into the context of the 31,549 harbour seal in the wider OSPAR region (based on Russell *et al*., 2017).

8.3.12.1. Assessment of Potential Effects

948. The assessment of the potential effects of the project alone for the Pen Llyn a'r Sarnau/Lleyn Peninsula and Sarnau SAC (**Section 8.3.8**) are the same for the potential effects on the Lambay Island SAC. For more details see **Chapter 12, Marine Mammals** of the ES. The potential effects of the project alone are summarised and assessed in relation to the Conservation Objectives for the Lambay Island SAC in **Table 8-43**.

949. Therefore, there would be no adverse effect on the integrity of the Lambay Island SAC in relation to the Conservation Objectives for grey and harbour seal (**Table 8-43**).

Table 8-43 Summary of the potential effects of the project alone on grey and harbour seal in relation to the Conservation Objectives for the Lambay Island SAC

Potential Effect	Maximum number of grey seal (% of OSPAR MU)	Maximum number of harbour seal (% of OSPAR MU)	Assessment in relation to the Conservation Objectives for the SAC
Underwater noise and risk of auditory injury (PTS) – see Section 8.3.8.2.1	0.019 individuals (0.00005% of OSPAR MU).	0.00006 individuals (0.0000002% of OSPAR MU)	The MMMP(s) will reduce the risk of permanent auditory injury as a result of underwater noise at the MDZ, therefore, there would be no adverse effect on the integrity of the SAC in relation to the conservation objectives for grey and harbour seal (i.e. to maintain the favourable conservation condition of grey seal and harbour seal).
Underwater noise and disturbance – see Section 8.3.8.2.2	0.11 individuals (0.0003% of OSPAR MU)	0.0004 individuals (0.000001% of OSPAR MU)	There would be no significant disturbance, therefore, there would be no adverse effect on the integrity of the SAC in relation to the conservation objectives for grey and harbour seal (i.e. to maintain the favourable conservation condition of grey seal and harbour seal).

Potential Effect	Maximum number of grey seal (% of OSPAR MU)	Maximum number of harbour seal (% of OSPAR MU)	Assessment in relation to the Conservation Objectives for the SAC
Disturbance from ADDs – see Section 8.3.8.2.3	16 individuals (0.04% of OSPAR MU).	0.05 individuals (0.0002% of OSPAR MU)	There would be no significant disturbance as ADD activation would be limited to 20 minutes and when needed, therefore, there would be no adverse effect on the integrity of the SAC in relation to the conservation objectives for grey and harbour seal (i.e. to maintain the favourable conservation condition of grey seal and harbour seal).
Collision risk with tidal devices and vessels – see Section 8.3.8.2.6	Up to 5 grey seal (0.012% of OSPAR MU).	Up to 0.01 individuals (0.00003% of OSPAR MU)	Taking into account the proposed phased deployment, monitoring and mitigation, there would be no adverse effect on the integrity of SAC in relation to the conservation objectives for grey and harbour seal (i.e. to maintain the favourable conservation condition of grey seal and harbour seal).
Entanglement with Mooring Lines - see Section 8.3.8.2.7	0	0	To date, there have been no recorded instances of marine mammal entanglement from mooring systems of renewable devices. The tidal devices and moorings would be regular checked, this would ensure that there was no material such as discarded nets, ropes or other debris which could increase the risk of entanglement. The mitigation and monitoring measures to reduce the risk of collision with operational turbines would also reduce the risk of entablement with mooring lines. Therefore, there would be no adverse effect on the integrity of the SAC in relation to the conservation objectives for grey and harbour seal (i.e. to maintain the favourable conservation condition of grey seal and harbour seal).
Barrier effects - see Section 8.3.8.2.8	2 individuals (0.005% of OSPAR)	0.006 individuals (0.00002% of OSPAR MU)	There would be no adverse effect on the integrity of the SAC in relation to the conservation objectives for grey and harbour seal (i.e. to maintain the favourable conservation condition of grey seal and harbour seal).
EMF effects - see Section 8.3.8.2.9	0.01 individuals (0.000025% of OSPAR)	0.00002 individuals (0.00000006% of OSPAR MU)	There would be no adverse effect on the integrity of the SAC in relation to the conservation objectives for grey and harbour seal (i.e. to maintain the favourable conservation condition of grey seal and harbour seal).
Disturbance at Sea Haul-Out Sites – see Section 8.3.8.2.10	0	0	There would be no adverse effect on the integrity of the SAC in relation to the conservation objectives for grey and harbour seal (i.e. to maintain the favourable conservation condition of grey seal and harbour seal).
Changes in water quality – see Section 8.3.8.2.11	0	0	Any potential in changes in marine water quality as a result of sediment re-suspension caused by seabed disturbance; mobilisation of contaminants adsorbed onto potentially re-suspended seabed sediments; and accidental discharge and spillage of oils, fuels and materials are likely to be localised, dispersed quickly, temporary and would have a negligible effect. Therefore, there would be no adverse effect on the integrity of the SAC in relation to the conservation objectives for grey and harbour seal (i.e. to maintain the favourable conservation condition of grey seal and harbour seal).

Potential Effect	Maximum number of grey seal (% of OSPAR MU)	Maximum number of harbour seal (% of OSPAR MU)	Assessment in relation to the Conservation Objectives for the SAC
Changes in prey availability as a result of habitat loss – see Section 8.3.8.2.12	0.34 individuals (0.00085% of OSPAR).	0.001 individuals (0.000003% of OSPAR MU)	There would be no adverse effect on the integrity of the SAC in relation to the conservation objectives for grey and harbour seal (i.e. to maintain the favourable conservation condition of grey seal and harbour seal).

950. The assessment of the potential in-combination effects for the Pen Llyn a'r Sarnau/Lleyn Peninsula and Sarnau SAC (**Section 8.3.8.2.13**) are the same for the potential effects on the Lambay Island SAC. The potential in-combination effects are summarised and assessed in relation to the Conservation Objectives for the Lambay Island SAC in **Table 8-44**.

951. The potential population level effects of collision risk on marine mammals have been assessed in **Appendix 12.2** (**Volume III**) of the ES.

952. Therefore, there would be no adverse effect on the integrity of the Lambay Island SAC in relation to the Conservation Objectives for grey and harbour seal (**Table 8-44**).

Table 8-44 Summary of the potential in-combination effects on grey and harbour seal in relation to the Conservation Objectives for the Lambay Island SAC

Potential Effect	Maximum number of grey seal (% of OSPAR MU)	Maximum number of harbour seal (% of OSPAR MU)	Assessment in relation to the Conservation Objectives for the SAC
Underwater noise and disturbance	Up to 69 individuals (0.2% of OSPAR MU)	Up to 0.2 individuals (0.0006% of OSPAR MU)	There would be no adverse effect on the integrity of the SAC in relation to the conservation objectives for grey and harbour seal (i.e. to maintain the favourable conservation condition of grey seal and harbour seal).
Collision risk with tidal devices and vessels	Up to 24 individuals (0.06% of OSPAR MU)	Up to 15* individuals (0.05% of OSPAR MU)	Taking into account the proposed phased deployment, monitoring and mitigation, there would be no adverse effect on the integrity of SAC in relation to the conservation objectives for grey and harbour seal (i.e. to maintain the favourable conservation condition of grey seal and harbour seal).
Changes in prey availability due to habitat loss	Up to 2 individuals (0.005% of OSPAR MU)	Up to 0.007 individuals (0.00002% of OSPAR MU)	There would be no adverse effect on the integrity of the SAC in relation to the conservation objectives for grey and harbour seal (i.e. to maintain the favourable conservation condition of grey seal and harbour seal).

*14.14 harbour seals form West Islay Tidal Energy Park

8.3.13. Saltee Islands SAC

953. The Saltee Islands SAC is located on the south-east coast of the Republic of Ireland and the site covers an area of approximately 158km^2, comprising of the Saltee Islands and the surrounding marine areas. There are two main islands (Great and Little Saltee) and a number of small islets and rocky outcrops approximately 4- 5km off the Irish coastlines (NPWS, 2011).

954. Annex I habitats listed as primary reasons for designation are tidal mud and sand flats, large shallow inlets and bays, reefs, vegetated sea cliffs and sea caves, as well as the Annex II species grey seal (NPWS, 2011).

955. Great Saltee Island has a breeding colony of grey seal, estimated at 571-744 in 2005, and 246 in 2007 (estimated from a one-off moult count) (NPWS, 2011).

956. The Conservation Objectives for grey seal at the Saltee Islands SAC (NPWS, 2011) are the same as those for the Lambay Island SAC (NPWS, 2013b):

To maintain the favourable conservation condition of grey seal in Saltee Islands SAC, which is defined by the following list of attributes and targets:

1. Access to suitable habitat: species range within the site should not be restricted by artificial barriers to site use.
2. Breeding behaviour: The breeding sites should be maintained in a natural condition.
3. Moulting behaviour: The moult haul-out sites should be maintained in a natural condition.
4. Resting behaviour: The resting haul-out sites should be maintained in a natural condition
5. Disturbance: human activities should occur at levels that do not adversely affect the grey seal and harbour seal population at the site.

957. The MDZ is located 176km from the Saltee Islands SAC. Therefore, there is no direct effect within the SAC area. However, there is the potential to affect grey and harbour seal from the Saltee Islands SAC if they are foraging or moving through the MDZ.

958. To take into account the movement of grey seal and that grey seal in the Saltee Islands SAC are part of the wider population the assessments have been put into the context of the 40,233 grey seal in the wider OSPAR region (based on Russell *et al*., 2017). The Saltee Islands SAC is not located in the South and West England and the Wales MU and it is highly unlikely that all grey seal in and around the MDZ would be from the Saltee Islands SAC only.

8.3.13.1. Assessment of Potential Effects

959. The assessment of the potential effects of the project alone for the Pen Llyn a'r Sarnau/Lleyn Peninsula and Sarnau SAC (**Section 8.3.8**) are the same for the potential effects on the Saltee Islands SAC. The potential effects of the project alone are summarised and assessed in relation to the Conservation Objectives for the Saltee Islands SAC in **Table 8-45**.

960. Therefore, there would be no adverse effect on the integrity of the Saltee Islands SAC in relation to the Conservation Objectives for grey seal (**Table 8-45**).

Table 8-45 Summary of the potential effects of the project alone on grey seal in relation to the Conservation Objectives for the Saltee Islands SAC

Potential Effect	Maximum number of grey seal (% of OSPAR MU)	Assessment in relation to the Conservation Objectives for the SAC
Underwater noise and risk of auditory injury	0.019 individuals (0.00005% of OSPAR MU).	The MMMP(s) will reduce the risk of permanent auditory injury as a result of underwater noise at the MDZ, therefore, there would be no adverse effect on the integrity of the SAC in relation to the conservation objectives

Potential Effect	Maximum number of grey seal (% of OSPAR MU)	Assessment in relation to the Conservation Objectives for the SAC
(PTS) – see Section 8.3.8.2.1		for grey seal (i.e. to maintain the favourable conservation condition of grey seal).
Underwater noise and disturbance – see Section 8.3.8.2.2	0.11 individuals (0.0003% of OSPAR MU)	There would be no significant disturbance, therefore, there would be no adverse effect on the integrity of the SAC in relation to the conservation objectives for grey seal (i.e. to maintain the favourable conservation condition of grey seal).
Disturbance from ADDs – see Section 8.3.8.2.3	16 individuals (0.04% of OSPAR MU).	There would be no significant disturbance as ADD activation would be limited to 20 minutes and when needed, therefore, there would be no adverse effect on the integrity of the SAC in relation to the conservation objectives for grey seal (i.e. to maintain the favourable conservation condition of grey seal).
Collision risk with tidal devices and vessels – see Section 8.3.8.2.6	Up to 5 grey seal (0.012% of OSPAR MU).	Taking into account the proposed phased deployment, monitoring and mitigation, there would be no adverse effect on the integrity of SAC in relation to the conservation objectives for grey seal (i.e. to maintain the favourable conservation condition of grey seal).
Entanglement with Mooring Lines - see Section 8.3.8.2.7	0	To date, there have been no recorded instances of marine mammal entanglement from mooring systems of renewable devices. The tidal devices and moorings would be regular checked, this would ensure that there was no material such as discarded nets, ropes or other debris which could increase the risk of entanglement. The mitigation and monitoring measures to reduce the risk of collision with operational turbines would also reduce the risk of entablement with mooring lines. Therefore, there would be no adverse effect on the integrity of the SAC in relation to the conservation objectives for grey seal (i.e. to maintain the favourable conservation condition of grey seal).
Barrier effects - see Section 8.3.8.2.8	2 individuals (0.005% of OSPAR)	There would be no adverse effect on the integrity of the SAC in relation to the conservation objectives for grey seal (i.e. to maintain the favourable conservation condition of grey seal).
EMF effects - see Section 8.3.8.2.9	0.01 individuals (0.000025% of OSPAR)	There would be no adverse effect on the integrity of the SAC in relation to the conservation objectives for grey seal (i.e. to maintain the favourable conservation condition of grey seal).
Disturbance at Sea Haul-Out Sites – see Section 8.3.8.2.10	0	There would be no adverse effect on the integrity of the SAC in relation to the conservation objectives for grey seal (i.e. to maintain the favourable conservation condition of grey seal).
Changes in water quality – see Section 8.3.8.2.11	0	Any potential in changes in marine water quality as a result of sediment re-suspension caused by seabed disturbance; mobilisation of contaminants adsorbed onto potentially re-suspended seabed sediments; and accidental discharge and spillage of oils, fuels and materials are likely to be localised, dispersed quickly, temporary and would have a negligible effect. Therefore, there would be no adverse effect on the integrity of the SAC in relation to the conservation objectives for grey seal (i.e. to maintain the favourable conservation condition of grey seal).
Changes in prey availability as a result of habitat loss – see Section 8.3.8.2.12	0.34 individuals (0.00085% of OSPAR).	There would be no adverse effect on the integrity of the SAC in relation to the conservation objectives for grey seal (i.e. to maintain the favourable conservation condition of grey seal).

961. The assessment of the potential in-combination effects for the Pen Llyn a'r Sarnau/Lleyn Peninsula and Sarnau SAC (**Section 8.3.8.2.13**) are the same for the potential effects on the Saltee Islands SAC. The potential in-combination effects are summarised and assessed in relation to the Conservation Objectives for the Saltee Islands SAC in **Table 8-46**.

962. Therefore, there would be no adverse effect on the integrity of the Saltee Islands SAC in relation to the Conservation Objectives for grey seal (**Table 8-46**).

Table 8-46 Summary of the potential in-combination effects on grey seal in relation to the Conservation Objectives for the Saltee Islands SAC

Potential Effect	Maximum number of grey seal (% of OSPAR MU)	Assessment in relation to the Conservation Objectives for the SAC
Underwater noise and disturbance	Up to 69 individuals (0.2% of OSPAR MU)	There would be no adverse effect on the integrity of the SAC in relation to the conservation objectives for grey seal (i.e. to maintain the favourable conservation condition of grey seal).
Collision risk with tidal devices and vessels	Up to 24 individuals (0.06% of OSPAR MU)	Taking into account the proposed phased deployment, monitoring and mitigation, there would be no adverse effect on the integrity of SAC in relation to the conservation objectives for grey seal (i.e. to maintain the favourable conservation condition of grey seal).
Changes in prey availability due to habitat loss	Up to 2 individuals (0.005% of OSPAR MU)	There would be no adverse effect on the integrity of the SAC in relation to the conservation objectives for grey seal (i.e. to maintain the favourable conservation condition of grey seal).

8.3.14. Other European Designated Sites for Grey and Harbour Seal

963. Other European Designated Sites (SACs) in the OSPAR MU where grey and harbour seal are a qualifying feature are all located more than 200km and 100km from the MDZ for grey and harbour seal, respectively, and therefore were screened out for any potential connectivity and realistic pathway for a potential effect. These sites are:

- Blasket Islands SAC for grey seal (518km);
- Roaringwater Bay and Islands SAC for grey seal (409km);
- Chaussee de Sein SAC for grey seal (559km);
- Ouessant-Molène SAC for grey seal (540km);
- Abers - Côtes des Légendes SAC for grey seal (544km);
- Baie de Morlaix SAC for grey seal (553km);
- Côte de Granit Rose-Sept-Iles SAC for grey seal (551km);
- Tregor Goëlo SAC for grey seal (578km);
- Murlough SAC for harbour seal (116km);
- Strangford Lough SAC for harbour seal (121km); and
- Slaney River Valley SAC for harbour seal (148km).

964. The assessment of the potential effects of the project alone for the Lambay Island SAC (**Section 8.3.12.1**) in relation to the OSPAR MU for grey and harbour seal are the same for the potential effects on these sites, as they are all located in the same OSPAR MU for grey and harbour seal.

965. Therefore, there would be no adverse effect on the integrity of the other European Designated Sites in relation to the Conservation Objectives for grey and harbour seal (i.e. to maintain the favourable conservation status of grey and harbour seal) for the Project alone or in-combination with other projects in Celtic and Irish Seas MU.

8.3.15. Summary

8.3.15.1. Summary of the Potential Effects on the Gogledd Môn Forol/North Anglesey Marine SAC

966. There is no potential for any adverse effects on the integrity of the Gogledd Môn Forol/North Anglesey Marine SAC from the Project alone in relation to the Conservation Objectives for harbour porpoise (**Table 8-47**).

967. Based on the information currently available, there is no potential for any adverse effect on the integrity of the Gogledd Môn Forol/North Anglesey Marine SAC from in-combination effects in relation to the Conservation Objectives for harbour porpoise (**Table 8-48**).

Table 8-47 Summary of the assessment of the potential effects on the Gogledd Môn Forol/North Anglesey Marine SAC in relation to the Conservation Objectives for harbour porpoise

Potential Effect	Conservation Objectives		
	Harbour porpoise is a viable component of the site	There is no significant disturbance of the species	The condition of supporting habitats and processes, and the availability of prey is maintained
Underwater noise and the risk of auditory injury	✓		
Underwater noise and disturbance		✓	
Collision risk with tidal devices	✓		
Increased collision risk with vessels	✓		
Entanglement with mooring lines	✓		
Barrier effects		✓	
EMF effects		✓	
Changes in water quality			✓
Changes in prey availability			✓

✓ = Conservation Objective is maintained and there is no potential for any adverse effect on the integrity of the site

Table 8-48 Summary of the assessment of the potential in-combination effects on the Gogledd Môn Forol/North Anglesey Marine SAC in relation to the Conservation Objectives for harbour porpoise

Potential In-Combination Effect	Conservation Objectives		
	Harbour porpoise is a viable component of the site	There is no significant disturbance of the species	The condition of supporting habitats and processes, and the availability of prey is maintained
Underwater noise and disturbance		✓	

Collision risk with tidal devices and vessels	✓		
Changes in prey availability due to habitat loss			✓

8.3.15.2. Summary of the Potential Effects on the Gorllewin Cymru Forol/West Wales Marine SAC

968. There is no potential for any adverse effects on the integrity of the Gorllewin Cymru Forol/West Wales Marine SAC from the Project alone in relation to the Conservation Objectives for harbour porpoise (**Table 8-49**).

969. Based on the information currently available, there is no potential for any adverse effect on the integrity of the Gorllewin Cymru Forol/West Wales Marine SAC from in-combination effects in relation to the Conservation Objectives for harbour porpoise (**Table 8-50**).

