Awel y Môr Offshore Wind Farm

Category 5: Reports

Report 5.2: Report to Inform Appropriate Assessment

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Fferm Wynt Alltraeth
AWEL Y MÔR
Offshore Wind Farm

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Contents

Figures

Tables

Glossary of terms

TERM	DEFINITION
Appropriate Assessment (AA)	An assessment to determine the implications of a plan or project on a European site in view of the site's Conservation Objectives. An AA forms part of the Habitats Regulations Assessment and is required when a plan or project likely to have a significant effect on a European site.
Annex I Habitat	Natural Habitat types of community interest whose conservation requires the designation of Special Area of Conservation.
Annex II Species	Animal and plant species of community interest whose conservation requires the designation of Special Areas of Conservation.
Barrier Effect	The potential for birds to fly around an array of turbines causing an increase in the overall distance flown than would otherwise have been the case if the wind turbines had not been present.
Birds Directive	Directive 2009/147/EC of the European Parliament and of the Council of 30th November 2009 on the Conservation of Wild Birds.
Biotope	A region of habitat associated with a particular ecological community.

TERM	DEFINITION
Collision Risk	A potential risk that birds collide with wind turbine or its blades.
Demersal	Relating to the seabed and area close to it. Demersal spawning species are those which deposit eggs onto the seabed.
Displacement	The potential for birds and other animals to avoid an area due to the presence of the wind turbines or from vessel activity.
Drop Down Video (DDV)	A survey method in which imagery of habitat is collected, used predominantly to survey marine environments.
Elasmobranchs	Cartilaginous fishes such as sharks, rays, and skates.
EUNIS habitat classification	A pan-European system which facilitates the harmonised description and classification of all types of habitat, through the use of criteria for habitat identification.
European Site	A Special Area of Conservation (SAC) or candidate SAC (cSAC), a Special Protection Area (SPA) or potential SPA (pSPA), a site listed as a Site of Community Importance (SCI) or a Ramsar site.
Fish larvae	The developmental stage of fish which have hatched from the egg and receive nutrients from the yolk sac until the yolk is completely absorbed.
Habitats Directive	Council Directive 92/43/EEC of the Council of the European Communities on the conservation of natural habitats and of wild fauna and flora.
Habitats Regulations	The Conservation of Habitats and Species Regulations 2017 and The Conservation of Offshore Marine Habitats and Species Regulations 2017.
Habitats Regulations Assessment	A process which helps determine likely significant effects and (where appropriate) assesses adverse impacts on the integrity of European conservation sites and Ramsar sites. The process consists of up to four stages of assessment: screening, appropriate assessment, assessment of alternative solutions and

TERM	DEFINITION
	assessment of imperative reasons of over-riding public interest (IROPI) and compensatory measures.
Holocene	The Holocene is the current geological epoch. It began approximately 11,650 calibrated years before present, after the last glacial period, which concluded with the Holocene glacial retreat. The Holocene and the preceding Pleistocene together form the Quaternary period.
In-Combination Effect	The combined effect of Awel y Môr in-combination with the effects from a number of different projects on the same feature/receptor.
Intertidal	The area of the shoreline between Mean High-Water Springs and Mean Low Water Springs.
Landfall	The generic term applied to the entire landfall area between Mean Low Water Spring (MLWS) tide and the Transition Joint Bays (TJB) inclusive of all construction works, including the offshore and onshore ECC, intertidal working area and landfall compound where the offshore cables come ashore at Ffrith beach and east of Rhyl
Mean High Water Springs (MHWS)	The height of mean high water during spring tides in a year.
Mean Low Water Springs (MLWS)	The height of mean low water during spring tides in a year.
Megafauna	Large animals of a particular region, habitat or geological period.
Megaripples	An extensive undulation of the surface of a sandy beach or seabed, typically tens of meters from crest to crest and tens of centimetres in height.
Mini-hamon grab	Comprises of a stainless-steel box shaped sampling scoop mounted in a triangular frame, ideal for sampling seabed sediments, as well as sampling for benthic macrofauna.
Mollusca	Phylum of invertebrates which have a soft

TERM	DEFINITION
	unsegmented body, commonly protected by a calcareous shell.
Nursery habitat	Habitats where high numbers of juveniles of a species occur, having a greater level of productivity per unit area than other juvenile habitats.
Pelagic	Any part of the water column (i.e. the sea from surface to bottom sediments) that is not close to the seabed. Pelagic spawning species release their eggs into the upper layers of the sea.
Permanent Threshold Shift (PTS)	A total or partial permanent loss of hearing at a particular frequency caused by some kind of acoustic trauma. PTS results in irreversible damage to the sensory hair cells of the ear, and thus a permanent reduction of hearing acuity at that frequency.
Ramsar Site	Wetlands of international importance, designated under the Ramsar Convention.
Special Area of Conservation (SAC)	Protected areas designated under the Habitats Regulations for habitats and species identified in Annexes 1 and 2 respectively of the Habitats Directive.
SACFOR	An abundance scale used for both littoral and sublittoral taxa from 1990 onwards.
Side Scan Sonar (SSS)	Side-imaging sonar used to create an image of the seafloor.
Single-beam and multi-beam echo sounders (SBES and MBES)	A type of sonar which transmits soundwaves, using the time taken between emission and return to establish a depth. This can be done using singular or multiple beams.
Sites of Community Importance	Sites that have been adopted by the European Commission in accordance with the Habitats Directives but not yet formally designated by the government of each country.
Sound Exposure Level	The constant sound level acting for one second,

TERM	DEFINITION
(SEL)	which has the same amount of acoustic energy, as indicated by the square of the sound pressure, as the original sound. It is the time-integrated, sound-pressure-squared level. SEL is typically used to compare transient sound events having different time durations, pressure levels, and temporal characteristics.
Sound Pressure Level (SPL)	The sound pressure level or SPL is an expression of the sound pressure using the decibel (dB) scale and the standard reference pressures of 1 μPa for water.
Spawning	The release or deposition of eggs and sperm, usually into water, by aquatic animals.
Special Protection Area (SPA)	Strictly protected sites designated under Article 4 of the Birds Directive for species listed on Annex I of the Directive and for regularly occurring migratory species.
Subtidal	The region of shallow waters which are below the Mean Low Water Springs.
Temporary Threshold Shift (TTS)	Temporary loss of hearing at a particular frequency as a result of exposure to sound over time. The mechanisms underlying TTS are not well understood, but there may be some temporary damage to the sensory cells. The duration of TTS varies depending on the nature of the stimulus, but there is generally recovery of full hearing over time.
Threshold	The threshold generally represents the lowest signal level an animal will detect in some statistically predetermined percent of presentations of a signal.
Unweighted sound level	Sound levels which are 'raw' or have not been adjusted in any way, for example to account for the hearing ability of a species.
Weighted sound level	A sound level which has been adjusted with respect to a 'weighting envelope' in the frequency domain, typically to make an unweighted level relevant to a particular species. The overall sound

TERM	DEFINITION
	level has been adjusted to account for the hearing ability of marine mammals.

Abbreviations and acronyms

TERM	DEFINITION
AA	Appropriate Assessment
ADD	Acoustic Deterrent Device
AEOI	Adverse Effect on Integrity
AyM	Awel y Môr
AyMOWFL	Awel y Môr Offshore Wind Farm Limited
BEIS	Department for Business, Energy and Industrial Strategy
CEA	Cumulative Effect Assessment
Cefas	Centre for Fisheries and Aquaculture Science
CfD	Contract for Difference
CJEU	The Court of Justice of the European Union
CRM	Collision Risk Modelling
CSIP	Cable Specification and Installation Plan
DCO	Development Consent Order
DECC (now (BEIS)	Department of Energy and Climate Change (now Business, Energy and Industrial Strategy)
DEFA	Department of Environment, Food and Agriculture
EC	European Commission
ECC	Export Cable Corridor
EDR	Effective Deterrent Radius

TERM	DEFINITION
EEA	European Economic Area
EIA	Environmental Impact Assessment
EMF	Electromagnetic Frequency
EPS	European Protected Species
ES	Environmental Statement
ETG	Expert Technical Group
GBS	Gravity Based System
GIS	Geographical Information System
GyM	Gwynt y Môr
HDD	Horizontal Directional Drilling
HRA	Habitat Regulations Assessment
HVAC	High Voltage Alternating Current
HVDC	High Voltage Direct Current
INNS	Invasive Non-Native Species
IROPI	Imperative Reasons of Overriding Public Interest
JNCC	Joint Nature Conservation Committee
JUVs	Jack-Up Vessels
LAT	Lowest Astronomical Tide
LSE	Likely Significant Effect
MCA	Marine and Coastguard Agency
MCAA	Marine and Coastal Access Act
MDS	Maximum Design Scenario
MFE	Mass Flow Excavation
MHWS	Mean High Water Springs

TERM	DEFINITION
MMMP	Marine Mammal Mitigation Protocol
MMO	Marine Management Organisation
MMOb	Marine Mammal Observer
MSL	Mean Sea Level
MU	Management Unit
NIGFS	Northern Irish Ground Fish Survey
NPS	National Policy Statement
NN	Nutrient Nitrogen
NOX	Nitrogen Oxides
NRW	Natural Resource Wales
NSIP	Nationally Significant Infrastructure Project
NWGFS	North West Ground Fish Survey
O&M	Operation & Maintenance
OnSS	Onshore Substation
OSP	Offshore Substation Platform
OWEP	Offshore Wind Extensions Plan
OWF	Offshore Wind Farm
PEIR	Preliminary Environmental Information Report
PELs	Probable Effect Levels
PEMP	Project Environment Management Plan
PINS	Planning Inspectorate
PSA	Particle Size Analysis
pSPA	Proposed Special Protection Area
PTS	Permanent Threshold Shift

TERM	DEFINITION
PVM	Permanent Vessel Moorings
RIAA	Report to Inform Appropriate Assessment
RLB	Red Line Boundary
RSPB	Royal Society for the Protection of Birds
SAC	Special Area of Conservation
SCI	Sites of Community Importance
SEL_{cum}	Cumulative Sound Exposure Level
SIP	Site Integrity Plan
SNCB	Statutory Nature Conservation Bodies
SNH	Scottish Natural Heritage
SNS	Southern North Sea
SoCG	Statement of Common Ground
SoS	Secretary of State
SPA	Special Protection Area
SPL_{peak}	Peak Sound Pressure Level
SSC	Suspended Sediment Concentrations
SSSI	Site of Special Scientific Interest
STC	System-Operator Transmission-Owner Code
TCE	The Crown Estate
TELs	Threshold Effect Levels
THSD	Trailer Hopper Suction Dredger
TJBs	Transition Joint Bays
TPO	Tree Preservation Order
TTS	Temporary Threshold Shift

TERM	DEFINITION
UK	United Kingdom
UXO	Unexploded Ordnance
WTGs	Wind Turbine Generators
ZoI	Zone of Influence

Units

UNIT	DEFINITION
dB	Decibel
GW	Giga Watt
m	metres
m^2	Square metre
m^3	Cubic metre
Mg/l	Milligrams per litre
MW	Mega Watt
nm	Nautical mile

1 Introduction

1.1 Report overview

1 The Awel y Môr Offshore Wind Farm (hereafter referred to as AyM) is a proposed sister project to the operational Gwynt y Môr offshore wind farm (GyM) off the north coast of Wales. AyM is a Nationally Significant Infrastructure Project (NSIP) under Section 15(3) of the Planning Act 2008 (as amended) (PA 2008) and therefore requires a Development Consent Order (DCO). The Applicant for the DCO will be Awel y Môr Offshore Wind Farm Limited (AyMOWFL) (hereafter referred to as 'the Applicant). The Applicant is also seeking parallel consent for marine activities from Natural Resources Wales (NRW) on behalf of the Welsh Government under the Marine and Coastal Access Act 2009 (MCAA 2009) via marine licences.

2 This 'Report to Inform the Appropriate Assessment' (or RIAA) supports the Habitat Regulations Assessment (HRA) of AyM in the consideration of the implications for designated sites (traditionally referred to as European sites) if AyM is consented. Following the United Kingdom's (UK) exit from the European Union (EU Exit), these sites (if located within the UK) are now collectively referred to as the National Site Network.

3 This RIAA builds upon the HRA Screening exercise that began with the issue of the HRA Screening Report (Innogy, 2020a) in June 2020 and has been subject to ongoing discussion with NRW, with final screening conclusions presented here. The purpose of the current report is to identify the environmental effects of AyM as they relate to relevant designated site integrity, and forms Stage Two of the HRA process.

4 This RIAA provides the basis for consultation in the application stage of AyM and accompanies the Environmental Statement (ES) (AyMOWFL, 2022).

5 The information in the RIAA will assist the Secretary of State of the Department for Business, Energy and Industrial Strategy (SoS for BEIS), as the relevant competent authority, to make its Appropriate Assessment (AA) under the HRA process for projects consented under Section 15(3) of the Planning Act 2008. Similarly, NRW is the competent authority for making AA under the HRA process for Marine Licence applications in Wales.

6 In addition to being responsible for marine licencing under the MCAA 2009, NRW is also involved in the selection process for the habitats and species of principal importance for the conservation and enhancement of biodiversity in Wales. NRW is also the relevant authority in charge of European Protected Species (EPS) licencing and environmental permits. When assessing a Marine Licence application, NRW must have regard to matters set out in sections 69(1), 69(2) and 69(3) of the 2009 Act. NRW must also take full account of additional legislative requirements including the Conservation of Habitats and Species Regulations 2017[i] and therefore, this RIAA will be important in informing the Marline Licence decision-making process.

7 HRA provides the process for the consideration of potential impacts of plans and projects on a particular type of designated conservation site. The requirement follows from the EU Habitats Directive and, by virtue of Article 8 of that Directive, also the Wild Birds Directive (the Nature Directives).

8 The Europe-wide network of nature conservation areas that are the subject of the HRA process was established under the Nature Directives. These areas are known as "European sites" and collectively, as the "Natura2000" network. The wording of Article 6(3) and 6(4) of the Habitats Directive underlies the sequential decision-making tests applied under the HRA process to projects likely to affect European sites.

9 Following the UK's departure from the European Union (EU) on 31 December 2020, the UK is no longer an EU Member State. Notwithstanding, the Directive (and transposing Regulations (the "Habitats Regulations (2017)" continue to provide the legislative backdrop for HRA in the UK through the Conservation of Habitats and species Amendment (EU Exit) Regulations 2019 ("EU Exit Regulations"). The HRA process implemented under the Habitats Regulations continues to apply (subject to minor changes) and the UK is bound by HRA judgments handed down by The Court of Justice of the European Union (CJEU) prior to 31 December 2020.

[i] https://www.legislation.gov.uk/uksi/2017/1012/contents

10 Accordingly, the EU Exit Regulations are considered to have no material bearing on the requirement or process for the HRA of AyM. The Applicant will comply with the requirements of the Habitat Regulations (2017) other than where specific changes are identified by the government. In accordance with the present position on HRA terminology (Defra, 2021), this report will still refer to "the Habitats Regulations", "European sites" and HRA caselaw. However, European sites in the UK are collectively termed the "National Site Network" and no longer form part of the Natura 2000 network. The HRA will not refer to any obligations under the Nature Directives but may have regard to European Commission (EC) guidance, so far as it is relevant.

1.2 Background to the project

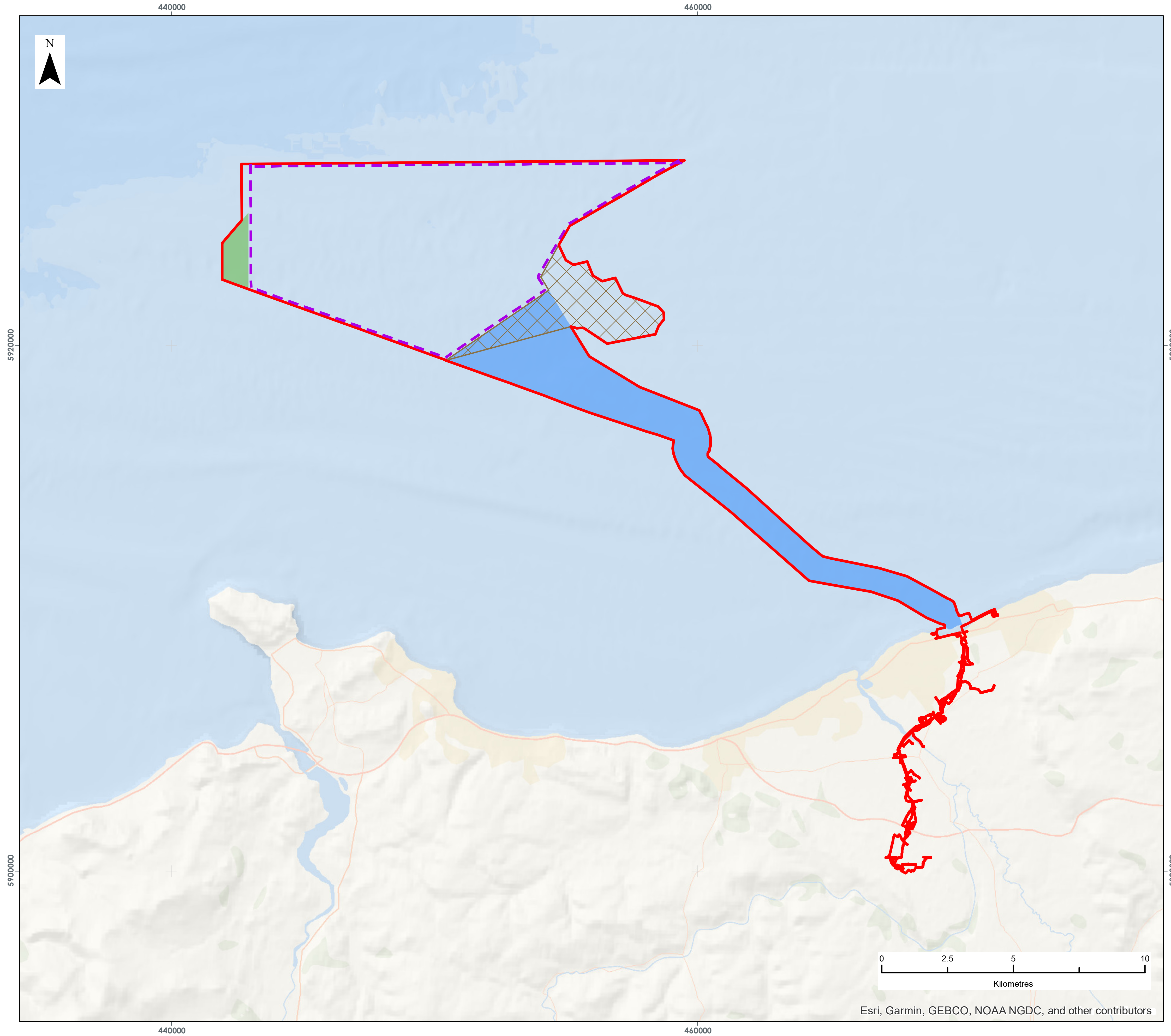
11 The UK government has committed to deliver 40 gigawatts (GW) of offshore wind generating capacity by 2030[ii]. This announcement was part of the government's commitment towards net zero emissions by 2050 and optimising the potential of the UK's offshore energy resources is part of the strategy to deliver this target.

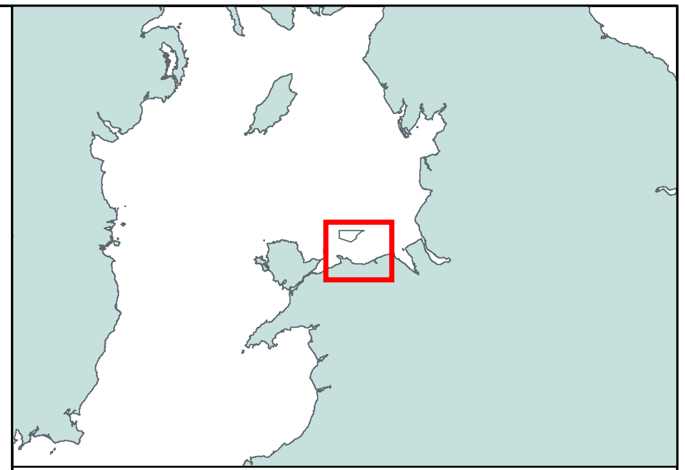
12 The Crown Estate (TCE), as the managers of most of the seabed around England and Wales and Northern Ireland, has identified 'extension projects' (the expansion of existing offshore wind farms) as an efficient means to increase the UK's installed capacity (The Crown Estate, 2019a). TCE's '2017 Offshore Wind Extensions opportunity' brought forward seven projects seeking to extend existing wind farms. This included a proposal to extend the existing GyM OWF, resulting in the project that is the subject of the current report: AyM, and which forms part of TCE's 2017 Offshore Wind Extensions Plan (OWEP).

13 AyM successfully progressed through the plan-level HRA of OWEP, which concluded that the plan would not adversely affect the integrity of any European sites (The Crown Estate, 2019b). AyM was subsequently awarded sea-bed development rights (an Agreement for Lease), subject to the necessary project-level assessments and consents required as a matter of law.

[ii] https://www.gov.uk/government/news/new-plans-to-make-uk-world-leader-in-green-energy

14 AyM is being developed by RWE Renewables on behalf of the project owners. AyM is located off the north coast of Wales (refer to Figure 1) and its infrastructure will generally comprise an array of wind turbines, associated turbine foundations, offshore export cable routes, landfall areas, onshore export cable route and a new onshore substation. A more detailed description of the project is provided in Volume 2, Chapter 1: Offshore Project Description (application ref: 6.2.1) and Volume 3, Chapter 1: Onshore Project Description (application ref: 6.3.1).





LEGEND

- Order Limits
- Array Area
- Offshore Export Cable Corridor
- Other Wind Farm Infrastructure Zone
- GyM Interlink Zone

Data Source:

PROJECT TITLE:

AWEL Y MÔR OFFSHORE WINDFARM

FIGURE TITLE:

AyM development area

VER	DATE	REMARKS	Drawn	Checked
1	18/09/2021	For Issue For PEIR	BPHB	RM
2	03/03/2022	For Issue For ES	BPHB	GG

FIGURE NUMBER:

Figure 1

SCALE:	PLOT SIZE:	DATUM:	PROJECTION:
1:150,000	A3	WGS84	UTM30N

Fferm Wynt Alltraeth
AWEL Y MÔR
Offshore Wind Farm

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1.3 Assessment process and supporting information

15 HRA is an iterative process, and this RIAA has not been prepared in isolation, but instead forms part of a suite of documents being submitted as part of the application process.

16 To ensure potential impacts are accurately described at every stage, the assessments must be updated, if necessary, to take account of new developments or information. The RIAA builds upon the conclusions of the HRA Screening exercise undertaken to date, which is detailed within The screening process for the project alone within the following supporting documents:

- Annex 1: HRA Screening Update (Non-Ornithology), (application ref 5.2.1);
- Annex 2: HRA Screening Update (Ornithology) (application ref 5.2.2);
- Annex 3: European Site Information (application ref 5.2.3)
- Annex 4: Bottlenose Dolphin and Grey Seal Additional Information (application ref 5.2.4);
- Annex 5: Ornithology Apportioning Note (application ref 5.2.5);
- Annex 6: Screening Matrices (application ref 5.2.6);
- Annex 7: Integrity Matrices (application ref 5.2.7); and
- Annex 8: Abundance and Distribution of Red Throated Diver in Gwynt y Môr Offshore Wind Farm and Wider Area (application ref 5.2.8).

17 The RIAA has been developed alongside the AyM ES produced as part of the Environmental Impact Assessment ("EIA") process (under the EIA Regulations). Where information was not at that time available, the Screening adopted a highly precautionary stance. The availability of assessments supporting the EIA process, together with an updated Maximum Design Scenario (MDS) (see Section 4.4), have provided the evidence to refine in some cases, the conclusions concerning impacts to European sites. Where design or supporting information is common to both assessments (ES and the HRA) this information has been used as referenced throughout the RIAA.

18 Other key documents include technical reports (both for site specific survey but also modelling and desk-based studies). A summary list of key project chapters and documents with information relevant to the HRA and this RIAA includes:

- ES Volume 1, Chapter 2: Policy and Legislation (application ref: 6.1.2) outlines the consents framework, key legislation and policies that have been considered for the development of AyM throughout the EIA process.
- ES Volume 1, Chapter 3: EIA Methodology (application ref: 6.1.3) provides details of the method followed to assess cumulative effects in relation to the offshore environment. This approach has informed the assessment of in-combination effects for the HRA.
- ES Volume 1, Chapter 4: Site Selection and Alternatives (application ref: 6.1.4) provides details of the process followed to determine the location for the proposed development and any alternative sites considered.
- ES Volume 1, Appendix 3.1: Cumulative Effects Assessment (application ref: 6.1.3.1) Short-listed developments sets out a short list of 'other developments' that may interact with the AyM respective Zones of Influence (ZOIs) during construction, Operation and Maintenance (O&M) or decommissioning.
- ES Volume 2, Chapter 1 (application ref: 6.2.1) and Volume 3 Chapter 1 (application ref: 6.3.1) provides a detailed description of the Proposed Development including the design parameters, where possible at this stage, and described in accordance with the Rochdale Envelope approach.
- ES Volume 2, Chapter 4: Offshore Ornithology (application ref: 6.2.4); an assessment at the EIA level of potential effects from the project's impacts to ornithological features in the offshore and intertidal environment.
- ES Volume 2, Chapter 5: Benthic & Intertidal Ecology (application ref: 6.2.5) sets out the proposed approach to characterise the benthic subtidal and intertidal ecology baseline environment as a basis for the EIA presented in the ES.
- ES Volume 2, Chapter 6: Fish and Shellfish Ecology (application ref: 6.2.6) provides the assessment methodology, detail on potential receptors, impact sources and consideration of sensitivity to impacts as a basis for the EIA presented in the ES.

- ES Volume 2, Chapter 7: Marine Mammal Ecology (application ref: 6.2.7); an assessment at the EIA level of potential effects from the project's impacts to marine mammal features in the offshore and intertidal environment.
- ES Volume 2, Chapter 9: Shipping and Navigation (application ref: 6.2.9); an assessment at the EIA level of potential effects from the project's impacts to shipping and navigation receptors.
- ES Volume 4, Annex 4.1: Offshore Ornithology Baseline Characterisation Report (application ref: 6.4.4.1); a detailed description of the baseline environment with respects to offshore and intertidal ornithology.
- ES Volume 4, Annex 4.2: Offshore Ornithology Displacement Report (application ref: 6.4.4.2); an assessment of the potential for displacement with respect to offshore and intertidal ornithological receptors.
- ES Volume 4, Annex 4.3: Offshore Ornithology Collision Risk Modelling Report (application ref: 6.4.4.3); an assessment of the potential for collision risk with respect to offshore and intertidal ornithological receptors.
- ES Volume 4, Annex 4.4: Offshore Ornithology Migratory Collision Risk Modelling Report (application ref: 6.4.4.4); an assessment of the potential for collision risk with respect to migratory offshore and intertidal ornithological receptors.
- ES Volume 4, Annexes 5.1, 5.2 and 5.3: Benthic Ecology – Intertidal and Subtidal Characterisation (application ref: 6.4.5.1, 6.4.5.2 and 6.4.5.3); a detailed description of the baseline environment with respects to benthic ecology.
- ES Volume 4. Annex 6.1: Fish and Shellfish Baseline (application ref: 6.4.6.1); a detailed description of the baseline environment with respects to fish and shellfish.
- ES Volume 4, Annex 7.1: Marine Mammals Technical Baseline (application ref: 6.4.7.1); a detailed description of the baseline environment with respects to marine mammals.
- ES Volume 8, Document 8.11: Schedule of Mitigation (application ref: 8.11) summarises the committed mitigation measures within the chapters of the ES and associated appendices.

1.4 Structure of the RIAA

19 This document is set out in a number of sections, with the overall structure of the document summarised below.

- Section 1: Introduction. Providing a background to the project, including the purpose and structure of the RIAA.
- Section 2: Legislation, Policy and Guidance. To identify the legislation driving the need for the report and the policy and guidance providing the structure.
- Section 3: Consultation. Summarising the consultation undertaken, with whom, issues raised, how and where these have been addressed. Including the Evidence Plan and need for Transboundary Consultation.
- Section 4: Project Overview. Drawing on the information presented in relevant chapters of the ES, providing the maximum adverse scenario for each receptor group including temporal and spatial aspects.
- Section 5: Mitigation Measures. Project specific mitigation per receptor group.
- Section 6: The Screening Process for the Project alone. Summarising the screening undertaken, including the approach, conclusion on the potential for LSE and any changes following completion of the screening process and the development of the ES.
- Section 7: The Screening Process for the Project In-Combination. Presenting the approach to identifying the plans and projects to consider in-combination.
- Section 8: Summary of Designated Sites. Summarising site-specific information for all designated sites screened in.
- Section 9: Assessment Criteria. Providing the definitions against which the potential for an adverse effect has been determined, on a receptor-by-receptor basis.
- Section 10: Assessment of Adverse Effect alone. Determination of whether the project alone will result in an adverse effect.
- Section 11: Assessment of Adverse Effect In-combination. Determination of whether the project in-combination with other plans and projects will result in an adverse effect.
- Section 12: Transboundary Statement.
- Section 13: Conclusion of the Assessment. Summarising the conclusions on adverse effect, alone and in-combination; and
- Section 14: References.

2 Legislation, policy and guidance

2.1 Legislative context

2.1.1 Habitats Regulations

20 The requirement to undertake HRA is provided by Section 63(1) of the Habitats Regulations that specifies that:

"A competent authority, before deciding to undertake, or give any consent, permission or other authorisation for, a plan or project which -

(a) is likely to have a significant effect on a European Site or a European offshore marine site (either alone or in combination with other plans or projects), and

(b) is not directly connected with or necessary to the management of that site,

must make an appropriate assessment of the implications of the plan or project for that site in view of that site's conservation objectives."

21 As the Project is not directly connected with or necessary to the management of a European site, a HRA of the Project is required.

22 As noted previously, the EU Exit Regulations (2019) contain EU Exit-related amendments to the Habitats Regulations (2017), with these considered to have no material implications on the requirement or process for a HRA of AyM.

2.1.2 European sites (post EU Exit)

23 The National Network comprises of European sites in the UK that already existed on 31 December 2020 (or proposed to the EC before that date) and established under the Nature Directives. Regulation 8 of the Habitats Regulations (2017) defines European sites as Special Areas of Conservation (SAC), Sites of Community Importance (SCI), Special Protection Areas (SPAs) and proposed sites (candidate SACs and proposed SPAs (pSPA).

24 The term 'European marine site' is interchangeable with European site and refers to SACs and SPAs covered by tidal water that protect marine and coastal habitats and species. UK planning policy also extended the definition to include proposed and designated Ramsar wetland sites of international importance designated under the Ramsar Convention 1971. Defra has confirmed that following Brexit, Ramsar sites remain protected in the same way as SACs and SPAs, but do not form part of the National Site Network (Defra, 2021).

2.2 The HRA process

25 The Stages covered by HRA are referenced in PINS' Advice Note 10 (see Figure 2). Each stage (except the last) defines the requirement for and scope of the next. An initial 'Screening' stage (Stage one) is followed by AA (Stage two) if proposals are likely to have a significant effect.

26 The latter stages become relevant if the AA cannot exclude the risk of an adverse effect on site integrity. These stages will be addressed in the event there is a negative outcome to the second stage of the AA. The current report therefore presents the conclusions of Stage one and the findings of Stage two; these findings do not identify any requirement to progress beyond Stage two.

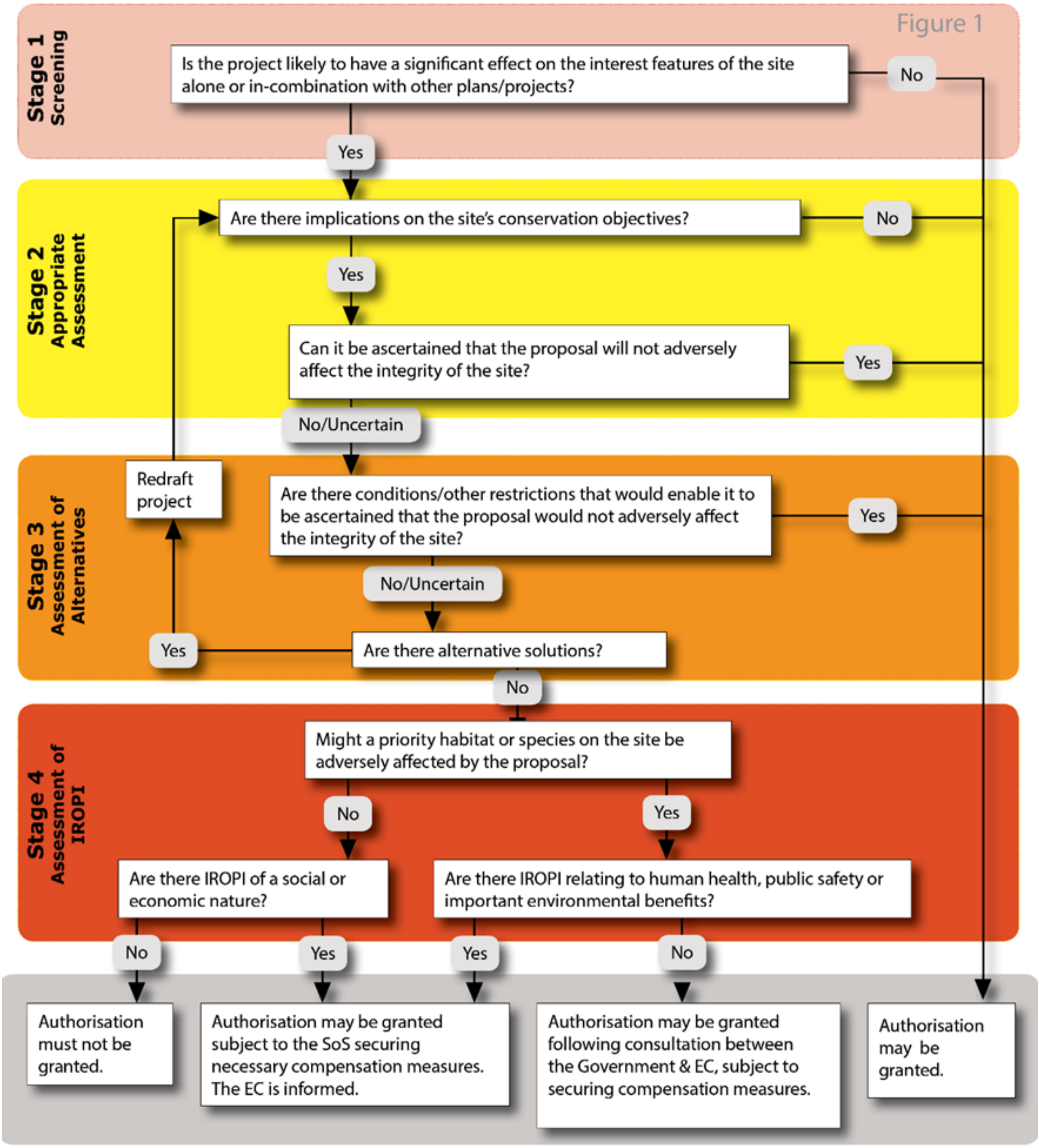

Figure 1: The stages of the HRA from PINS Advice Note 10 (version 8, November 2017).

2.3 Guidance documents

27 Reference to EC guidance on the interpretation of key HRA concepts post EU-Exit appears optional. Section 6(2) of the EU (Withdrawal) Act 2018 (as amended) establishes that UK courts "may have regard to anything done by an EU entity [i.e., the EC] (…) so far as it is relevant". Therefore, authorities might want to adhere to the same guidance. The appropriate authorities may publish guidance on meeting the management objectives for the National Site Network (the 'Network Objectives'). No such guidance has been identified and Defra (2021) has confirmed that existing guidance is still relevant.

28 The EC guidance listed below has been referenced. However, Advice Note 10, which deals explicitly with HRA for NSIPs under the PA 2008 process, is considered to be the primary guidance for the AyM HRA. Advice Note 10 also provides the templates for assessment matrices (HRA Stage 1: Screening Matrices) and (HRA Stage 2: Integrity Matrices). The Planning Inspectorate expects that applicants complete these and submit them with the HRA.

29 The RIAA has been carried out with reference to guidance listed below:

- Department for Environment, Food and Rural Affairs (Defra). 1 January 2021. Policy paper - Changes to the Habitats Regulations 2017 - Published 1 January 2021.
- Planning Inspectorate's Advice Note 10 (2017) (Version 8)
- 'Assessment of plans and projects significantly affecting Natura 2000 sites. Methodological guidance on the provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC' (EC, 2018)
- 'EU Guidance on wind energy development in accordance with the EU nature legislation' (EC, 2011)
- 'Communication from the Commission on the precautionary principle' (EC, 2000)
- "Managing Natura 2000 sites. The provisions of Article 6 of the 'Habitats' Directive 92/43/EEC" (EC, 2018); and
- 'When new marine Natura 2000 sites should be taken into account in offshore renewable energy consents and licences' (DECC, 2016), and
- Regulations and the Habitats Regulations Assessment Handbook (Tyldesley and Chapman, 2013).

2.4 Case law

30 Two cases are considered particularly pertinent to the HRA and the principles defined by them have been applied to this RIAA.

31 First, the approach takes into consideration the decision of the CJEU in 'People Over Wind and Sweetman v Coillte Teoranta' (C323/17) (April 2018) (the Sweetman ruling). This determined that where effects are likely in the absence of mitigation, an AA should be undertaken.

32 Secondly, the ruling in Holohan and others v An Bord Pleanala [2018] (Case C-461/17) EU:C:2018:883, on 7 November 2018 determined that the AA must identify and examine the implications of the project not only for the designated features present at the site, but also habitat types and species present outside the boundaries of that site and functionally linked; insofar as those implications are liable to affect the conservation objectives of the site.

3 Consultation

33 Pre-application consultation has been ongoing for AyM since the Screening Report (Innogy, 2020a) was issued for consultation in June 2020. This will all be summarised in a Consultation Report (application ref: 5.1), which has been produced to accompany the final application. Consultation undertaken specifically with regard to the HRA process has been managed through the following:

- Consultation on the Scoping Report (with consultation relevant to the HRA process summarised here in Table 1 and taken into account within the RIAA);
- Consultation on updates to the Screening Report (with all comments received summarised here in Table 1 and taken into account within the RIAA);
- Meetings of the AyM Evidence Plan and Expert Technical Groups (ETGs) (with all comments received through the Evidence Plan process summarised and taken into account within the RIAA);
- Consultation on the draft RIAA (with all comments received summarised and taken into account within the RIAA); and
- Preparation of Statements of Common Ground (SoCG) (to be undertaken and submitted during the DCO examination).

34 The Evidence Plan process has been followed during the drafting of and consultation on the RIAA.

35 A summary of the consultation to date relating to the HRA process and including where the comment has been addressed is provided in Table 1.

3.1 Transboundary consultation

36 PINS has undertaken transboundary consultation - copies of which are available on the PINS website[iii]. It should be noted that the Screening Report (Innogy, 2020a) undertook screening for all sites/features, regardless of the member state within which they occur; where transboundary sites were screened in for LSE, these are included within the RIAA.

37 The RIAA therefore provides the information necessary for transboundary consultation on HRA matters, initially through the identification of transboundary sites where there could be a LSE, followed by the determination of adverse effect alone and in-combination with other relevant plans or projects.

[iii] https://infrastructure.planninginspectorate.gov.uk/projects/wales/awel-y-mor-offshore-wind farm/?ipcsection=overview

Table 1: Summary of consultation relating to the HRA process.

DATE AND CONSULTATION PHASE	CONSULTATION AND KEY ISSUES RASIED	WHERE THE COMMENT IS ADDRESSED
Pre-Scoping Marine Processes and Ecology ETG Meeting – 21/11/19 Consultees: NRW, Denbighshire District Council, TWT.	NRW requested that the Applicant consider the extent of the tidal excursion on HRA screening.	The Applicant has considered the extent of the tidal excursion within the Annex 1: HRA Screening Report (application ref 5.2.1).
	NRW requested that the Applicant consider accidental pollution in the HRA screening, as no effects would be screened out on the basis of mitigation.	The Applicant has considered accidental pollution within the Annex 1: HRA Screening Report (application ref 5.2.1).
Pre-Scoping Offshore Ornithology and Marine Mammals ETG Meeting – 25/11/19 Consultees: NRW, RSPB, JNCC, Denbighshire District Council, TWT, WDC	NRW raised that they do not agree with the HRA screening of marine mammals based on ranges. NRW's position is that SACs (with marine mammal features) within the Management Unit (MU) should be screened-in. The Applicant agreed to consider this further in the drafting of the HRA screening.	The HRA screening was undertaken based on the following: Cetaceans - All European sites designated for harbour porpoise within the Celtic and Irish Sea MU (CIS MU), together with consideration of potential for site connectivity. All European sites designated for bottlenose dolphin within the Irish Sea MU (IS MU), together with consideration of potential for site connectivity. Pinnipeds - All SACs designated for grey and harbour seal within the provisional UK seal MUs utilised in Special Committee on Seals (SCOS) reporting (MU 12 – Wales), together with consideration of potential for grey seal site connectivity across the wider OSPAR Region III MU.
NRW Pre-application consultation response 04/09/2020	A number of comments received from NRW, discussed at the Evidence Plan ETG meeting on 10/11/2020. In summary, the key issues were around the consideration of Constable Bank as an Annex 1 feature (outwith a SAC, therefore not an HRA issue), the inclusion of more than just the effective deterrent radius (EDR) approach for impacts to harbour porpoise SACs.	Comments taken into consideration for the updates to screening (see Annex 1 for non-ornithology and the final screening update for ornithology in Annex 2). The Constable Bank is no longer crossed by cables and so is no longer directly impacted by AyM (see Section 4.3). Additional methods for assessment of impacts to harbour porpoise SACs are presented alongside the EDR approach in Section 10.2).

DATE AND CONSULTATION PHASE	CONSULTATION AND KEY ISSUES RAISED	WHERE THE COMMENT IS ADDRESSED
Pre-Section 42 Offshore Ornithology ETG Meeting – 18/09/20 Consultees: NRW, Conwy, Denbighshire District Council, RSPB	NRW indicated that there is a need to consider the potential negative metabolic effect. The Applicant confirmed that this would be presented within the offshore ornithology assessment approach position paper that was submitted to the offshore ornithology ETG on 12 March 2021.	The potential negative metabolic effect was presented within the offshore ornithology assessment approach position paper that was submitted to the offshore ornithology ETG on 12 March 2021.
Pre-Section 42 HRA (Non-Ornithology) ETG Meeting – 10/11/2020 Consultees: NRW, JNCC, TWT	NRW agreed that Constable Bank and biogenic reef features do not need to be considered as Annex I in HRA terms as they do not form part of designated sites. However, Constable Bank will be considered in the context of being a supporting habitat for the Liverpool Bay SPA, and features such as biogenic reefs would be considered in the context of the benthic ecology EIA assessment.	Constable Bank considered as part of the assessment of supporting habitats to the Liverpool Bay SPA in Section 7.2.
Pre-Section 42 HRA (Non-Ornithology) ETG Meeting – 10/11/2020 Consultees: NRW, JNCC, TWT	Marine Mammals JNCC position on acoustic deterrent devices (ADDs) used as mitigation, is that there is a need to demonstrate ADDs effectiveness and also to demonstrate that ADDs will not cause PTS/TTS. JNCC raised that the 26 km EDR approach may end up being the most appropriate method but would like to see more case-specific information. The conservation objectives specify the 10 and 20% thresholds so these would be appropriate.	ADD as mitigation – please see the MMMP (Volume 4, Annex 7.2: Outline MMMP (application ref: 6.4.7.2)). Approach to harbour porpoise assessment presented in Section 9.2.
Pre-Section 42 HRA (Non-Ornithology) ETG Meeting – 10/11/2020 Consultees: NRW, JNCC, TWT	Coastal Processes In relation to the 11 km screening range, NRW highlighted that it is important to look at how range varies from inshore to offshore.	11 km updated to 12 km for screening in Annex 1 – worst case assumed regardless of location (noting that range for offshore ECC is less than the range for the array).

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Pre-Section 42 HRA (Ornithology) ETG Meeting – 13/11/2020 Consultees: NRW, RSPB, JNCC, Denbighshire District Council, Natural England	Stakeholders raised concerns that sites and species were being screened on the basis of 12 months of survey data only, and therefore there was the potential for some to be prematurely screened out.	Response from 13/11/2020: The Applicant outlined that screening to date, due to the surveys being ongoing, has been based on 12 months of survey data and clarified that the data is used to identify key migratory seabird species that may interact with the site at an early stage when not all survey data is available (with non-seabird migratory species considered elsewhere in the approach). When new data becomes available later, screening will be reviewed, and the outcomes will be updated wherever appropriate and necessary. Updated response (07/02/2022): Section 10 and 11 has been updated to include 24-months of survey data for all ornithological receptors.
Pre-Section 42 HRA (Ornithology) ETG Meeting – 13/11/2020 Consultees: NRW, RSPB, JNCC, Denbighshire District Council, Natural England	NRW raised that they want to avoid discounting sites too early where more detail and justification could be provided at the AA stage. Some species (e.g. fulmar) are more complicated and would require further justification. NRW agreed that there is some scope to screen out some species and sites, provided sufficient evidence to screen out can be provided.	Further iterations to screening provided (Annexes 1 and 2) following consultation with NRW, final conclusions on Screening presented here in Section 6 and 7.
Pre-Section 42 HRA (Ornithology) ETG Meeting – 13/11/2020 Consultees: NRW, RSPB, JNCC, Denbighshire	JNCC position is that there is a need to ensure that colonies with larger foraging ranges are not screened out. Site-specific data is very important where available because of the variability between colonies for same species. For example, one colony can forage much further than at another colony and so coarse foraging ranges should not be applied as a 'one size fits all' for a particular species. Using mean-max eliminates some uncertainty, but some colonies may forage further. Therefore, site specific foraging ranges are really important.	The site consideration stage of the screening report (Innogy, 2020a) ensured that every SPA for breeding seabirds was considered to ensure no SPAs were missed.

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District Council, Natural England		
Pre-Section 42 HRA (Ornithology) ETG Meeting – 13/11/2020 Consultees: NRW, RSPB, JNCC, Denbighshire District Council, Natural England	The stakeholder screening response in relation to red-throated diver indicated that a 10 km displacement range should be applied, increasing the range over which sites are screened in for displacement.	The 4 km impact range for displacement proposed at screening was based on the current SNCB displacement advice guidance (2017 document). The 10 km displacement range was reviewed, for AyM increasing the range to 10 km will not bring in any additional red-throated diver SPAs.
Pre-Section 42 HRA (Ornithology) ETG Meeting – 13/11/2020 Consultees: NRW, RSPB, JNCC, Denbighshire District Council, Natural England	Screening response questioning whether due consideration of Welsh wintering estuarine SPAs had been given.	Migratory movements of birds potentially linked to Welsh wintering estuarine SPAs and Ramsar sites were screened in at the request of NRW and have been included in this Stage 2 assessment in relation to collision risk and barrier effect. Assessment of migratory birds is discussed in Section 10.
Fish and Shellfish Baseline NRW response 20/11/2020	Section 73 – the River Dee is designated under EU Habitats Directive for Atlantic Salmon. - 'As noted within the "Salmonid and fisheries statistics for England and Wales 2018", salmon rivers within England and Wales are considered to be predominantly 'at risk' or 'probably at risk', with year-on-year catches of salmon (net) broadly stable for 2017 and 2018 (10,133 and 10,645 respectively) but overall declined when compared to the 5-year mean. The England and Wales statistics draw on combined rod and net fishing statistics, with the 'rod days' decreasing during this period from 164,000 to 106,000, and the net licences also reducing from 304 to 231.' To contextualise these numbers the text should specify that these totals are for all rivers 64 in England and Wales.	Atlantic salmon screened in for the River Dee and Bala Lake SAC (see Section 7.6).
Cumulative Effects	Table 4.6 – Topic specific screening ranges, for marine mammals it states that it will be "Dependent on the reference population extent, i.e. the Celtic and Irish Seas MU for harbour porpoise." We support this	Plans and projects screened in for in-combination assessment mirrors the approach for ES and takes

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Assessment NRW comments 21/12/2020	and advise that the relevant MU should be used for each marine mammal species.	account of the relevant MU (see Section 1.1).
Cumulative Effects Assessment NRW comments 21/12/2020	Page 13, 4.2.1, 22: The applicant states "…these initial screening ranges are based on what are considered to be the maximum extents of potential impacts from those activities and are therefore considered to be highly precautionary." It is not clear how these initial screening ranges have been decided upon.	In-combination screening ranges for offshore ornithology have been based on mean-maximum foraging ranges +1SD (Woodward et al., 2019) during the breeding season, and the BDMPS (Furness 2015) approach during the non-breeding season.
Cumulative Effects Assessment NRW comments 21/12/2020	Page 13, Table 4.2: The proposed zone of influence for offshore energy for example, is 500 km. We are concerned that there may be offshore energy projects further away than 500 km which could be impacting upon some bird species from Welsh seabird sites. The potential effects should be looked at for each site on a case-by-case basis and should be based on a suitable evidence base e.g. tagging and tracking studies, foraging ranges and the relevant BDMPS (Furness 2015).	Response from 21/12/2020: In-combination screening ranges for offshore ornithology have been based on mean-maximum foraging ranges +1SD (Woodward et al., 2019) during the breeding season, and the BDMPS (Furness 2015) approach during the non-breeding season. Updated response (07/02/2022): Manx shearwater have additionally been screened in for a number of SPAs on request by NRW and have been considered in-combination. The foraging range for Manx shearwater is 1346.8±1018.7 km, however impacts are unlikely to occur at this distance. Therefore, it has been deemed more appropriate to include any plan or project within the BDMPS region and east coast of Ireland in-combination with AyM for Manx shearwater.
Cumulative Effects Assessment NRW Fish comments 05/01/2021	Table 4.6, - screening ranges maximum extent and justification for fish and shellfish receptors. The text says: "50 km from the array area, based on a precautionary impact range from underwater noise. 12 km from the offshore ECC, based on the distance of one tidal excursion ellipse." While we agree with the range proposed for the offshore ECC with regards to fish, we would advise that further justification for the proposed range of 50 km for UW noise for the array area. As discussed at the ETG meetings, fish are a mobile feature and as such, may be exposed to an impact outside sites	100 km applied as screening range for sites alone and plans and projects in-combination within the RIAA and applied for underwater noise at ES. Wylfa Newydd in-combination has not been included as the application for a DCO was withdrawn prior to determination on the basis that

DATE AND CONSULTATION PHASE	CONSULTATION AND KEY ISSUES RASIED	WHERE THE COMMENT IS ADDRESSED
	where they are protected, and a 100 km range has been agreed as appropriate for the HRA. Furthermore, UW noise is the only impact mentioned, it is not however, the only potential effect which should be considered relating to Cumulative Effects from other plans or projects. Finally, it would appear that the proposed tidal lagoon in the Dee estuary (the Flagstaff project) has been missed off the list of potential projects. Wylfa Newydd is included but only in the onshore cumulative matrix. We would advise that both projects be included for offshore and ECT, as they may have elements, such as dredging/ marine infrastructure works which may act cumulatively with the AyM development.	the developer is no longer pursuing the project. The tidal lagoon in the Dee estuary is acknowledged as a potential project but cannot be included in any meaningful way in this RIAA until documentation is publicly available.
HRA Screening Update JNCC 22/01/2021	JNCC feels it would be helpful if Table 2-2 included the country (e.g. Scotland, England, Wales etc.) for each Special Protected Area (SPA).	Final screening can be found in Annex 2 and Table 5.
HRA Screening Update JNCC 22/01/2021	We would question why sites in the rest of Europe have not been revisited based on the updated approach to screening?	The update to screening has been based on UK based evidence (Woodward *et al.*, 2019) and therefore hasn't been extended to other EU countries. Furthermore, re-screening of other EU countries is not necessary as no LSE would be found due to the distance from the AyM site to breeding SPAs in other EU countries. It is important to note that the Project is currently undertaking consultation with EU countries.
HRA Screening Update JNCC 22/01/2021	It would be useful for the update to describe the types of information used to supplement the generic approach (e.g. Woodward foraging ranges). For example, some features are screened out although they are within foraging range, because tracking data from the colony suggests no connectivity with AyM (e.g. gannets at Grassholm SPA). Whilst in other cases there is an assumption around the birds within AyM being primarily from one colony and therefore others are screened out even if within foraging range of AyM (e.g. some tern features). A generic description of the approaches and types of information used would be helpful.	A detailed methods section has been provided in Section 6.2 with further clarity in the accompanying HRA matrices.
HRA Screening Update JNCC 22/01/2021	With regard to paragraph 24, it is not clear what is meant here. Have they concluded that sites designated for fulmar and Manx shearwater were not screened in because of a perceived low risk? The risk to Manx shearwater is being revisited (given some evidence of higher flight heights in some areas/contexts). Sufficient justification is required if species are dropped due to low perceived risk, especially those occurring in high numbers within AyM.	Response (22/01/2021): Based on published evidence both fulmar and Manx shearwater are low risk to both collision and displacement (Bradbury *et al*, 2014). Both species were also recorded by site specific surveys to be found in relatively low densities at the site. Therefore, the risk of LSE is very low. With regard to the flight height of Manx shearwater, the screening

DATE AND CONSULTATION PHASE	CONSULTATION AND KEY ISSUES RASIED	WHERE THE COMMENT IS ADDRESSED
		process used published evidence to consider risk (i.e. Bradbury *et al*., 2014). Additionally, the Cook *et al*., 2012 publication "A review of flight heights and avoidance rates of birds in relation to offshore wind farms" which utilised observed flight height data from GyM among others, found flight heights of Manx shearwaters to be restricted to low altitudes well below collision risk height. It is therefore requested that any information which suggests a higher collision risk to be presented to the Project for consideration. However, based on publicly available evidence that the Project is aware of, collision risk for Manx shearwater indicates no LSE. Updated response (07/02/2022): Manx shearwater has been assessed for displacement risk by request from NRW in Section 10.
HRA Screening Update JNCC 22/01/2021	The layout, description and information columns in the screening spreadsheet are informative, useful and helpful. An additional column stating the country within the UK, and whether sites are inshore or offshore would be helpful in identifying which Statutory Nature Conservation Body (SNCB) should be consulted for each SPA.	Final screening can be found in Annex 2 and Table 5.
HRA Screening Update JNCC 22/01/2021	JNCC are content with screening decisions in the update regarding offshore (or partially offshore) sites.	Noted
HRA Screening Update JNCC 22/01/2021	NatureScot, the Department of Agriculture, Environment and Rural Affairs (DAERA) and Natural England (NE) should be consulted. There are several SPAs for which a generic approach would screen them in, but the decision has been taken to screen them out due to additional information (e.g. Manx shearwater and Rum SPA). This needs to be discussed with relevant SNCBs for each of these SPAs. JNCC are content with the approach and types of information used but cannot comment on screening of individual SPAs outside of our jurisdiction.	Response (22/01/2021): The Project is currently undergoing consultation with NatureScot, the Department of Agriculture, Environment and Rural Affairs (DAERA) and Natural England (NE) however, the JNCCs content is both welcomed and noted. Updated response (07/02/2022): All designated sites have been considered within Annex 2.

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HRA Screening Update JNCC 22/01/2021	Assumptions have been made around low vulnerability of Manx shearwater to offshore wind development. There is some evidence that Manx shearwaters may fly higher than generally assumed, in some areas or contexts. This is being explored further outside of the AyM context but should be borne in mind and may influence some screening decisions should there be deemed a risk of collision in some situations.	Response (22/01/2021): Based on published evidence Manx shearwater are of low vulnerability to offshore wind development (e.g. Bradbury *et al*., 2014 & Furness *et al*., 2013). Flight height of Manx shearwater was evidenced from published monitoring reports such as the Cook *et al*., 2012 publication "A review of flight heights and avoidance rates of birds in relation to offshore wind farms" which utilised observed flight height data from GyM OWF among others, found flight heights of Manx shearwaters to be restricted to low altitudes well below collision risk height. It is therefore, requested that any information which suggests a higher collision risk to be presented to the Project for consideration. However, based on publicly available evidence that the Project is aware of, collision risk for Manx shearwater indicates no LSE. Updated response (07/02/2022): Manx shearwater have been assessed in Section 10 on request by NRW.
HRA Screening Update JNCC 22/01/2021	JNCC has no comments to make as this applies to inshore SPAs only. However, as such, NatureScot, DAERA and NE should be consulted as the points raised by NRW may also be applicable outside of Wales.	Response (22/01/2021): The Project is currently undergoing consultation with NatureScot, the Department of Agriculture, Environment and Rural Affairs (DAERA) and Natural England (NE). Updated response (07/02/2022): All designated sites have been considered within Annex 2.
HRA Screening update Ornithology NRW comments 26/01/2021	Key issues: The report and accompanying spreadsheet are not precautionary enough. Features are dismissed without a proper evaluation. No evidence or insufficient evidence is presented for why features and/or sites have been screened out.	The report and spreadsheet have been based on Woodward *et al*., 2019 mean-maximum foraging ranges plus 1 standard deviation (SD) which was suggested by NRW and JNCC as being the suitable metric for informing the consideration of SPA

DATE AND CONSULTATION PHASE	CONSULTATION AND KEY ISSUES RASIED	WHERE THE COMMENT IS ADDRESSED
		screening during the breeding season while no formal screening advice exists. Site specific maximum foraging ranges have been used for species and breeding SPAs where available and presented in the Woodward *et al*., 2019 publication. Issue specific comments have been addressed in the following rows.
HRA Screening update Ornithology NRW comments 26/01/2021	Page 5, 2.3 Methods, 16: Mean maximum foraging ranges – we welcome the change to using the Mean maximum foraging ranges plus 1 standard deviation from Woodward *et al* 2019.	Noted
HRA Screening update Ornithology NRW comments 26/01/2021	Page 5, 2.3 Methods, 17: Regarding potential connectivity during migration and Criterion 4 from the AyM HRA screening Report (Innogy, 2020a), will there be an update to this following NRW's comments on the screening report and following the collection of the full 2 years of survey data?	Response (26/01/2021): Criterion 4 utilised records of birds reported during site specific survey data to understand the potential occurrence of seabirds at the project during migratory movements. As the HRA Screening to date has been based on a single year's worth of site-specific digital aerial survey data, an update will be provided to include any additional species recorded as more site-specific data becomes available. However, it is likely that the key focal species have already been recorded within the first year's survey data and therefore it is unlikely further species will be required to be considered. Updated response (07/02/2022): Ornithological assessment for migratory birds alone has been updated to include 24-months of survey data in Section 10. All sites have been considered and Table 5 presents all designated sites that have been screened in for assessment. Migratory CRM assessment can be found in Annex 4.4 Migratory CRM (application ref: 6.4.4.4).

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HRA Screening update Ornithology NRW comments 26/01/2021	Page 6, 2.4 Results, 23: Any analysis looking at foraging ranges of seabirds should do this via the sea and not across the land. Therefore, those colonies whose foraging ranges do not reach AyM via a sea route can be screened out. The foraging range from a colony should be measured from the location of the colony and not the SPA boundary. This can change things significantly, for instance, the common tern colony in the Dee is at the southern end of the estuary and is therefore 49 km away from AyM, this is way beyond the mean max +1SD of 26.9 km from Woodward *et al*, 2019.	Sites have been measured via a GIS from boundary to boundary to identify the shortest possible distance. Where sites are located overland, site specific measurements have been made. This approach presents a precautionary method to identify potential connectivity with breeding sites. Exact colony location may be utilised if necessary for sites screened into Stage 2.
HRA Screening update Ornithology NRW comments 26/01/2021	Page 6, Table 2-2: The common tern colony in the Dee Estuary SPA is not within foraging range of AyM, this feature can be screened out. NRW's view is that LSE cannot be discounted at this stage for: • Gannets from Grassholm SPA • Lesser black backed gull, Manx shearwater and storm petrel from Skomer, Skokholm and the Seas off Pembrokeshire SPA • Cormorant from Puffin Island SPA. These features/sites are within foraging range of AyM and should be screened in and included in the table. See further information on this below in comments on the spreadsheet.	Response (26/01/2021): The Project welcomes the screening out of common tern as a feature of the Dee Estuary SPA. Other SPA concerns raised here have been addressed in the SPA specific responses below. Updated response (07/02/2022): The Project welcomes the screening out of common tern from Dee Estuary SPA during the breeding bio-season, however is considered within Annex 4.4 Migratory CRM (application ref: 6.4.4.4) for collision risk during migration. Upon request by NRW, qualitative assessments of cormorant from Puffin Island SPA and storm petrel from Skomer, Skokholm and the Seas off Pembrokeshire SPA are presented in Section 10. Assessments for lesser black-backed gull and Manx shearwater from Skomer, Skokholm and the Seas off Pembrokeshire SPA have been presented, on request by NRW, in Section 10.
HRA Screening update Ornithology NRW comments 26/01/2021	3. Migratory non-seabird screening update, Table 3-1: There are breeding features of these wintering sites, which can potentially be screened out using Woodward *et al* 2019.	The Project welcomes this observation and as a result, a review of the breeding features has been undertaken and screened out if possible, using Woodward *et al.*, 2019 ranges within the final screening in Annex 2 and Table 5.
HRA Screening update	We disagree with sites being screened out at this very early stage without proper justification and evidence. The rationale provided in the spreadsheet is insufficient to satisfy the HRA process.	Response (26/01/2021): The HRA Screening report (Innogy, 2020a) has been

DATE AND CONSULTATION PHASE	CONSULTATION AND KEY ISSUES RASIED	WHERE THE COMMENT IS ADDRESSED
Ornithology NRW comments 26/01/2021	Screening for likely significant effects (LSE) should be a relatively quick and straightforward decision and: • show that a plan or project clearly has no ecological connectivity to the site's qualifying interests • show that a plan or project obviously won't undermine the conservation objectives for the qualifying interests to which it has a connection • should include plans and projects at any distance beyond the Natura site's boundaries • should include whether the plan or project concerned is capable of having an effect. If this document is draft due to not all the years of survey data being used it would be helpful if this was made clear.	revisited to include the standard deviation of mean-maximum foraging ranges as presented by Woodward *et al*., 2019, as requested by SNCBs during the first offshore ornithology ETG. This information has been presented in a spreadsheet to allow SNCBs to filter SPAs and Ramsar sites by county of interest. Information has been presented as a justification for the screening of sites. A table presenting the additional sites as a result of the re-screening exercise will be provided to SNCBs. It is important to note that over precaution during screening and the resulting increase of including all SPAs with any degree of connectivity and therefore not based on species specific sensitivity may increase the number of SPAs included in the assessment and dilute the realistic impact on key SPAs. The role of HRA screening is to identify effects which are likely to result in a significant impact to a designated site and feature to ensure dilution of impact at the assessment stage is avoided. Update (10/02/2022): Screening has taken into consideration the 4 criteria outlined in Section 6. Additionally, Criteria 2 was updated to assess within mean-maximum foraging range plus 1 SD upon request by SNCBs at the first ornithology ETG meeting. Additional sites beyond these criteria have also been included at the request of NRW (Table 5).
HRA Screening update Ornithology NRW comments 26/01/2021	Liverpool Bay SPA, we agree that breeding common tern can be screened out. The wintering features of Liverpool Bay SPA are not mentioned in these documents, to clarify, is this because it has already been screened in for wintering species?	Response (26/01/2022): The agreement of screening out of common tern from the Liverpool Bay SPA is welcomed. The Applicant can confirm that the HRA Screening update was undertaken to incorporate Woodward *et al*., 2019 mean-maximum foraging ranges plus standard deviation which is only applicable during

DATE AND CONSULTATION PHASE	CONSULTATION AND KEY ISSUES RASIED	WHERE THE COMMENT IS ADDRESSED
		the breeding season. Wintering features of SPAs or Ramsar sites have not been re-visited in this update and can be found in the original HRA Screening documentation. Update response (10/02/2022): Terns and red-breasted merganser have also now been considered for risk of collision on migration from Liverpool Bay SPA and have been assessed using the approach outlined in Annex 4.4 Migratory CRM (application ref: 6.4.4.4).
HRA Screening update Ornithology NRW comments 26/01/2021	We do not agree with the screening out of the cormorant feature of Puffin Island SPA without any justification or reference to any scientific evidence. AyM is within foraging range of cormorants from this site therefore there is a clear ecological connectivity.	Response (26/01/2021): Published evidence (Furness *et al.*, 2013, Bradbury *et al.*, 2014, Dierschke *et al.*, 2016 and Fliessbach *et al.*, 2019) suggests that cormorant are of low sensitivity to impacts associated with OWF. A full account of evidence will be provided for each impact within the matrix of this SPA. However, this SPA/ species combination has been screened into Stage 2 on a precautionary basis based on the request from NRW. Updated response (07/02/2022): Upon request by NRW, a qualitative assessment of cormorant at Puffin Island SPA has been included in Section 10.
HRA Screening update Ornithology NRW comments 26/01/2021	We do not agree with some of the features of Skomer and Skokholm and the Seas off Pembrokeshire SPA that have been screened out (lesser black backed gull, Manx shearwater and storm petrel). AyM is within the foraging range of all these species and therefore there is potential ecological connectivity and the potential for any of these species to be impacted by collision or displacement. The level of the potential effect needs to be assessed for these species. They should be looked at robustly through the use of the apportioning tool as well as potential effects of displacement and collision.	Response (26/01/2021): The Woodward *et al.*, 2019 publication presents maximum foraging ranges for some species and SPA combinations. The maximum foraging range for lesser black-backed gull as a breeding feature of Skomer and Skokholm and the Seas off Pembrokeshire SPA is presented by Woodward *et al.*, 2019 and suggest no connectivity during the breeding season. This maximum range is site specific and more appropriate for use in this

DATE AND CONSULTATION PHASE	CONSULTATION AND KEY ISSUES RASIED	WHERE THE COMMENT IS ADDRESSED
		instance when compared to the mean of maximums from various UK breeding SPAs. However, this SPA/ species combination has been screened into Stage 2 on a precautionary basis based on the request from NRW. Despite low anticipated risk of LSE for Manx shearwater, this SPA breeding colony has been screened into to Stage 2 of the assessment where additional evidence can be presented. Despite the Project array area being within mean-maximum foraging range (plus standard deviation) of storm petrels from this SPA, the species has very low sensitivity to impacts associated with offshore wind farms (Furness *et al*., 2013, Bradbury *et al*., 2014 and Fliessbach *et al*., 2019). It is therefore highly unlikely an LSE would be concluded for this species. Despite low anticipated risk of LSE for storm petrel, this SPA breeding colony has been screened into to Stage 2 of the assessment where additional evidence can be presented. Updated response (07/02/2022): Upon request by NRW, assessments for lesser black-backed gull, Manx shearwater and storm petrel from Skomer, Skokholm and the Seas off Pembrokeshire SPA have been presented in Section 10.
HRA Screening update Ornithology NRW comments 26/01/2021	We disagree with the dismissal of Manx shearwaters and storm petrels as having "relatively low sensitivity to impacts from OWF" with insufficient evidence to back this up. Manx shearwater have been screened in for Bardsey island yet not for Skomer and Skokholm. A breeding site cannot just be screened out on the effects during the breeding period but also the potential collision and displacement during the non-breeding season.	Despite low anticipated risk of LSE for Manx shearwater and storm petrel, Welsh SPA breeding colonies for both species have been screened into to Stage 2 of the assessment where additional evidence can be presented.
Pre-Section 42 Offshore Ornithology ETG Meeting –	NRW concern over that lack of evidence presented in the HRA screening spreadsheet. NRW stated that the evidence needed for screening would almost constitute an AA. Therefore, the key message from NRW was to take forward those sites and features to the AA stage and not screen them out NRW's position is that all sites with potential connectivity (in Wales) should be screened in.	The sites and features of concern identified by NRW will be taken forward to the stage 2 assessment within the RIAA.

DATE AND CONSULTATION PHASE	CONSULTATION AND KEY ISSUES RASIED	WHERE THE COMMENT IS ADDRESSED
25/03/2021 Consultees: NRW	NRW's position that all sites where there is a potential effect and potential connectivity should be carried through to the AA phase. Grassholm SPA – NRW would like gannet to be screened in on a precautionary basis and taken through to AA stage. Puffin Island SPA - NRW would not agree to screen cormorant out, without first seeing the evidence, as they could be affected by collision and there could be an effect on prey resource.	
Section 42 Responses NRW Comments 11/10/2021	Pg 113; 86: NRW agrees with the rule set out that "Where the assessment alone concludes a zero contribution from AyM to an effect, it therefore follows that there can be no contribution from AyM to any in-combination effect and no further assessment is required." However, NRW disagrees that this is set at "<1 individual contribution from AyM to an effect, a reasoned judgment is taken to the potential for any contribution to an in- combination effect." Where the predicted impact is 0 due to no birds of that species being recorded or no birds recorded in the PCH then it is fine to conclude no contribution to an in-combination effect. Also the applicant could potentially use the threshold of an increase of less than 1% of the mortality in terms of scoping out cumulative/in-combination thresholds. However, all these assessments need to be looked at against the conservation objectives of the site in question and the current state of the population, not just in terms of abundance, but also the other measures of the conservation objectives such as availability of habitat.	Alone and in-combination assessments, Section 10.3 and 11.3, respectively, have been updated for all species with >0 contribution. All relevant conservation objectives have been discussed in Section 10.3 for all relevant features.
Section 42 Responses NRW Comments 11/10/2021	Pg 121; 12.3; 101: As this assessment has been undertaken using only 18 months of the 24 months of survey NRW cannot yet agree with the conclusions of the report. NRW does not agree with the screening out of "species in more than very small numbers or more than very infrequently during the 18 consecutive months of baseline characterisation surveys within the AyM survey area (this covered AyM array and the area covered by a distance of 4 km projected around the proposed array) (further information on the surveys is provided within Annex 4.4.1);" The assessment also needs to include those small numbers of birds to see what effect this might have on a site both on its own and cumulatively. Also the assessment for red-throated diver displacement needs to be done on a 8km buffer to the south of the windfarm as described in "Awel y Môr Offshore Wind Farm: Ornithological Approach to Assessment Position Paper" which states "Gradient approach for red- throated diver displacement analysis 16 For red-throated diver, APEM proposes considering abundances in buffer zones in steps of 1 km, out to 8 km to the south (agreed with Natural Resources Wales and in line with the asymmetric survey design: IR0485 GyM Extension Aerial Baseline Surveys, Innogy Renewables UK Ltd. APEM Ref: P00003481, Date: November 2019.). This would enable a graduated approach to displacement analysis, with different displacement rates applied to the array area and each subsequent buffer."	The assessment of ornithological receptors has now been updated using 24 months of survey data in all relevant documents (Section 10.3 and 11.3 for ornithological alone and in-combination assessment, respectively). Alone and in-combination assessments, Section 10.3 and 11.3, respectively, have been updated for all species with >0 contribution. The red-throated diver alone assessment, using a gradient approach discussed within the HRA ETG, is discussed in Section 10.3.