Table 8-49 Summary of the assessment of the potential effects on Gorllewin Cymru Forol/West Wales Marine SAC in relation to the Conservation Objectives for harbour porpoise

Potential Effect	**Conservation Objectives**		
	Harbour porpoise is a viable component of the site	**There is no significant disturbance of the species**	**The condition of supporting habitats and processes, and the availability of prey is maintained**
Underwater noise and the risk of auditory injury	✓		
Underwater noise and disturbance		✓	
Collision risk with tidal devices	✓		
Increased collision risk with vessels	✓		
Entanglement with mooring lines	✓		
Barrier effects		✓	
EMF effects		✓	
Changes in water quality			✓
Changes in prey availability			✓

Table 8-50 Summary of the assessment of the potential in-combination effects on the Gorllewin Cymru Forol/West Wales Marine SAC in relation to the Conservation Objectives for harbour porpoise

Potential In-Combination Effect	**Conservation Objectives**		
	Harbour porpoise is a viable component of the site	**There is no significant disturbance of the species**	**The condition of supporting habitats and processes, and the availability of prey is maintained**
Underwater noise and disturbance		✓	

Potential In-Combination Effect	Conservation Objectives		
	Harbour porpoise is a viable component of the site	**There is no significant disturbance of the species**	**The condition of supporting habitats and processes, and the availability of prey is maintained**
Collision risk with tidal devices and vessels	✓		
Changes in prey availability due to habitat loss			✓

8.3.15.3. Summary of the Potential Effects on the Dynesfeydd Môr Hafren/Bristol Channel Approaches SAC

970. There is no potential for any adverse effects on the integrity of the Dynesfeydd Môr Hafren/Bristol Channel Approaches SAC from the Project alone in relation to the Conservation Objectives for harbour porpoise (**Table 8-51**).

971. Based on the information currently available, there is no potential for any adverse effect on the integrity of the Dynesfeydd Môr Hafren/Bristol Channel Approaches SAC from in-combination effects in relation to the Conservation Objectives for harbour porpoise (**Table 8-52**).

Table 8-51 Summary of the assessment of the potential effects on the Dynesfeydd Môr Hafren/Bristol Channel Approaches SAC in relation to the Conservation Objectives for harbour porpoise

Potential Effect	Conservation Objectives		
	Harbour porpoise is a viable component of the site	**There is no significant disturbance of the species**	**The condition of supporting habitats and processes, and the availability of prey is maintained**
Underwater noise and the risk of auditory injury	✓		
Underwater noise and disturbance		✓	
Collision risk with tidal devices	✓		
Increased collision risk with vessels	✓		
Entanglement with mooring lines	✓		
Barrier effects		✓	
EMF effects		✓	
Changes in water quality			✓
Changes in prey availability			✓

Table 8-52 Summary of the assessment of the potential in-combination effects on the Dynesfeydd Môr Hafren/Bristol Channel Approaches SAC in relation to the Conservation Objectives for harbour porpoise

Potential In-Combination Effect	Conservation Objectives		
	Harbour porpoise is a viable component of the site	There is no significant disturbance of the species	The condition of supporting habitats and processes, and the availability of prey is maintained
Underwater noise and disturbance		✓	
Collision risk with tidal devices and vessels	✓		
Changes in prey availability due to habitat loss			✓

✓ = Conservation Objective is maintained and there is no potential for any adverse effect on the integrity of the site

8.3.15.4. Summary of the Potential Effects on the North Channel SAC

972. There is no potential for any adverse effects on the integrity of the North Channel SAC from the Project alone in relation to the Conservation Objectives for harbour porpoise (**Table 8-53**).

973. Based on the information currently available, there is no potential for any adverse effect on the integrity of the North Channel SAC from in-combination effects in relation to the Conservation Objectives for harbour porpoise (**Table 8-54**).

Table 8-53 Summary of the assessment of the potential effects on the North Channel SAC in relation to the Conservation Objectives for harbour porpoise

Potential Effect	Conservation Objectives		
	Harbour porpoise is a viable component of the site	There is no significant disturbance of the species	The condition of supporting habitats and processes, and the availability of prey is maintained
Underwater noise and the risk of auditory injury	✓		
Underwater noise and disturbance		✓	
Collision risk with tidal devices	✓		
Increased collision risk with vessels	✓		
Entanglement with mooring lines	✓		
Barrier effects		✓	
EMF effects		✓	
Changes in water quality			✓
Changes in prey availability			✓

Table 8-54 Summary of the assessment of the potential in-combination effects on the North Channel SAC in relation to the Conservation Objectives for harbour porpoise

Potential In-Combination Effect	Conservation Objectives		
	Harbour porpoise is a viable component of the site	**There is no significant disturbance of the species**	**The condition of supporting habitats and processes, and the availability of prey is maintained**
Underwater noise and disturbance		✓	
Collision risk with tidal devices and vessels	✓		
Changes in prey availability due to habitat loss			✓

8.3.15.5. Summary of the Potential Effects on the Rockabill to Dalkey Island SAC

974. There is no potential for any adverse effects on the integrity of the Rockabill to Dalkey Island SAC from the Project alone in relation to the Conservation Objectives for harbour porpoise (**Table 8-55**).

975. Based on the information currently available, there is no potential for any adverse effect on the integrity of the Rockabill to Dalkey Island SAC from in-combination effects in relation to the Conservation Objectives for harbour porpoise (**Table 8-56**).

Table 8-55 Summary of the assessment of the potential effects on the Rockabill to Dalkey Island SAC in relation to the Conservation Objectives for harbour porpoise

Potential Effect	Conservation Objective
	To maintain the favourable conservation condition of harbour porpoise in Rockabill to Dalkey Island SAC
Underwater noise and the risk of auditory injury	✓
Underwater noise and disturbance	✓
Collision risk with tidal devices	✓
Increased collision risk with vessels	✓
Entanglement with mooring lines	✓
Barrier effects	✓
EMF effects	✓
Changes in water quality	✓
Changes in prey availability	✓

Table 8-56 Summary of the assessment of the potential in-combination effects on the Rockabill to Dalkey Island SAC in relation to the Conservation Objectives for harbour porpoise

Potential In-Combination Effect	**Conservation Objectives**
	To maintain the favourable conservation condition of harbour porpoise in Rockabill to Dalkey Island SAC
Underwater noise and disturbance	✓
Collision risk with tidal devices and vessels	✓
Changes in prey availability due to habitat loss	✓

8.3.15.6. Summary of the Potential Effects on the Pen Llŷn a'r Sarnau/Lleyn Peninsula and the Sarnau SAC

976. There is no potential for any adverse effects on the integrity of the Pen Llŷn a'r Sarnau/Lleyn Peninsula and the Sarnau SAC from the Project alone in relation to the Conservation Objectives for bottlenose dolphin and grey seal (**Table 8-57**).

977. Based on the information currently available, there is no potential for any adverse effect on the integrity of Pen Llŷn a'r Sarnau/Lleyn Peninsula and the Sarnau SAC from in-combination effects in relation to the Conservation Objectives for bottlenose dolphin and grey seal (**Table 8-58**).

Table 8-57 Summary of the assessment of the potential effects on the Pen Llŷn a'r Sarnau/Lleyn Peninsula and the Sarnau SAC in relation to the Conservation Objectives for bottlenose dolphin and grey seal

Potential Effect	**Conservation Objectives**		
	The populations are maintained on a long-term basis as a viable component of its natural habitat	**The species population within the site is such that the natural range of the population is not being reduced or likely to be reduced for the foreseeable future**	**The presence, abundance, condition and diversity of habitats and species required to support these species is such that the distribution, abundance and populations dynamics of the species within the site and population beyond the site is stable or increasing**
Underwater noise and the risk of auditory injury	✓		
Underwater noise and disturbance		✓	
Collision risk with tidal devices	✓		
Increased collision risk with vessels	✓		
Entanglement with mooring lines	✓		
Barrier effects		✓	
EMF effects		✓	

Potential Effect	Conservation Objectives		
	The populations are maintained on a long-term basis as a viable component of its natural habitat	**The species population within the site is such that the natural range of the population is not being reduced or likely to be reduced for the foreseeable future**	**The presence, abundance, condition and diversity of habitats and species required to support these species is such that the distribution, abundance and populations dynamics of the species within the site and population beyond the site is stable or increasing**
Disturbance at seal haul-out sites		✓	
Changes in water quality			✓
Changes in prey availability			✓

Table 8-58 Summary of the assessment of the potential in-combination effects on the Pen Llŷn a'r Sarnau/Lleyn Peninsula and the Sarnau SAC in relation to the Conservation Objectives for bottlenose dolphin and grey seal

Potential In-Combination Effect	Conservation Objectives		
	The populations are maintained on a long-term basis as a viable component of its natural habitat	**The species population within the site is such that the natural range of the population is not being reduced or likely to be reduced for the foreseeable future**	**The presence, abundance, condition and diversity of habitats and species required to support these species is such that the distribution, abundance and populations dynamics of the species within the site and population beyond the site is stable or increasing**
Underwater noise and disturbance		✓	
Collision risk with tidal devices and vessels	✓		
Changes in prey availability due to habitat loss			✓

8.3.15.7. Summary of the Potential Effects on the Bae Ceredigion/Cardigan Bay SAC

978. There is no potential for any adverse effects on the integrity of the Bae Ceredigion/Cardigan Bay SAC from the Project alone in relation to the Conservation Objectives for bottlenose dolphin and grey seal (**Table 8-59**).

979. Based on the information currently available, there is no potential for any adverse effect on the integrity of Bae Ceredigion/Cardigan Bay SAC from in-combination effects in relation to the Conservation Objectives for bottlenose dolphin and grey seal (**Table 8-60**).

Table 8-59 Summary of the assessment of the potential effects on the Bae Ceredigion/Cardigan Bay SAC in relation to the Conservation Objectives for bottlenose dolphin and grey seal

Potential Effect	Conservation Objectives		
	The populations are maintained on a long-term basis as a viable component of its natural habitat	The species population within the site is such that the natural range of the population is not being reduced or likely to be reduced for the foreseeable future	The presence, abundance, condition and diversity of habitats and species required to support these species is such that the distribution, abundance and populations dynamics of the species within the site and population beyond the site is stable or increasing
Underwater noise and the risk of auditory injury	✓		
Underwater noise and disturbance		✓	
Collision risk with tidal devices	✓		
Increased collision risk with vessels	✓		
Entanglement with mooring lines	✓		
Barrier effects		✓	
EMF effects		✓	
Disturbance at seal haul-out sites		✓	
Changes in water quality			✓
Changes in prey availability			✓

Table 8-60 Summary of the assessment of the potential in-combination effects on the Bae Ceredigion/Cardigan Bay SAC in relation to the Conservation Objectives for bottlenose dolphin and grey seal

Potential In-Combination Effect	Conservation Objectives		
	The populations are maintained on a long-term basis as a viable component of its natural habitat	The species population within the site is such that the natural range of the population is not being reduced or likely to be reduced for the foreseeable future	The presence, abundance, condition and diversity of habitats and species required to support these species is such that the distribution, abundance and populations dynamics of the species within the site and population beyond the site is stable or increasing
Underwater noise and disturbance		✓	
Collision risk with tidal devices and vessels	✓		

Potential In-Combination Effect	Conservation Objectives		
	The populations are maintained on a long-term basis as a viable component of its natural habitat	**The species population within the site is such that the natural range of the population is not being reduced or likely to be reduced for the foreseeable future**	**The presence, abundance, condition and diversity of habitats and species required to support these species is such that the distribution, abundance and populations dynamics of the species within the site and population beyond the site is stable or increasing**
Changes in prey availability due to habitat loss			✓

8.3.15.8. Summary of the Potential Effects on the Sir Benfro Forol/Pembrokeshire Marine SAC

980. There is no potential for any adverse effects on the integrity of the Sir Benfro Forol/Pembrokeshire Marine SAC from the Project alone in relation to the Conservation Objectives for grey seal (**Table 8-61**).

981. Based on the information currently available, there is no potential for any adverse effect on the integrity of Sir Benfro Forol/Pembrokeshire Marine SAC from in-combination effects in relation to the Conservation Objectives for grey seal (**Table 8-62**).

Table 8-61 Summary of the assessment of the potential effects on the Sir Benfro Forol/Pembrokeshire Marine SAC in relation to the Conservation Objectives for grey seal

Potential Effect	Conservation Objectives		
	The populations are maintained on a long-term basis as a viable component of its natural habitat	**The species population within the site is such that the natural range of the population is not being reduced or likely to be reduced for the foreseeable future**	**The presence, abundance, condition and diversity of habitats and species required to support these species is such that the distribution, abundance and populations dynamics of the species within the site and population beyond the site is stable or increasing**
Underwater noise and the risk of auditory injury	✓		
Underwater noise and disturbance		✓	
Collision risk with tidal devices	✓		
Increased collision risk with vessels	✓		
Entanglement with mooring lines	✓		
Barrier effects		✓	
EMF effects		✓	

Potential Effect	Conservation Objectives		
	The populations are maintained on a long-term basis as a viable component of its natural habitat	**The species population within the site is such that the natural range of the population is not being reduced or likely to be reduced for the foreseeable future**	**The presence, abundance, condition and diversity of habitats and species required to support these species is such that the distribution, abundance and populations dynamics of the species within the site and population beyond the site is stable or increasing**
Disturbance at seal haul-out sites		✓	
Changes in water quality			✓
Changes in prey availability			✓

Table 8-62 Summary of the assessment of the potential in-combination effects on the Sir Benfro Forol/Pembrokeshire Marine SAC in relation to the Conservation Objectives for grey seal

Potential In-Combination Effect	Conservation Objectives		
	The populations are maintained on a long-term basis as a viable component of its natural habitat	**The species population within the site is such that the natural range of the population is not being reduced or likely to be reduced for the foreseeable future**	**The presence, abundance, condition and diversity of habitats and species required to support these species is such that the distribution, abundance and populations dynamics of the species within the site and population beyond the site is stable or increasing**
Underwater noise and disturbance		✓	
Collision risk with tidal devices and vessels	✓		
Changes in prey availability due to habitat loss			✓

8.3.15.9. Summary of the Potential Effects on The Maidens SAC

982. There is no potential for any adverse effects on the integrity of The Maidens SAC from the Project alone in relation to the Conservation Objectives for grey seal (**Table 8-63**).

983. Based on the information currently available, there is no potential for any adverse effect on the integrity of The Maidens SAC from in-combination effects in relation to the Conservation Objectives for grey seal (**Table 8-64**).

Table 8-63 Summary of the assessment of the potential effects on The Maidens SAC in relation to the Conservation Objectives for grey seal

Potential Effect	Conservation Objective
	To maintain (or restore where appropriate) the grey seal to favourable condition
Underwater noise and the risk of auditory injury	✓
Underwater noise and disturbance	✓
Collision risk with tidal devices	✓
Increased collision risk with vessels	✓
Entanglement with mooring lines	✓
Barrier effects	✓
EMF effects	✓
Disturbance at seal haul-out sites	✓
Changes in water quality	✓
Changes in prey availability	✓

Table 8-64 Summary of the assessment of the potential in-combination effects on The Maidens SAC in relation to the Conservation Objectives for grey seal

Potential In-Combination Effect	Conservation Objectives
	To maintain (or restore where appropriate) the grey seal to favourable condition
Underwater noise and disturbance	✓
Collision risk with tidal devices and vessels	✓
Changes in prey availability due to habitat loss	✓

8.3.15.10. Summary of the Potential Effects on The Lambay Island SAC

984. There is no potential for any adverse effects on the integrity of Lambay Island SAC from the Project alone in relation to the Conservation Objectives for grey and harbour seal (**Table 8-65**).

985. Based on the information currently available, there is no potential for any adverse effect on the integrity of the Lamaby Island SAC from in-combination effects in relation to the Conservation Objectives for grey and harbour seal (**Table 8-66**).

Table 8-65 Summary of the assessment of the potential effects on the Lamabay Island SAC in relation to the Conservation Objectives for grey and harbour seal

Potential Effect	Conservation Objective
	To maintain the favourable conservation condition of grey seal and harbour seal in the Lambay Island SAC
Underwater noise and the risk of auditory injury	✓
Underwater noise and disturbance	✓
Collision risk with tidal devices	✓

Increased collision risk with vessels	✓
Entanglement with mooring lines	✓
Barrier effects	✓
EMF effects	✓
Disturbance at seal haul-out sites	✓
Changes in water quality	✓
Changes in prey availability	✓

Table 8-66 Summary of the assessment of the potential in-combination effects on the Lambay Island SAC in relation to the Conservation Objectives for grey and harbour seal

Potential In-Combination Effect	Conservation Objectives
	To maintain the favourable conservation condition of grey seal and harbour seal in the Lambay Island SAC
Underwater noise and disturbance	✓
Collision risk with tidal devices and vessels	✓
Changes in prey availability due to habitat loss	✓

8.3.15.11. Summary of the Potential Effects on the Saltee Isands SAC

986. There is no potential for any adverse effects on the integrity of the Saltee Islands SAC from the Project alone in relation to the Conservation Objectives for grey seal (**Table 8-67**).

987. Based on the information currently available, there is no potential for any adverse effect on the integrity of the Saltee Islands SAC from in-combination effects in relation to the Conservation Objectives for grey seal (**Table 8-68**).

Table 8-67 Summary of the assessment of the potential effects on the Saltee Islands SAC in relation to the Conservation Objectives for grey seal

Potential Effect	Conservation Objective
	To maintain the favourable conservation condition of grey seal in the Saltee Islands SAC
Underwater noise and the risk of auditory injury	✓
Underwater noise and disturbance	✓
Collision risk with tidal devices	✓
Increased collision risk with vessels	✓
Entanglement with mooring lines	✓
Barrier effects	✓
EMF effects	✓
Disturbance at seal haul-out sites	✓
Changes in water quality	✓
Changes in prey availability	✓

Table 8-68 Summary of the assessment of the potential in-combination effects on the Saltee Islands SAC in relation to the Conservation Objectives for grey seal

Potential In-Combination Effect	Conservation Objectives
	To maintain the favourable conservation condition of grey seal in the Saltee Islands SAC
Underwater noise and disturbance	✓
Collision risk with tidal devices and vessels	✓
Changes in prey availability due to habitat loss	✓

8.4. ONSHORE ECOLOGY

8.4.1. Glannau Ynys Gybi/ Holy Island Coast SAC

8.4.1.1. Conservation Objectives

988. The conservation objectives for Glannau Ynys Gybi/Holy Island Coast SAC are taken Glannau Ynys Gybi Core Management Plan (NRW, 2013). These are detailed below for vegetated sea cliffs of the Atlantic and Baltic Coasts.

989. The Onshore Development Area avoids all wet and dry heath habitat and this feature was screened out of AA during Stage 1 of the HRA. Therefore, potential impact on this feature are not discussed any further.