DATE AND CONSULTATION PHASE	CONSULTATION AND KEY ISSUES RASIED	WHERE THE COMMENT IS ADDRESSED
Section 42 Responses NRW Comments 11/10/2021	Pg 121; 12.3; 101: NRW disagrees with undertaking displacement work only on those species that have "been identified as sensitive to displacement and disturbance in relevant guidance (e.g. Bradbury et al., 2014; Furness and Wade, 2012; Furness et al., 2013);" There is evidence to show that Manx shearwaters have been displaced "for example Manx shearwaters have been shown to avoid the windfarm at North Hoyle in Liverpool Bay (Dierschke et al , 2016)" and NRW advise that this displacement is analysed to be able to make assessments on Manx shearwater SPAs.	Manx shearwater quantitative alone assessment is discussed in Section 10.3 for the relevant SPAs.
Section 42 Responses NRW Comments 11/10/2021	Pg 121; 103: Where species are considered only within the RIAA, and don't appear within the CRM and Displacement Analysis Annexes, there needs to be improved explanation in the text of the origin of the demographic rates used (e.g. age ratio, mortality rates). Clearer explanation for use of and calculation of "a generic population age ratio" throughout (i.e. at document locations 422, 451, 458, 465,471,506)	Information on the source and rationale of data used in the apportioning analysis has been discussed in Section 10.3.
Section 42 Responses NRW Comments 11/10/2021	Pg 121; 104: Currently the potential mortality impacts are only presented separated by timing (e.g. construction, O&M) and cause (e.g. displacement, collision), not allowing for a full assessment of total impacts on SPA features against the Conservation Objectives of the site. We advise that these impacts are treated additively and compared against the SPA population mortality baseline.	Combined impacts within phases of the development are discussed in Section 10.3 for the relevant features. The Applicant acknowledges the request for combining impacts across phases of the development. The predicted mortalities for each species are given per annum for each phase of the development. These phases are not expected to overlap, therefore, it is not deemed suitable to combine impacts across development phases.
Section 42 Responses NRW Comments 11/10/2021	Pg 121; 104: The document needs to include the calculations for the SNH (2018) apportioning approach to sites. It is not clear if this included large colonies and not just SPAs.	The apportioning approach is outlined within Annex 5 (application 5.2.5).
Section 42 Responses NRW Comments 11/10/2021	Pg 88; 67: NRW welcome the use of Woodward et al (2019) mean max foraging range plus 1SD as a metric for informing the consideration of SPA screening during the breeding season.	The screening results are presented in Annex 2 (application ref: 5.2.2).

DATE AND CONSULTATION PHASE	CONSULTATION AND KEY ISSUES RASIED	WHERE THE COMMENT IS ADDRESSED
Section 42 Responses NRW Comments 11/10/2021	Pg 93-98; Table 5: • Dee Estuary SPA – Redshank are only mentioned as wintering feature, not passage. • Burry Inlet SPA – Whimbrel and greenshank are not SPA features. • Grassholm SPA – Gannet in this table both construction and decommissioning "Direct disturbance and displacement", whereas in 5.1.2. Annex 2 it is "No LSE". • Skomer, Skokholm and Seas off Pembrokeshire SPA– Kittiwake and Lesser black-backed gull are also listed as non-breeding features.	Updates to SPA features screened in during assessment are presented in Table 5.
Section 42 Responses NRW Comments 11/10/2021	Pg 124; 109: The Conservation Objectives of the features of Welsh SPA sites are currently not accurate within Annex 3, see below section on 5.1.3 AyM PEIR RIAA Annex 3: European Site Information for details and for links to appropriate sources	All conservation objectives are updated within the alone assessment, Section 10.3 and Annex 3 (application ref: 5.2.3).
Section 42 Responses NRW Comments 11/10/2021	Liverpool Bay SPA: The applicant needs to consider the assemblage feature of Liverpool Bay as well. Red- breasted merganser is part of this assemblage and not a separate feature in its own right.	Red-breasted merganser has been assessed as an assemblage feature within the alone assessment, Section 10.3.
Section 42 Responses NRW Comments 11/10/2021	Pg 133;142: These are not the conservation objectives for Liverpool Bay SPA. The Reg 37 package (old reg 35) is the legal document explaining conservation advice for Liverpool Bay SPA [redacted]. At the moment this is in the process of being updated to include the new features brought in during 2017. NRW advise that the features of Liverpool Bay SPA must be assessed against the conservation objectives which for red-throated diver are: (i) The size of the red-throated diver population is at, or shows only non-significant fluctuation around the mean population at the time of designation of the SPA. to account for natural change; (ii) The extent of the supporting habitat within the site is maintained. And for common scoter are: (i) The size of the common scoter population is at, or shows only non-significant fluctuation around the mean population at the time of designation of the SPA to account for natural change; (ii) The extent of the supporting habitat within the site is maintained. And for the waterbird assemblage are:	All conservation objectives are updated within the alone assessment, Section 10.3 and Annex 3 (application ref: 5.2.3).

DATE AND CONSULTATION PHASE	CONSULTATION AND KEY ISSUES RASIED	WHERE THE COMMENT IS ADDRESSED
	(i) The size of the waterbird assemblage population shows only non-significant fluctuation around the mean at the time of designation to allow for natural change; (ii) The extent of the waterbird assemblage supporting habitat within the site is maintained.	
Section 42 Responses NRW Comments 11/10/2021	13.1.3 Dee Estuary Ramsar, SPA and SAC. Pg 145; 178: The conservation objectives for the features of the Dee SPA can be found here: [redacted]	All conservation objectives are updated within the alone assessment, Section 10.3 and Annex 3 (application ref: 5.2.3).
Section 42 Responses NRW Comments 11/10/2021	Pg 183; 284: As stated previously NRW does not agree with the screening process used. The PEIR therefore fails to assess a number of Welsh SPAs that should have been included. All the features of Liverpool Bay (including the assemblage) that could be displaced need to be assessed. The effect on displacement of the Manx shearwater features of Skomer, Skokholm and the Seas off Pembrokeshire SPA and Glannau Aberdaron ac Ynys Enlli / Aberdaron Coast and Bardsey Island SPA need to be assessed. Guillemot and Razorbill displacement and mortality need to be assessed and apportioned back to the seabird assemblage feature of Skomer, Skokholm and the Seas off Pembrokeshire SPA. NRW can only advise on Welsh sites, but sites from other countries may also need assessing.	The screening table including updates discussed in the AyM ETG are in Table 5 from the RIAA (application ref: 5.2) and Annex 2 (application ref: 5.2.2).
Section 42 Responses NRW Comments 11/10/2021	Pg 184; 285: As stated in the PEIR, there is potential for displacement and mortality during construction. NRW therefore advise this should be assessed in a similar way as in Preliminary Environmental Information Report; Volume 2, Chapter 4: Offshore Ornithology. This considered that construction was less than operation and therefore a 50% reduction in disturbance could be used in this assessment looking at various ranges of mortality.	Displacement during the construction and decommissioning phase for relevant species are provided in Section 10.3 using a 50% reduction in displacement rate compared to operation and maintenance phase.
Section 42 Responses NRW Comments 11/10/2021	Pg 185; 288: The features of Liverpool Bay SPA that have previously been mentioned by NRW and the applicant for disturbance and displacement will also need to be assessed for visual and/or noise disturbance (as this is how disturbance and displacement occurs).	Visual and/ or noise disturbance have been assessed for relevant features in Section 10.3.
Section 42 Responses NRW Comments 11/10/2021	Pg 186; 291: NRW does not agree with the screening process and therefore does not agree with this list of sites. All the features of Liverpool Bay, including the assemblage, that could be displaced need to be assessed. The effect on displacement of the Manx shearwater features of Skomer, Skokholm and the Seas off Pembrokeshire SPA and Glannau Aberdaron ac Ynys Enlli / Aberdaron Coast and Bardsey Island SPA need to be assessed. Guillemot and Razorbill displacement and mortality need to be assessed and apportioned back to the seabird assemblage feature of Skomer, Skokholm and the Seas off Pembrokeshire SPA. NRW can only advise on Welsh sites but there may be sites from other countries which need assessing.	The screening table including updates discussed in the AyM ETG are in Table 5 from the RIAA (application ref: 5.2) and Annex 2 (application ref: 5.2.2).

DATE AND CONSULTATION PHASE	CONSULTATION AND KEY ISSUES RASIED	WHERE THE COMMENT IS ADDRESSED
Section 42 Responses NRW Comments 11/10/2021	Pg 187; Collision Risk: NRW is unable to agree to any results until full survey has been analysed.	The assessment of ornithological receptors has now been updated using 24 months of survey data in all relevant documents (Section 10.3 and 11.3 for ornithological alone and in-combination assessment, respectively).
Section 42 Responses NRW Comments 11/10/2021	Pg 187; 295: NRW does not agree with the screening process and therefore does not agree with this list of sites. Common and Arctic tern need to be assessed for Anglesey tern SPA, Lesser Black-backed gull feature and kittiwake need to be assessed (as part of the assemblage feature) for Skomer, Skokholm and the Sea off Pembrokeshire SPA. NRW can only advise on Welsh sites but there may be sites from other countries which need assessing, for instance the applicant may need to consider SPAs for Common gull and Fulmar.	The alone assessment for Anglesey Terns / Morwenoliaid Ynys Môn SPA is discussed in Section 10.3. The alone assessment for lesser black-backed gull and kittiwake, as part of the seabird assemblage feature for Skomer, Skokholm and the Seas off Pembrokeshire SPA are discussed in Section 10.3.
Section 42 Responses NRW Comments 11/10/2021	Pg 189; 298: This should also include the Common and Arctic tern features of Anglesey tern SPA in terms of assessing potential barrier effects.	The alone assessment for Anglesey Terns / Morwenoliaid Ynys Môn SPA is discussed in Section 10.3.
Section 42 Responses NRW Comments 11/10/2021	Pg 190; 300: Red-breasted merganser is part of the assemblage feature and needs to be considered as such not separately.	Red-breasted merganser has been assessed as an assemblage feature within the alone assessment, Section 10.3.
Section 42 Responses NRW Comments 11/10/2021	Pg 190; 301-302: These are not the legal conservation objectives for the features of Liverpool Bay SPA. See previous comment and comments in 5.1.3 AyM PEIR RIAA Annex 3: European Site Information for details.	All conservation objectives are updated within the alone assessment, Section 10.3 and Annex 3 (application ref: 5.2.3).
Section 42 Responses NRW Comments 11/10/2021	Pg 192; 306: NRW agrees with the assessment assuming that there will be 100% displacement within a 2km buffer.	The assessment is presented in Section 10.3 for common scoter during cable installation.
Section 42 Responses NRW Comments	Pg 194; 311: The document should show 1 - 10% mortality rates to allow for an assessment of this. Here the document needs to include mapped aggregations of Red- throated diver in the cabling area and clearer calculations. NRW request a GIS file of the cabling area.	The presentation of a range of mortality rates is discussed in Section 10.3. Red-throated diver aggregations in the cable area are presented in

DATE AND CONSULTATION PHASE	CONSULTATION AND KEY ISSUES RASIED	WHERE THE COMMENT IS ADDRESSED
11/10/2021		Figure 6.
Section 42 Responses NRW Comments 11/10/2021	Pg 194; 314: There needs to be an 8km buffer to the south of the windfarm. NRW agrees with 50% displacement from the windfarm for 4km, looking at a range of mortality from 1 – 10%, then there will be a need to discuss the levels of displacement on a 1km gradient out to 8km as the applicant has already said they would do.	The red-throated diver alone assessment, using a gradient approach discussed within the HRA ETG, is discussed in Section 10.3. The presentation of a range of mortality rates is discussed in Section 10.3.
Section 42 Responses NRW Comments 11/10/2021	Pg 195; 317: NRW does not agree with the displacement methodology.	Red-throated diver displacement assessment has been updated using a gradient methodology agreed by NRW. Updates to the red-throated diver assessment is presented in Section 10.3.
Section 42 Responses NRW Comments 11/10/2021	Pg 196; 320: As all the data has not yet been analysed and NRW does not agree with the assessment variables, NRW is unable to agree with the conclusion for Red-throated diver in Liverpool Bay SPA. All the potential displacement from this project needs to be added together to look at the combined effect on the SPA.	Updates to the red-throated diver assessment are presented in Section 10.3. Impacts have been combined within phases in Section 10.3. The Applicant acknowledges the request for combining impacts across phases of the development. The predicted mortalities for each species are given per annum for each phase of the development. These phases are not expected to overlap, therefore, it is not deemed suitable to combine impacts across development phases.
Section 42 Responses NRW Comments 11/10/2021	Pg 197; 325: The displacement of common scoter from the cabling should be looked at using a 2km buffer, as has been done in the PIER Volume 4, Chapter 2 with 100% displacement and looking at a range of mortality from 1% to 10%.	Common scoter alone assessment is discussed in Section 10.3.
Section 42 Responses NRW Comments 11/10/2021	Pg 198; 328: This comment is assuming that birds do not fly or swim away and are just placid with the movement of the tide. If the boat is effectively static then this conflicts withs with the statement about birds being able to come back after it has moved.	The boat will be moving during cable laying activity so birds will be able to return to any specific area once the vessel has moved through. However, the speed of the boat is at a pace where it will look as if it is stationary for the majority of the time to birds due to tidal movements, minimizing any flushing response. NRW welcomed this explanation and agrees with the approach

DATE AND CONSULTATION PHASE	CONSULTATION AND KEY ISSUES RASIED	WHERE THE COMMENT IS ADDRESSED
		(see the Evidence Plan Report (application ref: 8.2)
Section 42 Responses NRW Comments 11/10/2021	Pg 199; 330: A clearer explanation is needed that the maximum of scoter mortality of 8.7 has been calculated with a 1% mortality rate. However, a 10% mortality rate should also be presented, as is done in 333 & 358.	The presentation of a range of mortality rates is discussed in Section 10.3.
Section 42 Responses NRW Comments 11/10/2021	Pg 199; 330: This section needs to show mapped distribution of Common scoters and the cabling area and clearer calculations. NRW request a GIS file of the cabling area.	Common scoter alone assessment is discussed in Section 10.3. Common scoter aggregations in the cable area are presented in Figure 7.
Section 42 Responses NRW Comments 11/10/2021	Pg 199; 330: The mortality rate for Common scoter used here (0.217 (Robinson, 2017)) is inconsistent with what is used within Volume 4, Chapter 2 (0.238).	The baseline mortality rates for each species and rationale is discussed and updated as relevant in Section 10.3.
Section 42 Responses NRW Comments 11/10/2021	Pg 194; 313: There is inconsistency in the mortality rate used for Red-throated diver, both within this document 0.2 here and 0.217 at point 331 and within volume 2 chapter 4 (0.143 in Table 13, and 0.233 used widely in the text).	The baseline mortality rates for each species and rationale is discussed and updated as relevant in Section 10.3.
Section 42 Responses NRW Comments 11/10/2021	Pg 200; 333: During construction NRW is happy for Common scoter displacement to be assessed at 50% displacement and a mortality rate of 10% out to 4km.	Common scoter alone assessment is discussed in Section 10.3 with a range of mortality rates presented.
Section 42 Responses NRW Comments 11/10/2021	Pg 200; 334: As all the data hasn't yet been analysed and NRW does not agree with the assessment variables, NRW is unable to agree with the conclusion for Common scoter in Liverpool Bay SPA. All the potential displacement from this project needs to be added together to look at the combined effect on the SPA.	Updates to the common scoter assessment are presented in Section 10.3. Impacts have been combined within phases in Section 10.3. The Applicant acknowledges the request for combining impacts across phases of the development. The predicted mortalities for each species are given per annum for each phase of the development. These phases are not expected to overlap, therefore, it is not deemed suitable to combine impacts across development phases.

DATE AND CONSULTATION PHASE	CONSULTATION AND KEY ISSUES RASIED	WHERE THE COMMENT IS ADDRESSED
Section 42 Responses NRW Comments 11/10/2021	Pg 202 -212: The headings and paragraphs in this section need some re-arranging for clarity. 13.3.5 Operation and Maintenance shouldn't be a numbered heading here (all others are the SPAs). Currently Pg 208; 357 appears to be under operation vessel disturbance and not under operation and maintenance. NRW suggest following the structure seen on pages 222 -224; 404-409 (e.g. barrier effects for red-throated diver followed by common scoter etc).	Report formatting has been updated for the relevant paragraphs in Section 10.3.
Section 42 Responses NRW Comments 11/10/2021	Pg 203; 343: The increase in boat traffic to do with the operation and maintenance of the project will need to be assessed properly to understand the increased disturbance/displacement on the red-throated diver feature of the site and the cumulative effect on this with the other disturbance/displacement issues. Therefore, NRW disagrees with the statement that this will not have adverse effect on the feature.	There are currently no planned vessel routes, therefore a quantitative assessment cannot be undertaken alone or in-combination for this impact on any feature. Potential vessel management mitigation is discussed in Section 10.3.
Section 42 Responses NRW Comments 11/10/2021	Pg 204; 345: states "The approach undertaken for red-throated diver assessment at AyM is using 100% displacement up to 4km and a 1% mortality rate during the operation and maintenance phase and 50% displacement, 1% mortality during construction and decommissioning (see Displacement Appendix, Annex 4.4.2). This is more precautionary than the already precautionary approach given by Vattenfall (2019)." As stated previously NRW does not agree with this methodology and this seems contrary to what was shared with NRW regarding the original plan to assess red-throated diver in Liverpool Bay.	The red-throated diver alone assessment, using a gradient approach discussed within the HRA ETG, is discussed in Section 10.3.
Section 42 Responses NRW Comments 11/10/2021	Pg 207; 355: The increase in boat traffic related to the operation and maintenance of the project will need to be assessed properly to understand the increased disturbance/displacement on the common scoter feature of the site and the cumulative effect on this with the other disturbance/displacement issues. Therefore, NRW disagrees with the statement that this will not have an adverse effect on the feature.	There is currently no planned vessel routes, therefore a quantitative assessment cannot be undertaken alone or in-combination for this impact on any feature. Potential vessel management mitigation is discussed in Section 10.3.
Section 42 Responses NRW Comments 11/10/2021	Pg 208; 357: NRW agrees with a using a buffer of 4km with a displacement rate of 100% and a mortality rate of 10% for common scoter.	Common scoter assessment is discussed in Section 10.3 with a range of mortality rates presented.
Section 42 Responses NRW Comments 11/10/2021	Page 205; 347: For Red-throated diver a 10% mortality rate and an 8 km buffer area should be presented.	The red-throated diver alone assessment, using a gradient approach discussed within the HRA ETG, is discussed in Section 10.3.

DATE AND CONSULTATION PHASE	CONSULTATION AND KEY ISSUES RASIED	WHERE THE COMMENT IS ADDRESSED
Section 42 Responses NRW Comments 11/10/2021	Pg 213; 378: We agree that these are the conservation objectives for the cormorant feature of Puffin Island SPA. Please amend the relevant section in 5.1.3 AyM PEIR RIAA Annex 3: European Site Information to reflect this.	All conservation objectives are updated within the alone assessment, Section 10.3 and Annex 3 (application ref: 5.2.3).
Section 42 Responses NRW Comments 11/10/2021	Pg 216; 387: These are not the conservation objectives for the features of The Dee Estuary SPA. See below section on 5.1.3 AyM PEIR RIAA Annex 3: European Site Information for details.	All conservation objectives are updated within the alone assessment, Section 10.3 and Annex 3 (application ref: 5.2.3).
Section 42 Responses NRW Comments 11/10/2021	Pg 219; 395: Dee Estuary SPA and Ramsar features need to be assessed for collision during migration using the SOSS or APEM tool as described in the PEIR.	Migratory waterbirds assessment using APEM's Migropath Modelling and migratory terns assessment using 'broad front' modelling are discussed in Section 10.3. Details on the approach can be found in Annex 4.4. Migratory CRM (application ref: 6.4.4.4).
Section 42 Responses NRW Comments 11/10/2021	Pg 221; 401: Anglesey Terns SPA - the legal conservation objectives in the management plan need to be used, found here: [redacted]	All conservation objectives are updated within the alone assessment, Section 10.3 and Annex 3 (application ref: 5.2.3).
Section 42 Responses NRW Comments 11/10/2021	Pg 222; 402: The mean max from Woodward et al. (2019) needs to be used. NRW staff have personal experience using ribs to track Sandwich terns up to 40 km away from colonies.	Sandwich tern assessment is discussed in Section 10.3.
Section 42 Responses NRW Comments 11/10/2021	Pg 223: Use SOSS or APEM migration tool for tern features from this site. Also need to assess collision risk for Common terns from this site.	Migratory terns assessment using 'broad front' modelling is discussed in Section 10.3 for relevant SPAs. Details on the approach can be found in Annex 4.4. Migratory CRM (application ref: 6.4.4.4).
Section 42 Responses NRW Comments 11/10/2021	Pg 286; 597: The conservation objectives in the management plan need to be used - found here [redacted]	All conservation objectives are updated within the alone assessment, Section 10.3 and Annex 3 (application ref: 5.2.3).

DATE AND CONSULTATION PHASE	CONSULTATION AND KEY ISSUES RASIED	WHERE THE COMMENT IS ADDRESSED
Section 42 Responses NRW Comments 11/10/2021	Pg 286; 597: The potential mortalities for Guillemot and Razorbill (which are part of the assemblage feature) need to be considered at and look to see whether the potential mortality from displacement has an affect or not. Also needed is an assessment of Manx shearwater in terms of displacement for this site.	Guillemot and razorbill are not within the mean-maximum +1SD foraging range (Woodward et al., 2019) from Skomer, Skokholm and the Seas off Pembrokeshire SPA to AyM and have subsequently, due to no connectivity, have not been considered for assessment during the breeding season. Guillemot and razorbill potential mortalities, as part of the assemblage feature, have been considered during the non-breeding season at this SPA in Section 10.3. Manx shearwater quantitative alone assessment is discussed in Section 10.3 for this SPA.
Section 42 Responses NRW Comments 11/10/2021	Pg 285; 597: The conservation objectives for the features of Skomer, Skokholm and the Seas off Pembrokeshire SPA can be found within [redacted]	All conservation objectives are updated within the alone assessment, Section 10.3 and Annex 3 (application ref: 5.2.3).
Section 42 Responses NRW Comments 11/10/2021	Pg 287; 598: NRW agrees with the displacement analysis for puffin using a 2 km buffer and a 15-35% displacement rate during construction and decommissioning. However, SNCB advice is the presentation of 1-10% mortality rate for this species, only 1% is presented here.	The presentation of a range of mortality rates is discussed in Section 10.3.
Section 42 Responses NRW Comments 11/10/2021	Pg 287; 600: Clarification is needed on why a population age ratio for puffins of 0.49 has been used. Modelling within Furness (2015) suggests between a 0.82 and 1.08 value.	Furness (2015) suggests using 1.04 immatures per adult as the most appropriate ratio for puffin. This as a percentage equates to 49% of individuals being adults, which equates to 0.49 as a proportion.
Section 42 Responses NRW Comments 11/10/2021	Pg 287; 602: Clarification is needed on how the annual background mortality of puffins within the SPA was calculated (Puffin are not within Table 13 of volume 2, chapter 4). The source of the mortality rate used in this calculation needs to be explained.	The source of mortality rate data used for puffin is discussed in Section 10.3.

DATE AND CONSULTATION PHASE	CONSULTATION AND KEY ISSUES RASIED	WHERE THE COMMENT IS ADDRESSED
Section 42 Responses NRW Comments 11/10/2021	Pg 288; 607: For storm petrels the data should be presented at the array plus 2 km buffer, rather than 4 km as presented here.	The storm petrel alone assessment is discussed in Section 10.3.
Section 42 Responses NRW Comments 11/10/2021	Pg 289; 609: NRW agree with the displacement analysis for puffin using a 2 km buffer and a 30-70% displacement rate during operation and maintenance. However, SNCB advice is the presentation of 1-10% mortality rate for this species, only 1% is presented here.	The presentation of a range of mortality rates is discussed in Section 10.3.
Section 42 Responses NRW Comments 11/10/2021	Pg 291; 613: The potential mortalities from all the displacement calculations need to be added together to then be able to assess whether there is a likely significant effect on a feature.	The Applicant acknowledges the request for combining impacts across phases of the development. The predicted mortalities for each species are given per annum for each phase of the development. These phases are not expected to overlap, therefore, it is not deemed suitable to combine impacts across development phases.
Section 42 Responses NRW Comments 11/10/2021	Pg 293; 616: There is an erroneous reference to Manx shearwater here.	Erroneous references have been updated to reflect correct ornithological features throughout the relevant sections in the RIAA (10.3 and 11.3 for alone and in-combination assessment).
Section 42 Responses NRW Comments 11/10/2021	Pg 294; 622: This population age ratio of 0.53 is not consistent with that used in volume 2, chapter 4 (Table 13 – 0.488). Clearer explanation of how these values are reached and a consistent approach is advised.	Sources and rationale for species age ratios used in the assessment are discussed in Section 10.3.
Section 42 Responses NRW Comments 11/10/2021	Pg 295; 623: The working out for apportioning needs to be shown. Clarification is needed as to whether it has included large colonies and not just SPAs.	The apportioning approach is outlined within Annex 5 (application ref: 5.2.5).
Section 42 Responses NRW Comments 11/10/2021	Pg 297; 628: Lesser black-gull collision for birds in the non-breeding season needs to be assessed and then apportioned back to colonies.	The alone lesser black-backed gull non-breeding season assessment for Skomer, Skokholm and the Seas off Pembrokeshire SPA is discussed in Section 10.3.

DATE AND CONSULTATION PHASE	CONSULTATION AND KEY ISSUES RASIED	WHERE THE COMMENT IS ADDRESSED
Section 42 Responses NRW Comments 11/10/2021	Pg 311; 675: These are not the Conservation Objectives for the Gannet feature of Grassholm SPA, which can be found in the management plan here [redacted] (and see section on 5.1.3 AyM PEIR RIAA Annex 3: European Site Information for details).	All conservation objectives are updated within the alone assessment, Section 10.3 and Annex 3 (application ref: 5.2.3).
Section 42 Responses NRW Comments 11/10/2021	Pg 312; 676: Mortality needs to be shown at 1-10% for Gannet from Grassholm SPA	The presentation of a range of mortality rates is discussed in Section 10.3.
Section 42 Responses NRW Comments 11/10/2021	Pg 312; 677: 95% confidence levels should also be shown, not just the mean peak abundance.	95% CI have been presented in the abundances within the baseline annex. 95% CI have not been assessed as the data used in the assessment (mean peak abundance across seasons) is already precautionary. Mean peak abundance assumes that the peak for each species will be maintained across all months of each season for each species, however this is highly unlikely.
Section 42 Responses NRW Comments 11/10/2021	Pg 312; 677: The array area plus 2km buffer should be assessed.	Gannet alone displacement assessment within the array plus 2km buffer is discussed in Section 10.3.
Section 42 Responses NRW Comments 11/10/2021	Pg 319; 696: NRW welcomes the addition of the operational impacts of both displacement and collision on gannets at Grassholm and the assessment of this combined value against the SPA population. We also advise that the applicant needs to combine the potential mortalities from displacement during construction, operation and decommissioning to make a full assessment for this feature and needs to show the working for apportioning.	Combined displacement and collision impacts for gannet during the Operation and Maintenance Phase are assessed alone and in-combination in Section 10.3 and 11.3, respectively. The Applicant acknowledges the request for combining impacts across phases of the development. The predicted mortalities for each species are given per annum for each phase of the development. These phases are not expected to overlap, therefore, it is not deemed suitable to combine impacts across development phases. The apportioning approach is outlined within

DATE AND CONSULTATION PHASE	CONSULTATION AND KEY ISSUES RAISED	WHERE THE COMMENT IS ADDRESSED
		Annex 5 (application ref: 5.2.5).
Section 42 Responses NRW Comments 11/10/2021	Pg 319; 693: this needs to show the apportioning for potential collision of gannets from Grassholm SPA.	The apportioning approach is outlined within Annex 5 (application ref: 5.2.5).
Section 42 Responses NRW Comments 11/10/2021	Pg 320 – 323; 13.3.25 Manx Shearwater: NRW welcomes the assessment of Manx shearwater, but advise that quantitative displacement analysis of this species (within the array plus 2 km buffer, at 30-70% displacement during operation and mortality shown at the 1-10% level) is needed. The information provided here about this species should be placed within the SPA sections it is relevant to, which will make it consistent with the rest of the document structure.	Manx shearwater quantitative alone assessment is discussed in Section 10.3 for the relevant SPAs.
Section 42 Responses NRW Comments 11/10/2021	Pg 321:702: The conservation objectives for Aberdaron coast and Bardsey Island SPA are available here [redacted] and those for Skomer, Skokholm and the Seas off Pembrokeshire SPA are here [redacted]	All conservation objectives are updated within the alone assessment, Section 10.3 and Annex 3 (application ref: 5.2.3).
Section 42 Responses NRW Comments 11/10/2021	Pg 324; 705: NRW advise that effect of displacement from the array area by Manx shearwater needs to be considered. There is evidence to show that Manx shearwaters have been displaced "for example Manx shearwaters have been shown to avoid the windfarm at North Hoyle in Liverpool Bay (Dierschke et al, 2016)"	Manx shearwater quantitative alone assessment is discussed in Section 10.3 for the relevant SPAs.
Section 42 Responses NRW Comments 11/10/2021	Pg 330; 710: NRW advise that bespoke modelling is undertaken using APEM's Migropath model or the SOSS migration model so that a quantitative assessment can be made against protected sites.	Migratory waterbirds assessment using APEM's Migropath Modelling and migratory terns assessment using 'broad front' modelling are discussed in Section 10.3. Details on the approach can be found in Annex 4.4. Migratory CRM (application ref: 6.4.4.4).
Section 42 Responses NRW Comments 11/10/2021	Pg 331; 710: NRW welcomes the inclusion of migratory waterfowl and waders in the final HRA but also advise that tern features are similarly considered.	Migratory waterbirds assessment using APEM's Migropath Modelling and migratory terns assessment using 'broad front' modelling are discussed in Section 10.3. Details on the approach can be found in Annex 4.4. Migratory CRM (application ref: 6.4.4.4).

DATE AND CONSULTATION PHASE	CONSULTATION AND KEY ISSUES RASIED	WHERE THE COMMENT IS ADDRESSED
Section 42 Responses NRW Comments 11/10/2021	In-combination assessments In terms of Welsh sites NRW are currently unable to advise fully what should be included in the cumulative assessment as the full 24 months of data have not yet been used and NRW does not agree with a number of the assessment levels used. However, NRW is able to advise that Common scoter, Red throated diver and the waterbird assemblage feature for Liverpool Bay SPA will need to be cumulatively assessed.	The in-combination assessment, using 24 months of survey data, is discussed in Section 11.3 for all relevant features.
Section 42 Responses NRW Comments 11/10/2021	Pg 386; Table 23: For the Red-throated diver and Common scoter features within Liverpool Bay SPA operational vessel movement during operation and maintenance needs to be include.	There is currently no planned vessel routes, therefore a quantitative assessment cannot be undertaken alone or in-combination for this impact on any feature. Potential vessel management mitigation is discussed in Section 10.3.
Section 42 Responses NRW Comments 11/10/2021	Pg 392 – 400; Table 25 & 26: These tables seem to miss out the potential collisions with Morlais that have been predicted through the CRM and ERM modelling.	The in-combination effect from all relevant plans and projects including Morlais is discussed in Section 11.3 for all relevant features.
Section 42 Responses NRW Comments 11/10/2021	Pg 403; Red-throated diver: When looking at cumulative impact for Red-throated diver in Liverpool Bay SPA, this needs to be assessed against the correct conservation objectives for this site but also, environmental statements and HRAs for previous projects and also data that has resulted from pre and post construction monitoring from other windfarms. For instance, Gwynt y Môr and Burbo Bank extension windfarms need to be considered.	The in-combination effect on the red-throated diver feature of Liverpool Bay SPA is discussed in Section 11.3. Results from Gwynt y Môr monitoring is presented in Section 10.3.
Section 42 Responses NRW Comments 11/10/2021	Pg 405; 827: Only a 1% mortality rate is used for red-throated divers here. SNCB advice is the use of a 10% mortality rate.	The presentation of a range of mortality rates is discussed in Section 10.3.
Section 42 Responses NRW Comments 11/10/2021	Pg 406; Common scoter: When looking at cumulative impact for common scoter in Liverpool Bay SPA, this needs to be assessed against the correct conservation objectives for this site but also, environmental statements and HRAs for previous projects and also data that has resulted from pre and post construction monitoring from other similar wind farms e.g. Gwynt y Môr and Burbo Bank extension windfarms.	The in-combination effect on the common scoter feature of Liverpool Bay SPA is discussed in Section 11.3.
Section 42 Responses NRW Comments	5.1.2. AyM PEIR RIAA Annex 2 HRA Screening Update Ornithology • Estuarine SPAs - NRW welcomes the assessment of all Welsh wintering estuarine SPAs including Traeth Lafan SPA, The Dyfi SPA, Burry Inlet SPA and Severn Estuary SPA.	The screening assessment has been updated in Table 5 of the RIAA (application ref: 5.2) and Annex 2 (application ref: 5.2.2).

DATE AND CONSULTATION PHASE	CONSULTATION AND KEY ISSUES RASIED	WHERE THE COMMENT IS ADDRESSED
11/10/2021	• Burry Inlet SPA – Whimbrel and Greenshank are not SPA features and therefore do not need to be included within the HRA. • Skomer, Skokholm and Seas off Pembrokeshire SPA – NRW has previously advised (28.8.2020) that the breeding bird assemblage should be screened in. Here only kittiwake of this assemblage has been screened in, while razorbill and guillemot have not. • Grassholm SPA – There is inconsistency here with RIAA, as Gannet are considered to have "direct disturbance and displacement" during construction and decommissioning in RIAA Table 5 etc, and "no LSE" here.	
Section 42 Responses NRW Comments 11/10/2021	5.1.3 AyM PEIR RIAA Annex 3: European Site Information It would be useful to provide information on whether SPAs are designated for wintering / breeding / passage features. Documentation for Conservation Objectives for the features of SPAs can be found on the NRW website via Natural Resources Wales / Find protected areas of land and sea (full address: [redacted]), searching for the protected area and under Management plans there are pdfs available.	SPA bio-season designations for each species can be found within the screening assessment in Annex 2 (application ref: 5.2.2). All conservation objectives are updated within the alone assessment, Section 10.3 and Annex 3 (application ref: 5.2.3).
Section 42 Responses NRW Comments 11/10/2021	Pg 42; 65 These are not the Conservation Objectives of the features of the SPA. The correct Conservation Objectives for the features of the Dee Estuary SPA should be taken from [redacted] Which is the document referenced on page 44; 69 (xxxix).	All conservation objectives are updated within the alone assessment, Section 10.3 and Annex 3 (application ref: 5.2.3).
Section 42 Responses NRW Comments 11/10/2021	Pg 59; 93 These are not the conservation objectives for Liverpool Bay SPA. The Reg 37 package (old reg 35) is the document that identifies the conservation objectives for Liverpool Bay SPA is here [redacted] At the moment this is in the process of being updated to include the new features added in 2017.	All conservation objectives are updated within the alone assessment, Section 10.3 and Annex 3 (application ref: 5.2.3).
Section 42 Responses NRW Comments 11/10/2021	Pg 62; 98 The conservation objectives of the features of Anglesey Terns SPA need to be used, and can be found here: [redacted]	All conservation objectives are updated within the alone assessment, Section 10.3 and Annex 3 (application ref: 5.2.3).
Section 42 Responses NRW Comments 11/10/2021	Pg 81; 141 The Conservation Objectives for the Features of Aberdaron Coast and Bardsey Island SPA haven't been listed here, although they are within the document referenced [redacted] 142 & 143 are quotes from the Habitats Directive found in Box 1 of the above document.	All conservation objectives are updated within the alone assessment, Section 10.3 and Annex 3 (application ref: 5.2.3).

DATE AND CONSULTATION PHASE	CONSULTATION AND KEY ISSUES RASIED	WHERE THE COMMENT IS ADDRESSED
Section 42 Responses NRW Comments 11/10/2021	Pg 86; 150 Within Skomer, Skokholm and the Seas off Pembrokeshire SPA designated features list Kittiwake is missing (is referred to within 5.1.2). Like Guillemot and Razorbill this species would also have an asterisk to denote that it is only recognised as part of the breeding seabird assemblage, and not as an individual species.	All designated features lists are updated within Annex 2 (application ref: 5.2.2).
Section 42 Responses NRW Comments 11/10/2021	Pg 86; 153 The conservation objectives for the features of The Skomer, Skokholm and the Seas off Pembrokeshire SPA in the management plan need to be used, and are found here [redacted]	All conservation objectives are updated within the alone assessment, Section 10.3 and Annex 3 (application ref: 5.2.3).
Section 42 Responses NRW Comments 11/10/2021	Pg 100; 184 NRW agree that Conservation Objectives for the Gannet feature of Grassholm can be found in the document referenced ([redacted] However, the Conservation Objectives for Gannet haven't actually been listed here and points 186 and 187 are quotes from the Habitats Directive found in Box 1 of the above document (also repeated on page 104, 108 and 111).	All conservation objectives are updated within the alone assessment, Section 10.3 and Annex 3 (application ref: 5.2.3).
Section 42 Responses NRW Comments 11/10/2021	Pg 102; 188 & Pg 103: 191: These refer to documentation (cv and cvii) that relates to Puffin Island SPA in Ireland (site code: 004003), rather than Puffin Island SPA in the UK (site code: UK9020285). The correct documentation can be found via NRW's website at ([redacted] which contains the conservation objectives for the cormorant feature of this SPA.	All conservation objectives are updated within the alone assessment, Section 10.3 and Annex 3 (application ref: 5.2.3).
Section 42 Responses NRW Comments 11/10/2021	Pg 104; 194-199: The Conservation Objectives for the features of Traeth Lafan SPA haven't been listed here, although they are within the document referenced ([redacted] 198 & 199 are quotes from the Habitats Directive found in Box 1 of the above document.	All conservation objectives are updated within the alone assessment, Section 10.3 and Annex 3 (application ref: 5.2.3).
Section 42 Responses NRW Comments 11/10/2021	Pg 108; 203: NRW agree the Conservation Objectives for Dyfi Estuary SPA can be found within the referenced document [redacted]. Points 205 and 206 are quotes from the Habitats Directive found in Box 1 of the above document.	All conservation objectives are updated within the alone assessment, Section 10.3 and Annex 3 (application ref: 5.2.3).
Section 42 Responses NRW Comments 11/10/2021	Pg 109; 208: Burry Inlet SPA designation includes a waterbirds assemblage, not a seabird assemblage.	SPA designations have been updated within Annex 3 (application ref: 5.2.3).

DATE AND CONSULTATION PHASE	CONSULTATION AND KEY ISSUES RASIED	WHERE THE COMMENT IS ADDRESSED
Section 42 Responses NRW Comments 11/10/2021	Pg 110; 210: NRW agree that the document referenced within this paragraph is the relevant source for Burry Inlet [redacted] however the link provided (cxiv) should be updated as it currently shows a link to the Dyfi Estuary SPA documentation.	All conservation objectives are updated within the alone assessment, Section 10.3 and Annex 3 (application ref: 5.2.3).
Section 42 Responses NRW Comments 11/10/2021	Pg 111; 212-213: No Conservation Objectives for the Burry Inlet SPA are listed here, and the generic text from Table 1 of the above document is again replicated here.	All conservation objectives are updated within the alone assessment, Section 10.3 and Annex 3 (application ref: 5.2.3).
Section 42 Responses NRW Comments 11/10/2021	Pg 113; 217-218: These are not the Conservation Objectives of the features of the SPA. The Conservation Objectives for the features of the Severn Estuary SPA should be taken from [redacted] which is referred to in point 217, but no link provided.	All conservation objectives are updated within the alone assessment, Section 10.3 and Annex 3 (application ref: 5.2.3).
Section 42 Responses NRW Comments 11/10/2021	Paragraph 129 "NRW (2018) reported that the potential for accidental introduction of INNS is a threat to the SAC. The example of the slipper limpet, accidentally introduced in 2006 to mussel lays in the Menai Strait and subsequently eradicated, is cited. Measures to prevent such occurrences in the future are focused on fishing and bait collection but include 'the introduction of 'Codes of Good Practice' and other measures', with the PEMP proposed for AyM fulfilling that requirement. "- NRW advise measures to prevent additional INNS arriving at the sites should be detailed in the Biosecurity Risk Assessment as highlighted in Volume 2, Chapter 5: Benthic Subtidal and Intertidal Ecology. The risk assessment and management plan should include consideration of all activities, vessels and equipment used as well as how the risk will be minimised through appropriate mitigation and adherence to best practice guidance and management measures. The risk assessment should include a review of all the available data in relation to the presence of marine INNS where applicable to the current proposal, and the potential risks associated to each species identified.	Text specific to the slipper limpet has been added into paragraph 131 within section 10.1.1. This document now aligns with the assessments and conclusions drawn in the benthic chapter in relation to INNS.
Section 42 Responses NRW Comments 11/10/2021	Paragraph 178 Conservation objectives for the Dee Estuary SAC – NRW advise the conservation objectives should be taken from the Regulation 33 advice package as these are the agreed conservation objectives for the site between NRW and Natural England. Please note there are different conservation objectives for each feature i.e. the conservation objectives for the "Estuaries" feature are not the same as those for the" Mudflats and sandflats not covered by seawater at low tide" feature.	The reference has been amended to the Regulation 33 advice package which contains details on the features and objectives for this site.

DATE AND CONSULTATION PHASE	CONSULTATION AND KEY ISSUES RASIED	WHERE THE COMMENT IS ADDRESSED
Section 42 Responses NRW Comments 11/10/2021	Paragraph 198 "Measures to prevent additional INNS arriving at the sites will be detailed within the proposed PEMP for AyM." – As noted above, NRW advise measures to prevent additional INNS arriving at the sites should be detailed in the Biosecurity Risk Assessment as highlighted in Volume 2, Chapter 5: Benthic Subtidal and Intertidal Ecology.	The text has been amended to include details on INNS measures following the above response. This document now aligns with the assessments and conclusions drawn in the benthic chapter in relation to INNS.
Section 42 Responses NRW Comments 11/10/2021	Page 346, Table 18: Summary of the maximum modelled impact ranges for 15m diameter piles for Atlantic salmon and lamprey sp. NRW note that this appears to be referring to the MDS for the 15 large WTG monopiles assessed in the spatial MDS, rather than the temporal MDS for maximum number of smaller WTGs. In the response above on Chapter 6, NRW have asked for clarification on the scenarios assessed under the spatial and temporal MDS, which also applies to this RIAA document. NRW also made comments regarding the assumptions made for fleeting receptors, and we do not consider it realistic to include salmon smolts as fleeting receptors, using the assumption of fleeing at a rate of 1.5m/s directly away from the noise source.	The ranges presented are the worst cast scenario ranges, which is deemed to be the maximum spatial extent. However, for the case of the assessments, both the maximum spatial and temporal extent has been considered based on the overal magnitude and sensitivity assessments. The assessment for salmon smolts is considered appropriate as while it is likely that the true impact range is somewhere between stationary and fleeing due to their reduced speed, it is noted that migratory instincts in the smolts will ensure that they act as a fleeing receptor.
Section 42 Responses NRW Comments 11/10/2021	Page 353, paragraph 739. NRW has made comments above on Chapter 6, and on the Fish and Shellfish baseline report that NRW do not agree there is sufficient evidence to support the statements made regarding salmon migratory routes being primarily coastal. Despite the comments made above NRW agree with the conclusion of no AEoI to migratory fish features of the River Dee and Bala Lake/ Afon Dyfrdwy a Llyn Tegid SAC and Dee Estuary/ Aber Dyfrdwy (UK) (England/ Wales] SAC from the AyM development alone or in-combination with other relevant plans and projects.	The Applicant acknowledges the note that the evidence is anecdotal. The only evidence is the observational evidence from fishermen suggesting that they have a coastal route. However, there is no evidence to say that they to suggest the opposite, and ultimately the conslusions drawn from the assessment do not rely soley on this statement. The Applicant welcomes NRW's agreement in the conclusion of no AEoI
Section 42 Responses NRW Comments 11/10/2021	Report 5.1 Report to Inform Appropriate Assessment • The MMMP currently offers insufficient detail to be considered adequate mitigation of impacts from PTS, and NRW cannot agree with the conclusion regarding the potential for Adverse Effect on Site Integrity. • Given NRW's concerns regarding the use of an EDR approach to assess disturbance (UXO and piling), NRW cannot reach a conclusion regarding the potential for Adverse Effect on Site Integrity.	The Applicant acknowledges this feedback on the MMMP and has undertaken further consultation on a revised MMMP which can be found at annex 7.2 (application ref: 6.4.7.2). EDR for UXO: A clarification note has been drafted and sent to NRW that outlines the thresholds that are available and suitable to assess the impact of disturbance from UXOs. It also explains why the piling dose-

DATE AND CONSULTATION PHASE	CONSULTATION AND KEY ISSUES RASIED	WHERE THE COMMENT IS ADDRESSED
		response curve is not appropriate. EDR for piling: The dose-response curve will be used in the RIAA to estimate the overlap of the disturbance contours with the SAC
Section 42 Responses NRW Comments 11/10/2021	Report 5.1 Annex 1 HRA screening update (non-ornithology) • NRW Advisory do not agree that there is no possibility for LSE at these sites from vessel collisions or disturbance from vessel activity from either construction, operation & maintenance, or decommissioning.	The Applicant acknowledges this feedback. The Project is making a commitment to minimise the risk of collisions. The adoption of best practice vessel handing protocols (e.g. following the Codes of Conduct provided by the WiSe Scheme, Scottish Marine Wildlife Watching Code or Guide to Best Practice for Watching Marine Wildlife) will minimise the potential for any impact. The final codes of conduct will be discussed and agreed with NRW and JNCC through the marine licence conditions.
Section 42 Responses NRW Comments 11/10/2021	Table 1, page 45 Row: Pre-Scoping Offshore Ornithology and Marine Mammals Evidence Plan Meeting minutes – 25/11/19 Consultees: NRW, RSPB, JNCC, Denbighshire District Council, TWT, WDC NRW agree that our comments regarding the use of MMMUs has been taken into account. Row; Cumulative Effects Assessment NRW comments 21/12/2020 NRW agree that our comments regarding the use of MMMUs has been taken into account.	The Applicant acknowledges this and welcomes NRW's approval of their previous comments being addressed.
Section 42 Responses NRW Comments 11/10/2021	Table 3: mitigation measures Marine mammals, page 80 Row; Marine Mammal Mitigation Protocol (MMMP) As per NRW's comments on PEIR Volume 4, Annex 7.2: Draft Outline Marine Mammal Mitigation Protocol, the current outline MMMP presents insufficient detail to be considered effective mitigation of impacts from piling and UXO. NRW also note that the MMMP does not appear in Document 8.1: Schedule of Mitigation as stated.	The Applicant acknowledges this feedback on the MMMP and has undertaken further consultation on a revised MMMP which can be found at annex 7.2 (application ref: 6.4.7.2).
Section 42 Responses NRW Comments 11/10/2021	Paragraph 60, page 86 NRW acknowledge and agree that NRW's comments regarding the use of MU's to screen sites for grey seal have been taken into account, and that Pembrokeshire Marine/ Sir	The Applicant acknowledges this and welcomes NRW's approval of their previous comments being addressed.

DATE AND CONSULTATION PHASE	CONSULTATION AND KEY ISSUES RASIED	WHERE THE COMMENT IS ADDRESSED
	Benfro Forol SAC has now been included in Report 5.1 Annex 1 HRA screening update (non-ornithology).	
Section 42 Responses NRW Comments 11/10/2021	Table 4: Summary of potential for LSE for non-ornithology features, page 89 As per the comments on Report 5.1 Annex 1 HRA screening update (non-ornithology), NRW agree with the conclusion that there is a potential for LSE at all marine mammal SACs in Wales from underwater noise from construction and decommissioning, namely; • Cardigan Bay/ Bae Ceredigion • Pen Llŷn a'r Sarnau/ Lleyn Peninsula and the Sarnau • Pembrokeshire Marine/ Sir Benfro Forol • North Anglesey Marine / Gogledd Môn Forol • West Wales Marine / Gorllewin Cymru Forol • Bristol Channel Approaches / Dynesfeydd Môr Hafren As per the comments on Report 5.1 Annex 1 HRA screening update (non-ornithology), NRW consider that there is sufficient cause for pathways of impact to marine mammals from disturbance and collision from vessel activity to be considered to have a likely significant effect.	The Applicant acknowledges this and welcomes NRW's agreement on the conclusions of LSE. The Project is making a commitment to minimise the risk of collisions. The adoption of best practice vessel handing protocols (e.g. following the Codes of Conduct provided by the WiSe Scheme, Scottish Marine Wildlife Watching Code or Guide to Best Practice for Watching Marine Wildlife) will minimise the potential for any impact. The final codes of conduct will be discussed and agreed with NRW and JNCC through the marine licence conditions.
Section 42 Responses NRW Comments 11/10/2021	Paragraph 81 NRW agree that the MMMU is the appropriate scale in which to screen in project for in- combination impacts.	The Applicant acknowledges this and welcomes NRW's agreement on this matter.
Section 42 Responses NRW Comments 11/10/2021	Paragraph 98 NRW do not consider a sufficient argument is currently presented to justify the conclusion of low cetacean sensitivity to PTS. Please see the comments on PEIR Volume 2, Chapter 7: Marine Mammals section 1.5.1 'Cetacean sensitivity to PTS' for full detail.	A clarification note has been drafted and sent to NRW that outlines the results of the expert elicitation on the impacts of PTS and provides an updated set of definitions for sensitivity for marine mammals.
Section 42 Responses NRW Comments 11/10/2021	Paragraph 214, page 155 As per the comments on PEIR Volume 4, Annex 7.2: Draft Outline Marine Mammal Mitigation Protocol section 1.10.1 'PTS from Piling' on page 79, it is unclear if or how the accumulation of impacts from piling events over time has been taken into account when estimating the number of animals potentially exposed to PTS. As per the general comments on PEIR Volume 4, Annex 7.2: Draft Outline Marine Mammal Mitigation Protocol, NRW appreciate that finalising an MMMP without the final details of the project infrastructure	Additional information will be added to the MMMP (for review and agreement by the ETG). This will include the evidence base for the use of ADDs and the potential noise reduction levels that can be achieved with at-source noise abatement methods.

DATE AND CONSULTATION PHASE	CONSULTATION AND KEY ISSUES RASIED	WHERE THE COMMENT IS ADDRESSED
	can present challenges. However, with the level of information currently provided, the outline MMMP does not fully consider how potential injury for marine mammals will be monitored and mitigated. This document will need significant development before NRW can be confident that this risk will be fully mitigated.	
Section 42 Responses NRW Comments 11/10/2021	Paragraph 216, page 158 As currently there is insufficient detail to consider the MMMP as effective mitigation of impacts from piling or UXO, it may not be possible to rule out an Adverse Effect on Site Integrity.	Additional information will be added to the MMMP (for review and agreement by the ETG). This will include the evidence base for the use of ADDs and the potential noise reduction levels that can be achieved with at-source noise abatement methods. Please note: The draft outline MMMP is for pile driving only. It is not intended to cover UXO which will be the subject of a separate marine licence application.
Section 42 Responses NRW Comments 11/10/2021	Paragraph 217 As per the comments on PEIR Volume 2, Chapter 7: Marine Mammals section 1.10.6 'Disturbance from UXO', NRW do not sign up to the use of EDRs to quantify disturbance. Please see our comments on that section for full details.	The Applicant acknowledges this feedback regarding the use of EDRs. The Applicant is aware that NRW have undertaken a review of the methodologies available to assessing impacts to marine mammal SACs from underwater noise, and relevant assessments will be updated to align with the recommendations from NRW's report. EDR for UXO: A clarification note has been drafted and sent to NRW that outlines the thresholds that are available and suitable to assess the impact of disturbance from UXOs. The piling dose-response curve is not appropriate. EDR for piling: The dose-response curve will be used in the RIAA to estimate the overlap of the disturbance contours with the SAC.

DATE AND CONSULTATION PHASE	CONSULTATION AND KEY ISSUES RASIED	WHERE THE COMMENT IS ADDRESSED
Section 42 Responses NRW Comments 11/10/2021	Paragraph 221, page 159 A more recent joint agency Conservation Objectives and Advice on Operations document dated March 2019 is available from the NRW website: [redacted]	The link provided within this comment did not work, with no document found. However, a version of the Conservation Objectives and Advice on Operations document dated March 2019 was found from the following link: https://data.jncc.gov.uk/data/f4c19257-2341-46b3-8e29-49665cd8f3d2/NorthAnglesey-Conservation-Advice.pdf. The reference has been updated to match.
Section 42 Responses NRW Comments 11/10/2021	Paragraph 225, page 161 As previously stated, NRW do not sign up to the JNCC (2020) noise guidance. The method presented to assume that "Since during the 'off season' the area is no different in terms of average densities than the rest of the MU, SNCBs' advice is that the EPS's strict protection measures apply and no additional noise management measures are required. The noise management approach in this guidance should therefore not apply outside the relevant season" refers specifically to applying the guidance to assessments, and as NRW do not sign up to the guidance, NRW do not apply this method by default. Instead, NRW recommend that the impacts of projects be assessed on a case by case basis.	This text has been removed from the RIAA.
Section 42 Responses NRW Comments 11/10/2021	Paragraph 226 NRW do not agree with the statement that "works outside that period would effectively be subject to EPS licensing requirements and not HRA." The works would still meet the criteria such to be subject to HRA, but the content of the assessment will vary depending on the timing of the works.	This text has been removed from the RIAA.
Section 42 Responses NRW Comments 11/10/2021	Paragraph 227, page 162 NRW considers that there is still considerable uncertainty in the evidence underpinning the calculation of Effective Deterrent Range (EDR), especially in Welsh waters, and as such has not signed up to the cited JNCC guidance for assessing the significance of noise disturbance against Conservation Objectives of harbour porpoise SACs. (England & Northern Ireland). NRW therefore advise that applicants should calculate disturbance distances on a case by case basis using the latest published information and modelling procedures rather than EDRs (Sinclair et. al.,, in press). Given that a dose response approach has been used to assess impacts underwater noise in other sections of the PEIR, NRW recommend that approach is also applied to the RIAA. For disturbance from piling noise, the dose response assessment in PEIR Volume 2, Chapter 7: Marine Mammals section 1.10.3 has already identified disturbance effects within the boundary of North Anglesey Marine SAC. To now apply an EDR approach despite this supplied evidence is contradictory and not defensible. The provided dose response evidence should be taken into account in this	The Applicant acknowledges this feedback regarding the use of EDRs. The Applicant is aware that NRW have undertaken a review of the methodologies available to assessing impacts to marine mammal SACs from underwater noise, and relevant assessments will be updated to align with the recommendations from NRW's report. EDR for UXO: A clarification note has been drafted and sent to NRW that outlines the thresholds that are available and suitable to assess the impact of disturbance from UXOs. The piling dose-response curve is not appropriate.

DATE AND CONSULTATION PHASE	CONSULTATION AND KEY ISSUES RASIED	WHERE THE COMMENT IS ADDRESSED
	assessment.	EDR for piling: The dose-response curve will be used in the RIAA to estimate the overlap of the disturbance contours with the SAC.
Section 42 Responses NRW Comments 11/10/2021	Paragraph 230, page 164 Given NRWs concerns regarding the use of an EDR approach to assess disturbance, we cannot agree with the outcome of the assessment as presented. Until further detail is provided in line with our recommendations, NRW cannot reach a conclusion regarding the potential for an Adverse Effect on Site Integrity on North Anglesey Marine SAC.	The Applicant acknowledges this feedback regarding the use of EDRs. The Applicant is aware that NRW have undertaken a review of the methodologies available to assessing impacts to marine mammal SACs from underwater noise, and relevant assessments will be updated to align with the recommendations from NRW's report. EDR for UXO: A clarification note has been drafted and sent to NRW that outlines the thresholds that are available and suitable to assess the impact of disturbance from UXOs. The piling dose-response curve is not appropriate. EDR for piling: The dose-response curve will be used in the RIAA to estimate the overlap of the disturbance contours with the SAC.
Section 42 Responses NRW Comments 11/10/2021	Paragraph 235, page 165 As per our comments on PEIR Volume 2, Chapter 7: Marine Mammals section 1.10.6 'Disturbance from UXO', NRW do not sign up to the use of EDRs to quantify disturbance. Please see the comments on that section for full details.	The Applicant acknowledges this feedback regarding the use of EDRs. The Applicant is aware that NRW have undertaken a review of the methodologies available to assessing impacts to marine mammal SACs from underwater noise, and relevant assessments will be updated to align with the recommendations from NRW's report. EDR for UXO: A clarification note has been drafted and sent to NRW that outlines the thresholds that are available and suitable to assess the impact of disturbance from UXOs. The piling dose-response curve is not

DATE AND CONSULTATION PHASE	CONSULTATION AND KEY ISSUES RASIED	WHERE THE COMMENT IS ADDRESSED
		appropriate. EDR for piling: The dose-response curve will be used in the RIAA to estimate the overlap of the disturbance contours with the SAC.
Section 42 Responses NRW Comments 11/10/2021	Paragraph 245, page 170 Please see NRW's comments on Report 5.1 Annex 4 Bottlenose dolphin and grey seal additional information section 1 '1 Information for the bottlenose dolphin RIAA' for full comments.	Comments addressed within relevant sections and within the appropriate Annex (application ref: 5.2.1)
Section 42 Responses NRW Comments 11/10/2021	Paragraph 247, page 171 Please see the previous comments on the relevant supporting documentation (PEIR Volume 4, Annex 7.1: Marine Mammal Baseline Characterisation & PEIR Volume 4, Annex 7.3: Marine Mammal Quantitative Assessment Assumptions) for details on NRW's concerns regarding the approach taken to estimate the worst case disturbance scenario using the NW and SE modelling locations and the approach taken to estimate of number of bottlenose dolphin impacted. In addition, as per the comments on PEIR Volume 2, Chapter 7: Marine Mammals Paragraph 118, NRW recommend that in line with NRW's position on the use of MMMU's, as per our comments on Report 5.1 Annex 4 Bottlenose dolphin and grey seal additional information, we consider the area of the MMMU to be functionally linked with the SACs within it. Thus as was done for grey seal, rather than assuming 50% of the animals present are 'SAC animals', all animals present within the MMMU should be considered as a component of the sites. Should the approach be revised in the manners described, NRW advisory recommend reframing the assessment to focus on the area of disturbance as a percentage of the MMMU outside of the protected site, the percentage of the MMMU population impacted, the proximity to the protected site, the temporal extent of the impact, and the objectives of the protected site. NRW do not anticipate this to substantially alter the conclusions of the assessment but consider it a more robust method by which to assess the impact. At this stage NRW consider it unlikely that the conclusions of the RIAA on the potential for impacts from disturbance from piling on bottlenose dolphin to result in an Adverse Effect on Site Integrity would change should the approach be updated to follow NRW's recommendations to make it more robust.	The Applicant acknowledges this feedback and has updated the RIAA to consider the area of the MMMU to be functionally linked with the SACs within it. As such two approaches are detailed: 1) assuming impacts to the MU population and assuming impacts to the SAC population.

DATE AND CONSULTATION PHASE	CONSULTATION AND KEY ISSUES RASIED	WHERE THE COMMENT IS ADDRESSED
Section 42 Responses NRW Comments 11/10/2021	Paragraph 248 As per previous comments, NRW do not sign up to the use of EDRs in assessments. NRW recommend a more evidenced approach is taken to assess disturbance.	The Applicant acknowledges this feedback on the MMMP and has undertaken further consultation on a revised MMMP which can be found at annex 7.2. (application ref: 6.4.7.2). EDR for UXO: A clarification note has been drafted and sent to NRW that outlines the thresholds that are available and suitable to assess the impact of disturbance from UXOs. The piling dose-response curve is not appropriate. EDR for piling: The dose-response curve will be used in the RIAA to estimate the overlap of the disturbance contours with the SAC.
Section 42 Responses NRW Comments 11/10/2021	Paragraph 251, page 172 Please see the previous comments on the relevant supporting documentation for details on NRW's reservations on the approach taken regarding the estimate of number of individuals impacted and the use of EDRs. However, at this stage NRW consider it unlikely that the conclusions of the RIAA on the potential for impacts of disturbance from noise sources other than piling on bottlenose dolphin to result in an Adverse Effect on Site Integrity would change should the approach be updated to follow NRW's recommendations to make it more robust.	The Applicant acknowledges this feedback on the MMMP and has undertaken further consultation on a revised MMMP which can be found at annex 7.2 (application ref: 6.4.7.2). EDR for UXO: A clarification note has been drafted and sent to NRW that outlines the thresholds that are available and suitable to assess the impact of disturbance from UXOs. The piling dose-response curve is not appropriate. EDR for piling: The dose-response curve will be used in the RIAA to estimate the overlap of the disturbance contours with the SAC. The Applicant welcomes NRW's agreement on the conclusions of Adverse Effect on Site Integrity.

DATE AND CONSULTATION PHASE	CONSULTATION AND KEY ISSUES RASIED	WHERE THE COMMENT IS ADDRESSED
Section 42 Responses NRW Comments 11/10/2021	Disturbance and grey seal The separate conclusions from disturbance from piling noise and other noise sources are not as clearly stated here as for previous receptors in the relevant paragraphs (276 & 280). For clarity and consistency, NRW recommend these be approached in the same manner as other marine mammal receptors.	The Applicant acknowledges this feedback and has updated the MMMP to present the conclusions more clearly.
Section 42 Responses NRW Comments 11/10/2021	Paragraph 261, page 177 Please see the comments on Report 5.1 Annex 4 Bottlenose dolphin and grey seal additional information section 2 'Information for the grey seal RIAA' for our comments on the worst case number of seals disturbed by piling activity.	At PEIR, the worst case was concurrent piling. However, the Applicant has removed simultaneous piling from the ES Project Design Envelope and as such the comments on simultaneous piling are no longer relevant.
Section 42 Responses NRW Comments 11/10/2021	Paragraph 276, page 181 Please see the previous comments on the relevant supporting documentation for details on NRW's reservations on the approach taken regarding the estimate of the worst-case disturbance scenario. However, given the level of precaution in the assessment methodology, at this stage NRW consider it unlikely that the conclusions of the RIAA on the potential for impacts from disturbance from piling on grey seal to result in Adverse Effect on Site Integrity would change should the approach be updated to follow NRW's recommendations to make it more robust.	At PEIR, the worst case was concurrent piling. However, the Applicant has removed simultaneous piling from the ES Project Design Envelope and as such the comments on simultaneous piling are no longer relevant.
Section 42 Responses NRW Comments 11/10/2021	Paragraph 277 As per the previous comments, NRW do not sign up to the use of EDRs in assessments. NRW recommend a more evidenced approach is taken to assess disturbance. Insufficient evidence has been provided at this time for NRW to reach a conclusion regarding the impact of disturbance from UXO.	The Applicant acknowledges this feedback on the MMMP and has undertaken further consultation on a revised MMMP which can be found at annex 7.2 (application ref: 6.4.7.2). EDR for UXO: A clarification note has been drafted and sent to NRW that outlines the thresholds that are available and suitable to assess the impact of disturbance from UXOs. The piling dose-response curve is not appropriate. EDR for piling: The dose-response curve will be used in the RIAA to estimate the overlap of the disturbance contours with the SAC.

DATE AND CONSULTATION PHASE	CONSULTATION AND KEY ISSUES RASIED	WHERE THE COMMENT IS ADDRESSED
Section 42 Responses NRW Comments 11/10/2021	Paragraph 280 Please see the previous comments on the relevant supporting documentation for details on NRW's reservations on the approach taken regarding use of EDRs. However, given the level of precaution in the assessment methodology, at this stage NRW consider it unlikely that the conclusions of the RIAA on the potential impacts of disturbance from noise sources other than piling on bottlenose dolphin seal to result in Adverse Effect on Site Integrity would change should the approach be updated to follow NRW's recommendations to make it more robust.	Noted – that NRW do not consider it likely that the conclusions of the RIAA on the impacts (on grey seal) of disturbance from underwater noise sources in-combination would change should the approach be updated to follow NRW's recommendations' for UXO: A clarification note has been drafted and sent to NRW that outlines the thresholds that are available and suitable to assess the impact of disturbance from UXOs. The piling dose-response curve is not appropriate. EDR for piling: The dose-response curve will be used in the RIAA to estimate the overlap of the disturbance contours with the SAC.
Section 42 Responses NRW Comments 11/10/2021	Onset of PTS, page 382 As per the comments on paragraph 216, NRW do not consider there to be sufficient detail in the outline MMMP to consider it effective mitigation of PTS as a pathway. Please see our previous comments on the MMMP on for the assessment from the project alone for full details.	Additional information will be added to the MMMP (for review and agreement by the ETG). This will include the evidence base for the use of ADDs and the potential noise reduction levels that can be achieved with at-source noise abatement methods.
Section 42 Responses NRW Comments 11/10/2021	Paragraph 800 NRW are not content with the approach to assume that Annex IV European Protected Species are offered sufficient protections by this legislation such to conclude no impact on Annex II sites is possible from PTS onset. These assessments are conducted separately, and the assumptions of the protections of one piece of legislation should not be used to justify conclusions regarding the other.	Additional information will be added to the RIAA to better justify why PTS should be scoped out of the in-combination impact assessment.
Section 42 Responses NRW Comments 11/10/2021	Paragraph 805, page 383 As per our previous comments, NRW do not sign up to the use of EDRs in assessments. NRW recommend a more evidenced approach is taken to assess disturbance.	The Applicant acknowledges this feedback on the MMMP and has undertaken further consultation on a revised MMMP which can be found at annex 7.2 (application ref: 6.4.7.2). EDR for UXO: A clarification note has been drafted and sent to NRW that outlines the thresholds that are available and suitable to assess the impact of disturbance

DATE AND CONSULTATION PHASE	CONSULTATION AND KEY ISSUES RASIED	WHERE THE COMMENT IS ADDRESSED
		from UXOs. The piling dose-response curve is not appropriate. EDR for piling: The dose-response curve will be used in the RIAA to estimate the overlap of the disturbance contours with the SAC.
Section 42 Responses NRW Comments 11/10/2021	Paragraph 807, page 385 Please see the previous comments on the relevant supporting documentation for details on NRW's reservations on the approach taken regarding use of EDRs. However, at this stage NRW do not consider it likely that the conclusions of the RIAA on the impacts of disturbance from underwater noise sources in-combination would change should the approach be updated to follow NRW's recommendations to make it more robust.	The Applicant acknowledges this feedback on the MMMP and has undertaken further consultation on a revised MMMP which can be found at annex 7.2 (application ref: 6.4.7.2). EDR for UXO: A clarification note has been drafted and sent to NRW that outlines the thresholds that are available and suitable to assess the impact of disturbance from UXOs. The piling dose-response curve is not appropriate. EDR for piling: The dose-response curve will be used in the RIAA to estimate the overlap of the disturbance contours with the SAC. The Applicant welcomes NRW's agreement on the conclusions of Adverse Effect on Site Integrity.
Section 42 Responses NRW Comments 11/10/2021	16 Conclusions of the Assessment Please see the comments for each receptor for our detailed comments on the outcome of each assessment.	Comments addressed within the appropriate sections of the docuemnt.
Section 42 Responses NRW Comments 11/10/2021	Document; Report 5.1 Annex 1 HRA screening update (non-ornithology) Table 5 – Effect groups considered for marine mammals NRW note that as per NRW's comments on the HRA screening in 2020, decommissioning has now been considered as a pathway to marine mammals and that Pembrokeshire Marine SAC has now been "screened in for effect in a manner consistent with other marine mammal sites at distance". NRW agree with the conclusion that there is a potential for LSE at all marine mammal SACs in Wales,	The Applicant welcomes NRW's agreement on the conclusions for a potential for LSE at those sites listed. The Applicant notes that for vessel collisions and disturbance, the Project is making a commitment to minimise the risk of collisions. The adoption of

DATE AND CONSULTATION PHASE	CONSULTATION AND KEY ISSUES RASIED	WHERE THE COMMENT IS ADDRESSED
	namely; • Cardigan Bay/ Bae Ceredigion • Pen Llŷn a'r Sarnau/ Lleyn Peninsula and the Sarnau • Pembrokeshire Marine/ Sir Benfro Forol • North Anglesey Marine / Gogledd Môn Forol • West Wales Marine / Gorllewin Cymru Forol • Bristol Channel Approaches / Dynesfeydd Môr Hafren NRW do not agree that there is no possibility for LSE at these sites from vessel collisions or disturbance from vessel activity from either construction, operation & maintenance, or decommissioning.	best practice vessel handing protocols (e.g. following the Codes of Conduct provided by the WiSe Scheme, Scottish Marine Wildlife Watching Code or Guide to Best Practice for Watching Marine Wildlife) will minimise the potential for any impact. The final codes of conduct will be discussed and agreed with NRW and JNCC and are proposed to be the subject of a marine licence condition.
Section 42 Responses NRW Comments 11/10/2021	Document; Report 5.1 Annex 3 European site information NRW are content that this document accurately reflects the information for the protected European sites with marine mammal features, with the following exceptions; 1.1.1 Qualifying features, page 13 Harbour porpoise are a grade 'D' feature of the site, and are thus not a 'qualifying feature 'of Cardigan Bay/ Bae Ceredigion Special Area of Conservation on the register entry [redacted]	Classification of harbour porpoise has been amended.
Section 42 Responses NRW Comments 11/10/2021	Document; Report 5.1 Annex 4 Bottlenose dolphin and grey seal additional information 1 Information for the bottlenose dolphin RIAA This section focuses only on Cardigan Bay / Bae Ceredigion SAC. Pen Llŷn a'r Sarnau/ Lleyn Peninsula and the Sarnau is also scoped into the RIAA, and so is also relevant. NRW are not currently satisfied with the approach to assume no bottlenose dolphin presence beyond 6km from the coastline. Please see our comments on PEIR Volume 2, Chapter 7: Marine Mammals section 1.10.3 'Disturbance from piling' for full details. The statement "While the maximum number of bottlenose dolphins predicted to be disturbed was 16 individuals (from the maximum design scenario piling of a monopile at the NW modelling location" does not align with PEIR Volume 2, Chapter 7: Marine Mammals section 1.10.3 'Disturbance from piling' paragraph 118, which states "the number of bottlenose dolphins predicted to be disturbed by pile driving at both the NW and SE locations for both monopiles and multileg jacket foundations" "results in low numbers of dolphins predicted to be disturbed on each piling day (up to 17 individuals which represents 5.8% of the MU." The worst case scenario should be used for assessment, which in this case is	As recommended by NRW, the bottlenose dolphin density surface has been amended to assume a higher density within the 20 m depth contour, and the SCANS III density beyond this. The Applicant has removed simultaneous piling from the Project Design Envelope and as such the comments on simultaneous piling are no longer relevant.

DATE AND CONSULTATION PHASE	CONSULTATION AND KEY ISSUES RASIED	WHERE THE COMMENT IS ADDRESSED
	simultaneous piling at two locations. NRW are not currently satisfied that the two piling locations chosen represent the worst case scenario for simultaneous piling activities. Please see the comments on PEIR Volume 4, Annex 6.2: Underwater Noise Technical Report section 5.3 'Multiple location modelling' for full details.	
Section 42 Responses NRW Comments 11/10/2021	1.2 SAC population assessment Due to the mobile nature of all Annex II marine mammal features, it is accepted that they do not stay within site boundaries. Therefore, should an activity occur outside a site, marine mammal features of the sites could travel to and thus be impacted by that activity, wherever it may be in the MMMU. NRW generally consider that there is the potential for the MMMU to be 'functionally linked' to SACs given, in most cases, the evidence demonstrating the degree of connectiveness and the fact that SACs are dependent on the wider population within the MMMU and represent special areas of sea within it (NRW 2020). As such, NRW do not consider there to be discrete SAC populations, but rather a wider MMMU population. As for the approach taken in section 2 for grey seal, NRW do not consider that an 'SAC dolphin' exists.	The HRA will be revised to assume that all animals in the MMMU are functionally linked to the SAC.
Section 42 Responses NRW Comments 11/10/2021	1.5 Population modelling, page 6 As mentioned in the comments on section 1, NRW have concerns regarding the 6km buffer used to assume bottlenose dolphin presence and that the greater degree of impact from concurrent piling should be taken into account. While it is reasonable that an indicative piling schedule is not available at this stage, justification for piling days being "randomly spread throughout the 12 month construction period", based on typical construction activities should be provided. Given that the worst case scenario for the total area of disturbance impacts for piling on any one day has been established to be concurrent piling at two locations, this scenario should be assessed. The description of scenario 1 as "two monopiles were piled in 1 day", and the choice of the 'number of piling operations' for this scenario in Table 1 being 1 suggests this has not been considered. This should also be modelled for comparison, and the worst case used for assessment. NRW's position on determining Adverse Effect on Site Integrity for marine mammal site features in Wales in relation to potential anthropogenic removals (mortality) from marine developments (NRW 2020b) is relevant to any assessment of population decline due to anthropogenic activity.	As recommended by NRW, the bottlenose dolphin density surface has been amended to assume a higher density within the 20 m depth contour, and the SCANS III density beyond this. The Applicant is not able to provide any further detail on the potential piling schedule, and as such, the only information available is that piling will occur within a 1 year window. Therefore, the only way to create a piling schedule that does not have any seasonal variation was to randomly assign piling days throughout the year.

DATE AND CONSULTATION PHASE	CONSULTATION AND KEY ISSUES RASIED	WHERE THE COMMENT IS ADDRESSED
Section 42 Responses NRW Comments 11/10/2021	2 Information for the grey seal RIAA As for bottlenose dolphin in section 1, the worst case scenario for disturbance of grey seal described in PEIR Volume 2, Chapter 7: Marine Mammals section 1.10.3 'Disturbance from piling' is from concurrent piling at the NW and SE locations. This value was stated as 109 grey seals (paragraph 131, page 102), rather than 83 as stated here. NRW are not currently satisfied that the two piling locations chosen represent the worst case scenario for simultaneous piling activities. Please see our comments on PEIR Volume 4, Annex 6.2: Underwater Noise Technical Report section 5.3 'Multiple location modelling' for full details.	The Applicant has removed simultaneous piling from the Project Design Envelope and as such the comments on concurrent piling are no longer relevant.
Section 42 Responses NRW Comments 11/10/2021	2.3.2 Consequences of disturbance As for bottlenose dolphin and related to the point above, any modelling of impacts from two piles being installed in one day should take into account the impacts of concurrent piling.	The Applicant has removed simultaneous piling from the Project Design Envelope and as such the comments on concurrent piling are no longer relevant.
Section 42 Responses JNCC Comments 09/11/2021	Assessment criteria We refer to our previous comments on the sensitivity score for PTS in cetaceans and highlight that changing this may change the outcomes of this RIAA.	A clarification note has been drafted and sent to NRW that outlines the results from the expert elicitation on PTS and updated sensitivity definitions and scores.
Section 42 Responses JNCC Comments 09/11/2021	Injury (PTS) assessment We agree the purpose of the MMMP is to reduce the risks of injury to negligible levels (Table 3) however there is currently insufficient detail to conclude this is feasible. We highlight that the JNCC mitigation guidelines for piling and UXO clearance will be updated in the coming year and recommend AyM monitor the JNCC webpage	The Applicant acknowledges this feedback on the MMMP and has undertaken further consultation on a revised MMMP which can be found at annex 7.2 (application ref: 6.4.7.2).
Section 42 Responses JNCC Comments 09/11/2021	Disturbance assessment We confirm that the noise management approach for the North Anglesey Marine SAC only needs to be considered during the summer season (paragraph 226) however this advice relates to Conversation Objective 2, disturbance of the species, only. All activities, regardless of when they occur, need to be assessed in respect the remaining conservation objectives. When considering noise management measures, the SNCB advice (as referred to in paragraph 225) is referring to application of the spatial temporal thresholds. Any mitigation measures applied to reduce injury and/or disturbance (e.g. ADD use, noise abatement if deemed appropriate) would have to be used all year round to comply with EPS licensing, which prohibits injury and disturbance It is not clear in the assessment whether there could be overlap between UXO clearance and piling activities; this needs to be clarified. If there is the potential for overlap, we would look for a commitment that the two activities would not happen on the same day. Our previous comments	The Applicant can confirm that there will be no overlap between UXO clearance and piling activities.

DATE AND CONSULTATION PHASE	CONSULTATION AND KEY ISSUES RASIED	WHERE THE COMMENT IS ADDRESSED
	regarding injury/behaviour following multiple piling events also apply to the RIAA.	
Section 42 Responses JNCC Comments 09/11/2021	In-combination assessment While the assumption that other projects would not be awarded consent if there were a risk to marine mammals is fair, we do not agree it can be automatically assumed there would be no risk when multiple projects are considered in combination (paragraph 801). The likelihood of in-combination disturbance is of greater concern, however, potential impacts will depend on the timing and locations of the specific activities so in-combination impacts can't be ruled out. We highlight that all cetacean species are listed as EPS throughout the UK and Europe, not just in Welsh waters as implied in paragraph 800.	Additional information will be added to the RIAA to better justify why PTS should be scoped out of the in-combination impact assessment.
Section 42 Responses JNCC Comments 09/11/2021	Overarching Comments We note that the PEIR is based on only 18 months of data and the additional 6 months of data will be fully integrated in the final ES submission. Thus the figures presented in the PEIR regarding impacts are subject to change. Thus, we reserve the right to revise the advice provided such that it remains based on the best available evidence and considers the full 24 months of data once it is available	The assessment has now been updated for 24 months of survey data in all relevant documents (Section 10.3 and 11.3 for ornithological alone and in-combination assessment, respectively).
Section 42 Responses JNCC Comments 09/11/2021	10.4; 86. Consideration of both alone, and in-combination impacts need to make reference to a sites conservation objectives, which are not always restricted to population sizes. Therefore in some cases (e.g. Liverpool Bay SPA, and see later comments) cumulative loss of habitat or changes in distribution may need to be considered in-combination with other plans and projects.	Assessments to all relevant conservation objectives for each SPA have been updated in the alone and in-combination assessments within Section 10.3 and 11.3, respectively.
Section 42 Responses JNCC Comments 09/11/2021	12.3; 101. Decisions around 'very small numbers' and 'very infrequently' should be made on only 18 months of data. In addition, such decisions should be documented and numbers shown so that we can comment on such decisions. In addition; numbers of red-throated diver would need to be considered within the array plus 10km (or, as previously discussed and agreed for AYM, 8km).	The assessment has now been updated for 24 months of survey data in all relevant documents (Section 10.3 and 11.3 for ornithological alone and in-combination assessment, respectively). Small numbers presented within the alone assessment Section 10.3 for all relevant species discussed within the AyM ETG. The red-throated diver alone assessment, using a gradient approach discussed within the HRA ETG, is discussed in Section 10.3.
Section 42 Responses JNCC Comments 09/11/2021	12.3; 104. Apportioning calculations do not appear to have been presented . These should be shown somewhere. In addition, whilst we agree with use of the SNH (2018) apportioning method as a generic approach, please bear in mind that a UK-wide version of the MS apportioning tool (currently presented within Searle et al. 2019) is under development and may be available in time for the final RIAA incorporating the full 24 months of survey data. In addition, there may in some cases be site-specific	The apportioning approach is outlined within Annex 5 (application ref: 5.2.5).

DATE AND CONSULTATION PHASE	CONSULTATION AND KEY ISSUES RASIED	WHERE THE COMMENT IS ADDRESSED
	data that can support apportioning for some colonies.	
Section 42 Responses JNCC Comments 09/11/2021	13.1.2; published conservation objectives for Liverpool Bay SPA can be found [redacted] This is being updated and an updated version may be available for the final RIAA including the full 24 months of data. The update includes objectives for red-throated diver.	All conservation objectives are updated within the alone assessment, Section 10.3 and Annex 3 (application ref: 5.2.3).
Section 42 Responses JNCC Comments 09/11/2021	13.3.2; note our comments on screening and additional SPA features that should be considered. Guillemot and Razorbill displacement and mortality needs to be assessed for Skomer, Skokholm and the Seas off Pembrokeshire SPA.	Guillemot and razorbill are not within the mean-maximum +1SD foraging range (Woodward et al., 2019) from Skomer, Skokholm and the Seas off Pembrokeshire SPA to AyM and have subsequently, due to no connectivity, have not been considered for assessment during the breeding season. Guillemot and razorbill potential mortalities, as part of the assemblage feature, have been considered during the non-breeding season at this SPA in Section 10.3.
Section 42 Responses JNCC Comments 09/11/2021	13.3.4; 302. published conservation objectives for Liverpool Bay SPA can be found [redacted] This is being updated and an updated version may be available for the final RIAA including the full 24 months of data. The update includes objectives for red-throated diver.	All conservation objectives are updated within the alone assessment, Section 10.3 and Annex 3 (application ref: 5.2.3).
Section 42 Responses JNCC Comments 09/11/2021	13.3.4; 311 – 313. Mortality rates of 10% should be presented (and this is not thought to be over-precautionary given Searle et al (2020) estimate mortality rates for some displaced birds higher than 10%, albeit different species and season than wintering red-throated diver).	The presentation of a range of mortality rates is discussed in Section 10.3.
Section 42 Responses JNCC Comments 09/11/2021	13.3.4; 316. Species-specific hotspots are delineated which combined make up the SPA boundary. These delineations are based on objective criteria and it can be assumed that all of a species-specific 'hotspot' is important habitat for that species.	The relevant habitat conservation objectives for each feature of Liverpool Bay SPA are discussed in Section 10.3.
Section 42 Responses JNCC Comments 09/11/2021	13.3.4; 317. Note previous comments re displacement assessment: numbers and distribution of red-throated diver would need to be considered within the array plus 10km (or, as previously discussed and agreed for AYM, 8km). Mortality rates of 10% should be presented (and this is not thought to be over-precautionary given Searle et al (2020) estimate mortality rates for some displaced birds higher than	The red-throated diver alone assessment, using a gradient approach discussed within the HRA ETG, is discussed in Section 10.3.

DATE AND CONSULTATION PHASE	CONSULTATION AND KEY ISSUES RASIED	WHERE THE COMMENT IS ADDRESSED
	10%, albeit different species and season than wintering red-throated diver).	The presentation of a range of mortality rates is discussed in Section 10.3.
Section 42 Responses JNCC Comments 09/11/2021	13.3.4; 318 -320. See above comments. We do not agree with the displacement analysis for red-throated diver presented. In addition, mortality from ECC should be calculated and added to that resulting from the array to estimate a total annual mortality.	The red-throated diver alone assessment with combined mortality impacts within phases is discussed in Section 10.3.
Section 42 Responses JNCC Comments 09/11/2021	13.3.4; 325. Mortality rates of 10% should be presented (and this is not thought to be over precautionary given Searle et al (2020) estimate mortality rates for some displaced birds higher than 10%, albeit different species and season than wintering common scoter).	The presentation of a range of mortality rates is discussed in Section 10.3.
Section 42 Responses JNCC Comments 09/11/2021	13.3.4; 310, 315, 329 (and other paragraphs discussing mortality rates): JNCC are not aware of empirical evidence re mortality rates of displaced birds. Searle et al (2020) estimate mortality rates of displaced birds of higher than 10% for some species, based on a modelling approach using latest available data and understanding of the ecology of seabirds. We therefore (and as advised in the SNCB displacement note) would like to see results using a mortality rate of 10%.	The presentation of a range of mortality rates is discussed in Section 10.3.
Section 42 Responses JNCC Comments 09/11/2021	13.3.4; 341. A buffer of 10km (or, as previously discussed and agreed for AYM, 8km) should be used for red-throated diver, instead of 4km.	The red-throated diver alone assessment, using a gradient approach discussed within the HRA ETG, is discussed in Section 10.3.
Section 42 Responses JNCC Comments 09/11/2021	13.3.4; 313, 331, 334, 347, 358. given comments above re mortality rates and displacement buffers, we cannot agree with conclusions of 'no potential for a AEOI' from these paragraphs.	The alone assessment for ornithological features are discussed in Section 10.3.
Section 42 Responses JNCC Comments 09/11/2021	13.3.4; 342. The conservation objectives for Liverpool Bay SPA include a requirement to maintain or restore the distribution of the qualifying species within the site. An assessment of the potential for vessel movements associated with the operation and maintenance of the array to impact on distribution of SPA features (in particular common scoter, and red-throated diver) is required, alone and in-combination with other activities	The relevant habitat conservation objectives for each feature of Liverpool Bay SPA are discussed in Section 10.3.
Section 42 Responses JNCC Comments	For assessment of array operation and maintenance: A buffer of 10km (or, as previously discussed and agreed for AYM, 8km) should be used for red-throated diver, instead of 4km.	The red-throated diver alone assessment, using a gradient approach discussed within the HRA ETG, is discussed in Section 10.3.

DATE AND CONSULTATION PHASE	CONSULTATION AND KEY ISSUES RASIED	WHERE THE COMMENT IS ADDRESSED
09/11/2021		
Section 42 Responses JNCC Comments 09/11/2021	For all displacement assessments, from array and from associated vessel movements, and for all species, impacts based on a mortality rate of 10% should be presented.	There is currently no planned vessel routes during operation and maintenance, therefore a quantitative assessment cannot be undertaken alone or in-combination for this impact on any feature. Potential vessel management mitigation is discussed in Section 10.3.
Section 42 Responses JNCC Comments 09/11/2021	Impacts from vessel movements should be added to those from array to provide a total impact during operational phases.	There is currently no planned vessel routes during operation and maintenance, therefore a quantitative assessment cannot be undertaken alone or in-combination for this impact on any feature. Potential vessel management mitigation is discussed in Section 10.3.
Section 42 Responses NE Comments Undated	The analysis has been undertaken on 18 months of survey data. Natural England advise that 24 months of (preferably consecutive) baseline survey data are required. We acknowledge from the Offshore Ornithology Expert Technical Group (ETG) that 24 months of data will be integrated into a single Baseline Technical Report for the Environmental Statement. Some additional analysis may be required once 24 months of data is available, e.g., birds considered to have been recorded in 'trivial' numbers up to this point may need to be considered.	The assessment has now been updated for 24 months of survey data in all relevant documents (Section 10.3 and 11.3 for ornithological alone and in-combination assessment, respectively). Small numbers presented within the alone assessment Section 10.3 for all relevant species discussed within the AyM ETG.
Section 42 Responses NE Comments Undated	Mortality estimates arising from each pathway (collision, displacement) have been presented for discreet project time frames (cable laying, construction, operation, and decommissioning). Total mortality estimates have not been calculated. Natural England advise that the total estimated mortality impacts should be presented for each pathway (e.g. collision, displacement). Further, for species which may be impacted by both collision and displacement (e.g. gannet), the impacts from both should also be considered cumulatively. At present, the Statutory Nature Conservation Bodies (SNCBs) regard the two impacts (collision and displacement) as additive and advise that they should be summed. Further information on this is available in the 2017 SNCB Interim Displacement Advice Note[iv].	Combined impacts within phases (e.g. gannet combined displacement and collision impacts within the operational and maintenance phase) for relevant species are assessed alone and in-combination in Section 10.3 and 11.3, respectively. The Applicant acknowledges the request for combining impacts across phases of the development. The predicted mortalities for each species are given per annum for each phase of the development. These phases are not expected to overlap, therefore, it is not deemed suitable to combine impacts across development phases.

[iv] https://data.jncc.gov.uk/data/9aecb87c-80c5-4cfb-9102-39f0228dcc9a/Joint-SNCB-Interim-Displacement-AdviceNote-2017-web.pdf

DATE AND CONSULTATION PHASE	CONSULTATION AND KEY ISSUES RASIED	WHERE THE COMMENT IS ADDRESSED
Section 42 Responses NE Comments Undated	Conclusions of no Adverse Effect on Integrity (AEoI) do not consider all Special Protection Area (SPA) conservation objectives. Using Liverpool Bay SPA and red-throated diver as an example, the conclusion of no AEoI has been made against the objective to maintain or restore the population, through putting the estimated mortality into context against the SPA population. However, the objective to maintain or restore the distribution of the qualifying feature has not been properly considered. It is likely that the operation of the wind farm will lead to a change in distribution of red-throated diver at Liverpool Bay SPA. Natural England advise that all SPA conservation objectives must be considered throughout the assessment.	All relevant conservation objectives have been discussed in Section 10.3 for all relevant features.
Section 42 Responses NE Comments Undated	Generic population age ratios (Furness, 2015) have been used throughout. No site-specific data is utilised. It is noted that throughout the assessment generic age ratios have been applied in preference to site specific data, with small sample sizes being used to justify this approach. In some cases (e.g. gannet where most observations are from within the breeding season and birds can be accurately aged) it may be more appropriate to use site specific age data. Further clarity is required on what constitutes a small sample size, how this has been determined, and the implications of using generic data.	Information on the source and rationale of data used in the apportioning analysis has been discussed in Section 10.3.
Section 42 Responses NE Comments Undated	Assessment has been made against the citation populations, but also an updated population based on the latest count which is often based on a single year of data and may not be contemporary (e.g. para 454 Lambay Island guillemot count from 2015) It is not appropriate to assess impacts using a single population count, which does not account for any source of variation and may not be representative. Natural England advise that impacts should be assessed using the citation population unless an alternative (e.g. a mean count from the most recent 3-5 years of count data) is agreed with the relevant SNCBs. This may be appropriate if a population can be shown to have increased or declined significantly against the baseline.	Impacts have been assessed against the citation population for all species for which a quantitative assessment has been undertaken. Latest population counts have also been assessed against in order to demonstrate changes to populations. This method of assessment has been undertaken for other recent offshore wind farms in the UK. Therefore, it is deemed appropriate to assess AyM impacts using both citation and latest counts.
Section 42 Responses NE Comments Undated	Anglesey terns SPA - only sandwich tern and roseate tern features have been assessed. It is not clear why common and arctic terns have been excluded from the assessment. If this cannot be adequately justified Natural England advise that they should be considered for assessment.	The alone assessment for Anglesey Terns / Morwenoliaid Ynys Môn SPA is discussed in Section 10.3.
Section 42 Responses NE Comments Undated	A number of species names are incorrect in the text, see e.g. paragraph 440 (gannet should read herring gull), paragraph 482 (gannet should read guillemot).	Erroneous references have been updated to reflect correct ornithological features throughout the relevant sections in the RIAA (10.3 and 11.3 for alone and in-combination assessment).

DATE AND CONSULTATION PHASE	CONSULTATION AND KEY ISSUES RASIED	WHERE THE COMMENT IS ADDRESSED
Section 42 Responses NE Comments Undated	1% Mortality rates have been used in displacement assessments. Natural England's general position regarding mortality rates from displacement is that as definitive mortality rates for seabirds are unknown, we advise investigating a range of figures for mortality rates. Natural England do not agree that a 1% mortality rate for red-throated diver is precautionary. Natural England's response to the MacArthur Green review[v] of available evidence for red-throated diver displacement at our Deadline 3 submission for the Norfolk Vanguard Offshore Wind Farm is available on the PINS website[vi] Natural England advise that mortality rates of 1-10% should be considered in displacement assessments for red-throated diver and auks (for impacts arising from the developed site, its construction and cable laying vessels). We advise that the same approach is taken for common scoter (mortality rate range of 1-10%).	The presentation of a range of mortality rates is discussed in Section 10.3.
Section 42 Responses NE Comments Undated	A 4km buffer has been used to assess displacement of red-throated diver. Natural England have recently approved the Joint SNCB Interim Advice on The Treatment of Displacement for Red-Throated Diver (2021) which will be published shortly. Following this guidance, it is advised that displacement is assessed using a 10km buffer as the project is within 10km of Liverpool Bay SPA, which is designated for non-breeding red-throated diver. This buffer is not necessarily required in all directions from the array (i.e. a 4km buffer may be appropriate on the seaward boundary). Assessing a displacement gradient (rather than assuming 100%) may be appropriate over the 10km buffer.	The red-throated diver alone assessment, using a gradient approach discussed within the HRA ETG, is discussed in Section 10.3.
Section 42 Responses NE Comments Undated	Method used to assess displacement in construction and decommissioning phases (displacement rates have been reduced by 50%). Natural England have advised other projects that it is acceptable to broadly reflect the likely reduced spatial and temporal scale of displacement effects during construction by calculating displacement for the construction period as 50% of that at the operational phase. We suggest this method is simpler than reducing displacement rates by 50%.	Displacement during the construction and decommissioning phase for relevant species are provided in Section 10.3 using a 50% reduction in displacement rate compared to operation and maintenance phase.
Section 42 Responses NE Comments	Common scoter displacement during cable laying has been assessed using a 1 km buffer around cable laying vessels, justified by Schwemmer et al. (2011). Note that reference list is incomplete, e.g. does not include Schwemmer et al. (2011)[vii]. Although Schwemmer et al. (2011) found a median flush distance of 804m for common scoter, the	The assessment for common scoter during cable installation is presented in Section 10.3. References have been updated in Section 14.

[v] MacArthur Green Review of ornithology constraints for Offshore Wind Leasing in Areas 3 (Yorkshire Coast) and 4 (The Wash). Report to The Crown Estate. March 2019

[vi] https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010079/EN010079-002568-DL3%20-%20Natural%20England%20-%20Deadline%203%20Submission.pdf

[vii] Schwemmer, P., Mendel, B., Sonntag, N., Dierschke, V., & Garthe, S. (2011). Effects of ship traffic on seabirds in offshore waters: implications for marine conservation and spatial planning. Ecological Applications, 21(5), 1851–1860. [redacted]

DATE AND CONSULTATION PHASE	CONSULTATION AND KEY ISSUES RASIED	WHERE THE COMMENT IS ADDRESSED
Undated	study found the species flush distance response to vessels to be highly variable. A flock was recorded flushing at 3.2km, and the 95% upper confidence level flush distance presented is >2km (see figure 3). Note that flush distances of 1-2km were reported by Kaiser et al. (2006)[viii]. Natural England advise that a 2km buffer should be used to assess displacement of common scoter by cable laying activities, as used for red-throated diver.	
Section 42 Responses NE Comments Undated	Gannet displacement – assessment only considers the array area There is no justification for the use of the array area only. NE advises that displacement assessments should also consider the 2km buffer.	Gannet alone displacement assessment within the array plus 2km buffer is discussed in Section 10.3.
Section 42 Responses NE Comments Undated	Total crew transfer vessel movements appear to be very low (1095) over the operating life of the wind farm. The stated number of movements equates to less than one crew transfer vessel visiting the site each week. Vessel routes are unknown at present. If routes do not follow pre-existing shipping routes new areas within Liverpool Bay SPA will be subject to additional disturbance. Please confirm if vessel movements listed are totals over the 25-year operational period and correct (it appears more likely than annual vessel movements have been presented). Natural England cannot currently agree that "vessels transiting to and from the port during the 25-year operational lifetime of the Awel y Môr project and the wind farm will have a negligible effect on the levels of shipping disturbance". A vessel management plan will need to be produced to avoid and mitigate disturbance as far as possible. If vessels are routed through Liverpool Bay SPA it will be necessary to assess displacement (particularly of red-throated diver and common scoter) along those routes, especially where those routes deviate from existing shipping lanes.	The information presented around 1095 vessel movements is considered to be accurate and are presented for the full 25-year period. There is currently no planned vessel routes during operation and maintenance, therefore a quantitative assessment cannot be undertaken alone or in-combination for this impact on any feature. Potential vessel management mitigation is discussed in Section 10.3.
Section 42 Responses NE Comments Undated	A site-specific foraging range for Sandwich tern breeding at the Cemlyn colony has been used to evidence the claim that adverse effects can be discounted (no connectivity). Data informing the colony specific maximum foraging range is not considered robust. It was gathered over a single breeding season (2009) and many of the tracks were incomplete[ix]. Natural England advise the use of the precautionary mean max +1SD foraging range presented in Woodward et al. (2019)[x] to account for inter-annual variation and a high level of uncertainty in the colony specific	The alone assessment for Anglesey Terns / Morwenoliaid Ynys Môn SPA is discussed in Section 10.3.

[viii] Kaiser, M.J., M. Galanidi, D. A. Showler, A. J. Elliott, R. W. G. Caldow, E. I. S. Rees, R. A. Stillman and W. J. Sutherland. 2006. Distribution and behaviour of common scoter Melanitta nigra relative to prey resources and environmental parameters. Ibis 148: 110-128.
[ix] https://data.jncc.gov.uk/data/926cdbbd-c384-42a9-b9e5-81abd778bbd0/JNCC-Report-500-FINAL-WEB.pdf
[x] Woodward, I., Thaxter, C.B., Owen, E. & Cook, A.S.C.P. 2019. Desk-based revision of seabird foraging ranges used for HRA screening. BTO research report number 724

DATE AND CONSULTATION PHASE	CONSULTATION AND KEY ISSUES RASIED	WHERE THE COMMENT IS ADDRESSED
	range.	
Section 42 Responses NE Comments Undated	Manx shearwater displacement has not been assessed. Natural England advise that displacement of Manx shearwater should be assessed due to a lack of evidence on potential sensitivity and impacts and potential for future in-combination impacts in the region. It is suggested that analysis considers a displacement rate range of 30-70% and mortality rate range of 1-10% at the array + 2km buffer area (i.e., the same parameters as auks). We acknowledge that it has been set out in the ETG meeting that Manx shearwater will be included in the Environmental Statement, although were missing from the PEIR.	Manx shearwater quantitative alone assessment is discussed in Section 10.3 for the relevant SPAs.
Section 42 Responses NE Comments Undated	Predicted collision mortality estimates are presented (assumed to be the mean value), but the assessment does not account for the range of predicted impacts. I.e. a worst-case scenario is not considered. Natural England advise that collision risk assessments need to present data and predicted impacts in a way that allows the full range of uncertainty (e.g. around input data, analysis, methodology) to be understood and evaluated. Natural England advise the use of a 95% UCL to represent a precautionary worst-case scenario of collision mortality.	The collision risk assessment has been updated showing the mean, minimum and maximum scenarios to account for variability within Section 10.3 for all relevant features.
Section 42 Responses NE Comments Undated	Migrating terns have not been considered. Natural England advise that low numbers of birds recorded in baseline surveys is not sufficient justification to scope out migrant species from Collision Risk Modelling (CRM) assessments. Digital Aerial Survey represent a snapshot and can easily miss migratory movements. The SOSS Migration Tool (SOSS-MAT) or Migropath are not considered suitable to assess migrant seabirds (including terns), which tend to migrate following coastlines at a distance offshore and do not migrate following straight lines between a point of origin and a destination. An alternative approach is to estimate the number of a species of bird migrating through a wind farm footprint area based on an apportionment of migrant bird numbers across a broad migratory front. See the report for the Marine Scotland project on strategic assessment of collision risk of Offshore Wind Farms to migrating birds (WWT Consulting & MacArthur Green Ltd. 2014)[xi]	Migratory terns assessment using 'broad front' modelling is discussed in Section 10.3 for relevant SPAs. Details on the approach can be found in Annex 4.4. Migratory CRM (application ref: 6.4.4.4).
Section 42 Responses NE Comments Undated	In-combination impacts do not consider data from projects that previously scoped in SPA populations using Thaxter et al. (2012) foraging ranges. No displacement analysis of gannet at sites in range. A number of projects have not been considered due to a lack of data. Natural England advise that all Offshore Wind Farm plan and projects within the relevant spatial scale	All sites have been considered in-combination in Section 11.3. The Applicant does not deem it appropriate to reassess impacts from developments that either did not produce a quantitative assessment or due to the use of the

[xi] https://www.gov.scot/publications/scottish-marine-freshwater-science-volume-5-number-12-strategic-assessment/

DATE AND CONSULTATION PHASE	CONSULTATION AND KEY ISSUES RASIED	WHERE THE COMMENT IS ADDRESSED
	should be considered by in-combination assessments. In some cases, it is likely that sites with "no data" could have been assessed by other more recent sites to assess in-combination impacts. In any case, simply disregarding impacts from such sites is not appropriate.	Thaxter et al. (2012) foraging ranges. Only projects which have undertaken a displacement analysis within range have been included in-combination as the Applicant does not deem it appropriate to reassess impacts from developments.
Section 42 Responses NE Comments Undated	In-combination displacement assessments only consider impacts at operation and maintenance phase for Awel y Môr. Natural England advise that the assessment should also fully consider the impacts of the construction phase (including cable installation) and operation and maintenance works, in additional to effects from the array itself. This should consider vessel movements (including cabling vessels and helicopter traffic).	The in-combination assessment for relevant ornithological receptors is discussed in Section 11.3.
AyM HRA ETG 17/12/2021	NRW advised that Guillemot and razorbill as assemblage features of Skomer, Skokholm and Seas of Pembrokeshire SPA should be assessed in the breeding season (and in terms of the lesser black backed gull).	The Applicant believes this is in reference to the non-breeding season, not the breeding season as was discussed in the AyM ETG. Guillemot, razorbill and lesser black-backed gull are not within the mean-maximum +1SD foraging range (Woodward et al., 2019) from Skomer, Skokholm and the Seas off Pembrokeshire SPA to AyM and have subsequently, due to no connectivity, have not been considered for assessment during the breeding season. Guillemot and razorbill potential mortalities, as part of the assemblage feature, and lesser black-backed gull have been considered during the non-breeding season at this SPA in Section 10.3.
AyM HRA ETG 17/12/2021	GoBe Consultants to submit a revised MMMP to the ETG members within January.	An updated MMMP was provided to ETG memebers and was discsussed at the HRA ETG in the week commencing 31/01/22

4 Project overview

4.1 Proposed development

38 AyM is a proposed 'sister project' to the existing and operational GyM OWF and comprises an offshore and onshore development. The offshore and onshore components of the development are presented in Figure 1.

39 As described in the offshore project description application ref: 6.2.1, the offshore component of the development encompasses:

- The array area: where the Wind Turbine Generators (WTGs), Offshore Substation Platforms (OSPs), associated foundations, inter-array cables and export cables will be installed;
- The GyM interlink zone: where a single cable connection linking the infrastructure of AyM to the western GyM OSP will be installed;
- The 'other wind farm infrastructure' zone: an area to the west of the array area, which will preclude WTGs, OSPs and export cables but will allow for a meteorological mast (met mast) or floating LIDAR (FLIDAR), array cables and Permanent Vessel Moorings (PVMs); and
- The offshore Export Cable Corridor (ECC): where the offshore export cables will be installed, bringing power generated to the onshore cable circuits at landfall between Rhyl and Prestatyn.

40 Within these areas, AyM will be comprised of WTGs, offshore substation platforms and all associated infrastructure required to transmit the electricity generated to the National Grid network via the grid connection at Bodelwyddan, as well as all infrastructure required to operate and maintain the wind farm, such as the met mast and PVMs.

41 The onshore component of the development encompasses:

- The landfall: the intertidal area from Mean Low Water Springs (MLWS) to Mean High Water Springs (MHWS) where the offshore export cables will be brought ashore to the east of Rhyl;
- The onshore ECC: where permanent infrastructure connects the cables at landfall to the proposed onshore substation at Bodelwyddan and the onwards link to the existing National Grid Substation; and

- The onshore substation (OnSS): where the power supplied from the wind farm is transformed to 400 kV and the power quality and power factor are adjusted as required to meet the UK System-Operator Transmission-Owner Code (STC) for supply to the National Grid substation.

42 Within these areas, AyM will be comprised of export cables and associated infrastructure required to transmit the electricity generated to the National Grid network via the grid connection at Bodelwyddan. The transmission voltage will be up to 400 kV, with a maximum of two export cables circuits, and will use High Voltage Alternating Current (HVAC) technology.

4.2 Development components

43 The key permanent offshore components of AyM will include:

- Foundations;
- WTGs (up to 34 at the larger end of the design envelope and up to 50 at the smaller end);
- Two OSPs;
- One meteorological mast (met mast);
- Three PVMs;
- Subsea inter-array cables linking individual WTGs, the met mast and PVMs to one another and to the OSPs;
- Subsea export cables linking OSPs to shore;
- Interlink cable between AyM and GyM;
- Scour protection around foundations;
- Cable protection where sufficient cable burial is not achievable; and
- Cable crossings
- The key permanent onshore components of AyM will include:
- Infrastructure at landfall and Horizontal Directional Drilling (HDD) installations where the offshore cables are brought ashore;
- Up to two Transition Joint Bays (TJBs) connecting the offshore cables to the onshore cables;
- Installed cable ducts, joint pits and cables comprising up to two circuits;
- Trenchless installations to facilitate cable crossings of roads, watercourses and potentially areas of woodland;

- The OnSS at Bodelwyddan; and
- Up to two interconnecting cable circuits for the grid connection from the OnSS to the existing National Grid substation.

44 The onshore cable corridor will be approximately 14 km in length.

45 It is likely that the components for AyM will be fabricated at manufacturing sites across the UK, Europe and farther afield. A construction base (port facility) may be used to stockpile some components before delivery to site for installation. Other components, such as prefabricated units and cables, may be delivered directly to site when required.

46 Table 2 summarises key offshore and onshore infrastructure information. More detail on each component is described in Volume 2, Chapter 1.

Table 2: General wind farm maximum design envelope parameters.

PARAMETER	MAXIMUM DESIGN ENVELOPE
Total site area (array) (km^2)	78
Number of WTGs	50 (smaller turbines), or 34 (larger turbines)
Number of OSPs	2
Number of met masts	1
Number of PVMs	3
Total inter-array cable length (km)	116
Number of offshore export cable circuits	2
Total offshore export cable length (km)	79.4 – including 10 km of GyM Interlink cable
Total number of cable crossings	15 – including one within the GyM interlink area
TJB area	200 m^2 in total (100 m^2 per TJB)
Number of TJBs	2
Total onshore export cable length (km)	14

PARAMETER	MAXIMUM DESIGN ENVELOPE
Number of onshore export cable circuits	2
Number of power cables per circuit	3
Number of ducts per circuit	7 (3 x power cable, 3 x comms. Cable and 1 x earth cable)
Export cable voltage	Up to 400 kV

4.3 Consideration of alternatives

47 The AyM proposal has resulted from and been informed by detailed consideration of alternatives. This is presented within Volume 1, Chapter 4: Site Selection and Alternatives (application ref: 6.1.4). With reference to HRA, particular focus is placed on the reduction of the array area, which inherently reduces the potential displacement of birds, and interaction with marine mammal sites to the west of the proposed project, and the project decision to avoid the Constable Bank. Whilst not designated within a site, Constable Bank is considered Annex I for the purposes of Habitats Regulations reporting and was the subject of a scoping and screening phase request from NRW to avoid cable installation. RWE considered the feedback received and made a project commitment to avoid cabling through the Constable Bank post-scoping. Since then, following Section 42 consultation, the array area size has been further reduced, minimising the impact on protected sites and species.

4.4 Maximum design scenario

48 The project for assessment throughout the ES and the RIAA is referred to as the maximum design scenario (MDS). Adopting this approach ensures that the scenario that would have the greatest impact (e.g. largest footprint, longest exposure, or tallest dimensions, depending on the topic) is assessed for each relevant receptor; it can then be assumed that any other (lesser) scenarios will have an impact that is no greater than that assessed. This is also known as the project design envelope approach or the ‘Rochdale Envelope’ approach (PINS, 2012a).

49 The Screening Report (Innogy, 2020a) identified a number of receptor groups, with the topic specific MDS for each group presented within the relevant chapter from the ES. The relevant MDS for each receptor group can be found within the following tables and ES chapters:

- Table 14 from Volume 2, Chapter 4;
- Table 11 from Volume 2, Chapter 5;
- Table 9 from Volume 2, Chapter 6;
- Table 14 from Volume 2, Chapter 7; and
- Table 11 from Volume 3, Chapter 5.

50 The MDS, as it applies to each receptor group, has not been repeated but is available in the ES chapters set out above. For clarity regarding the differences in the MDS between receptor groups, the information is presented according to individual project parameters, including a note regarding why the scenario is relevant to that receptor. Where relevant, the information includes any designed-in mitigation (see Section 5, Table 3).

4.5 Construction programme

51 A high-level indicative programme of relevant works is presented in Figure 3, illustrating the main project infrastructure elements and the window within which construction will occur. While the entire construction period for AyM covers a five-year period, Year 1 (2026) is expected to be onshore construction activity only. Offshore construction work is not expected to commence until Year 2 (2027), and foundation installation activities (including UXO clearance and piling) could occur any time between 2027 and 2029 inclusive, but only for a 12-month period within that three-year window (expected date is 2028).

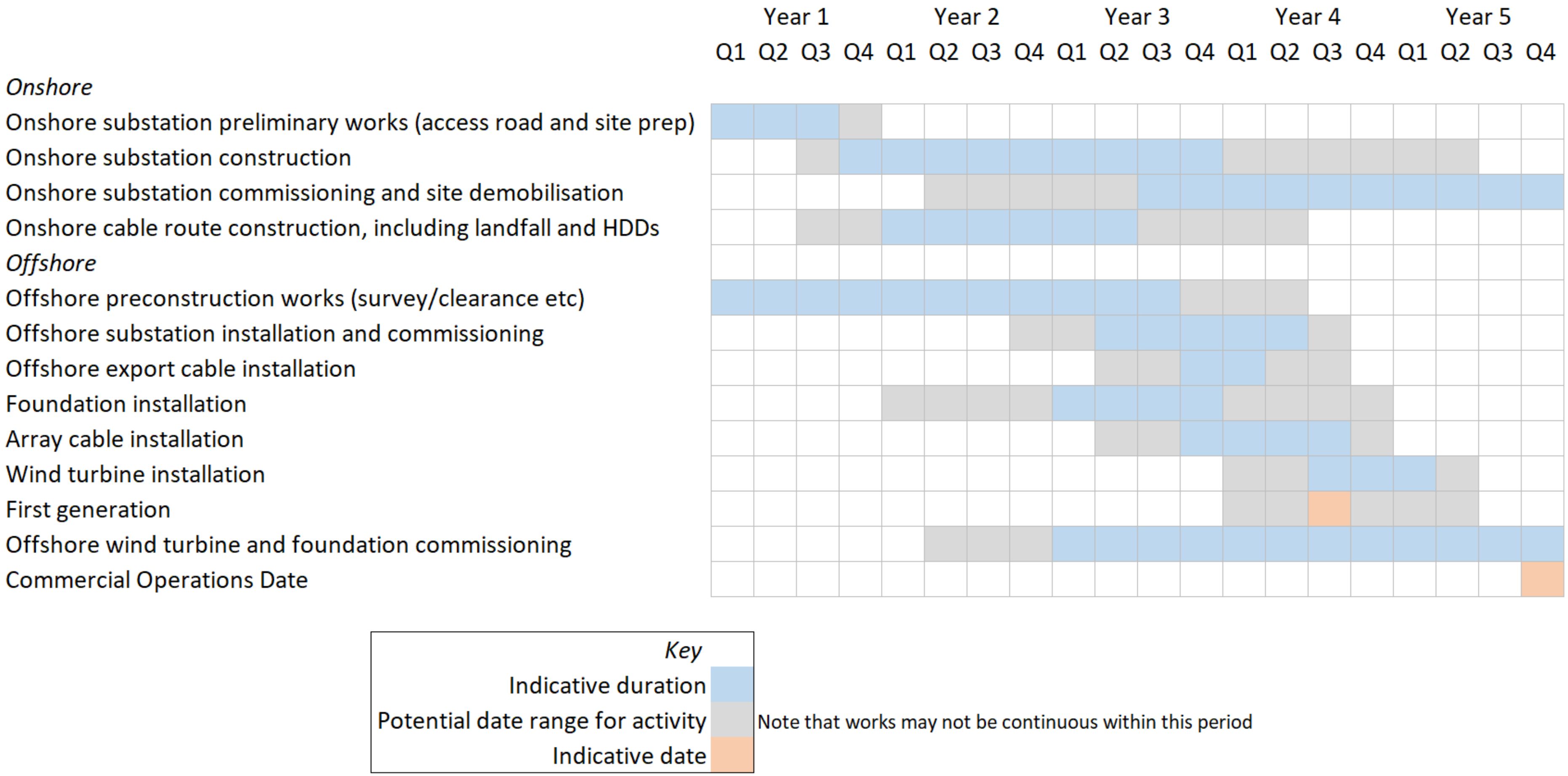


Figure 3: Indicative programme of works.

4.6 Operation, maintenance and decommissioning programme

52 The proposed operational phase for the development is in the order of 25 years. It is anticipated that, if consent is granted construction would commence in 2026 and the OWF be fully operational by 2030. During the operational period, scheduled and unscheduled monitoring and maintenance activities will be required. Full details of the operation, maintenance and decommissioning programme is available in ES Volume 2, Chapter 1 and Volume 3 Chapter 1.

5 Mitigation measures

53 The information on mitigation measures per receptor draws on individual ES topic chapters (where relevant and appropriate) and, mitigation specific to the RIAA. For ES, all mitigation is detailed in the Schedule of Mitigation (Document 8.11). The mitigation measures specific to each receptor group can be found within the following tables and ES chapters:

- Table 15 from Volume 2, Chapter 4;
- Table 12 from Volume 2, Chapter 5;
- Table 11 from Volume 2, Chapter 6
- Table 15 from Volume 2, Chapter 7; and
- Table 12 from Volume 3 Chapter 5.

54 Mitigation measures that were identified and adopted as part of the evolution of the project design (embedded into the project design) and that are relevant to the RIAA are listed in Table 3. The mitigation includes embedded measures such as design changes and applied mitigation which is subject to further study or approval of details; these include avoidance measures that will be informed by pre-construction surveys, and necessary additional consents where relevant. The composite of embedded and applied mitigation measures apply to all parts of the AyM development works, including pre-construction, construction, O&M and decommissioning.

Table 3: Mitigation measures relating to the RIAA.

MITIGATION MEASURES	AIM OF THE MITIGATION	MITIGATION REFERENCE
Project Design		
Design Changes	A series of design changes have been adopted as a result of statutory consultation including: Refinement of the offshore array area and corresponding number of WTGs: Area: reduced from 106 km2 at scoping, to 88 km2 at PEIR, to 78 km2 at application; Number of turbines: reduced from 107 at scoping, to 48 large/91 small at PEIR, to 34 large/50 small at application. The maximum rotor diameter of the smaller turbines was increased from 220 m to 250 m , and the maximum rotor diameter of the larger turbines was increased from 300m to 306m. Refinement of onshore cable corridor; Refinement of the Other Wind Farm Infrastructure Zone (OWFIZ) where the met mast could be located from the north-west corner to a smaller area further south; Refinement of offshore piling parameters: Concurrent piling removed (except in the instance of pin piles at the same jacket)	Document 5.1: Consultation Report

MITIGATION MEASURES	AIM OF THE MITIGATION	MITIGATION REFERENCE
	Refinement of maximum piling scenario; and Soft-start/ramp-up profiled refined; Max duration of monopile piling at max energy reduced from 5.5 to 4 hours; Maximum duration of piling per day reduced from 12 to 10 hours; and Number of monopiles within one day reduced from 8 to 4. Commitment to CAA-mandated aviation lights that dim to 200 cd (from 2,000 cd at maximum intensity) when visibility is >5 km.	
Subtidal and Intertidal Benthic Ecology		
Project Environmental Management Plan (PEMP)	A Project Environment Management Plan (PEMP) is proposed to be implemented, through informing project design and standard practice, as a pre-construction marine licence mitigation measure to ensure that the potential for contaminant release is strictly controlled. The purpose of the PEMP is to provide protection to marine life across all phases of the life of the wind farm. The PEMP will incorporate plans to cover accidental spills, potential contaminant release and include key emergency contact details. Typical measures will include only using chemicals	Document 8.11: Schedule of Mitigation.

MITIGATION MEASURES	AIM OF THE MITIGATION	MITIGATION REFERENCE
	approved under the Offshore Chemicals Regulations 2002; storage of all chemicals in secure designated areas with impermeable bunding (generally to 110% of the volume); and double skinning of pipes and tanks containing hazardous materials.	
Biosecurity Plan	Relevant best practice guidelines will be followed and implemented through the implementation of a Biosecurity Plan to minimise INNS introduction/ spread. Any vessels used for the delivery of materials to site will adhere to industry legislation, codes of conduct and/or best practice to reduce the risk of introduction or spread of invasive non-native species (INNS).	Document 8.11: Schedule of Mitigation.
Marine Mammals		
Marine Mammal Mitigation Protocol (MMMP)	A MMMP will be drafted and implemented in order to reduce to negligible the risk of Permanent Threshold Shift (PTS) auditory injury to any marine mammal species in close proximity of the pile driving for the installation of AyM foundation structures. The MMMP draws on the guidance provided by the Joint Nature Conservation Committee (JNCC) (2010) and Statutory Nature Conservation Bodies (SNCB) recommendations with regards to ADD use	Document 8.11: Schedule of Mitigation. Volume 4, Annex 7.2.

MITIGATION MEASURES	AIM OF THE MITIGATION	MITIGATION REFERENCE
	(JNCC *et al*. 2016). A draft MMMP is included with the ES.	
Vessel codes of conduct	The adoption of best practice vessel handing protocols (e.g. following the Codes of Conduct provided by the WiSe Scheme, Scottish Marine Wildlife Watching Code or Guide to Best Practice for Watching Marine Wildlife) will minimise the potential for any impact. The final codes of conduct will be discussed and agreed with NRW and JNCC.	
Offshore and Intertidal Ornithology		
Code of Construction Practice (CoCP)	Includes details regarding an Air Quality Management Plan; Principles for storage and handling of oils, fuel or other potentially polluting substance; and Management of surface water Soil management.	Document 8.11: Schedule of Mitigation.
MMMP	A piling MMMP will be developed which will include proposals for soft start and ramp-up of piling to help reduce disturbance impacts on marine mammals. While none of the mitigation measures detailed in the MMMP are focused on ornithological features, it is likely that there will be incidental effects on non-mammal receptors (including birds). A draft MMMP will be included	Document 8.11: Schedule of Mitigation.

MITIGATION MEASURES	AIM OF THE MITIGATION	MITIGATION REFERENCE
	with the ES (Annex 4.7.2)	
Onshore Biodiversity and Nature Conservation		
Not relevant (see Section 6.1)		
Migratory Fish		
Cable Specification and Installation Plan (CSIP)	The CSIP will be developed post-consent and will set out appropriate cable burial depth in accordance with industry good practice, minimizing the risk of cable exposure.	Document 8.11: Schedule of Mitigation.
MMMP	A piling MMMP will be developed which will include proposals for soft start and ramp-up of piling to help reduce disturbance impacts on marine mammals. While none of the mitigation measures detailed in the MMMP are focused on fish features, it is likely that there will be incidental effects on non-mammal receptors (including fish). A draft MMMP will be included with the ES (Annex 4.7.2).	Document 8.11: Schedule of Mitigation.
Scour Protection Management Plan (SPMP)	A Scour Protection Management Plan will be developed post-consent. It will include details of the need, type, quantity and installation methods for scour protection.	Document 8.11: Schedule of Mitigation.

MITIGATION MEASURES	AIM OF THE MITIGATION	MITIGATION REFERENCE
Decommissioning Programme	A Decommissioning Programme will be developed post-consent to cover the decommissioning phase.	Document 8.11: Schedule of Mitigation.

6 The screening process for the project alone

6.1 Screening undertaken for AyM

55 As noted in Section 2.2, the first stage to the HRA process is Screening, which is the process followed to identify any potential for LSE from the project, alone and/or in-combination, on European sites of nature conservation importance. Where potential for LSE is identified (or cannot be discounted), then AA is required. Initial screening for AyM was undertaken during Scoping, with the Screening Report issued in June 2020 (Innogy, 2020a) along with the Scoping Report (Innogy, 2020b). The following organisations were consulted on screening:

- Natural Resources Wales (NRW);
- Natural England (NE);
- Joint Nature Conservation Committee (JNCC);
- Royal Society for the Protection of Birds (RSPB);
- The Wildlife Trusts (TWTs);
- Whale and Dolphin Conservation (WDC);
- Denbighshire Council;
- Gwynedd Council;
- Conwy Council;
- Anglesey Council; and
- Flintshire Council.

56 Following consultation on the Screening Report, an update to the screening conclusions was issued in December 2020 (Annex 1 and 2). This update summarised changes made to the screening conclusions following consultation. Additional consultation in relation to birds (as presented in Table 1) has resulted in further changes to screening, with these changes documented in Annex 2.

57 During the drafting of the ES, a number of changes have been made to the project boundary, both onshore and offshore. These have resulted in some additional changes to screening for the receptors excluding birds (and therefore an additional update to Annex 2), specifically following the refinement of the onshore cable corridor and the reduction in the offshore boundary (documented in Volume 1, Chapter 4). These changes can be summarised as follows:

- Coedwigoedd Penrhyn Creuddyn/ Creuddyn Peninsula Woods SAC. Site screened in during Screening for onshore features based on 0.05 km range to AyM onshore boundary (Screening Report [Innogy, 2020a] and Update to Screening Annex 1). Subsequent refinements to the onshore cable corridor mean the project is now 18.7 km distant and therefore beyond the relevant screening range applied in the Screening Report (Innogy, 2020a). The site has therefore been screened out of further assessment.
- Coedwigoedd Dyffryn Elwy/ Elwy Valley Woods SAC. Site screened in during Screening for onshore features based on 0.05 km range to AyM onshore boundary (Screening Report [Innogy, 2020a] and Update to Screening Annex 1). Subsequent refinements to the onshore cable corridor mean the project is now 1.8 km distant and therefore beyond the relevant screening range applied in the Screening Report (Innogy, 2020a). The site has therefore been screened out of further assessment.
- Y Fenai a Bae Conwy/ Menai Strait and Conwy Bay (UK) SAC. Site screened in during Screening for offshore and onshore features based on 0.18 km range to AyM onshore boundary and 6.1 km range to AyM to the offshore array (Screening Report [Innogy, 2020a] and Update to Screening Annex 1). Subsequent refinements to the onshore cable corridor mean the project is now 19.4 km distant and therefore beyond the relevant screening range applied in the Screening Report (Innogy, 2020a). The effects on onshore hydrology and physical habitat loss/ disturbance have therefore been screened out of further assessment. However, this site is still screened in for offshore elements and following design refinements the site remains 6.1 km from the array area and offshore ECC.

- Dee Estuary Ramsar. Site screened in during Screening for onshore and offshore features based on 0.05 km range to AyM onshore boundary and 0.08 km range to AyM to the offshore boundary (Screening Report [Innogy, 2020a] and Update to Screening Annexes 1 and 2 Subsequent refinements to the onshore cable corridor mean the project is now 2.1 km distant and therefore direct habitat loss/disturbance will not occur nor will onshore effects (Innogy, 2020a). The effects on onshore hydrology and physical habitat loss/ disturbance and the Natterjack Toad feature have therefore been screened out of further assessment. However, this site is still screened in for offshore elements and following design refinements the site is now 21.0 km from the array area and 3.5 km from the offshore ECC.
- Dee Estuary/ Aber Dyfrdwy (UK) (England/ Wales]. Site screened in during Screening for onshore and offshore features based on 0.05 km range to AyM onshore boundary and 0.08 km range to AyM offshore boundary (Screening Report [Innogy, 2020a] and Update to Screening Annex 1). Subsequent refinements to the onshore cable corridor mean the project is now 2.1 km distant and therefore direct habitat loss/ disturbance will not occur nor will onshore effects (Innogy, 2020a). The effects on onshore hydrology and physical habitat loss/ disturbance have therefore been screened out of further assessment. However, this site is still screened in for offshore elements and following design refinements the site is now 20.9 km from the array area and 3.4 km from the offshore ECC.

58 In addition, further updates to screening have been made for grey seal. The Screening Report (Innogy, 2020a) for grey seal applied the (then) relevant MU; the Welsh MU. Comments were received on the Screening Report (Innogy, 2020a) as regards sites screened in, and Pembrokeshire Marine SAC was subsequently added (Annex 1), with no comments received on the MU applied or sites outside Welsh waters. Subsequently, NRW (2020) highlighted the need for a wider MU for grey seal, with ES (Volume 2, Chapter 7) duly applying 2 MUs in the assessment: the Welsh MU and adjacent north-west England MU (SCOS, 2020); and the wider OSPAR Region II: Celtic Seas MU (NRW, 2020).

59 To ensure complete screening for grey seal, potential connectivity with SACs outside Welsh waters is investigated in the ES (Volume 2, Chapter 7), specifically drawing on telemetry tracks from 23 grey seals; 22 of which were tagged in the West England and Wales MU, and 1 of which was tagged in the West Scotland MU. The 23 grey seals showed connectivity with the following grey seal SACs:

- Pen Llyn a`r Sarnau/ Lleyn Peninsula and the Sarnau (Wales);
- Cardigan Bay/ Bae Ceredigion (Wales);
- Pembrokeshire Marine/ Sir Benfro Forol (Wales);
- The Saltee Islands (Ireland); and
- Lambay Island (Ireland).

60 Of these, the two Irish sites are additional to the three Welsh sites previously screened in. For completeness, these two SACs (The Saltee Islands SAC and Lambay Island SAC) have been screened in for grey seal for underwater noise during construction and decommissioning.

61 Table 4 provides conclusions to the screening undertaken for AyM. For receptors excluding birds, Table 4 represents an update on the Screening presented in Annex 2, and therefore takes account of the updates noted in Section 6.1 above.

Table 4: Summary of potential for LSE for non-ornithology features.

DESIGNATED SITE	OVERLAP AND/ OR RANGE			FEATURE(S) SCREENED IN	POTENTIAL FOR LIKELY SIGNIFICANT EFFECT		
	ARRAY (KM)	ECR (KM)	ONSHORE ORDER LIMITS (KM)		CONSTRUCTION	O&M	DECOMMISSIONING
Y Fenai a Bae Conwy/ Menai Strait and Conwy Bay (UK) SAC	6.1	6.1	6.1	⅄ Sandbanks which are slightly covered by sea water all the time ⅄ Reefs ⅄ Large shallow inlets and bays ⅄ Submerged or partially submerged sea caves	⅄ Physical habitat loss/ disturbance ⅄ Suspended sediment and deposition ⅄ Pollution ⅄ Marine INNS ⅄ Changes to physical processes	⅄ Physical habitat loss/ disturbance ⅄ Suspended sediment and deposition ⅄ Pollution ⅄ Marine INNS ⅄ Electromagnetic Frequency (EMF) ⅄ Changes to physical processes	⅄ Physical habitat loss/ disturbance ⅄ Suspended sediment and deposition ⅄ Pollution ⅄ Marine INNS ⅄ Changes to physical processes
				⅄ Mudflats and sandflats not covered by seawater at low tide	⅄ Suspended sediment and deposition ⅄ Pollution ⅄ Marine INNS ⅄ Changes to physical processes	⅄ Suspended sediment and deposition ⅄ Pollution ⅄ Marine INNS ⅄ Changes to physical processes	⅄ Suspended sediment and deposition ⅄ Pollution ⅄ Marine INNS ⅄ Changes to physical processes
Liverpool Bay/ Bae Lerpwl (UK) SPA	0.1	0.0	0.0	⅄ Supporting habitat only (designated features addressed separately under offshore and intertidal ornithology, see Table 5). ⅄ The potential for effect is considered in the context of the designated features, taking account of the role of supporting habitat.			
The Dee Estuary (UK) SPA	21.0	3.5	2.1	⅄ Supporting habitat only (designated features addressed separately under offshore and intertidal ornithology, see Table 5). ⅄ The potential for effect is considered in the context of the designated features, taking account of the role of supporting habitat.			
Dee Estuary	21.0	3.5	2.1	⅄ Criterion 1: Extensive intertidal mud and sand flats with large expanses of saltmarsh	⅄ Suspended sediment and deposition ⅄ Pollution ⅄ INNS	⅄ Suspended sediment and deposition ⅄ Pollution ⅄ INNS ⅄ EMF	⅄ Suspended sediment and deposition ⅄ Pollution ⅄ INNS

DESIGNATED SITE	OVERLAP AND/ OR RANGE			FEATURE(S) SCREENED IN	POTENTIAL FOR LIKELY SIGNIFICANT EFFECT		
	ARRAY (KM)	ECR (KM)	ONSHORE ORDER LIMITS (KM)		CONSTRUCTION	O&M	DECOMMISSIONING
Ramsar[xii]					- Changes to physical processes	- Changes to physical processes	- Changes to physical processes
Dee Estuary/ Aber Dyfrdwy (UK) [England/ Wales] SAC	21.0	3.5	2.1	- Mudflats and sandflats not covered by seawater at low tide - *Salicornia* and other annuals colonizing mud and sand - Atlantic salt meadows (Glauco-Puccinellietalia maritimae) - Estuaries	- Suspended sediment/ deposition - Pollution - Marine INNS	- Suspended sediment/ deposition - Pollution - Marine INNS - EMF - Changes to physical processes	- Suspended sediment/ deposition - Pollution - Marine INNS
				- Sea lamprey - River lamprey	- Underwater noise - Suspended sediment and deposition - Pollution	- Pollution - EMF	- Underwater noise - Suspended sediment and deposition - Pollution
River Dee and Bala Lake/ Afon Dyfrdwy a Llyn Tegid SAC	46.1	27.7	26.1	- Atlantic salmon - Sea lamprey - River lamprey	- Underwater noise - Suspended sediment and deposition - Pollution	- Pollution - EMF	- Underwater noise - Suspended sediment and deposition - Pollution
North Anglesey Marine/ Gogledd Môn Forol (UK) SAC	23.5	30.8	22.6	- Harbour porpoise	- Underwater noise	- N/A	- Underwater noise
Bristol Channel Approaches/ Dynesfeydd Môr Hafren (UK) SAC	195.1	191.6	182.6	- Harbour porpoise	- Underwater noise	- N/A	- Underwater noise

xii Note – remaining Ramsar criteria (criterion 5 and 6) relate to birds and are addressed separately in the ornithological note

DESIGNATED SITE	OVERLAP AND/ OR RANGE			FEATURE(S) SCREENED IN	POTENTIAL FOR LIKELY SIGNIFICANT EFFECT		
	ARRAY (KM)	ECR (KM)	ONSHORE ORDER LIMITS (KM)		CONSTRUCTION	O&M	DECOMMISSIONING
Cardigan Bay/ Bae Ceredigion (UK) SAC	63.4	64.1	60.2	Grey seal Bottlenose dolphin	Underwater noise	N/A	Underwater noise
North Channel (UK) SAC	112.4	123.0	112.2	Harbour porpoise	Underwater noise	N/A	Underwater noise
Pen Llŷn a`r Sarnau/ Lleyn Peninsula and the Sarnau (UK) SAC	55.2	53.7	47.4	Bottlenose dolphin Grey seal	Underwater noise	N/A	Underwater noise
Rockabill to Dalkey Island SAC (IE) SAC	139.8	147.8	139.0	Harbour porpoise	Underwater noise	N/A	Underwater noise
West Wales Marine/ Gorllewin Cymru Forol (UK) SAC	72.2	75.7	71.7	Harbour porpoise	Underwater noise	N/A	Underwater noise
Pembrokeshire Marine SAC	189.7	191.3	185.1	Grey seal	Underwater noise	N/A	Underwater noise
The Saltee Islands (Ireland)	226.8	231.3	226.2	Grey seal	Underwater noise	N/A	Underwater noise
Lambay Island (Ireland).	141.2	149.1	140.3	Grey seal	Underwater noise	N/A	Underwater noise
Nord Bretagne DH (FR) SAC	412.3	400.4	391.3	Harbour porpoise	Underwater noise	N/A	Underwater noise
Roaringwater Bay and Islands SAC (IE) SAC	430.9	436.4	430.1	Harbour porpoise	Underwater noise	N/A	Underwater noise

DESIGNATED SITE	OVERLAP AND/ OR RANGE			FEATURE(S) SCREENED IN	POTENTIAL FOR LIKELY SIGNIFICANT EFFECT		
	ARRAY (KM)	ECR (KM)	ONSHORE ORDER LIMITS (KM)		CONSTRUCTION	O&M	DECOMMISSIONING
Récifs et landes de la Hague (FR) SAC	425.9	410.9	402.3	Harbour porpoise	Underwater noise	N/A	Underwater noise
Anse de Vauville (FR) SAC	434.8	419.9	411.3	Harbour porpoise	Underwater noise	N/A	Underwater noise
Banc et récifs de Surtainville (FR) SAC	454.5	439.7	431.1	Harbour porpoise	Underwater noise	N/A	Underwater noise
Blasket Islands SAC (IE) SAC	468.7	475.3	467.9	Harbour porpoise	Underwater noise	N/A	Underwater noise
Tregor Goëlo (FR) SAC	486.8	476.0	466.7	Harbour porpoise	Underwater noise	N/A	Underwater noise
Côte de Granit rose-Sept-Iles (FR) SAC	486.8	476.0	466.7	Harbour porpoise	Underwater noise	N/A	Underwater noise
Mers Celtiques - Talus du golfe de Gascogne (FR) SAC	505.3	502.3	493.3	Harbour porpoise	Underwater noise	N/A	Underwater noise
Chausey (FR) SAC	506.2	491.6	483.0	Harbour porpoise	Underwater noise	N/A	Underwater noise
Cap d'Erquy-Cap Fréhel (FR) SAC	511.4	498.1	489.2	Harbour porpoise	Underwater noise	N/A	Underwater noise
Baie de Morlaix (FR) SAC	512.1	502.5	493.2	Harbour porpoise	Underwater noise	N/A	Underwater noise

* Note that additional feature(s) may be included within the designation; however, those detailed here are limited to the habitat and/ or species screened in for LSE. All feature(s) are included within the Screening Matrix.

6.2 Ornithological Screening Update

62 In June 2020, RWE Renewables UK Limited submitted a HRA Screening Report of European Designated Sites for the proposed AyM offshore wind farm to relevant interested stakeholders.

63 The AyM HRA Screening Report used a series of criteria to identify impact pathways and screen SPAs and Ramsar sites into Stage 2 of the HRA process (the AA). The following Criteria were used:

- Criteria 1A – European site(s) within the search area;
- Criteria 1B – European site(s) with supporting, or functionally linked habitat located within the search area;
- Criteria 2 – European site(s) for qualifying mobile species whose range (e.g. foraging, migratory, overwintering, breeding or natural habitat range) may interact with the Project's sphere of influence;
- Criteria 3 – European site(s) with a feature located within the potential range of a Project-effect. Hydrological connectivity (onshore) or indirect linkages could extend this range; and
- Criteria 4 – European site(s) for qualifying species recorded during site specific surveys.

64 Criterion 2 focused on identifying potential connectivity between breeding seabird colonies at SPAs and Ramsar sites and AyM. Foraging ranges presented in Woodward *et al*. (2019) were used to identify those colonies within range of the Project, based on a multi-colony analysis of species-specific values. The mean-maximum range was used from the Woodward *et al*. (2019) review as it provides the average across the maximum foraging distance for each colony included within the study. This is therefore highly precautionary as it used the maximum range as a basis of the calculation for each species and, was deemed appropriate in identifying potential for LSE. Screening for Criteria 2 is based on birds travelling around major land masses as it is unlikely that birds would travel across land in order to forage offshore.

65 During consultation, Statutory Nature Conservation Bodies (JNCC and NRW) advised that in the absence of official guidance on how to interpret the values presented in Woodward *et al*. (2019), the standard deviation of the mean-maximum foraging ranges should be used. As a result, HRA screening was re-run for ornithological receptors, to incorporate the standard deviation for each of the species-specific foraging ranges (mean maximum foraging range + 1 standard deviation (Mean Max +1 SD), as presented in Woodward *et al*. (2019)).

66 Additionally, upon completion of the updated screening using mean maximum foraging range +1 standard deviation (Woodward *et al*., 2019), NRW requested additional sites to be included in the Stage 2 assessment (Table 1). The final offshore ornithology screening is presented in Annex 2 (application ref: 5.2.2).

6.2.1 Confirmed Screening for the Project Alone

67 For ornithological receptors, Table 5 summarises the screening conclusions outlined in Annex 2. It should be noted that the tables include only those sites, features and effects where potential for LSE has been identified; the reasoning for no LSE is presented in the original Screening Report (Innogy, 2020a) as updated in Annex 2. Table 4 and Table 5 therefore include all changes and updates to screening to December 2020 and provides the basis for the subsequent Stage 2 assessment.

Table 5: Summary of potential for LSE for ornithology features (distances presented are calculated across land, however screening for Criteria 2 only considers those breeding seabirds within foraging range when travelling around major land masses).