990. The vision for vegetated sea cliffs (of the Atlantic and Baltic coasts) is for it to be in a favourable conservation status, where all of the following conditions are satisfied:

- Cliff and crevice vegetation, maritime grassland and maritime heath occurs throughout the site in appropriate areas and their relative extent and zonation are determined by topography, exposure, grazing and natural stochastic events (e.g. storms);
- The cliff vegetation is composed of native plants such as sea spurrey *Spergularia rupicola*, Sea lavenders *Limonium britannicum*, *L. procerum*, *L. binervosum* and sea samphire *Crithmum maritimum*;
- Non-native plants, such as Hottentot fig *Carpobrotus edulis* or purple dew-plant *Disphyma crassifolium* are preferably absent or at least not spreading from their 2000 extent;
- Maritime grassland occupies higher ledges on the coastal cliffs and the cliff-top.
- The following plants are common in the maritime grassland: red fescue *Festuca rubra*, thrift *Armeria maritima*, spring squill *Scilla verna* and sea plantain *Plantago maritima*;
- Maritime Heathland occupies areas inland of the maritime grassland;
- The following plants are common in the maritime heathland: heather *Calluna vulgaris*, bell heather *Erica cinerea*, western gorse *Ulex gallii*, thrift *Armeria maritima*, sea plantain *Plantago maritima*, buck's horn plantain *Plantago coronopus* or spring squill;
- Competitive species indicative of under-grazing, particularly bracken *Pteridium aquilinum* and gorse *Ulex europaeus* and grass species indicative of improvement including creeping

bent *Agrostis stolonifera*, cock's foot *Dactylus glomerata*, perennial rye-grass *Lolium perenne* and Yorkshire fog *Holcus lanatus* are largely absent from the heath;

- Sustainable populations of the plants which make up the Atlantic sea cliff rare plant assemblage will be present, notably, South Stack fleawort *Tephroseris integrifolia*, Sea lavenders *Limonium britannicum, L. procerum, L. binervosum* Golden hair lichen *Teloschistes flavicans* and Ciliate strap lichen *Heterodermia leucomelo*; and
- All factors affecting the achievement of these conditions, including grazing intensity and burning, will be under control

8.4.1.2. Assessment of potential effect of the proposed scheme during construction, operation and decommissioning

8.4.1.2.1. Disturbance, temporary and permanent habitat loss

991. The designated land is characterised by improved grassland and poor semi improved grassland, with a strip of unimproved neutral grassland (4,200 m^2) and maritime cliff and slope (9,850 m^2) adjacent to the bay where landfall will occur, which fall within the interests of the 'Vegetated sea cliffs of the Atlantic and Baltic Coasts' designated feature. Spotted rock rose is recorded at numerous locations around the coastline (**Figure 19.10, Volume II** of the ES), but this plant is associated with heath habitat and no records coincide with the Onshore Development Area.

992. Conservation Objectives for the SAC include for the vegetated coastal cliffs to remain largely undisturbed and support the endemic South Stack fleawort and other notable plants. Also, that 70% of the site should be characterised by good quality lowland and coastal heath and that in some areas where there are rocky outcrops in heathland, the habitat should be favourable for the spotted rock rose which occurs in the thin crusts of soil with lichens and mosses and short grasses. Areas of herb rich neutral grassland may be maintained for their floristic, invertebrate and chough feeding value.

993. The preferred option of transporting the cables ashore at landfall is to use HDD (see **Chapter 4, Project Description, Volume I** of the ES). This will avoid any interaction with the intertidal environment, vegetated sea cliffs and coastal fringe habitat, utilising the grasslands set further back from the coast (**Figure 19.6, Volume II** of the ES). Entry and Exit pits will be set back a minimum 10 m from sensitive coastal habitats. Should HDD be used as the landfall methodology, the designated site and its qualifying features will be avoided entirely, as will the habitat and species for which it is afforded protection, and consequently there will be no impact on Holy Island, SPA, SAC.

994. Under a worst-case scenario where HDD at landfall is not possible for technical / engineering reasons, landfall activities will involve trenching the cabling through a narrow coastal strip of the Holy Island SAC designation. This will involve disturbance, temporary habitat loss and some limited permenant habitat loss.

995. A maximum of 14,050 m^2 (0.032 % of the entire designated site) of the Onshore Development Area is within the neutral grassland and maritime cliff and slope habitat which contributes to the 'Vegetated sea cliffs of the Atlantic and Baltic Coasts' feature. In reality, the percentage of this

feature disturbed during construction activities is likely to be less, as the full footprint of the Onshore Development Area is unlikely to be required for construction.

996. As described in **Chapter 4, Project Description** (**Volume I** of the ES), up to nine trenches will be placed 0.5 m wide and 0.6 m apart, or a single trench of 10 m wide with a working area buffer of up to 30 m each side will be required, equalling a corridor of 70 m wide across the grassland habitat. J-tubes will be grouped in a corridor approximately 30 m wide down the cliffs with a construction footprint of 30 m either side, equalling 90 m corridor. This corridor equates to 5,300 m^2 (0.012 % of the entire designated site) of which 1,400 m^2 is in the neutral grassland habitat and 1,770 m^2 is in the maritime cliff and slope habitat.

997. Temporary habitat loss will still occur within the designated site in this 70 m wide corridor in the grassland habitat and the temporary 30 m construction footprint either side of the J-tubes, including across vegetated cliff and slope habitat and neutral grassland, which falls within the Annex 1 feature and on the cliff face where cables are pinned in shallow slots, in a corridor of up to 30 m wide however, it is expected that all structures laid upon the cliff face and foreshore will be removed upon decommissioning, with any buried cables will remain *in situ*. To minimise any potential impacts to the designated sites or their features during construction, toolbox talks will be delivered to all construction personnel detailing the importance of the designated area. A strict construction footprint will be maintained throughout, and temporary fencing will be installed to physically delineate the designated site from the construction footprint. All materials and plant will be stored appropriately within the construction footprint and a habitat re-instatement plan will be implemented upon completion of the works.

998. Several notable plants are known to be present in the area surrounding the landfall and Landfall Substation and form part of the Conservation Objectives of the SAC. It is recommended that prior to construction, further detailed botanical survey work is undertaken to ensure the risk of impacts to spatulate (South Stack) fleawort, golden-hair lichen and spotted rock-rose (and other areas of botanically rich vegetation) can be avoided. Such survey work should be carried out in May or June when fleawort is in flower and morning time when spotted rock rose is more likely to flower.

999. If, under a worst-case scenario, the cables are trenched at landfall, further consultation will be undertaken with NRW and RSPB to determine appropriate methods, mitigation and any appropriate consents to undertake the work. This would include any habitat reinstatement and planting schemes which will be detailed in the Ecological Action Plan (EAP), along with frequency of any required monitoring programme.

1000. There will be temporary trenching across the maritime cliff and slope habitat and neutral grassland and potential long-term pinning of cables on the cliff habitat. Temporary habitat lost will be compensated for within the onshore site or enhancement will take place at nearby adjacent cliff and slope habitat of poorer quality than that which is being temporarily lost. This will be detailed in the EAP. The compensatory/enhancement habitat will aim to maintain the functionality of the habitat that is lost. The area of compensatory/enhancement habitat will be as a minimum the same area of habitat that is lost. Compensatory/enhancement habitat will be subject to a habitat creation and management plan, undertaken in consultation with the IoACC and NRW. The habitat creation and management plan will include:

- A defined area which will be subject to the plan;
- A plan for any pre-construction surveys;
- Details of suitable planting and ground preparation and planting methodology;
- Details of any post-creation monitoring surveys, reporting and reviewing required;
- A schedule/programme for delivery of the plan;
- Responsibilities attributed to the relevant parties to deliver the plan; including creation, maintenance and monitoring of the new habitat; and
- Consideration of the future of the new habitat following decommissioning of the Landfall Substation site.
- This plan will be developed with the relevant stakeholders and should be complimentary to other proposed mitigation measures.

1001. On the basis of the available information, the possibility of an adverse effect on site integrity due to disturbance habitat loss can be excluded for the Glannau Ynys Gybi/ Holy Island Coast SAC due to the low percentage of designated habitat that may be affected (less than 0.07%) and the mitigation measures which will be implemented in the event of construction works occurring within the boundary of the Glannau Ynys Gybi/Holy Island Coast SAC the amount of habitat loss on the cliff face will be 1,770 m^2 (0.004%) of the entire designated site and is considered to be *de minimis*, with no impact on the site integrity. Although the permanent impacts are considered to be *de minimis*, it is recognised that the project will involve (under the worst case) works within an SAC, a site protected under European Law. As such, as additional management, compensation habitat is also proposed for within the onshore site, or enhancement will take place at nearby adjacent cliff and slope habitat of poorer quality than that which is being temporarily lost.

8.4.1.2.2. Pollution/contamination of habitat

1002. Air quality impacts on designated ecological sites are considered in **Chapter 22, Air Quality** (**Volume I** of the ES). Impacts on designated sites relating to construction phase dust and particulate matter emissions were considered. Risk of dust impacts to ecological receptors, including the designated sites, were assessed to be high during earthworks, low during construction activities and medium from trackout from Heavy Goods Vehicles (HGV) movements. There are not anticipated to be any significant impacts on designated sites associated with road traffic emissions due to the expected low number of vehicle movements in the construction, operational and decommissioning phases.

1003. Step 3 of the Institute of Air Quality Management (IAQM) guidance identifies the appropriate good practice mitigation measures required based on the findings of Step 2 of the assessment methodology. Step 2 of the dust assessment determined that the greatest risk of impacts was ‘high risk’ resulting from construction activities without the implementation of mitigation measures.

1004. The recommendations detailed in IAQM guidance document and are considered to be ‘highly recommended’ by the IAQM for sites with a high risk of dust impacts and were tailored to the requirements and nature of the Project. The measures in **Table 8-69** will be considered and where appropriate incorporated into a construction phase management plan, to be agreed with the local planning authority prior to construction commencing.

Table 8-69 Site Specific Air Quality Mitigation

Activity	Mitigation Measures
Communications	▪ Develop and implement a stakeholder communications plan that includes community engagement before work commences on site. ▪ Display the name and contact details of person(s) accountable for air quality and dust issues on the site boundary and the head or regional office contact information. This may be the environment manager/engineer or the site manager.
Dust management	▪ Develop and implement a Dust Management Plan (DMP), which may include measures to control other emissions, approved by IoACC; ▪ Record all dust and air quality complaints, identify cause(s), take appropriate measures to reduce emissions in a timely manner, and record the measures taken; ▪ Make the complaints log available to IoACC when asked; ▪ Record any exceptional incidents that cause dust and/or air emissions, either on- or offsite, and the action taken to resolve the situation in the log book; ▪ Liaise with any other high-risk construction sites within 500 m of the onshore development area, to ensure plans are co-ordinated and dust and particulate matter emissions are minimised. It is important to understand the interactions of the off-site transport/deliveries which might be using the same strategic road network routes; ▪ Undertake daily on-site and off-site inspection, where receptors (including roads) are nearby, to note any dust deposition, record inspection results, and make the log available to IoACC when asked; ▪ Increase the frequency of site inspections by the person accountable for air quality and dust issues on site when activities with a high potential to produce dust are being carried out and during prolonged dry or windy conditions; ▪ Plan the working area so that machinery and dust causing activities are located away from receptors, as far as is practicable; ▪ Erect solid screens or barriers around dusty activities, or the works boundary, that are at least as high as any stockpiles on site; ▪ Take measures to control site runoff of water or mud; ▪ Keep fencing, barriers and scaffolding clean using wet methods; ▪ Remove materials that have a potential to produce dust from site as soon as possible; ▪ Cover, seed or fence stockpiles to prevent wind whipping; ▪ Ensure all vehicles switch off engines when stationary - no idling vehicles; ▪ Minimise the use of diesel- or petrol-powered generators and use mains electricity or battery powered equipment where practicable;

Activity	Mitigation Measures
	▪ Impose and signpost a maximum-speed-limit of 15 mph on surfaced, and 10 mph on unsurfaced, haul roads and work areas; ▪ Produce a Construction Logistics Plan to manage the sustainable delivery of goods and materials; ▪ Implement the Travel Plan that has been produced for the proposed scheme, which supports and encourages sustainable travel for contractor operatives and staff (public transport, cycling, walking, and car-sharing); ▪ Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction, e.g. suitable local exhaust ventilation systems; ▪ Use enclosed chutes and conveyors and covered skips; and ▪ Bonfires and burning of waste materials should not be permitted.
Earthworks	▪ Re-vegetate or cover earthworks and exposed areas/soil stockpiles to stabilise surfaces as soon as practicable; and ▪ Only remove the cover in small areas during work and not all at once.
Construction	▪ Ensure sand and other aggregates are stored in a controlled and well-managed manner; ▪ Avoid scabbling (roughening of concrete surfaces) if possible; ▪ Ensure bulk cement and other fine powder materials are delivered in enclosed tankers to prevent escape of material; and ▪ For smaller supplies of fine power materials ensure bags are sealed after use and stored appropriately to prevent dust release
Trackout	▪ Use water-assisted dust sweeper(s) on the access and local roads, to remove, as necessary, any material tracked out of the site; ▪ Ensure vehicles loaded with dusty materials entering and leaving sites are covered to prevent escape of materials during transport; ▪ Record all inspections of haul routes and any subsequent action in a site log book; ▪ Install hard surfaced haul routes, where practicable and appropriate, which are regularly damped down with fixed or mobile sprinkler systems, or mobile water bowsers and regularly cleaned; ▪ If required as a result of visual inspection, install a wheel washing system (with rumble grids to dislodge accumulated dust and mud) prior to leaving the site where reasonably practicable; and, ▪ Ensure there is an adequate area of hard surfaced road between the wheel wash facility and the site exit, wherever site size and layout permits.
Non-Road Mobile Machinery	NRMM and plant would be well maintained. If any emissions of dark smoke occur then the relevant machinery should stop immediately, and any problem rectified. In addition, the following controls would apply to NRMM: ▪ All NRMM should use fuel equivalent to ultralow sulphur diesel (fuel meeting the specification within EN590:2004); ▪ All NRMM will comply with regulation (EU) 2016/1628 of the European Parliament and of the European Council; ▪ All NRMM should be fitted with Diesel Particulate Filters (DPF) conforming to defined and demonstrated filtration efficiency (load/duty cycle permitting);

Activity	Mitigation Measures
	▪ The ongoing conformity of plant retrofitted with DPF, to a defined performance standard, should be ensured through a programme of onsite checks; and ▪ Implementation of energy conservation measures including instructions to throttle down or switch off idle construction equipment, switch off the engines of trucks while they are waiting to access the site and while they are being loaded or unloaded, and ensure equipment is properly maintained to ensure efficient energy consumption.

1005. The implementation of the appropriate mitigation measures will reduce the magnitude of dust emissions and the likelihood of their occurrence. The residual impacts from construction are considered to be **not significant**, in accordance with IAQM guidance.

1006. With the implementation of the recommended mitigation measures, i.e. adherence to best practice dust minimisation and suppression methods as recommended by the IAQM, including creation of a Dust Management Plan (DMP), impacts to ecological receptors are considered to be not significant and therefore airborne pollution is not expected to cause an adverse effect on site integrity of the Holy Island Coast SAC.

8.4.1.3. Conclusions

1007. On the basis of the information presented above, none of the impact pathways screened into Stage 2 of the HRA have the potential compromise the conservation objectives or cause an adverse effect on site integrity of this SAC.

8.4.2. Glannau Ynys Gybi/ Holy Island Coast SPA

8.4.2.1. Conservation Objectives

1008. The conservation objectives for the Glannau Ynys Gybi/Holy Island Coast SPA are taken from NRW (2013). These are detailed below for chough, which is the only ornithological qualifying feature of this SPA.

- The breeding population of chough within the SPA is at least 18 pairs, of which at least 12 should be within the Glannau Ynys Gybi / Tre Wilmot SSSI and at least 6 should be within the Glannau Rhoscolyn SSSI;
- The non-breeding population of chough is at least 18 individuals or 2.5 % of the GB wintering population;
- Sufficient suitable habitat (including Atlantic sea cliffs, maritime grassland, maritime heath, wet heath and dry heath) is present and in appropriate condition to support the breeding populations; and
- All factors affecting the achievement of these conditions are under control.

8.4.2.2. Assessment of Impact Pathways

8.4.2.2.1. Disturbance at Nesting, Foraging and Roosting Sites by Airborne Noise and/or Visual Disturbance

1009. Construction, maintenance and decommissioning activities at the cable landfall and the onshore cable route will generate noise and visual disturbance due to the presence of plant, vehicles and workers. Such disturbance will be temporary (occurring for a period of less than 12 months overall across the whole onshore cable route) and localised. It is anticipated that during the construction and decomissioning phases, works will not occur simultaneously along the entire onshore cable route, but that different discrete areas will be the focus of activity at different times. During operation, such impacts would be highly infrequent and are likely to only be occurring in a single location at any time, though this may occur at any time during the lifespan of the project. In general, operational events are unlikely to generate as much noise and visual disturbance in terms of intensity and duration as works during construction or decommissioning.

1010. The cable landfall is approximately 120 m at the nearest point from a regularly used chough nest site, and the onshore cable route passes within approximately 250 m of another regularly used nest site. Due to these relatively small standoff distances there is potential for works during the breeding season at these particular locations to cause disturbance to active chough nests, possibly resulting in breeding failure. There is consequently a possibility that this impact pathway could result in an adverse effect on site integrity. As a result, mitigation is required to remove this risk and ensure that the conservation objectives are not compromised.

1011. The onshore cable route passes through fields used by chough for foraging throughout the year, including foraging areas potentially used by nesting birds; within the breeding season chough tend to feed within 300-600 m of their nest (Johnstone *et al*., 2011; Whitehead *et al*., 2005). There is therefore potential for construction, maintenance and/or decommissioning works to disturb and displace foraging chough. It is noted however that the onshore cable route follows existing roads, and chough may not use foraging habitats immediately adjacent to roads or may use them less than undisturbed foraging habitat. Due to pre-existing, non-project related disturbance occurring in the vicinity of the onshore cable route, no adverse effect on site integrity due to this impact pathway is predicted.

1012. The nearest known chough roost site to the onshore cable route is approximately 500 m from the cable landfall, and not within direct line of sight. At this distance, disturbance to birds using the roost is considered very unlikely given the nature of the activities that will be occurring during all project phases.

1013. Noise modelling has been undertaken for the onshore construction works to predict noise levels in surrounding area. This can be used to assess the likelihood that noise levels would be so high as to be potentially disturbing to birds including chough. Much of the work undertaken on bird responses to airborne noise disturbance in the UK has focussed on wintering estuarine waterbirds (Cutts et al. 2013, Wright et al. 2010). These studies tend to suggest that bird response to noise disturbance is likely to be minor at levels of 60 dBA and lower (note that A refers to A-weighting which approximates the frequency response of the human ear). A distinction may be made between ‘average’ noise levels (L_{Aeq}) and maximum (impulsive) noise levels (L_{Amax}) (**Chapter 21, Noise and Vibration, Volume I** of the ES). Sudden impulsive noises (for example a gun shot or an explosion) are potentially most likely to cause disturbance reactions. Bird responses to noise may include increased vigilance, suspension of feeding behaviour and flushing. where birds walk, swim or fly away from a noise source. The findings from studies on wintering waterbirds can only be regarded as providing general context to the current assessment as they apply to different species during the non-breeding season (when behavioural responses may differ).

1014. At the cable landfall, the worst-case scenario in terms of noise emissions would be HDD. Modelled noise levels (L_{Aeq}) during daytime and night time are shown in **Figures A19.2.9** and **A19.2.10 (Volume III** of the ES**)** and are highest during the day. Daytime predictions indicate that levels in excess of 60dBLAeq, which might potentially cause chough to avoid these areas, are only predicted over small areas, mostly within the development footprint. These predictions indicate that noise associated with the works at the cable landfall is not likely to increase the areas from which birds are likely to be excluded due to the presence of construction plant and personnel, as discussed above. Predicted noise levels in the vicinity of the closest nest site to the landfall, A25, about 120 m from the landfall site, are less than 30 dBA and would not be expected to cause disturbance to birds at the nest.

1015. As detailed in **Chapter 21, Noise and Vibration** (**Volume I** of the ES), the impacts of the alternative open cut trenching construction method are expected to be no greater at the nearest sensitive receptors at the landfall location, than the HDD at the landfall.