DESIGNATED SITE	OVERLAP AND/OR RANGE (KM)			FEATURE(S) SCREENED IN	POTENTIAL FOR LIKELY SIGNIFICANT EFFECT		
	ARRAY	ECC	ORDER LIMITS		CONSTRUCTION	O&M	DECOMMISSIONING
Liverpool Bay/ Bae Lerpwl (UK) SPA	0.1	0.0	0.0	Common scoter (non-breeding) Red-throated diver (non-breeding)	Direct disturbance and displacement	Direct disturbance and displacement Barrier effect	Direct disturbance and displacement
				Red-breasted merganser (non-breeding)*	Direct disturbance and displacement	Direct disturbance and displacement Barrier effect Risk of collision on migration	Direct disturbance and displacement
				Common tern (passage) Little tern (passage)	No LSE	Risk of collision on migration	No LSE
				Little gull (non-breeding)	No LSE	Risk of collision	No LSE
The Dee Estuary (UK) SPA (offshore)	21.0	3.5	2.2	Sandwich tern (passage)	No LSE	Risk of collision on migration Barrier effect Direct disturbance and displacement	No LSE
				Common tern (passage) Little tern Bar-tailed godwit Redshank Shelduck Teal Pintail Oystercatcher Grey plover Knot Dunlin	No LSE	Risk of collision on migration	No LSE

DESIGNATED SITE	OVERLAP AND/OR RANGE (KM)			FEATURE(S) SCREENED IN	POTENTIAL FOR LIKELY SIGNIFICANT EFFECT		
	ARRAY	ECC	ORDER LIMITS		CONSTRUCTION	O&M	DECOMMISSIONING
				- Black-tailed godwit - Curlew - Waterbird assemblage			
The Dee Estuary (UK) SPA (onshore)	26.2	13.0	11.6	- Little tern - Sandwich tern - Bar-tailed godwit - Redshank (wintering and passage) - Shelduck - Teal - Pintail - Oystercatcher - Grey plover - Knot - Dunlin - Black-tailed godwit - Curlew - Waterbird assemblage	- Visual and/ or noise disturbance to species	- Visual and/ or noise disturbance to species - Risk of collision on migration	- Visual and/ or noise disturbance to species
Dee Estuary (UK) Ramsar	21.0	3.5	2.2	- Redshank (wintering and passage) - Shelduck - Teal - Pintail - Oystercatcher - Grey plover - Knot - Dunlin - Black-tailed godwit - Curlew - Bar-tailed godwit	- Visual and/ or noise disturbance to species (onshore)	- Visual and/ or noise disturbance to species (onshore) - Risk of collision during migration (offshore)	- Visual and/ or noise disturbance to species (onshore)

DESIGNATED SITE	OVERLAP AND/OR RANGE (KM)			FEATURE(S) SCREENED IN	POTENTIAL FOR LIKELY SIGNIFICANT EFFECT		
	ARRAY	ECC	ORDER LIMITS		CONSTRUCTION	O&M	DECOMMISSIONING
				- Waterbird assemblage			
Anglesey Terns/ Morwenoliaid Ynys Mon (UK) SPA	15.2	19.7	14.8	- Sandwich tern (breeding and passage)	- No LSE	- Direct disturbance and displacement - Risk of collision - Barrier effect	- No LSE
				- Roseate tern (breeding and passage)	- No LSE	- Direct disturbance and displacement - Risk of collision - Barrier effect	- No LSE
				- Common tern (breeding and passage) - Arctic tern (breeding and passage)	- No LSE	- Risk of collision (screened in on a precautionary basis as requested) - Barrier effect (screened in on a precautionary basis as requested)	-
Ribble and Alt Estuaries (UK) SPA	30.8	29.6	28.8	- Lesser black-backed gull (breeding and non-breeding)	- No LSE	- Risk of collision	- No LSE
Ribble and Alt Estuaries (UK) Ramsar	30.8	29.6	28.8	- Lesser black-backed gull (breeding and non-breeding)	- No LSE	- Risk of collision	- No LSE
Morecambe Bay and Duddon Estuary (UK) SPA	58.7	65.3	58.7	- Lesser black-backed gull (breeding and non-breeding) - Herring gull (breeding and non-breeding) - Great black-backed gull (breeding and non-breeding)	- No LSE	- Risk of collision	- No LSE
Morecambe Bay (UK)Ramsar	58.7	65.3	58.7	- Herring gull (breeding and non-breeding) - Lesser black-backed gull (breeding and non-breeding)	- No LSE	- Risk of collision	- No LSE

DESIGNATED SITE	OVERLAP AND/OR RANGE (KM)			FEATURE(S) SCREENED IN	POTENTIAL FOR LIKELY SIGNIFICANT EFFECT		
	ARRAY	ECC	ORDER LIMITS		CONSTRUCTION	O&M	DECOMMISSIONING
Bowland Fells (UK) SPA and pSPA	76.8	81.3	80.6	Lesser black-backed gull (breeding and non-breeding)	No LSE	Risk of collision	No LSE
Lambay Island (IE) SPA	141.2	149.1	140.3	Kittiwake (breeding) Lesser black-backed gull (breeding)	No LSE	Risk of collision	No LSE
				Guillemot (breeding) Razorbill (breeding) Puffin (breeding)	Direct disturbance and displacement	Direct disturbance and displacement	Direct disturbance and displacement
Ailsa Craig (UK) SPA	209.1	217.9	209.0	Lesser black-backed gull (breeding and non-breeding) Kittiwake (breeding and non-breeding)*	No LSE	Risk of collision	No LSE
				Gannet (breeding and non-breeding)	Direct disturbance and displacement	Direct disturbance and displacement Risk of collision	Direct disturbance and displacement
Ireland's Eye (IE) SPA	145.8	153.3	144.7	Kittiwake (breeding)	No LSE	Risk of collision	No LSE
				Guillemot (breeding) Razorbill (breeding)	Direct disturbance and displacement	Direct disturbance and displacement	Direct disturbance and displacement
Howth Head Coast (IE) SPA	145.0	152.5	144.0	Kittiwake (breeding)	No LSE	Risk of collision	No LSE
Wicklow Head (IE) SPA	152.0	158.3	151.2	Kittiwake (breeding)	No LSE	Risk of collision	No LSE
Glannau Aberdaron ac Ynys Enlli/ Aberdaron Coast and Bardsey Island (UK) SPA	88.5	91.7	88.1	Manx shearwater (breeding and non-breeding)	Screened in on a precautionary basis for displacement as requested (Table 1)	Screened in on a precautionary basis for displacement as requested (Table 1)	Screened in on a precautionary basis for displacement as requested (Table 1)

DESIGNATED SITE	OVERLAP AND/OR RANGE (KM)			FEATURE(S) SCREENED IN	POTENTIAL FOR LIKELY SIGNIFICANT EFFECT		
	ARRAY	ECC	ORDER LIMITS		CONSTRUCTION	O&M	DECOMMISSIONING
Copeland Islands (UK) SPA	168.9	181.0	200.8	Manx shearwater (breeding and non-breeding)	Screened in on a precautionary basis for displacement as requested (Table 1)	Screened in on a precautionary basis for displacement as requested (Table 1)	Screened in on a precautionary basis for displacement as requested (Table 1)
Skomer, Skokholm and the Seas off Pembrokeshire/ Sgomer, Sgogwm a Moroedd Penfro (UK) SPA	207.9	209.3	202.5	Kittiwake (breeding and non-breeding)*	No LSE	Risk of collision	No LSE
				Lesser black-backed gull (breeding and non-breeding)	No LSE	Screened in on a precautionary basis for risk of collision as requested (Table 1)	No LSE
				Puffin (breeding)	Direct disturbance and displacement	Direct disturbance and displacement	Direct disturbance and displacement
				Manx shearwater (breeding and non-breeding) Guillemot (non-breeding)* Razorbill (non-breeding)*	Screened in on a precautionary basis for displacement as requested (Table 1)	Screened in on a precautionary basis for displacement as requested (Table 1)	Screened in on a precautionary basis for displacement as requested (Table 1)
				Storm petrel	Screened in on a precautionary basis as requested (Table 1)	Screened in on a precautionary basis as requested (Table 1)	Screened in on a precautionary basis as requested (Table 1)
Rathlin Island (UK) SPA	246.9	257.4	246.8	Puffin (breeding)*	Direct disturbance and displacement	Direct disturbance and displacement	Direct disturbance and displacement
Saltee Islands (IE) SPA	233.2	237.7	232.6	Kittiwake (breeding) Lesser black-backed gull (breeding)	No LSE	Risk of collision	No LSE
				Puffin (breeding)	Direct disturbance and displacement	Direct disturbance and displacement	Direct disturbance and displacement
Wexford Harbour and Slobs (IE) SPA	206.2	211.0	205.5	Lesser black-backed gull (breeding)	No LSE	Risk of collision	No LSE
Helvick Head to	291.9	297.1	291.2	Kittiwake (breeding)	No LSE	Risk of collision	No LSE

DESIGNATED SITE	OVERLAP AND/OR RANGE (KM)			FEATURE(S) SCREENED IN	POTENTIAL FOR LIKELY SIGNIFICANT EFFECT		
	ARRAY	ECC	ORDER LIMITS		CONSTRUCTION	O&M	DECOMMISSIONING
Ballyquin (IE) SPA							
Grassholm (UK) SPA	217.6	219.4	214.1	- Gannet (breeding)	- Direct disturbance and displacement	- Direct disturbance and displacement - Risk of collision	- Direct disturbance and displacement
Ynys Seiriol/ Puffin Island (UK) SPA	17.3	21.3	17.03	- Cormorant	- Screened in on a precautionary basis as requested (Table 1)	- Screened in on a precautionary basis as requested (Table 1)	- Screened in on a precautionary basis as requested (Table 1)
Traeth Lafan/ Layan Sands, Conway Bay (UK) SPA	21.3	22.8	21.3	- Oystercatcher - Curlew - Great crested grebe - Red-breasted merganser	- No LSE	- Risk of collision on migration	- No LSE
Dyfi Estuary/ Aber Dyfi (UK) SPA	95.2	90.0	80.7	- Greenland white-fronted goose	- No LSE	- Risk of collision on migration	- No LSE
Burry Inlet (UK) SPA	195.7	190.0	180.6	- Shelduck - Wigeon - Teal - Pintail - Shoveler - Oystercatcher - Grey plover - Knot - Dunlin - Curlew - Redshank - Turnstone - Waterbird assemblage	- No LSE	- Risk of collision on migration	- No LSE

DESIGNATED SITE	OVERLAP AND/OR RANGE (KM)			FEATURE(S) SCREENED IN	POTENTIAL FOR LIKELY SIGNIFICANT EFFECT		
	ARRAY	ECC	ORDER LIMITS		CONSTRUCTION	O&M	DECOMMISSIONING
Burry Inlet (UK) Ramsar	195.7	190.0	180.6	Pintail Oystercatcher Knot Redshank Waterbird assemblage	No LSE	Risk of collision on migration	No LSE
Severn Estuary (UK) SPA	204.7	187.3	179.5	Bewick's swan Dunlin Gadwall Greater white-fronted goose Redshank Shelduck Waterbird assemblage	No LSE	Risk of collision on migration	No LSE
Severn Estuary (UK) Ramsar	204.7	187.3	179.5	Bewick's swan Dunlin Gadwall Greater white-fronted goose Redshank Shelduck Pintail Teal Ringed plover Waterbird assemblage	No LSE	Risk of collision on migration	No LSE

*Assemblage feature only

7 The screening process for the project in-combination

7.1 Overview to in-combination screening

68 Regulation 63 of the Habitats Regulations includes a requirement for the Competent Authority to make the AA alone and/ or in-combination with other plans or projects, where these are not directly connected with or necessary to the management of the site. Screening for the project alone is summarised in Section 6, with screening for the project in-combination being provided here.

69 For screening, there is a presumption that where potential for LSE has been identified for the project alone, then potential LSE in-combination applies. Consideration has also been given to the potential for LSE in-combination even where the project alone was insufficient to trigger the threshold for potential LSE; however given the precautionary approach that has been taken to screening alone, no such instances have been identified either by the project or through consultation.

70 Where potential LSE in-combination has been identified, it follows that relevant plans and projects need to be identified as it is these that would need to be considered in-combination with AyM within the Stage 2 assessment. The legislation does not provide a definition of alone or in-combination. The following (not exhaustive) list has been applied to AyM when identifying plans and projects for consideration in-combination:

- Permitted ongoing activities, such as discharge consents and abstraction licences;
- Approved or consented plans which have not yet been completed;
- Plans and projects where the application for consent has been submitted but has not yet been approved by the competent authorities; and

- Plans and projects which are reasonably foreseeable, i.e. projects for which an application has not yet been submitted, but which are likely to progress before completion of the development being assessed and for which sufficient information is available to adequately assess the likelihood of cumulative and in-combination effects.

71 A full review of such plans and projects has been conducted for AyM and reported in Volume 1, Annex 3.1: Cumulative Effects Assessment Methodology (application ref: 6.1.3.1). Each individual topic chapter for the ES has screened the full list of projects, plans and activities for consideration, to identify those relevant to individual receptor groups. The relevant plan/ project screening tables to the receptor groups within the RIAA are presented within the ES chapters as follows:

- Table 39 within Volume 2, Chapter 4;
- Table 18 within Volume 2, Chapter 5;
- Table 29 within Volume 2, Chapter 6;
- Table 38 within Volume 2, Chapter 7; and
- Table 16 within Volume 3, Chapter 5.

72 In addition, through consultation (see Table 1) additional plans and projects have been highlighted. Of note are the Wylfa Newydd and the proposed tidal lagoon in the Dee. Of these, Wylfa Newydd has not been included in-combination as a result of the withdrawal of the DCO application. Similarly, the River Dee tidal lagoon project has also been excluded as there is no planning information available in the public domain on which basis an assessment could be undertaken.

73 With respect to in-combination effects within the HRA process, the Screening Report (Innogy, 2020a) identified the broad categories of plans and projects to be considered within this RIAA. The specific plans and projects relevant to individual receptors draw on those identified within the individual ES chapters, as highlighted above. For the RIAA, for an in-combination effect to occur there needs to be potential for a spatial and or temporal overlap of effect between AyM and one or more of the identified plans and projects.

74 The determination of LSE in-combination takes into account the following:

- Level of detail available for project/ plans;
- Potential for an effect-pathway-receptor link;

- Potential for a physical interaction; and
- Potential for temporal interaction.

75 As is typical for an in-combination assessment, for many plans and projects there is uncertainty regarding project design and timeframe but also quantified environmental impacts. For this reason, in common with the ES, a tiered approach has been applied to the in-combination assessment. These 'tiers' reflect the current stage of the plan or project within the planning and development process and allows the assessment to consider several future development scenarios, each with a differing potential for being ultimately built out. Appropriate weight may therefore be given to each scenario (tier) in the decision-making process when considering the potential in-combination impact associated with AyM.

76 The tier structure is intended to ensure that there is a clear understanding of the level of confidence in the in-combination assessment within the RIAA. The tiers and sub-tiers (ornithology only) presented in Table 6apply to all receptors apart from marine mammals, which are presented separately in Table 7. The proposed tier structure for marine mammals is different to that presented for the other receptors in Table 6 due to the need to take into account greater levels of uncertainty in the degree and timing of overlap of activities which will generate significant levels of underwater noise during the construction phase of projects. This is the established approach for marine mammal assessments and has been accepted by stakeholders via the Evidence Plan process (application ref: 8.2) and used in the most recent offshore wind farm EIAs in UK waters (for example: Hornsea Project Four ES Volume 2 Chapter 4, Norfolk Vanguard ES Volume 1 Chapter 12 and East Anglia Three ES Volume 1 Chapter 12).

Table 6: Description of tiers and sub-tiers of other developments considered for all receptors (except marine mammals) in-combination assessment (adapted from PINS Advice Note 17, PINS, 2019).

TIER	ORNITHOLOGY SUB-TIER	DESCRIPTION
Tier 1	Tier 1a	Projects in operation
	Tier 1b	Projects under construction.
	Tier 1c	Permitted applications, whether under the Planning Act 2008 or other regimes, but not yet implemented.
	Tier 1d	Submitted applications, whether under the Planning Act 2008 or other regimes, but not yet determined.
Tier 2	N/A	Projects on the Planning Inspectorate's Programme of Projects where a Scoping Report has been submitted as well as projects that have applied for a Marine Licence from NRW (or the Marine Management Organisation (MMO) or Marine Scotland as appropriate).
Tier 3	Tier 3a	Projects on the Planning Inspectorate's Programme of Projects where a Scoping Report has not been submitted.
	Tier 3b	Identified in the relevant Development Plan (and emerging Development Plans with appropriate weight being given as they move closer to adoption) recognising that much information on any relevant proposals will be limited.
	Tier 3c	Identified in other plans and programmes (as appropriate) which set the framework for future development consents/ approvals, where such development is reasonably likely to come forward.

Table 7: Description of tiers of other developments considered within the marine mammal receptor in combination assessment.

TIER	DESCRIPTION
Tier 1	Projects in operation or under construction which were not in place when baseline data was collected. Projects with a legally secure consent (i.e. projects which are not on hold subject to an ongoing judicial review process) that have been awarded a Contract for Difference (CFD) but have not yet been implemented. All other Tier 1 projects that were operational or ongoing at the time of the baseline data collection have been screened out of the assessment.
Tier 2	Projects that have a legally secure consent but have no CFD therefore there is uncertainty about the timeline for construction of these projects.
Tier 3	Projects for which an application has been submitted, but not yet determined.
Tier 4	Projects that the regulatory body are expecting to be submitted for determination and for projects for which Preliminary Environmental Information Report (PEIR) has been submitted, but a full ES has not yet been submitted.
Tier 5	Projects that the regulatory body are expecting to be submitted for determination (e.g. projects listed under the Planning Inspectorate programme of projects). Projects that have low data confidence and no established timeline are screened out of assessment.

7.2 Subtidal and intertidal benthic ecology

77 Following the assumption that where potential for LSE applies alone it similarly applies in-combination, the initial step to screening for plans and projects in-combination for subtidal and intertidal benthic ecology receptors is to identify those located within sufficient proximity to the relevant designated sites (based on a receptor-specific screening range).

78 For subtidal and intertidal benthic ecology, the full list of plans and projects identified for cumulative assessment within Volume 2, Chapter 5 of the ES are provided within Table 18 of that chapter. For the purposes of the RIAA, these have been filtered, through the use of a Geographical Information System (GIS), to identify those plans and projects located within 12 km of the designated sites screened in for potential LSE for benthic habitats in Table 8 (applying the maximum project specific screening range applied in Volume 2, Chapter 5 of the ES.

79 For the plans and projects highlighted as being within sufficient proximity to one or more sites screened in for benthic habitats, it is considered that there is potential for LSE in-combination with AyM. The potential for such an effect will vary, depending on parameters such as the timing of works and the nature of those works, with these to be considered in full in the determination of AEoI.

Table 8: Plans and projects to assess in-combination for subtidal and intertidal benthic ecology.

DESIGNATED SITE	BENTHIC FEATURE(S) SCREENED IN	PLANS AND PROJECTS WITHIN 12 KM	TIER
Liverpool Bay SPA	- Supporting habitat only (designated features addressed separately under offshore and intertidal ornithology).	- OWFs (GyM, Rhyl Flats, and North Hoyle); - OWF Export Cables (GyM OWF OFTO, Rhyl Flats, and North Hoyle); - Aggregate Exploration and Option Area - Liverpool Bay (1808); - Aggregate Production Areas (Hilbre Swash (392 and 393) and Liverpool Bay (457)); - Geo-Eirgrid (East West Interconnector) interconnector cable; - Western High Voltage Direct Current (HVDC) Link telecommunications cable;	- 1

DESIGNATED SITE	BENTHIC FEATURE(S) SCREENED IN	PLANS AND PROJECTS WITHIN 12 KM	TIER
		- Pipelines (DD-POA Gas Export (PL1030), POA-DD Methanol (PL1033), POA-DD Condensate (PL1032), Conwy to Douglas Oil Export (PL2939), Douglas to Conwy Water Injection (PL2940), Douglas to Conwy Condensate Injection (PL2941), Douglas to Conwy Umbilical (PLU2942), Douglas to CACM (PL1031), Hamilton to Douglas Gas Line (PL1039), Hamilton North to Douglas Gas Line (PL1041), Douglas to Hamilton North (PL1042), Douglas to Lennox Gas Line (PL1036A), Lennox to Douglas Gas Line (PL1035), Douglas to Lennox Chemical Line (PL1037), Douglas to Hamilton (PL1040), and Douglas to Lennox Chemical Line (PL1038)); - Oil and Gas projects (Douglas DA, Douglas DP, and Douglas DW); and - Outfall pipes (MTF_INDUSTRIAL.23044, and MTF_INDUSTRIAL.23045).	
Dee Estuary SPA	- Supporting habitat only (designated features addressed separately under offshore and intertidal ornithology).	- OWFs (GyM, and North Hoyle); - OWF Export Cables (GyM OWF OFTO, Rhyl Flats, and North Hoyle);	- 1

DESIGNATED SITE	BENTHIC FEATURE(S) SCREENED IN	PLANS AND PROJECTS WITHIN 12 KM	TIER
Dee Estuary Ramsar	- Extensive intertidal mud and sand flats with large expanses of saltmarsh.	- Aggregate Production Areas (Hilbre Swash (392 and 393)); - Geo-Eirgrid (East West Interconnector) interconnector cable; - Western HVDC Link telecommunications cable; and - Pipelines (DD-POA Gas Export (PL1030), POA-DD Methanol (PL1033), POA-DD Condensate (PL1032)).	
Dee Estuary SAC	- Mudflats and sandflats not covered by seawater at low tide; - *Salicornia* and other annuals colonizing mud and sand; - Atlantic salt meadows (Glauco-Puccinellietalia maritimae); and - Estuaries.		
Menai Strait and Conwy Bay SAC	- Sandbanks which are slightly covered by sea water all the time - Reefs - Large shallow inlets and bays - Submerged or partially submerged sea caves	- OWFs (GyM, Rhyl Flats and North Hoyle); - OWF Export Cables (GyM OWF OFTO, and Rhyl Flats); - Geo-Rirgrid (East West Interconnector) interconnector cable; and - Outfall pipes (MTF_INDUSTRIAL.23044, and MTF_INDUSTRIAL.23045).	- 1

DESIGNATED SITE	BENTHIC FEATURE(S) SCREENED IN	PLANS AND PROJECTS WITHIN 12 KM	TIER
	- Mudflats and sandflats not covered by seawater at low tide		

7.3 Marine mammals

80 Screening in-combination for marine mammals similarly aims to identify plans and projects located within sufficient proximity to the relevant designated site(s) to contribute to an in-combination effect with AyM. Screening for marine mammals applied a Management Unit (MU) approach in the Screening Report (Innogy, 2020a), with plans and projects to consider in-combination therefore identified from within the same MUs. That approach has also been applied within Volume 2, Chapter 7: Marine Mammals (application ref: 6.2.7). Therefore, the same list of plans and projects applied for the CEA in the ES are also applied here, as relevant to the species screened into the RIAA. The notable exception is where ongoing seismic survey work has been identified in the ES. The assessment presented in the RIAA is focused on future plans and projects and not ongoing activity and therefore only includes seismic surveys where there are publicly available plans for that to be undertaken. No such surveys have been identified.

81 Following the approach presented in Volume 2, Chapter 7: Marine Mammals (application ref: 6.2.7), the long list of projects was refined to remove all projects that have:

- no data available,
- no timeline available,
- no conceptual effect-receptor pathway,
- no physical effect-receptor overlap, and
- no temporal overlap.

82 The conclusions of that screening are provided in Table 4.

83 For the plans and projects highlighted as being within the same MU as one or more sites screened in for marine mammals, it is considered that there is potential for LSE in-combination with AyM. The potential for such an effect will vary, depending on parameters such as the timing of works and the nature of those works; timing of works is particularly important for underwater noise, with that taken into account in Volume 2, Chapter 7: Marine Mammals (application ref: 6.2.7). The nature of the works are then considered in full in the determination of AEoI.

Table 9: Plans and projects to assess in-combination for marine mammals.

DESIGNATED SITE	MARINE MAMMAL FEATURE(S) SCREENED IN	PLANS AND PROJECTS WITHIN RELEVANT MU	TIER
North Anglesey Marine/ Gogledd Môn Forol (UK) SAC	- Harbour Porpoise - (Celtic and Irish Sea MU)	- North Hoyle OWF - Dublin Array - Arklow Bank Phase 2 - WestWave Demo	- 1 - 5 - 5 - 2
Bristol Channel Approaches/ Dynesfeydd Môr Hafren (UK) SAC	- Harbour Porpoise - (Celtic and Irish Sea MU)	- North Hoyle OWF - Dublin Array - Arklow Bank Phase 2 - WestWave Demo	- 1 - 5 - 5 - 2
North Channel (UK) SAC	- Harbour Porpoise - (Celtic and Irish Sea MU)	- North Hoyle OWF - Dublin Array - Arklow Bank Phase 2 - WestWave Demo	- 1 - 5 - 5 - 2
West Wales Marine/ Gorllewin Cymru Forol (UK) SAC	- Harbour Porpoise - (Celtic and Irish Sea MU)	- North Hoyle OWF - Dublin Array - Arklow Bank Phase 2 - WestWave Demo	- 1 - 5 - 5 - 2
Transboundary	- Harbour Porpoise	- North Hoyle OWF	- 1

DESIGNATED SITE	MARINE MAMMAL FEATURE(S) SCREENED IN	PLANS AND PROJECTS WITHIN RELEVANT MU	TIER
Sites (21 sites)	(Celtic and Irish Sea MU)	Dublin Array Arklow Bank Phase 2 WestWave Demo	5 5 2
Cardigan Bay/ Bae Ceredigion (UK) SAC	Bottlenose Dolphin and grey seal (Irish Sea MU and OSPAR Region III MU)	North Hoyle OWF Dublin Array Arklow Bank Phase 2 WestWave Demo	1 5 5 2
Pen Llŷn a`r Sarnau/ Lleyn Peninsula and the Sarnau (UK) SAC	Bottlenose dolphin and grey seal	North Hoyle OWF Dublin Array Arklow Bank Phase 2 WestWave Demo (Irish Sea MU and OSPAR Region III MU)	1 5 5 2
Pembrokeshire Marine SAC	Grey Seal (OSPAR Region III MU)	North Hoyle OWF Dublin Array Arklow Bank Phase 2 WestWave Demo	1 5 5 2
The Saltee Islands (Ireland) SAC	Grey Seal (OSPAR Region III MU)	North Hoyle OWF Dublin Array Arklow Bank Phase 2	1 5 5

DESIGNATED SITE	MARINE MAMMAL FEATURE(S) SCREENED IN	PLANS AND PROJECTS WITHIN RELEVANT MU	TIER
		- WestWave Demo	- 2
Lambay Island (Ireland) SAC	- Grey Seal - (OSPAR Region III MU)	- North Hoyle OWF - Dublin Array - Arklow Bank Phase 2 - WestWave Demo	- 1 - 5 - 5 - 2

7.4 Offshore and Intertidal Ornithology

84 Screening in-combination for offshore and intertidal ornithology similarly aims to identify plans and projects located within sufficient proximity to the relevant designated site(s) to contribute to an in-combination effect with AyM.

85 For the plans and projects highlighted as being within the mean-maximum foraging range plus 1SD as one or more sites screened in for offshore and intertidal ornithology, it is considered that there is potential for LSE in-combination with AyM. The potential for such an effect will vary, depending on parameters such as the timing of works and the nature of those works, with these considered in full in the determination of AEoI.

86 For offshore and intertidal ornithology, the screening process alone has been undertaken on an extremely precautionary basis. While there remains a presumption that where potential for LSE alone applies then assessment alone and in-combination will follow, prior to the in-combination assessment a brief review of the conclusions from the assessment alone will be made. Specifically for the following reasons:

- Where the assessment alone concludes a zero contribution from AyM to an effect, it therefore follows that there can be no contribution from AyM to any in-combination effect and no further assessment is required. All such cases are clearly documented at the start of Section 11.
- Where the assessment alone concludes a <1 individual contribution from AyM to an effect, a reasoned judgment is taken to the potential for any contribution to an in-combination effect. That will consider the contribution by other plans and projects, the inconsequential nature of such an effect, the error margins of the assessment, the population of the species at that site and the change in baseline mortality predicted to result. All such cases are clearly documented at the start of Section 11.
- Where the assessment alone concludes a >1 individual contribution to an in-combination effect, the level of detail in subsequent in-combination assessment will be informed by the potential contribution by AyM to any such effect and the significance of the effect alone.

87 Due to the novel approach of using mean-maximum foraging range + 1SD for the in-combination assessment, there are significant numbers of windfarms considered in-combination for each SPA feature screened in for in-combination. The assessment can be found in Section 11.3 of this report and Table 40 and Table 41 shows the windfarms considered in-combination with each screened in SPA feature.

7.5 Onshore Ecology

88 As noted in Section 6.1 above, all onshore ecology sites and features have been screened out of the assessment and therefore there can be no contribution to any in-combination effect from AyM. No assessment is therefore required.

7.6 Migratory Fish

89 Following the assumption that where potential for LSE applies alone it similarly applies in-combination, the initial step to screening for plans and projects in-combination for migratory fish receptors is to identify those located within sufficient proximity to the relevant designated sites (based on a receptor specific screening range).

90 For migratory fish, the full list of plans and projects identified for cumulative assessment within Volume 2, Chapter 6 of the ES are provided within Table 29 of that chapter. For the purposes of the RIAA, these have been filtered, through the use of a GIS, to identify those plans and projects located within the screening range of the designated sites screened in for potential LSE for migratory fish in Table 10 (applying the maximum project specific screening range applied in the original Screening Report (Innogy, 2020a)). It should be noted that the relevant range for migratory fish may not be from the SAC itself but the point of access, i.e. the estuary mouth. For migratory fish, two screening ranges have been used for different impacts:

- For underwater noise impacts, a highly precautionary 100 km range has been used due to the large areas over which this impact could act; and
- For other impacts (i.e. noise, EMF, etc.), a 12 km range, based on the physical processes modelling and the predicted effect area over which AyM could contribute to any in-combination effects.

91 The conclusions of that screening are provided in Table 4 and Table 10.

92 For the plans and projects highlighted as being within sufficient proximity to one or more sites screened in for migratory fish, it is considered that there is potential for LSE in-combination with AyM. The potential for such an effect will vary, depending on parameters such as the timing of works and the nature of those works, with these to be considered in the determination of AEoI.

Table 10: Plans and projects to assess in-combination for migratory fish.

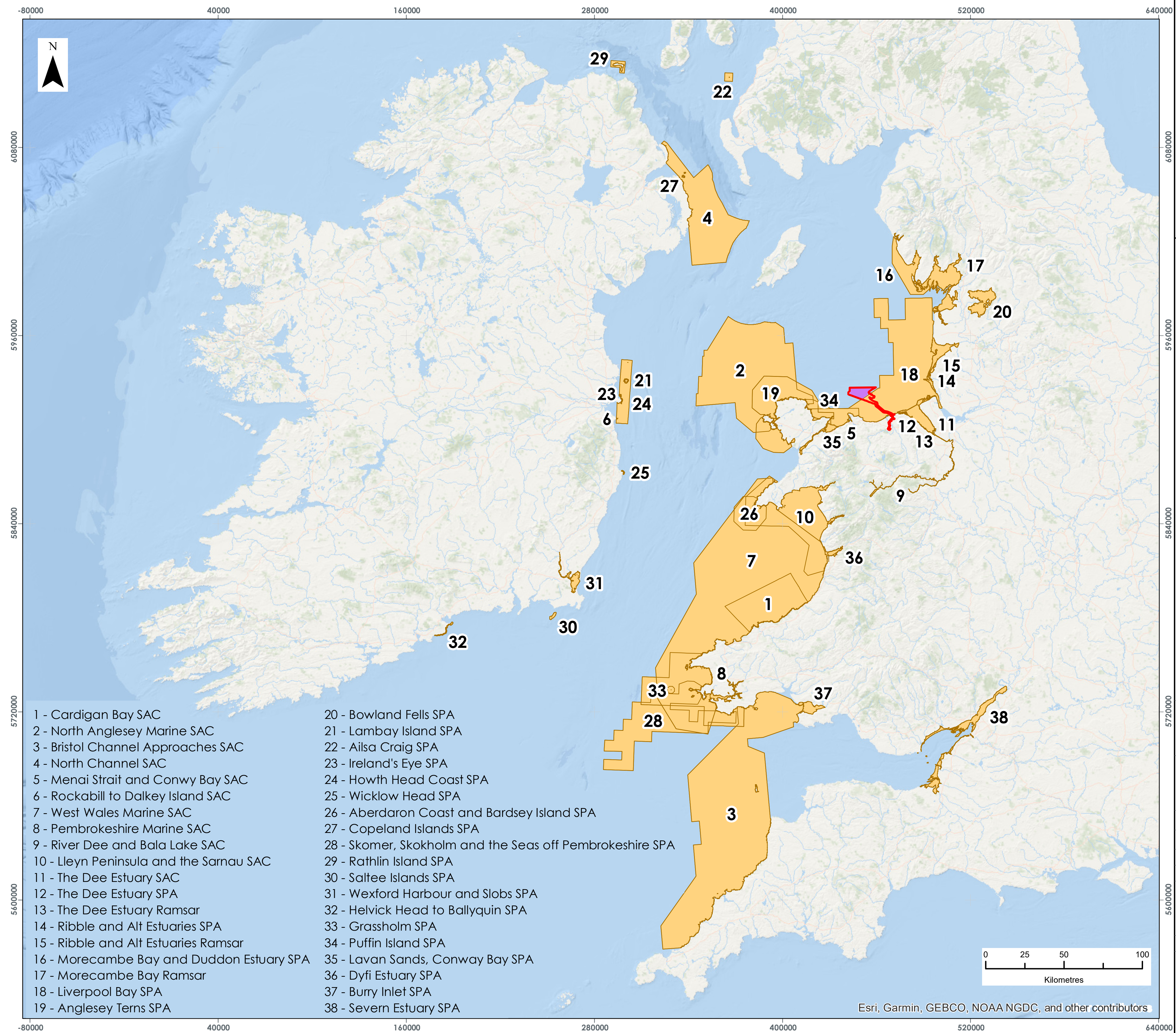
DESIGNATED SITE	MIGRATORY FISH FEATURE(S) SCREENED IN	PLANS AND PROJECTS	TIER
Dee Estuary SAC	- Sea lamprey - River lamprey	- Within 100 km for noise impacts: - EnBW and BP 1 and 2 – Round 4 - Cobra & Flotation Energy – Round 4 - Within 12 km for non-noise impacts: - OWFs (GyM, and North Hoyle); - OWF Export Cables (GyM OWF OFTO, Rhyl Flats, and North Hoyle); - Aggregate Production Areas (Hilbre Swash (392 and 393));	 - 3 - 3 - 1

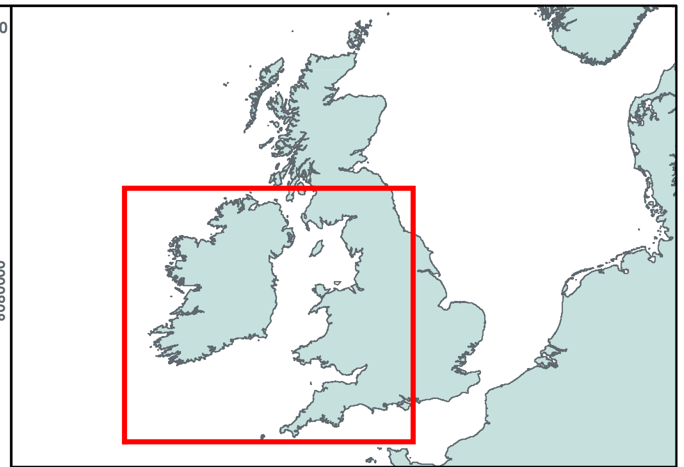
DESIGNATED SITE	MIGRATORY FISH FEATURE(S) SCREENED IN	PLANS AND PROJECTS	TIER
River Dee and Bala Lake SAC	- Sea lamprey - River lamprey - Atlantic salmon	- Geo-Eirgrid (East West Interconnector) interconnector cable; - Western HVDC Link telecommunications cable; and - Pipelines (DD-POA Gas Export (PL1030), POA-DD Methanol (PL1033), POA-DD Condensate (PL1032)).	

8 Summary of Designated Sites

8.1 Summary of information

93 The precautionary nature of screening has resulted in a lengthy list of sites and features screened in for assessment (notably in the case of offshore and intertidal ornithology). Information on a site-by-site basis, including a location plan relative to AyM, is provided in Annex 3. Figure 4 shows all screened in sites in relation to AyM. That information is drawn on for the subsequent assessment. For detail on the baseline environment with respect to each receptor group, the relevant chapters and technical reports are referenced above in Section 1.3.





LEGEND

- Order Limits
- Array Area
- Designation (SPA/SAC/Ramsar)

PROJECT TITLE:

AWEL Y MÔR OFFSHORE WINDFARM

FIGURE TITLE: **All sites screened into the assessment**

VER	DATE	REMARKS	Drawn	Checked
1	14/04/2022	For Issue	SWM	BB

FIGURE NUMBER: **Figure 4**

SCALE:	PLOT SIZE:	DATUM:	PROJECTION:
1:2,500,000	A3	WGS84	UTM30N

Fferm Wynt Alltraeth AWEL Y MÔR Offshore Wind Farm

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9 Assessment criteria

9.1 Subtidal and Intertidal Benthic Ecology

94 The RIAA has been prepared in accordance with Advice Note 10: Habitats Regulations Assessment Relevant to Nationally Significant Infrastructure Projects (PINS, 2017), with the method for determining potential impact with respect to subtidal and intertidal benthic ecology being compliant with the Chartered Institute of Ecology and Environmental Management (CIEEM) guidelines (CIEEM, 2016).

95 The assessment criteria and conclusions presented within the ES (Volume 2, Chapter 5) have been drawn on to inform this report when considering the potential for adverse effects on site integrity with respect to intertidal and benthic ecology features, with the ES conclusions on significance being considered here specifically in the context of the conservation objectives, site based advice and conservation status of the designated site(s) and feature(s) (or supporting habitat) being assessed. The final assessment for each effect is based upon expert judgement. Where possible, parameters drawn from ES are quantified and predicted changes presented directly in relation to the designated site.

96 Full detail of the assessment criteria and assignment of significance applied within the ES are provided within that chapter, and take account of the following:

- Sensitivity/ importance of the environment (drawing on MarLIN and MarESA sensitivity categories and the importance of the receptor[xiii)][xiv]);
- Magnitude of impact (the degree of change from baseline, in terms of: conservation objectives/ features and ecological function, population, temporal and physical extent);
- Significance of potential effect in terms of major/ moderate/ minor and negative/ beneficial (defined in a matrix combining sensitivity and magnitude).

[redacted]

9.2 Marine Mammals

97 The criteria applied in ES (Volume 2, Chapter 7) to determine the significance of effects is a two-stage process that involves defining the sensitivity of the receptors and the magnitude of the impacts. Magnitude is defined by a series of factors including the spatial extent of any interaction, the likelihood, duration, frequency and reversibility of a potential impact. The sensitivities of marine mammal receptors are defined by both their potential vulnerability to an impact from the proposed development, their recoverability, and the value or importance of the receptor. The subsequent matrix to define significance draws on both magnitude and sensitivity.

98 Key to the assessment for marine mammals is the consequence of underwater noise. The ES describes Permanent Threshold Shift (PTS), with the RIAA similarly applying the risk of onset of PTS as the threshold of risk of injury. The chapter also describes the sensitivity of cetaceans and seals to PTS, with all marine mammals defined as having a low sensitivity to PTS, with the exception of dolphin species, which was assessed as having a medium sensitivity to PTS. Disturbance can be defined in a number of ways, with the ES finding that:

- Harbour porpoise have a low sensitivity to disturbance and resulting displacement from foraging grounds;
- Bottlenose dolphins have a low sensitivity to behavioural disturbance from piling; and
- Grey seals have a low sensitivity to disturbance and resulting displacement from foraging grounds during pile-driving events.

99 For the RIAA, the assessment of potential for adverse effect draws on the conclusions of the ES but specifically in the context of the designated feature (or supporting habitats), in light of the relevant conservation objectives, site-based advice and feature condition. The assessment approach for each species/effect is defined within the assessment in Section 10.2.

9.3 Offshore and Intertidal Ornithology

100 The criteria applied in ES (Volume 2, Chapter 4) to determine the significance of effects is a two-stage process that involves defining the sensitivity of the receptors and the magnitude of the impacts. Magnitude is defined by a series of factors including the spatial extent of any interaction, the likelihood, duration, frequency and reversibility of a potential impact. The sensitivities of offshore and intertidal ornithology receptors are defined by both their potential vulnerability to an impact from the proposed development, their recoverability, and the value or importance of the receptor. The subsequent matrix to define significance draws on both magnitude and sensitivity.

101 The assessment has been based on the relevant guidance for conducting HRA and assessing OWFs (e.g. EC, 2011; Maclean *et al*., 2009; Natural England, 2010; PINS Advice Note 10, 2017; Natural England, 2021) and applied the criteria contained in that guidance where relevant to the interest features under consideration.

102 Key to the assessment of offshore and intertidal ornithology is the consequence of impacts arising from disturbance/displacement, collision risk and barrier effect. Collision Risk Modelling (CRM) and Displacement Analysis has been undertaken for relevant species, see Volume 4, Annex 4.2 (application ref: 6.4.4.2) Annex 4.3 (application ref: 6.4.4.3), and Annex 4.4 (application ref: 6.4.4.4) for further details on species considered within these assessments and their numerical outcomes. For each species the CRM output option used in the assessment is provided in Section 10.3 (See Volume 4, Annex 4.3 for more information on the CRM Options). Displacement and consequent mortality was determined for each species based on the displacement interim guidance (JNCC, 2017) unless otherwise specified within the assessment text for each species.

103 For the RIAA, the assessment of potential for adverse effect, using outputs from the CRM and Displacement Analysis, draws on the conclusions of the ES but specifically in the context of the designated feature, in light of the relevant conservation objectives, site-based advice and feature condition.

104 Effects from CRM and Displacement Analysis have been apportioned to designated site features following the NatureScot (formerly known as SNH) (2018) apportioning approach and AEoI determined. Details of the apportioning approach can be found in Annex 5: Ornithology Apportioning Note (application ref: 5.2.5). The determination of AEoI is based on the factors that contribute to the definition of maintaining integrity, namely that the ecological structure and function of the site is not adversely affected, that the ability of the habitat to sustain the bird species that are interest features is not adversely affected (i.e. that breeding, roosting and foraging locations are maintained and that food sources are maintained) and that the population of the interest feature is maintained both in numbers and across the area of the site.

105 Impacts are assessed for each phase of the development in order to present annual impacts to each SPA feature for each stage of the development. Where appropriate, outputs have been combined within phases (e.g. gannet collision risk and displacement mortalities have been combined for the operation and maintenance phase) in order to assess total impact per annum. The assessment approach for each species/effect is defined within the assessment in Section 10.3.

9.4 Onshore Ecology

106 No sites designated for onshore ecology remain screened in.

9.5 Migratory Fish

107 The criteria applied in ES (Volume 2, Chapter 6) to determine the significance of effects is a two-stage process that involves defining the sensitivity of the receptors and the magnitude of the impacts. Magnitude is defined by a series of factors including spatial extent of any interaction, the likelihood, duration, frequency and reversibility of a potential impact. The sensitivities of migratory fish receptors are defined by both their potential vulnerability to an impact from the proposed development, their recoverability, and the value or importance of the receptor. The subsequent matrix to define significance draws on both magnitude and sensitivity.

108 The approach taken to the assessment of migratory fish is based upon the following:

- The distance between the array boundary and cable corridor and the relevant designated sites (noting that the mouth of the Dee Estuary is key here, being the entry and exit point for migratory fish associated with the SACs screened in)
- Sensitivity of the receptors (including consideration of the vulnerability, recoverability, value and importance of the receptors);
- Magnitude of impact (drawing on the spatial extent of any interaction, the likelihood, duration, frequency and reversibility of a potential impact);
- Significance of potential effect in terms of major/ moderate/ minor and negative/ beneficial (defined in a matrix combining sensitivity and magnitude).
- The effects screened in for LSE; and
- Relevant mitigation, as identified in Table 3.

109 For the RIAA, the assessment of potential for adverse effect draws on the conclusions of the ES but specifically in the context of the designated feature (or supporting habitats), in light of the relevant conservation objectives, site-based advice and feature condition.

10 Assessment of Adverse Effects Alone

110 Where a LSE on a European site has been identified, there is a requirement to consider whether those effects will adversely affect the integrity of the site in view of its conservation objectives. The conclusion on LSE for AyM alone is presented in Table 4 and Table 5, with the conservation objectives for all relevant sites provided in Annex 3. The information is presented below according to the following receptor groupings:

- Subtidal and Intertidal Benthic Ecology;
- Marine Mammals;
- Offshore and Intertidal Ornithology;
- Onshore Ecology; and
- Migratory Fish.

10.1 Subtidal and Benthic Intertidal Habitats

111 A description of the significance of project level effects upon the designated sites grouped under 'subtidal and intertidal benthic ecology', as relevant to features and effect pathways screened in for LSE (as summarised in Table 4) is provided below.

10.1.1 Y Fenai a Bae Conwy/ Menai Strait and Conwy Bay (UK) SAC

112 At its nearest point, the SAC is located some 6.1 km from the array boundary and ECC. Information on the SAC, including the citation and conservation objectives, is presented in Appendix 1.6. The features screened in for potential LSE and the impact pathways during each phase of construction are outlined in Table 4.

113 The following benthic habitat features are screened in for potential LSE:

- Sandbanks which are slightly covered by sea water all the time;
- Reefs;
- Large shallow inlets and bays;
- Submerged or partially submerged sea caves; and
- Mudflats and sandflats not covered by seawater at low tide.

114 The potential for an AEoI to arise on the benthic habitats relates to the following pathways screened in for potential LSE:

- Suspended sediment and deposition;
- Pollution;
- Marine INNS;
- Changes to physical processes; and
- EMF.

115 Of the above pathways, all were screened in for all above named features for all project stages except for EMF, which is screened in for all features with the exception of mudflats and sandflats not covered by seawater at low tide

116 The conservation objectives that relate to the supporting habitats of the designated features[xv] are to maintain or restore favourable conservation status through (noting that separate objectives apply to the features):

- Ensuring that the overall distribution and extent of the habitat features within the site, and each of their main component parts is stable or increasing;
- Ensuring that the physical, biological, and chemical structure and functions necessary for the long-term maintenance and quality of the habitat are not degraded; and
- The presence, abundance, condition and diversity of typical species is such that habitat quality is not degraded.

Suspended sediment and deposition

117 Temporary increases in suspended sediment concentration (SSC) and associated sediment deposition are expected from the seabed preparation works (including sandwave clearance) and foundation and cable installation work during construction, with effects during decommissioning expected to be less than that during construction. ES Volume 2, Chapter 2: Marine Geology, Oceanography and Physical Process (application ref: 6.2.2) and Volume 4, Annex 2.1: Physical Processes Technical Baseline Report (application ref: 6.4.2.1) provides a full description of the physical assessment, with a summary of the MDS for benthic ecology provided in Section 5.8 in the chapter.

118 SSCs in the Irish Sea vary widely both spatially and temporally, with a general pattern of an inshore to offshore gradient in SSC. SSCs also vary with proximity to the seabed, coastline and are also dependent upon meteorological conditions. Mean "normal" (non-surge/storm events) SSC background levels in measures at Burbo Bank (c. 20 km north east of AyM) have been reported in the range of 5 to 20 mg/l within surface waters, increasing to circa 150 mg/l near the seabed (Dong Energy, 2013). These values increase inshore towards the Mersey and Dee estuaries, with SSCs in the Mersey estuary (at Sandon Dock) reaching values in the range of 30 to 450 mg/l near surface waters and 70 to 1,500 mg/l near the seabed. During storm events SSCs are expected to increase to values in the order of hundreds of milligrams.

[redacted]

119 The MDS for SSC and deposition during the construction phase of AyM would result in the total release of approximately 0.0183 km^3 of sediment in the array area and offshore ECC.

120 To summarise the information presented in the project specific hydrodynamic modelling undertaken (ES Volume 4, Annex 2.3: Modelling Report (application ref: 6.4.2.3)), sediment plumes caused by seabed preparation and installation activities are expected to be restricted to well-within the tidal excursion, with plumes expected to occur over a maximum distance of 12 km from the source within the array, and 8.5 km within the ECC. Sediment plumes are expected to quickly dissipate after cessation of the activities, due to settling and wider dispersion with the concentrations reducing quickly over time to background levels. Sediment deposition will consist primarily of coarser sediments deposited close to the source, with a small proportion of silt deposition (reducing exponentially from source). Any fine material being dispersed by construction works is likely to be widely distributed and will quickly form part of the background concentrations; deposition of 1 mm will be restricted to <1 km from the order limits.

121 Model predictions show that there is no potential for increased SSC or deposition reaching the eastern boundary of Y Fenai a Bae Conwy/ Menai Strait and Conwy Bay (UK) SAC, and there is no prediction for any deposit of measurable thickness within the SAC. Further, within the SAC itself the sandbank features are the closest features to the eastern boundary (and AyM) but are located c. 6 km further west (NRW, 2016); the plume generated by the AyM construction activities will therefore not reach any of the benthic features for which the SAC has been designated.

122 The potential for effect during the O&M and decommissioning phase are expected to be less than that during construction.

123 Given the lack of connectivity between the effect (suspended sediment and deposition) and not just the boundary of the SAC but all designated features of the SAC, there is, **therefore, no potential for an AEoI to the conservation objectives of the site in relation to suspended sediment and deposition effects from AyM alone. Therefore, subject to natural change, all features will be maintained in the long term with respect to the potential for suspended sediment and deposition.**

Pollution

124 As noted in Table 3 (mitigation measures), a PEMP is proposed to be produced as a pre-construction marine licence mitigation measure to ensure that the potential for contaminant release is strictly controlled. The purpose of the PEMP is to provide protection to marine life across all phases of the life of the wind farm. The PEMP will incorporate plans to cover accidental spills, potential contaminant release and include key emergency contact details. Typical measures will include: only using chemicals approved under the Offshore Chemicals Regulations 2002; storage of all chemicals in secure designated areas with impermeable bunding (generally to 110% of the volume); and double skinning of pipes and tanks containing hazardous materials.

125 Further, ES Volume 2, Chapter 5 reported on contaminant surveys undertaken in both the array and ECC, which reported no pollutants with concentrations above their respective Effects Range Low (ERL) values. All metals concentrations were also less than their respective Cefas guideline Action Levels (AL1 and AL2). Total two to six ring polycyclic aromatic hydrocarbon (PAH) concentrations were broadly comparable to the median concentration recorded during the Strategic Environmental Assessment (SEA6 area) Irish Sea surveys.

126 Given the low background levels of contaminants in sediment that may be disturbed, lack of connectivity between such sediment and all features within the Y Fenai a Bae Conwy/ Menai Strait and Conwy Bay (UK) SAC and the mitigation afforded by the PEMP, there is, **therefore, no potential for an AEoI to the conservation objectives of the site in relation to pollution effects from AyM alone. Therefore, subject to natural change, all features will be maintained in the long term with respect to the potential for pollution.**

Marine INNS

127 Marine INNS can be introduced via a number of potential routes; specific to AyM, vessel traffic during all project stages is the potential source. Further, hard substrate introduced by the project during O&M could provide a 'stepping stone' for INNS.

128 Numerous inherent mitigation design measures will be incorporated into construction methods via the biosecurity plan to ensure relevant best practice guidelines are followed (Natural England and Natural Resources Wales Biosecurity Planning guidance (Cook *et al*., 2014)) (see mitigation as outlined in Section 5), which will ensure that the risk of the introduction and/or spread of INNS will be minimised.

129 The 'stepping-stone' effect has the potential to extend the impact beyond a local scale. However, based on current scientific knowledge it is not possible to predict whether such a spread will occur, to what extent and which species, if any, this may involve. However, given that post construction monitoring surveys at the nearby Burbo Bank OWF determined that no INNS were found to colonise the turbines and scour protection at that site (CMACS 2009), it is anticipated that AyM will also not act as a vector for the introduction of INNS.

130 NRW (2018) reported that the potential for accidental introduction of INNS is a threat to Y Fenai a Bae Conwy/ Menai Strait and Conwy Bay (UK) SAC. The example of the slipper limpet, accidentally introduced in 2006 to mussel lays in the Menai Strait and subsequently eradicated, is cited. Measures to prevent such occurrences in the future are focused on fishing and bait collection but include 'the introduction of 'Codes of Good Practice' and other measures', with the PEMP proposed for AyM fulfilling that requirement. Moreover, through the implementation of a Biosecurity Plan, following relevant best practice guidelines (Natural England and NRW Biosecurity Planning guidance (Cook *et al*., 2014)), it will ensure that the risk of the introduction and/ or spread of INNS will be minimised.

131 Further, as noted above, there is significant distance between AyM and the designated features of the SAC, in itself sufficient to result in a lack of connectivity between sediment released at AyM and the designated features and therefore likely to limit the potential for spread of any INNS that may occur at AyM to those features.

132 Given the lack of evidence for any stepping-stone effect in the area in relation to OWFs, the distance between AyM and the designated features and the mitigation afforded by the PEMP, there is, **therefore, no potential for an AEoI to the conservation objectives of the site in relation to INNS from AyM alone. Therefore, subject to natural change, all features will be maintained in the long term with respect to INNS.**

Changes to Physical Processes

133 Volume 2 Chapter 5 to the ES considered the potential for a change to physical processes to affect benthic ecology in the O&M phase only. However, on request by NRW during Screening consultation (see Table 1), the potential effect is considered to apply at all project phases for the assessment of features screened in of the Y Fenai a Bae Conwy/ Menai Strait and Conwy Bay (UK) SAC (as infrastructure will progressively be in place during construction).

134 The process of sediment removal activities, dredging and disposal and the subsequent physical presence of foundations, scour protection and cable protection material may introduce changes to the local hydrodynamics and wave regime, resulting in changes to the sediment transport pathways and associated effects on benthic ecology. Scour and increases in flow rates can change the characteristics of the sediment potentially making the habitat less suitable for some species.

135 ES Volume 2, Chapter 2 considers the potential for changes to result to designated sites during all stages at AyM. No direct or indirect interaction with physical processes at the Y Fenai a Bae Conwy/ Menai Strait and Conwy Bay (UK) SAC is noted, with the chapter stating 'no material will be removed from the local system and sediment transport to these areas [Menai Strait and Conway Bay SAC (6.1 km from the offshore ECC) and Dee Estuary/ Aber Dyfrdwy SAC/ SPA (3.5 km from the offshore ECC] will therefore remain unaltered from baseline conditions'. Further, the chapter states 'the resultant change in wave and hydrodynamic processes are expected to be very small and highly localised, not resulting in morphological impacts to either Constable Bank, Rhyl Flats, designated sites or the coast'.

136 Given the lack of evidence for any connectivity between the Y Fenai a Bae Conwy/ Menai Strait and Conwy Bay (UK) SAC and any change in physical processes associated with AyM, there is, **therefore, no potential for an AEoI to the conservation objectives of the site in relation to a change in physical processes from AyM alone. Therefore, subject to natural change, all features will be maintained in the long term with respect to a change in physical processes.**

EMF

137 The potential for EMF to cause a disturbance to features of the Y Fenai a Bae Conwy/ Menai Strait and Conwy Bay (UK) SAC is limited to the O&M phase only and, of the features screened in, excludes mudflats and sandflats not covered by seawater at low tide. This is to be consistent with the agreement by NRW (letter dated 4 September 2020, Table 1) to screen out habitat loss at this feature (based on distance to AyM, which has now significantly increased subsequent to these discussions). However, the assessment that follows is relevant to all features of the Y Fenai a Bae Conwy/ Menai Strait and Conwy Bay (UK) SAC.

138 EMF are generated by the current that passes through an electric cable. It is known that EMF can be detected by fish and elasmobranchs and it is thought that many benthic invertebrates can also detect EMF. Three types of fields are generated by underwater electric cables: electric fields (E-fields), magnetic fields (B-fields) and induced electric fields (iE-fields). Standard industry practice is for the cables used to have sufficient shielding to contain the E-fields generated and the cable system descriptions for the inter-array and export cables have abided by this (Volume 2, Chapter 1). Shielding and/ or burial does not reduce the B-fields and it is these fields that allow the formation of iE-fields. As such, further reference here to EMF is limited to B-fields and associated iE-fields.

139 Impacts from changes in EMFs arising from cables are not considered to result in a significant effect on benthic subtidal and intertidal receptors, with the range between any cable associated with AyM and the Y Fenai a Bae Conwy/ Menai Strait and Conwy Bay (UK) SAC being at least 6.1 km, with the range to designated features within the site being significantly more (noting above that the closest feature is located c. 6 km further west from AyM). EMFs are likely to be generated by subsea cables and detectable above background levels in close proximity to the cables only. Although burial does not mask EMFs, it increases the distance between species that may be affected by EMFs and the source. As the cable will be buried or protected, any behavioural responses are likely to be mitigated.

140 ES Volume 2 Chapter 5 considered the potential for EMF to result in a significant effect on mobile and sessile benthic species, concluding that any potential negative effects would be confined to a localised area surrounding the cables. Given the distance between AyM and the Y Fenai a Bae Conwy/ Menai Strait and Conwy Bay (UK) SAC, it is clear that any effect would be limited to mobile benthic species that may travel between the AyM project area and the SAC boundary. No significant effect on such species was identified in Volume 2 Chapter 5. Further, with regard to mobile species, Volume 2 Chapter 6 found that 'whilst it is possible that some fish and shellfish species present within the area around AyM may be able to detect the iE or B fields generated by the cables, it is unlikely that the field strengths will disrupt feeding, spawning or migratory behaviours', concluding no significant effect.

141 NRW (2018) notes the following as relevant to cabling and EMF: 'dependent on depth of cable burial in seabed – localised modification of species composition, variety. Modification of behaviour caused by electro-magnetic effect'. Given the location of AyM relative to the Y Fenai a Bae Conwy/ Menai Strait and Conwy Bay (UK) SAC, no localised modification of species composition within the SAC will result and drawing on the findings from Volume 2 Chapter 6 no significant modification of mobile species behaviour is expected.

142 Given the distance between the Y Fenai a Bae Conwy/ Menai Strait and Conwy Bay (UK) SAC and AyM and therefore the lack of any direct connectivity to the designated features, together with the lack of significant behavioural change in mobile species, there is, **therefore, no potential for an AEoI to the conservation objectives of the site in relation to EMF from AyM alone. Therefore, subject to natural change, all features will be maintained in the long term with respect to EMF.**

10.1.2 Liverpool Bay SPA

143 Information on the SPA, including the citation and conservation objectives, is presented in Appendix 1.6. Designated bird features screened in are assessed separately in 10.3, with the focus here being on the supporting benthic habitats.

144 The conservation objectives that relate to the supporting habitats of the designated features[xvi] are to maintain or restore (noting that separate objectives apply to the features):

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

145 The conservation objective that relates to the supporting habitats of the assemblage is, subject to natural change, to maintain or enhance the supporting habitats in favourable condition. The supporting habitat will be considered in favourable condition if the following is met (noting that a further condition applies to the feature):

- The extent of the waterbird assemblage supporting habitat within the site is maintained.

146 The supporting habitat can be viewed indirectly as the benthos (which potentially provides prey or supporting habitat for prey for the designated features) and the water column (as a potential source of prey). The Regulation 35 document was published in 2012[xvii], which refers to the seabed consisting of a wide range of mobile sediments including a number of sandbanks. Weak tidal currents are referenced, that encourage the deposition of sediment, with the Bay holding various fish and shellfish species.

[redacted]

147 Key supporting habitat for red-throated diver (a named feature under Article 4.1) is referenced as 'shallow (between 0-20 m deep and less frequently in depths of around 30 m) inshore waters, often occurring within sandy bays, firths and sea lochs, although open coastline is also frequently used'. It also notes that 'as an active fish-feeder…, the distribution and concentrations of red-throated divers will at least partly be determined by the presence, abundance, and availability of their prey species'. The Regulation 35 document goes on to state '*the link between the birds and benthic habitats is not well understood but it probably reflects the association between some of their prey species (small fish such as gadoids, sprat, herring and sandeel between c. 25 and 55 g in weight) and sandbanks… Supporting habitats may have a functional role (as nursery, spawning or feeding grounds or in providing shelter) in supporting these fish species*'.

148 For common scoter (a named feature under Article 4.1), key habitat is referenced as 'water depth range of 2-20 m and a mean depth of 10-12 m' with a strong association to the distribution of benthic prey.

149 Red-breasted merganser forms part of the assemblage under Article 4.2 and is not a named species under Article 4.1. No reference to habitat for the species is provided in the Regulation 35 document. The NBN Atlas[xviii] notes that it is a piscivorous species, diving to 4 m to catch prey, with Natural England noting that they feed on small fish and crustaceans[xix].

150 The Regulation 35 document highlighted a number of habitat related effects to which red-throated diver, common scoter and red-breasted merganser may be sensitive or vulnerable (all remaining effects were linked directly to the birds and not to the supporting habitat, with the assessment for offshore and intertidal ornithology presented in Section 10.3):

- Physical loss of supporting habitat;
- Smothering; and
- Physical damage to supporting habitat.

[redacted]

151 Each of these are considered below for all stages of AyM. Due to the overlapping nature and pathways of the physical loss and physical damage effects, these are considered as one.

Physical loss of and physical damage to supporting habitat

152 Liverpool Bay SPA is coincident with the offshore ECC from AyM only; the array boundary falls wholly outside the SPA. Further, as part of the project design evolution the Applicant has chosen an ECC that avoids Constable Bank (a sand bank feature partially within the Liverpool Bay SPA and to the south and west of AyM). Therefore, the potential for direct physical loss of supporting habitat within the SPA boundary relates to works within the offshore ECC only (with the landward boundary of the SPA being mean low water). The potential for habitat loss within the ECC is defined in the MDS as 242,853 m^2 or 0.24 km^2. That consists of export cable protection, export cable crossings and export cable remediation. The Liverpool Bay SPA extends to some 252,757.73 ha, equivalent to 2,527.6 km^2. The potential supporting habitat loss within the project footprint of AyM therefore equates to 0.009% of the benthic habitat (as a supporting feature) within the SPA.

153 The potential for direct benthic habitat loss and damage to occur within the ECC and also to the Constable Bank, which lies partially within the SPA and to the south and west of AyM is identified in the ES as potentially resulting from:

- Construction:
  - Potential changes arising from the combined influence of sediment removal activities (seabed preparation) e.g. dredging/disposal and sandwave clearance.
- Construction, O&M:
  - Direct habitat loss in footprint of the export cable (benthic consequences addressed following the assessment presented);
  - Potential changes to Constable Bank, or the wider the Liverpool Bay SPA arising from blockage effects associated with installed infrastructure.
- O&M
  - Potential for scour of seabed sediments, including that around scour protection structures;

- Potential for changes to Constable Bank and designated sites arising from modification of physical processes, including tidal regime, wave regime and sediment transport regime.

- Decommissioning
  - All potential effects during decommissioning will be the same as or less than those during construction and O&M.

Physical loss and direct damage due to seabed preparation during construction

154 Potential for benthic habitat loss and damage during seabed preparation prior to cable installation is discussed in ES (Volume 2, Chapter 2), which found that the available evidence suggests that where sandwaves and megaripples are present in the offshore ECC, the seabed is highly mobile. Therefore, any direct disturbance resulting from sandwave levelling will likely only result in short-term change in seabed morphology, with no loss of habitat. In very shallow areas where waves are regularly re-working the bed, it is likely that recovery to baseline conditions may occur over a period of weeks to months. In deeper areas the recovery timescale is likely to be slightly longer due to more limited wave action but offset by a higher tidally driven net sediment transport rate (order of months to a few years).

155 Dredging can be expected to result in localised lowering of the seabed in response to the presence of mobile sand wave features. Typically, (and given the known characteristics of sandwaves within the offshore ECC following the project specific geophysical survey), dredging to depths of between 1- 3 m is realistic in most areas. Whilst highly localised changes to waves and tidal currents may potentially occur in the vicinity of the dredged seabed areas, dredging activity would be focused on levelling sections of sand waves, which are moderately to highly mobile, with water depths varying in response to their migration. Accordingly, the dredging activity is not expected to cause changes in water depths that are outside of the range that would be occurring naturally over time.

156 The subsequent dredge disposal will be made within the offshore ECC in close proximity to the dredge location. The disposal is not expected to result in morphological impacts to Constable Bank, designated sites or the coast.

157 The potential for seabed preparation and dredge and disposal to result in changes to sediment supply are discussed in ES (Volume 2, Chapter 2). It is important to note that no sediment will be lost from the system as a result of the activity. Overall sediment availability will remain largely unaltered; this is a particularly relevant consideration for Constable Bank, which is known to act as a pathway for sediment supply to Rhyl Flats and both banks may potentially provide an onshore directed supply of finer sediment.

Potential physical damage from blockage effects

158 The installation of any turbine foundations, OSP foundations and cable protection measures all have the potential to result in a localised blockage of waves, tides and sediment transport. This blockage will commence when offshore construction begins, increasing incrementally up to the MDS which is represented by the fully operational project. The potential for effect is considered during the O&M phase (see below), as the potential for effect during construction will gradually increase but be contained within the level of effect at that point.

Potential physical damage from scour

159 Scour refers to the development of pits, troughs or other depressions in seabed sediments around the base of wind turbine foundations, with the potential for effect on supporting habitats of the Liverpool Bay SPA therefore limited to indirect effects. Scour is the result of net sediment removal over time due to the complex three-dimensional interaction between the foundation and ambient flows (currents and/or waves). Such interactions result in locally accelerated mean flow and locally elevated turbulence levels that also locally enhance sediment transport potential. For all foundations, the footprint area of scour protection is larger than the predicted footprint of local scour. Any elevations in SSC because of scour will be short lived and localised and within the range of natural variability.

Potential physical damage from changes to physical processes

160 The interaction between the tidal regime and the foundations of the wind farm infrastructure will result in a general reduction in current speed and an increase in levels of turbulence in a narrow, localised wake due to frictional drag and the shape of the structure. Changes to the tidal regime may also indirectly impact seabed morphology (including bedforms) due to the close relationship between flow speed and bedform type (e.g. Belderson *et al*., 1982) With respect to the supporting habitats of the Liverpool Bay SPA, ES (Volume 2, Chapter 2) found that no measurable changes to the tidal regime are predicted to extend to Constable Bank, with wake features contained within the AyM array itself and at most a theoretical risk of impact on seabed morphology within the SPA boundary.

161 The interaction between waves and the foundations of the wind farm infrastructure may result in a reduction in wave energy locally around foundations. The combined changes arising from all foundations may give rise to an array-scale change that could extend outside of the AyM array and into the wider study area (and therefore potentially into the Liverpool Bay SPA). It is noted that changes of less than 5% of the baseline wave height would be indistinguishable from natural variability. With respect to a potential change at Constable Bank, there may be a small reduction in wave height of up to ~3-4% in the vicinity (and therefore be within natural variability). However, waves from these sectors only occur for approximately 20% of the time and any impacts would be intermittent in nature. For the Liverpool Bay SPA more generally, wave height could theoretically be reduced by up to ~10% under specific circumstances; however, water depths are typically ~20 m below LAT and wave stirring of the bed is likely to be very limited under baseline conditions, with tidal currents dominating.

162 Modification of existing sediment transport pathways could occur in response to changes in the wave and tidal regimes resulting from the presence of turbine and substation foundations and/or the presence of cable protection measures. Regional bedload sediment transport pathways (described in Volume 4; Annex 2.1) are aligned with the tide in a broad west northwest to east southeast direction and therefore do not connect the AyM array area with Constable Bank.

163 The presence of cable protection measures may also have the potential to cause a direct (albeit very localised and limited volume) blockage to sediment transport, with protection resulting in a local elevation of the seabed by up to 1.4 m. Cable protection would be placed onto the seabed surface above the cable and therefore could directly trap sediment, locally impacting down-drift locations. For all areas in which cable protection is used (including where sand waves are present), ES found no continuous effect on patterns of sediment transport, following an initial period of limited sediment accumulation around the cable protection. It follows that any changes on seabed morphology away from the cable protection will also be very small. The extent of the cable protection measures does not constitute or cause a continuous blockage along the offshore ECC.

Summary of physical benthic habitat loss

164 It is clear from the above text that a small area of habitat will be lost along the ECC as a result of the physical presence of cable protection within the ECC. That loss equates to approximately 0.009% of the SPA. Whilst a larger area of habitat may be physically damaged, there will be rapid recovery of affected areas and no direct or indirect effects to Constable Bank, with the consequences for physical process small scale and localised, with changes either within natural variation or subject to rapid recovery, taking up to a few months in shallower areas. **Therefore, no significant change to the extent, distribution, structure, function or supporting processes for the supporting habitats will occur.**

The effect on benthic habitats and fish ecology

165 The physical changes described above are considered in the ES with respect to the potential for effect on benthic habitats and fish ecology (Volume 2, Chapter 5 and Volume 2 Chapter 6). The benthic habitats may support a prey resource directly (if benthic foraging by birds occurs) or indirectly (pelagic prey). The consideration of effect on prey resource therefore builds on the physical habitat assessment described above. Benthic habitats that characterise the ECC are dominated by subtidal sands and gravels, both widespread and common habitats throughout the eastern Irish Sea and wider. With respect to habitat loss, the ES is clear that although assessed as habitat loss, it the ECC also offers potential beneficial effects (e.g. providing new habitats for different faunal assemblages to colonise, resulting in a likely increase in biodiversity and biomass).

166 While the potential for impact to benthic habitats directly affected is significant, the footprint of the area affected is highly localised. Furthermore, the habitats and characterising biotopes are common and widespread throughout the SPA and wider region. **Therefore, the loss of or temporary damage to these habitats as regards benthic ecology would be discernible but slight with no significant effect for benthic ecology.**

167 Predicted recovery, based on a review of post construction monitoring data from other OWF sites includes the nearby GyM (MMO, 2014), which concluded that, to date, OWFs have not had significant impacts on the benthic habitats and associated faunal communities.

168 During O&M, the presence of foundations, scour protection and cable protection material may introduce changes to the local hydrodynamic and wave regime, resulting in changes to the sediment transport pathways and associated effects on benthic ecology. Scour and increases in flow rates can change the characteristics of the sediment potentially making the habitat less suitable for some species. On the basis of the at most small scale and localised physical processes changes noted above, ES (Volume 2, Chapter 5) found no significant effects for benthic ecology, supported by results from monitoring at adjacent OWF. **Based on the same evidence base, it is concluded that no significant change to the extent, distribution, structure, function or supporting processes for the supporting habitats and associated benthic species will occur.**

169 The potential to affect fish ecology is considered in ES Volume 2 Chapter 6 with respect to loss or damage to individuals and potential fish habitat within the footprint of the works. The mobility of finfish and shellfish, the highly localised and small-scale nature of the effect and the widespread availability of alternative habitat, means **no significant effect for finfish and shellfish (which could represent prey) is predicted. For crustacean species, a potential positive effect is noted with the creation of new habitat and refuge areas.**

Conclusion for physical loss of or temporary damage to supporting habitat

170 Although a very small percentage of the overall benthic habitat within the SPA will be lost (0.009%), and on a temporary and localised basis an area of supporting habitat within the SPA will be damaged, it is clear that there will be no significant consequences for the habitats and associated prey species in regard to their supporting function to the designated features of the SPA. Any change will be highly localised and small scale, not affecting key supporting habitats such as sandbanks and will not be discernible in the context of the wider supporting habitat across the SPA. There is potential for a positive effect for crustaceans from the introduction of new hard substrate providing increased habitat availability for some species.

171 As a result of the very small proportional loss of and at most localised and short-term damage to benthic habitat within the SPA in the context of supporting habitat, together with the lack of significant effect for prey species, there is, **therefore, no potential for an AEoI to the conservation objectives of the supporting habitats in the SPA in relation to habitat loss or damage from AyM alone. Therefore, subject to natural change, all features will be maintained in the long term with respect to habitat loss and damage.**

Smothering

172 Potential for smothering to affect supporting habitats within the SPA has been discussed in detail within ES, both in terms of understanding the scale and extent but also the effect on habitats (Volume 2, Chapter 2 and Volume 2, Chapter 5). The potential for smothering damage to supporting habitats to occur within the SPA is identified in ES as potentially resulting from:

- Construction:
  - Potential changes arising from dredging and disposal, foundation installation, drilling, seabed preparation and cable installation.
- O&M and decommissioning
  - All potential effects will be the same as or less than those during construction.

173 During construction of the project, sediment will be disturbed and released into the water column. This will give rise to suspended sediment plumes and localised changes in bed levels as material settles out of suspension. The physical aspects of the increases in suspended sediment and the resulting sediment plume are described in the Volume 2, Chapter 2, with the potential for smothering assessed in the Volume 2, Chapter 5. A summary of the of the conditions in the Irish Sea are provided in the assessment for Y Fenai a Bae Conwy/ Menai Strait and Conwy Bay (UK) SAC.

174 Sediment plume modelling presented within ES for the MDS (Volume 2, Chapter 2) illustrates that within the array, plumes spread in a broad east/ west axis, with the easterly excursion potentially entering the SPA boundary. Along the ECC, the plume results to either side of the ECC. The potential plume extent from works within the array is up to 12 km and up to 10 km for the ECC (for values up to 1 mg/l).

175 Sediment deposition from the plume occurs most rapidly for coarse grained material, with the depth of deposition falling to approximately 0.5 cm within a few tens to 100 m (for the Mass Flow Excavation (MFE) trenching along the ECC) and within a few 100 m following disposal of dredged spoil. Deposition of up to 1 mm depth is restricted to <1 km from the order limits, which would not cause a measurable change in bed level or sediment type in practice.

The effect on benthic habitats and fish ecology

176 The communities and habitats identified within the ES (Volume 2, Chapter 5) are acclimated to the high levels of SSC that occur naturally within the region and are subject to and able to tolerate variations in SSC and some degree of sediment deposition. The biotopes found along the offshore stretch of the cable corridor have a low sensitivity to <5 cm of sediment deposition, with biotopes across AyM more widely having non/ low sensitivity. The extent of such deposition along the ECC (and therefore within the SPA) will be within 100 m.

177 The limited areas of effect that are predicted and the intermittent nature of the impacts, both spatially and temporally, will facilitate rapid recruitment from adjacent communities. The amphipods and polychaetes which characterise the communities are highly mobile and are capable of colonising new habitats from the surrounding area by adult migration. These habitats are naturally dynamic and, as such, the faunal component is naturally relatively sparse and low in species richness. Therefore, the community might be considered 'mature' (in terms of representative species present) only a few days or weeks after the disturbance, as displaced polychaetes and crustaceans re-enter the substratum (MarLIN, 2019). Increases in SSC and associated sediment deposition will represent a temporary and short-term intermittent impact, affecting a small portion of the supporting habitats in the Liverpool Bay SPA. **There will therefore be no long-term change in the extent, distribution, structure, function or supporting processes of the supporting habitat within the SPA.**

Conclusion for smothering

178 There is, therefore, **no potential for an AEoI to the conservation objectives of the supporting habitats in the SPA in relation to smothering from AyM alone and therefore, subject to natural change, all features will be maintained in the long term with respect to smothering.**

10.1.3 Dee Estuary Ramsar, SPA and SAC

179 Information on the Ramsar, SPA and SAC, including the citations and conservation objectives, are presented in Annex 13 For the SPA and Ramsar site, the bird features screened in are assessed in Section 10.3. For the SAC, the migratory fish features screened in are assessed in Section 10.5 No sites have been screened in for onshore ecology and therefore no assessment of potential AEoI alone is required. For the SPA, the habitats are screened in as supporting habitat for designated features. The assessment is therefore made on that basis.

180 For the SAC and SPA sites, the conservation objectives[xx] are 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.

181 For the Ramsar site, the conservation objectives are to maintain or restore the favourable conservation condition of the features listed for this site. The list of conditions required for the achievement of this status can be found described within the Natural England & the Countryside Council for Wales' advice given under Regulation 33(2) of the Conservation (Natural Habitats &c.) Regulations 1994, The Dee Estuary Marine Site.

182 For the SAC, the following benthic habitat features are screened in for potential LSE:

- Mudflats and sandflats not covered by seawater at low tide;
- *Salicornia* and other annuals colonizing mud and sand;
- Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*); and
- Estuaries.

183 For the Ramsar, the following benthic habitat feature is screened in for potential LSE:

- Extensive intertidal mud and sand flats with large expanses of saltmarsh.

184 The Ramsar features are therefore contained within the listed SAC features (except for the SAC feature 'estuaries') and the assessment will be made jointly, with conclusions drawing on site specific detail.

[redacted]

185 The potential for an **AEoI to arise on the benthic habitats relates to the following pathways screened in for potential LSE:**

- **Suspended sediment and deposition;**
- **Pollution;**
- **Marine INNS;**
- **Changes to physical processes; and**
- **EMF.**

186 **Of the above pathways, all were screened in for all above named features for all project stages except for EMF, which is screened in for O&M phase only.**

Suspended sediment and deposition

187 Temporary increases in SSC and associated sediment deposition are expected from the foundation and cable installation works and seabed preparation works (including sandwave clearance) during construction, with effects during decommissioning expected to be less than that during construction. A brief summary of the expected SSC to arise from AyM, alongside baseline conditions for the Irish Sea can be found above in the assessment for Y Fenai a Bae Conwy/ Menai Strait and Conwy Bay (UK) SAC. That summary draws on ES Volume 2, Chapter 2 with a summary of the MDS for benthic ecology provided in Section 2.8. Volume 4, Annex 2.1 provides a full description of the physical assessment for benthic ecology.

188 Model predictions (for details see ES Volume 4, Annex 2.3) show that there is a potential for a slight increase in SSC and deposition reaching the western boundary of the Dee Estuary sites. The sediment plume (< 5 mg/l) is predicted to extend through the seaward extent of the estuary feature of the SAC and over the more seaward of the intertidal mudflats and sandflats (which are designated as mudflats and sandflats not covered by seawater at low tide within the SAC, as extensive intertidal mud and sand flats in the Ramsar and as supporting habitat for the SPA), but the concentrations are not predicted to exceed 5 mg/l during spring tides (1 mg/l during neaps). Deposition of up to 1 mm depth is restricted to <1 km from the order limits and as this site is 2.1 km from the order limits at its closest point, it is therefore predicted that there will be no deposition of any measurable thickness within the SAC, Ramsar or SPA boundary.

189 Three of the designated features relevant to subtidal and benthic intertidal habitats at the Dee Estuary sites are considered favourable: mudflats and sandflats not covered by seawater at low tide, *Salicornia* and other annuals colonising mud and sand, and Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*). The designated feature 'Estuaries' is considered unfavourable due to its chemical status; the predicted suspended sediment and deposition rate will not alter the chemical status of the estuary and will therefore no hinder the feature regaining favourable condition.

190 Given that the predicted deposition rate within the designated sites is < 1 mm, (which is considered to be below the level of natural variation, immeasurable and temporary) and the SSC values will not exceed the natural variation within the region, there will be no change to the extent, distribution, structure, function or supporting processes for any of the features as a result of suspended sediment and deposition from AyM.

191 The potential for effect during the O&M and decommissioning phase are expected to be less than that during construction.

192 Given the lack of significance of the effect on all designated features of the SAC and Ramsar and supporting habitats of the SPA, there is, therefore, no potential for an AEoI to the conservation objectives of the sites in relation to suspended sediment and deposition effects from AyM alone. Therefore, **subject to natural change, all features will be maintained in the long term with respect to the potential for suspended sediment and deposition**.

Pollution

193 As noted in Table 3 (mitigation measures) and described above in Y Fenai a Bae Conwy/ Menai Strait and Conwy Bay (UK) SAC, a PEMP is proposed to be produced as a pre-construction marine licence mitigation measure to ensure that the potential for contaminant release is strictly controlled. The purpose of the PEMP is to provide protection to marine life across all phases of the life of the wind farm. The PEMP will incorporate plans to cover accidental spills, potential contaminant release and include key emergency contact details. Typical measures will include: only using chemicals approved under the Offshore Chemicals Regulations 2002; storage of all chemicals in secure designated areas with impermeable bunding (generally to 110% of the volume); and double skinning of pipes and tanks containing hazardous materials.

194 Further, ES Volume 2, Chapter 5 reported on contaminant surveys undertaken in both the array and ECC, which reported no pollutants with concentrations above their respective ERL values. All metals concentrations were also less than their respective Cefas guideline Action Levels (AL1 and AL2). Total two to six ring PAH concentrations were broadly comparable to the median concentration recorded during the Strategic Environmental Assessment (SEA6 area) Irish Sea surveys.

195 The only feature from all three sites not in favourable condition is the designated SAC feature 'Estuaries'. This feature was designated as unfavourable, primarily due to its chemical status, due to the presence of mercury and its compounds, as water quality is considered an important aspect of the structure and function of this feature. However, due to the low level of contaminants (including metals) and an immeasurable level of deposition resulting from AyM, the proposed works will not affect the potential for the feature to regain favourable status.

196 Given the lack of measurable impact on all features within the sites and the mitigation afforded by the PEMP, there is, therefore, no potential for an AEoI to the conservation objectives of the sites in relation to pollution effects from AyM alone. Therefore, **subject to natural change, all features will be maintained in the long term with respect to the potential for pollution.**

Marine INNS

197 Marine INNS can be introduced via a number of potential routes; specific to AyM, vessel traffic during all project stages is the potential source. Further, hard substrate introduced by the project during O&M could provide a 'stepping stone' for INNS.

198 Numerous inherent mitigation design measures will be incorporated into construction methods via the biosecurity plan to ensure relevant best practice guidelines are followed (Natural England and Natural Resources Wales Biosecurity Planning guidance (Cook *et al*., 2014)) (see mitigation as outlined in 5), which will ensure that the risk of the introduction and/or spread of INNS will be minimised.

199 The 'stepping stone' effect has the potential to extend the impact beyond a local scale. However, based on current scientific knowledge it is not possible to predict whether such a spread will occur, to what extent and which species, if any, this may involve. However, given that post construction monitoring surveys at the nearby Burbo Bank OWF determined that no INNS were found to colonise the turbines and scour protection at that site (CMACS 2009), it is anticipated that AyM will also not act as a vector for the introduction of marine INNS.

200 NRW (2018) reported that the Chinese mitten crab (*Eriocheir sinensis*) is an INNS present within the Dee Estuary, however there is no evidence that it is affecting the features of the site. With this considered, the NRW report (2018) does classify the relevant features to this benthic assessment as favourable. Measures to prevent additional INNS arriving at the sites will be detailed within the proposed PEMP for AyM. Moreover, through the implementation of a Biosecurity Plan, following relevant best practice guidelines (Natural England and NRW Biosecurity Planning guidance (Cook *et al*., 2014)), it will ensure that the risk of the introduction and/ or spread of INNS will be minimised. Furthermore, as noted above, there is significant distance between AyM array and the designated features of the sites, and therefore likely to limit the potential for spread of any marine INNS that may occur at AyM to those features.

201 Given the lack of evidence for any stepping-stone effect in the area, the distance between AyM and the designated features and the mitigation afforded by the PEMP, there is, therefore, no potential for an AEoI to the conservation objectives of the sites in relation to INNS from AyM alone. Therefore, **subject to natural change, all features will be maintained in the long term with respect to INNS**.

Changes to Physical Processes

202 Volume 2 Chapter 5 to the ES considered the potential for a change to physical processes to affect benthic ecology in the O&M phase only. However, during Screening consultation it was suggested that the potential effect is considered to apply at all project phases for the assessment of features screened in of the Dee Estuary Ramsar and Dee Estuary/ Aber Dyfrdwy (UK) SAC. The Estuary (UK) SPA is considered with respect to the supporting habitat only for the designated features identified by the ornithology assessments.

203 ES Volume 2, Chapter 2 considers the potential for changes to result to designated sites during all stages at AyM. No significant interaction with physical processes at the Dee Estuary sites is noted, with wave regime changes considered to be localised in nature resulting in no interaction with the site. The chapter states 'no material will be removed from the local system and sediment transport to these areas [Menai Strait and Conway Bay SAC (6 km from the offshore ECC) and Dee Estuary SAC/ SPA (2.1 km from the offshore ECC)] will therefore remain unaltered from baseline conditions'. As detailed within the assessment for Liverpool Bay SPA, any changes to physical processes are small scale and highly localised, with effects to sediment transport, wave regime and tidal regime not extending over a wide enough area to impact on the Dee Estuary designated sites (Volume 2, Chapter 2).

204 Given the lack of evidence for any connectivity between the Dee Estuary sites and any change in physical processes associated with AyM, there is, therefore, no potential for an AEoI to the conservation objectives of the sites in relation to a change in physical processes from AyM alone. Therefore, **subject to natural change, all features will be maintained in the long term with respect to a change in physical processes**.

EMF

205 The potential for EMF to cause a disturbance to features of the Dee Estuary sites is limited to the O&M phase only. EMF are generated by the current that passes through an electric cable. It is known that EMF can be detected by fish and elasmobranchs and it is thought that many benthic invertebrates can also detect EMF. Three types of fields are generated by underwater electric cables: E-fields, B-fields and iE-fields. Standard industry practice is for the cables used to have sufficient shielding to contain the E-fields generated and the cable system descriptions for the inter-array and export cables have abided by this (Volume 2, Chapter 1). Shielding and/ or burial does not reduce the B-fields and it is these fields that allow the formation of iE-fields. As such, further reference here to EMF is limited to B-fields and associated iE-fields.

206 Impacts from changes in EMFs arising from cables are not considered to result in a significant effect on benthic subtidal and intertidal receptors, with the range between any cable associated with AyM and the Dee Estuary sites being at least 2.1 km. EMFs are likely to be generated by subsea cables and detectable above background levels in close proximity to the cables only. Although burial does not mask EMFs it increases the distance between species that may be affected by EMFs and the source. As the cable will be buried or protected, any behavioural responses are likely to be mitigated.

207 ES Volume 2, Chapter 5 considered the potential for EMF to result in a significant effect on mobile and sessile benthic species, concluding that any potential negative effects would be confined to a localised area surrounding the cables. Given the distance between AyM and the Dee Estuary sites, it is clear that any effect would be limited to mobile benthic species that may travel between the AyM project area and the site boundaries. No significant effect on such species was identified in Volume 2, Chapter 5. Further, with regards mobile species, Volume 2, Chapter 6 found that 'whilst it is possible that some fish and shellfish species present within the area around AyM may be able to detect the iE or B fields generated by the cables, it is unlikely that the field strengths will disrupt feeding, spawning or migratory behaviours', concluding no significant effect.

208 NRW (2018) notes the following as relevant to cabling and EMF: 'dependent on depth of cable burial in seabed – localised modification of species composition, variety. Modification of behaviour caused by electro-magnetic effect'. Given the location of AyM relative to the Dee Estuary sites, no localised modification of species composition within the SAC will result and drawing on the findings from ES Volume 2, Chapter 6 no significant modification of mobile species behaviour is expected.

209 Given the distance between the Dee Estuary sites and AyM and therefore the lack of any direct connectivity to the designated features, together with the lack of significant behavioural change in mobile species, there is, **therefore, no potential for an AEoI to the conservation objectives of the sites in relation to EMF from AyM alone. Therefore, subject to natural change, all features will be maintained in the long term with respect to EMF.**

10.2 Marine Mammals

210 A description of the significance of project level effects upon the receptors grouped under 'marine mammals', as relevant to the designated site and its associated features screened in for LSE (as summarised in Table 4), is provided below.

10.2.1 Underwater Noise

211 The Stage 1 Screening for marine mammals concluded potential for LSE for a single effect pathway; underwater noise during construction and decommissioning only. To minimise repetition, information is presented first to provide detail on the effect, followed by the assessment on a species and site basis. Information on the SACs, including the citation and conservation objectives, is presented in Appendix 1.6. The sites screened in for potential LSE (including the relevant marine mammal feature(s)) are as follows:

- North Anglesey Marine/ Gogledd Môn Forol (UK) SAC (harbour porpoise);
- Bristol Channel Approaches/ Dynesfeydd Môr Hafren (UK) SAC (harbour porpoise);
- Cardigan Bay/ Bae Ceredigion (UK) SAC (grey seal and bottlenose dolphin);

- North Channel (UK) SAC (harbour porpoise);
- Pen Llŷn a`r Sarnau/ Lleyn Peninsula and the Sarnau (UK) SAC (bottlenose dolphin and grey seal);
- West Wales Marine/ Gorllewin Cymru Forol (UK) SAC (harbour porpoise);
- Pembrokeshire Marine SAC (grey seal); and
- Transboundary sites (21 sites for harbour porpoise).

212 Within the citations for the designated sites, the population size of the feature within each site is identified. However, with respect to harbour porpoise and as identified within the conservation advice for the North Anglesey Marine SAC, the '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' and that the 'reference population for assessments against this objective is the MU population in which the SAC is situated'[xxi]. The same logic should also be considered to apply in many ways to bottlenose dolphin, specifically the concept of, for example, a "Cardigan Bay SAC bottlenose dolphin", with photo-ID data showing that the dolphins recorded around the north-west Wales coast having much larger ranges than the SAC area(s), and limited site fidelity (Lohrengel *et al*., 2018). Additionally, as demonstrated by telemetry data from tagged seals, there is no such thing as a SAC specific grey seal, with telemetry data showing high mobility of seals between SACs along the Welsh coast and also more widely to England, Scotland and Ireland (see Annex 4). Therefore, since all animals within the MU are considered to be functionally linked to the SACs located within the MU, the entire MU population is considered when assessing impacts on both bottlenose dolphin and grey seal SACs.

213 Underwater noise is assessed through two potential pathways for marine mammals during construction and decommissioning only; onset of PTS and disturbance, with each considered below in turn.

[xxi]https://data.jncc.gov.uk/data/f4c19257-2341-46b3-8e29-49665cd8f3d2/NorthAnglesey-Conservation-Advice.pdf

Onset of PTS

214 PTS-onset is assessed in ES Volume 2 Chapter 7, specifically in relation to clearance of unexploded ordnance (UXO) and piling.

215 For all marine mammals, the ES assessment concluded small numbers of individuals could be at risk from of PTS-onset in the absence of mitigation. As a consequence, AyM has committed to a piling MMMP (see Table 3) to reduce the risk of PTS-onset to any individual to negligible levels (see Volume 4, Annex 7.2). In addition to this mitigation, it is also likely that the presence of project vessels and associated construction activity will ensure that the vicinity of the pile is free of marine mammals by the time that piling begins (e.g. Graham *et al*., 2019).

216 With respect to the potential for PTS-onset to affect the relevant sites screened in, Table 11 presents the conclusions. It should be noted that all sites are located at some (variable) distance from AyM (as defined in Table 4), with the marine mammal features of each site being part of the wider MU population.

Table 11: Assessment for PTS-onset as a consequence of underwater noise.

DESIGNATED SITE	FEATURE	CONSERVATION OBJECTIVE[xxii]	CONSERVATION STATUS	CONCLUSION
North Anglesey Marine/ Gogledd Môn Forol (UK) SAC	Harbour porpoise	Maintain site integrity specifically ensuring that 'harbour porpoise is a viable component of the site'	Favourable or unknown[xxiii]	In harbour porpoise SACs, the viability test is typically addressed through risk of injury (PTS-onset). Application of project level mitigation reduces the risk of PTS-onset to individual animals to negligible and therefore no potential effect on harbour porpoise viability will result. No potential for AEoI.
Bristol Channel Approaches/ Dynesfeydd Môr Hafren (UK) SAC	Harbour porpoise			
North Channel (UK) SAC	Harbour porpoise			
West Wales Marine/ Gorllewin Cymru Forol (UK) SAC	Harbour porpoise			
Transboundary sites (21 sites)	Harbour porpoise	Variable The closest site (Rockabill to Dalkey Islands SAC) in Ireland		Application of project level mitigation reduces the risk of PTS-onset to negligible and therefore no potential effect

[xxii] Relevant to PTS onset and therefore risk of injury

[xxiii] https://jncc.gov.uk/jncc-assets/Art17/S1351-UK-Habitats-Directive-Art17-2019.pdf

DESIGNATED SITE	FEATURE	CONSERVATION OBJECTIVE[xxii]	CONSERVATION STATUS	CONCLUSION
		is 130 km distant. Objectives are very site focused[xxiv]		on harbour porpoise at sites located at a considerable distance. No potential for AEoI.
Cardigan Bay/ Bae Ceredigion (UK) SAC	Bottlenose dolphin	Population maintained as a viable component[xxv]	Favourable[xxvi]	Application of project level mitigation reduces the risk of PTS-onset to negligible and therefore no potential effect on bottlenose dolphin or grey seal viability will result. No potential for AEoI.
	Grey seal			
Pen Llŷn a`r Sarnau/ Lleyn Peninsula and the Sarnau (UK) SAC	Bottlenose dolphin	Population maintained as a viable component[xxvii]	Favourable[xxviii]	
	Grey seal			
Pembrokeshire Marine SAC	Grey seal	Population maintained as a	Favourable[xxx]	

[redacted]

DESIGNATED SITE	FEATURE	CONSERVATION OBJECTIVE[xxii]	CONSERVATION STATUS	CONCLUSION
		viable component[xxix]		

[redacted]

217 There is, therefore, **no potential for an AEoI to the conservation objectives of the marine mammal feature(s) of all sites screened in for PTS-onset (underwater noise) from AyM alone. Therefore, subject to natural change, the marine mammal feature(s) will be maintained in the long term.**

Disturbance

218 The potential for disturbance as a consequence of underwater noise to affect marine mammals is assessed in Volume 2 Chapter 7, primarily in relation to foundation piling and UXO clearance but also for other construction activities including cable laying, dredging, trenching, rock placement, vessel noise, drilling and sheet piling at landfall.

219 The impact of non-foundation piling construction noise under the MDS is not considered to have a significant effect on any marine mammal species considered in ES, with little evidence for the impact from such disturbance. Available evidence reported a variable range for disturbance, which would all be contained within the footprint of disturbance associated with piling activity and would occur on a temporary basis and much shorter duration than piling. Consequently, any behavioural effects will be less than that expected to occur for foundation piling which will be over a wider area and for a longer duration than any other noise sources.

220 The potential for disturbance from piling and UXO is considered below in more detail for each of the marine mammal species screened in and in the context of the relevant designated sites.

Disturbance and Harbour Porpoise

221 Harbour porpoise are known to be sensitive to disturbance from pile driving, with ES Volume 2 Chapter 7 referencing studies that report disturbance associated with various levels of noise (dB). The level of effect decreases as the received level decreases as the sound propagates through the water, with any subsequent displacement typically being short term (1-3 days). The evidence base is discussed in detail within the ES and not repeated here.

222 The UK sites screened in for harbour porpoise were all designated in the last few years, with disturbance from underwater noise being a key consideration. The conservation objectives and advice on activities available is very similar between each of all these sites, with information supporting the closest such site (North Anglesey Marine/ Gogledd Môn Forol possible SAC) being drawn on here[xxxi,xxxii,xxxiii], with presumed final advice available from JNCC dated 2019 [xxxiv] (Table 12 below).

Table 12: Harbour porpoise sites in UK waters and advice on disturbance.

DESIGNATED SITE	SEASONAL USE OF THE SITE	CONSERVATION OBJECTIVE[xxxv]	CONSERVATION STATUS
North Anglesey Marine/ Gogledd Môn Forol (UK) SAC	Summer months (April to September)	Maintain site integrity specifically ensuring that 'There is no significant disturbance of the species'	Favourable or unknown[xxxvi]
Bristol Channel Approaches/ Dynesfeydd Môr Hafren (UK) SAC	Winter months (October to March)		
North Channel (UK) SAC	Winter months (October to March)		
West Wales Marine/ Gorllewin Cymru Forol (UK) SAC	Year-round importance, with the summer area extending throughout the SAC and the		

xxxi https://data.jncc.gov.uk/data/f4c19257-2341-46b3-8e29-49665cd8f3d2/NorthAnglesey-Conservation-Advice.pdf

xxxii https://jncc.gov.uk/our-work/north-anglesey-marine-mpa/

[redacted]

xxxiv https://data.jncc.gov.uk/data/f4c19257-2341-46b3-8e29-49665cd8f3d2/NorthAnglesey-Conservation-Advice.pdf

xxxv Relevant to disturbance

xxxvi https://jncc.gov.uk/jncc-assets/Art17/S1351-UK-Habitats-Directive-Art17-2019.pdf

DESIGNATED SITE	SEASONAL USE OF THE SITE	CONSERVATION OBJECTIVE[xxxv]	CONSERVATION STATUS
	winter area focused inshore and to the south of Cardigan Bay		

223 The conservation advice also provides a definition for significant disturbance, as follows:

'Noise disturbance within an SAC from a plan/project individually or in combination is significant if it excludes harbour porpoises from more than:

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

an average of 10% of the relevant area of the site over a season.'

224 It is clear from the advice that the assessment is an area-based approach – specifically relating to the potential for disturbance occurring within the SAC boundary. The area-based approach to assessing disturbance is further supported by the statement within the advice that '*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, this assessment has not sought to determine the number of harbour porpoise within each SAC that may be subject to disturbance (with that approach presented, in a MU context, within ES), rather it seeks to establish whether the potential exists for disturbance within an SAC sufficient to result in exclusion of harbour porpoise to occur. Should such exclusion occur, it would be considered adverse if the daily and/ or seasonal thresholds defined above were exceeded.

225 The assessment approach to disturbance of harbour porpoise within SACs is well tested for the Southern North Sea SAC, with multiple projects progressing through the HRA process in or in proximity to that site in recent years.

226 Three different approaches are taken here to assess the potential for disturbance to harbour porpoise:

- the adoption of the harbour porpoise dose-response curve (Graham *et al*., 2017) for pile driving,
- the adoption of the 26 km effective deterrence range (EDR) for pile driving and UXO clearance (JNCC *et al*., 2020), and
- the adoption of the TTS-onset thresholds (Southall *et al*., 2019) as a proxy for disturbance from clearance of UXOs.

Pile driving: Dose-response approach

227 The dose-response approach for piling rules out any potential disturbance within all of the harbour porpoise SACs screened in, with the exception of the North Anglesey Marine/ Gogledd Môn Forol (UK) SAC, which lies approximately 21 km from the array at its nearest point. Should piling occur at the closest location within the array area to the North Anglesey Marine/ Gogledd Môn Forol (UK) SAC, then the 120 dB SEL_{SS} impact contour for the installation of a monopile at maximum hammer energy (5,000 kJ) is predicted to cover 654.73 km^2 of the SAC, however using the dose-response approach, not all of the animals within this area would respond. The dose-response curve has been applied to identify the proportion of each impact contour that would actually result in an impact to the animals present. At most that would result in a footprint of disturbance within the SAC of 172.61 km^2 (Table 13).

Table 13: Calculation of the proportion of the North Anglesey Marine/ Gogledd Môn Forol (UK) SAC impacted by pile driving of a monopile at the NW location.

IMPACT CONTOUR (DB SEL_{SS})	AREA OF CONTOUR WITHIN SAC (KM^2)	DOSE-RESPONSE	IMPACTED AREA OF SAC (KM^2)
180	0.00	0.9994	0.00
175	0.00	0.9973	0.00
170	0.00	0.9898	0.00
165	0.00	0.9685	0.00
160	0.00	0.9192	0.00
155	0.00	0.8266	0.00
150	0.00	0.6849	0.00
145	17.77	0.509	9.05
140	103.23	0.3312	34.19
135	313.60	0.1852	58.08
130	496.79	0.0878	43.62
125	577.21	0.0349	20.14
120	654.73	0.0115	7.53
TOTAL SAC AREA IMPACTED (KM^2)			**172.61**
AREA OF SAC (KM^2)			**3,249**
% SAC IMPACTED			**5.31%**

228 The North Anglesey Marine/ Gogledd Môn Forol (UK) SAC covers an area of 3,249 km^2. The footprint of disturbance (based on the dose-response approach and a single piling activity at the worst-case location) would at most be 5.31% of the total SAC area, and therefore well within the daily 20% threshold (other piling locations within the array would have a reduced level of impact). Even should such activity occur every day of the season in sufficient proximity to the site, the contribution to the 10% seasonal threshold would be at most 5.31% and therefore well within the seasonal threshold.

229 Therefore, by applying the dose-response approach to assessing disturbance from pile driving to harbour porpoise within the SACs screened in, it is clear that there is, **therefore, no potential for an AEoI to the conservation objectives of the harbour porpoise feature of all sites screened in for piling disturbance (underwater noise) from AyM alone. Therefore, subject to natural change, the harbour porpoise feature at all sites will be maintained in the long term.**

Pile driving: EDR approach

230 The EDR approach advocates the use of 26 km for piling (monopiles without noise mitigation at source) and UXO clearance. The use of such a range would effectively rule out any potential disturbance within all of the harbour porpoise SACs screened in, with the exception of the North Anglesey Marine/ Gogledd Môn Forol (UK) SAC, which lies approximately 21 km from the array at its nearest point. Should piling occur at the closest location within the array area to the North Anglesey Marine/ Gogledd Môn Forol (UK) SAC, at most that would result in a footprint of disturbance of 7.69 km^2 (based on the application of the 26 km EDR for a single piling activity per day).

231 The North Anglesey Marine/ Gogledd Môn Forol (UK) SAC covers an area of 3,249 km^2. The footprint of disturbance (based on an EDR of 26 km and a single piling activity at the worst-case location) would at most be 0.24% of the total and therefore well within the daily 20% threshold (other piling locations within the array would have a reduced level of impact). Even should such activity occur every day of the season in sufficient proximity to the site (which would not be possible, as only a limited proportion of the array area falls within 26 km), the contribution to the 10% seasonal threshold would be at most 0.24% and therefore well within the 10% threshold.

232 Therefore, by applying the EDR approach to assessing disturbance from pile driving to harbour porpoise within the SACs screened in, it is clear that there is, **therefore, no potential for an AEoI to the conservation objectives of the harbour porpoise feature of all sites screened in for piling disturbance (underwater noise) from AyM alone. Therefore, subject to natural change, the harbour porpoise feature at all sites will be maintained in the long term.**

UXO: TTS-onset approach

233 For the assessment of disturbance from the clearance of UXOs, the approach used is the application of the TTS-onset thresholds (Southall *et al*. 2019) as a proxy for disturbance. This is a result of discussion in Southall *et al*. (2007) which states that in the absence of empirical data on responses, the use of the TTS-onset threshold may be appropriate for single pulses (like UXO detonation):

"…upon exposure to a single pulse, the onset of significant behavioral disturbance is proposed to occur at the lowest level of noise exposure that has a measurable transient effect on hearing (i.e., TTS-onset). We recognize that this is not a behavioral effect per se, but we use this auditory effect as a de facto behavioral threshold until better measures are identified… [] …Although TTS is not a behavioral effect per se, this approach is used because any compromise, even temporarily, to hearing functions has the potential to affect vital rates by interfering with essential communication and/or detection capabilities. This approach is expected to be precautionary because TTS at onset levels is unlikely to last a full diel cycle or to have serious biological consequences during the time TTS persists."

234 The underwater noise modelling presented in ES Volume 4 Annex 6.2 Underwater Noise Report assumes the maximum UXO charge size will be 164 kg. The maximum TTS-onset impact range for harbour porpoise (VHF cetaceans) for a UXO of this size is 16 km (using SPL_{peak}) or 3.3 km (using SEL_{ss}). Even if the UXO were to be located within the array at the location closest to the North Anglesey Marine/ Gogledd Môn Forol (UK) SAC, the impact range would not extend far enough to overlap with the SAC (which is a minimum distance of 21 km from the array area).

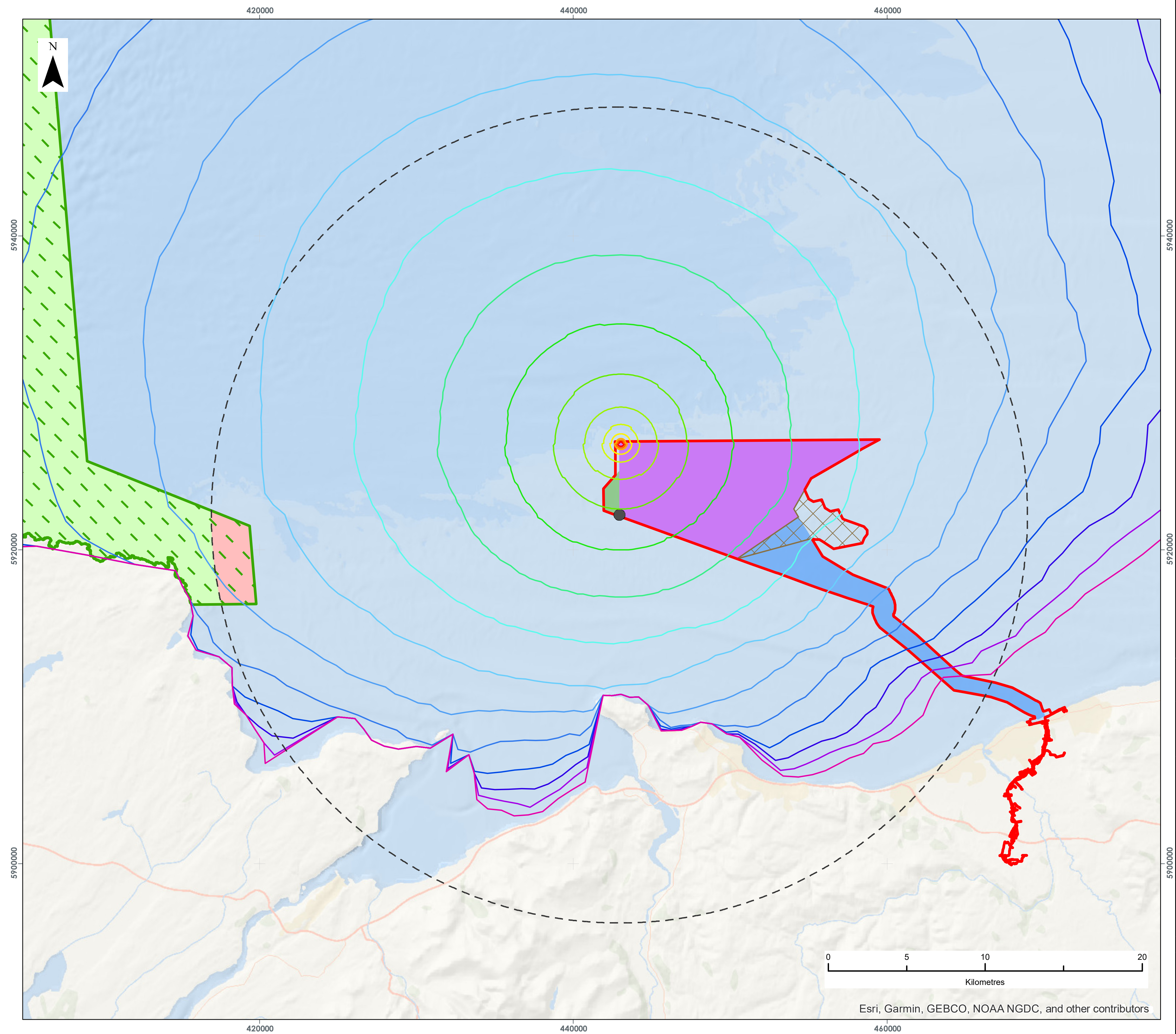
235 Therefore, by applying the TTS-onset threshold as a proxy for disturbance to assess disturbance from UXO detonation to harbour porpoise within the SACs screened in, it is clear that there is, therefore, **no potential for an AEoI to the conservation objectives of the harbour porpoise feature of all sites screened in for UXO detonation disturbance (underwater noise) from AyM alone and therefore, subject to natural change, the harbour porpoise feature at all sites will be maintained in the long term.**

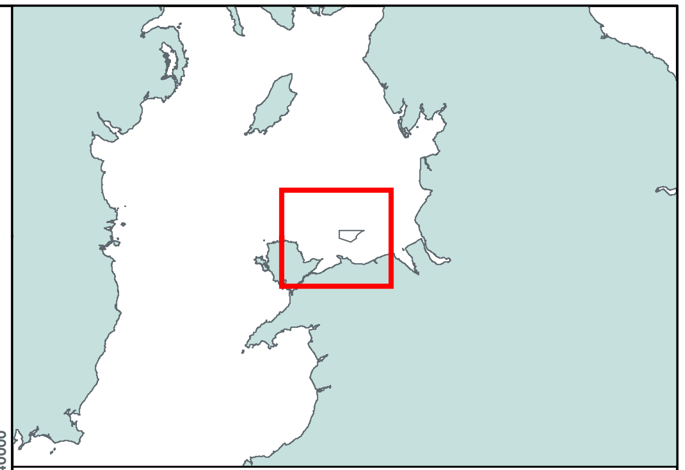
UXO: EDR approach

236 The EDR approach advocates the use of 26 km for high-order UXO clearance. The use of such a range would effectively rule out any potential disturbance within all of the harbour porpoise SACs screened in, with the exception of the North Anglesey Marine/ Gogledd Môn Forol (UK) SAC, which lies approximately 21 km from the array at its nearest point. Should UXO clearance occur at the closest location within the array area to the North Anglesey Marine/ Gogledd Môn Forol (UK) SAC, at most that would result in a footprint of disturbance of 7.69 km^2.

237 The North Anglesey Marine/ Gogledd Môn Forol (UK) SAC covers an area of 3,249 km^2. The footprint of disturbance (based on the EDR approach) would at most be 0.24% of the total SAC area, and therefore well within the daily 20% threshold. Even should such activity occur every day of the season in sufficient proximity to the site, the contribution to the 10% seasonal threshold would be at most 0.24% and therefore well within the seasonal threshold.

238 Therefore, by applying the EDR approach to assessing disturbance of harbour porpoise within the SACs screened in, it is clear that there is, therefore, **no potential for an AEoI to the conservation objectives of the harbour porpoise feature of all sites screened in for disturbance (underwater noise) from AyM alone. Therefore, subject to natural change, the harbour porpoise feature at all sites will be maintained in the long term.**





LEGEND

- Order Limits
- Array Area
- Offshore Export Cable Corridor
- Other Wind Farm Infrastructure Zone
- GyM Interlink Zone
- Closest Possible Piling Location
- 26km Effective Deterrence Radius (EDR)
- North Anglesey Marine / Gogledd Môn Forol SAC (3248km²)
- Area of SAC within 26km EDR (13.2km²)
- Area of SAC outwith 26km EDR (3234.8km²)

Unweighted SELss Isopleths (dB re 1 μPa ²s)

120	150	180
125	155	185
130	160	190
135	165	195
140	170	200
145	175	

Data Source:

PROJECT TITLE:

AWEL Y MÔR OFFSHORE WINDFARM

FIGURE TITLE: **EDR approach used for assessment**

VER	DATE	REMARKS	Drawn	Checked
1	18/09/2021	For Issue For PEIR	BPHB	RM
2	03/03/2022	For Issue For ES	BPHB	GG

FIGURE NUMBER: **Figure 5**

SCALE:	PLOT SIZE:	DATUM:	PROJECTION:
1:250,000	A3	WGS84	UTM30N

Fferm Wynt Alltraeth
AWEL Y MÔR
Offshore Wind Farm

G:\GIS\GIS_Projects\0141 AyM\GIS\Figures\ES\RIAA\AYM_RIAA_Fig5_EDR.mxd

Disturbance from other noise sources

239 Consideration to the potential for disturbance from noise other than piling or UXO clearance is given below. As demonstrated in Volume 2, Chapter 9: Shipping and Navigation, the area surrounding AyM already experiences high levels of vessel traffic, and thus the introduction of additional vessels during construction AyM is not a novel impact for marine mammals present in the area.

240 The potential for disturbance from vessel traffic is highly localised to the vessel. There are very few studies that indicate a critical level of activity in relation to risk of disturbance, but specific to the North Anglesey Marine SAC, site advice found that 'lower densities of harbour porpoise were found in areas with high levels of shipping traffic (based on a threshold of approximately 50 ships per day) in the summer'[xxxvii]. Vessel traffic in the AyM area, even considering the addition of AyM construction traffic will still be well below this figure (Volume 2, Chapter 9). Porpoise displacement has been observed up to 4 km from construction vessels (Benhemma-Le Gall *et al*. 2021), therefore, no adverse effect will therefore result as a consequence of the localised disturbance from vessel traffic, located outside the SAC.

241 There is little evidence on the impact of disturbance of harbour porpoise from other construction activities, such as cable laying, dredging, trenching, rock placement and drilling. There are some studies which have reported potential disturbance ranges from dredging activities, with these summarised in the ES (Volume 2, Chapter 7). All such activities were found to have the potential to result in disturbance on a temporary and short-term basis, up to a distance of 5 km from source (but typically less) (e.g. Verboom 2014, McQueen *et al*. 2020). There is therefore no potential for disturbance to result within any of the harbour porpoise SACs as a result (the closest being approximately 21 km distant) and therefore no contribution to any significant disturbance within the sites.

[xxxvii] https://data.jncc.gov.uk/data/f4c19257-2341-46b3-8e29-49665cd8f3d2/NorthAnglesey-SAC-Selection-Assessment-Document.pdf

242 Therefore, with respect to disturbance of harbour porpoise within the SACs screened in from any project activities, it is clear that there is, therefore, **no potential for an AEoI to the conservation objectives of the harbour porpoise feature of all sites screened in for disturbance (underwater noise) from AyM alone. Therefore, subject to natural change, the harbour porpoise feature at all sites will be maintained in the long term**.

Disturbance and Bottlenose Dolphin

243 Bottlenose dolphins are known to be sensitive to disturbance from underwater noise, with Volume 2, Chapter 7 referencing studies that report displacement of individuals in response to underwater noise but also studies showing individuals were not excluded from the vicinity of piling activities as a result of piling and in general that 'these data highlight a small spatial and temporal scale disturbance to bottlenose dolphins as a result of impact piling activities'. The potential consequences of disturbance are discussed in detail within the chapter, with that text not repeated here. Overall bottlenose dolphin were categorised as having a low sensitivity to behavioural disturbance.

244 Bottlenose dolphins within the 'Irish Sea' MU, within which both the SACs screened in for bottlenose dolphin are located (Cardigan Bay/ Bae Ceredigion (UK) SAC and the Pen Llŷn a`r Sarnau/ Lleyn Peninsula and the Sarnau (UK) SAC), have an estimated abundance of 293 dolphins (95% CI: 108 – 793, CV: 0.54) (estimated using data from SCANS III and ObSERVE) (IAMMWG 2021 in prep). No bottlenose dolphins were identified during site specific surveys although there were several sightings of dolphins which could not be identified to species level. Bottlenose dolphin have, however, been recorded in the wider region during the GyM surveys and around the coastal waters of north Wales by the Sea Watch Foundation. There is evidence of large home ranges and connectivity of bottlenose dolphins within the MU with photo-identification from boat-based and land-based surveys identifying the same individuals in both north Wales and Cardigan Bay/ Bae Ceredigion (UK) SAC (Feingold and Evans 2014). The population is known to have a large home range (Pesante *et al*. 2008) and therefore there is potential for connectivity between AyM and both the Cardigan Bay/ Bae Ceredigion (UK) SAC and the Pen Llŷn a`r Sarnau/ Lleyn Peninsula and the Sarnau (UK) SAC[xxxviii]. Site level information is summarised in Table 14 below.

245 The Regulation 37 Advice[xxxix] for the Cardigan Bay/ Bae Ceredigion (UK) SAC notes that bottlenose dolphins are seen year-round within the designated site, with numbers peaking in summer and group size peaking September to October. The Regulation 37 Advice notes 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 Llŷn 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. Within Cardigan Bay itself, they are most frequently seen along the southern coastline, inshore from about Aberystwyth to the Teifi Estuary. Individuals are known to use the north Wales coastline in the winter months and even in summer.

[redacted]

246 The advice on activity for both SACs included particular concerns in relation to noise, specifically in relation to species diversity, density or range.

Table 14: Summary of the bottlenose dolphin feature within SACs screened in.

DESIGNATED SITE	SITE POPULATION	CONSERVATION OBJECTIVE[xl]	CONSERVATION STATUS
Cardigan Bay/ Bae Ceredigion (UK) SAC	Given as 101-250 individuals in the citation[xli]. Is noted as being present and A in terms of size and density of the population (15-100% of the population), with conservation B (good), isolation of C (not isolated) and global value of A (excellent).	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.	Favourable[xlii]
Pen Llŷn a`r Sarnau/ Lleyn Peninsula and the Sarnau (UK) SAC	Not given in the citation document[xliii] but is noted as being present and C in terms of size and density of the population (0-2% of the population), with		Favourable[xliv]

[xl] Relevant to disturbance

[xli] https://jncc.gov.uk/jncc-assets/SAC-N2K/UK0012712.pdf

[redacted]

[xliii] https://jncc.gov.uk/jncc-assets/SAC-N2K/UK0013117.pdf

[redacted]

DESIGNATED SITE	SITE POPULATION	CONSERVATION OBJECTIVE[xl]	CONSERVATION STATUS
	conservation B (good), isolation of C (not isolated) and global value of C (significant).		

247 The Regulation 37 Advice requires that for disturbance 'appropriate steps are taken to avoid deterioration of habitats and significant disturbance of species'. When assessing whether an operation may result in such disturbance, the guidance notes that consideration should be given to: feature sensitivity; the type of operation; and vulnerability of the feature to those effects.

248 The Cardigan Bay SAC site evaluation for bottlenose dolphins lists a population size of 101 (min) to 250 (max) and was considered to be based on Moderate data quality (based on partial data with some extrapolation) (JNCC 2015). Population estimates have been modelled using photo-ID closed population mark-recapture modelling for both the Cardigan Bay SAC and the wider Cardigan Bay area (referring to both Cardigan Bay SAC and northern Cardigan Bay – which includes the majority of the Pen Llyn a'r Sarnau SAC) by Lohrengel *et al*. (2018). Using a closed population capture-mark-recapture, in 2016 there were estimated to be a population of 147 bottlenose dolphins in the Cardigan Bay SAC (95% CI: 127 – 194, CV: 0.29) and a population of 174 bottlenose dolphins in the wider Cardigan Bay area (95% CI: 150 – 246, CV: 0.30). Therefore the "Cardigan Bay SAC Population" size used herein is 147 bottlenose dolphins.

249 The Regulation 37 Advice[xlv] for the Pen Llŷn a`r Sarnau/ Lleyn Peninsula and the Sarnau (UK) SAC notes that bottlenose dolphins are considered of significant importance within the site but do not appear to form a semi-resident group and should be seen as part of a wider population that ranges across waters of the Irish Sea, and includes the Cardigan Bay SAC. It is also clear that connectivity between Cardigan Bay, the Lleyn Peninsula, around Anglesey and east towards Liverpool Bay exists. Within the SAC itself activity appears focused in Tremadog Bay, at the entrances to estuaries and close to some of the sarnau reefs, indicating that the catchments of the freshwater tributaries entering the site together with the offshore reefs contribute to the overall site integrity for the species. Food resources appear to be a primary factor in determining movements and site fidelity in bottlenose dolphins, with the SAC containing important potential feeding areas.

250 While it is clear that there is connectivity between both SACs and north Wales, it is not clear that all SAC bottlenose dolphins utilise the north Wales coastline – for example the Cardigan Bay Regulation 37 document notes 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 Llŷn Peninsula around the Isle of Anglesey, with other individuals having more localised behaviour within the SACs (to the southern end of Cardigan Bay for example). That does not mean that the remaining 70% do not use the north Wales coastline, but it is also clear that assuming 100% do would be overly precautionary. Annex 4 provides an assessment of the potential connectivity between north Wales and Cardigan Bay. In summary it was identified that up to 50% of the dolphin within north Wales may be connected to the Cardigan Bay SAC.

251 It is worth noting that, noise disturbance contours for bottlenose dolphin presented at ES do not extend south of Anglesey and therefore direct disturbance of bottlenose dolphins within either of the SACs will not occur. However, the bottlenose dolphins present in the coastal waters of north Wales could potentially be functionally linked to the two SAC populations.

252 Two different approaches are presented here to assess the AEoI:

[redacted]

- assuming all bottlenose dolphins in the Irish Sea MU are functionally linked to the SAC, and thus the "SAC population" is effectively considered to be the MU population
- assuming that not all bottlenose dolphins in the Irish Sea MU are linked to the SAC, and thus the impact is allocated to the SAC designated population.

253 ES Volume 2, Chapter 7 assesses potential for disturbance on bottlenose dolphin across the entire MU. The main potential source of disturbance to bottlenose dolphin relates to piling activity and UXO clearance.

Disturbance from pile driving

254 The disturbance assessment for pile driving was assessed using the harbour porpoise dose-response curve (Graham *et al*., 2017) for pile driving in the absence of species-specific response information for bottlenose dolphins.

255 The ES found that up to 23 individual bottlenose dolphins may be disturbed by noise from piling, per piling day, at the north-west (NW) location (representing 7.9% of the Irish Sea MU). That number represents the worst-case piling location, with all other piling locations resulting in disturbance of fewer individuals; down to 16 individuals at the south-east location (representing 5.5% of the MU).

MU population approach

256 In order to assess whether the predicted level of disturbance would be sufficient to cause a population level effect to the bottlenose dolphin MU, the interim iPCoD model (version 5.2) was run. The scenario run assumed that all bottlenose dolphins in the Irish Sea MU are functionally linked to the SAC, and thus the "SAC population" is effectively considered to be the MU population (293 animals) (see Annex 6.4.7.1 for details). The model assumed the absolute worst case scenario, that there could be a total of up to 201 days on which piling might occur (where it was precautionarily assumed that it could take up to three days to install a monopile, resulting in 150 piling days for 50 WTGs, 48 piling days for the two OSPs and 3 piling days for one met mast).The results of the modelling showed that there was some predicted impact on the MU population as a result of the piling activity at AyM (see Annex 6.4.7.1 for details). The median ratio of the impacted:un-impacted population size after 6 years of simulation (1 year of impact followed by 5 years with no impact) was 1 and the impacted mean population size after 6 years of simulation (1 year of impact followed by 5 years with no impact) was only 5 individuals smaller than the un-impacted mean population size (such that the impacted population size is expected to be 98.3% of the un-impacted population size). The population size remained the same after 12 years of simulation (1 year of impact followed by 11 years with no impact) and thus the population trajectory of both the impacted and un-impacted populations are expected to be stable in the long term.

257 The results from this precautionary worst-case scenario (assuming 23 dolphins were disturbed on every piling day and that it would take three days to install each monopile) is considered to be representative of a medium magnitude, whereby temporary changes in behaviour of individuals is at a scale that would result in potential reductions to lifetime reproductive success to some individuals although the population trajectory is not altered over a generation scale. As highlighted in ES Volume 2, Chapter 7: Marine Mammals, the sensitivity of bottlenose dolphins to disturbance from pile driving is expected to be low, since, while there remains the potential for disturbance and displacement to affect individual behaviour and therefore vital rates and population level changes, bottlenose dolphins do have some capability to adapt their behaviour and tolerate certain levels of temporary disturbance (New et al. 2013). This results in a minor overall impact, which is not significant with respect to the EIA Regulations.

258 As outlined in Annex 6.4.7.1, the iPCoD modelling conducted here is considered to be highly precautionary and likely to over-estimate the population level impacts of disturbance. If the model were to be run to include more realistic parameters (e.g. fewer piling days, inclusion of density dependence and different numbers of animals impacted from different piling location) then the population level results would more than likely be classified as a low magnitude.

259 Therefore, there were **no significant population level consequences to the bottlenose dolphin MU predicted by the modelling.**

SAC Population approach

260 In order to assess whether the predicted level of disturbance would be sufficient to cause a population level effect to the "SAC population", the interim iPCoD model (version 5.2) was run. The scenario run assumed that not all bottlenose dolphins in the Irish Sea MU are linked to the SAC, and thus all the impact is allocated to the SAC designated population (147 animals) (a significant overestimate, considering just 50% of the north Wales bottlenose dolphin may show some connectivity to the Cardigan Bay SAC) (see Annex 6.4.7.1 for full details).

261 The results of the modelling showed that there was some predicted impact on the "SAC population" as a result of the piling activity at AyM (see Annex 6.4.7.1 for full details). The median ratio of the impacted:un-impacted population size after 6 years of simulation (1 year of impact followed by 5 years with no impact) was 1 and the impacted mean population size after 6 years of simulation (1 year of impact followed by 5 years with no impact) was only 3 individuals smaller than the un-impacted mean population size (such that the impacted population size is expected to be 98% of the un-impacted population size). The population size remained the same after 12 years of simulation (1 year of impact followed by 11 years with no impact) and thus the population trajectory of both the impacted and un-impacted populations are expected to be stable in the long term.

262 The results from this precautionary worst-case scenario (assuming 23 dolphins were disturbed on every piling day, that all impact is attributed to the "SAC population" and that it would take three days to install each monopile) is considered to be representative of a medium magnitude. The sensitivity of bottlenose dolphins to disturbance from pile driving is expected to be low, therefore this results in a minor overall impact, which is not significant with respect to the EIA Regulations.

263 However, as outlined in Annex 6.4.7.1, the iPCoD modelling conducted here is considered to be highly precautionary and likely to over-estimate the population level impacts of disturbance.

264 Therefore, with respect to piling related disturbance of bottlenose dolphin within the SACs screened in, it is clear that there is, **therefore, no potential for an AEoI to the conservation objectives of the bottlenose dolphin feature of all sites screened in for disturbance (underwater noise) from AyM alone. Therefore, subject to natural change, the bottlenose dolphin feature at all sites will be maintained in the long term with respect to the population of the species.**

Disturbance from UXO clearance

265 As regards the potential for disturbance to bottlenose dolphin from UXO clearance, the TTS-onset thresholds as a proxy for disturbance have been applied, as described above for harbour porpoise. The maximum TTS-onset ranges for bottlenose dolphins (HF cetacean) from the detonation of a 164 kg UXO were 0.92 km (SPL_{peak}) and 0.34 km (SEL_{ss}), resulting in TTS-onset to less than a single bottlenose dolphin. As for the piling assessment above, there is therefore no potential for direct disturbance of bottlenose dolphin within either SAC.

266 Given the small impact ranges and the fact that less than one individual is predicted to be impacted for a given detonation event, it is clear that there is, therefore, no potential for an AEoI to the conservation objectives of the bottlenose dolphin feature of all sites screened in for disturbance from UXO clearance (underwater noise) from AyM alone and therefore, **subject to natural change, the bottlenose dolphin feature at all sites will be maintained in the long term with respect to the population of the species**.

Disturbance from other noise sources

267 As regards the potential for vessel related disturbance to affect bottlenose dolphin, ES cited previous modelling of bottlenose dolphin in the Moray Firth in response to increased vessel traffic from offshore wind development, finding it to have no negative impact on the local population (Lusseau *et al*. 2011). There is also evidence of bottlenose dolphins becoming habituated to increased boat traffic, particularly larger commercial vessels which have predictable patterns of movement and do not actively disrupt feeding behaviour as a recreational or tourist vessel may (Sini *et al*. 2005). It can therefore be concluded that no adverse effect will result to bottlenose dolphin with connectivity to the SACs as a consequence of AyM.

268 There is little evidence on the impact of disturbance of bottlenose dolphin from other construction activities, such as cable laying, dredging, trenching, rock placement and drilling. There are some studies which have reported potential disturbance ranges for marine mammals from dredging activities, with these summarised in the ES (Volume 2, Chapter 7). All such activities were found to have the potential to result in disturbance on a temporary and short-term basis, up to a distance of 5 km from source (but typically less). Sheet piling at the cofferdam in the intertidal area will result in short-term, small-scale disturbance, with only a small area affected by the noise due to rapid attenuation of sound with shallow water. There is therefore no potential for disturbance to result within either of the bottlenose dolphin SACs as a result. With respect to the significance of such disturbance for individual bottlenose dolphins, ES found it to be within (less) than that from piling and therefore no potential for adverse effect will similarly result.

269 Therefore, with respect to disturbance of bottlenose dolphin within the SACs screened in from any project activities, it is clear that there is, therefore, **no potential for an AEoI to the conservation objectives of the bottlenose dolphin feature of both sites screened in for disturbance (underwater noise) from AyM alone. Therefore, subject to natural change, the bottlenose dolphin feature at both sites will be maintained in the long term with respect to the range and the population of the species.**

Disturbance and Grey Seal

270 ES (Volume 2, Chapter 7) found limited data on grey seal behavioural responses to pile driving, with the key dataset being within Aarts *et al*. (2018) and Hastie *et al.* (2021). The tagged grey seals showed varying responses to the pile driving, including no response, altered surfacing and diving behaviour, and changes in swimming direction. The distances at which seals responded varied significantly; one grey seal showed responses at 45 km from the pile location, while other grey seals showed no response within 12 km. The telemetry data also showed that seals returned to the pile driving area after pile driving ceased. Overall, ES found grey seal to have a negligible sensitivity to disturbance resulting in displacement as a consequence of pile driving.

271 As regards grey seal sensitivity to vessel disturbance, ES (Volume 2, Chapter 7) referenced several papers (e.g. Jones *et al*. (2017) and Thomsen *et al*. (2006)) that found a large degree of co-occurrence of ships and seals at sea in the UK, particularly within 50 km of the coast close to seal haul-outs, with no evidence relating decreasing seal populations with high levels of co-occurrence between ships and animals. ES assessed the sensitivity of grey seals to disturbance from vessels as negligible.

272 NRW advise that for the purposes of HRA, the entire MU is considered (NRW, 2020). For grey seals NRW advise that the most appropriate interim MU is the OSPAR Region III: Celtic Seas area. The OSPAR Region III: Celtic Seas MU contains an estimated 66,100 grey seals (calculated as the total number of grey seals expected to be at-sea based on the seal habitat preference maps (Carter *et al*. 2020) and scaled to account for those seals on-land).

273 As detailed in Annex 4, there is evidence from the telemetry data obtained from tagged grey seals that there is connectivity between the AyM area and the following SACs:

- Lleyn Peninsula and the Sarnau/ Pen Llyn a`r Sarnau (Wales);
- Pembrokeshire Marine/ Sir Benfro Forol (Wales);
- Cardigan Bay/ Bae Ceredigion (Wales);
    - Saltee Islands (Ireland);
- Lambay Island (Ireland); and
- Isles of Scilly Complex (England).

274 Therefore, these six SACs are screened into the assessment for grey seals. The closest of these sites for AyM is Pen Llŷn a`r Sarnau/ Lleyn Peninsula and the Sarnau (UK) SAC at approximately 55 km distant.

275 The highest levels of connectivity (Annex 4.7.1) with AyM are with the Pen Llyn a`r Sarnau/ Lleyn Peninsula and the Sarnau SAC, where 11 of the 23 grey seals recorded telemetry track data (48%). There were much lower levels of connectivity with the other SACs: only three of the 23 grey seals recorded telemetry data within the Cardigan Bay/ Bae Ceredigion SAC (13%), four recorded telemetry data within the Pembrokeshire Marine/ Sir Benfro Forol SAC (17%), two recorded data in the Saltee Islands SAC (9%) and one seal recorded telemetry data near the Lambay Island SAC.

276 As shown from the telemetry data, the photo-ID data held in the EIRPHOT database found high levels of connectivity between sites along the Welsh coast, within SACs, between different SACs, and between SACs and non-designated areas (Annex 4). These data further highlight the fact that there is no such thing as a "Lleyn Peninsula SAC grey seal" as there is evidence from both the telemetry and photo-ID data that grey seals move between SACs along the Welsh coastline. As such, all grey seals within the MU are considered to be functionally linked to the SACs within that MU.

277 Site level information for each SAC screened in (together with the Isle of Scilly complex) is summarised in Table 15 below.

Table 15: Summary of the grey seal feature within SACs screened in.

DESIGNATED SITE	SITE POPULATION	% OF TAGGED SEAL SHOWING SOME SAC CONNECTIVITY	CONSERVATION OBJECTIVE[xlvi]	CONSERVATION STATUS
Pen Llŷn a`r Sarnau/ Lleyn Peninsula and the Sarnau (UK) SAC	101-250	48%	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	Favourable[xlvii]
Cardigan Bay/ Bae Ceredigion (UK) SAC	None given	13%		Favourable[xlviii]
Pembrokeshire Marine (UK) SAC	1001-10,000	17%		Favourable[xlix]
Isle of Scilly complex (UK) SAC	272	0% noted in Annex 4.7.1	Human activities should occur at levels that do not adversely affect the grey seal population at the site	Favourable
Saltee Islands (Ireland) SAC	571-734	9%	Human activities should occur at levels that do not adversely	Assumed favourable

[xlvi] Relevant to disturbance

[redacted]

[xlix] https://naturalresourceswales.gov.uk/media/684239/indicative-condition-assessment-2018-pembrokeshire-marine-sacv2.pdf

DESIGNATED SITE	SITE POPULATION	% OF TAGGED SEAL SHOWING SOME SAC CONNECTIVITY	CONSERVATION OBJECTIVE[xlvi]	CONSERVATION STATUS
			affect the grey seal population [within the site][l]	(target is to maintain)
Lambay Island (Ireland) SAC	196-252	4%	Human activities should occur at levels that do not adversely affect the grey seal population at the site[li]	Assumed favourable (target is to maintain)

[redacted]

278 Within the Regulation 37 documents for the Welsh sites, potential for disturbance from noise is noted with respect to mobile species particularly mammals. Advice on action that may be required is mainly around cumulative effects, management and maintaining favourable conservation status (FCS).

Disturbance from piling

279 ES (Volume 2, Chapter 7) identified the maximum number of grey seals predicted to be disturbed on a single piling day as being 81 individuals (0.1% of the MU), from pile driving of a monopile at the NW location. All other piling scenarios would disturb fewer individuals.

280 For the population of grey seal within each SAC, there will be no direct disturbance within any of the SACs screened in. However, it is considered that all grey seals that are impacted by AyM, are functionally linked to each of the SACs.

281 Two different approaches are presented here to assess the AEoI:

- assuming all grey seals in the OSPAR Region III MU are functionally linked to the SACs, and thus the "SAC populations" is effectively considered to be the MU population
- assuming that not all grey seals in the OSPAR Region III MU are linked to the SACs, and thus the impact is allocated to the SAC designated population.

MU population approach

282 In order to assess whether the predicted level of disturbance would be sufficient to cause a population level effect to the grey seal MU, the interim iPCoD model (version 5.2) was run. The scenario run assumed that all grey seals in the OSPAR Region III MU are functionally linked to the SACs, and thus the "SAC populations" are effectively considered to be the MU population (66,100 animals) (see Annex 6.4.7.1 for details). The model assumed the absolute worst-case scenario, that there could be a total of up to 201 days on which piling might occur (where it was precautionarily assumed that it could take up to three days to install a monopile, resulting in 150 piling days for 50 WTGs, 48 piling days for the two OSPs and 3 piling days for one met mast). The model assumed that one monopile is installed in one day, equating to 67 piling days (50 piling days for WTGs, 1 for the met mast and 16 for the OSPs). An indicative piling schedule was not available for use, and therefore the piling days were randomly spread throughout the 12-month construction period.

283 The results of the modelling showed that there was no impact on the MU population as a result of the piling activity at AyM (see Annex 6.4.6.2). The median ratio of the impacted vs un-impacted population size after 6 years of simulation (1 year of impact followed by 5 years with no impact) was 1 and the impacted mean population size after 6 years of simulation (1 year of impact followed by 5 years with no impact) was the same as the un-impacted mean population size. Therefore, there were **no population level consequences to the grey seal MU predicted by the modelling.**

SAC population approach

284 It should be noted that when attributing impacts to the "grey seal SAC population" of any of the identified SACs below it is important to consider that the grey seal population in the UK has been significantly increasing for several years, and therefore the "SAC population size" at the time of SAC designation is considerably smaller than that estimated by the current count data. Whilst the information presented in the following paragraphs is based on the citations for the relevant sites, these do not necessarily accurately represent the current population; a specific example of the difference between the citation population for the Lleyn Peninsula and the Sarnau SAC and the current population based on count data for the site is provided in Annex 4 and summarised below.

285 The Pen Llŷn a`r Sarnau/ Lleyn Peninsula and the Sarnau (UK) SAC is the closest of the 5 SACs to AyM (at approximately 55 km range). The population of the SAC identified in the citation is 101-250 individuals (Natura data form dated 2016[lii]), with the 2018 feature condition assessment[liii] noting that pup production at regularly monitored sites (Bardsey Island) and haul out numbers have been maintained or increased since 2009, with the site population in favourable condition. More recent analysis of the photo-ID images within the EIRPHOT database (as summarised in Annex 4) identified 618 individuals at Bardsey Island in 2011 which is the main breeding site within the Lleyn Peninsula and the Sarnau SAC. This highlights that the SAC designation size is not reflective of the number of grey seals using the SAC. Therefore, using the estimated population size at the time of SAC designation against which to assess potential impacts is considered to be inappropriate as it is not reflective of the current level of grey seal usage within the SAC.

286 In order to assess whether the predicted level of disturbance would be sufficient to cause a population level effect to the Pen Llŷn a`r Sarnau/ Lleyn Peninsula and the Sarnau (UK) SAC population, the interim iPCoD model (version 5.2) was run. The scenario run assumed all impact was attributed to the "SAC population" (618 animals) (see Annex 6.4.7.1 for full details).

[lii] https://jncc.gov.uk/jncc-assets/SAC-N2K/UK0013117.pdf
[redacted]

287 The results of the modelling showed that there was no impact on the MU population as a result of the piling activity at AyM (see Annex 6.4.6.2). The median ratio of the impacted vs un-impacted population size after 6 years of simulation (1 year of impact followed by 5 years with no impact) was 1 and the impacted mean population size after 6 years of simulation (1 year of impact followed by 5 years with no impact) was the same as the un-impacted mean population size. Therefore, there were **no population level consequences to the Lleyn Peninsula and the Sarnau predicted by the modelling.**

288 This modelling was considered to be highly precautionary since it was assumed that all grey seals impacted by AyM are considered to be SAC seals, whereas the telemetry data for grey seals in the vicinity of AyM showed that only approximately 48% of the impacted seals are expected to show connectivity to the Pen Llŷn a`r Sarnau/ Lleyn Peninsula and the Sarnau (UK) SAC.

289 All other SACs are further away from AyM than the Pen Llŷn a`r Sarnau/ Lleyn Peninsula and the Sarnau (UK) SAC and since no impact is predicted to the Pen Llŷn a`r Sarnau/ Lleyn Peninsula and the Sarnau (UK) SAC population, there is expected to be no impact to any other grey seal SAC.

290 The Cardigan Bay/ Bae Ceredigion (UK) SAC is approximately 119 km from AyM, with no site population given in the Natura 2000 data form[liv]. There are no regularly monitored sites for grey seal in the SAC[lv]. Construction (and decommissioning) activity at AyM has the potential to disturb grey seals, which are present in the OSPAR Region III MU and therefore considered to be functionally linked to the Cardigan Bay/ Bae Ceredigion (UK) SAC. Based on the telemetry data for grey seals in the vicinity of AyM, approximately 13% of the impacted seals are expected to show connectivity with the Cardigan Bay/ Bae Ceredigion (UK) SAC. **There is expected to be no population level impact to the SAC as a result of this low level disturbance.**

[liv] https://jncc.gov.uk/jncc-assets/SAC-N2K/UK0012712.pdf
[redacted]

291 The Pembrokeshire Marine (UK) SAC is approximately 189 km from AyM, with the Natura data form giving a site population of 1001-10,000[lvi]. The site condition assessment found that pup production has increased in the SAC over the last decade or more, in some cases exponentially. Construction (and decommissioning) activity at AyM has the potential to disturb grey seals, which are present in the OSPAR Region III MU and therefore considered to be functionally linked to the Pembrokeshire Marine (UK) SAC. Based on the telemetry data for grey seals in the vicinity of AyM, approximately 17% of the impacted seals are expected to show connectivity with the Pembrokeshire Marine (UK) SAC. **There is expected to be no population level impact to the SAC as a result of this low level disturbance.**

292 At its closest point the Saltee Islands SAC is located approximately 232.1 km from AyM, with the Natura 2000 data form giving a population of 571-734 individuals[lvii]. Construction (and decommissioning) activity at AyM has the potential to disturb grey seals, a proportion of which are likely to show some connectivity to the SAC. Based on the telemetry data for grey seals in the vicinity of AyM, approximately 9% of the impacted seals are expected to show connectivity with the Saltee Islands SAC. **There is expected to be no population level impact to the SAC as a result of this low-level disturbance.**

293 At its closest point, the Lambay Island SAC is located approximately 138.6 km from AyM, with the Natura 2000 data form giving a population of 196-252 individuals[lviii]. Construction (and decommissioning) activity at AyM has the potential to disturb grey seals, a proportion of which are likely to show some connectivity to the SAC. Based on the telemetry data for grey seals in the vicinity of AyM, approximately 4% of the impacted seals are expected to show connectivity with the Lambay Island SAC. **There is expected to be no population level impact to the SAC as a result of this low-level disturbance.**

[lvi] https://jncc.gov.uk/jncc-assets/SAC-N2K/UK0013116.pdf

[lvi] [redacted]

294 At its closest point, the Isle of Scilly complex SAC is located approximately 416.6 km from the proposed AyM array, with the Natura 2000 data form giving a population of 272 individuals[lix]. Construction (and decommissioning) activity at AyM has the potential to disturb grey seals, which are present in the OSPAR Region III MU and therefore considered to be functionally linked to the Isle of Scilly complex SAC. **There is expected to be no population level impact to the SAC as a result of this low-level disturbance.**

Disturbance from UXO clearance

295 As regards the potential for disturbance to grey seal from UXO clearance, ES applies the TTS-onset thresholds as a proxy for disturbance, as described above for harbour porpoise. The predicted TTS-onset impact ranges for seals for a 164 kg UXO are 3.1 km (SPL_{peak}) and 12 km (SEL_{ss}).

296 As for the piling assessment above, there is therefore no potential for direct disturbance of grey seal within any of the SACs screened in, with disturbance being related to range outwith the sites and disturbance of individuals. As for piling, the range of grey seal will not be reduced beyond that temporary and short-term basis and will therefore not be adversely affected. For disturbance of individuals, the number of animals that may be disturbed per UXO clearance event is up to 195 grey seals (0.29% of the MU). Such events are expected to occur up to 10 times. Given this low level of repeated disturbance, it is unlikely that any change in individual vital rates would be significant, and thus there is expected to be no change to the population. **Therefore, no adverse effect will result to the grey seal population within the MU or within each SAC.**

[lix] https://jncc.gov.uk/jncc-assets/SAC-N2K/UK0013694.pdf

Disturbance from other noise sources

297 As stated in ES (see Volume 2, Chapter 9), the area surrounding AyM already experiences a high amount of vessel traffic. Therefore, the introduction of additional vessels during construction and decommissioning of AyM is not a novel impact for marine mammals present in the area but will add to the existing level of background shipping noise. Grey seals have been shown to respond to both small (~2 kHz) and large (~0.25 kHz) vessels at approximately 400 m (Thomsen *et al*. 2006). However, they are frequently observed in areas of high vessel traffic, particularly within 50 km of the coast close to seal haul-outs (Jones *et al*. 2017). The co-occurrence of grey seals and vessel traffic has also not been linked to any adverse impact on population size. Therefore, no adverse effect will result with respect to grey seal range or the population within individual SACs.

298 There is little evidence on the impact of disturbance of marine mammals from other construction activities, such as cable laying, dredging, trenching, rock placement and drilling. There are some studies which have reported potential disturbance ranges from dredging activities, with these summarised in ES (Volume 2, Chapter 7). All such activities were found to have the potential to result in disturbance on a temporary and short-term basis, up to a distance of 5 km from source (but typically less). There is therefore no potential for disturbance to result within any of the grey seal SACs as a result. With respect to the significance of such disturbance for individual marine mammals, ES found it to be within (less) than that from piling and therefore no potential for adverse effect will result.

299 Therefore, with respect to underwater noise related disturbance of grey seal within the SACs screened in, it is clear that there is, therefore, **no potential for an AEoI to the conservation objectives of the grey seal feature of all sites screened in for disturbance (underwater noise) from AyM alone. Therefore, subject to natural change, the grey seal feature at all sites will be maintained in the long term with respect to range and population of the species.**

10.3 Offshore and Intertidal Ornithology

10.3.1 Introduction

300 A description of the significance of project level effects upon the receptors grouped under ‘offshore and intertidal ornithology’, as relevant to the designated site and its associated features screened in for LSE (as summarised in Table 5), is provided below.

Construction and Decommissioning

Disturbance and Displacement

301 The construction and decommissioning phases have the potential to affect birds in the marine environment through disturbance from a number of sources including the installation of foundations, towers, blades, export cables and other infrastructure and the movement of vessels and helicopters. The disturbance created has the potential to result in displacement of birds from the site of construction and decommissioning, from an area around it and from routes used by vessels to access the construction/decommissioning site. This displacement could effectively result in temporary habitat loss through a reduction in the area available to birds for feeding, resting and moulting.

302 The screening process concluded there was potential for disturbance and displacement during the construction and decommissioning phases where LSE cannot be ruled out, relating to the following designated sites and the relevant features:

- Liverpool Bay/ Bae Lerpwl SPA – red-throated diver, common scoter and red-breasted merganser (assemblage feature only) during the non-breeding bio-season;
- Lambay Island SPA – guillemot, razorbill and puffin during the breeding bio-season;
- Ireland’s Eye SPA – guillemot and razorbill during the breeding bio-season;
- Skomer, Skokholm and the Seas off Pembrokeshire/ Sgomer, Sgogwm a Moroedd Penfro SPA – puffin during the breeding bio-season;
- Rathlin Island SPA – puffin during the breeding bio-seasons (assemblage feature only);

- Saltee Islands SPA – puffin during the breeding bio-season;
- Grassholm SPA – gannet during the breeding bio-season; and
- Ailsa Craig SPA – gannet during the breeding and non-breeding bio-seasons.