1016. For works associated with the installation of the onshore cable, running initially south and then southeast and east from the landfall site, noise modelling indicates that predicted noise levels reduce to 60 dB_{LAeq} at a maximum of 147 m from the outer boundary, without mitigation, and 83 m from the boundary with best practical mitigation measures in place. If chough avoid areas where sound levels are in excess of 60 dBA, then, with mitigation in place, they would potentially be displaced around 83 m from the onshore cable working areas. However, given that the noise sources are machinery and likely to be regular/continuous over the period that plant/vehicles are operation, rather than sudden or irregular and impulsive noise, birds may habituate to noise and displacement distances may decrease.

1017. Noise and visual disturbance in the eastern part of the Onshore Development Area, associated with HDD for road and rail crossing, and works at the grid connection point (**Figure 19.1, Volume II** of the ES) are not considered in relation to disturbance to chough, as these areas are more than 2 km from any chough nest sites.

1018. The mitigation for disturbance to chough nest sites is that works at the cable landfall will not be permitted within 500 m of an active nest site during the breeding season, with the possible exception of some works within areas of existing anthropogenic activity, such as along roads. This will require the collection of survey data to ensure a sufficiently up to date picture of chough nesting activity is available.

1019. Providing that this mitigation measure is implemented where works within 500 m of an active chough nest are proposed during the chough breeding season, it is predicted that the construction, operation and decommissioning of the project would not compromise the conservation objectives for this SPA, and site integrity would therefore be unaffected.

8.4.2.2.2. Habitat loss during construction and operation

1020. The landfall for the project offshore export cable passes through the Holy Island Coast SPA where there are designated coastal habitats from the mean low water mark to the top of the cliffs. If trenching is used to lay the cable through the SPA (which is the worst-case scenario) then there will be temporary habitat loss within the SPA boundary during construction, which could last for several months. The area in question is known to not support any chough nest sites or established roosting locations and is relatively small in area in relation to the extent of coastal cliff habitats within the wider SPA. If Horizontal Direction Drilling (HDD) is used so the cable passes underneath the SPA, then there will be no temporary habitat loss within the SPA.

1021. Inland of the landfall, the onshore cable route does not pass through the SPA. There will therefore be no temporary habitat loss within the SPA associated with trenching to lay the onshore cable. There may be some temporary foraging habitat loss for chough associated with trenching for the cable, although the route follows existing roads and chough may use foraging habitats immediately adjacent to disturbance sources such as roads less than habitat which is not as heavily disturbed.

1022. It is understood that the onshore cable will be buried and habitats restored when the cable is laid. Thus, there will be no permanent habitat loss as a result of the proposed development.

1023. The relatively small area of potential temporary habitat loss within the SPA during construction of the cable landfall, the lack of chough activity within or near this area, and the absence of any predicted effects elsewhere, means that an adverse effect on site integrity due to habitat loss as a result of the construction, operation and decommissioning of the project can be ruled out.

8.4.2.2.3. Pollution/contamination of habitat during construction and operation

1024. Construction, operation and decommissioning activities may result in the release of pollutants or contaminants which may adversely affect the habitats used by chough, both within and outside the SPA.

1025. Construction activity will only take place within the SPA if the cable is installed through the landfall by trenching, or during operation if the cable requires excavation. This area of the SPA comprises rocky coastal habitats between the MLWS and the top of the cliffs. This area is not used for by chough for nesting and does not comprise an important foraging area, as chough feed on coastal grasslands inland of the clifftops. There is therefore no potential for pollution or contamination to adversely affect chough habitats within the SPA. In addition, the project construction design will include the use of best practice measures to minimise the risk of pollution or contamination events associated with construction works, and plans will be in place to rapidly and safely control any such incidents.

1026. The onshore cable route does not run through the SPA. There is potential for pollution or contamination to affect foraging areas for chough outside the SPA. However, the project design will include the use of best practice measures to minimise the risk of pollution/contamination events associated with construction works, and plans will be in place to rapidly and safely control any such incidents.

1027. As a result, it is predicted that the construction, operation and decommissioning of the project will not compromise the conservation objectives due to this impact pathway, and adverse effects on site integrity can be ruled out.

9. REFERENCES

Andersen, S. M., Teilmann, J., Dietz, R., Schmidt, N. M. and Miller, L. A. (2012). Behavioural responses of harbour seals to human-induced disturbances. Aquatic Conservation: Marine and Freshwater Ecosystem 22(1), pp. 113-121.

ABPMer (2014) Wave and Tidal Further Leasing Plan HRA: Principles Document. Report R.2160a. April 2014. A report for The Crown Estate

APEM (2017). Mainstream Kittiwake and Auk Displacement Report (APEM Scientific Report No. P000001836).

Baines, M.E. and Evans, P.G.H. (2012). Atlas of the Marine Mammals of Wales. CCW

Banks, A.N., Burton, N.H.K., Calladine, J.R., Austin, G.E. (2007). Winter gulls in the UK: population estimates from the 2003/04-2005/06 Winter Gull Roost Survey (BTO Research Report No. 456).

Benjamins, S., Harnois, V., Smith, H.C.M., Johanning, L., Greenhill, L., Carter, C. and Wilson, B. (2014). Understanding the potential for marine megafauna entanglement risk from renewable marine energy developments. Scottish Natural Heritage Commissioned Report No. 791.

Burger, J. (1998). Effects of Motorboats and Personal Watercraft on Flight Behavior over a Colony of Common Terns. The Condor 100, 528–534. https://doi.org/10.2307/1369719

Camphuysen, C.J., Fox, A.D., Leopold, M.F., Krag Petersen, I., 2004. Towards standardised seabirds at sea census techniques in connection with environmental impact assessments for offshore wind farms in the U.K. A comparison of ship and aerial sampling methods for marine birds, and their applicability to offshore wind farm assessments (No. COWRIE – BAM-02-2002). Royal Netherlands Institute for Sea Research.

CCW (2009a). Pen Llŷn a'r Sarnau /Lleyn Peninsula and the Sarnau Marine European Marine Site: Advice provided by the Countryside Council for Wales in fulfilment of Regulation 33 of the Conservation (Natural Habitats, andC.) Regulations 1994.

CCW (2009b). Cardigan Bay European Marine Site: Advice Provided by The Countryside Council for Wales in Fulfilment of Regulation 33 of The Conservation (Natural Habitats, andC.) Regulations 1994.

CCW (2009c). Pembrokeshire Marine European Marine Site: Advice provided by the Countryside Council for Wales in fulfilment of Regulation 33 of the Conservation (Natural Habitats, andC.) Regulations 1994.

Clarke, L.J., Banga, R., Robinson, G.J., Lindenbaum, C.P., Morris, C.W. and Stringell, T.B. (2018). Grey Seal (*Halichoerus grypus*) Pup Production and Distribution in North Wales, 2017. NRW Evidence Report No. xxx. 55pp. Natural Resources Wales, Bangor.

Cleasby, I.R., Owen, E., Wilson, L.J., Bolton, M., 2018. Combining habitat modelling and hotspot analysis to reveal the location of high density seabird areas across the UK (Research Report No. 63). RSPB Centre for Conservation Science.

Clewley, G.D., Scragg, E.S., Thaxter, C.B., Burton, N.H.K., 2017. Assessing the habitat use of Lesser Black-backed Gulls (Larus fuscus) from the Bowland Fells SPA ANNEX 1 – 2017 update (BTO Research Report No. 694a). BTO, Thetford.

Coulson, J.C., 2011. The Kittiwake. T. and A.D. Poyser, London.

Cox, S.L., Miller, P.I., Embling, C.B., Scales, K.L., Bicknell, A.W.J., Hosegood, P.J., Morgan, G., Ingram, S.N., Votier, S.C., 2016. Seabird diving behaviour reveals the functional significance of shelf-sea fronts as foraging hotspots. Royal Society Open Science 3. https://doi.org/10.1098/rsos.160317

Cramp, S. (Ed.), 1985. Handbook of the Birds of Europe, the Middle East and North Africa: The Birds of the Western Palearctic. Volume 4: Terns to Woodpeckers. Oxford University Press.

Cramp, S., Simmons, K.E.L. (Eds.), 1983. Handbook of the Birds of Europe, the Middle East and North Africa: The Birds of the Western Palearctic. Volume 3: Waders to Gulls. Oxford University Press.

Cramp, S., Simmons, K.E.L. (Eds.), 1977. Handbook of the Birds of Europe, the Middle East and North Africa: The Birds of the Western Palearctic. Volume 1: Ostrich to Ducks. Oxford University Press.

Cronin, M., Kavanagh, A. and Rogan, E. (2008). The foraging ecology of the harbour seal (*Phoca vitulina vitulina*) in southwest Ireland.

Cronin, M.A. (2011). The conservation of seals in Irish waters: how research informs management. Marine Policy 35:748-755.

Cunningham, L., Baxter, J.M., Boyd., I.L., Duck, C.D., Lonergan, M., Moss, S.E. and McConnell, B. (2009). Harbour seal movements and haul-out patterns: implications for monitoring and management. Aquatic Conservation: Marine and Freshwater Ecosystems. 19, pp.398-407.

Cutts, N., Hemingway, K., Spencer, J., 2013. Waterbird Disturbance Mitigation Toolkit Informing Estuarine Planning & Construction Projects. Institute of Estuarine & Coastal Studies (IECS) University of Hull

DAERA (2017). The Maidens SAC Conservation Objectives. March, 2017.

DAERA and JNCC (2017). SAC Selection Assessment: North Channel. January, 2017. Joint Nature Conservation Committee, UK. Available from: http://jncc.defra.gov.uk/page-7242.

Dean, B., 2012. The at-sea behaviour of the Manx shearwater (Thesis submitted for the degree of Doctor of Philosophy). University of Oxford, Oxford.

Dean, B., Freeman, R., Kirk, H., Leonard, K., Phillips, R., M Perrins, C., Guilford, T., 2012. Behavioural mapping of a pelagic seabird: Combining multiple sensors and a hidden Markov model reveals the distribution of at-sea behaviour. Journal of the Royal Society Interface 10. https://doi.org/10.1098/rsif.2012.0570

DECC (now Department for Business, Energy and Industrial Strategy) (2016). UK Offshore Energy Strategic Environmental Assessment 3 (OESEA3).

Deppe, L., Rowley, O., Rowe, L.K., Shi, N., McArthur, N., Gooday, O., Goldstien, S.J., 2017. Investigation of fallout events in Hutton's shearwaters (*Puffinus huttoni*) associated with artificial lighting. Notornis 64, 181–191.

Dierschke, V., Furness, R.W., Garthe, S., 2016. Seabirds and offshore wind farms in European waters: Avoidance and attraction. Biological Conservation 202, 59–68. https://doi.org/10.1016/j.biocon.2016.08.016

Erwin, R.M., 1989. Responses to human intruders by birds nesting in colonies: Experimental results and management guidelines. Colonial Waterbirds 12, 104–108.

Evans, P. G. H., Carson, Q., Fisher, P., Jordan, W., Limer, R and Rees, I. (1993). A study of the reactions of harbour porpoises to various boats in the coastal waters of Shetland. In European research on cetaceans, pp 60. Eds Evans. European Cetacean Society, Cambridge.

Feingold, D. and Evans P.G.H (2014). Bottlenose Dolphin and Harbour Porpoise Monitoring in Cardigan Bay and Pen Llŷn a'r Sarnau Special Areas of Conservation 2011 - 2013. NRW Evidence Report Series Report No: 4, 120 pp, Natural Resources Wales, Bangor.

Fontaine, M.C., Baird, S.J.E., Piry, S., Ray, N., Ferreira, M., Jauniaux, T., Llavona, A., Ozturk, B., Ozturk, A.A., Ridoux, V., Rogan, E., Sequeira, M., Siebert, U., Vikingsson, G.A., Bouquegneau, J.M. and Michaux, J.R. (2007). Rise of oceanographic barriers in continuous populations of a cetacean: the genetic structure of harbour porpoises in Old World waters. BMC BIOLOGY, 5. Available from: http://www.biomedcentral.com/1741-7007/5/30 .

Fontaine, M.C., Roland, K., Calves, I., Austerlitz, F., Palstra, F.P., Tolley, K.A., Ryan, S., Ferreira, M., Jauniaux, T., Llavona, A. and Öztürk, B. (2014). Postglacial climate changes and rise of three ecotypes of harbour porpoises, *Phocoena phocoena*, in western Palearctic waters. Molecular ecology, 23(13), pp.3306-3321.

Frederiksen, M., Moe, B., Daunt, F., Phillips, R.A., Barrett, R.T., Bogdanova, M.I., Boulinier, T., Chardine, J.W., Chastel, O., Chivers, L.S., Christensen-Dalsgaard, S., Clément-Chastel, C., Colhoun, K., Freeman, R., Gaston, A.J., González-Solís, J., Goutte, A., Grémillet, D., Guilford, T., Jensen, G.H., Krasnov, Y., Lorentsen, S.-H., Mallory, M.L., Newell, M., Olsen, B., Shaw, D., Steen, H., Strøm, H., Systad, G.H., Thórarinsson, T.L., Anker-Nilssen, T., 2012. Multicolony tracking reveals the winter distribution of a pelagic seabird on an ocean basin scale. Diversity and Distributions 18, 530–542. https://doi.org/10.1111/j.1472-4642.2011.00864.x

Frost, T.M., Austin, G.E., Calbrade, N.A., Mellan, H.J., Hearn, R.D., Stroud, D.A., Wotton, S.R., Balmer, D.E., 2018. Waterbirds in the UK 2016/17: The Wetland Bird Survey. BTO/RSPB/JNCC, Thetford.

Furness, R., 2015. Non-breeding season populations of seabirds in UK waters: Population sizes for Biologically Defined Minimum Population Scales (BDMPS). Natural England Commissioned Report 164.

Furness, R.W., Garthe, S., Trinder, M., Matthiopoulos, J., Wanless, S., Jeglinski, J., 2018. Nocturnal flight activity of northern gannets Morus bassanus and implications for modelling collision risk at offshore wind farms. Environmental Impact Assessment Review 73, 1–6. https://doi.org/10.1016/j.eiar.2018.06.006

Furness, R.W., Wade, H.M., 2012. Vulnerability of Scottish seabirds to offshore wind turbines. Marine Scotland Science.

Furness, R.W., Wade, H.M., Robbins, A.M.C., Masden, E.A., 2012. Assessing the sensitivity of seabird populations to adverse effects from tidal stream turbines and wave energy devices. ICES Journal of Marine Science 69, 1466–1479. https://doi.org/10.1093/icesjms/fss131

Garthe, S., Hüppop, O., 2004. Scaling possible adverse effects of marine wind farms on seabirds: developing and applying a vulnerability index. Journal of Applied Ecology 41, 724–734. https://doi.org/10.1111/j.0021-8901.2004.00918.x.

Gill A., Gloyne-Phillips, I., Neal, K. and Kimber, J. (2005). The potential effects of electromagnetic fields generated by sub-sea power cables associated with offshore wind farm developments on electrically and magnetically sensitive marine organisms – a review. Report to Collaborative Offshore Wind Research into the Environment (COWRIE) group, Crown Estates.

Gill, P., Elston, D., Grant, M., Sales, D., Clough, R., McMyn, I., 2018. Operational and Construction Monitoring and Analysis of Nine Years of Ornithological Data at Greater Gabbard Offshore Wind Farm.

Green, J., Green, R. and Jefferies, D. J. (1984). A radio-tracking survey of otters Lutra lutra on a Perthshire river system. Lutra. 27, pp.85-145.

Guilford, T.C., Meade, J., Freeman, R., Biro, D., Evans, T., Bonadonna, F., Boyle, D., Roberts, S., M. PERRINS, C., 2008. GPS tracking of the foraging movements of Manx Shearwaters Puffinus puffinus breeding on Skomer Island, Wales. Ibis 150, 462–473. https://doi.org/10.1111/j.1474-919X.2008.00805.x

Hammond, P.S., Northridge, S.P., Thompson, D., Gordon J.C.D., Hall, A.I., Aarts, G. and Matthiopoulos, J. (2005). Background information on marine mammals for Strategic Environmental Assessment 6. Sea Mammal Research Unit.

Hammond P.S., Macleod K., Berggren P., Borchers D.L., Burt L., Cañadas A., Desportes G., Donovan G.P., Gilles A., Gillespie D., Gordon J., Hiby L., Kuklik I., Leaper R., Lehnert K, Leopold M., Lovell P., Øien N., Paxton C.G.M., Ridoux V., Rogano E., Samarraa F., Scheidatg M., Sequeirap M., Siebertg U., Skovq H., Swifta R., Tasker M.L., Teilmann J., Canneyt O.V. and Vázquez J.A. (2013). Cetacean abundance and distribution in European Atlantic shelf waters to inform conservation and management. Biological Conservation 164, 107-122.

Hammond, P.S., Lacey, C., Gilles, A., Viquerat, S., Boerjesson, P., Herr, H., Macleod, K., Ridoux, V., Santos, M., Scheidat, M. and Teilmann, J. (2017). Estimates of cetacean abundance in European Atlantic waters in summer 2016 from the SCANS-III aerial and shipboard surveys. Wageningen Marine Research.

Haney, J., Stone, A.E., 1988. Seabird foraging tactics and water clarity: Are plunge divers really in the clear? Marine Ecology Progress Series 49, 1–9. https://doi.org/10.3354/meps049001

Harris, M.P., Wanless, S., 2011. The Puffin. T. and A.D. Poyser, London.

Harwood, A.J.P., Perrow, M.R., Berridge, R.J., Tomlinson, M.L., Skeate, E.R., 2017. Unforeseen Responses of a Breeding Seabird to the Construction of an Offshore Wind Farm, in: Köppel, J. (Ed.), Wind Energy and Wildlife Interactions. Springer International Publishing.

Heinänen, S. and Skov, H. (2015). The identification of discrete and persistent areas of relatively high harbour porpoise density in the wider UK marine area, JNCC Report No.544 JNCC, Peterborough.

Hobson, K.A., Welch, H.E., 1992. Observations of Foraging Northern Fulmars (Fulmarus Glacialis) in the Canadian High Arctic. ARCTIC; Vol 45, No 2 (1992): June: 105–210DO - 10.14430/arctic1387.

IAMMWG (2013). Management Units for marine mammals in UK waters (June 2013).

Inter-Agency Marine Mammal Working Group (IAMMWG) (2015). Management Units for cetaceans in UK waters (January 2015). JNCC Report No. 547, JNCC Peterborough.

Isaacman, L. and Daborn, G. (2011). Pathways of Effects for Offshore Renewable Energy in Canada. Report to Fisheries and Oceans Canada. Acadia Centre for Estuarine Research (ACER) Publication No. 102, Acadia University, Wolfville, NS, Canada. 70 pp.

Kastelein, R.A., Hardemann, J. and Boer, H. (1997). Food consumption and body weight of harbour porpoises (*Phocoena phocoena*). In The biology of the harbour porpoise, Read, A.J., Wiepkema, P.R., Nachtigall P.E. 1997pp. 217–234. ed. Woerden, The Netherlands: De Spil Publishers.

JNCC, 2019. Special Protection Areas (SPAs): Full UK SPA Site List.

JNCC, 2016. Draft Departmental Brief: Irish Sea Front potential SPA. JNCC, Peterborough.

JNCC (2013). Individual Species Reports –3rd UK Habitats Directive Reporting 2013. Available at: http://jncc.defra.gov.uk/page-6391

JNCC (2017) SAC Selection Assessment: Bristol Channel Approaches / Dynesfeydd Môr Hafren. January 2017. Joint Nature Conservation Committee, UK. Available from: http://jncc.defra.gov.uk/page-7241

JNCC and NRW (2016a). Harbour Porpoise (*Phocoena phocoena*) possible Special Area of Conservation: North Anglesey Marine/ Gogledd Môn Forol Draft Conservation Objectives and Advice on Activities. January, 2016.