303 Any impacts resulting from disturbance and displacement during the construction phase are considered to be short-term, temporary and reversible in nature, lasting only for the duration of construction activities, as birds would return to the area once construction activities have ceased. Disturbance and displacement of birds during the construction phase is most likely to affect birds foraging in and around the construction area. The level of disturbance at each work location would differ dependent on the activities taking place, but there could be vessel movements at any time of day or night over the entire construction period.

304 Disturbance from areas around construction activity in effect represents indirect habitat loss, which could potentially reduce the area available to those seabirds (that are sensitive to disturbance) to forage, loaf and/ or moult that currently occur within and around AyM. Displacement may contribute to individual birds experiencing fitness consequences, which at an extreme level could lead to the mortality of individuals. The level of effect is defined by the MDS used for assessment which can be found in Volume 2, Chapter 4.

305 In order to assess the risk resulting from disturbance and displacement, an analysis of key displacement sensitive species has been carried out as described in Volume 4, Annex 4.2.

306 It is recognised that the potential disturbance and displacement to ornithological receptors from construction and decommissioning activities is expected to be less than during the operational phase of the offshore wind farm. Currently, few studies have provided definitive empirical displacement rates for the construction phase of offshore wind farm developments. Disturbance during construction is mainly focused around where construction vessels and piling activities are occurring. Displacement rates for auks during construction have been shown to either be significantly lower or comparable to that during the operational phase (Royal Haskoning, 2013; Vallejo *et al*., 2017). Additionally, differences are seen between operational and non-operational turbines such as gannets having higher flight paths next to operating versus non-operating turbines (Krijgsveld *et al*., 2011). These studies would suggest that although the level of disturbance from construction activities can be high, it is focussed around a limited area of the development site, therefore, displacement rates for the entire site reflect reduced displacement rates within the site away from construction areas.

307 Actual rates of displacement during the construction are difficult to determine, however impacts are unlikely to reach the same level as those estimated during the operational phase of AyM. Therefore, for the purpose of providing a precautionary approach to assessing the potential impacts on gannets and auks during the construction phase of AyM, the magnitude of displacement used in this assessment will be 50% (as agreed with SNCBs (Table 5)) of that applied in the operational phase assessments. The level of displacement for gannets and auk species will therefore be as follows:

- For gannet, consideration is provided to half of the O&M displacement rates (range of 60% to 80%), which is 30% to 40% displacement during the construction phase;
- For auk species (guillemot, razorbill and puffin) consideration is also provided to half of the O&M displacement rate of 50% displacement (with a range of 30% to 70%), which is 25% displacement (with a range of 15% to 35%) during the construction phase;
- For gannet and auk species the level of mortality applied for this assessment is 1% of those displaced as impacts are temporally/ spatially limited, though this is likely to be overly precautionary (Presented within section 4.12.1 of Chapter 4 Offshore Ornithology); and

- SNCBs advise using a range of mortality rates for gannet and auk species of 1-10%. Assessment using 10% mortality rates are presented at the end of the alone assessment in Table 29 for all designated features screened in for AyM.

308 During construction and decommissioning, red-throated diver and common scoter have been assessed at Liverpool Bay SPA for displacement impacts within the array plus the buffer and export cable corridor. Details on displacement and mortality rates used for red-throated diver and common scoter for these two impacts can be found within their corresponding assessments. Additionally, the impacts of these two pathways are additively combined for each species to allow overall assessment during construction and decommissioning within the SPA.

309 The assessments provided within this RIAA include a number of assumptions that contribute to the predicted impacts and potential effects being considered overly precautionary, including:

- The population assessed within each bio-season being the mean (Volume 4, Annex 4.1) of the peaks from each survey year. This makes the assumption that such a high population is maintained for each of the months within the bio-season, whilst the actual abundance of each species is likely to be less than this for much of the bio-season;
- The maximum extent of displacement considered for each species is likely to be greater than actually experienced within the array area and buffer zone;
- The 1% mortality of birds displaced is highly unlikely, as the species assessed in this RIAA are not solely dependent upon the area within the AyM array area and buffer for all their foraging needs either within the breeding or non-breeding bio-seasons; and
- The adult birds that are actively breeding will respond to displacement by putting themselves to further stress to the extent of dying rather than ceasing to breed (i.e. abandoning eggs or young) and surviving to breed in a later year.

310 For the purpose of this assessment the impacts from decommissioning are similar to and potentially less than outlined in the construction phase. Therefore, decommissioning impacts will be at a maximum those that are presented for construction.

311 Additional sites have been screened in during the construction and decommissioning phases on request by NRW (Table 1), these could not be ruled out for the following designated sites and the relevant features:

- Ynys Seiriol/ Puffin Island SPA – cormorant;
- Skomer, Skokholm and the Seas off Pembrokeshire/ Sgomer, Sgogwm a Moroedd Penfro SPA – Manx shearwater, storm petrel, guillemot (non-breeding only; assemblage feature only) and razorbill (non-breeding only; assemblage feature only);
- Copeland Islands SPA – Manx shearwater; and
- Glannau Aberdaron ac Ynys Enlli/ Aberdaron Coast and Bardsey Island SPA – Manx shearwater.

312 The level empirical evidence of displacement rate (and indeed, any consequential mortality) for Manx shearwater is currently largely unknown, therefore through discussion with NRW the following rates have been used for Manx shearwater at Skomer, Skokholm and the Seas off Pembrokeshire SPA, Aberdaron Coast and Bardsey Island SPA and Copeland Island SPA:

- Consideration is provided to half of the O&M displacement rates (range of 30% to 70%), which is 15% to 35% displacement during the construction phase;
- The level of mortality applied for this assessment is 1% of those displaced as impacts are temporally/ spatially limited, though this is likely to be overly precautionary (based on evidence provided within Section 4.12.1 of the Environmental Statement, Offshore Ornithology (Chapter 4));
- SNCBs advise using a range of mortality rates for Manx shearwater of 1-10%. Assessment using 10% mortality rates are presented at the end of the alone assessment in Table 29 for all designated features screened in for AyM.

313 Impacts to storm petrel and cormorant at Copeland Island SPA have been assessed using a qualitative assessment as discussed with NRW.

Visual and/ or noise disturbance to species

314 The screening process concluded that potential for LSE (from visual and/ or noise disturbance to species during the construction and decommissioning phases) could not be ruled out for the following designated sites and the relevant features:

- The Dee Estuary SPA (onshore) – little tern, sandwich tern, bar-tailed godwit, redshank (wintering and passage), shelduck, teal, pintail, oystercatcher, grey plover, knot, dunlin, black-tailed godwit, curlew and waterbird assemblage; and
- The Dee Estuary Ramsar (onshore) – redshank (wintering and passage), shelduck, teal, pintail, oystercatcher, grey plover, knot, dunlin, black-tailed godwit, curlew, bar-tailed godwit and waterbird assemblage.

Operation and Maintenance

Disturbance and Displacement

315 The presence of WTGs has the potential to directly disturb and displace seabirds that would normally reside within and around the area of sea where AyM is proposed to be developed. Disturbance and displacement may also be caused by the movement of vessels during the operational phase, such as maintenance vessels.

316 The screening process concluded that potential for LSE (from disturbance and displacement during the O&M phase) could not be ruled out for the following designated sites and the relevant features:

- Liverpool Bay/ Bae Lerpwl SPA – red-throated diver, common scoter and red-breasted merganser (assemblage feature only) during the non-breeding bio-season;
- Anglesey Terns/ Morwenoliaid Ynys Mon SPA – sandwich tern and roseate tern during the breeding bio-season;
- Lambay Island SPA – guillemot, razorbill and puffin during the breeding bio-season;
- Ireland's Eye SPA – guillemot and razorbill during the breeding bio-season;
- Skomer, Skokholm and the Seas off Pembrokeshire/ Sgomer, Sgogwm a Moroedd Penfro SPA – puffin during the breeding bio-season;
- Rathlin Island SPA – puffin during the breeding bio-season (assemblage feature only);
- Saltee Islands SPA – puffin during the breeding bio-season;
- Ailsa Craig SPA – gannet during the breeding and non-breeding bio-seasons; and
- Grassholm SPA – gannet during the breeding bio-season.

317 Activities associated with the O&M of WTGs and the presence of WTGs themselves may disturb and displace species within the array area and potentially within surrounding buffers to a lower extent. This in effect represents indirect habitat loss, which would potentially reduce the area available to those seabirds to forage, loaf and/or moult that currently occur within and around AyM and may be susceptible to displacement from such a development. Displacement may contribute to individual birds experiencing fitness consequences, which at an extreme level could lead to the mortality of individuals. The level of effect is defined by the MDS used for assessment which can be found in ES Volume 2, Chapter 4.

318 In order to assess the risk resulting from disturbance and displacement, an analysis of key displacement sensitive species has been carried out as described in Volume 4, Annex 4.2.

319 The Applicant level of displacement for gannets and auk species will be as follows:

- For gannet, the O&M displacement rates used are a range of 60% to 80%;
- For auk species (guillemot, razorbill and puffin) the O&M displacement rate of 50% displacement will be used (with a range of 30% to 70%);
- For gannet and auk species the level of mortality applied for this assessment is 1% of those displaced, though this is likely to be overly precautionary; and
- SNCBs advise using a range of mortality rates for gannet and auk species of 1-10%. Assessment using 10% mortality rates are presented at the end of the alone assessment in Table 29 for all designated features screened in for AyM.

320 Details on the displacement and mortality rates used by the Applicant for auks and gannet are discussed in Volume 2, Chapter 4 Offshore Ornithology (application ref: 2.4). Additionally, displacement rate ranges will be presented in line with the Displacement Interim Guidance (SNCB, 2017).

321 Details on displacement and mortality rates used for red-throated diver, common scoter and terns can be found within their corresponding assessments.

322 The assessments provided within this RIAA include a number of assumptions that contribute to the predicted impacts and potential effects being considered overly precautionary, including:

- The population assessed within each bio-season being the mean (Volume 4, Annex 4.1) of the peaks from each survey year. This makes the assumption that such a high population is maintained for each of the months within the bio-season, whilst the actual abundance of each species is likely to be less than this for much of the bio-season;
- The maximum extent of displacement considered for each species is likely to be greater than actually experienced within the array area and buffer zone;
- The 1% mortality of birds displaced is highly unlikely, as the species assessed in this RIAA are not solely dependent upon the area within the AyM array area and buffer for all their foraging needs either within the breeding or non-breeding bio-seasons; and
- The adult birds that are actively breeding will respond to displacement by putting themselves to further stress to the extent of dying rather than ceasing to breed (i.e. abandoning eggs or young) and surviving to breed in a later year.

323 Additionally, the following sites have been screened into assessment during O&M phase by request from NRW (Table 1):

- Ynys Seiriol/ Puffin Island SPA – cormorant;
- Skomer, Skokholm and the Seas off Pembrokeshire/ Sgomer, Sgogwm a Moroedd Penfro SPA – storm petrel, Manx shearwater, guillemot (displacement during non-breeding only; assemblage feature only) and razorbill (displacement during non-breeding only; assemblage feature only);
- Copeland Islands SPA – Manx shearwater; and
- Glannau Aberdaron ac Ynys Enlli/ Aberdaron Coast and Bardsey Island SPA – Manx shearwater.

324 The level of displacement and mortality for Manx shearwater is currently largely unknown, therefore through discussion with NRW the following rates have been used for Manx shearwater:

- The O&M displacement rates used will be a range of 30% to 70%;
- The level of mortality applied for this assessment is 1% of those displaced, though this is likely to be overly precautionary;

- SNCBs advise using a range of mortality rates for Manx shearwater of 1-10%. Assessment using 10% mortality rates are presented at the end of the alone assessment in Table 29 for all designated features screened in for AyM.

325 NRW also requested that cormorant from Ynys Seiriol/ Puffin Island SPA and storm petrel from Skomer, Skokholm and the Seas off Pembrokeshire SPA be assessed qualitatively during O&M. As the impact for assessment was not specified, disturbance and displacement, collision risk and barrier effect have all been assessed for this feature at this SPA.

Visual and/ or noise disturbance to species

326 The screening process concluded that potential for LSE (from visual and/ or noise disturbance to species during the O&M phase) could not be ruled out for the following designated sites and the relevant features:

- The Dee Estuary SPA (onshore) – little tern, sandwich tern, bar-tailed godwit, redshank (wintering and passage), shelduck, teal, pintail, oystercatcher, grey plover, knot, dunlin, black-tailed godwit, curlew and waterbird assemblage; and
- The Dee Estuary Ramsar (onshore) – redshank (wintering and passage), shelduck, teal, pintail, oystercatcher, grey plover, knot, dunlin, black-tailed godwit, curlew, bar-tailed godwit and waterbird assemblage.

Collision Risk

327 There is a potential collision risk to birds which fly through the AyM array area whilst foraging for food, commuting between breeding sites and foraging areas, or when on migration. The risk to birds arises from colliding with the WTG rotors and associated infrastructure resulting in injury or fatality.

328 The screening process concluded that potential for LSE (from collision risk during the O&M phase) could not be ruled out for the following designated sites and the relevant features:

- Liverpool Bay SPA – red-breasted merganser, common tern and little tern during the migration bio-seasons and little gull during the non-breeding bio-seasons;

- The Dee Estuary SPA – Sandwich tern, little tern, common tern, bar-tailed godwit, redshank, shelduck, teal, pintail, oystercatcher, grey plover, knot, dunlin, black-tailed godwit, curlew and waterbird assemblage during the migration bio-seasons;
- Dee Estuary Ramsar – redshank, shelduck, teal, pintail, oystercatcher, grey plover, knot, dunlin, black-tailed godwit, curlew, bar-tailed godwit and waterbird assemblage during the migration bio-seasons;
- Anglesey Terns/ Morwenoliaid Ynys Mon SPA – Sandwich tern, common tern, Arctic tern and roseate tern during the breeding and migration bio-seasons;
- Ribble and Alt Estuaries SPA – lesser black-backed gull during the breeding and non-breeding bio-seasons;
- Ribble and Alt Estuaries Ramsar – lesser black-backed gull during the breeding and non-breeding bio-seasons;
- Morecambe Bay and Duddon Estuary SPA – lesser black-backed gull, herring gull and great black-backed gull during the breeding and non-breeding bio-seasons;
- Morecambe Bay Ramsar – herring gull, lesser black-backed gull during the breeding and non-breeding bio-seasons;
- Bowland Fells SPA and pSPA – lesser black-backed gull during the breeding and non-breeding bio-seasons;
- Lambay Island SPA – kittiwake, lesser black-backed gull during the breeding bio-season;
- Ailsa Craig SPA – gannet, lesser black-backed gull and kittiwake (assemblage feature only) during the breeding and non-breeding bio-seasons;
- Ireland's Eye SPA – kittiwake during the breeding bio-season;
- Howth Head Coast SPA – kittiwake during the breeding bio-season;
- Wicklow Head SPA – kittiwake during the breeding bio-season;
- Skomer, Skokholm and the Seas off Pembrokeshire/ Sgomer, Sgogwm a Moroedd Penfro SPA – kittiwake (assemblage feature only) and lesser black-backed gull during the breeding bio-seasons;
- Saltee Islands SPA – kittiwake and lesser black-backed gull during the breeding bio-season;
- Wexford Harbour and Slobs SPA – lesser black-backed gull during the breeding bio-season;

- Helvick Head to Ballyquin SPA – kittiwake during the breeding bio-season;
- Grassholm SPA – gannet during the breeding bio-season;
- Traeth Lafan/ Layan Sands, Conway Bay SPA – oystercatcher, curlew, great crested grebe and red-breasted merganser during the migration bio-seasons;
- Dyfi Estuary/ Aber Dyfi SPA – Greenland white-fronted goose during the migration bio-seasons;
- Burry Inlet SPA – shelduck, wigeon, teal, pintail, shoveler, oystercatcher, grey plover, knot, dunlin, curlew, redshank, turnstone, waterbird assemblage during the migration bio-seasons;
- Burry Inlet Ramsar – pintail, oystercatcher, knot, redshank, waterbird assemblage during the migration bio-seasons;
- Severn Estuary SPA – Bewick's swan, dunlin, gadwall, greater white-fronted goose, redshank, shelduck, waterbird assemblage during the migration bio-seasons; and
- Severn Estuary Ramsar - Bewick's swan, dunlin, gadwall, greater white-fronted goose, redshank, shelduck, pintail, teal, ringed plover and waterbird assemblage during the migration bio-seasons.

329 Seabirds flying through the array area during the operational phase of the Project may be at risk of collision with WTGs. It is assumed that any such collision would be fatal. This risk would be present throughout the array area, and for the entire period of operation of the project. The level of effect is defined by the MDS used for assessment which can be found in ES Volume 2, Chapter 4. In order to assess the risk resulting from potential collisions, CRM has been carried out as described in Volume 4, Annex 4.3. Additionally, migratory CRM has been undertaken for species, in particular non-seabirds, at risk of collision during migration. Details of this assessment can be found in Annex 4.4 Migratory CRM (application ref: 6.4.4.4).

330 Within this report the outputs from Band Option 3 (BO3) are presented for large gulls whilst Band Option 2 (BO2) is presented for all other species. BO2 for large gulls is presented in ES Volume 2, Chapter 4. However, for the purpose of this assessment the Applicant considers BO3 to be the most appropriate model to use for large gulls, as it takes into account skewed vertical distribution of bird flight heights between the lowest and the highest levels of the rotors. Sample sizes of flight height estimates from site-specific aerial digital surveys were too small to produce robust estimates of flight height and therefore Band Option 1 was not used.

331 BO2 applies a uniform distribution of bird flights between the lowest and the highest levels of the rotors. The proportion of birds at Potential Collision Height (PCH) was determined from the results of the Strategic Ornithological Support Services SOSS-02 project (Cook *et al*., 2012) that analysed the flight height measurements taken from boat surveys conducted around the UK. The project was updated following Johnston *et al*. (2014), and the revised published spreadsheet is used to determine the 'generic' percentage of flights at PCH for each species based on the proposed project's WTG parameters.

332 BO3 uses an extended version of the model, which considers collision risk based on the proportion of birds within each 1m altitude band within the PCH range. As for BO2, the input flight height bands were extracted from the revised spreadsheet published by Johnston *et al*. (2014).

333 Additionally, NRW have requested that lesser black-backed gull (non-breeding) from Skomer, Skokholm and the Seas off Pembrokeshire SPA be assessed quantitively during O&M and cormorant from Ynys Seiriol/ Puffin Island SPA and storm petrel from Skomer, Skokholm and the Seas off Pembrokeshire SPA be assessed qualitatively during O&M. As the impact for assessment was not specified, disturbance and displacement, collision risk and barrier effect have all been assessed for this feature at this SPA.

Precautionary Nature to CRM

334 It must be noted that a number of elements of additional precaution were included in the input parameters applied in the sCRM for this assessment, including considering a range of nocturnal activity factors and lower avoidance rates than that currently predicted from the latest scientific evidence. The nature of such precaution is evidenced through the findings of the Bird Collision Avoidance Study funded by ORJIP (Offshore Renewables Joint Industry Programme), which undertook a study to understand seabird behaviour at sea around offshore wind farms (Skov *et al*., 2018). The ORJIP project studied birds around Thanet offshore wind farm for a two-year period (between 2014 and 2016) recording over 12,000 bird movements throughout the day and night (Skov *et al*., 2018). The findings of this study presented updated values for both nocturnal activity and avoidance behaviour from an empirical data source, which it recommended for future incorporation in CRM. It also reported that only six birds (all gull species) collided with WTGs from over 12,000 birds recorded during the two-year period, providing evidence of the precautionary nature of collision risk modelling for all species of seabirds.

335 A further review of the data from the ORJIP project was undertaken by Bowgen and Cook (2018), which analysed all the data collected across the two-year period to understand more about seabird behaviour and provide evidence to support updates to the previous avoidance rates from Cook *et al*. (2014). The findings from this study were that for gannet and kittiwake higher avoidance rates were more appropriate of 99.5% and 99.0%, respectively. It concluded that even when applying these higher rates of avoidance, precaution remained within the estimated number of collision mortality rates.

336 Another recent study on gannets by APEM Ltd during the migratory period (APEM, 2014) found that overall avoidance of WTGs was higher than the SNCBs recommended rate of 98.9%. This study found that all gannets avoided the WTGs within the study area, which provided evidence that gannets may actually have an avoidance rate as high as 100% during migratory periods at least. However, the concluding recommendation from APEM's research suggested that if it was not appropriate to use a 100% avoidance rate, then a rate of 99.5% for the autumn migration will still offer suitable precaution in collision estimates. This indicates that when estimating gannet collision mortality rates, the use of an avoidance rate of 98.9% is understood to overestimate the risk to this species, as noted by Cook *et al*. (2014), who acknowledged that precaution remained within the avoidance rates put forward for gannets and gull species.

337 Therefore, it is considered that the CRM input parameters used in the assessment of collision risk to seabirds for AyM and those from other developments at the cumulative level incorporate a high degree of precaution.

Barrier effects

338 During the operational phase of AyM, the presence of WTGs could create a barrier to the movements of birds. This may result in permanent changes in flight routes for the birds concerned and lead to an increase in energetic demands associated with those movements. As a worst case, this might result in a lower rate of breeding success or in reduced survival chances for the individuals affected.

339 The AyM screening process concluded that potential for LSE (from barrier effects during the O&M phase) could not be ruled out for the following designated sites and relevant features:

- Liverpool Bay SPA – red-throated diver, common scoter and red-breasted merganser (assemblage feature only) during the non-breeding bio-season; and
- Anglesey Terns SPA – Sandwich tern, common tern, Arctic tern and roseate tern during the breeding bio-season.

340 Additionally, NRW have requested that cormorant from Ynys Seiriol/ Puffin Island SPA and storm petrel from Skomer, Skokholm and the Seas off Pembrokeshire SPA be assessed qualitatively during O&M. As the impact for assessment was not specified, disturbance and displacement, collision risk and barrier effect have all been assessed for this feature at this SPA.

Combined impacts across operation

341 During operation and maintenance, gannet have been assessed at Grassholm SPA and Ailsa Craig SPA for impacts by both displacement and collision risk. These impacts have therefore, been additively combined for each SPA to allow overall assessment during operation and maintenance. Impacts have been combined throughout the assessment, where appropriate, for ornithological receptors. However, it must be noted that the Applicant does not deem it appropriate to combine impacts across phases of the development. Impacts from phases are presented on an annual basis and phases do not overlap. Therefore, the following assessment for each SPA, presents the species impact for each phase of the development alone.

Additional assessment data

342 Within the assessment, adult proportions within the population are used within the apportioning calculations (Annex 5, application ref: 6.5.2.5). The following adult proportions were used:

- Puffin – 0.49 (Furness, 2015 – calculated from 1.04 immatures per adult ratio);
- Guillemot – 0.57 (Furness, 2015);
- Razorbill – 0.57 (Furness, 2015);
- Manx shearwater – 0.54 (Furness, 2015);
- Lesser black-backed gull – 0.6 (Furness, 2015);
- Herring gull – 0.48 (Furness, 2015);
- Kittiwake – 0.53 (Furness, 2015); and
- Gannet – 0.94 (site specific adult proportions).

343 All adult proportions for auks, Manx shearwater and gulls were taken from Furness (2015) for the following reasons:

- Auks and Manx shearwater are difficult to age on surveys, therefore, generic age proportions were used for these species;
- For large gulls and terns, few individuals were recorded within the aerial digital surveys, therefore, generic proportions were used for these species; and
- Kittiwake generic adult proportions were used taken from Furness (2015) rather than site specific age ratios, as it is not possible to split adult kittiwakes from juvenile 2nd winter birds (majority of kittiwake breed for the first time at age four (Horswill and Robison, 2015)) either in digital imagery or in the field.

344 A total of 608 gannets were aged on baseline surveys in the study area. In the breeding season (March to September; Furness, 2015) age was recorded for 505 gannets, with 33 immature (non-breeding) birds (6.5%) and 472 adults (93.5%) aged on surveys (Table 16).

Table 16: Monthly breakdown of immature and adult gannets in the AyM study area based on monthly surveys.

	J	F	M	A	M	J	J	A	S	O	N	D
Immature	0	0	0	4	0	5	10	9	5	0	0	0
Adult	0	0	31	185	39	17	89	26	85	78	25	0
Unknown	0	0	0	0	3	4	5	7	1	0	0	0
Number aged	0	0	31	189	39	22	99	35	90	78	25	0
Percentage of adult birds	-	-	100	97.9	100	77.3	89.9	74.3	94.4	100	100	-

345 Adult mortality rates for each species were used in the assessment in order to assess changes to baseline mortality rates for features within screened in SPAs and Ramsar's. All mortality rates were taken from Horswill and Robinson (2015), unless otherwise stated within the text. The following adult mortality rates were therefore used:

- Gannet – 0.081;
- Kittiwake – 0.146;

- Lesser black-backed gull – 0.115;
- Herring gull – 0.166;
- Guillemot – 0.061;
- Razorbill – 0.105;
- Puffin – 0.094; and
- Manx shearwater – 0.13.

346 Rates used for red-throated diver and common scoter assessment at Liverpool Bay SPA are taken from Table 19 in the ES Volume 2, Chapter 4 (application ref: 2.4). These were calculated as an average mortality rate across age classes, as Liverpool Bay SPA is designated for individuals of red-throated diver and common scoter during the non-breeding bio-season, regardless of age class.

10.3.2 Liverpool Bay/ Bae Lerpwl SPA

Features and Effects for Assessment

347 Potential for LSE alone has been identified for the following for Liverpool Bay SPA:

- Red-throated diver (non-breeding seasons) – Construction, O&M and Decommissioning Phase, disturbance and displacement and O&M Phase, barrier effect;
- Common scoter (non-breeding seasons) – Construction, O&M and Decommissioning Phase, disturbance and displacement and O&M Phase, barrier effect;
- Red-breasted merganser (assemblage feature only) (non-breeding seasons) – Construction, O&M and Decommissioning Phase, disturbance and displacement and O&M Phase, barrier effect; and
- Little gull (non-breeding seasons) – O&M Phase, collision risk.

Assessment information

348 The conservation objective (as described in Annex 3) for Liverpool Bay/ Bae Lerpwl SPA Interest feature 1: Internationally important non-breeding population of red-throated diver (*Gavia stellata*):

- Subject to natural change, maintain or enhance the red-throated diver population and its supporting habitats in favourable condition.

349 The interest feature red-throated diver will be considered to be in favourable condition only when both of the following two conditions are met:

- The size of the red-throated diver population is at, or shows only non-significant fluctuation around the mean population at the time of designation of the SPA to account for natural change; and
- The extent of the supporting habitat within the site is maintained.

350 The conservation objective for Liverpool Bay/ Bae Lerpwl SPA Interest feature 2: Internationally important non-breeding population of common scoter (*Melanitta nigra*):

- Subject to natural change, maintain or enhance the common scoter population and its supporting habitats in favourable condition.

351 The interest feature common scoter will be considered to be in favourable condition only when both of the following two conditions are met:

- The size of the common scoter population is at, or shows only non-significant fluctuation around the mean population at the time of designation of the SPA to account for natural change; and
- The extent of the supporting habitat within the site is maintained.

352 The conservation objective for Liverpool Bay/ Bae Lerpwl SPA Interest feature 3: Non-breeding assemblage of over 20,000 waterbirds:

- Subject to natural change, maintain or enhance the waterbird assemblage and its supporting habitats in favourable condition.

353 The interest feature waterbird assemblage will be considered to be in favourable condition only when both of the following two conditions are met:

- The size of the waterbird assemblage population shows only non-significant fluctuation around the mean at the time of designation to allow for natural change; and
- The extent of the waterbird assemblage supporting habitat within the site is maintained.

354 Based on the above conservation objectives, the specific targets for the features of this SPA are as follows:

- The size of the red-throated diver population is at, or shows only non-significant fluctuation around the mean population at the time of designation of the SPA to account for natural change (designated for 1,171 individuals during the non-breeding season);
- The extent of the supporting habitat for red-throated diver within the site is maintained;
- The size of the common scoter population is at, or shows only non-significant fluctuation around the mean population at the time of designation of the SPA to account for natural change (designated for 56,679 individuals during the non-breeding season);
- The extent of the supporting habitat for common scoter within the site is maintained;
- The size of the waterbird assemblage population shows only non-significant fluctuation around the mean at the time of designation to allow for natural change (the site regularly supports at least 69,687 individual waterbirds during the non-breeding season); and
- The extent of the waterbird assemblage supporting habitat within the site is maintained.

355 Although red-breasted merganser is only a named feature of the seabird assemblage, for the purpose of this assessment it has been considered in a similar manner to qualifying species, though the conclusion is not whether an AEoI would result from AyM alone on red-breasted merganser as a feature, but more as an important component of the waterbird assemblage.

356 There were no conservation objectives for the little gull feature of this SPA.

Construction and decommissioning

Disturbance and displacement

Red-throated diver (non-breeding)

357 Red-throated diver is a non-breeding feature of the Liverpool Bay SPA and was screened into the assessment due to the potential for disturbance resulting from movements of construction vessels through part of the SPA to and from the construction port for AyM.

358 Red-throated diver has been identified as being highly sensitive during the winter to non-physical disturbance such as noise and visual presence (Garthe and Hüppop, 2004; Furness *et al*., 2013; Dierschke *et al*., 2017) and are particularly sensitive to human activities, including vessel traffic disturbance (Garthe and Hüppop, 2004; Schwemmer *et al*., 2011; Furness *et al*., 2013; Bradbury *et al*., 2014; Dierschke *et al*., 2017, Mendel *et al*., 2019) in marine areas (Dierschke *et al*., 2016). Therefore, **significant local disturbance and displacement effects are predicted to arise from noise and visual impacts from wind farm construction, maintenance traffic and visually from the turbines themselves (Natural England and JNCC, 2010).**

Offshore export cable installation

359 There is potential for disturbance and displacement of non-breeding red-throated divers resulting from the presence of vessels installing the offshore cables for AyM, including when cables are laid through the Liverpool Bay SPA. However, cable laying vessels are relatively slow moving with the impact a relatively low noise emitting operation, particularly when compared to activities such as piling.

360 The magnitude of disturbance to red-throated diver for AyM has been estimated on a 'worst case' basis. This assumes that there would be 100% displacement of birds within a 2 km buffer around the source, in this case from two cable laying vessel spreads. This 100% displacement is consistent with suggestions in Garthe and Hüppop (2004) and Schwemmer *et al*. (2011) that all red-throated divers present fly away from approaching vessels at a distance of more than 1 km. The laying of the export cable between the array and cable landfall for AyM will be undertaken across a 13-month period, involving a total of 291 vessel movements. However, it is anticipated that vessels will be present intermittently over the 13-month construction period. Whilst there may be a number of vessels present during each stage of installation, it is likely that each vessel will only be present in any one area of the offshore ECC for very short durations (hours to days).

361 Definitive mortality rates associated with displacement for red-throated divers (or for any other seabird species) are not known. As a result, a precautionary estimate must be used. There is no evidence that birds (including red-throated diver) displaced from wind farms (or by vessels) suffer any mortality as a consequence of displacement (Dierschke *et al*. 2017). If there was any potential for displacement induced mortality, it would be most likely a result of increased bird density in areas outside the affected area. This may result in increased competition for prey resources in locations where red-throated diver was elevated (Dierschke *et al*. 2017). However, even if displacement was to be at this level, any such impacts are likely to be negligible (and below levels that could be quantified in assessment) as red-throated divers are unlikely to be affected by density-dependent competition for resources during the non-breeding period (noting that red-throated diver are a non-breeding feature of the SPA) (Dierschke *et al*. 2017).

362 MacArthur Green (2019) undertook a review of available evidence for red-throated diver displacement as part of the Norfolk Vanguard OWF assessment submission. The review concluded that there would be little or no effect of displacement on red-throated diver survival. Additionally, it is expected that the mortality rate of red-throated diver would be lower during cable installation than during construction and operation of the array area. Displacement impacts throughout the cable construction are temporary, therefore mortality rates are expected to be less than the mortality rates for individuals displaced from the array area plus buffer zone as individuals displaced from the cable corridor can return intermittently. Consequently, a maximum, and hence precautionary, displacement caused mortality rate of 0.5% was identified as appropriate for this assessment.

363 In order to calculate the number of red-throated divers that would potentially be at risk of displacement from the AyM offshore cable corridor during the cable laying process, the density of red-throated divers in the Liverpool Bay SPA along the section crossed by the offshore cable corridor was estimated. This was derived from site specific survey information collected to inform the extension proposal for the Liverpool Bay SPA (Lawson *et al*., 2016) which indicated that the peak density of birds in the region of the SPA crossed by the cable route was between 0.86 and 1.15 per km^2.

364 The worst-case area from which birds could be displaced was 25.13 km^2, calculated as the summed area within 2 km of two cable laying vessels. If 100% displacement is assumed to occur within this area, then between 21.6 and 28.9 red-throated divers could be displaced at any given time (but only if both vessels are within the SPA at the same time). This would lead to an increase of around 0.7% in diver density in the remaining areas of the SPA, if it is assumed that displaced birds all remain within the SPA, given it encompasses their preferred habitat.

365 As the vessels move, it has been assumed that displaced birds return and therefore any individual will be subjected to only a brief period of impact. It is considered very reasonable to assume that birds will return following passage of the vessel since the cable laying vessels will move at a maximum of 400 m per hour during cable laying activities which represents a maximum vessel speed of 6.7 m per minute. To place the maximum vessel speed during cable laying into context, hydrodynamic modelling of the peak surface current speed within the ECC shows a modest tidal flow rate for the region is an order of magnitude higher, at approximately 1m per second (i.e., 60m per minute). The tide would therefore be flowing at least nine times faster than the cable laying vessels. Thus, for the purposes of estimating displacement in relation to sensitive species, the vessels can be considered as effectively stationary (i.e., from the perspective of the birds affected which will be moving with the tide based on the rate of peak surface current provided above). Consequently, it can be assumed that the estimated number displaced represents the total number displaced over the course of a single winter, since the zone of exclusion can be treated as fixed.

366 Therefore, using 100% displacement within a 2 km buffer and 0.5% mortality leads to a highly precautionary assumption that a single instance of displacement (based on a worst-case scenario of two cable laying vessels operating concurrently, as described above) will result in a maximum of 0.14 red-throated diver being expected to die across the entire winter period (September to April) as a result of any potential displacement effects from the offshore cable installation activities.

367 Baseline annual mortality for red-throated diver was calculated as 0.233 (ES Volume 2, Chapter 4). The estimated natural mortality for the SPA population (1,171), would therefore be 272.8 individuals per annum. The addition of a maximum of 0.14 individuals to this total during a single year would increase the mortality rate in that year by approximately 0.05%. This is less than the SNCB advised 1% threshold of detectable change in mortality.

368 Therefore, it is reasonable to conclude that there will be **no potential for an AEoI to the population conservation objective of the red-throated diver features of Liverpool Bay SPA in relation to displacement due to cable laying for the proposed AyM project alone. Therefore, subject to natural change, the red-throated diver feature will be maintained in the long term with respect to the potential for displacement.**

369 Additionally, the cable corridor runs through the SPA, therefore, impacts to the habitat conservation objectives for the screened in features of the Liverpool Bay SPA must be considered for Liverpool Bay SPA. Higher densities of red-throated diver utilize the area of the proposed cable corridor, compared to the array area as it lies within the SPA (Lawson *et al.* 2016; Figure 6). However, as described above, the cable construction impacts will be temporary and localized, therefore it is not expected that there will be long term habitat loss for red-throated divers from the construction of the cable route corridor. Section 10.1.2 considers impacts on subtidal and benthic intertidal habitats at Liverpool Bay SPA for red-throated diver, common scoter and the waterbird assemblage, this assessment found no AEoI to physical loss of and physical damage to supporting habitats.

370 Therefore, it is reasonable to conclude that there will be **no potential for an AEoI to the supporting habitat conservation objective of the red-throated diver features of Liverpool Bay SPA in relation to displacement due to cable laying for the proposed AyM project alone. Therefore, subject to natural change, the red-throated diver feature will be maintained in the long term with respect to the potential for displacement.**

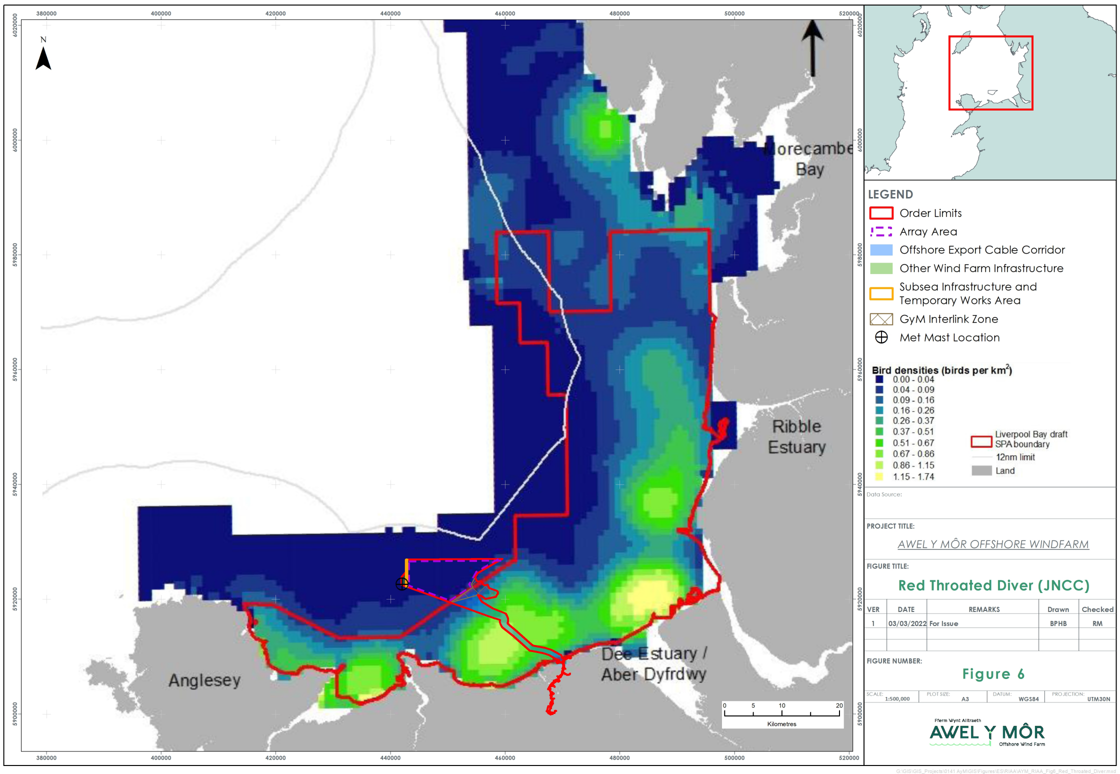


Figure 6: Red-throated diver density within Liverpool Bay SPA taken from Lawson *et al*. (2016).

Array area plus buffer

371 Red-throated diver are sensitive to noise and visual impacts from wind farm construction, maintenance traffic and visually from the turbines themselves (Natural England and JNCC 2010), leading to disturbance and displacement effects on the species during construction and decommissioning activities.

372 Definitive mortality rates associated with displacement for red-throated diver are currently not known. A recent review for the Norfolk Vanguard DCO examination found that the strongest evidence-led position would be a displacement rate of 90% to a 2 km buffer and a 1% mortality rate of displaced birds (MacArthur Green, 2019). This is significantly lower than the most precautionary rates recommended by SNCBs of 100% displacement to a 4 km buffer and 10% mortality (SNCBs, 2017), which is not supported by evidence with regard to mortality rates.

373 Additional site-specific evidence comes from the GyM post-consent monitoring (APEM, 2019). Aerial digital surveys were carried out from 2010 through to 2019, covering pre-construction, during construction and post-construction phases. These surveys found that displacement within the array area is not 100%, as birds were found within the array area within both the during construction and post-construction phases (0.02 birds per km^2 and 0.01 bird per km^2, respectively). Further details of the survey areas are included in Volume 4, Annex 4.1 (application ref: 6.4.4.1). However, some displacement may still be occurring as discussed in ES Volume 2, Chapter 4.

374 Additionally, the AyM array area is located in an area with low density of red-throated divers with large areas of similar suitable habitat available. It is therefore expected that low numbers of red-throated divers would be displaced at this location and where displacement may occur, this would not be expected to lead to significant increase in competition for resources and therefore, not lead to significant consequent mortality.

375 For red-throated diver, displacement assessment has been considered for the array area and surrounding 4-8 km buffer (4 km buffer considered to the north and 8 km buffer considered to the south of the array). It has been agreed with NRW (NRW written advice following ETG held on 12/11/2021) that for this project, the displacement rates to be used during operation and maintenance are 100% displacement within the array area, 90% displacement in the 0-5 km buffer zone and 50% displacement in the 5-8 km buffer zone (see Volume 4, Annex 4.2 (application ref: 6.4.4.2) for a map of the buffer zones). It is expected that the impact during construction and decommissioning will be 50% less than that experienced in the operation and maintenance phase, therefore the numbers considered displaced within the construction and decommissioning assessment will be half of that calculated for operation and maintenance. It is notable that much of the evidence for such high displacement rates comes from the German Bight, with UK studies typically finding far lower displacement effects. The most site-relevant data from GyM would suggest displacement rates are likely to be far lower. Therefore, although used for this assessment, the Applicant regards these displacement rates as highly precautionary.

376 Red-throated diver has been screened in for the post-breeding migration bio-season of September to November, pre-breeding migration bio-season of February to April and the migration-free winter season of December to January at Liverpool Bay SPA. For this assessment it has been assumed that 100% of red-throated diver recorded within the array plus buffer are from Liverpool Bay SPA. During the post-breeding migration bio-season 62 individuals were recorded within the array area and 4-8 km buffer zone. Using the gradient displacement approach outlined above and a mortality rate of 1%, 0.16 individuals would be at risk of displacement consequent mortality. During the pre-breeding migration bio-season 86 individuals were recorded within the array area and 4-8 km buffer zone. Using the gradient displacement approach and a mortality rate of 1%, 0.3 individuals would be at risk of displacement consequent mortality. During the migration-free winter bio-season 47 individuals were recorded within the array area and 4-8 km buffer zone. Using the gradient displacement approach and a mortality rate of 1%, 0.14 individuals would be at risk of displacement consequent mortality.

377 In total, of the 195 individuals recorded in the array area and 4-8 km buffer zone during the migratory and migration-free winter bio-seasons, 0.6 are subject to displacement consequent mortality. When considering the potential impact of this loss to the Liverpool Bay SPA (with a classified red-throated diver population of 1,171 adults and an annual background mortality of 272.8 breeding adults), then using the prediction of 0.6 breeding adults per annum suffering mortality as a consequence of displacement, assuming 100% are apportioned to Liverpool Bay SPA, would represent a 0.2% increase in baseline mortality for red-throated diver at Liverpool Bay SPA. This increase would be indistinguishable from natural fluctuations in the population.

378 Therefore, there would be **no potential for an AEoI to the population conservation objective of the red-throated diver feature at Liverpool Bay SPA in relation to potential adverse displacement effects from the construction and decommissioning phase of AyM alone. Therefore, subject to natural change, red-throated diver would be maintained as a feature in the long term.**

379 Additionally, although the array area of AyM is adjacent to the SPA, the buffer zone lies within the Liverpool Bay SPA, therefore, impacts to the habitat conservation objectives for the screened in features of the Liverpool Bay SPA must be considered for Liverpool Bay SPA. Red-throated divers have two strategies for foraging; individuals are either concentrated foragers meaning they forage in one area which creates hotspots (e.g. large congregations of wintering red-throated divers to the north east of the AyM) or they are highly mobile foragers, which travel significant distances and utilise various foraging locations.

380 SeaMaST data showed that hotspots were not found within AyM array area, with hotspots of red-throated diver were seem more towards the coast of Liverpool Bay. Additionally, this is supported by data from Lawson *et al*. (2016) which shows that the AyM array area has very low densities of red-throated diver compared to coastal regions of Liverpool Bay SPA (Figure 6). Additionally, post-construction data from Gwynt y Môr, discussed above, showed that red-throated diver were recorded within the array and buffer during both construction and post-construction, suggesting that the habitat utilised by red-throated diver is not lost upon construction of an offshore wind farm in Liverpool Bay SPA. Section 10.1.2 considers impacts on subtidal and benthic intertidal habitats at Liverpool Bay SPA for red-throated diver, common scoter and the waterbird assemblage, this assessment found no AEoI to physical loss of and physical damage to supporting habitats. Therefore, as the array area does not overlap with Liverpool Bay SPA, and red-throated diver are likely to utilise the buffer zone in this area there is unlikely to be habitat loss or change in habitat quality at the SPA.

381 Therefore, there would be **no potential for an AEoI to the supporting habitat conservation objective of the red-throated diver feature at Liverpool Bay SPA in relation to potential adverse displacement effects from the construction and decommissioning phase of AyM alone. Therefore, subject to natural change, red-throated diver would be maintained as a feature in the long term.**

Visual and/or noise disturbance to species

382 The results of modelling of airborne noise at the landfall, both including and excluding driven piling, are provided in Volume 5, Annex 5.5: Noise Modelling for Important Ornithological Features (Onshore). Applying the criteria for irregular noise presented by Cutts *et al*. (2013), noise levels would equate to a moderate to high disturbance effect on waterbirds over an area of approximately 500 m either side of the landfall if driven piling was undertaken during the winter period. However, this would reduce to a low to moderate disturbance effect over the vast majority of this area following the implementation of proposed mitigation measures in respect of piling. As such, taking the mitigation into account and given that most species use the full length of the beach for foraging, significant noise disturbance is considered unlikely.

383 All other visual and/or noise disturbance impacts that may occur during the construction of AyM has been taken into consideration within the quantitative analysis for the cable route installation and the construction within the array area above.

Combined displacement impact during construction and decommissioning

384 During cable construction 0.14 red-throated diver individuals are subject to displacement induced mortality per annum and 0.6 individuals during construction within the array area plus gradient buffer. In total 0.7 individuals are estimated to be at risk of mortality during the construction and decommissioning phase. When considering the potential impact of this loss to the Liverpool Bay SPA (with a classified red-throated diver population of 1,171 adults and an annual background mortality of 272.8 breeding adults), then using the prediction of 0.7 individuals per annum suffering mortality as a consequence of displacement, assuming 100% are apportioned to Liverpool Bay SPA, would represent a 0.3% increase in baseline mortality for red-throated diver at Liverpool Bay SPA.

385 Therefore, it is reasonable to conclude that there will be **no potential for an AEoI to the population conservation objective of the red-throated diver feature of Liverpool Bay SPA in relation displacement due to combined displacement impacts during construction and decommissioning for the proposed AyM project alone. Therefore, subject to natural change, the red-throated diver feature will be maintained in the long term with respect to the potential for displacement during construction and decommissioning.**

386 Additionally, the above sections assess the potential loss of habitat within Liverpool Bay SPA. The construction of the cable route corridor is unlikely to have long term impacts on the Liverpool Bay SPA red-throated diver habitat as the impacts are localised and temporary. Additionally, the array area does not overlap with the Liverpool Bay SPA, where aggregations of red-throated diver are low (Lawson *et al*., 2016). Data from previous wind farms such as GyM show red-throated divers utilising the array plus buffer during construction and post-construction, suggesting minimal habitat loss or change in habitat quality will occur in the buffer zone. Additionally, Section 10.1.2 considers impacts on subtidal and benthic intertidal habitats at Liverpool Bay SPA for red-throated diver, common scoter and the waterbird assemblage, this assessment found no AEoI to physical loss of and physical damage to supporting habitats.

387 Therefore, it is reasonable to conclude that there will be **no potential for an AEoI to the supporting habitat conservation objective of the red-throated diver feature of Liverpool Bay SPA in relation displacement due to combined displacement impacts during construction and decommissioning for the proposed AyM project alone. Therefore, subject to natural change, the red-throated diver feature will be maintained in the long term with respect to the potential for displacement during construction and decommissioning.**

Common scoter (non-breeding)

388 Common scoter is a non-breeding feature of the Liverpool Bay SPA and was screened into the assessment due to the potential for disturbance resulting from movements of construction vessels through part of the SPA to and from the construction port for AyM.

389 Common scoter has been identified as being sensitive to human activities in marine areas (Dierschke *et al*., 2016), including through the disturbance effects of vessel traffic (Garthe and Hüppop, 2004; Schwemmer *et al*., 2011; Furness *et al*., 2013; Bradbury *et al*., 2014, Mendel *et al*. 2019). Common scoter are highly sensitive to non-physical disturbance by noise and visual presence during the winter (Garthe and Hüppop 2004, Furness *et al*. 2013, Dierschke *et al*. 2017).

390 Locally, disturbance and displacement effects are predicted to arise from noise and visual impacts from wind farm construction, maintenance traffic and visually from the turbines themselves (Natural England and JNCC 2010). Disturbance and displacement effects may also arise from shipping (including recreational boating) and boat movements associated with marine aggregate and fishing activities. Marine aggregate activities tend to be temporary and localised. Dredging and shipping activities are expected to be confined to existing shipping channels, which are already known to be avoided by common scoter (Natural England and JNCC 2010).

Offshore export cable installation

391 There is potential for disturbance and displacement of non-breeding common scoter resulting from the presence of vessels installing the offshore cables for AyM, including when cables are laid through the Liverpool Bay SPA. However, cable laying vessels are static for large periods of time and move only short distances as cable installation takes place. Offshore cable installation activity is also a relatively low noise emitting operation, particularly when compared to activities such as piling.

392 The magnitude of disturbance to common scoter for AyM has been estimated on a 'worst case' basis. This assumes that there would be 100% displacement of birds within a 2 km buffer around the source, in this case from two cable laying vessel spreads.

393 Definitive mortality rates associated with displacement for common scoter (or for any other seabird species) are not known. As a result, a precautionary estimate must be used. There is no evidence that birds (including common scoter) displaced from wind farms suffer any mortality as a consequence of displacement (e.g., Dierschke *et al*. 2017). If there was any chance of displacement induced mortality would be most likely a result of increased bird density in areas outside the affected area. This may result in increased competition for prey resources in locations where common scoter was elevated. However, even if displacement was to be at this level, any such impacts are likely to be negligible (and below levels that could be quantified in assessment) as common scoter are unlikely to be affected by density-dependent competition for resources during the non-breeding period.

394 Additionally, it is expected that the mortality rate of common scoter would be lower during cable installation than during construction and operation of the array. Displacement impacts throughout the cable construction are temporary, therefore mortality rates are expected to be less than the mortality rates for individuals displaced from the array area plus buffer zone as individuals displaced from the cable corridor can return intermittently. Consequently, a maximum, and hence precautionary, displacement caused mortality rate of 0.5% was identified as appropriate for this assessment.

395 In order to calculate the number of common scoter that would potentially be at risk of displacement from the AyM offshore cable corridor during the cable laying process, the density of common scoter in the Liverpool Bay SPA along the section crossed by the offshore cable corridor was estimated. This was derived from site specific survey information collected to inform the extension proposal for the Liverpool Bay SPA (Lawson *et al*., 2016) which indicated that the peak density of birds in the region of the SPA crossed by the cable route was between 99.22 and 138.23 per km^2.

396 On a precautionary basis, the area from which birds could be displaced was 25.13 km^2, calculated as the summed area within 2 km of two cable laying vessels. If 100% displacement is assumed to occur within this area, then between 2,493 and 3,474 common scoter could be displaced at any given time (but only if both vessels are within the SPA at the same time).

397 As the vessels move, it has been assumed that displaced birds return and therefore any individual will be subjected to only a brief period of impact. It is considered very reasonable to assume that birds will return following passage of the vessel since the cable laying vessels will move at a maximum of 400 m per hour during cable laying activities which represents a maximum vessel speed of 6.7 m per minute. To place the maximum vessel speed during cable laying into context, hydrodynamic modelling of the peak surface current speed within the ECC shows a modest tidal flow rate for the region is an order of magnitude higher, at approximately 1 m per second (i.e., 60 m per minute). The tide would therefore be flowing at least nine times faster than the cable laying vessels. Thus, for the purposes of estimating displacement in relation to sensitive species, the vessels can be considered as effectively stationary (i.e., from the perspective of the birds affected which will be moving with the tide based on the rate of peak surface current provided above). Consequently, it can be assumed that the estimated number displaced represents the total number displaced over the course of a single winter, since the zone of exclusion can be treated as fixed.

398 Therefore, using 100% displacement within 2 km and 0.5% mortality leads to a precautionary assumption that a single instance of displacement (based on a worst-case scenario of two cable laying vessels operating concurrently, as described above) will result in a maximum of 17.4 common scoter being expected to die across the entire winter period (September to April) as a result of any potential displacement effects from the offshore cable installation activities.

399 Baseline annual mortality for common scoter was calculated as 0.238 (ES Volume 2, Chapter 4). When considering the potential impact of this loss to the Liverpool Bay SPA (with a classified common scoter population of 56,679 individuals and an annual background mortality of 13,490), then using the prediction of a maximum of 17.4 individuals per annum suffering mortality as a consequence of displacement due to cable installation would represent a 0.13% increase in baseline mortality for common scoter at Liverpool Bay SPA. This is less than the SNCB advised 1% threshold of detectable change in mortality.

400 Therefore, it is reasonable to conclude that there will be **no potential for an AEoI to the population conservation objective of the common scoter feature of Liverpool Bay SPA in relation displacement due to cable laying for the proposed AyM project alone. Therefore, subject to natural change, the common scoter feature will be maintained in the long term with respect to the potential for displacement from cable laying.**

401 Additionally, the cable corridor runs through the SPA, therefore, impacts to the habitat conservation objectives for the screened in features of the Liverpool Bay SPA must be considered for Liverpool Bay SPA. Higher densities of common scoter utilize the area of the proposed cable corridor, compared to the array area (Lawson *et al*. 2016; Figure 7). However, the cable construction impacts will be temporary and localized, therefore it is not expected that there will be long term habitat loss for common scoters from the construction of the cable route corridor. Additionally, Section 10.1.2 considers impacts on subtidal and benthic intertidal habitats at Liverpool Bay SPA for red-throated diver, common scoter and the waterbird assemblage, this assessment found no AEoI to physical loss of and physical damage to supporting habitats.

402 Therefore, it is reasonable to conclude that there will be **no potential for an AEoI to the supporting habitat conservation objective of the common scoter feature of Liverpool Bay SPA in relation displacement due to cable laying for the proposed AyM project alone. Therefore, subject to natural change, the common scoter feature will be maintained in the long term with respect to the potential for displacement from cable laying.**

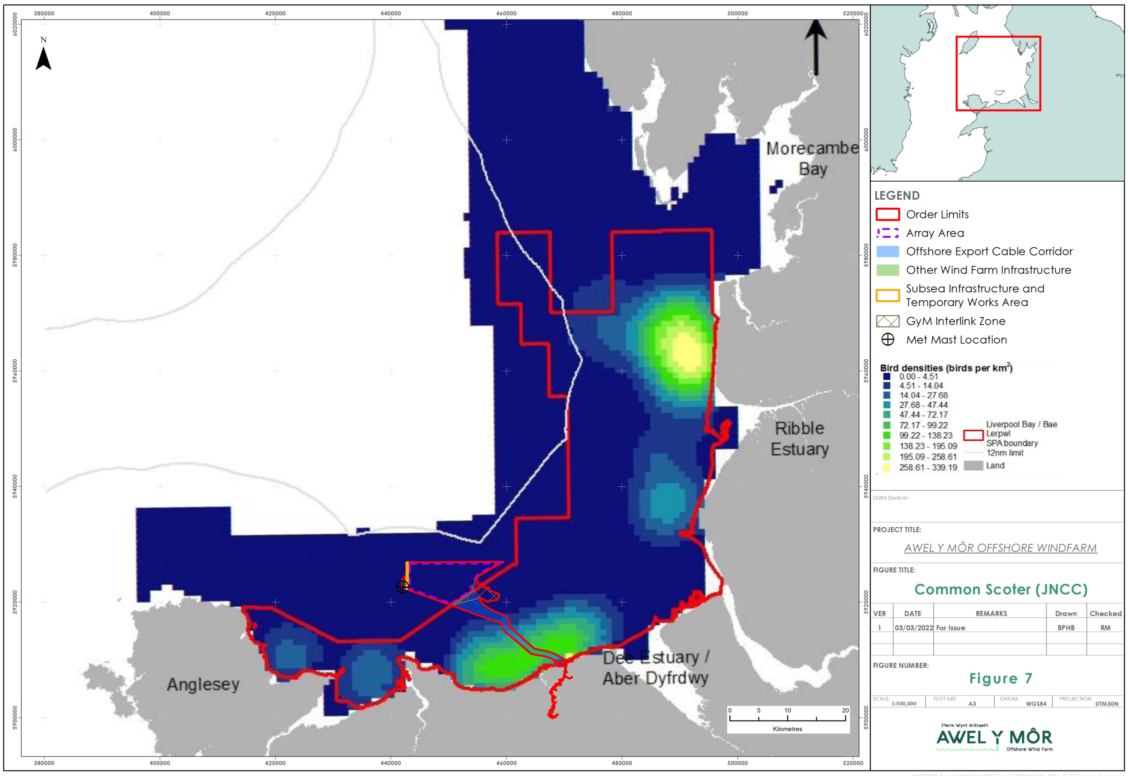


Figure 7: Common scoter density within Liverpool Bay SPA taken from Lawson *et al*. (2016).

Array area plus 4 km buffer zone

403 Common scoter are sensitive to noise and visual impacts from wind farm construction, maintenance traffic and visually from the turbines themselves (Natural England and JNCC 2010), leading to disturbance and displacement effects on the species during construction and decommissioning activities.

404 During the non-breeding bio-season of September to April (Cramp and Simmons, 1977), 31 individuals were recorded in the array area and 4 km buffer zone and zero birds were recorded during the breeding bio-season for this species. Definitive mortality rates associated with displacement for common scoter are currently not known and therefore, estimates were based on expert judgement. For this assessment, in line with the Joint SNCB Interim Displacement Advice Note (JNCC, 2017) a displacement rate of 50% and a mortality rate of 1% has been used for common scoter across the array area and extending out to a 4 km buffer during the construction and decommissioning phases (see Displacement Volume 4, Annex 4.2). On this basis, of the 31 individuals recorded in total during the survey period in the array area and 4 km buffer, 0.16 would be at risk of displacement consequent mortality during the construction and decommissioning phase.

405 When considering the potential impact of this loss to the Liverpool Bay (with a classified common scoter population of 56,679 breeding adults and an annual background mortality of 13,490 breeding adults), then using the prediction of 0.16 breeding adults per annum suffering mortality as a consequence of displacement, assuming 100% of these are apportioned to Liverpool Bay SPA, would represent a 0.001% increase in baseline mortality for common scoter at Liverpool Bay SPA. This increase would be indistinguishable from natural fluctuations in the population.

406 Therefore, there would be **no potential for an AEoI to the population conservation objective of the common scoter feature at Liverpool Bay SPA in relation to potential adverse displacement effects from the construction and decommissioning phase of AyM alone. Therefore, subject to natural change, common scoter would be maintained as a feature in the long term.**

407 Additionally, although the array area of AyM is adjacent to the SPA, the buffer zone lies within the Liverpool Bay SPA, therefore, impacts to the habitat conservation objectives for the screened in features of the Liverpool Bay SPA must be considered for Liverpool Bay SPA. Data from Lawson *et al*. (2016) shows that the AyM array area has very low densities of common scoter compared to coastal regions of Liverpool Bay SPA (Figure 8). Section 10.1.2 considers impacts on subtidal and benthic intertidal habitats at Liverpool Bay SPA for red-throated diver, common scoter and the waterbird assemblage, this assessment found no AEoI to physical loss of and physical damage to supporting habitats. Therefore, it is unlikely that habitat loss or change in habitat quality will occur in the buffer zone.

408 Therefore, there would be **no potential for an AEoI to the supporting habitat conservation objective of the common scoter feature at Liverpool Bay SPA in relation to potential adverse displacement effects from the construction and decommissioning phase of AyM alone. Therefore, subject to natural change, common scoter would be maintained as a feature in the long term.**

Visual and/or noise disturbance to species

409 The results of modelling of airborne noise at the landfall, both including and excluding driven piling, are provided in Volume 5, Annex 5.5: Noise Modelling for Important Ornithological Features (Onshore). Applying the criteria for irregular noise presented by Cutts *et al*. (2013), noise levels would equate to a moderate to high disturbance effect on waterbirds over an area of approximately 500 m either side of the landfall if driven piling was undertaken during the winter period. However, this would reduce to a low to moderate disturbance effect over the vast majority of this area following the implementation of proposed mitigation measures in respect of piling. As such, taking the mitigation into account and given that most species use the full length of the beach for foraging, significant noise disturbance is considered unlikely.

410 All other visual and/or noise disturbance impacts that may occur during the construction of AyM has been taken into consideration within the quantitative analysis for the cable route installation and the construction within the array area above.

Combined displacement impact during construction and decommissioning

411 During cable construction a maximum of 17.4 common scoter individuals are subject to displacement induced mortality and 0.16 individuals during construction within the array area plus 4 km buffer. In total 17.5 individuals are estimated to be at risk of mortality during the construction and decommissioning phase. When considering the potential impact of this loss to the Liverpool Bay SPA (with a classified common scoter population of 56,679 individuals and an annual background mortality of 13,490 individuals), then using the prediction of 17.5 individuals per annum suffering mortality as a consequence of displacement, assuming 100% are apportioned to Liverpool Bay SPA, would represent a 0.13% increase in baseline mortality for common scoter at Liverpool Bay SPA.

412 Therefore, it is reasonable to conclude that there will be **no potential for an AEoI to the population conservation objective of the common scoter feature of Liverpool Bay SPA in relation displacement due to combined displacement impacts during construction and decommissioning for the proposed AyM project alone. Therefore, subject to natural change, the common scoter feature will be maintained in the long term with respect to the potential for displacement during construction and decommissioning.**

413 The above sections assess the potential loss of habitat within Liverpool Bay SPA. The construction of the cable route corridor is unlikely to have long term impacts on the Liverpool Bay SPA common scoter habitat as the impacts are localised and temporary. Additionally, the array area does not overlap with the Liverpool Bay SPA and aggregations of common scoter are low in the array (Lawson *et al*., 2016). The buffer zone overlaps with the SPA, however Section 10.1.2 considers impacts on subtidal and benthic intertidal habitats at Liverpool Bay SPA for red-throated diver, common scoter and the waterbird assemblage, this assessment found no AEoI to physical loss of and physical damage to supporting habitats. Therefore, there is unlikely to be significant habitat loss or change in habitat quality within the SPA.

414 Therefore, it is reasonable to conclude that there will be **no potential for an AEoI to the supporting habitat conservation objectives of the common scoter feature of Liverpool Bay SPA in relation displacement due to combined displacement impacts during construction and decommissioning for the proposed AyM project alone. Therefore, subject to natural change, the common scoter feature will be maintained in the long term with respect to the potential for displacement during construction and decommissioning.**

Waterbird assemblage (non-breeding)

Red-breasted merganser (non-breeding)

Offshore export cable installation

415 Red-breasted merganser is a wintering assemblage component of the Liverpool Bay SPA and was screened into the assessment due to the potential for disturbance resulting from movements of construction vessels through part of the SPA to and from the construction port for AyM.

416 Red-breasted merganser has been identified as being impartial to human activities in marine areas (i.e., the species is weakly attracted to offshore wind developments; Dierschke *et al*., 2016). However, the species has been evidenced to be sensitive to the disturbance effects of vessel traffic in certain environments (Fliessbach *et al*., 2019, Gittings & O'Donoghue, 2016).

417 Red-breasted merganser were recorded in low numbers during a single site-specific survey during the non-breeding season within the Liverpool Bay SPA. Red-throated divers are widely determined to be one of the most sensitive marine bird species to vessel disturbance (Fliessbach *et al*., 2019, Furness *et al*., 2013). Fliessbach *et al*. (2019) found that red-breasted mergansers were around 16.5% less vulnerable to the vessel disturbance than red-throated divers. Density maps are not available for red-breasted merganser as it is an assemblage feature, therefore a quantitative assessment cannot be undertaken for this species. Raw observations generally match with the higher density areas identified for other species, namely red-throated diver and common scoter (Lawson *et al*., 2016), with the largest density of the assemblage feature is north-east of the SPA.

418 As the cable laying vessels move, it has been assumed that displaced birds return and therefore any individual will be subjected to only a brief period of impact. It is considered very reasonable to assume that birds will return following passage of the vessel since the cable laying vessels will move at a maximum of 400 m per hour during cable laying activities which represents a maximum vessel speed of 6.7 m per minute. To place the maximum vessel speed during cable laying into context, hydrodynamic modelling of the peak surface current speed within the ECC shows a modest tidal flow rate for the region is an order of magnitude higher, at approximately 1 m per second (i.e., 60 m per minute). The tide would therefore be flowing at least nine times faster than the cable laying vessels. Thus, the vessels can be considered as effectively stationary (i.e., from the perspective of the birds affected which will be moving with the tide based on the rate of peak surface current provided above).

419 It is therefore reasonable to conclude that there will be **no potential for an AEoI to the population conservation objective of the waterbird assemblage, of which red-breasted merganser is a named feature of the Liverpool Bay SPA in relation to displacement due to cable laying for the proposed AyM project alone. Subject to natural change, the waterbird assemblage feature will therefore be maintained in the long term with respect to the potential for displacement.**

420 Additionally, the cable corridor runs through the SPA, therefore, impacts to the habitat conservation objectives for the screened in features of the Liverpool Bay SPA must be considered for Liverpool Bay SPA. However, the cable construction impacts will be temporary and localized, therefore it is not expected that there will be long term habitat loss for the waterbird assemblage feature from the construction of the cable route corridor. Additionally, Section 10.1.2 considers impacts on subtidal and benthic intertidal habitats at Liverpool Bay SPA for red-throated diver, common scoter and the waterbird assemblage, this assessment found no AEoI to physical loss of and physical damage to supporting habitats.

421 It is therefore reasonable to conclude that there will be **no potential for an AEoI to the supporting habitat conservation objective of the waterbird assemblage, of which red-breasted merganser is a named feature of the Liverpool Bay SPA in relation to displacement due to cable laying for the proposed AyM project alone. Subject to natural change, the waterbird assemblage feature will therefore be maintained in the long term with respect to the potential for displacement.**

Array area plus 4 km buffer zone

422 The Red-breasted merganser is a non-breeding waterbird assemblage feature of the Liverpool Bay SPA. Red-breaster merganser were found by Dierschke *et al*. (2016) to be attracted to OWFs with post-construction monitoring at operational OWF. The species is therefore highly unlikely to be displaced from AyM. Additionally, zero red-breasted mergansers were recorded within the array area plus 2 km buffer. **Therefore, adverse effects can be discounted as there is no pathway for effect and consequently no potential for an AEoI to the population conservation objectives of the waterbird assemblage, of which Red-breasted merganser is a named feature of Liverpool Bay SPA in relation to displacement effects from AyM alone**.

Visual and/or noise disturbance to species

423 The results of modelling of airborne noise at the landfall, both including and excluding driven piling, are provided in Volume 5, Annex 5.5: Noise Modelling for Important Ornithological Features (Onshore). Applying the criteria for irregular noise presented by Cutts *et al*. (2013), noise levels would equate to a moderate to high disturbance effect on waterbirds over an area of approximately 500 m either side of the landfall if driven piling was undertaken during the winter period. However, this would reduce to a low to moderate disturbance effect over the vast majority of this area following the implementation of proposed mitigation measures in respect of piling. As such, taking the mitigation into account and given that most species use the full length of the beach for foraging, **significant noise disturbance is considered unlikely**.

424 All other visual and/or noise disturbance impacts that may occur during the construction of AyM has been taken into consideration within the assessment for the cable route installation and the construction within the array area above.

Other waterbird assemblage features (non-breeding)

425 Cormorant is the only other named component of the waterbird assemblage which is not a designated feature in its own right. Following discussions with NRW (Table 1), all components of the waterbird assemblage have been considered in the assessment for AyM.

426 Cormorant were recorded in just one of the aerial digital surveys within the AyM array area, with a peak estimated abundance of eight individuals in February 2020. Cormorants had a mean peak density of 0.05 individuals/ km^2 within the AyM array area. The peak abundance of 11 birds was greatest in the non-breeding bio-season within the 2 km buffer, with no birds being recorded during the breeding bio-season.

Disturbance from vessel movements

427 Cormorant has relatively low vulnerability to vessel movement disturbance associated with construction and decommissioning activity (Fliessbach *et al*., 2019). Based on the low vulnerability of cormorant to vessel movements, and the spatial and temporal coverage of construction activities being short term, intermittent and temporary and being limited to low frequencies of vessel, there is no potential for an AEoI to the conservation objectives of the waterbird assemblage feature, of which cormorant is a named feature of Liverpool Bay SPA from AyM alone. **Therefore, with respect to the potential for disturbance and displacement, the waterbird assemblage feature, subject to natural change, will be maintained in the long term at Liverpool Bay SPA.**

Visual and/or noise disturbance to species

428 The results of modelling of airborne noise at the landfall, both including and excluding driven piling, are provided in Volume 5, Annex 5.5: Noise Modelling for Important Ornithological Features (Onshore). Applying the criteria for irregular noise presented by Cutts *et al*. (2013), noise levels would equate to a moderate to high disturbance effect on waterbirds over an area of approximately 500 m either side of the landfall if driven piling was undertaken during the winter period. However, this would reduce to a low to moderate disturbance effect over the vast majority of this area following the implementation of proposed mitigation measures in respect of piling. As such, taking the mitigation into account and given that most species use the full length of the beach for foraging, **significant noise disturbance is considered unlikely.**

429 All other visual and/or noise disturbance impacts that may occur during the construction of AyM has been taken into consideration within the assessment above.

Operation and Maintenance

Disturbance and displacement

Red-throated diver (non-breeding)

Operational vessel disturbance

430 Vessel movements during the operation of the wind farm for maintenance activities have the potential to disturb red-throated divers. However, within the confines of the wind farm site and the 4-8 km buffer, the magnitude of displacement due to the AyM wind farm itself (assessed using a gradient approach requested by SNCBs (Table 1) of 100% within the array, 90% within a 0-5 km buffer and 50% within a 6-8 km buffer) is such that there would be virtually no additional effect caused by vessel movements (as all individuals are assumed to be already displaced). Therefore, no further assessment for operational vessel movements within the AyM wind farm site and 4-8 km buffer is required.

431 The O&M port has not been confirmed for AyM at this stage. As described in ES Volume 2, Chapter 1, the total indicative number of vessel movements (i.e. return trips) over the 25-year operating life of the array is 1,232 comprising jack-up vessels (JUVs, 10 movements) service operations vessels (52 movements), crew transfer vessels (1,095 movements), lift vessels (10 movements) auxiliary vessels (64 movements) and a single cable maintenance vessel movement. This would equate to approximately 1 vessel movement every 4 days. However, it is clear from consideration of the existing volume of shipping traffic through the Liverpool Bay region (average of 58 unique vessels per day; Volume 4, Annex 9.1: Navigational Risk Assessment (application ref: 6.4.9.1)) which includes the Liverpool Bay SPA that the addition of a small number (indicative maximum average of 22 on a single day, likely maximum of 6 on any day) of vessels transiting to and from the port during the 25 year operational lifetime of the AyM project and the wind farm will have a negligible effect on the levels of shipping disturbance over and above the large number of vessel movements per day (derived from AIS data, and therefore not including smaller vessels).

432 Additional potential measures may, however, also be implemented at project-level to ensure no adverse effect on site integrity of the European site and its qualifying features. This could include, for example, the agreement of an appropriate vessel traffic management plan to reduce disturbance of red-throated divers, which would typically include:

- Restricting vessel movements to existing navigation routes (where the densities of divers are typically relatively low);
- Where it is necessary to go outside of established navigational routes, selecting routes that avoid known aggregations of birds;
- Maintaining direct transit routes (to minimise transit distances through areas used by divers);
- Avoidance of over-revving of engines (to minimise noise disturbance); and,
- Briefing of vessel crew on the purpose and implications of these vessel management practices (through, for example, tool-box talks) (See Vessel Management Plan as presented in Table 3).

433 Therefore, there would be **no potential for an AEoI to the population conservation objective of the red-throated diver feature at Liverpool Bay SPA in relation to potential adverse vessel disturbance effects from the operation and maintenance phase of AyM alone. Therefore, subject to natural change, red-throated diver would be maintained as a feature in the long term.**

434 As vessel movement may occur through the SPA during operation and maintenance, therefore, impacts to the habitat conservation objectives for the screened in features must be considered for Liverpool Bay SPA. The vessel movement impacts will be temporary and intermittent, therefore it is not expected that there will be habitat loss or change to habitat quality as a result of vessel movement to and from the site for operation and maintenance. Additionally, Section 10.1.2 considers impacts on subtidal and benthic intertidal habitats at Liverpool Bay SPA for red-throated diver, common scoter and the waterbird assemblage, this assessment found no AEoI to physical loss of and physical damage to supporting habitats.

435 Therefore, there would be **no potential for an AEoI to the supporting habitat conservation objective of the red-throated diver feature at Liverpool Bay SPA in relation to potential adverse vessel disturbance effects from the operation and maintenance phase of AyM alone. Therefore, subject to natural change, red-throated diver would be maintained as a feature in the long term.**

Array area plus buffer

436 Red-throated diver are sensitive to noise and visual impacts from wind farm construction, maintenance traffic and visually from the turbines themselves (Natural England and JNCC 2010), leading to disturbance and displacement effects on the species during operation and maintenance activities.

437 Definitive mortality rates associated with displacement for red-throated diver are currently not known. A recent review for the Norfolk Vanguard DCO examination found that the strongest evidence-led position would be a displacement rate of 90% to a 2 km buffer and a 1% mortality rate of displaced birds (MacArthur Green, 2019). This is significantly lower than the most precautionary rates recommended by SNCBs of 100% displacement to a 4 km buffer and 10% mortality (SNCBs, 2017), which is not supported by evidence with regard to mortality rates. Numerous other studies have also attempted to quantify displacement rates for red-throated diver including Thanet which found a percentage reduction in diver density within the wind farm area of 82% (Percival, 2013), Kentish Flats Extension (89%) (Percival and Ford, 2018), London Array (<50%) (APEM, 2016), Alphha Ventus (90%) (Welcker & Nehls, 2016), Horns Rev 1 (90%) (Petersen *et al*., 2006) and Horns Rev 2 (50%) (Petersen *et al*., 2014).

438 East Anglia ONE North and East Anglia TWO carried out a modelling analysis using survey data collected in the Outer Thames region between 2002 and 2018 across multiple survey programmes (MacArthur Green & Royal HaskoningDHV, 2021). This time period ranges from before any OWF construction in the region through to the completed construction of Kentish Flats, Gunfleet Sands, London Array, Thanet and Greater Gabbard. Using density distributions from 2013, the predicted reduction in density as a result of EA1N was predicted to be a maximum of 42.2% within the array area, with reduced impact in each buffer zone out to a maximum of 8km from the array area, beyond which there was no predicted decrease in density. Using the 2018 density distribution, the model predicted a 44.2% reduction in density within the array area and no reduction in density beyond 9km from the array area. It was noted that the total number of birds predicted to be displaced were similar to the numbers estimated using an approach of 100% displacement from the array area plus 4 km buffer.

439 MacArthur Green & Royal Haskoning DHV (2021), based on feedback received previously from Natural England, also presented a "Natural England" approach consisting of 100% displacement within the array area, declining linearly in 1 km intervals out to 0% displacement at distances beyond 12 km from the array. It is noted that the original advice from Natural England (Natural England, 2020b) does not explicitly recommend this approach, but does recommend consideration of "varying spatial extents of effect up to 12 km" and "varying magnitudes of displacement [including a magnitude of] up to 100% within the OWF area".

440 Additional site-specific evidence comes from the GyM post-consent monitoring (APEM, 2019). Aerial digital surveys were carried out from 2010 through to 2019, covering pre-construction, during construction and post-construction phases. These surveys found that displacement within the array area is not 100%, as birds were found within the array area within both the during construction and post-construction phases (0.02 birds per km^2 and 0.01 bird per km^2, respectively). Further details of the survey areas are included in Volume 4, Annex 4.1 (application ref: 6.4.4.1). However, some displacement may still be occurring as discussed in ES Volume 2, Chapter 4.

441 For red-throated diver, displacement assessment has been considered for the array area and surrounding 4-8 km buffer (4 km buffer considered to the north and 8 km buffer considered to the south of the array). It has been agreed with NRW (NRW written advice following ETG held on 12/11/2021) that for this project, the displacement rates to be used during operation and maintenance are 100% displacement within the array area, 90% displacement in the 0-5 km buffer zone and 50% displacement in the 5-8 km buffer zone (see Volume 4, Annex 4.2 (application ref: 6.4.4.2) for a map of the buffer zones). It is notable that much of the evidence for such high displacement rates comes from the German Bight, with UK studies typically finding far lower displacement effects. The most site-relevant data from GyM would suggest displacement rates are likely to be far lower. Therefore, although used for this assessment, the Applicant regards these displacement rates as highly precautionary.

442 During winter red-throated divers are known to exhibit two different foraging strategies. Individuals tend to either consistently occupy a particular area of optimal foraging habitat each year or remain continually mobile throughout the winter period. As presented in Lawson *et al*. (2016) based on the eight winter seasons of monitoring used to inform the Liverpool Bay SPA selection/ extension process, there are distinct congregations of higher red-throated diver densities close to the Dee, Mersey and Ribble Estuaries to the East of the AyM array area and closer inshore to the south of the AyM array area. These areas of higher densities likely correlate with optimal habitat of red-throated divers off the North Wales coast. Within the AyM array area predominantly single individuals were recorded only (Figure 15 of Volume 4 Annex 4.1: Offshore Ornithology Baseline Characterisation Report (application ref: 6.4.4.1), suggesting that the AyM array area is not located within optimal foraging habitat and the individuals recorded utilise a mobile foraging strategy. As suggested in Dierschke *et al*. (2017) if an OWF is displacing highly mobile over site faithful red-throated divers the impacts from displacement are likely to be low in comparison. Furthermore, if red-throated divers are displaced from AyM into the known areas of optimal habitat (Lawson *et al*., 2016), this could have a positive effect due to reduction in time and energy required for foraging in optimal habitat. This, therefore, suggests that consequential displacement mortality as a result of AyM is unlikely to be as high as recommended by SNCBs.

443 The Crown Estate commissioned a plan-level HRA which considered the impacts of a potential extension to OWFs including GyM (prior to AyM being awarded the Agreement for Lease to develop that extension; The Crown Estate, 2019). As part of that, they considered the potential impact of displacement on red-throated divers and found:

444 "There is no evidence currently available that displacement will directly result in the mortality of individual birds. Mortality as a consequence of displacement is more likely to occur as a result of increased densities outside of the impacted area, which may lead to increased competition for resources. Displacement of birds from lower density areas (e.g. the area associated with the 4 km buffer associated with Gwynt y Môr), which are likely to be of lower habitat quality is less likely to result in mortality than would be the case in areas of high density and hence higher habitat quality. It is assumed that there are more opportunities for birds in lower quality habitats to relocate to habitats of similar quality. As such, the use of a 1% mortality rate is considered appropriate for this assessment."

445 MacArthur Green (2019) and MacArthur Green & Royal Haskoning DHV (2021) reviewed evidence into the ecological impacts of displacement on red-throated diver. The ecological impacts of displacement are complex, and so quantification via empirical observation remains elusive. However, the reviews identified clear evidence that red-throated diver populations are not constrained by resources in wintering grounds, but by available breeding habitat. This would suggest that an increase in density in wintering areas as a result of displacement would not have a negative impact on survival, as there is more than sufficient resource to maintain the current population. Furthermore, it is noted that considering the area of OWFs already constructed, and extensive vessel traffic within the North Sea, if displacement led to a 10% mortality rate, this ought to be evident from an increase in population-level mortality rates, but no such increase has been observed. Both MacArthur Green (2019) and MacArthur Green & Royal HaskoningDHV (2021) conclude that on the basis of available evidence, even a 1% mortality rate is likely to be precautionary and present this as the respective applicants' preferred value.

446 Considering the ecology of red-throated divers and evidence for displacement effects across a wide range of species, it is likely that any increase in mortality will be close to 0% and is highly unlikely to exceed a precautionary increase of 1%. The AyM array area is located in an area with low density of red-throated divers with large areas of similar suitable habitat available. It is therefore expected that low numbers of red-throated divers would be displaced at this location and where displacement may occur, this would not be expected to lead to significant increase in competition for resources and therefore, not lead to significant consequent mortality. Therefore, on the basis of this evidence, a mortality rate of 1% of displaced birds is put forward as the Applicant's evidence-led approach, whilst still retaining a significant degree of precaution.

447 Red-throated diver has been screened in for the post-breeding migration bio-season of September to November, pre-breeding migration bio-season of February to April and the migration-free winter season of December to January at Liverpool Bay SPA. For this assessment it has been assumed that 100% of red-throated diver recorded within the array plus buffer are from Liverpool Bay SPA. During the post-breeding migration bio-season 62 individuals were recorded within the array area and 4-8 km buffer zone. Using the gradient displacement approach outlined above and a mortality rate of 1%, 0.3 individuals would be at risk of displacement consequent mortality. During the pre-breeding migration bio-season 86 individuals were recorded within the array area and 4-8 km buffer zone. Using the gradient displacement approach and a mortality rate of 1%, 0.6 individuals would be at risk of displacement consequent mortality. During the migration-free winter bio-season 47 individuals were recorded within the array area and 4-8 km buffer zone. Using the gradient displacement approach and a mortality rate of 1%, 0.3 individuals would be at risk of displacement consequent mortality.

448 In total, of the 195 individuals recorded in the array area and 4-8 km buffer zone during the migratory and migration-free winter bio-seasons, 1.2 are subject to displacement consequent mortality. When considering the potential impact of this loss to the Liverpool Bay SPA (with a classified red-throated diver population of 1,171 adults and an annual background mortality of 272.8 breeding adults), then using the prediction of 1.2 breeding adults per annum suffering mortality as a consequence of displacement, assuming 100% are apportioned to Liverpool Bay SPA, would represent a 0.4% increase in baseline mortality for red-throated diver at Liverpool Bay SPA. This increase would be indistinguishable from natural fluctuations in the population.

449 Therefore, there would be **no potential for an AEoI to the population conservation objective of the red-throated diver feature at Liverpool Bay SPA in relation to potential adverse displacement effects from the operation and maintenance phase of AyM alone. Therefore, subject to natural change, red-throated diver would be maintained as a feature in the long term.**

450 Additionally, although the array area of AyM is adjacent to the SPA, the buffer zone lies within the Liverpool Bay SPA, therefore, impacts to the habitat conservation objectives for the screened in features of the Liverpool Bay SPA must be considered for Liverpool Bay SPA. Red-throated divers have two strategies for foraging; individuals are either concentrated foragers meaning they forage in one area which creates hotspots (e.g. large congregations of wintering red-throated divers to the north-east of the AyM) or they are highly mobile foragers, which travel significant distances and utilize various foraging locations.

451 SeaMaST data showed that hotspots were not found within AyM array area, with hotspots of red-throated diver were seem more towards the coast of Liverpool Bay. Additionally, this is supported by data from Lawson *et al*. (2016) which shows that the AyM array area has very low densities of red-throated diver compared to coastal regions of Liverpool Bay SPA (Figure 6). Additionally, post-construction data from Gwynt y Môr, discussed above, showed that red-throated diver were recorded within the array and buffer during both construction and post-construction, suggesting that the habitat utilised by red-throated diver is not lost upon construction of an offshore wind farm in Liverpool Bay SPA. Section 10.1.2 considers impacts on subtidal and benthic intertidal habitats at Liverpool Bay SPA for red-throated diver, common scoter and the waterbird assemblage, this assessment found no AEoI to physical loss of and physical damage to supporting habitats. Therefore, as the array area does not overlap with Liverpool Bay SPA, and red-throated diver are likely to utilise the buffer zone in this area there is unlikely to be habitat loss or change in habitat quality at the SPA.

452 Therefore, there would be **no potential for an AEoI to the supporting habitat conservation objective of the red-throated diver feature at Liverpool Bay SPA in relation to potential adverse displacement effects from the operation and maintenance phase of AyM alone. Therefore, subject to natural change, red-throated diver would be maintained as a feature in the long term.**

Barrier effect

453 Barrier effects increase travel distance and flying time for individuals moving around a wind farm to reach favoured foraging areas although this is likely to be less for wintering birds that are not central-placed foragers (Searle *et al*., 2014). However, it is noted that for some species (such as common scoter) offshore wind farms can act as barriers to movement between important foraging and roosting areas.

454 Due to the location of the AyM array area being located outside of the Liverpool Bay SPA, red-throated divers were present in very low densities within the AyM array area and 4 km buffer. This is particularly apparent when comparing the AyM location to the areas of highest density recorded in Lawson *et al*. (2016), which shows the locations of highest diver density are in the south-east of the SPA, to the north of the Dee Estuary.

455 The potential for a barrier effect to impact wintering bird populations within Liverpool Bay was considered during the assessment of GyM. Subsequent post-construction monitoring (required by the Marine Licence and noting that the methodology and subsequent reports have been reviewed and agreed by NRW (APEM, 2019)), covered the pre- during- and post-construction phases of GyM (2010-2019).

456 The GyM monitoring report (APEM, 2019) subsequently provided no evidence which suggested barrier effect to red-throated diver. The same report also recorded red-throated diver within the array area of the operational wind farm at similar densities recorded prior to construction of the project, which suggests that site specific evidence does not support a barrier effect for this species.

457 Therefore, there would be **no potential for an AEoI to the conservation objectives of the red-throated diver feature at Liverpool Bay SPA in relation to potential adverse barrier effects from the O&M phase of AyM alone. Therefore, subject to natural change, red-throated diver would be maintained as a feature in the long term**.

Visual and/or noise disturbance to species

458 The results of modelling of airborne noise at the landfall, both including and excluding driven piling, are provided in Volume 5, Annex 5.5: Noise Modelling for Important Ornithological Features (Onshore). Applying the criteria for irregular noise presented by Cutts *et al*. (2013), noise levels would equate to a moderate to high disturbance effect on waterbirds over an area of approximately 500 m either side of the landfall if driven piling was undertaken during the winter period. However, this would reduce to a low to moderate disturbance effect over the vast majority of this area following the implementation of proposed mitigation measures in respect of piling. As such, taking the mitigation into account and given that most species use the full length of the beach for foraging, **significant noise disturbance is considered unlikely**.

459 All other visual and/or noise disturbance impacts that may occur during the operation and maintenance of AyM has been taken into consideration within the assessment for vessel movement and the operation within the array area above.

Common scoter (non-breeding)

Operational vessel disturbance

460 Vessel movements during the operation of the wind farm for maintenance activities have the potential to disturb common scoter. However, within the confines of the wind farm site and the 4 km buffer, the magnitude of displacement due to the AyM wind farm itself (assessed as 100%) is such that there would be virtually no additional effect caused by vessel movements (as all individuals will already have been displaced). Therefore, no further assessment for operational vessel movements within the AyM wind farm site and 4 km buffer is required.

461 The O&M port has not been confirmed for AyM at this stage. As described in ES Volume 2, Chapter 1, the total indicative number of vessel movements (i.e. return trips) over the 25-year operating life of the array is 1,232 comprising jack-up vessels (JUVs, 10 movements) service operations vessels (52 movements), crew transfer vessels (1,095 movements), lift vessels (10 movements) auxiliary vessels (64 movements) and a single cable maintenance vessel movement. This would equate to approximately 1 vessel movement every 4 days. However, it is clear from consideration of the existing volume of shipping traffic through the Liverpool Bay region (average of 58 unique vessels per day; Volume 4, Annex 9.1: Navigational Risk Assessment (application ref: 6.4.9.1)) which includes the Liverpool Bay SPA that the addition of a small number (indicative maximum average of 22 on a single day, likely maximum of 6 on any day) of vessels transiting to and from the port during the 25 year operational lifetime of the AyM project and the wind farm will have a negligible effect on the levels of shipping disturbance over and above the large number of vessel movements per day (derived from AIS data, and therefore not including smaller vessels).

462 Additional potential measures may, however, also be implemented at project-level to ensure no adverse effect on site integrity of the European site and its qualifying features. This could include, for example, the agreement of an appropriate vessel traffic management plan to reduce disturbance of Liverpool Bay SPA features, which would typically include:

- Restricting vessel movements to existing navigation routes;
- Where it is necessary to go outside of established navigational routes, selecting routes that avoid known aggregations of birds;
- Maintaining direct transit routes;
- Avoidance of over-revving of engines (to minimise noise disturbance); and,
- Briefing of vessel crew on the purpose and implications of these vessel management practices (through, for example, tool-box talks).

463 Therefore, there would be **no potential for an AEoI to the population conservation objective of the common scoter feature at Liverpool Bay SPA in relation to potential adverse vessel disturbance effects from the operation and maintenance phase of AyM alone. Therefore, subject to natural change, common scoter would be maintained as a feature in the long term.**

464 As vessel movement may occur through the SPA during operation and maintenance, therefore, impacts to the habitat conservation objectives for the screened in features must be considered for Liverpool Bay SPA. The vessel movement impacts will be temporary and intermittent, therefore it is not expected that there will be habitat loss or change to habitat quality as a result of vessel movement to and from the site for operation and maintenance. Additionally, Section 10.1.2 considers impacts on subtidal and benthic intertidal habitats at Liverpool Bay SPA for red-throated diver, common scoter and the waterbird assemblage, this assessment found no AEoI to physical loss of and physical damage to supporting habitats.

465 Therefore, there would be **no potential for an AEoI to the supporting habitat conservation objective of the common scoter feature at Liverpool Bay SPA in relation to potential adverse vessel disturbance effects from the operation and maintenance phase of AyM alone. Therefore, subject to natural change, common scoter would be maintained as a feature in the long term.**

Array area plus 4 km buffer zone

466 Common scoter are sensitive to noise and visual impacts from wind farm construction, maintenance traffic and visually from the turbines themselves (Natural England and JNCC 2010), leading to disturbance and displacement effects on the species during operation and maintenance activities.

467 During the non-breeding bio-season of September to April (Cramp and Simmons, 1977), 31 individuals were recorded in the array area and 4 km buffer zone and zero birds were recorded during the breeding bio-season for this species. Definitive mortality rates associated with displacement for common scoter are currently not known and therefore, precautionary estimates are used. For this assessment, based on expert judgement, a displacement rate of 100% and a mortality rate of 1% has been used for common scoter across the array area and extending out to a 4 km buffer during operation and maintenance phase (see Displacement Volume 4, Annex 4.2). On this basis, of the 31 individuals recorded in total during the survey period in the array area and 4 km buffer, 0.3 would be at risk of displacement consequent mortality during the construction and decommissioning phase.

468 When considering the potential impact of this loss to the Liverpool Bay SPA (with a classified common scoter population of 56,679 breeding adults and an annual background mortality of 13,490 breeding adults), then using the prediction of 0.3 breeding adults per annum suffering mortality as a consequence of displacement, assuming 100% are apportioned to Liverpool Bay SPA, would represent a 0.002% increase in baseline mortality for common scoter at Liverpool Bay SPA. This increase would be indistinguishable from natural fluctuations in the population.

469 Therefore, there would be **no potential for an AEoI to the population conservation objective of the common scoter feature at Liverpool Bay SPA in relation to potential adverse displacement effects from the operation and maintenance phase of AyM alone. Therefore, subject to natural change, common scoter would be maintained as a feature in the long term.**

470 Additionally, although the array area of AyM is adjacent to the SPA, the buffer zone lies within the Liverpool Bay SPA, therefore, impacts to the habitat conservation objectives for the screened in features of the Liverpool Bay SPA must be considered for Liverpool Bay SPA. Data from Lawson *et al*. (2016) shows that the AyM array area has very low densities of common scoter compared to coastal regions of Liverpool Bay SPA (Figure 8). Section 10.1.2 considers impacts on subtidal and benthic intertidal habitats at Liverpool Bay SPA for red-throated diver, common scoter and the waterbird assemblage, this assessment found no AEoI to physical loss of and physical damage to supporting habitats. Therefore, it is unlikely that habitat loss or change in habitat quality will occur in the buffer zone.

471 Therefore, there would be **no potential for an AEoI to the supporting habitat conservation objective of the common scoter feature at Liverpool Bay SPA in relation to potential adverse displacement effects from the operation and maintenance phase of AyM alone. Therefore, subject to natural change, common scoter would be maintained as a feature in the long term.**

Barrier effect

472 Barrier effects increase travel distance and flying time for individuals moving around a wind farm to reach favoured foraging areas although this is likely to be less for wintering birds that are not central-placed foragers (Searle *et al*., 2014). However, it is noted that for some species (such as common scoter) offshore wind farms can act as barriers to movement between important foraging and roosting areas.

473 Due to the location of the AyM array area being located outside of the Liverpool Bay SPA, common scoter were not recoded within the AyM array area during site specific surveys and were present in very low densities within the 4 km buffer. This is particularly apparent when comparing the AyM location to the areas of highest density recorded in Lawson *et al*. (2016), which shows the locations of highest common scoter density are a significant distance from the project area in the north east of the SPA near Shell Flats.

474 The potential for a barrier effect to impact wintering bird populations within Liverpool Bay was considered during the assessment of GyM. Subsequent post-construction monitoring (required by the Marine Licence and noting that the methodology and subsequent reports have been reviewed and agreed by NRW (APEM, 2019)), covered the pre- during- and post-construction phases of GyM (2010-2019).

475 The GyM monitoring report (APEM, 2019) subsequently provided no evidence which suggested barrier effect to common scoter. The same report also recorded common scoter within the array area of the operational windfarm at similar densities recorded prior to construction of the project, which suggests that site specific evidence does not support a barrier effect for this species. Additional, flight direction analysis (APEM, 2019) found no evidence of flight direction change between the pre and post construction monitoring at GyM.

476 Therefore, there would be **no potential for an AEoI to the conservation objectives of the common scoter feature at Liverpool Bay SPA in relation to potential adverse barrier effects from the O&M phase of AyM alone. Therefore, subject to natural change, common scoter would be maintained as a feature in the long term.**

Visual and/or noise disturbance to species

477 The results of modelling of airborne noise at the landfall, both including and excluding driven piling, are provided in Volume 5, Annex 5.5: Noise Modelling for Important Ornithological Features (Onshore). Applying the criteria for irregular noise presented by Cutts *et al*. (2013), noise levels would equate to a moderate to high disturbance effect on waterbirds over an area of approximately 500 m either side of the landfall if driven piling was undertaken during the winter period. However, this would reduce to a low to moderate disturbance effect over the vast majority of this area following the implementation of proposed mitigation measures in respect of piling. As such, taking the mitigation into account and given that most species use the full length of the beach for foraging, **significant noise disturbance is considered unlikely.**

478 All other visual and/or noise disturbance impacts that may occur during the operation and maintenance of AyM has been taken into consideration within the assessment for vessel movement and the operation within the array area above.

Waterbird assemblage (non-breeding)

Red-breasted merganser (non-breeding season)

Operational vessel disturbance

479 Vessel movements during the operation of the wind farm for maintenance activities have the potential to disturb red breasted merganser. However, within the confines of the wind farm site and the 4 km buffer, the magnitude of displacement due to the AyM wind farm itself (assessed as 100%) is such that there would be virtually no additional effect caused by vessel movements (as all individuals will already have been displaced). Therefore, no further assessment for operational vessel movements within the AyM wind farm site and 4 km buffer is required.

480 The O&M port has not been confirmed for AyM at this stage. As described in ES Volume 2, Chapter 1, the total indicative number of vessel movements (i.e. return trips) over the 25-year operating life of the array is 1,232 comprising jack-up vessels (JUVs, 10 movements) service operations vessels (52 movements), crew transfer vessels (1,095 movements), lift vessels (10 movements) auxiliary vessels (64 movements) and a single cable maintenance vessel movement. This would equate to approximately 1 vessel movement every 4 days. However, it is clear from consideration of the existing volume of shipping traffic through the Liverpool Bay region (average of 58 unique vessels per day; Volume 4, Annex 9.1: Navigational Risk Assessment (application ref: 6.4.9.1)) which includes the Liverpool Bay SPA that the addition of a small number (indicative maximum average of 22 on a single day, likely maximum of 6 on any day) of vessels transiting to and from the port during the 25 year operational lifetime of the AyM project and the wind farm will have a negligible effect on the levels of shipping disturbance over and above the large number of vessel movements per day (derived from AIS data, and therefore not including smaller vessels).

481 Additional potential measures may, however, also be implemented at project-level to ensure no adverse effect on site integrity of the European site and its qualifying features. This could include, for example, the agreement of an appropriate vessel traffic management plan to reduce disturbance of Liverpool Bay SPA features, which would typically include:

- Restricting vessel movements to existing navigation routes;

- Where it is necessary to go outside of established navigational routes, selecting routes that avoid known aggregations of birds;
- Maintaining direct transit routes;
- Avoidance of over-revving of engines (to minimise noise disturbance); and,
- Briefing of vessel crew on the purpose and implications of these vessel management practices (through, for example, tool-box talks).

482 Therefore, there would be **no potential for an AEoI to the population conservation objective of the waterbird assemblage feature, of which red-breasted merganser is a named component at Liverpool Bay SPA in relation to potential adverse vessel disturbance effects from the operation and maintenance phase of AyM alone. Therefore, subject to natural change, the waterbird assemblage would be maintained as a feature in the long term.**

483 As vessel movement may occur through the SPA during operation and maintenance, therefore, impacts to the habitat conservation objectives for the screened in features must be considered for Liverpool Bay SPA. The vessel movement impacts will be temporary and intermittent, therefore it is not expected that there will be habitat loss or change to habitat quality as a result of vessel movement to and from the site for operation and maintenance. Additionally, Section 10.1.2 considers impacts on subtidal and benthic intertidal habitats at Liverpool Bay SPA for red-throated diver, common scoter and the waterbird assemblage, this assessment found no AEoI to physical loss of and physical damage to supporting habitats.

484 Therefore, there would be **no potential for an AEoI to the supporting habitat conservation objective of the waterbird assemblage feature, of which red-breasted merganser is a named component at Liverpool Bay SPA in relation to potential adverse vessel disturbance effects from the operation and maintenance phase of AyM alone. Therefore, subject to natural change, the waterbird assemblage would be maintained as a feature in the long term.**

Array area plus 4 km buffer zone

485 The Red-breasted merganser is a non-breeding waterbird assemblage feature of the Liverpool Bay SPA. Red-breasted merganser were found by Dierschke *et al*. (2016) to be attracted to OWFs with post-construction monitoring at operational OWF. The species is therefore highly unlikely to be displaced or barriered from AyM. Additionally, zero red-breasted mergansers were recorded within the array area plus 2 km buffer. **Therefore, adverse effects can be discounted as there is no pathway for effect and consequently no potential for an AEoI to the population conservation objectives of the waterbird assemblage, of which Red-breasted merganser is a named feature of Liverpool Bay SPA in relation to displacement effects from AyM alone**.

Barrier effect

486 Barrier effects increase travel distance and flying time for individuals moving around a wind farm to reach favoured foraging areas although this is likely to be less for wintering birds that are not central-placed foragers (Searle *et al*., 2014). However, it is noted that for some species (such as common scoter) offshore wind farms can act as barriers to movement between important foraging and roosting areas.

487 Due to the location of the AyM array area being located outside of the Liverpool Bay SPA, red-breasted merganser were present in very low densities within the AyM array area and 4 km buffer.

488 The potential for a barrier effect to impact wintering bird populations within Liverpool Bay was considered during the assessment of GyM. Subsequent post-construction monitoring (required by the Marine Licence and noting that the methodology and subsequent reports have been reviewed and agreed by NRW (APEM, 2019)), covered the pre- during- and post-construction phases of GyM (2010-2019).

489 The GyM monitoring report (APEM, 2019) subsequently provided no evidence which suggested barrier effect to red-breasted merganser. The same report also recorded red-breasted merganser within the array area of the operational wind farm at similar densities recorded prior to construction of the project, which suggests that site specific evidence does not support a barrier effect for this species.

490 Therefore, there would be **no potential for an AEoI to the conservation objectives of the red-breasted merganser feature at Liverpool Bay SPA in relation to potential adverse barrier effects from the O&M phase of AyM alone. Therefore, subject to natural change, red-breasted merganser would be maintained as a feature in the long term.**

Visual and/or noise disturbance to species

491 The results of modelling of airborne noise at the landfall, both including and excluding driven piling, are provided in Volume 5, Annex 5.5: Noise Modelling for Important Ornithological Features (Onshore). Applying the criteria for irregular noise presented by Cutts *et al*. (2013), noise levels would equate to a moderate to high disturbance effect on waterbirds over an area of approximately 500 m either side of the landfall if driven piling was undertaken during the winter period. However, this would reduce to a low to moderate disturbance effect over the vast majority of this area following the implementation of proposed mitigation measures in respect of piling. As such, taking the mitigation into account and given that most species use the full length of the beach for foraging, **significant noise disturbance is considered unlikely**.

492 All other visual and/or noise disturbance impacts that may occur during the operation and maintenance of AyM has been taken into consideration within the assessment for vessel movement and the operation within the array area above.

Other waterbird assemblage features (non-breeding)

493 Cormorant is the only other named component of the waterbird assemblage which is not a designated feature in its own right. Following discussions with NRW (Table 1), all components of the waterbird assemblage have been considered in the assessment for AyM.

494 Cormorant were recorded in just one of the aerial digital surveys within the AyM array area, with a peak estimated abundance of eight individuals in February 2020. Cormorants had a mean peak density of 0.05 individuals/ km^2 within the AyM array area. The peak abundance of 11 birds was greatest in the non-breeding bio-season within the 2 km buffer, with no birds being recorded during the breeding bio-season.

Disturbance from vessel movements

495 Cormorant has relatively low vulnerability to vessel movement disturbance associated with construction and decommissioning activity (Fliessbach *et al*., 2019). Based on the low vulnerability of cormorant to vessel movements, and the spatial and temporal coverage of construction activities being short term, intermittent and temporary and being limited to low frequencies of vessel, there is **no potential for an AEoI to the conservation objectives of the waterbird assemblage feature, of which cormorant is a named feature of Liverpool Bay SPA from AyM alone. Therefore, with respect to the potential for disturbance and displacement, the waterbird assemblage feature, subject to natural change, will be maintained in the long term at Liverpool Bay SPA.**

Disturbance and Displacement and Barrier Effect

496 Bradbury *et al*. (2014) assessed regularly occurring UK seabirds to determine their vulnerability to a number of impacts. Their assessment determined cormorants to have moderate vulnerability to displacement with offshore wind turbines. However, more recent analysis by Dierschke *et al*. (2016) found that cormorant have "strong attraction" to wind farm structures meaning that these species' show a "large increase in numbers in a marine area, which has been used little by this species pre-construction". This is as a result of cormorants using offshore wind farms as outposts, i.e., they are attracted to offshore wind farms structures for roosting and drying plumage with the possibility of resting on turbine railings/ platforms, met masts and transformer platforms allowing them to open new foraging areas further offshore. Cormorants (and other species including large gulls (herring, lesser black-backed and great black-backed gull) have regularly been observed to sit on structures such as platforms, jacket foundation and weather masts (e.g., Leopold *et al*., 2013; Mendel *et al*., 2013; Petersen *et al*., 2006; PMSS, 2007; Vanermen *et al*., 2013, 2016). Including, extensive use of two wind farms off the Dutch coast by cormorants as roosting and foraging sites (Leopold *et al*., 2011).

497 Based on the above examples, there is no evidence to suggest that the species is sensitive to displacement related impacts during operation. This very low likelihood of sensitivity to displacement also infers a highly unlikely chance of barrier effects for commuting cormorants associated with the SPA. Furthermore, site specific digital aerial survey data recorded very low numbers of cormorant within the offshore array area of the proposed AyM site.

498 Therefore, in relation to disturbance and displacement effects and barrier effects, there is **no potential for an AEoI to the conservation objectives of the waterbird assemblage feature, of which cormorant is a named feature of Liverpool Bay SPA from AyM alone or in-combination with other plans or projects. Therefore, with respect to the potential for disturbance and displacement and barrier effects, the waterbird assemblage feature, subject to natural change, will be maintained in the long term at Liverpool Bay SPA.**

Collision

499 During the operational phase of the Project, seabirds flying through the array area may be at risk of collision with WTGs. This risk will be present throughout the whole array area for the entirety of the project's operational period. During the assessment process it is assumed that all collisions will be fatal.

500 However, cormorant have low vulnerability to collision risk with offshore wind turbines (Bradbury *et al*., 2014, Furness *et al.*, 2013) due to their low flight heights. Despite evidence (Dierschke *et al.* (2016) suggesting cormorant are strongly attracted to OWF, their low flight height suggests no pathway for effect. Furthermore, very small numbers of cormorant were recorded within the AyM array area during site specific digital aerial surveys. Therefore, in relation to collision risk effects, there is **no potential for an AEoI to the conservation objectives of the waterbird assemblage feature, of which cormorant is a named component of Liverpool Bay SPA from AyM alone with other plans or projects. Therefore, with respect to the potential for collision risk, the waterbird assemblage feature, subject to natural change, will be maintained in the long term at Liverpool Bay SPA.**

501 Habitat conservation objectives for the screened in waterbird assemblage features of the Liverpool Bay SPA must be considered. The vessel movements are unlikely to have long term impacts on the Liverpool Bay SPA habitat as the impacts are localised and temporary. Additionally, the array area does not overlap with the SPA, therefore, it is unlikely that habitat loss from the array area will impact the waterbird assemblage feature of this SPA. The buffer zone overlaps with the SPA, however Section 10.1.2 considers impacts on subtidal and benthic intertidal habitats at Liverpool Bay SPA for red-throated diver, common scoter and the waterbird assemblage, this assessment found no AEoI to physical loss of and physical damage to supporting habitats. Therefore, it is unlikely that habitat loss or change in habitat quality will occur in the buffer zone.

502 Therefore, there is **no potential for an AEoI to the habitat conservation objectives of the waterbird assemblage feature of Liverpool Bay SPA from AyM alone. Therefore, with respect to the potential for disturbance and displacement and collision risk, the waterbird assemblage feature, subject to natural change, will be maintained in the long term at Liverpool Bay SPA.**

Visual and/or noise disturbance to species

503 The results of modelling of airborne noise at the landfall, both including and excluding driven piling, are provided in Volume 5, Annex 5.5: Noise Modelling for Important Ornithological Features (Onshore). Applying the criteria for irregular noise presented by Cutts *et al*. (2013), noise levels would equate to a moderate to high disturbance effect on waterbirds over an area of approximately 500 m either side of the landfall if driven piling was undertaken during the winter period. However, this would reduce to a low to moderate disturbance effect over the vast majority of this area following the implementation of proposed mitigation measures in respect of piling. As such, taking the mitigation into account and given that most species use the full length of the beach for foraging**, significant noise disturbance is considered unlikely**.

504 All other visual and/or noise disturbance impacts that may occur during the operation and maintenance of AyM has been taken into consideration within the assessment above.

Little gull – non-breeding

Collision

505 Little gull has moderate vulnerability to collision risk with turbines (Bradbury *et al*., 2014), therefore, based on the close proximity of the SPA to the Project site, this feature was screened into Stage 2 of the assessment.

506 Site specific surveys, details in Volume 4, Annex 4.1, recorded no little gulls in the array or 4 km buffer zone during any season. Although there are no specific conservation objectives for little gull at Liverpool Bay SPA, there is **no pathway of effect and consequently no potential for an AEoI to the little gull feature of Liverpool Bay SPA in relation to collision risk effects from AyM alone. Subject to natural change, the little gull feature will therefore be maintained in the long term with respect to the potential for collision risk effect.**

10.3.3 Ynys Seiriol/ Puffin Island SPA

507 A potential LSE has been identified for the following for Ynys Seiriol/ Puffin Island SPA based on potential connectivity during the breeding season based on the species mean-maximum foraging range plus 1SD (Woodward *et al*., 2019):

- Cormorant – All phases of development

Assessment information

508 This species/ SPA was screened into assessment at Stage 2 on a precautionary basis, as discussed with Natural Resources Wales during the AyM Environmental Technical Group Meeting (see Table 1).

509 At its closest point, Puffin Island SPA lies 16.9 km from AyM array, and therefore, only a small proportion of the array area is within mean-maximum foraging range for cormorant (25.6 km (Woodward *et al*., 2019)) from Puffin Island SPA.

510 The conservation objective for the site is to maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests for this SPA.

- The conservation objective for cormorant is to achieve and maintain favourable conservation status. Based on this conservation objective for this SPA, the relevant target for this species is as follows:
  - The number of breeding cormorants within the SPA are stable or increasing.

511 Cormorant were recorded in just one of the aerial digital surveys within the AyM array area, with a peak estimated abundance of eight individuals in February 2020. Cormorants had a mean peak density of 0.05 individuals/ km^2 within the AyM array area. The peak abundance of 11 birds was greatest in the non-breeding bio-season within the 2 km buffer, with no birds being recorded during the breeding bio-season.

Construction and Decommissioning

Disturbance from vessel movements

512 Cormorant has relatively low vulnerability to vessel movement disturbance associated with construction and decommissioning activity (Fliessbach *et al.*, 2019). Based on the low vulnerability of cormorant to vessel movements, and the spatial and temporal coverage of construction activities being short term, intermittent and temporary and being limited to low frequencies of vessel, **there is no potential for an AEoI to the population conservation objective of the cormorant feature of Ynys Seiriol/ Puffin Island SPA from AyM alone or in combination with other plans or projects. Therefore, with respect to the potential for disturbance and displacement, the cormorant feature, subject to natural change, will be maintained in the long term at Ynys Seiriol/ Puffin Island SPA.**

Operation and maintenance

Disturbance and Displacement and Barrier Effect

513 Bradbury *et al*. (2014) assessed regularly occurring UK seabirds to determine their vulnerability to a number of impacts. Their assessment determined cormorants to have moderate vulnerability to displacement with offshore wind turbines. However, more recent analysis by Dierschke *et al*. (2016) found that cormorant have "strong attraction" to wind farm structures meaning that these species' show a "large increase in numbers in a marine area, which has been used little by this species pre-construction". This is as a result of cormorants using offshore wind farms as outposts, i.e., they are attracted to offshore wind farms structures for roosting and drying plumage with the possibility of resting on turbine railings/ platforms, met masts and transformer platforms allowing them to open new foraging areas further offshore. Cormorants (and other species including large gulls (herring, lesser black-backed and great black-backed gull) have regularly been observed to sit on structures such as platforms, jacket foundation and weather masts (e.g., Leopold *et al*., 2013; Mendel *et al*., 2013; Petersen *et al*., 2006; PMSS, 2007; Vanermen *et al*., 2013, 2016). Including, extensive use of two wind farms off the Dutch coast by cormorants as roosting and foraging sites (Leopold *et al*., 2011).

514 Based on the above examples, there is no evidence to suggest that the species is sensitive to displacement related impacts during operation. This very low likelihood of sensitivity to displacement also infers a highly unlikely chance of barrier effects for commuting cormorants associated with the SPA. Furthermore, site specific digital aerial survey data recorded very low numbers of cormorant within the offshore array area of the proposed AyM site.

515 Therefore, in relation to disturbance and displacement effects and barrier effects, there is **no potential for an AEoI to the population conservation objective of the cormorant feature of Puffin Island SPA from AyM alone or in-combination with other plans or projects. Therefore, with respect to the potential for disturbance and displacement and barrier effects, the cormorant feature, subject to natural change, will be maintained in the long term at Puffin Island SPA.**

Collision

516 During the operational phase of the Project, seabirds flying through the array area may be at risk of collision with WTGs. This risk will be present throughout the whole array area for the entirety of the project's operational period. During the assessment process it is assumed that all collisions will be fatal.

517 However, cormorant have low vulnerability to collision risk with offshore wind turbines (Bradbury *et al*., 2014, Furness *et al*., 2013) due to their low flight heights. Despite evidence (Dierschke *et al*. (2016) suggesting cormorant are strongly attracted to OWF, their low flight height suggests no pathway for effect. Furthermore, very small numbers of cormorant were recorded within the AyM array area during site specific digital aerial surveys. **Therefore, in relation to collision risk effects, there is no potential for an AEoI to the population conservation objective of the cormorant feature of Puffin Island SPA from AyM alone with other plans or projects. Therefore, with respect to the potential for collision risk, the cormorant feature, subject to natural change, will be maintained in the long term at Puffin Island SPA.**

10.3.4 Dee Estuary SPA and Ramsar (onshore and offshore)

Features and Effects for Assessment

518 Potential for LSE alone has been identified for the following for Dee Estuary SPA and Ramsar site:

- Dee Estuary SPA – O&M Phase disturbance and displacement, collision risk and barrier effect - Sandwich tern (non-breeding season)
- Dee Estuary SPA – risk of collision on migration and visual and/ or noise disturbance to species – common tern, little tern, Bar-tailed godwit, redshank (wintering and passage), shelduck, teal, pintail, oystercatcher, grey plover, knot, dunlin, black-tailed godwit, curlew, Waterbird Assemblage (non-breeding) including great crested grebe, cormorant, shelduck, wigeon, teal, pintail, oystercatcher, grey plover, lapwing, knot, sanderling, dunlin, black-tailed godwit, bar-tailed godwit, curlew and redshank.

- Dee Estuary Ramsar – risk of collision on migration and visual and/ or noise disturbance to species – Redshank (wintering and passage), shelduck, teal, pintail, oystercatcher, grey plover, knot, dunlin, black-tailed godwit, curlew, bar-tailed godwit, Waterbird assemblage (species not listed in Ramsar information sheet) – non-breeding bio-season (non-breeding season)

Assessment information

519 The conservation objectives (as described in Annex 3) for The Dee Estuary SPA is to maintain the feature in a favourable condition.

520 Based on the above conservation objective, the specific relevant targets for the features of this SPA is that the species will be considered to be in favourable condition when the following is met:

- The five-year mean peak population size for the autumn passage sandwich tern population is no less than 957 individuals [i.e. the five-year mean peak between 1995-1999].
- the five-year peak mean population size for the wintering bar-tailed godwit population is no less than 1,150 individuals [i.e. the five-year mean peak between 1994/95-1998/99];
- the five-year mean population size for the breeding common tern population is no less than 392 breeding pairs [i.e. the five-year mean between 1995-1999];
- the five-year mean population size for the breeding little tern population is no less than 69 breeding pairs [i.e. the five-year mean between 1995-1999];
- the five-year mean peak population size for the autumn passage sandwich tern population is no less than 957 individuals [i.e. the five-year mean peak between 1995- 1999];
- the five-year peak mean population size for the passage redshank population is no less than 8,795 individuals [i.e. the five-year mean peak between 1994/95-1998/99];
- the five-year peak mean population size for the wintering shelduck population is no less than 7,725 individuals [i.e. the five-year mean peak between 1994/95-1998/99];
- the five-year peak mean population size for the wintering teal population is no less than 5,251 individuals [i.e. the five-year mean peak between 1994/95-1998/99];

- the five-year peak mean population size for the wintering pintail population is no less than 5,407 individuals [i.e. the five-year mean peak between 1994/95-1998/99];
- the five-year peak mean population size for the wintering oystercatcher population is no less than 22,677 individuals [i.e. the five-year mean peak between 1994/95-1998/99];
- the five-year peak mean population size for the wintering grey plover population is no less than 1,643 individuals [i.e. the five-year mean peak between 1994/95-1998/99];
- the five-year peak mean population size for the wintering knot population is no less than 12,394 individuals [i.e. the five-year mean peak between 1994/95-1998/99];
- the five-year peak mean population size for the wintering dunlin population is no less than 27,769 individuals [i.e. the five-year mean peak between 1994/95-1998/99];
- the five-year peak mean population size for the wintering black-tailed godwit population is no less than 1,747 individuals [i.e. the five-year mean peak between 1994/95- 1998/99];
- the five-year peak mean population size for the wintering curlew population is no less than 3,899 individuals [i.e. the five-year mean peak between 1994/95-1998/99];
- the five-year peak mean population size for the wintering redshank population is no less than 5,293 individuals [i.e. the five-year mean peak between 1994/95-1998/99]; and
- the five-year peak mean population size for the wintering waterbird assemblage is no less than 120,726 individuals [i.e. the five-year mean peak between 1994/95-1998/99].

521 The conservation objectives for the Dee Estuary Ramsar are to maintain or restore the favourable conservation condition of the features listed for this site. The list of conditions required for the achievement of this status can be found described within the Natural England & the Countryside Council for Wales' advice given under Regulation 33(2) of the Conservation (Natural Habitats &c.) Regulations 1994, The Dee Estuary Marine Site.

Visual and/ or noise disturbance to species (onshore impact)

522 The Dee Estuary SPA and Ramsar was screened into assessment based on its proximity to the onshore and offshore ornithological designated features based on 0.05 km range to AyM onshore boundary and 0.08 km range to AyM to the offshore boundary (Screening Report and Update to Screening Appendix). Offshore impacts are assessed in Section 10.3.4. Subsequent refinements to the onshore cable corridor mean the project is now 2.1 km distant and therefore beyond the relevant screening range applied in the Screening Report (Innogy, 2020a).

523 Based on the onshore and intertidal components of the Project being a significant distance beyond 500m from the Ramsar or areas of functionally linked habitat (ES Volume 3, Chapter 5), it is highly unlikely that construction, O&M, and to a lesser extent decommissioning activity, will result in the production of visual and/ or noise disturbance to species associated with the SPA and/ or Ramsar site that would result in a significant effect (Cutts, Phelps & Burdon, 2009). **It can therefore be concluded with confidence that adverse effects associated with the ornithological features of Dee Estuary SPA and Ramsar can be discounted as there is no pathway for effects and consequently no potential for AEoI to the conservation objectives of the ornithology features of Dee Estuary SPA and Ramsar in relation to visual and/ or noise disturbance effects from AyM alone.**

Operation and Maintenance

Disturbance and displacement

Sandwich tern (non-breeding)

524 Sandwich tern are a designated feature of the Dee Estuary SPA during the post-breeding migration bio-season and have been screened into the assessment of the O&M phase based on its sensitivity to potential displacement by the presence of the WTGs during passage. The aerial digital surveys (Volume 4, Annex 4.1) found zero Sandwich terns within the array area during the migration bio-seasons, and an estimated abundance of 33 individuals within a 4 km buffer around the array area. However, all flight directions of Sandwich tern recorded by aerial digital surveys during the post-breeding migration bio-season observe birds travelling east and west along the north Wales coast. Zero birds recorded within the array area suggests birds are unlikely to forage in the offshore waters where the array is located. Displacement effects during migration are also likely to be of less significance than during the breeding season. The costs of one-off avoidances during migration are trivial, accounting for less than 1.75% of available energy reserves (Speakman *et al*., 2009).

525 There is, therefore, **no potential for an AEoI to the conservation objectives of the Sandwich tern feature of Dee Estuary SPA in relation to disturbance and displacement effects from AyM alone. Therefore, subject to natural change, the Sandwich tern feature will be maintained in the long term with respect to the potential for disturbance and displacement.**

10.3.5 Barrier effect

Sandwich tern (non-breeding)

526 Sandwich tern are a designated feature of the Dee Estuary SPA during the post-breeding migration bio-season. The aerial digital surveys (Volume 4, Annex 4.1) found zero Sandwich terns within the array area during the migration bio-seasons, and an estimated abundance of 33 individuals within a 4 km buffer around the array area. However, all flight directions of Sandwich tern recorded by aerial digital surveys during the post-breeding migration bio-season observe birds travelling east and west along the north Wales coast. Zero birds recorded within the array area suggests birds are unlikely to forage in the offshore waters beyond the AyM array area. Therefore, there is no evidence to suggest that a barrier effect would occur.

527 Although it cannot be completely ruled out that, on occasion, Sandwich terns associated with Dee Estuary SPA might forage in the waters on the far side of the AyM array area, the evidence suggests that this would be a very rare occurrence and of negligible consequence to the fitness of the individual involved or the migratory population supported at the SPA. Furthermore, barrier effects during migration are also likely to be of less significance than during the breeding season. The costs of one-off avoidances during migration are trivial, accounting for less than 1.75% of available energy reserves (Speakman *et al*., 2009).

528 There is, therefore, **no potential for an AEoI to the conservation objectives of the Sandwich tern feature of Dee Estuary SPA in relation to barrier effects from AyM alone. Therefore, subject to natural change, the Sandwich tern feature will be maintained in the long term with respect to the potential for barrier effects.**

Collision

Sandwich tern (non-breeding)

529 Sandwich tern are a designated feature of the Dee Estuary SPA during the post-breeding migration bio-season and have been screened into the assessment of the O&M phase based on its sensitivity to potential collision risk by the presence of the WTGs during passage. Zero Sandwich tern were recorded within the proposed AyM array area during the site-specific aerial digital surveys. However, on request by NRW (Table 1), Sandwich tern has been assessed for migratory collision risk, this assessment can be found in the migratory tern section in Section 10.

Collision

All other species

530 All other species designated at Dee Estuary SPA and Ramsar which have been screened in for risk of collision during migration are assessed in the migratory terns and migratory non-seabird sections in Section 10.

10.3.6 Anglesey Terns/ Morwenoliaid Ynys Mon SPA

Features and Effects for Assessment

531 Potential for LSE alone has been identified for the following for Anglesey Terns/ Morwenoliaid Ynys Mon SPA:

- Sandwich tern (breeding season) – O&M Phase, disturbance and displacement, collision risk and barrier effect;
- Roseate tern (breeding season) – O&M Phase, disturbance and displacement, collision risk and barrier effect;
- Common tern (breeding season) – O&M Phase, collision risk and barrier effect (screened in on a precautionary basis as requested (Table 1)); and
- Arctic tern (breeding season) – O&M Phase, collision risk and barrier effect (screened in on a precautionary basis as requested (Table 1)).

Assessment information

532 The conservation objectives (as described in Annex 3) for Anglesey Terns/ Morwenoliaid Ynys Mon SPA for Feature 1-4: Breeding population Terns are as follows:

- The number of breeding terns within the SPA is stable or increasing;
- The number of chicks successfully fledged in the SPA and beyond is sufficient to help sustain the population;
- The range and distribution of terns within the SPA and beyond is not constrained or hindered;
- 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; and
- Actions or events likely to impinge on the sustainability of the population are under control.

533 Based on the above conservation objectives, the specific relevant targets for the features of this SPA are as follows:

- 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 breeding population of Common tern should be stable or increasing. The site was designated for 189 pairs across the SPA; and
- The breeding population of Arctic tern should be stable or increasing. The site was designated for 1,290 pairs across the SPA.

Operation and Maintenance

Disturbance and displacement

Sandwich tern (breeding)

534 Anglesey Terns SPA was screened into assessment as the AyM array area is within the mean-max + 1SD foraging range (Woodward *et al*., 2019) of Sandwich terns from the marine boundary of the Anglesey Terns SPA. However, the sandwich tern colony at Cemlyn Lagoon (the only breeding colony of sandwich tern at Anglesey Terns SPA) is approximately 40 km distance from AyM. The colony specific maximum foraging range of tracked Sandwich tern breeding at Anglesey Terns Mon SPA was recorded as 25 km in Woodward *et al*. (2019) and 34.8 km by Wilson et al. (2014). AyM is therefore beyond the maximum foraging range from the breeding colony at Cemlyn Lagoon using either of these calculated maximum foraging ranges. However, for the purpose of this assessment we use the mean-max + 1SD foraging range for this species, as requested by NRW at the AyM ETG.

535 Sandwich tern was not recorded in the AyM array area in any aerial digital survey. In the AyM array area plus 2 km buffer, Sandwich tern were recorded in one aerial digital surveys, with a peak estimated abundance of 11 individuals in the post-breeding migration season. No sandwich tern were recorded within the array area plus 2 km buffer during the breeding bio-season. Therefore, there is no pathway for effect during the breeding bio-season. This is supported by tracking data from sandwich tern at Anglesey Terns SPA (formerly Ynys Feurig, Cemlyn Bay and The Skerries SPA) which show that this species mainly forages within the coastal waters (Wilson et al., 2014). There is therefore, unlikely to be connectivity of sandwich tern from Anglesey Terns SPA to AyM.

536 Consequently, there is **no potential for an AEoI to the population conservation objective of the sandwich tern feature of Anglesey Terns SPA in relation to displacement effects from AyM alone.**

Roseate tern (breeding)

537 Anglesey Terns SPA was screened into assessment as the AyM array area is within the mean-max + 1SD foraging range (23.2 km) (Woodward *et al.*, 2019) of roseate terns from the marine boundary of the Anglesey Terns SPA. However, the distance between the closest potential roseate tern breeding colony at Cemlyn Bay/ Lagoon (noting the three colony locations identified by Miles *et al.*, 2018 are The Skerries, Ynys Feurig and Cemlyn Bay) to the AyM array area is approximately 40 km. As the AyM array area is beyond the mean-max + 1SD foraging range (Woodward *et al.*, 2019) for this species from its closest breeding colony at the SPA, **adverse effects can be discounted as there is no pathway for effects and consequently no potential for an AEoI to the population conservation objective of the Roseate tern feature of Anglesey Terns SPA in relation to displacement effects from AyM alone.**

Collision risk

Sandwich tern (breeding)

538 Anglesey Terns SPA was screened into assessment as the AyM array area is within the mean-max + 1SD foraging range (Woodward *et al.*, 2019) of Sandwich terns from the marine boundary of the Anglesey Terns SPA and more specifically from the breeding colony at Cemlyn Lagoon on Anglesey, which is the only breeding colony for the species in Wales and is the sole Sandwich tern colony of the SPA. Zero Sandwich tern were recorded within the AyM array area during any season, therefore, there is no potential for collision induced mortality for this species.

539 Consequently, there is **no potential for an AEoI to the population conservation objective of the sandwich tern feature of Anglesey Terns SPA in relation to collision risk effects from AyM alone.**

Roseate tern (breeding)

540 Anglesey Terns SPA was screened into assessment as the AyM array area is within the mean-max + 1SD foraging range (23.2 km) (Woodward *et al*., 2019) of Roseate terns from the marine boundary of the Anglesey Terns SPA. However, the distance between the closest potential Roseate tern breeding colony at Cemlyn Bay/ Lagoon (noting the three colony locations identified by Miles *et al*., 2018 are The Skerries, Ynys Feurig and Cemlyn Bay) to the AyM array area is approximately 40 km. Furthermore, no roseate tern were recorded within the AyM array area.

541 As the AyM array area is beyond the mean-max + 1SD foraging range (Woodward *et al*., 2019) for this species from its closest breeding colony at the SPA and no observations of this species were recorded within the array during the site-specific surveys, **adverse effects can be discounted as there is no pathway for effects. Consequently, there is no potential for an AEoI to the population conservation objective of the Roseate tern feature of Anglesey Terns SPA in relation to collision risk effects from AyM alone.**

Common tern (breeding)

542 Anglesey Terns SPA was screened into assessment, following consultation with NRW (Table 1), as the AyM array area is within the mean-max + 1SD foraging range (26.9 km) (Woodward *et al*., 2019) of common terns from the marine boundary of the Anglesey Terns SPA. However, the distance between the closest potential common tern breeding colony at Cemlyn Bay/ Lagoon (noting the three colony locations identified by Miles *et al*., 2018 are The Skerries, Ynys Feurig and Cemlyn Bay) to the AyM array area is approximately 40 km. Furthermore, no common terns were recorded within the AyM array area during the migration-free breeding season and there was an abundance of only 4 'common tern' individuals during the post-breeding migration.

543 As the AyM array area is beyond the mean-max + 1SD foraging range (Woodward *et al*., 2019) for this species from its closest breeding colony at the SPA, **adverse effects can be discounted as there is no pathway for effects. Consequently, there is no potential for an AEoI to the population conservation objective of the common tern feature of Anglesey Terns SPA in relation to collision risk effects from AyM alone.**

Arctic tern (breeding)

544 Anglesey Terns SPA was screened into assessment, following consultation with NRW (Table 1), as the AyM array area is within the mean-max + 1SD foraging range (40.5 km) (Woodward *et al*., 2019) of Arctic terns from the marine boundary of the Anglesey Terns SPA. However, the distance between the closest potential Arctic tern breeding colony at Cemlyn Bay/ Lagoon (noting the three colony locations identified by Miles *et al*., 2018 are The Skerries, Ynys Feurig and Cemlyn Bay) to the AyM array area is approximately 40 km. There is therefore, unlikely to be connectivity between Arctic tern colonies at Anglesey Terns SPA and AyM array area during the breeding bio-season. Furthermore, no Arctic terns were recorded within the AyM array area during the migration-free breeding season and there was an abundance of only 4 'common tern' individuals during the post-breeding migration. Additionally, Arctic tern has very low vulnerability to collisions with offshore wind farms (Bradbury *et al*., 2014). Arctic terns also have low to very low vulnerability to disturbance from vessel movements associated with construction activity (Fliessbach *et al*., 2019) and displacement/ disturbance from offshore wind farms (Bradbury *et al*., 2014). Evidence from previous projects suggests this species are unlikely to avoid offshore wind farms (Dierschke *et al*., 2016) and are therefore unlikely to be impacted by disturbance/ displacement during operation.

545 Therefore, Arctic tern are unlikely to be at risk from collision and displacement risks during construction and decommissioning and O&M. Consequently, there is **no potential for an AEoI to the population conservation objective of the Arctic tern feature of Anglesey Terns SPA in relation to any effects from AyM alone**.

Barrier effect

Sandwich tern (breeding)

546 Anglesey Terns SPA was screened into assessment as the AyM array area is within the mean-max + 1SD foraging range (Woodward *et al*., 2019) of Sandwich terns from the marine boundary of the Anglesey Terns SPA. However, the sandwich tern colony at Cemlyn Lagoon (the only breeding colony of sandwich tern at Angleysey Terns SPA) is approximately 40 km distance from AyM. The colony specific maximum foraging range of tracked Sandwich tern breeding at Anglesey Terns Mon SPA was recorded as 25 km in Woodward *et al*. (2019) and 34.8 km by Wilson *et al*. (2014). AyM is therefore beyond the maximum foraging range from the breeding colony at Cemlyn Lagoon using either of these calculated maximum foraging ranges. However, for the purpose of this assessment we use the mean-max + 1SD foraging range for this species, as requested by NRW (Table 1).

547 A peak abundance of 11 individuals were recorded in the array area plus 2 km buffer during the post-breeding migration bio-season and zero were recorded during the breeding bio-season. Therefore, there is no pathway for effect during the breeding bio-season. This is supported by tracking data from sandwich tern at Anglesey Terns SPA (formerly Ynys Feurig, Cemlyn Bay and The Skerries SPA) which shows that this species mainly forages within the coastal waters (Wilson *et al*., 2014). There is therefore, unlikely to be connectivity of sandwich tern from Anglesey Terns SPA to AyM.

548 Consequently, there is **no potential for an AEoI to the population conservation objective of the sandwich tern feature of Anglesey Terns SPA in relation to barrier effects from AyM alone.**

Roseate tern (breeding)

549 Anglesey Terns SPA was screened into assessment as the AyM array area is within the mean-max + 1SD foraging range (23.2 km) (Woodward *et al.*, 2019) of Roseate terns from the marine boundary of the Anglesey Terns SPA. However, the distance between the closest potential roseate tern breeding colony at Cemlyn Bay/ Lagoon (noting the three colony locations identified by Miles *et al.*, 2018 are The Skerries, Ynys Feurig and Cemlyn Bay) to the AyM array area is approximately 40 km. As the AyM array area is beyond the mean-max + 1SD foraging range (Woodward *et al.*, 2019) for this species from its closest breeding colony at the SPA, **adverse effects can be discounted as there is no pathway for effects. Consequently, there is no potential for an AEoI to the population conservation objective of the Roseate tern feature of Anglesey Terns SPA in relation to barrier effects from AyM alone.**

Common tern (breeding)

550 Anglesey Terns SPA was screened into assessment, upon request (Table 1), as the AyM array area is within the mean-max + 1SD foraging range (26.9 km) (Woodward *et al.*, 2019) of common terns from the marine boundary of the Anglesey Terns SPA. However, the distance between the closest potential common tern breeding colony at Cemlyn Bay/ Lagoon (noting the three colony locations identified by Miles *et al.*, 2018 are The Skerries, Ynys Feurig and Cemlyn Bay) to the AyM array area is approximately 40 km. As the AyM array area is beyond the mean-max + 1SD foraging range (Woodward *et al.*, 2019) for this species from its closest breeding colony at the SPA, **adverse effects can be discounted as there is no pathway for effects. Consequently, there is no potential for an AEoI to the population conservation objective of the common tern feature of Anglesey Terns SPA in relation to barrier effects from AyM alone.**

Arctic tern (breeding)

551 Anglesey Terns SPA was screened into assessment, upon request for a qualitative assessment (Table 1), as the AyM array area is within the mean-max + 1SD foraging range (40.5 km) (Woodward *et al*., 2019) of Arctic terns from the marine boundary of the Anglesey Terns SPA. However, the distance between the closest potential Arctic tern breeding colony at Cemlyn Bay/ Lagoon (noting the three colony locations identified by Miles *et al*., 2018 are The Skerries, Ynys Feurig and Cemlyn Bay) to the AyM array area is approximately 40 km. There is therefore, unlikely to be connectivity between Arctic tern colonies at Anglesey Terns SPA and AyM array area during the breeding bio-season.

552 Evidence suggests that Arctic tern are not impacted by displacement/ disturbance and collision risk during offshore wind farm operation (Bradbury *et al*., 2014; Fliessbach *et al.,* 2019). Additionally, evidence from previous projects suggests this species are unlikely to avoid offshore wind farms (Dierschke *et al*., 2016). Therefore, Arctic tern are unlikely to be at risk of barrier effect impacts.

553 Therefore, Arctic tern are unlikely to be at risk from barrier effects during O&M. Consequently, there is **no potential for an AEoI to the population conservation objective of the Arctic tern feature of Anglesey Terns SPA in relation to barrier effects from AyM alone.**

10.3.7 Ribble and Alt Estuaries SPA and Ramsar

Features and Effects for Assessment

554 Potential for LSE alone has been identified for the following for Ribble and Alt Estuaries SPA and Ramsar:

- Lesser black-backed gull (breeding and non-breeding) – O&M Phase, collision risk.

Assessment information

555 The objectives (as described in Annex 3) are to ensure that, subject to natural change, 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.

556 Based on the above conservation objective, the specific feature target for the lesser black-backed gull feature of the SPA is:

- Breeding population: abundance – Maintain the size of the breeding population at a level which is above 8,097 pairs, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent.

557 The conservation objectives (as described in Annex 3) for Ribble and Alt Estuaries Ramsar are to maintain or restore the favourable conservation condition of the features listed for this site. Details regarding the features considered and the Ramsar criteria applied can be found in The Ribble and Alt Estuaries Information Sheet on Ramsar Wetlands (dated May 2005).

Operation and Maintenance

Collision risk

Lesser black-backed gull (breeding season)

558 Lesser black-backed gull is a designated feature of the Ribble and Alt Estuaries SPA and Ramsar during the breeding bio-season and has been screened in based on its sensitivity to collision risk during operation. Lesser black-backed gull were recorded in the AyM array area in a single aerial digital survey (Volume 4, Annex 4.1), with estimated abundance of eight individuals in July 2020. Individuals were recorded during the migration-free breeding bio-season and zero individuals in the non-breeding bio-seasons. Although numbers recorded by surveys were low and will therefore lead to negligible outputs when apportioned, the results have been presented here on a precautionary basis, as discussed with NRW during the AyM ETGs (Table 1).

559 Results are presented on a seasonal basis as impact varies by season. Lesser black-backed gull outputs are therefore presented for the migration-free breeding season of May-July only, as no individuals were recorded in the non-breeding bio-seasons for this species.

560 During the breeding bio-season, when birds are limited in the distance and number of days over which they can forage by the need to return regularly to the nest site, it can be expected that the area in and around AyM will contain a high proportion of adult birds that can be attributed to those designated sites within foraging range, the Ribble and Alt Estuaries SPA and Ramsar lies within the mean maximum ± 1SD foraging range of lesser black-backed gull (127±109 km; Woodward *et al.*, 2019), along with a number of other designated and non-designated sites based on distances around land. Predicted collision mortality has therefore been apportioned to each of these sites following NatureScot (2018) (Annex 5: Ornithology Apportioning Note (application ref: 5.2.5)).

561 Due to small sample sizes of individuals from survey data, a generic population age proportion of lesser black-backed gulls has been used of 0.6 adults across all months of the year taken from Furness (2015).

Breeding

562 The predicted collision resultant mortality from the operation of AyM in the breeding bio-season (BO3) is 0.26 (0-1.03) individuals. Mortality during the breeding bio-season was apportioned to Ribble and Alt Estuaries SPA and Ramsar following the NatureScot (2018) method. Following this method, 30.4% of birds subject to collision risk may be breeding age individuals from Ribble and Alt Estuaries SPA and Ramsar. Table 17 presents the apportioning results for lesser black-backed gull at Ribble and Alt Estuaries SPA and Ramsar.

Table 17: Breeding season apportioning results attributed for lesser black-backed gull screened in at Ribble and Alt Estuaries SPA and Ramsar for collision risk.

COLLISION INDUCED MORTALITIES ATTRIBUTED TO SPA	SPA LESSER BLACK-BACKED GULL POPULATION		INCREASE IN BASELINE MORTALITY (%)	
	CITATION (1993)	SMP (2021)	CITATION (1993)	SMP (2021)
0.05 (0-0.19)	3600	8978	0.01 (0-0.05)	0.005 (0-0.02)

Conclusion

563 The potential addition of 0.05 (0-0.19) breeding adult lesser black-backed gull mortalities per annum equates to less than 0.1% increase in baseline mortality for either citation or latest colony count. This increase would be indistinguishable from natural fluctuations in the population. There is, therefore, **no potential for an AEoI to the population conservation objective of the lesser black-backed gull feature of Ribble and Alt Estuaries SPA and Ramsar in relation to collision risk effects from AyM alone. Therefore, subject to natural change, the lesser black-backed gull feature will be maintained in the long term with respect to the potential for collision risk.**

10.3.8 Morecambe Bay and Duddon Estuary SPA

Features and Effects for Assessment

564 Potential for LSE alone has been identified for the following for Morecambe Bay and Duddon Estuary SPA:

- Great black-backed gull (breeding and non-breeding) – O&M Phase, collision risk;
- Herring gull (breeding and non-breeding) – O&M Phase, collision risk; and
- Lesser black-backed gull (breeding and non-breeding) – O&M Phase, collision risk.

Assessment information

565 The objectives (as described in Annex 3) are 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.

566 Based on the above conservation objective, the specific feature targets for the herring gull and lesser black-backed gull features of the SPA are:

- Lesser black-backed gull Breeding population: abundance – Restore the size of the breeding population to a level which is above 10,000 pairs whilst avoiding deterioration from its current level as indicted by the latest mean peak count or equivalent;
- Lesser black-backed gull Non-breeding population: abundance – Maintain the size of the non-breeding population to a level which is above the citation value of 9,450 individuals whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent; and
- Herring gull Breeding population: abundance – Restore the size of the breeding population to a level which is above 10,000 pairs whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent.

Operation and Maintenance

Collision risk

Great black-backed gull

567 Morecambe Bay and Duddon Estuary SPA was initially screened into assessment as the AyM array area is within the mean-max + 1SD foraging range (Woodward *et al*., 2019) of great black-backed gull from the marine boundary of the SPA. This was based on the information provided on the Natural England Designated Site portal, which listed great black-backed gull as a component feature of the breeding seabird assemblage. This information was referenced as being sourced from the Morecambe Bay and Duddon Estuary pSPA Departmental Brief (Natural England, 2016). Following the sites designation, the Morecambe Bay and Duddon Estuary SPA Citation has been published (Natural England, 2017). The Morecambe Bay and Duddon Estuary SPA Citation does not list great black-backed gull as a component of the seabird assemblage, or standalone designated feature of the SPA. This information is further corroborated by the Natura 2000 Standard Data Form for the SPA (JNCC, 2017).

568 To conclude, great black-backed gull is not a designated feature of the Morecambe Bay and Duddon Estuary SPA and is therefore not considered further in this assessment.

Herring gull

569 Herring gull has been screened into the assessment of the O&M phase based on the density of birds in flight in the array area and its flight behaviour that places it at risk of collision with the turning blades of the WTGs. The population of birds in the area in and around AyM changes through the seasons. Therefore, the assessment is carried out on a seasonal basis as the potential impact on the Morecambe Bay and Duddon Estuary SPA varies by season. Herring gull has, therefore, been screened in for the breeding season of March to August, and non-breeding season of September to February in relation to Morecambe Bay and Duddon Estuary SPA.

570 During the breeding bio-season, when birds are limited in the distance and number of days over which they can forage by the need to return regularly to the nest site, it can be expected that the area in and around AyM will contain a high proportion of adult birds that can be attributed to those designated sites within foraging range. The Morecambe Bay and Duddon Estuary SPA lies within the mean maximum ± 1SD foraging range of herring gull (58.8±26.8 km; Woodward *et al*., 2019), along with a number of other designated and non-designated sites based on distances around land. Predicted collision mortality has therefore been apportioned to each of these sites following NatureScot (2018) (Annex 5: Ornithology Apportioning Note (application ref: 5.2.5)).