JNCC and NRW (2016b). Harbour Porpoise (*Phocoena phocoena*) possible Special Area of Conservation: West Wales Marine / Gorllewin Cymru Forol Draft Conservation Objectives and Advice on Activities. January, 2016.

JNCC and NRW (2017). SAC Selection Assessment: North Anglesey Marine/ Gogledd Môn Forol. January, 2017. Joint Nature Conservation Committee, UK. Available from: http://jncc.defra.gov.uk/page-7244

JNCC, NE and CCW (2010). Draft EPS Guidance - The protection of marine European Protected Species from injury and disturbance. Guidance for the marine area in England and Wales and the UK offshore marine area. Joint Nature Conservation Committee, Natural England and Countryside Council for Wales. October 2010.

JNCC, NRW and DAERA (2019a). Harbour Porpoise (*Phocoena phocoena*) Special Area of Conservation: North Anglesey Marine/Gogledd Môn Forol Conservation Objectives and Advice on Operations. March, 2019.

Johnstone, I., Mucklow, C., Cross, T., Lock, L., Carter, I., 2011. The return of the Red-billed Chough to Cornwall: the first ten years and prospects for the future. British Birds 104, 416–431.

Jones, P.H., Whalley, P., 2004. Birds of Anglesey. Mentor Mon, Llangefni.

Kastelein, R.A., Hardemann, J. and Boer, H. (1997). Food consumption and body weight of harbour porpoises (*Phocoena phocoena*). In The biology of the harbour porpoise Read, A.J., Wiepkema, P.R., Nachtigall, P.E (1997). Eds. Woerden, The Netherlands: De Spil Publishers. pp. 217–234.

Kastelein, R.A., Van de Voorde, S, and Jennings, N. (2018). Swimming Speed of a Harbour Porpoise (*Phocoena phocoena*) During Playbacks of Offshore Pile Driving Sounds. Aquatic Mammals: 44(1):92-99.

Kiely, O., Lidgard, D., McKibben, M., Connolly, N. & Baines, M.E. (2000). Grey seals: Status and monitoring in the Irish and Celtic Seas. Maritime Ireland/Wales INTERREG Report No. 3.

Laguna, J.M., Barbara, N., Metzger, B., 2014. Light pollution impact on “tubenose” seabirds: an overview of areas of concern in the Maltese Islands. Birdlife Malta.

Langston, R., 2010. Offshore wind farms and birds: Round 3 zones, extension to Round 1 and Round 2 sites and Scottish Territorial waters (RSPB Research Report No. 39). RSPB Centre for Conservation Science.

Leopold, M.F., van Bemmelen, R.S.A., Zuur, A.F., 2013. Responses of Local Birds to the Offshore Wind Farms PAWP and OWEZ off the Dutch mainland coast (No. C151/12). IMARES - Institute for Marine Resources & Ecosystem Studies, Texel.

Livezey, K.B., Fernández-Juricic, E., Blumstein, D., 2016. Database and metadata of bird flight initiation distances worldwide to assist in estimating human disturbance effects and delineating buffer areas. Journal of Fish and Wildlife Management 7, 181–191. https://doi.org/10.3996/082015-JFWM-078.

Macleod,K., Burt, M.L., Cañadas, A., Rogan, E., Santos, B., Uriarte, A., Van Canneyt, O., Vázquez, J. A. and Hammond, P. S. (2009). Design-based estimates of cetacean abundance in offshore European Atlantic waters. Appendix I in the Final Report of the Cetacean Offshore Distribution and Abundance in the European Atlantic. 16pp.

Matthiopoulos J, McConnell B.J, Duck C and Fedak M.A. (2004). Using satellite telemetry and aerial counts to estimate space use by grey seals around the British Isles. Journal of Applied Ecology. 41(3), pp.476-491.

McConnell, B.J., Fedak, M.A., Lovell, P. and Hammond, P.S. (1999). Movements and foraging of grey seals in the North Sea. Journal of Applied Ecology. 36, pp.573-590.

McGarry, T., de Silva, R., Canning, S., Mendes, S., Prior, A., Stephenson, S. and Wilson, J. (2018). Guide for the selection and deployment of acoustic deterrent devices. JNCC Report No. 615, JNCC, Peterborough. ISSN 0963-8091.

Musgrove, A.J., Austin, G.E., Hearn, R.D., Holt, C.A., Stroud, D.A., Wotton, S.R., 2011. Overwinter population estimates of British waterbirds. British Birds 104, 364–397.

Natural England, Countryside Council for Wales, 2010. Departmental Brief: Liverpool Bay / Bae Lerpwl Special Protection Area.

Natural England, JNCC and NRW (2016). Harbour Porpoise (*Phocoena phocoena*) possible Special Area of Conservation: Bristol Channel Approaches / Dynesfeydd Môr Hafren Draft Conservation Objectives and Advice on Activities. January, 2016.

Natural Power, 2018. Displacement and habituation of seabirds in response to marine activities (No. MMO 1139). Marine Management Organisation.

NMFS (2018) Revisions to: Technical Guidance for assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing (Version 2.0): Underwater Thresholds for Onset of Permanent and Temporary Threshold Shift. U.S. Dept. of Commer., NOAA. NOAA Technical Memorandu, NMFS-OPR-59.

Normandeau, Exponent,Tricas, T. and Gill, A. (2011). Effects of EMFs from Undersea Power Cables on Elasmobranchs and Other Marine Species. OCS Study BOEMRE 2011-09, U.S. Department of the Interior, Bureau of Ocean Energy Management, Regulation, and Enforcement, Pacific OCS Region, Camarillo, California. https://www.boem.gov/Environmental-Stewardship/Environmental-Studies/Pacific-Region/Studies/2011-09-EMF-Effects.aspx

NPWS (2011). Conservation Objectives: Saltee Islands SAC 000707 and Saltee Islands SPA 004002. Version 1.0. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.

NPWS (2013a). Conservation Objectives: Rockabill to Dalkey Island SAC 003000. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.

NPWS (2013b). Conservation Objectives: Lambay Island SAC 000204. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.

NPWS, 2017a. Howth Head Coast SPA Citation.

NPWS, 2017b. Ireland's Eye SPA Citation.

NPWS, 2017c. Lambay Island SPA Citation.

NPWS, 2017d. Saltee Islands SPA Citation.

NRW, 2015a. Northern Cardigan Bay/Gogledd Bae Ceredigion Draft Special Protection Area (Advice to the Welsh Government).

NRW, 2015b. Proposal to extend and reclassify Ynys Feurig, Cemlyn Bay and The Skerries Special Protection Area and rename it as Anglesey Terns Special Protection Area (Departmental Advice to Welsh Government).

NRW (2017). Pen Llŷn a'r Sarnau / Lleyn Peninsula and the Sarnau Special Area of Conservation: Advice provided by Natural Resources Wales in fulfilment of Regulation 35 of the Conservation of Habitats and Species Regulations 2010 (as amended). Available from: https://naturalresources.wales/media/682010/pen-llyn-ar-sarnau-reg-35-report.pdf

NRW (2018a). Cardigan Bay/ Bae Ceredigion Special Area of Conservation Advice provided by Natural Resources Wales in fulfilment of Regulation 37 of the Conservation of Habitats and Species Regulations 2017. March, 2018.

NRW (2018b). Pembrokeshire Marine / Sir Benfro Forol Special Area of Conservation Advice provided by Natural Resources Wales in fulfilment of Regulation 37 of the Conservation of Habitats and Species Regulations 2017. March, 2018.

NRW and JNCC (2017). SAC Selection Assessment Document: West Wales Marine / Gorllewin Cymru Forol. January, 2017. Natural Resources Wales and Joint Nature Conservation Committee, UK. Available from: http://jncc.defra.gov.uk/page-7343

NRW and JNCC (2019). Harbour Porpoise (Phocoena phocoena) Special Area of Conservation: West Wales Marine / Gorllewin Cymru Forol Conservation Objectives and Advice on Operations. March, 2019.

O'Brien, S., J. Wilson, L., Webb, A., A. Cranswick, P., 2010. Revised estimate of numbers of wintering Red-throated Divers Gavia stellata in Great Britain: Capsule An estimated 17 000 Red-throated Divers winter around Great Britain. Bird Study 55, 152–160. https://doi.org/10.1080/00063650809461517

Oppel, S., Bolton, M., Carneiro, A.P.B., Dias, M.P., Green, J.A., Masello, J.F., Phillips, R.A., Owen, E., Quillfeldt, P., Beard, A., Bertrand, S., Blackburn, J., Boersma, P.D., Borges, A., Broderick, A.C., Catry, P., Cleasby, I., Clingham, E., Creuwels, J., Crofts, S., Cuthbert, R.J., Dallmeijer, H., Davies, D., Davies, R., Dilley, B.J., Dinis, H.A., Dossa, J., Dunn, M.J., Efe, M.A., Fayet, A.L., Figueiredo, L., Frederico, A.P., Gjerdrum, C., Godley, B.J., Granadeiro, J.P., Guilford, T., Hamer, K.C., Hazin, C., Hedd, A., Henry, L., Hernández-Montero, M., Hinke, J., Kokubun, N., Leat, E., Tranquilla, L.M., Metzger, B., Militão, T., Montrond, G., Mullié, W., Padget, O., Pearmain, E.J., Pollet, I.L., Pütz, K., Quintana, F., Ratcliffe, N., Ronconi, R.A., Ryan, P.G., Saldanha, S., Shoji, A., Sim, J., Small, C., Soanes, L., Takahashi, A., Trathan, P., Trivelpiece, W., Veen, J., Wakefield, E., Weber, N., Weber, S., Zango, L., Daunt, F., Ito, M., Harris, M.P., Newell, M.A., Wanless, S., González-Solís, J., Croxall, J., 2018. Spatial scales of marine conservation management for breeding seabirds. Marine Policy 98, 37–46. https://doi.org/10.1016/j.marpol.2018.08.024

Otani, S., Naito, T., Kato, A. and Kawamura, A. (2000). Diving behaviour and swimming speed of a free-ranging harbour porpoise (*Phocoena phocoena*). Marine Mammal Science, Volume 16, Issue 4, pp 811-814, October 2000.

Paterson, W., Russell, D. J. F, Wu, M., McConnell, B. J. and Thompson, D. (2015). Harbour seal haul-out monitoring, Sound of Islay. Scottish Natural Heritage Commissioned Report No.894.

Paxton, C.G.M., Scott-Hayward, L., Mackenzie, M., Rexstad, E. and Thomas, L. (2016). Revised Phase III Data Analysis of Joint Cetacean Protocol Data Resources with Advisory Note, JNCC Report 517, ISSN 0963-8091: http://jncc.defra.gov.uk/page-7201.

Perrins, C.M., Wood, M., Garroway, C., Boyle, D., Oakes, O., Revera, R., Collins, P., Taylor, C., 2012. A whole-island census of the Manx Shearwaters Puffinus puffinus breeding on Skomer Island in 2011. Seabird 25, 1–13.

Perrow, M.R., Skeate, E.R., Gilroy, J., 2011. Visual tracking from a rigid-hulled inflatable boat to determine foraging movements of breeding terns. Journal of Field Ornithology 82, 68–79. https://doi.org/10.1111/j.1557-9263.2010.00309.x

Polacheck, T. and Thorpe, L. (1990). The swimming direction of harbor porpoises in relationship to a survey vessel. Report of the International Whaling Commission, 40, pp.463-470.

Regular, P.M., Hedd, A., Montevecchi, W.A., 2011. Fishing in the dark: a pursuit-diving seabird modifies foraging behaviour in response to nocturnal light levels. PloS one 6, e26763–e26763. https://doi.org/10.1371/journal.pone.0026763

Robbins, A.M.C., 2017. Seabird ecology in high-energy environments: approaches to assessing impacts of marine renewables. University of Glasgow, Glasgow.

Roche, K., Harris, R., Warrington, S. and Copp, G.H. 1995. Home range and diet of re-introduced European otters *Lutra lutra* (L.) in Hertfordshire rivers. Aquat. Conserv. 5, pp.87–96.

Rodgers Jr., J.A., Schwikert, S.T., 2002. Buffer-Zone Distances to Protect Foraging and Loafing Waterbirds from Disturbance by Personal Watercraft and Outboard-Powered Boats. Conservation Biology 16, 216–224. https://doi.org/10.1046/j.1523-1739.2002.00316.x

Rodgers Jr., J.A., Smith, H.T., 1995. Set-Back Distances to Protect Nesting Bird Colonies from Human Disturbance in Florida. Conservation Biology 9, 89–99. https://doi.org/10.1046/j.1523-1739.1995.09010089.x

Rodríguez, A., Burgan, G., Dann, P., Jessop, R., Negro, J.J., Chiaradia, A., 2014. Fatal Attraction of Short-Tailed Shearwaters to Artificial Lights. PLOS ONE 9, e110114. https://doi.org/10.1371/journal.pone.0110114

Rodríguez, A., Moffett, J., Revoltós, A., Wasiak, P., McIntosh, R.R., Sutherland, D.R., Renwick, L., Dann, P., Chiaradia, A., 2017. Light pollution and seabird fledglings: Targeting efforts in rescue programs. The Journal of Wildlife Management 81, 734–741. https://doi.org/10.1002/jwmg.21237

Rodríguez, A., Rodríguez, B., Negro, J.J., 2015. GPS tracking for mapping seabird mortality induced by light pollution. Scientific reports 5, 10670–10670. https://doi.org/10.1038/srep10670

Rogan, E., Breen, P., Mackey, M., Cañadas, A., Scheidat, M., Geelhoed, S. & Jessopp, M. (2018). Aerial surveys of cetaceans and seabirds in Irish waters: Occurrence, distribution and abundance in 2015-2017. Department of Communications, Climate Action & Environment and National Parks and Wildlife Service (NPWS), Department of Culture, Heritage and the Gaeltacht, Dublin, Ireland. 297pp.

Russell, D.J.F, Jones, E.L. and Morris, C.D. (2017). Updated Seal Usage Maps: The Estimated at-sea Distribution of Grey and Harbour Seals. Scottish Marine and Freshwater Science Vol 8 No 25, 25pp. DOI: 10.7489/2027-1.

Schwemmer, P., Garthe, S., 2008. Regular habitat switch as an important feeding strategy of an opportunistic seabird species at the interface between land and sea. Estuarine, Coastal and Shelf Science 77, 12–22. https://doi.org/10.1016/j.ecss.2007.08.017.

Sea Watch Foundation (2019). Wales Recent Sightings. Available from: http://seawatchfoundation.org.uk/legacy_tools/region.php?output_region=10

Sharples R.J., Matthiopoulos, J. and Hammond, P.S. (2008). Distribution and movements of harbour seals around the coast of Britain: Outer Hebrides, Shetland, Orkney, the Moray Firth, St Andrews Bay, The Wash and the Thames. Report to DTI July 2008.

Sharples, R.J., Moss, S.E., Patterson, T.A. and Hammond, P.S. (2012). Spatial Variation in Foraging Behaviour of a Marine Top Predator (*Phoca vitulina*) Determined by a Large-Scale Satellite Tagging Program. PLoS ONE 7(5): e37216.

Shoji, Akiko, Aris-Brosou, S., Fayet, A., Padget, O., Perrins, C., Guilford, T., 2015. Dual foraging and pair coordination during chick provisioning by Manx shearwaters: empirical evidence supported by a simple model. The Journal of experimental biology 218, 2116–2123. https://doi.org/10.1242/jeb.120626

Shoji, A., Dean, B., Kirk, H., Freeman, R., Perrins, C.M., Guilford, T., 2016. The diving behaviour of the Manx Shearwater Puffinus puffinus. Ibis 158, 598–606. https://doi.org/10.1111/ibi.12381

Shoji, A., Elliot, K., Fayet, A., Boyle, D., Perrins, C., Guilford, T., 2015. Foraging behaviour of sympatric razorbills and puffins. Mar Ecol Prog Ser 520, 257–267.

SNH, 2016. Assessing collision risk between underwater turbines and marine wildlife (Guidance note). Scottish Natural Heritage.

SNH, 2018. Interim Guidance on Apportioning Impacts from Marine Renewable Developments to Breeding Seabird Populations in Special Protection Areas (Guidance note). Scottish Natural Heritage.

SNH (2019). Inner Hebrides and the Minches SAC: Conservation Objectives and Advice to Support Management. April, 2019.

Sparling, C.E., Coram, A.J., McConnell, B., Thompson, D., Hawkins, K.R. and Northridge S.P. (2013). Paper Three: Mammals. Wave & Tidal Consenting Position Paper Series.

Special Committee on Seals (SCOS) (2014). SCOS Report. Scientific Advice on Matters Related to the Management of Seal Populations: 2014.

Special Committee on Seals (SCOS) (2017). SCOS Report. Scientific Advice on Matters Related to the Management of Seal Populations: 2017.

Strong, P. and Morris, S.R. (2010). Grey seal (*Halichoerus grypus*) disturbance, ecotourism and the Pembrokeshire Marine Code around Ramsey Island. J. Ecotourism 9(2): 117–132.

Stroud, D.A., Bainbridge, I.P., Maddock, A., Anthony, S., Baker, H., Buxton, N., Chambers, D., Enlander, I., Hearn, R.D., Jennings, K.R., Mavor, R., Whitehead, S., Wilson, J.D., 2016. The status of UK SPAs in the 2000s: the Third Network Review. JNCC, Peterborough.

Subacoustech (2014). Underwater noise modelling of tidal devices and other associated noise at the Perpetuus Tidal Energy Centre off the coast of the Isle of Wight, England. Subacoustech Report No. E432R0105.

Subacoustech, 2019. Morlais tidal project, Holy Island – Underwater noise technical note. A report prepared for HaskoningDHV Ltd.

Thaxter, C., Lascelles, B., Sugar, K., Cook, A., Roos, S., Bolton, M., Langston, R., Burton, N., 2012. Seabird foraging ranges as a preliminary tool for identifying candidate Marine Protected Areas. Biological Conservation 156. https://doi.org/10.1016/j.biocon.2011.12.009

The Crown Estate. Wave and tidal enabling action: consolidation of wave and tidal EIA / HRA issues and research priorities (2014). Technical Report.

Thompson, P.M., McConnell, B.J., Tollit, D.J., Mackay, A., Hunter, C. and Racey, P.A. (1996). Comparative distribution, movements and diet of harbour and grey seals from the Moray Firth, N.E. Scotland. Journal of Applied Ecology. 33, pp.1572-1584.

Thomsen, F., Lüdemann, K., Kafemann, R. and Piper, W. (2006). Effects of offshore wind farm noise on marine mammals and fish, on behalf of COWRIE Ltd.

Tolley, K.A. and Rosel, P.E., (2006). Population structure and historical demography of eastern North Atlantic harbour porpoises inferred through mtDNA sequences. Marine Ecology Progress Series, 327, pp.297-308.

Vallejo, G.C., Grellier, K., Nelson, E.J., McGregor, R.M., Canning, S.J., Caryl, F.M., McLean, N., 2017. Responses of two marine top predators to an offshore wind farm. Ecology and Evolution 7, 8698–8708. https://doi.org/10.1002/ece3.3389

Vanermen, N., Onkelinx, T., Courtens, W., Van de walle, M., Verstraete, H., Stienen, E.W.M., 2015. Seabird avoidance and attraction at an offshore wind farm in the Belgian part of the North Sea. Hydrobiologia 756, 51–61. https://doi.org/10.1007/s10750-014-2088-x

Veneruso, G. and Evans, P.G.H. (2012a). Connectivity of Bottlenose Dolphins in Welsh Waters: North Wales Photo-Monitoring Interim Report. Report to Countryside Council for Wales. Sea Watch Foundation. 17pp.

Veneruso, G. and Evans, P.G.H. (2012b). Bottlenose Dolphin and Harbour Porpoise Monitoring in Cardigan Bay and Pen Llyn a‟r Sarnau Special Areas of Conservation. CCW Monitoring Report No. 95. 66pp.

Wakefield, E.D., Bodey, T.W., Bearhop, S., Blackburn, J., Colhoun, K., Davies, R., Dwyer, R.G., Green, J.A., Grémillet, D., Jackson, A.L., Jessopp, M.J., Kane, A., Langston, R.H.W., Lescroël, A., Murray, S., Le Nuz, M., Patrick, S.C., Péron, C., Soanes, L.M., Wanless, S., Votier, S.C., Hamer, K.C., 2013. Space Partitioning Without Territoriality in Gannets. Science 341, 68. https://doi.org/10.1126/science.1236077

Wakefield, E.D., Owen, E., Baer, J., Carroll, M.J., Daunt, F., Dodd, S.G., Green, J.A., Guilford, T., Mavor, R.A., Miller, P.I., Newell, M.A., Newton, S.F., Robertson, G.S., Shoji, A., Soanes, L.M., Votier, S.C., Wanless, S., Bolton, M., 2017. Breeding density, fine-scale tracking, and large-scale modeling reveal the regional distribution of four seabird species. Ecological Applications 27, 2074–2091. https://doi.org/10.1002/eap.1591

Wanless, S., Okill, J.D., 1994. Body measurements and flight performance of adult and juvenile gannets morus bassanus. Ringing & Migration 15, 101–103. https://doi.org/10.1080/03078698.1994.9674081

Wernham, C., Toms, M., Marchant, J.H., Clark, J., Siriwardena, G., Baillie, S.R., 2002. The Migration Atlas: Movements of the Birds of Britain and Ireland. T. and A.D. Poyser, London.

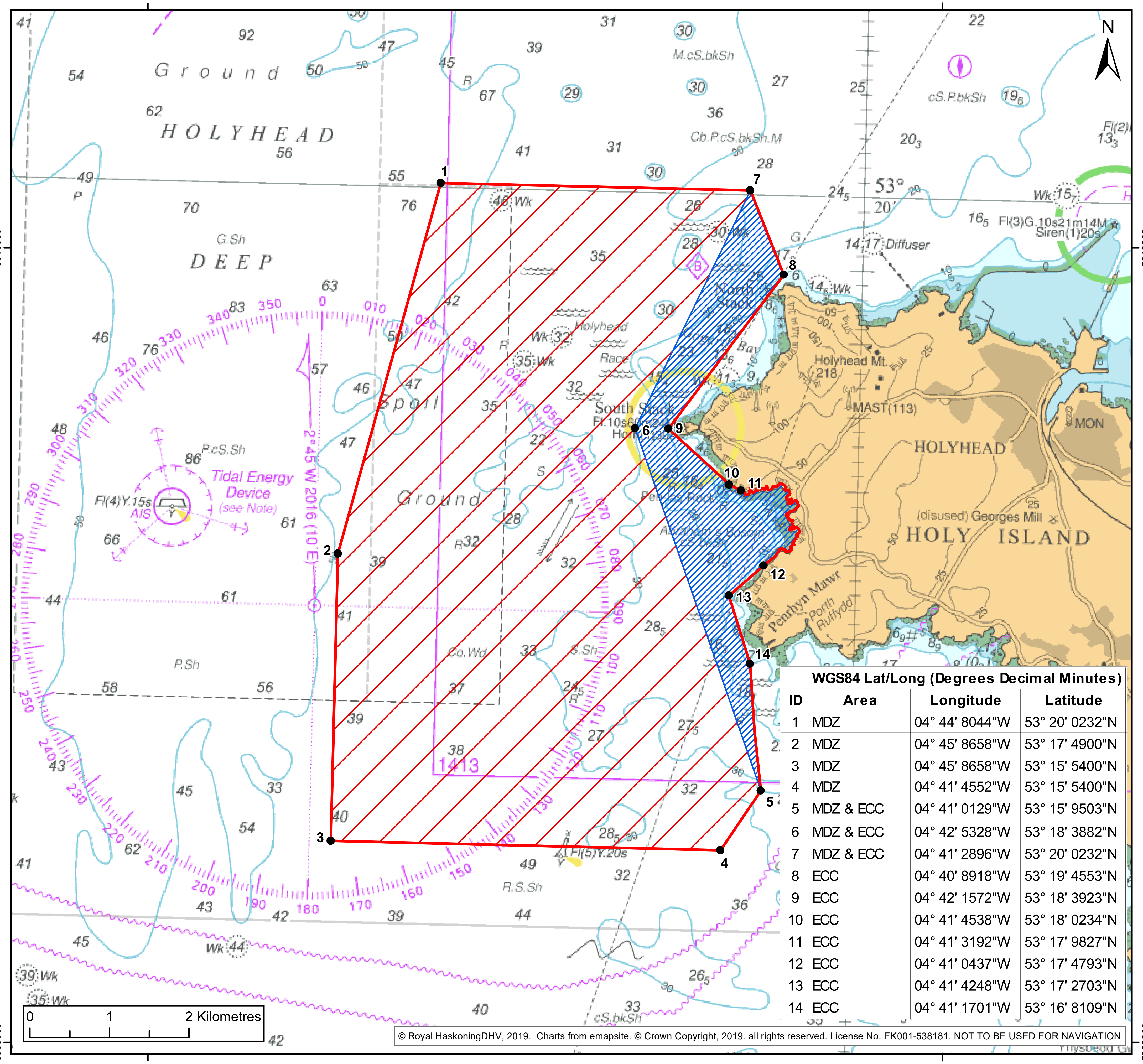
Whitehead, S., Johnstone, I., Wilson, J., 2005. Choughs Pyrrhocorax pyrrhocorax breeding in Wales select foraging habitat at different spatial scales. Bird Study 52, 193–203. https://doi.org/10.1080/00063650509461391

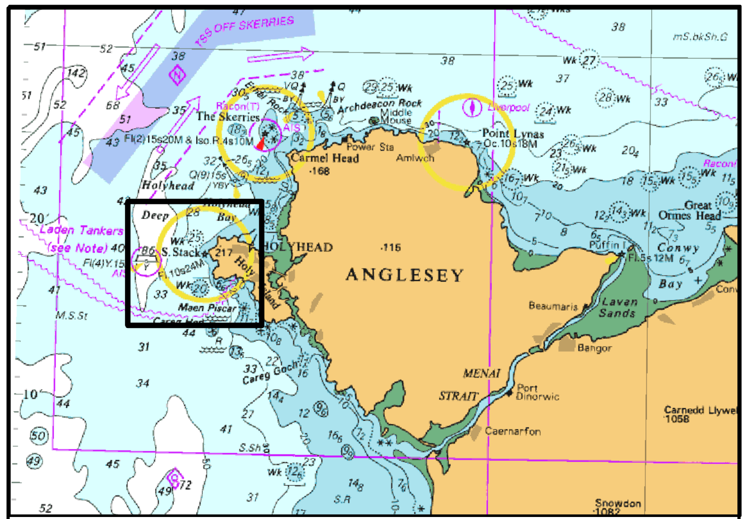
Wilson, L.J., Black, J., Brewer, M.J., Potts, J.M., Kuepfer, A., Win, I., Kober, K., Bingham, C., Mavor, R., Webb, A., 2014. Quantifying usage of the marine environment by terns Sterna sp. around their breeding colony SPAs (JNCC Report No. 500). JNCC.

Wilson, S. (2014). The impact of human disturbance at seal haul-outs. A literature review for the Seal Conservation Society. http://www.pinnipeds.org/attachments/article/199/Disturbance%20for%20SCS%20-%20text.pdf.

Wright, M.D., Goodman, P., Cameron, T., 2010. Exploring behavioural responses of shorebirds to impulsive noise. Wildfowl 60, 150–167

SUPPORTING FIGURES





Legend:

- Offshore Development Area
- Morlais Demonstration Zone (MDZ)
- Export Cable Corridor (ECC)

WGS84 Lat/Long (Degrees Decimal Minutes)

ID	Area	Longitude	Latitude
1	MDZ	04° 44' 8044"W	53° 20' 0232"N
2	MDZ	04° 45' 8658"W	53° 17' 4900"N
3	MDZ	04° 45' 8658"W	53° 15' 5400"N
4	MDZ	04° 41' 4552"W	53° 15' 5400"N
5	MDZ & ECC	04° 41' 0129"W	53° 15' 9503"N
6	MDZ & ECC	04° 42' 5328"W	53° 18' 3882"N
7	MDZ & ECC	04° 41' 2896"W	53° 20' 0232"N
8	ECC	04° 40' 8918"W	53° 19' 4553"N
9	ECC	04° 42' 1572"W	53° 18' 3923"N
10	ECC	04° 41' 4538"W	53° 18' 0234"N
11	ECC	04° 41' 3192"W	53° 17' 9827"N
12	ECC	04° 41' 0437"W	53° 17' 4793"N
13	ECC	04° 41' 4248"W	53° 17' 2703"N
14	ECC	04° 41' 1701"W	53° 16' 8109"N

Client: morlais / MENTER MÔN

Project: morlais ANGLESEY MARINE ENERGY

Title:

Offshore Development Area

Figure: 1-1 Drawing No: PB5034-ES-001-001

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
02	01/07/19	LB	CG	A3	1:50,000
01	12/04/19	FC	CG	A3	1:50,000

Co-ordinate system: WGS 1984 UTM Zone 30N

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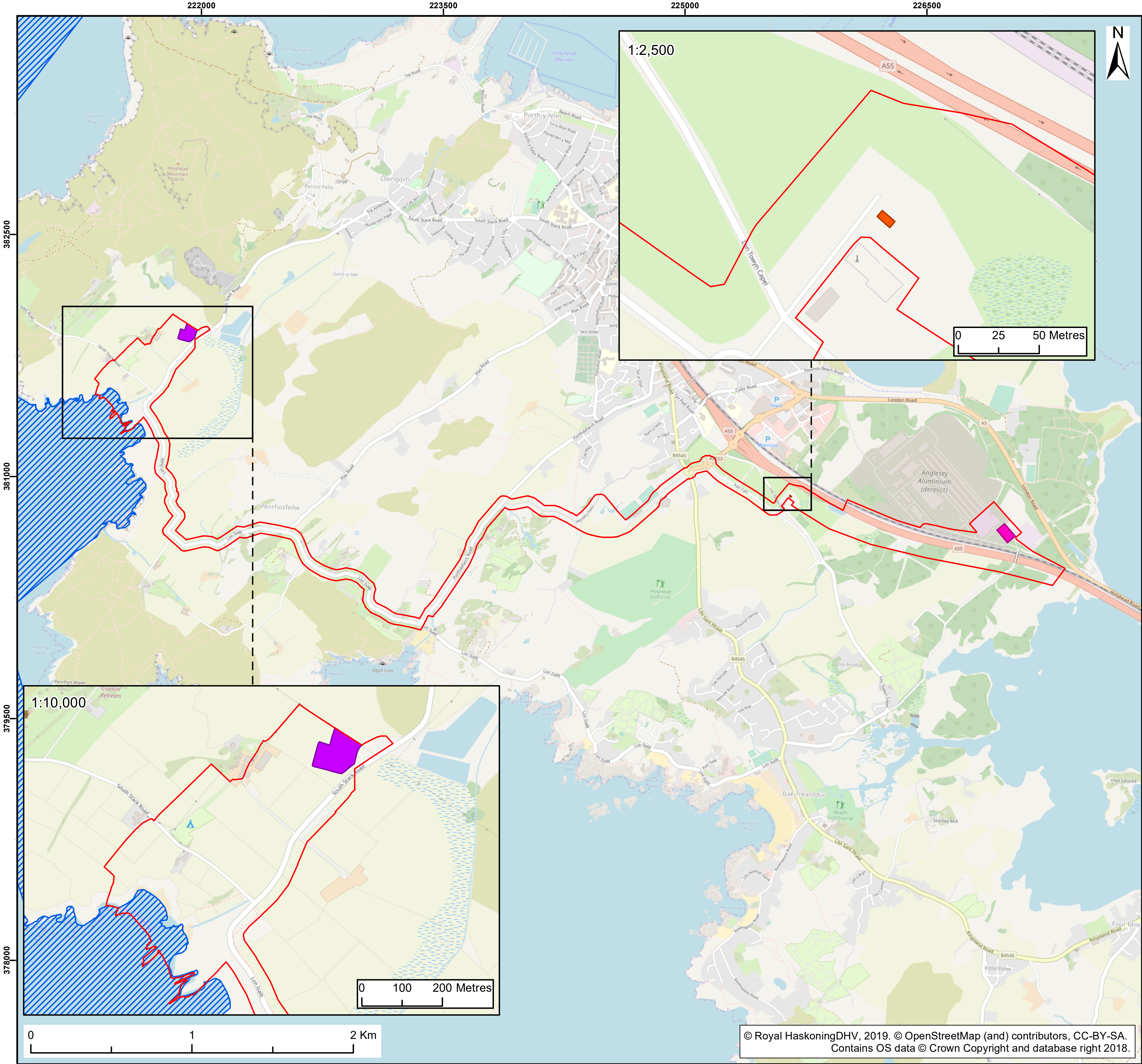

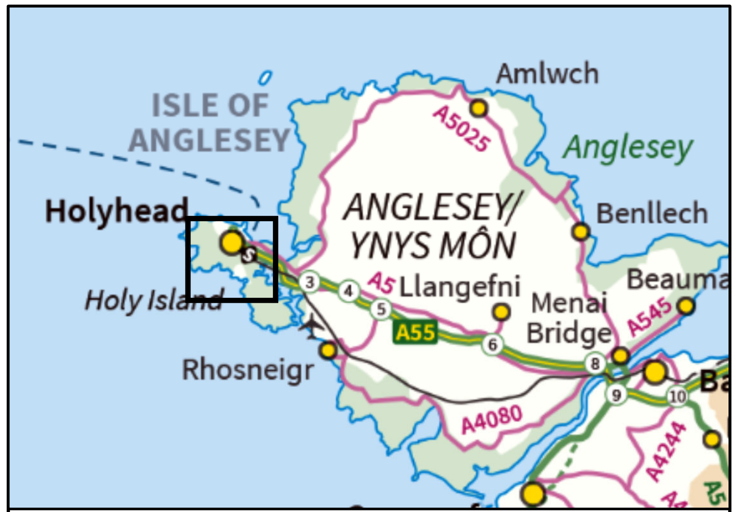

Legend:

- Onshore Development Area
- Export Cable Corridor (ECC)
- Grid Connection Substation
- Landfall Substation
- Switchgear Building

Client: morlais / MENTER MÔN

Project: morlais ANGLESEY MARINE ENERGY

Title:

Onshore Development Area

Figure: 1-2 | Drawing No: PB5034-ES-001-002

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
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Co-ordinate system: British National Grid

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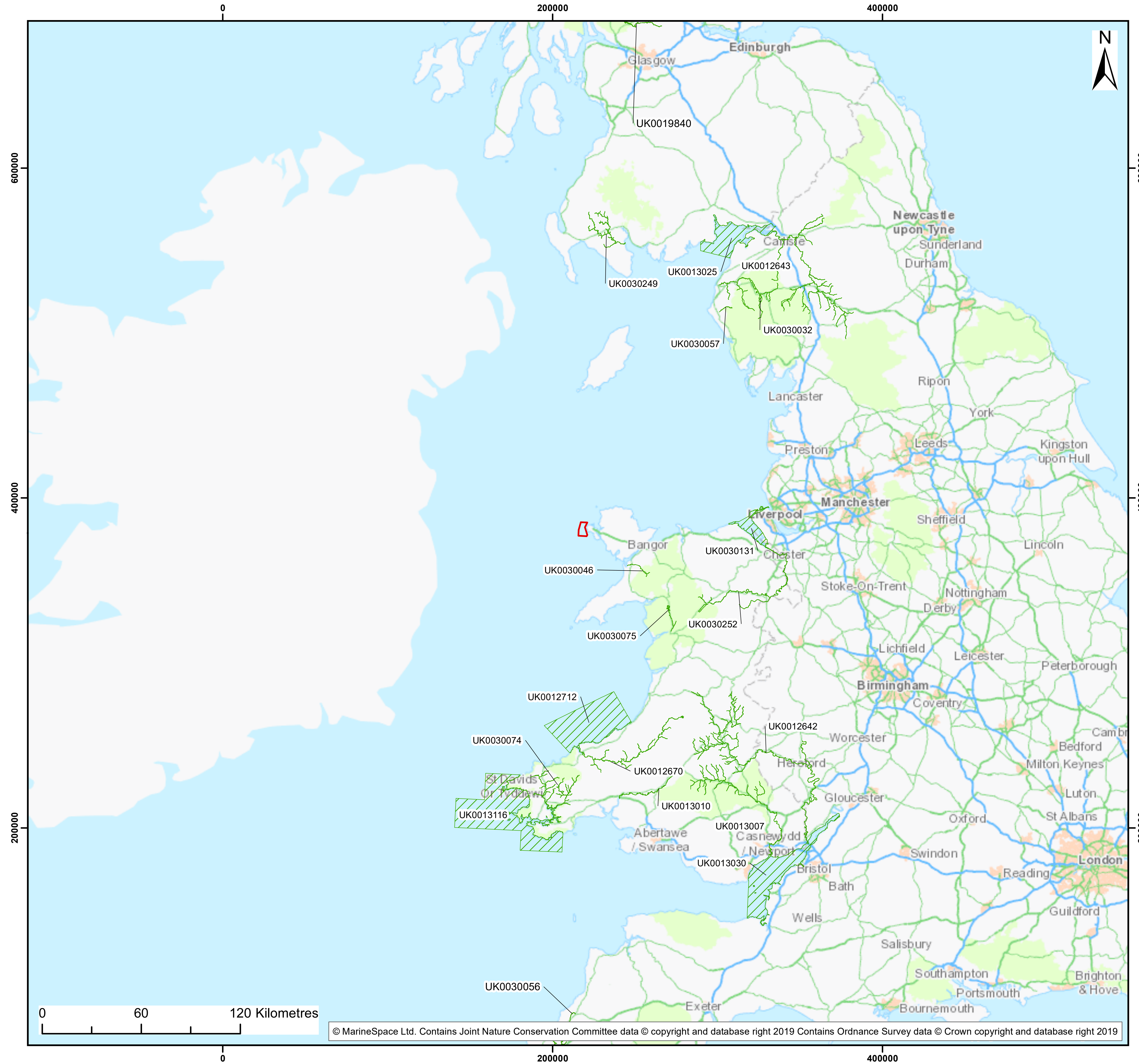

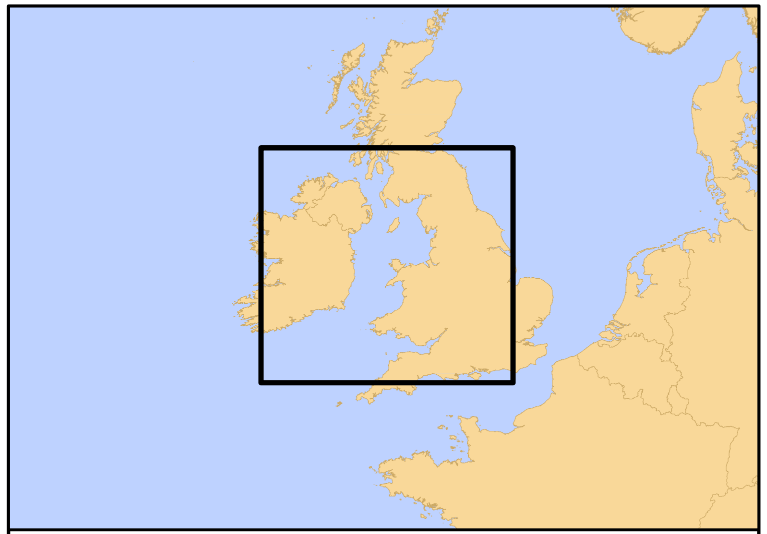

Legend:

- Morlais Demonstration Zone
- SAC screened in for migratory fish

Client:

Project:

Title: Location of Special Areas of Conservation (SACs) with migratory fish as a designated feature in the vicinity of the study area

Figure: 5-1 | Drawing No: PB5034-ES-0XX-051

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
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Co-ordinate system: British National Grid

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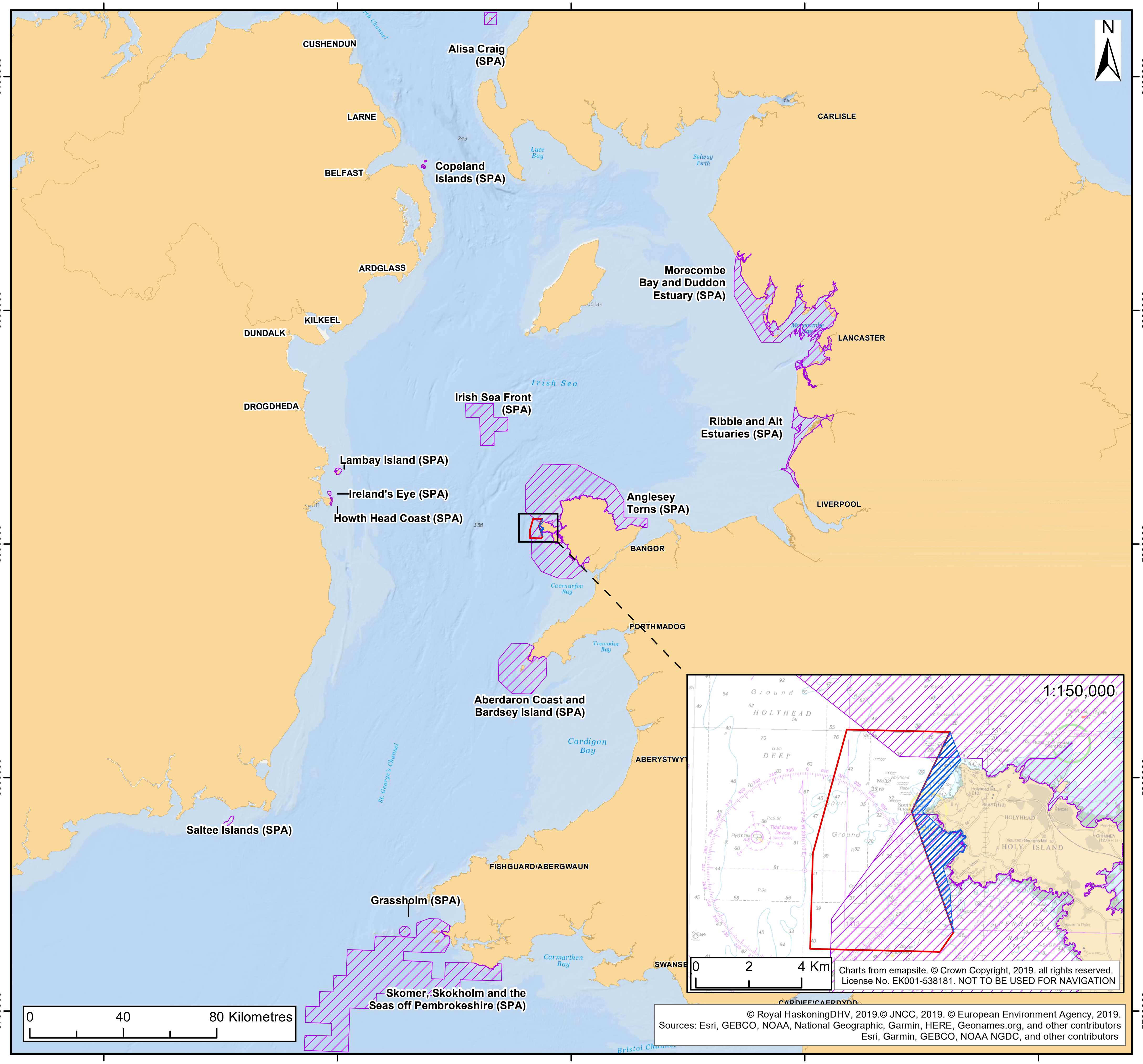
Making Sense of the Marine Environment ™



Legend:

- Morlais Demonstration Zone (MDZ)
- Export Cable Corridor (ECC)
- Special Protection Area (SPA)

Client: morlais MENTER MÔN

Project: morlais ANGLESEY MARINE ENERGY

Title:

Designated Sites Screened into the HRA for Marine Ornithology

Figure: 6-1 | Drawing No: PB5034-HRA-007-001

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
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02	16/05/2019	JT	CG	A3	1:1,700,000

Co-ordinate system: WGS 1984 UTM Zone 30N

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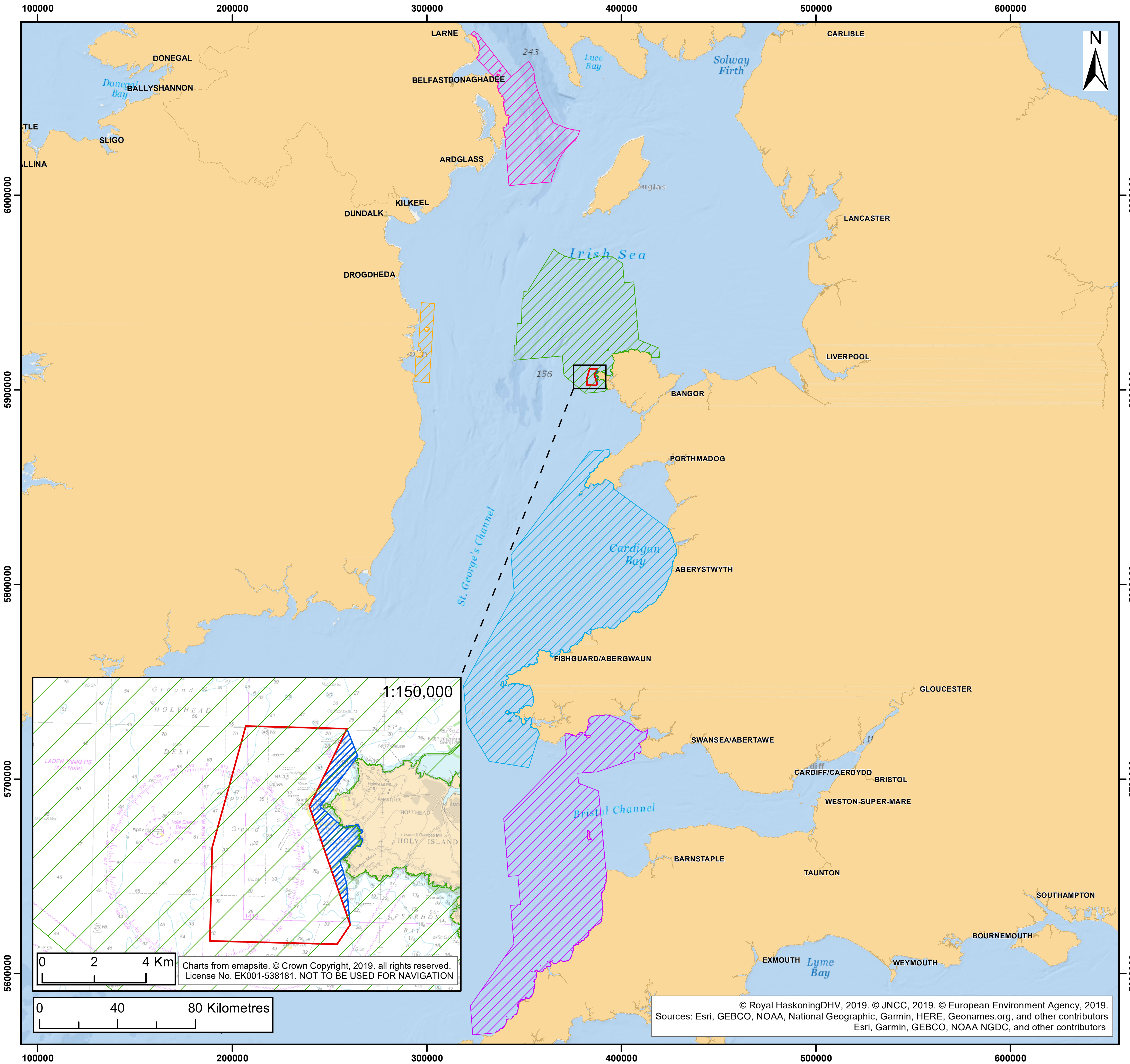

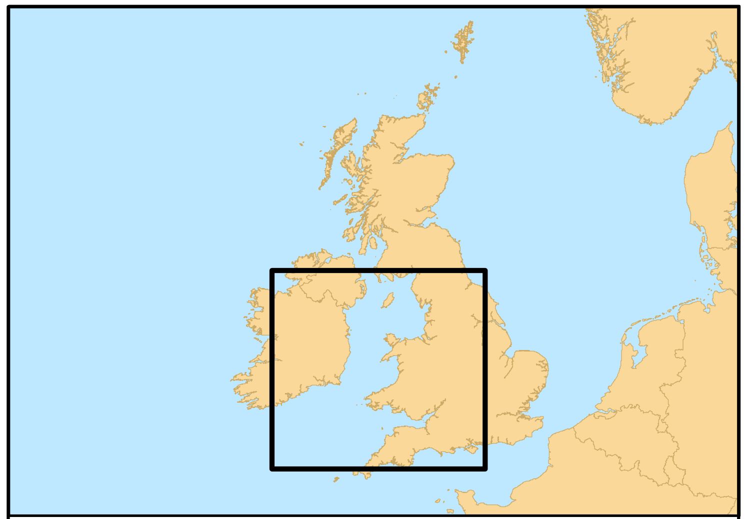

Legend:

- Morlais Demonstration Zone (MDZ)
- Export Cable Corridor (ECC)

Special Area of Conservation (SAC)

- North Channel (SAC)
- North Anglesey Marine / Gogledd Môn Forol (SAC)
- West Wales Marine / Gorllewin Cymru Forol (SAC)
- Bristol Channel Approaches / Dynesfeydd Môr Hafren (SAC)
- Rockabill to Dalkey Island (SAC)

Client: morlais | MENTER MÔN

Project: morlais ANGLESEY MARINE ENERGY

Title:

Designated Sites Screened into the HRA for Harbour Porpoise

Figure: 6-2 | Drawing No: PB5034-HRA-007-002

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
03	03/07/2019	LB	CG	A3	1:2,000,000
02	16/05/2019	JT	CG	A3	1:2,000,000

Co-ordinate system: WGS 1984 UTM Zone 30N

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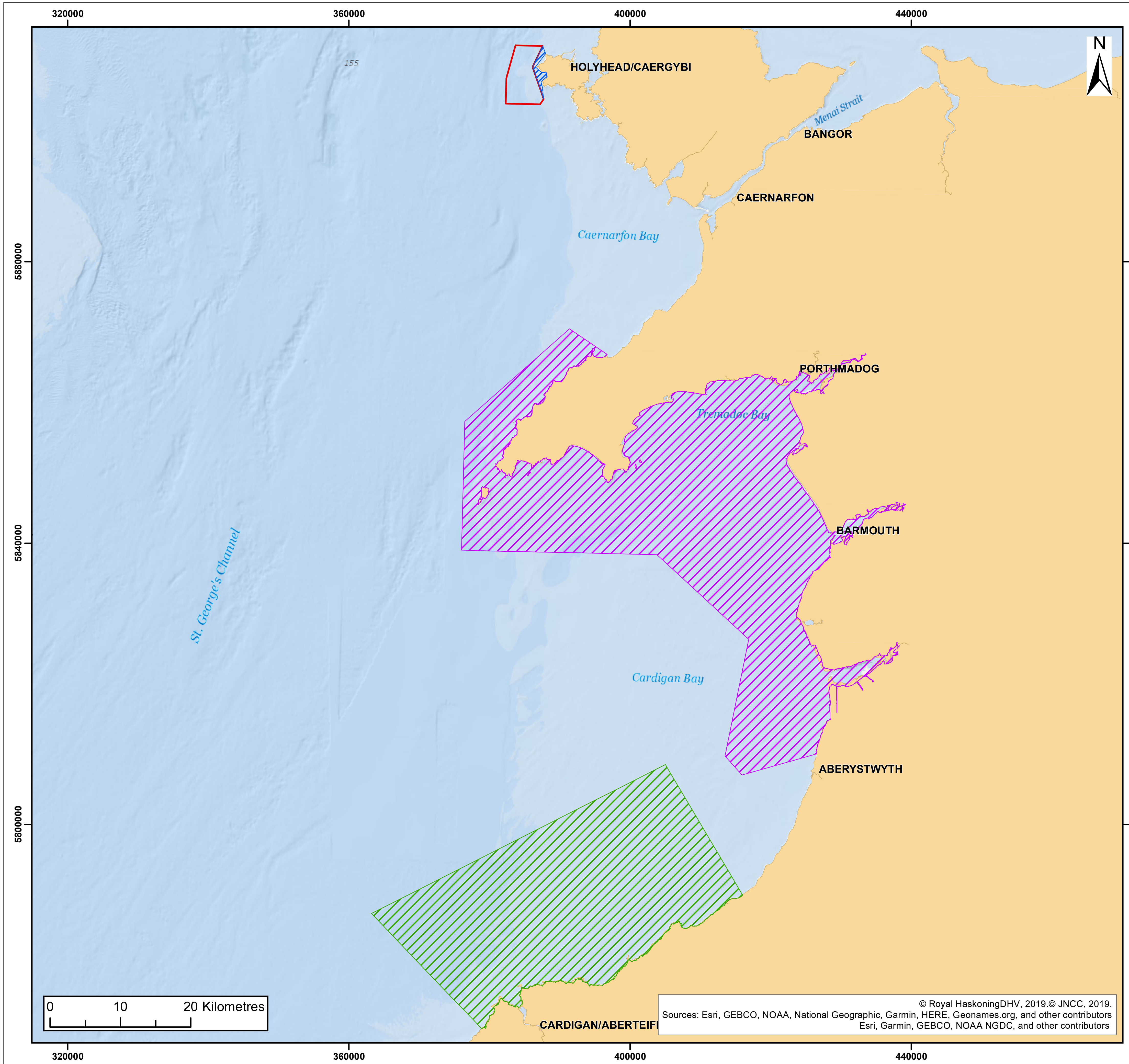

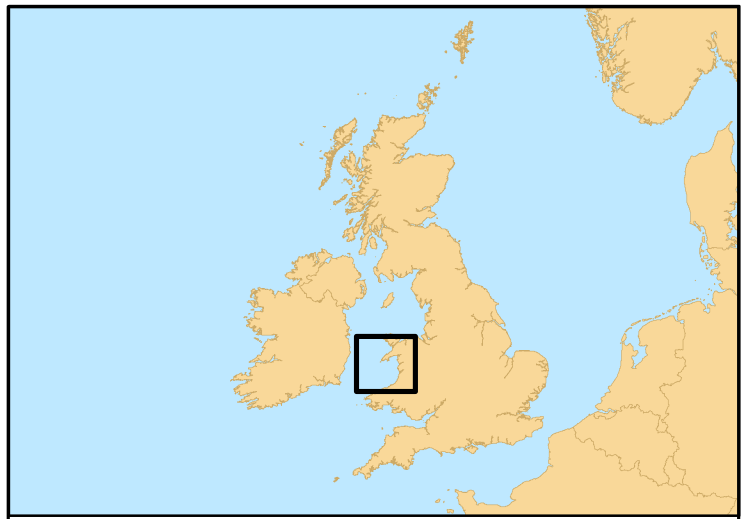

Legend:

- Morlais Demonstration Zone (MDZ)
- Export Cable Corridor (ECC)

Special Area of Conservation (SAC)

- Cardigan Bay/ Bae Ceredigion (SAC)
- Pen Llyn a`r Sarnau/ Lleyn Peninsula and the Sarnau (SAC)

Client: morlais, MENTER MÔN

Project: morlais ANGLESEY MARINE ENERGY

Title:

Designated Sites Screened into the HRA for Bottlenose Dolphin

Figure: 6-3 Drawing No: PB5034-HRA-007-003

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
03	03/07/2019	LB	CG	A3	1:550,000
02	16/05/2019	JT	CG	A3	1:550,000

Co-ordinate system: WGS 1984 UTM Zone 30N

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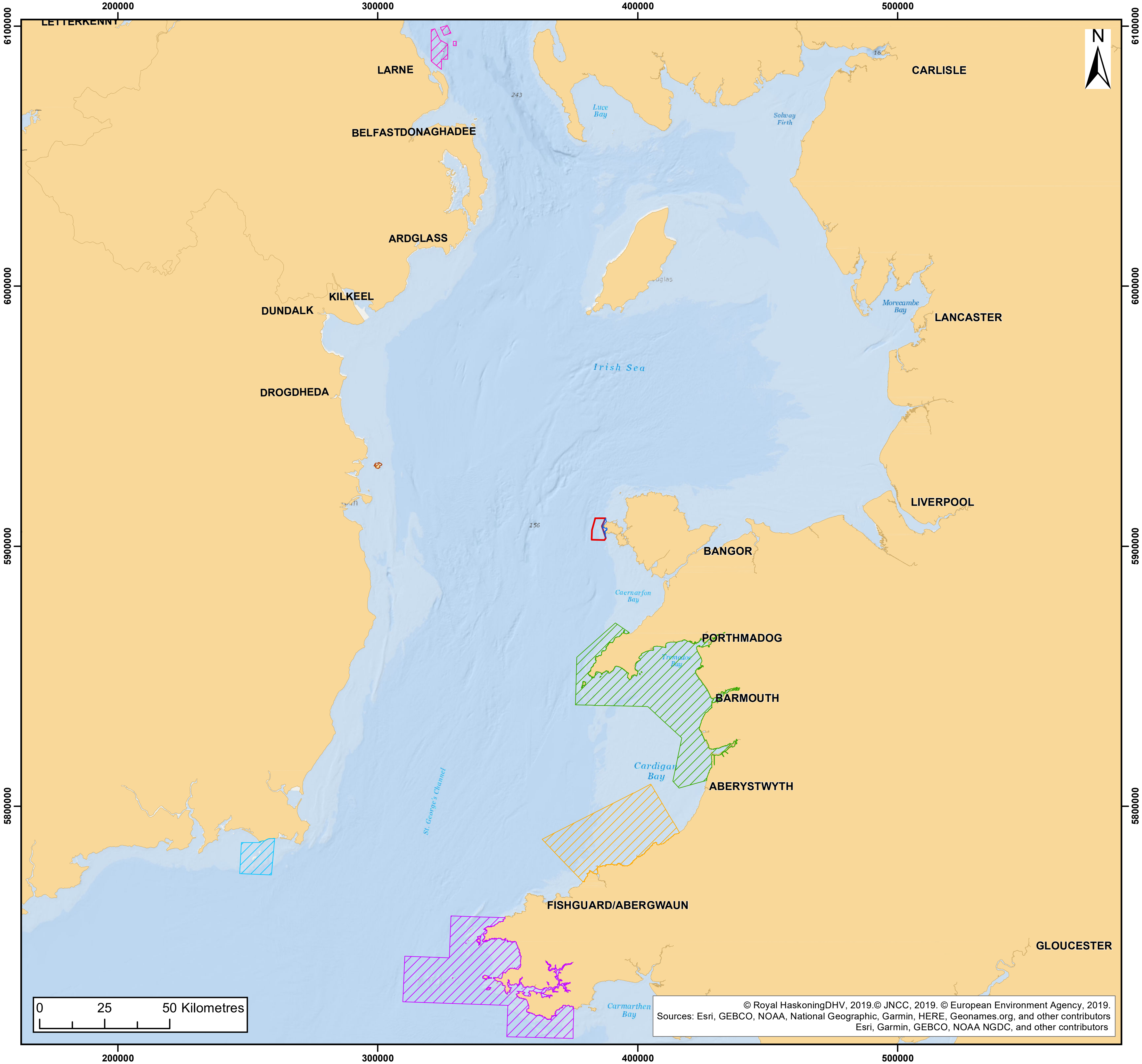

Legend:

- Morlais Demonstration Zone (MDZ)
- Export Cable Corridor (ECC)

Special Area of Conservation (SAC)

- The Maidens (SAC)
- Pen Llyn a`r Sarnau/ Lleyn Peninsula and the Sarnau (SAC)
- Cardigan Bay/ Bae Ceredigion (SAC)
- Pembrokeshire Marine/ Sir Benfro Forol (SAC)
- Lambay Island (SAC)
- Saltee Islands (SAC)

Client: morlais MENTER MÔN

Project: morlais ANGLESEY MARINE ENERGY

Title:

Designated Sites Screened into the HRA for Grey Seal

Figure: 6-4

Drawing No: PB5034-HRA-007-004

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
03	03/07/2019	LB	CG	A3	1:1,500,000
02	16/05/2019	JT	CG	A3	1:1,500,000

Co-ordinate system: WGS 1984 UTM Zone 30N

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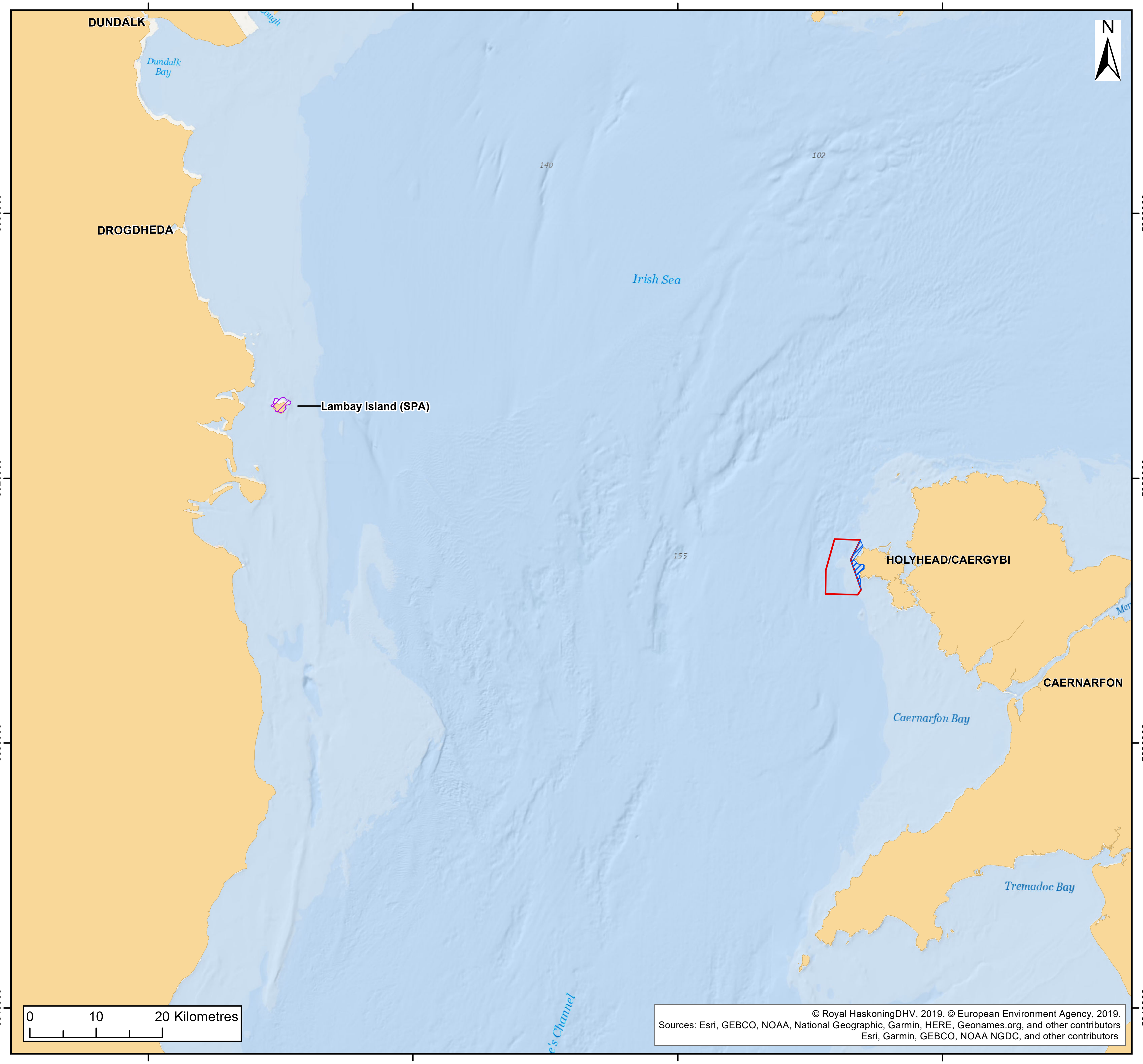

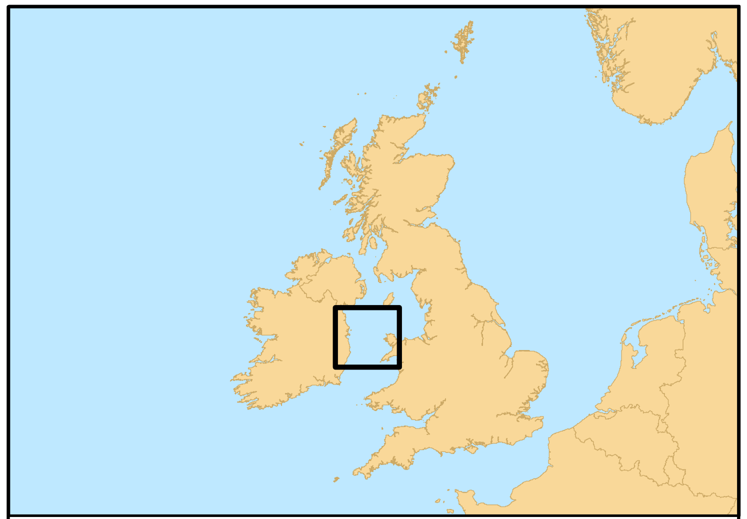

Legend:

- Morlais Demonstration Zone (MDZ)
- Export Cable Corridor (ECC)

Special Area of Conservation (SAC)

- Lambay Island (SAC)

Client:

Project:

ANGLESEY MARINE ENERGY

Title:

Designated Sites Screened into the HRA for Harbour Seal

Figure: 6-5 Drawing No: PB5034-HRA-007-005

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
03	03/07/2019	LB	CG	A3	1:600,000
02	16/05/2019	JT	CG	A3	1:600,000

Co-ordinate system: WGS 1984 UTM Zone 30N

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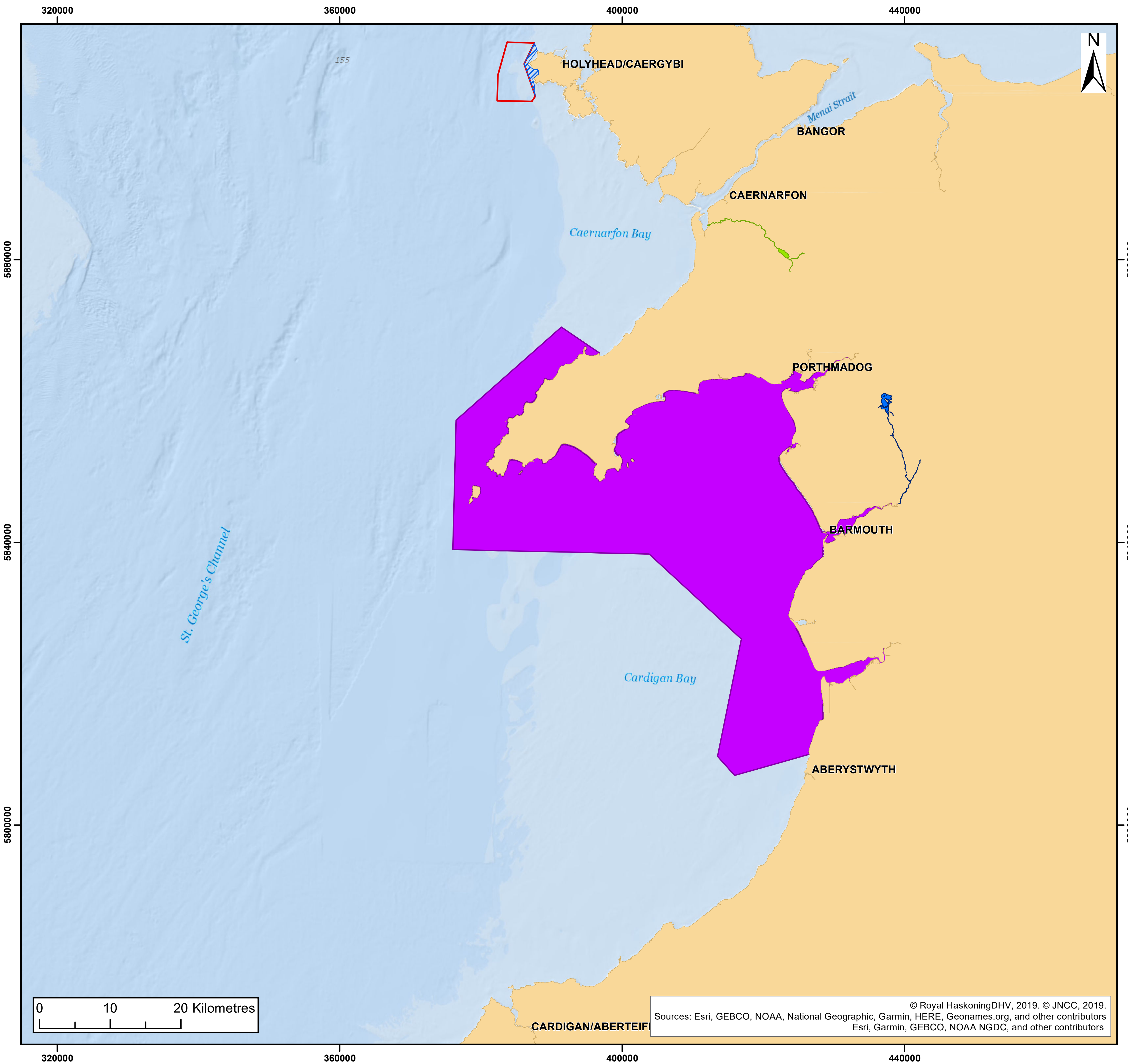

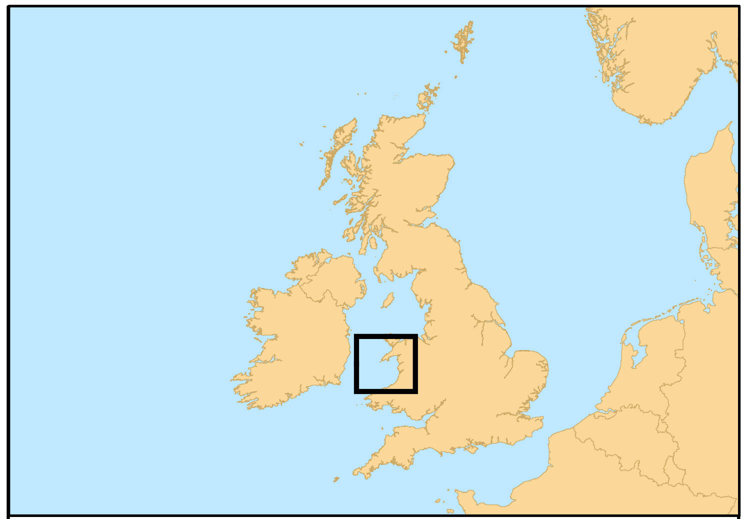

Legend:

- Morlais Demonstration Zone (MDZ)
- Export Cable Corridor (ECC)

Special Area of Conservation (SAC)

- Pen Llyn a`r Sarnau/ Lleyn Peninsula and the Sarnau (SAC)
- Afon Eden - Cors Goch Trawsfynydd (SAC)
- Afon Gwyrfai a Llyn Cwellyn (SAC)

Client: morlais | MENTER MÔN

Project: morlais ANGLESEY MARINE ENERGY

Title:

European Designated Sites for Otter

Figure: 6-6 Drawing No: PB5034-HRA-007-006

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
03	03/07/2019	LB	CG	A3	1:550,000
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Co-ordinate system: WGS 1984 UTM Zone 30N

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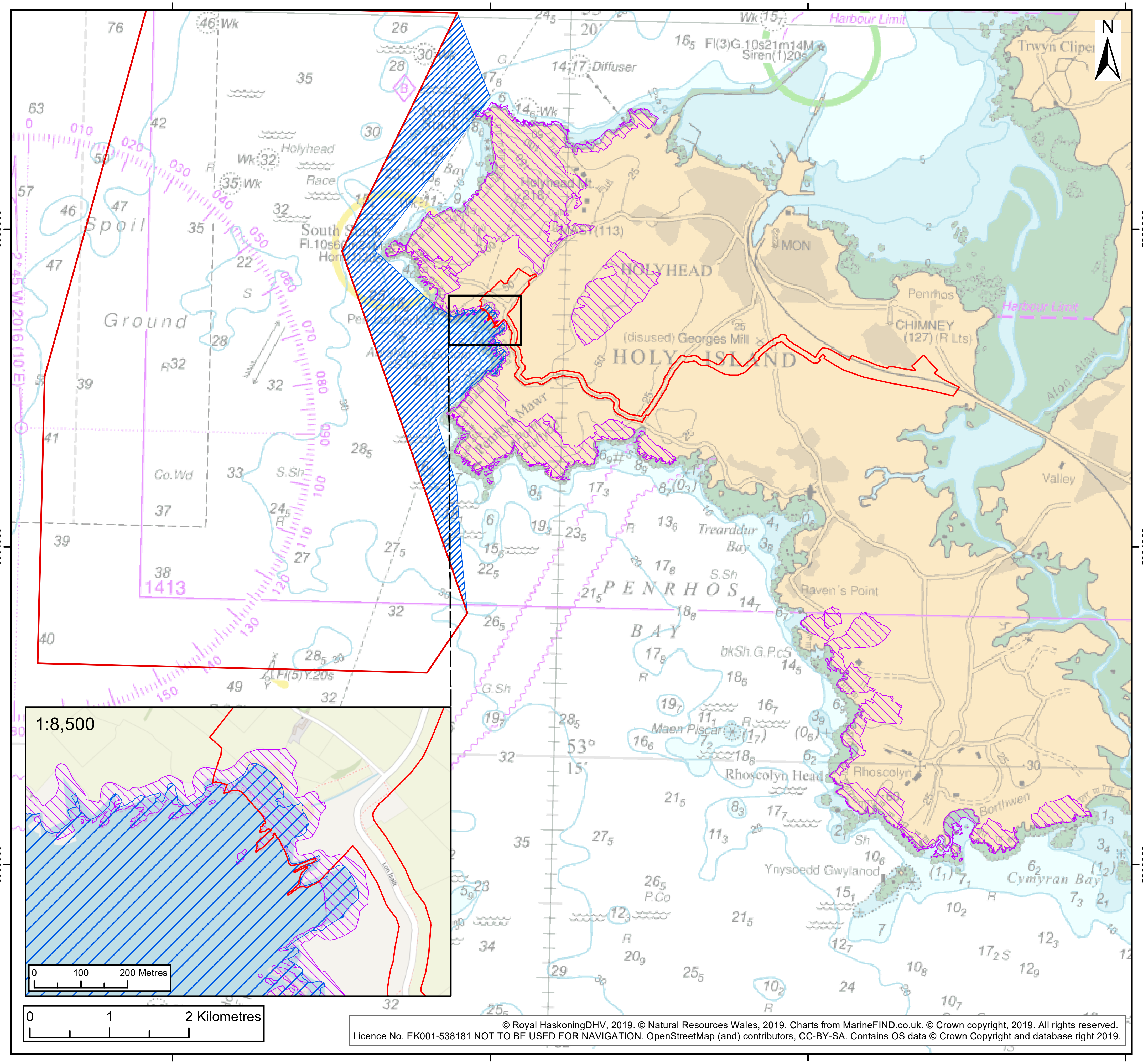

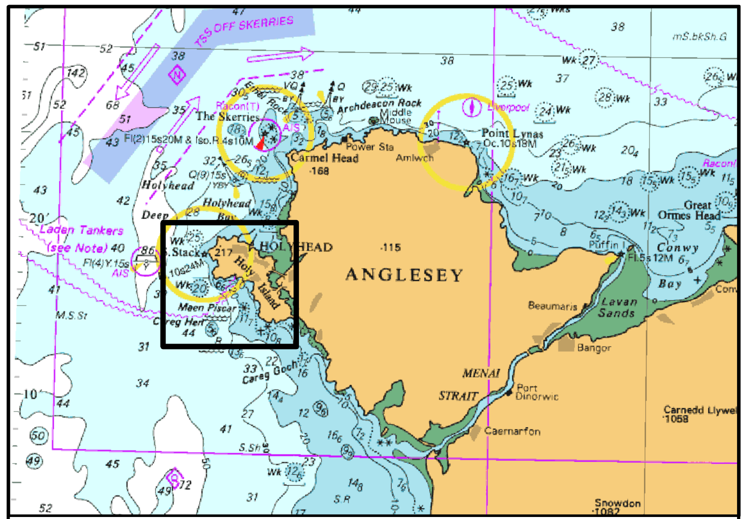

Legend:

- Morlais Demonstration Zone (MDZ)
- Export Cable Corridor (ECC)
- Onshore Development Area

Special Protection Area (SPA)

- Glannau Ynys Gybi / Holy Island Coast (SPA and SAC)

Client: morlais, MENTER MÔN

Project: morlais ANGLESEY MARINE ENERGY

Title:

Designated Sites Screened into the HRA for Onshore Ecology

Figure: 6-7 Drawing No: PB5034-HRA-007-006

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
04	08/07/2019	JT	CG	A3	1:50,000
03	03/07/2019	JT	CG	A3	1:50,000

Co-ordinate system: WGS 1984 UTM Zone 30N

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