571 Outside the breeding bio-season, the population of herring gull contains a mix of individuals from UK breeding colonies and from further away, therefore, a much lower percentage of birds can be attributed to any particular breeding colony SPA population. During these non-breeding bio-seasons, the information on populations contained in Furness (2015) has been applied for the purpose of apportionment.

572 Due to small sample sizes of individuals from survey data, a generic population age proportion of herring gulls has been used of 0.48 adults across all months of the year taken from Furness (2015).

Breeding

573 The predicted collision resultant mortality from the operation of AyM in the breeding bio-season (BO3) is 0.84 (0-3.53) individuals. Mortality during the breeding bio-season was apportioned to Morecambe Bay and Duddon Estuary SPA following the NatureScot (2018) method. Following this method, 6.2% of birds subject to collision risk may be breeding age individuals from Morecambe Bay and Duddon Estuary SPA. On this basis, 0.02 (0-0.11) breeding adults are predicted to suffer collision mortality attributable to this SPA.

Non-breeding

574 The predicted collision resultant mortality as a result of the operation of AyM during the non-breeding bio-season (BO3) is 0.65 (0-3.21) adults.

575 In the non-breeding bio-season these birds will have come from a range of seabird breeding colonies in the UK and overseas. The UK Western waters BDMPS population during the non-breeding season is estimated to be 173,299 individuals (Furness, 2015). It is expected that 80% of Herring gull breeding adults from Morecambe Bay and Duddon Estuary SPA will remain in the UK Western waters BDMPS throughout the non-breeding bio-seasons (Furness, 2015). As such, breeding adults from Morecambe Bay and Duddon Estuary SPA are considered to contribute to 1.6% of the UK Western waters population during the non-breeding season. On that basis 0.01 (0-0.05) breeding adults that suffer collision consequent mortality during the non-breeding season can be attributed to the SPA.

Conclusion

576 The potential impact of collision on Herring gulls in the array area during the O&M phase of AyM is a predicted consequent mortality of 0.02 (0-0.11) adult birds from Morecambe Bay and Duddon Estuary SPA during the breeding bio-season and 0.01 (0-0.05) during the non-breeding bio-seasons. This equates to 0.04 (0-0.16) breeding adult birds per annum for the planned duration of operational and maintenance activities. When considering the potential impact of this loss to the Morecambe Bay and Duddon Estuary SPA (with a classified Herring gull population of 20,000 breeding adults and an annual background mortality of 3,320 breeding adults), then using the prediction of 0.04 (0-0.16) breeding adults per annum suffering mortality as a consequence of collision would represent a 0.001% (0-0.005%) increase in baseline mortality for Herring gull at Morecambe Bay and Duddon Estuary SPA. The population of Herring gulls has changed since the citation population count, therefore it is also appropriate to assess the potential impact against the latest population count undertaken between 2016-2020 for the three colonies within the MMF+1 SD of AyM (1,616 breeding adults and therefore a baseline mortality of 268.3 breeding adults). On this basis, 0.04 (0-0.16) breeding adults, per annum suffering collision consequent mortality at Morecambe Bay and Duddon Estuary SPA would represent a 0.013% (0-0.06%) increase in baseline mortality per annum.

577 The potential addition of 0.04 (0-0.16) breeding adult herring gull mortalities per annum equates to less than 0.1% increase in baseline mortality for either citation or latest colony count. This increase would be indistinguishable from natural fluctuations in the population.

578 Therefore, there would be **no potential for an AEoI to the population conservation objective of the Herring gull feature at Morecambe Bay and Duddon Estuary SPA in relation to potential adverse collision effects from the O&M phase of AyM alone. Therefore, subject to natural change, Herring gull would be maintained as a feature in the long term.**

Lesser black-backed gull

579 Lesser black-backed gull are a designated feature of the Morecambe Bay and Duddon Estuary SPA during the breeding bio-season and has been screened in the assessment based on its sensitivity to collision risk during operation. Lesser black-backed gull were recorded in the AyM array area in a single aerial digital survey (see Volume 4, Annex 4.1), with estimated abundance of eight individuals in July 2020. Individuals were recorded during the migration-free breeding bio-season and zero individuals in the non-breeding bio-seasons. Although numbers recorded by surveys were low and will therefore lead to negligible outputs when apportioned, the results have been presented here on a precautionary basis, as discussed with NRW during the AyM ETGs (Table 1).

580 Results are presented on a seasonal basis as impact varies by season. Lesser black-backed gull outputs are therefore presented for the migration-free breeding season of May-July only, as no individuals were recorded in the non-breeding bio-seasons for this species.

581 During the breeding bio-season, when birds are limited in the distance and number of days over which they can forage by the need to return regularly to the nest site, it can be expected that the area in and around AyM will contain a high proportion of adult birds that can be attributed to those designated sites within foraging range, the Morecambe Bay and Duddon Estuary SPA lies within the mean maximum ± 1SD foraging range of lesser black-backed gull (127±109 km; Woodward *et al*., 2019), along with a number of other designated and non-designated sites based on distances around land. Predicted collision mortality has therefore been apportioned to each of these sites following NatureScot (2018) (Annex 5: Ornithology Apportioning Note (application ref: 5.2.5)).

582 Due to small sample sizes of individuals from survey data, a generic population age proportion of lesser black-backed gulls has been used of 0.6 adults across all months of the year taken from Furness (2015).

Breeding

583 The predicted collision resultant mortality from the operation of AyM in the breeding bio-season (BO3) is 0.26 (0-1.03) individuals. Mortality during the breeding bio-season was apportioned to Morecambe Bay and Duddon Estuary SPA following the NatureScot (2018) method. Following this method, 1.4% of birds subject to collision risk may be breeding age individuals from Morecambe Bay and Duddon Estuary SPA. Table 18 presents the apportioning results for lesser black-backed gull at Morecambe Bay and Duddon Estuary SPA.

Table 18: Breeding season apportioning results attributed for lesser black-backed gull screened in at Morecambe Bay and Duddon Estuary SPA for collision risk.

COLLISION INDUCED MORTALITIES ATTRIBUTED TO SPA	SPA LESSER BLACK-BACKED GULL POPULATION		INCREASE IN BASELINE MORTALITY (%)	
	CITATION (2011-2015)	SMP (2018-2020)	CITATION (2011-2015)	SMP (2018-2020)
0.002 (0-0.009)	9720	815	0.0002 (0-0.0008)	0.002 (0-0.010)

Conclusion

584 The potential addition of 0.002 (0-0.009) breeding adult lesser black-backed gull mortalities per annum equates to less than 0.1% increase in baseline mortality for either citation or latest colony count. This increase would be indistinguishable from natural fluctuations in the population. There is, therefore, **no potential for an AEoI to the population conservation objective of the lesser black-backed gull feature of Morecambe Bay and Duddon Estuary SPA in relation to collision risk effects from AyM alone. Therefore, subject to natural change, the lesser black-backed gull feature will be maintained in the long term with respect to the potential for collision risk**.

10.3.9 Morecambe Bay Ramsar

Features and Effects for Assessment

585 Potential for LSE alone has been identified for the following for Morecambe Bay Ramsar:

- Herring gull (breeding and non-breeding) – O&M Phase, collision risk; and
- Lesser black-backed gull (breeding and non-breeding) – O&M Phase, collision risk.

Assessment information

586 The conservation objective (as described in Annex 3) for Morecambe Bay Ramsar is to maintain or restore the favourable conservation condition of the features listed for this site. Details regarding the features considered and the Ramsar criteria applied can be found in The Morecambe Bay Sheet on Ramsar Wetlands (dated September 1999).

Collision Risk

Herring gull

587 Herring gull has been screened into the assessment of the O&M phase based on the density of birds in flight in the array area and its flight behaviour that places it at risk of collision with the turning blades of the WTGs. The population of birds in the area in and around AyM changes through the seasons. Therefore, the assessment is carried out on a seasonal basis as the potential impact on the Morecambe Bay Ramsar varies by season. Herring gull has, therefore, been screened in for the breeding season of March to August, and non-breeding season of September to February in relation to Morecambe Bay Ramsar.

588 During the breeding bio-season, when birds are limited in the distance and number of days over which they can forage by the need to return regularly to the nest site, it can be expected that the area in and around AyM will contain a high proportion of adult birds that can be attributed to those designated sites within foraging range. The Morecambe Bay Ramsar lies within the mean maximum ± 1SD foraging range of herring gull (58.8±26.8 km; Woodward *et al.*, 2019), along with a number of other designated and non-designated sites based on distances around land. Predicted collision mortality has therefore been apportioned to each of these sites following NatureScot (2018) (Annex 5: Ornithology Apportioning Note (application ref: 5.2.5)).

589 Outside the breeding bio-season, the population of herring gull contains a mix of individuals from UK breeding colonies and from further away, therefore, a much lower percentage of birds can be attributed to any particular breeding colony Ramsar population. During these non-breeding bio-seasons, the information on populations contained in Furness (2015) has been applied for the purpose of apportionment.

590 Due to small sample sizes of individuals from survey data, a generic population age proportion of herring gulls has been used of 0.48 adults across all months of the year taken from Furness (2015).

Breeding

591 The predicted collision resultant mortality from the operation of AyM in the breeding bio-season (BO3) is 0.84 (0-3.53) individuals. Mortality during the breeding bio-season was apportioned to Morecambe Bay Ramsar following the NatureScot (2018) method. Following this method, 6.2% of birds subject to collision risk may be breeding age individuals from Morecambe Bay Ramsar. On this basis, 0.02 (0-0.1) breeding adults are predicted to suffer collision mortality attributable to this Ramsar.

Non-breeding

592 The predicted collision resultant mortality as a result of the operation of AyM during the non-breeding bio-season (BO3) is 0.65 (0-3.21) adults.

593 In the non-breeding bio-season these birds will have come from a range of seabird breeding colonies in the UK and overseas. The UK Western waters BDMPS population during the non-breeding season is estimated to be 173,299 individuals (Furness, 2015). It is expected that 80% of Herring gull breeding adults from Morecambe Bay Ramsar will remain in the UK Western waters BDMPS throughout the non-breeding bio-seasons (Furness, 2015). As such, breeding adults from Morecambe Bay Ramsar are considered to contribute to 1.6% of the UK Western waters population during the non-breeding season. On that basis 0.01 (0-0.05) breeding adults that suffer collision consequent mortality during the non-breeding season can be attributed to the Ramsar.

Conclusion

594 The potential impact of collision on Herring gulls in the array area during the O&M phase of AyM is a predicted consequent mortality of 0.02 (0-0.1) adult birds from Morecambe Bay and Duddon Estuary Ramsar during the breeding bio-season and 0.01 (0-0.05) during the non-breeding bio-seasons. This equates to 0.04 (0-0.16) breeding adult birds per annum for the planned duration of operational and maintenance activities. When considering the potential impact of this loss to the Morecambe Bay Ramsar (with a classified Herring gull population of 20,862 breeding adults and an annual background mortality of 3,463.1 breeding adults), then using the prediction of 0.04 (0-0.16) breeding adults per annum suffering mortality as a consequence of collision would represent a 0.001% (0-0.005%) increase in baseline mortality for Herring gull at Morecambe Bay Ramsar. The population of Herring gulls has changed since the citation population count, therefore it is also appropriate to assess the potential impact against the latest population count undertaken between 2016-2020 for the two colonies within the MMF+ 1SD of AyM (1,614 breeding adults and therefore a baseline mortality of 267.9 breeding adults). On this basis, 0.04 (0-0.16) breeding adults, per annum suffering collision consequent mortality at Morecambe Bay Ramsar would represent a 0.013% (0-0.06%) increase in baseline mortality per annum.

595 The potential addition of 0.04 (0-0.16) breeding adult herring gull mortalities per annum equates to less than 0.1% increase in baseline mortality for either citation or latest colony count. This increase would be indistinguishable from natural fluctuations in the population and therefore, **there would be no potential for an AEoI to the population conservation objective of the Herring gull feature at Morecambe Bay Ramsar in relation to potential adverse collision effects from the O&M phase of AyM alone. Therefore, subject to natural change, Herring gull would be maintained as a feature in the long term.**

Lesser black-backed gull

596 Lesser black-backed gull are a designated feature of the Morecambe Bay Ramsar during the breeding bio-season and has been screened into the assessment based on its sensitivity to collision risk during operation. Lesser black-backed gull were recorded in the AyM array area in a single aerial digital survey (Volume 4, Annex 4.1), with estimated abundance of eight individuals in July 2020. Individuals were recorded during the migration-free breeding bio-season and zero individuals in the non-breeding bio-seasons. Although numbers recorded by surveys were low and will therefore lead to negligible outputs when apportioned, the results have been presented here on a precautionary basis, as discussed with NRW during the AyM ETGs (Table 1).

597 Results are presented on a seasonal basis as impact varies by season. Lesser black-backed gull outputs are therefore presented for the migration-free breeding season of May-July only, as no individuals were recorded in the non-breeding bio-seasons for this species.

598 During the breeding bio-season, when birds are limited in the distance and number of days over which they can forage by the need to return regularly to the nest site, it can be expected that the area in and around AyM will contain a high proportion of adult birds that can be attributed to those designated sites within foraging range. Morecambe Bay Ramsar lies within the mean maximum ± 1SD foraging range of lesser black-backed gull (127±109 km; Woodward *et al*., 2019), along with a number of other designated and non-designated sites based on distances around land. Predicted collision mortality has therefore been apportioned to each of these sites following NatureScot (2018) (Annex 5: Ornithology Apportioning Note (application ref: 5.2.5)).

599 Due to small sample sizes of individuals from survey data, a generic population age proportion of lesser black-backed gulls has been used of 0.6 adults across all months of the year taken from Furness (2015).

Breeding

600 The predicted collision resultant mortality from the operation of AyM in the breeding bio-season (BO3) is 0.26 (0-1.03) individuals. Mortality during the breeding bio-season was apportioned to Morecambe Bay Ramsar following the NatureScot (2018) method. Following this method, 1.4% of birds subject to collision risk may be breeding age individuals from Morecambe Bay Ramsar. Table 19 presents the apportioning results for lesser black-backed gull at Morecambe Bay Ramsar.

Table 19: Breeding season apportioning results attributed for lesser black-backed gull screened in at Morecambe Bay Ramsar for collision risk.

COLLISION INDUCED MORTALITIES ATTRIBUTED TO SPA	SPA LESSER BLACK-BACKED GULL POPULATION		INCREASE IN BASELINE MORTALITY (%)	
	CITATION (2011-2015)	SMP (2018-2020)	CITATION (2011-2015)	SMP (2018-2020)
0.002 (0-0.009)	9720	815	0.0002 (0-0.0008)	0.002 (0-0.010)

Conclusion

601 The potential addition of 0.002 (0-0.009) breeding adult lesser black-backed gull mortalities per annum equates to less than 0.1% increase in baseline mortality for either citation or latest colony count. This increase would be indistinguishable from natural fluctuations in the population. There is, therefore, **no potential for an AEoI to the population conservation objective of the lesser black-backed gull feature of Morecambe Bay Ramsar in relation to collision risk effects from AyM alone. Therefore, subject to natural change, the lesser black-backed gull feature will be maintained in the long term with respect to the potential for collision risk**.

10.3.10 Bowland Fells SPA and pSPA

Features and Effects for Assessment

602 Potential for LSE alone has been identified for the following for Bowland Fells SPA and pSPA:

- Lesser black-backed gull (breeding and non-breeding seasons) – O&M, risk of collision.

Assessment information

603 The objectives (as described Annex 3) are 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.

604 Based on the above conservation objective, the specific target for the lesser black-backed gull feature of the SPA is to maintain or restore:

- The population of each of the qualifying features.

Operation and Maintenance

Collision risk

Lesser black-backed gull

605 Lesser black-backed gull are a designated feature of the Bowland Fells SPA and pSPA during the breeding bio-season and has been screened into the assessment based on sensitivity to collision risk during operation. Lesser black-backed gull were recorded in the AyM array area in only a single aerial digital survey (Volume 4, Annex 4.1), with estimated abundance of eight individuals in July 2020. Individuals were recorded during the migration-free breeding bio-season and zero individuals in the non-breeding bio-seasons. Although numbers recorded by surveys were low and will therefore lead to negligible outputs when apportioned, the results have been presented here on a precautionary basis, as discussed with NRW during the AyM ETGs (Table 1).

606 Results are presented on a seasonal basis as impact varies by season. Lesser black-backed gull outputs are therefore presented for the migration-free breeding season of May-July only, as no individuals were recorded in the non-breeding bio-seasons for this species.

607 During the breeding bio-season, when birds are limited in the distance and number of days over which they can forage by the need to return regularly to the nest site, it can be expected that the area in and around AyM will contain a high proportion of adult birds that can be attributed to those designated sites within foraging range. Bowland Fells SPA and pSPA lies within the mean maximum ± 1SD foraging range of lesser black-backed gull (127±109 km; Woodward *et al*., 2019), along with a number of other designated and non-designated sites based on distances around land. Predicted collision mortality has therefore been apportioned to each of these sites following NatureScot (2018) (Annex 5: Ornithology Apportioning Note (application ref: 5.2.5)).

608 Due to small sample sizes of individuals from survey data, a generic population age proportion of lesser black-backed gulls has been used of 0.6 adults across all months of the year taken from Furness (2015).

Breeding

609 The predicted collision resultant mortality from the operation of AyM in the breeding bio-season (BO3) is 0.26 (0-1.03) individuals. Mortality during the breeding bio-season was apportioned to Bowland Fells SPA and pSPA following the NatureScot (2018) method. Following this method, 46.2% of birds subject to collision risk may be breeding age individuals from Bowland Fells SPA and pSPA. Table 20 presents the apportioning results for lesser black-backed gull at Bowland Fells SPA and pSPA.

Table 20: Breeding season apportioning results attributed for lesser black-backed gull screened in at Bowland Fells SPA and pSPA for collision risk.

COLLISION INDUCED MORTALITIES ATTRIBUTED TO SPA	SPA LESSER BLACK-BACKED GULL POPULATION		INCREASE IN BASELINE MORTALITY (%)	
	CITATION (2009-2012)	SMP (2018)	CITATION (2009-2012)	SMP (2018)
0.07 (0-0.3)	9,150	29,254	0.007 (0-0.03)	0.002 (0-0.009)

Conclusion

610 The potential addition of 0.07 (0-0.3) breeding adult lesser black-backed gull mortalities per annum equates to less than 0.1% increase in baseline mortality for either citation or latest colony count. This increase would be indistinguishable from natural fluctuations in the population. There is, therefore, **no potential for an AEoI to the population conservation objective of the lesser black-backed gull feature of Bowland Fells SPA and pSPA in relation to collision risk effects from AyM alone. Therefore, subject to natural change, the lesser black-backed gull feature will be maintained in the long term with respect to the potential for collision risk.**

10.3.11 Lambay Island SPA

Features and Effects for Assessment

611 Potential for LSE alone has been identified for the following for Lambay Island SPA:

- Kittiwake (breeding) – O&M Phase, collision risk;
- Lesser black-backed gull (breeding) – O&M Phase, collision risk;
- Guillemot (breeding) – C&D and O&M Phases, displacement;
- Razorbill (breeding) – C&D and O&M Phases, displacement; and
- Puffin (breeding) – C&D and O&M Phases, displacement.

Assessment information

612 The conservation objective (described fully in Annex 3) for Lambay Island SPA is to maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests for this SPA.

613 Based on the above conservation objective, the specific target for those screened in features of the SPA, in order for favourable conservation status to be achieved, is 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.

Construction and Decommissioning

Displacement

Guillemot

614 Guillemot has been screened into the assessment of the construction and decommissioning phase based on its sensitivity to displacement during the construction and decommissioning activities (Bradbury *et al*., 2014). In order to assess the potential impact on guillemot, a displacement effect distance was determined of the array area and 2 km buffer. The percentage of birds displaced, and consequential mortality was determined, for guillemot the level of displacement was set of 25% and the consequential mortality of 1% during construction and decommissioning. Guillemot from Lambay Island SPA were screened into the assessment based on potential connectivity to AyM during the breeding season, therefore, guillemot have been screened in for the breeding bio-season of March to July, only (Furness, 2015).

615 In the breeding bio-season, the mean peak abundance of guillemot estimated to occur in the array area plus 2 km buffer is 1,569 individuals. During the breeding bio-season, when birds are limited in the distance and number of days over which they can forage by the need to return regularly to the nest site, it can be expected that the area in and around AyM will contain a high proportion of adult birds that can be attributed to those designated sites within foraging range. The Lambay Island SPA lies within the mean maximum (± SD) foraging range of guillemot (73.2±80.5 km; Woodward *et al*., 2019), along with a number of other designated and non-designated sites based on distances around land. Predicted displacement mortality has therefore been apportioned to each of these sites following NatureScot (2018) (Annex 5: Ornithology Apportioning Note (application ref: 5.2.5)).

616 As guillemot are not possible to age on surveys, a generic population age proportion has been used of 0.57 adults across all months of the year taken from Furness (2015).

Breeding

617 During the breeding bio-season, a peak abundance of 1,569 guillemot within the array area plus 2 km buffer are estimated to be at risk of displacement. Using a displacement rate of 25% and a mortality rate of 1% would result in 3.9 individuals being subject to mortality. Mortality during the breeding bio-season was apportioned to Lambay Island SPA following the NatureScot (2018) method. Following this method, 14% of birds subject to displacement may be breeding age individuals from Lambay Island SPA. On this basis, 0.3 breeding adults are predicted to suffer displacement mortality attributable to this SPA.

Conclusion

618 The potential impact of displacement on guillemots in the array area plus 2 km buffer during the Construction and Decommissioning Phases of AyM is a predicted consequent mortality of 0.3 adult birds from Lambay SPA during the breeding bio-season. When considering the potential impact of this loss to the Lambay SPA (with a classified guillemot population of 77,998 breeding adults and an annual background mortality of 4757.9 breeding adults), then using the prediction of 0.3 breeding adults per annum suffering mortality as a consequence of displacement would represent a 0.007% increase in baseline mortality for guillemot at Lambay SPA.

619 The population of guillemots has changed since the citation population count, therefore it is also appropriate to assess the potential impact against the latest population count undertaken in 2015 (59,983 breeding adults and therefore a baseline mortality of 3659.0 breeding adults). On this basis, 0.3 breeding adults, per annum, suffering displacement consequent mortality at Lambay SPA would represent a 0.009% increase in baseline mortality per annum.

620 The potential addition of 0.3 breeding adult guillemot mortalities per annum equates to less than 0.01% increase in baseline mortality for either citation or latest colony count. This increase would be indistinguishable from natural fluctuations in the population and therefore, **there would be no potential for an AEoI to the population conservation objective of the guillemot feature at Lambay Island SPA in relation to potential adverse displacement effects from the construction and decommissioning phase of AyM alone. Therefore, subject to natural change, guillemot would be maintained as a feature in the long term.**

Razorbill

621 Razorbill has been screened into the assessment of the construction and decommissioning phases based on its sensitivity to construction and decommissioning activities. In order to assess the potential impact on razorbill, a displacement effect distance was determined of the array area and 2 km buffer. The percentage of birds displaced and consequential mortality was determined, for razorbill the level of displacement was set at 25% and the consequential mortality at 1% during construction and decommissioning. Razorbill from Lambay Island SPA were screened into the assessment based on potential connectivity to AyM during the breeding season, therefore, razorbill have been screened in for the breeding bio-season of April to July, only (Furness, 2015).

622 In the breeding bio-season, the mean peak abundance of razorbill estimated to occur in the array area plus 2 km buffer is 140 individuals. During the breeding bio-season, when birds are limited in the distance and number of days over which they can forage by the need to return regularly to the nest site, it can be expected that the area in and around AyM will contain a high proportion of adult birds that can be attributed to those designated sites within foraging range. The Lambay Island SPA lies within the mean maximum (± SD) foraging range of razorbill (88.7±75.9 km; Woodward *et al*., 2019), along with a number of other designated and non-designated sites based on distances around land. Predicted displacement mortality has therefore been apportioned to each of these sites following NatureScot (2018) (Annex 5: Ornithology Apportioning Note (application ref: 5.2.5)).

623 As razorbill are not possible to age on surveys, a generic population age proportion has been used of 0.57 adults across all months of the year taken from Furness (2015).

Breeding

624 During the breeding bio-season, a peak abundance of 140 razorbill within the array area plus 2 km buffer are estimated to be at risk of displacement. Using a displacement rate of 25% and a mortality rate of 1% would result in 0.4individuals being subject to mortality. Mortality during the breeding bio-season was apportioned to Lambay Island SPA following the NatureScot (2018) method. Following this method, 13.4% of birds subject to displacement may be breeding age individuals from Lambay Island SPA. On this basis, 0.03 breeding adults are predicted to suffer displacement mortality attributable to this SPA.

Conclusion

625 The potential impact of displacement on razorbills in the array area plus 2 km buffer during the Construction and Decommissioning Phases of AyM is a predicted consequent mortality of 0.03 adult birds from Lambay Island SPA during the breeding bio-season. When considering the potential impact of this loss to the Lambay Island SPA (with a classified razorbill population of 7,610 breeding adults and an annual background mortality of 799 breeding adults), then using the prediction of 0.03 breeding adults per annum suffering mortality as a consequence of displacement would represent a 0.003% increase in baseline mortality for razorbill at Lambay Island SPA.

626 The population of razorbills has changed since the citation population count, therefore it is also appropriate to assess the potential impact against the latest population count undertaken in 2015 (7,353 breeding adults and therefore a baseline mortality of 772 breeding adults). On this basis, 0.03breeding adults, per annum, suffering displacement consequent mortality at Lambay Island SPA would represent a 0.003% increase in baseline mortality per annum.

627 The potential addition of 0.03 breeding adult razorbill mortalities per annum equates to less than 0.01% increase in baseline mortality for either citation or latest colony count. This increase would be indistinguishable from natural fluctuations in the population. Therefore, there would be **no potential for an AEoI to the population conservation objective of the razorbill feature at Lambay Island SPA in relation to potential adverse displacement effects from the construction and decommissioning phase of AyM alone. Therefore, subject to natural change, razorbill would be maintained as a feature in the long term.**

Puffin

628 Puffin has been screened into the assessment of the construction and decommissioning phases based on its sensitivity to construction and decommissioning activities. In order to assess the potential impact on puffin, a displacement effect distance was determined of the array area and 2 km buffer. The percentage of birds displaced and consequential mortality was determined, for puffin the level of displacement was set at 25% and the consequential mortality at 1% during construction and decommissioning. Puffin from Lambay Island SPA were screened into the assessment based on potential connectivity to AyM during the breeding season, therefore, puffin have been screened in for the breeding bio-season of April to July, only (Furness, 2015).

629 In the breeding bio-season, the mean peak abundance of puffin estimated to occur in the array area and 2 km buffer is 14 individuals. During the breeding bio-season, when birds are limited in the distance and number of days over which they can forage by the need to return regularly to the nest site, it can be expected that the area in and around AyM will contain a high proportion of adult birds that can be attributed to those designated sites within foraging range. The Lambay Island SPA lies within the mean maximum (± SD) foraging range of puffin (137.1±128.3 km; Woodward *et al*., 2019), along with a number of other designated and non-designated sites based on distances around land. Predicted displacement mortality has therefore been apportioned to each of these sites following NatureScot (2018) (Annex 5: Ornithology Apportioning Note (application ref: 5.2.5)).

630 Due to small sample sizes of individuals from survey data, a generic population age proportion of puffins has been used of 0.49 adults across all months of the year taken from Furness (2015) (calculated from a 1.04 immatures per adult ratio).

Breeding

631 During the breeding bio-season, a peak abundance of 14 Puffin within the array area plus 2 km buffer are estimated to be at risk of displacement. Using a displacement rate of 25% and a mortality rate of 1% would result in 0.04 individuals being subject to mortality. Mortality during the breeding bio-season was apportioned to Lambay Island SPA following the NatureScot (2018) method. Following this method, 0.8% of birds subject to displacement may be breeding age individuals from Lambay Island SPA. On the basis, 0.0001 breeding adults are predicted to suffer displacement mortality attributable to this SPA.

Conclusion

632 The potential impact of displacement on puffins in the array area plus 2 km buffer during the Construction and Decommissioning Phases of AyM is a predicted consequent mortality of 0.0001 adult birds from Lambay Island SPA during the breeding bio-season. When considering the potential impact of this loss to the Lambay Island SPA (with a classified puffin population of 418 breeding adults and an annual background mortality of 39.3 breeding adults), then using the prediction of 0.0001 breeding adults per annum suffering mortality as a consequence of displacement would represent a 0.0003% increase in baseline mortality for puffin at Lambay Island SPA.

633 The population of puffins has changed since the citation population count, therefore it is also appropriate to assess the potential impact against the latest population count undertaken in 2015 (144 breeding adults and therefore a baseline mortality of 13.5 breeding adults). On this basis, 0.0001 breeding adults, per annum, suffering displacement consequent mortality at Lambay Island SPA would represent a 0.001% increase in baseline mortality per annum.

634 The potential addition of 0.0001 breeding adult puffin mortalities per annum equates to less than 0.01% increase in baseline mortality for either citation or latest colony count. This increase would be indistinguishable from natural fluctuations in the population. Therefore, there would be **no potential for an AEoI to the population conservation objective of the puffin feature at Lambay Island SPA in relation to potential adverse displacement effects from the construction and decommissioning phase of AyM alone. Therefore, subject to natural change, puffin would be maintained as a feature in the long term.**

Operation and maintenance

Collision

Kittiwake

635 Kittiwake has been screened into the assessment of the O&M phase based on the density of birds in flight in the array area and its flight behaviour that places it at risk of collision with the turning blades of the WTGs. Kittiwake from Lambay Island SPA were screened into the assessment based on potential connectivity to AyM during the breeding season, therefore kittiwake has been screeded in for the migration-free breeding bio-season only of May to July.

636 During the breeding bio-season, when birds are limited in the distance and number of days over which they can forage by the need to return regularly to the nest site, it can be expected that the area in and around AyM will contain a high proportion of adult birds that can be attributed to those designated sites within foraging range. The Lambay Island SPA lies within the mean maximum (± SD) foraging range of kittiwake (156.1±144.5 km; Woodward *et al.*, 2019), along with a number of other designated and non-designated sites based on distances around land. Predicted collision mortality has therefore been apportioned to each of these sites following NatureScot (2018) (Annex 5: Ornithology Apportioning Note (application ref: 5.2.5)).

637 It is not possible to split adult kittiwakes from juvenile 2nd winter birds (majority of kittiwake breed for the first time at age four (Horswill and Robison, 2015)) from survey data. Therefore, kittiwake generic adult proportions of 0.53 were used in the assessment (Furness, 2015).

Breeding

638 The predicted collision resultant mortality from the operation of AyM in the migration-free breeding bio-season (BO2) is 12.3 (3.2-29.0) individuals. Mortality during the breeding bio-season was apportioned to Lambay Island SPA following the NatureScot (2018) method. Following this method, 2.2% of birds subject to collision risk may be breeding age individuals from Lambay Island SPA. On this basis, 0.15 (0.04-0.3) breeding adults are predicted to suffer collision mortality attributable to this SPA.

Conclusion

639 The potential impact of collision on kittiwakes in the array area during the O&M phase of AyM is a predicted consequent mortality of 0.15 (0.04-0.3) adult birds from Lambay Island SPA during the breeding bio-season. When considering the potential impact of this loss to the Lambay Island SPA (with a classified kittiwake population of 7,894 breeding adults and an annual background mortality of 1,153 breeding adults), then using the prediction of 0.15 (0.04-0.3) breeding adults per annum suffering mortality as a consequence of collision would represent a 0.01% (0.003-0.03%) increase in baseline mortality for kittiwake at Lambay Island SPA. The population of kittiwake has changed since the citation population count, therefore it is also appropriate to assess the potential impact against the latest population count undertaken in 2015 (6640 breeding adults and therefore a baseline mortality of 969.4 breeding adults). On this basis, 0.15 (0.04-0.3) breeding adults, per annum suffering collision consequent mortality at Lambay Island SPA would represent a 0.02% (0.004-0.04%) increase in baseline mortality per annum.

640 The potential addition of 0.15 (0.04-0.3) breeding adult kittiwake mortalities per annum equates to less than 0.1% increase in baseline mortality for either citation or latest colony count. This increase would be indistinguishable from natural fluctuations in the population and therefore, there would be **no potential for an AEoI to the population conservation objective of the kittiwake feature at Lambay Island SPA in relation to potential adverse collision effects from the O&M phase of AyM alone. Therefore, subject to natural change, kittiwake would be maintained as a feature in the long term.**

Lesser black-backed gull

641 Lesser black-backed gull are a designated feature of the Lambay Island SPA during the breeding bio-season and have been screened into the assessment during the breeding bio-season based on its sensitivity to collision risk during operation. Lesser black-backed gull were recorded in the AyM array area in a single aerial digital survey (Volume 4, Annex 4.1), with estimated abundance of eight individuals in July 2020. Individuals were recorded during the migration-free breeding bio-season and zero individuals in the non-breeding bio-seasons. Although numbers recorded by surveys were low and will therefore lead to negligible outputs when apportioned, the results have been presented here on a precautionary basis, as discussed with NRW during the AyM ETGs (Table 1).

642 Lesser black-backed gull is screened in for Lambay Island SPA for the breeding bio-season only, therefore, results are presented for the migration-free breeding season of May-July only.

643 During the breeding bio-season, when birds are limited in the distance and number of days over which they can forage by the need to return regularly to the nest site, it can be expected that the area in and around AyM will contain a high proportion of adult birds that can be attributed to those designated sites within foraging range. Lambay Island SPA lies within the mean maximum ± 1SD foraging range of lesser black-backed gull (127±109 km; Woodward *et al.*, 2019), along with a number of other designated and non-designated sites based on distances around land. Predicted collision mortality has therefore been apportioned to each of these sites following NatureScot (2018) (Annex 5: Ornithology Apportioning Note (application ref: 5.2.5)).

644 Due to small sample sizes of individuals from survey data, a generic population age proportion of lesser black-backed gulls has been used of 0.6 adults across all months of the year taken from Furness (2015).

Breeding

645 The predicted collision resultant mortality from the operation of AyM in the breeding bio-season (BO3) is 0.26 (0-1.03) individuals. Mortality during the breeding bio-season was apportioned to Lambay Island SPA following the NatureScot (2018) method. Following this method, 0.5% of birds subject to collision risk may be breeding age individuals from Lambay Island SPA. Table 21 presents the apportioning results for lesser black-backed gull at Lambay Island SPA.

Table 21: Breeding season apportioning results attributed for lesser black-backed gull screened in at Lambay Island SPA for collision risk.

COLLISION INDUCED MORTALITIES ATTRIBUTED TO SPA	SPA LESSER BLACK-BACKED GULL POPULATION		INCREASE IN BASELINE MORTALITY (%)	
	CITATION (2004)	SMP (2010)	CITATION (2004)	SMP (2010)
0.0007 (0-0.003)	266	952	0.002 (0-0.01)	0.0007 (0-0.003)

Conclusion

646 The potential addition of 0.0007 (0-0.003) breeding adult lesser black-backed gull mortalities per annum equates to less than 0.1% increase in baseline mortality for either citation or latest colony count. This increase would be indistinguishable from natural fluctuations in the population. There is, therefore, **no potential for an AEoI to the population conservation objective of the lesser black-backed gull feature of Lambay Island SPA in relation to collision risk effects from AyM alone. Therefore, subject to natural change, the lesser black-backed gull feature will be maintained in the long term with respect to the potential for collision risk.**

Displacement

Guillemot

647 Guillemot has been screened into the assessment of the O&M phase based on its sensitivity to the presence of the WTGs. In order to assess the potential impact on guillemot, a displacement effect distance was determined of the array area and 2 km buffer. The percentage of birds displaced and consequential mortality was determined, for guillemot the level of displacement was set at 50% and the consequential mortality at 1% during O&M. Guillemot from Lambay Island SPA were screened into the assessment based on potential connectivity to AyM during the breeding season, therefore, guillemot have been screened in for the breeding bio-season of March to July, only (Furness, 2015).

648 In the breeding bio-season, the mean peak abundance of guillemot estimated to occur in the array area plus 2 km buffer is 1,569 individuals. During the breeding bio-season, when birds are limited in the distance and number of days over which they can forage by the need to return regularly to the nest site, it can be expected that the area in and around AyM will contain a high proportion of adult birds that can be attributed to those designated sites within foraging range. The Lambay Island SPA lies within the mean maximum (± SD) foraging range of guillemot (73.2±80.5 km; Woodward *et al*., 2019), along with a number of other designated and non-designated sites based on distances around land. Predicted displacement mortality has therefore been apportioned to each of these sites following NatureScot (2018) (Annex 5: Ornithology Apportioning Note (application ref: 5.2.5)).

649 As guillemots are difficult to age on surveys, a generic population age proportion has been used of 0.57 adults across all months of the year taken from Furness (2015).

Breeding

650 During the breeding bio-season, a peak abundance of 1,569 guillemot within the array area are estimated to be at risk of displacement. Using a displacement rate of 50% and a mortality rate of 1% would result in 7.8 individuals being subject to mortality. Mortality during the breeding bio-season was apportioned to Lambay Island SPA following the NatureScot (2018) method. Following this method, 14% of birds subject to displacement may be breeding age individuals from Lambay Island SPA. On this basis, 0.6 breeding adults are predicted to suffer displacement mortality attributable to this SPA.

Conclusion

651 The potential impact of displacement on guillemots in the array area during the O&M phase of AyM is a predicted consequent mortality of 0.6 adult birds from Lambay Island SPA during the breeding bio-season. When considering the potential impact of this loss to the Lambay Island SPA (with a classified guillemot population of 77,998 breeding adults and an annual background mortality of 4,757.9 breeding adults), then using the prediction of 0.6 breeding adults per annum suffering mortality as a consequence of displacement would represent a 0.01% increase in baseline mortality for guillemot at Lambay Island SPA.

652 The population of guillemots has changed since the citation population count, therefore it is also appropriate to assess the potential impact against the latest population count undertaken in 2015 (59,983 breeding adults and therefore a baseline mortality of 3,659 breeding adults). On this basis, 0.6 breeding adults, per annum, suffering displacement consequent mortality at Lambay Island SPA would represent a 0.02% increase in baseline mortality per annum.

653 The potential addition of 0.6 breeding adult guillemot mortalities per annum equates to less than 0.1% increase in baseline mortality for either citation or latest colony count. This increase would be indistinguishable from natural fluctuations in the population. Therefore, there would be **no potential for an AEoI to the population conservation objective of the guillemot feature at Lambay Island SPA in relation to potential adverse displacement effects from the O&M phase of AyM alone. Therefore, subject to natural change, guillemot would be maintained as a feature in the long term.**

Razorbill

654 Razorbill has been screened into the assessment of the O&M phase based on its sensitivity to the presence of the WTGs. In order to assess the potential impact on razorbill, a displacement effect distance was determined of the array area and 2 km buffer. The percentage of birds displaced and consequential mortality was determined, for razorbill the level of displacement was set at 50% and the consequential mortality at 1% during O&M. Razorbill from Lambay Island SPA were screened into the assessment based on potential connectivity to AyM during the breeding season, therefore, razorbill have been screened in for the breeding bio-season of April to July (Furness, 2015).

655 In the breeding bio-season, the mean peak abundance of razorbill estimated to occur in the array area plus 2 km buffer is 140 individuals. During the breeding bio-season, when birds are limited in the distance and number of days over which they can forage by the need to return regularly to the nest site, it can be expected that the area in and around AyM will contain a high proportion of adult birds that can be attributed to those designated sites within foraging range. The Lambay Island SPA lies within the mean maximum (± SD) foraging range of razorbill (88.7±75.9 km; Woodward *et al*., 2019), along with a number of other designated and non-designated sites based on distances around land. Predicted displacement mortality has therefore been apportioned to each of these sites following NatureScot (2018) (Annex 5: Ornithology Apportioning Note (application ref: 5.2.5)).

656 As razorbills are difficult to age on surveys, a generic population age proportion has been used of 0.57 adults across all months of the year taken from Furness (2015).

Breeding

657 During the migration-free breeding bio-season, a peak abundance of 140 razorbill within the array area plus 2 km buffer are estimated to be at risk of displacement. Using a displacement rate of 50% and a mortality rate of 1% would result in 0.7 individuals being subject to mortality. Mortality during the breeding bio-season was apportioned to Lambay Island SPA following the NatureScot (2018) method. Following this method, 13.4% of birds subject to displacement may be breeding age individuals from Lambay Island SPA. On this basis, 0.05 breeding adults are predicted to suffer displacement mortality attributable to this SPA.

Conclusion

658 The potential impact of displacement on razorbills in the array area plus 2 km buffer during the O&M phase of AyM is a predicted consequent mortality of 0.05 adult birds from Lambay Island SPA during the breeding bio-season. When considering the potential impact of this loss to the Lambay Island SPA (with a classified razorbill population of 7,610 breeding adults and an annual background mortality of 799 breeding adults), then using the prediction of 0.05 breeding adults per annum suffering mortality as a consequence of displacement would represent a 0.007% increase in baseline mortality for razorbill at Lambay Island SPA.

659 The population of razorbills has changed since the citation population count, therefore it is also appropriate to assess the potential impact against the latest population count undertaken in 2015 (7,353 breeding adults and therefore a baseline mortality of 772 breeding adults). On this basis, 0.05 breeding adults, per annum, suffering displacement consequent mortality at Lambay Island SPA would represent a 0.007% increase in baseline mortality per annum.

660 The potential addition of 0.05 breeding adult razorbill mortalities per annum equates to less than 0.01% increase in baseline mortality for either citation or latest colony count. This increase would be indistinguishable from natural fluctuations in the population. Therefore, there would be **no potential for an AEoI to the population conservation objective of the razorbill feature at Lambay Island SPA in relation to potential adverse displacement effects from the O&M phase of AyM alone. Therefore, subject to natural change, razorbill would be maintained as a feature in the long term.**

Puffin

661 Puffin has been screened into the assessment of the O&M phase based on its sensitivity to the presence of the WTGs. In order to assess the potential impact on puffin, a displacement effect distance was determined of the array area and 2 km buffer. The percentage of birds displaced and consequential mortality was determined, for puffin the level of displacement was set at 50% and the consequential mortality at 1% during O&M. Puffin from Lambay Island SPA were screened into the assessment based on potential connectivity to AyM during the breeding season, therefore, puffin have been screened in for the breeding bio-season of April to July (Furness, 2015).

662 In the breeding bio-season, the mean peak abundance of puffin estimated to occur in the array area and 2 km buffer is 14 individuals. During the breeding bio-season, when birds are limited in the distance and number of days over which they can forage by the need to return regularly to the nest site, it can be expected that the area in and around AyM will contain a high proportion of adult birds that can be attributed to those designated sites within foraging range. The Lambay Island SPA lies within the mean maximum (± SD) foraging range of puffin (137.1±128.3 km; Woodward *et al.*, 2019), along with a number of other designated and non-designated sites based on distances around land. Predicted displacement mortality has therefore been apportioned to each of these sites following NatureScot (2018) (Annex 5: Ornithology Apportioning Note (application ref: 5.2.5)).

663 Due to small sample sizes of individuals from survey data, a generic population age proportion of puffins has been used of 0.49 adults across all months of the year taken from Furness (2015) (calculated from 1.04 immatures per adult ratio).

Breeding

664 During the breeding bio-season, a peak abundance of 14 puffin within the array area plus 2 km buffer are estimated to be at risk of displacement. Using a displacement rate of 50% and a mortality rate of 1% would result in 0.07 individuals being subject to mortality. Mortality during the breeding bio-season was apportioned to Lambay Island SPA following the NatureScot (2018) method. Following this method, 0.8% of birds subject to displacement may be breeding age individuals from Lambay Island SPA. On the basis, 0.0003 breeding adults are predicted to suffer displacement mortality attributable to this SPA.

Conclusion

665 The potential impact of displacement on puffins in the array area plus 2 km buffer during the O&M phase of AyM is a predicted consequent mortality of 0.0003 adult birds from Lambay Island SPA during the breeding bio-season. When considering the potential impact of this loss to the Lambay Island SPA (with a classified puffin population of 418 breeding adults and an annual background mortality of 39.3 breeding adults), then using the prediction of 0.0003 breeding adults per annum suffering mortality as a consequence of displacement would represent a 0.0007% increase in baseline mortality for puffin at Lambay Island SPA.

666 The population of puffins has changed since the citation population count, therefore it is also appropriate to assess the potential impact against the latest population count undertaken in 2015 (144 breeding adults and therefore a baseline mortality of 13.5 breeding adults). On this basis, 0.0003 breeding adults, per annum, suffering displacement consequent mortality at Lambay Island SPA would represent a 0.002% increase in baseline mortality per annum.

667 The potential addition of 0.0003 breeding adult puffin mortalities per annum equates to less than 0.01% increase in baseline mortality for either citation or latest colony count. This increase would be indistinguishable from natural fluctuations in the population. Therefore, there would be **no potential for an AEoI to the population conservation objective of the puffin feature at Lambay Island SPA in relation to potential adverse displacement effects from the O&M phase of AyM alone. Therefore, subject to natural change, puffin would be maintained as a feature in the long term.**

10.3.12 Wexford Harbour and Slobs SPA

Features and Effects for Assessment

668 Potential for LSE alone has been identified for the following for Wexford Harbour and Slobs SPA:

- Lesser black-backed gull (breeding) – O&M, risk of collision.

669 The conservation objective for the Wexford Harbour and Slobs SPA is to maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests for this SPA, which is defined by the following list of attributes and targets:

- Long term population trend stable or increasing; and
- There should be no significant decrease in the numbers or range of areas used by waterbird species, other than that occurring from natural patterns of variation.

670 Based on the above conservation objective, the specific target for those screened in features of the SPA, in order for favourable conservation status to be achieved, is 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.

671 Wexford Harbour and Slobs SPA was initially screened into assessment as the AyM array area is within the mean-max + 1SD foraging range (Woodward *et al*., 2019) of lesser black-backed gull from the marine boundary of the SPA. However, further investigation of SPA supporting information (such as the Site Synopsis (National Parks & Wildlife Service, 2011) shows that the lesser black-backed gull feature of the SPA is a non-breeding feature. As mean-maximum foraging ranges are only applicable to birds during the breeding season (Woodward *et al*., 2019), they cannot be applied to non-breeding features of an SPA. As a result, there is no connectivity between the lesser black-backed gull feature of Wexford Harbour and Slobs SPA during the breeding season. Therefore, adverse effects can be discounted as there is no pathway for effects.

10.3.13 Ailsa Craig SPA

Features and Effects for Assessment

672 Potential for LSE alone has been identified for the following for Ailsa Craig SPA:

- Gannet (breeding and non-breeding) – O&M Phase, risk of collision and displacement, Construction and Decommissioning, displacement;
- Lesser black-backed gull (breeding and non-breeding) – O&M Phase, risk of collision; and
- Kittiwake (breeding and non-breeding) – O&M Phase, risk of collision.

Assessment information

673 The conservation objectives (as described in Annex 3) for the site are as follows:

- 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.

674 Although kittiwake is only a named feature of the seabird assemblage, for the purpose of this assessment it has been considered in a similar manner to qualifying species, though the conclusion is not whether an AEoI would result from AyM alone on kittiwake as a feature, but more as an important component of the seabird assemblage.

Construction and Decommissioning

Displacement

Gannet

675 Gannet has been screened into the assessment of the construction and decommissioning phase based on its sensitivity to construction and decommissioning activities. In order to assess the potential impact on gannet, a displacement effect distance was determined of the array area plus 2 km buffer. The percentage of birds displaced and consequential mortality was determined, for gannet the level of displacement was set at 30-40% and the consequential mortality at 1% during construction and decommissioning, based on the displacement interim guidance (JNCC, 2017). Gannet from Grassholm SPA were screened into the assessment based on potential connectivity to AyM during the breeding bio-season of April to August, post-breeding bio-season of September to November and pre-breeding bio-season of December to March (Furness, 2015).

676 In the migration-free breeding bio-season, the mean peak abundance of gannet estimated to occur in the array area plus 2 km buffer is 328 individuals. During the post-breeding bio-season the mean peak abundance of gannet estimated to occur in the array area plus 2 km buffer is 201 individuals and 0 during the pre-breeding season.

677 During the breeding bio-season, when birds are limited in the distance and number of days over which they can forage by the need to return regularly to the nest site, it can be expected that the area in and around AyM will contain a high proportion of adult birds that can be attributed to those designated sites within foraging range. The Ailsa Craig SPA lies within the mean maximum (± SD) foraging range of AyM (315.2±194.2 km; Woodward *et al*., 2019), along with a number of other designated and non-designated sites based on distances around land. Predicted displacement mortality has therefore been apportioned to each of these sites following NatureScot (2018) (Annex 5: Ornithology Apportioning Note (application ref: 5.2.5)).

678 Outside the breeding bio-season, the population of gannet contains a mix of individuals from UK breeding colonies and from further away, therefore, a much lower percentage of birds can be attributed to any particular breeding colony SPA population. During these non-breeding bio-seasons, the information on populations contained in Furness (2015) has been applied for the purpose of apportionment.

679 Age proportion for gannet has been determined from site specific data. An adult age proportion has been used of 0.94 across the breeding bio-season. Apportioning for the non-breeding bio-seasons have been undertaken using Furness (2015), therefore no additional age ratio is required in these bio-seasons.

Breeding

680 During the migration-free breeding bio-season, a peak abundance of 328 gannets within the array area plus 2 km buffer are estimated to be at risk of displacement. Using displacement rates between 30 – 40% and a mortality rate of 1% would result in between 1.0-1.3 individuals being subject to mortality. Mortality during the breeding bio-season was apportioned to Ailsa Craig SPA following the NatureScot (2018) method. Following this method, 46.2% of birds subject to displacement may be breeding age individuals from Ailsa Craig SPA. On the basis, 0.4-0.6 breeding adults are predicted to suffer displacement mortality attributable to this SPA.

Migratory

681 During the post-breeding bio-season, a peak abundance of 201 gannets within the array area plus 2 km buffer are estimated to be at risk of displacement. Using displacement rates between 30-40% and a mortality rate of 1% would result in between 0.6-0.8 individuals being subject to mortality. During the pre-breeding bio-season, zero gannets were recorded within the array area plus 2 km buffer, therefore zero individuals are estimated to be at risk of displacement and consequently zero individuals are subject to mortality during the pre-breeding bio-season. As no gannets were recorded during the pre-breeding bio-season, there is therefore, no pathway for effect and **no AEoI is determined for gannet at Ailsa Craig SPA during pre-breeding bio-season for displacement during the Construction and Decommissioning Phases, and no further assessment will be made for gannet during this bio-season.**

682 In the migratory bio-season, birds will have come from a range of seabird breeding colonies in the UK and overseas. The UK Western waters BDMPS population during the post-breeding season is estimated to be 545,954 individuals (Furness, 2015). It is expected that all Ailsa Craig SPA breeding adults will remain in the UK Western waters BDMPS throughout the migratory bio-seasons (Furness, 2015). As such, breeding adults from Ailsa Craig SPA are considered to contribute to 9.9% of the UK Western waters population during the post-breeding migration. On that basis between 0.06 and 0.08 breeding adults that suffer displacement consequent mortality during the migration bio-season can be attributed to the SPA.

Conclusion

683 The potential impact of displacement on gannets in the array area plus 2 km buffer during the Construction and Decommissioning Phases of AyM is a predicted consequent mortality of between 0.4-0.6 adult birds from Ailsa Craig SPA during the breeding bio-season and 0.06 and 0.08 during the migratory bio-seasons. This equates to between 0.5 and 0.6 breeding adult birds per annum for the planned duration of construction and decommissioning activities.

684 When considering the potential impact of this loss to the Alisa Craig SPA (with a classified gannet population of 46,000 breeding adults and an annual background mortality of 3,726 breeding adults), then using the prediction of between 0.5 and 0.6 breeding adults per annum suffering mortality as a consequence of displacement would represent a 0.01% to 0.02% increase in baseline mortality for gannet at Ailsa Craig SPA.

685 The population of gannets has significantly increased since the citation population count, therefore it is also appropriate to assess the potential impact against the latest population count undertaken in 2014 (66,452 breeding adults and therefore a baseline mortality of 5382.6 breeding adults). On this basis, between 0.5 and 0.6 breeding adults, per annum, suffering displacement consequent mortality at Ailsa Craig SPA would represent a 0.009% to 0.01% increase in baseline mortality per annum.

686 The potential addition of between 0.5 and 0.6 breeding adult gannet mortalities per annum equates to less than 0.02% increase in baseline mortality for either citation or latest colony count. This increase would be indistinguishable from natural fluctuations in the population and therefore, there would be **no potential for an AEoI to the population conservation objective of the gannet feature at Ailsa Craig SPA in relation to potential adverse displacement effects from the construction and decommissioning phase of AyM alone. Therefore, subject to natural change, gannet would be maintained as a feature in the long term.**

Operation and Maintenance

Displacement

Gannet

687 Gannet has been screened into the assessment of the O&M phase based on its sensitivity to the presence of the WTGs. In order to assess the potential impact on gannet, a displacement effect distance was determined of the array area plus 2 km buffer. The percentage of birds displaced and consequential mortality was determined, for gannet the level of displacement was set at 60-80% and the consequential mortality at 1% during O&M, based on the displacement interim guidance (JNCC, 2017). Gannet from Ailsa Craig SPA has connectivity to AyM during the migration-free breeding bio-season of April to August, post-breeding bio-season of September to November and pre-breeding bio-season of December to March (Furness, 2015).

688 In the migration-free breeding bio-season, the mean peak abundance of gannet estimated to occur in the array area plus 2 km buffer is 328 individuals. During the post-breeding bio-season the mean peak abundance of gannet estimated to occur in the array area plus 2 km buffer is 201 individuals and 0 during the pre-breeding season.

689 During the breeding bio-season, when birds are limited in the distance and number of days over which they can forage by the need to return regularly to the nest site, it can be expected that the area in and around AyM will contain a high proportion of adult birds that can be attributed to those designated sites within foraging range. The Ailsa Craig SPA lies within the mean maximum (± SD) foraging range of AyM (315.2±194.2 km; Woodward *et al*., 2019), along with a number of other designated and non-designated sites based on distances around land. Predicted displacement mortality has therefore been apportioned to each of these sites following NatureScot (2018) (Annex 5: Ornithology Apportioning Note (application ref: 5.2.5)).

690 Outside the breeding bio-season, the population of gannet contains a mix of individuals from UK breeding colonies and from further away, therefore, a much lower percentage of birds can be attributed to any particular breeding colony SPA population. During these non-breeding bio-seasons, the information on populations contained in Furness (2015) has been applied for the purpose of apportionment.

691 Age proportion for gannet has been determined from site specific data. An adult age proportion has been used of 0.94 across the breeding bio-season. Apportioning for the non-breeding bio-seasons have been undertaken using Furness (2015), therefore no additional age ratio is required in these bio-seasons.

Breeding

692 During the migration-free breeding bio-season, a peak abundance of 328 gannets within the array area plus 2 km buffer are estimated to be at risk of displacement. Using displacement rates between 60 – 80% and a mortality rate of 1% would result in between 2.0 and 2.6 individuals being subject to mortality. Mortality during the breeding bio-season was apportioned to Ailsa Craig SPA following the NatureScot (2018) method. Following this method, 46.2% of birds subject to displacement may be breeding age individuals from Ailsa Craig SPA. On this basis, between 0.9 and 1.1 breeding adults are predicted to suffer displacement mortality attributable to this SPA.

Migratory

693 During the post-breeding bio-season, a peak abundance of 201 gannets within the array area plus 2 km buffer are estimated to be at risk of displacement. Using displacement rates between 60-80% and a mortality rate of 1% would result in between 1.2 and 1.6 individuals being subject to mortality. During the pre-breeding bio-season, zero gannets were recorded within the array area, therefore zero individuals are estimated to be at risk of displacement and consequently zero individuals are subject to mortality during the pre-breeding bio-season. As no gannets were recorded during the pre-breeding bio-season, there is therefore, no pathway for effect and **no AEoI is determined for gannet at Ailsa Craig SPA during pre-breeding bio-season for displacement during the Operational and Maintenance Phase, and no further assessment will be made for gannet during this bio-season.**

694 In the migratory bio-season, birds will have come from a range of seabird breeding colonies in the UK and overseas. The UK Western waters BDMPS population during the post-breeding season is estimated to be 545,954 individuals (Furness, 2015). It is expected that all Ailsa Craig SPA breeding adults will remain in the UK Western waters BDMPS throughout the migratory bio-seasons (Furness, 2015). As such, breeding adults from Ailsa Craig SPA are considered to contribute to 9.9% of the UK Western waters population during the post-breeding migration. On that basis between 0.1 and 0.2 breeding adults that suffer displacement consequent mortality during the migration bio-season can be attributed to the SPA.

Conclusion

695 The potential impact of displacement on gannets in the array area during the O&M phase of AyM is a predicted consequent mortality of between 0.9 and 1.1 adult birds from Ailsa Craig SPA during the breeding bio-season and 0.1 to 0.2 during the migratory bio-seasons. This equates to between 1.0 and 1.3 breeding adult birds per annum for the planned duration of operational and maintenance activities. When considering the potential impact of this loss to the Alisa Craig SPA (with a classified gannet population of 46,000 breeding adults and an annual background mortality of 3,726 breeding adults), then using the prediction of between 1.0 and 1.3 breeding adults per annum suffering mortality as a consequence of displacement would represent a 0.03% increase in baseline mortality for gannet at Ailsa Craig SPA.

696 The population of gannets has significantly increased since the citation population count, therefore it is also appropriate to assess the potential impact against the latest population count undertaken in 2014 (66,452 breeding adults and therefore a baseline mortality of 5,382.6 breeding adults). On this basis, between 1.0 and 1.3 breeding adults, per annum, suffering displacement consequent mortality at Ailsa Craig SPA would represent a 0.02% increase in baseline mortality per annum.

697 The potential addition of between 1.0 and 1.3 breeding adult gannet mortalities per annum equates to less than 0.04% increase in baseline mortality for either citation or latest colony count. This increase would be indistinguishable from natural fluctuations in the population and therefore, there would be **no potential for an AEoI to the population conservation objective of the gannet feature at Ailsa Craig SPA in relation to potential adverse displacement effects from the O&M phase of AyM alone. Therefore, subject to natural change, gannet would be maintained as a feature in the long term.**

Collision risk

Gannet

698 Gannet has been screened into the assessment of the O&M phase based on the density of birds in flight in the array area plus 2 km buffer and its flight behaviour that places it at risk of collision with the turning blades of the WTGs. The population of birds in the area in and around AyM changes through the seasons. Therefore, the assessment is carried out on a seasonal basis as the potential impact on the Ailsa Craig SPA varies by season. Gannet has, therefore, been screened in for the migration-free breeding bio-season of April to August, post-breeding bio-season of September to November and pre-breeding bio-season of December to March (Furness, 2015) in relation to Ailsa Craig SPA.

699 During the breeding bio-season, when birds are limited in the distance and number of days over which they can forage by the need to return regularly to the nest site, it can be expected that the area in and around AyM will contain a high proportion of adult birds that can be attributed to those designated sites within foraging range. The Ailsa Craig SPA lies within the mean maximum (± SD) foraging range of gannet (315.2±194.2 km; Woodward *et al*., 2019), along with a number of other designated and non-designated sites based on distances around land. Predicted collision mortality has therefore been apportioned to each of these sites following NatureScot (2018) (Annex 5: Ornithology Apportioning Note (application ref: 5.2.5)).

700 Outside the breeding bio-season, the population of gannet contains a mix of individuals from UK breeding colonies and from further away, therefore, a much lower percentage of birds can be attributed to any particular breeding colony SPA population. During these non-breeding bio-seasons, the information on populations contained in Furness (2015) has been applied for the purpose of apportionment.

701 Age proportion for gannet has been determined from site specific data. An adult age proportion has been used of 0.94 across the breeding bio-season. Apportioning for the non-breeding bio-seasons have been undertaken using Furness (2015), therefore no additional age ratio is required in these bio-seasons.

Breeding

702 The predicted collision resultant mortality from the operation of AyM in the breeding bio-season (BO2) is 12.2 (1.7-34.9) individuals. Mortality during the breeding bio-season was apportioned to Ailsa Craig SPA following the NatureScot (2018) method. Following this method, 46.2% of birds subject to collision risk may be breeding age individuals from Ailsa Craig SPA. On this basis, 5.3 (0.7-15.2) breeding adults are predicted to suffer collision mortality attributable to this SPA.

Migratory

703 During the pre-breeding migration bio-season, zero gannets were recorded within the array area, therefore zero individuals are estimated to be at risk of collision and consequently zero individuals are subject to mortality during the pre-breeding bio-season. As no gannets were recorded during the pre-breeding bio-season, there is therefore, no pathway for effect and **no AEoI is determined for gannet at Ailsa Craig SPA during pre-breeding bio-season for collision during the Operational and Maintenance Phase, and no further assessment will be made for gannet during this bio-season.**

704 During the post-breeding migration bio-season 8.3 (1.5-25.1) individual gannets are predicted to suffer collision consequent mortality. In total, 8.3 (1.5-25.1) individual birds are predicted to suffer collision related mortality during the migratory bio-seasons (there is no migration free winter bio-season).

705 In the migratory bio-season these birds will have come from a range of seabird breeding colonies in the UK and overseas. The UK Western waters BDMPS population during the post-breeding season is estimated to be 545,954 individuals (Furness, 2015). It is expected that all Ailsa Craig SPA breeding adults will remain in the UK Western waters BDMPS throughout the migratory bio-seasons. As such, breeding adults from Ailsa Craig SPA are considered to contribute to 9.9% of the UK Western waters BDMPS population during the post-breeding migration. On that basis 0.8 (0.1-2.5) breeding adults that suffer collision consequent mortality during the migration bio-season can be attributed to the SPA.

Conclusion

706 The potential impact of collision on gannets in the array area during the O&M phase of AyM is a predicted consequent mortality of 5.3 (0.7-15.2) adult birds from Ailsa Craig SPA during the breeding bio-season and 0.8 (0.1-2.5) during the non-breeding bio-seasons. This equates to 6.1 (0.9-17.7) breeding adult birds per annum for the planned duration of operational and maintenance activities. When considering the potential impact of this loss to the Alisa Craig SPA (with a classified gannet population of 46,000 breeding adults and an annual background mortality of 3,726 breeding adults), then using the prediction of 6.1 (0.9-17.7) breeding adults per annum suffering mortality as a consequence of collision would represent a 0.2% (0.02-0.5%) increase in baseline mortality for gannet at Ailsa Craig SPA.

707 The population of gannets has significantly increased since the citation population count, therefore it is also appropriate to assess the potential impact against the latest population count undertaken in 2014 (66,452 breeding adults and therefore a baseline mortality of 5,382.6 breeding adults). On this basis, 6.1 (0.9-17.7) breeding adults, per annum suffering collision consequent mortality at Ailsa Craig SPA would represent a 0.1% (0.02-0.3%) increase in baseline mortality per annum.

708 The potential addition of 6.1 (0.9-17.7) breeding adult gannet mortalities per annum equates to less than 1% increase in baseline mortality for either citation or latest colony count. This increase would be indistinguishable from natural fluctuations in the population and therefore, there would be **no potential for an AEoI to the population conservation objective of the gannet feature at Ailsa Craig SPA in relation to potential adverse collision effects from the O&M phase of AyM alone. Therefore, subject to natural change, gannet would be maintained as a feature in the long term.**

Combined gannet impacts during operation and maintenance

709 As gannet are deemed to be potentially sensitive to both displacement and collision risk, impacts during the operational phase of the project need to be summed. While this results in some degree of double counting, it provides a precautionary approach and is in line with assessing displacement effects as provided in SNCB *et al* (2017). During O&M it is predicted that 1.0 to 1.3 individuals will suffer displacement consequent mortality, whilst 6.1 (0.9-17.7) will suffer collision consequent mortality. This gives a combined 7.1-7.4 using 60-80% displacement combined with mean CRM output (1.8-18.6 using 60% displacement combined with minimum and maximum CRM outputs and 2.2-19.0 using 80% displacement combined with minimum and maximum CRM outputs) individuals suffering mortality as a result of AyM during the breeding season attributed to Ailsa Craig SPA.

710 When considering the potential impact of this loss to the Alisa Craig SPA (with a classified gannet population of 46,000 breeding adults and an annual background mortality of 3,726 breeding adults), then using the prediction of 7.1 to 7.4 (and a range of 1.8 to 19.0) breeding adults per annum suffering mortality as a consequence of collision and displacement would represent a 0.2% (and a range of 0.05 to 0.5%) increase in baseline mortality for gannet at Ailsa Craig SPA.

711 The population of gannets has significantly increased since the citation population count, therefore it is also appropriate to assess the potential impact against the latest population count undertaken in 2014 (66,452 breeding adults and therefore a baseline mortality of 5,382.6 breeding adults). On this basis, 7.1 to 7.4 (and a range of 1.8 to 19.0) breeding adults, per annum suffering collision and displacement consequent mortality at Ailsa Craig SPA would represent a 0.1% (and a range of 0.03 to 0.4%) increase in baseline mortality per annum.

712 The potential addition of 7.1 to 7.4 (and a range of 1.8 to 19.0) breeding adult gannet mortalities per annum equates to less than 0.6% increase in baseline mortality for either citation or latest colony count. This increase would be indistinguishable from natural fluctuations in the population and therefore, there would be **no potential for an AEoI to the population conservation objective of the gannet feature at Ailsa Craig SPA in relation to potential adverse combined collision and displacement effects from the O&M phase of AyM alone. Therefore, subject to natural change, gannet would be maintained as a feature in the long term.**

Kittiwake

713 Kittiwake has been screened into the assessment of the O&M phase based on the density of birds in flight in the array area and its flight behaviour that places it at risk of collision with the turning blades of the WTGs. The population of birds in the area in and around AyM changes through the seasons. Therefore, the assessment is carried out on a seasonal basis as the potential impact on the Ailsa Craig SPA varies by season. Kittiwake has, therefore, been screened in for the migration-free breeding season of May to July, the post-breeding season of August to December and the pre-breeding season of January to April in relation to Ailsa Craig SPA.

714 During the breeding bio-season, when birds are limited in the distance and number of days over which they can forage by the need to return regularly to the nest site, it can be expected that the area in and around AyM will contain a high proportion of adult birds that can be attributed to those designated sites within foraging range. The Ailsa Craig SPA lies within the mean maximum ± 1SD foraging range of kittiwake (156.1±144.5 km; Woodward *et al*., 2019), along with a number of other designated and non-designated sites based on distances around land. Predicted collision mortality has therefore been apportioned to each of these sites following NatureScot (2018) (Annex 5: Ornithology Apportioning Note (application ref: 5.2.5)).

715 Outside the breeding bio-season, the population of kittiwake contains a mix of individuals from UK breeding colonies and from further away, therefore, a much lower percentage of birds can be attributed to any particular breeding colony SPA population. During these non-breeding bio-seasons, the information on populations contained in Furness (2015) has been applied for the purpose of apportionment.

716 It is not possible to split adult kittiwakes from juvenile 2nd winter birds (majority of kittiwake breed for the first time at age four (Horswill and Robison, 2015)) from survey data. Therefore, kittiwake generic adult proportions of 0.53 were used in the assessment (Furness, 2015).

Breeding

717 The predicted collision resultant mortality from the operation of AyM in the breeding bio-season (BO2) is 12.3 (3.2-29.0) individuals. Mortality during the breeding bio-season was apportioned to Ailsa Craig SPA following the NatureScot (2018) method. Following this method, 0.1% of birds subject to collision risk may be breeding age individuals from Ailsa Craig SPA. On this basis, 0.01 (0.002-0.02) breeding adults are predicted to suffer collision mortality attributable to this SPA.

Migratory

718 The predicted collision resultant mortality as a result of the operation of AyM in the return migration bio-season (BO2) is 28.4 (8.4-70.7) individuals and in the post-breeding migration bio-season (BO2) is 13.1 (2.01-38.3) individuals (there is no migration-free winter bio-season). In total, 41.6 (10.4-109.0) individuals are predicted to suffer collision related mortality during the migratory bio-season.

719 In the migratory bio-season these birds will have come from a range of seabird breeding colonies in the UK and overseas. The UK Western waters plus Channel BDMPS population during the post-breeding season is estimated to be 911,586 individuals (Furness, 2015). During the return migration, an estimated 691,526 individuals are present in the UK Western waters plus Channel BDMPS region (Furness, 2015). It is expected that 60% of kittiwake adults from Ailsa Craig SPA will remain in the UK Western waters plus Channel BDMPS throughout the post-breeding bio-season and 80% during the pre-breeding bio-season. As such, breeding adults from Ailsa Craig SPA are considered to contribute to 0.06% of the UK Western waters and Channel population during the post-breeding migration and 0.11% during the pre-breeding season migration. On that basis 0.01 (0.001-0.02) breeding adults that suffer collision consequent mortality during the post-breeding migration bio-season and 0.03 (0.01-0.08) breeding adults during the pre-breeding season. Overall, 0.04 (0.01-0.1) collision consequent mortality during the migratory bio-seasons can be attributed to the SPA.

Conclusion

720 The potential impact of collision on kittiwakes in the array area during the O&M phase of AyM is a predicted consequent mortality of 0.01 (0.002-0.02) adult birds from Ailsa Craig SPA during the breeding bio-season and 0.04 (0.01-0.1) during the migratory bio-seasons. This equates to 0.05 (0.01-0.1) breeding adult birds per annum for the planned duration of operational and maintenance activities. When considering the potential impact of this loss to the Ailsa Craig SPA (with a classified kittiwake population of 6,200 breeding adults and an annual background mortality of 906 breeding adults), then using the prediction of 0.05 (0.01-0.1) breeding adults per annum suffering mortality as a consequence of collision would represent a 0.005% (0.001-0.01%) increase in baseline mortality for kittiwake at Ailsa Craig SPA. The population of kittiwake has changed since the citation population count, therefore it is also appropriate to assess the potential impact against the latest population count undertaken in 2021 (980 breeding adults and therefore a baseline mortality of 143.1 breeding adults). On this basis, 0.05 (0.01-0.1) breeding adults, per annum suffering collision consequent mortality at Ailsa Craig SPA would represent a 0.03% (0.009-0.08%) increase in baseline mortality per annum.

721 The potential addition of 0.05 (0.01-0.1) breeding adult kittiwake mortalities per annum equates to less than 0.1% increase in baseline mortality for either citation or latest colony count. This increase would be indistinguishable from natural fluctuations in the population and. Therefore, there would be **no potential for an AEoI to the population conservation objective of the seabird assemblage, of which kittiwake is a named feature of Ailsa Craig SPA in relation to potential adverse collision effects from the O&M phase of AyM alone. Therefore, subject to natural change, the seabird assemblage would be maintained as a feature in the long term.**

Lesser black-backed gull

722 Lesser black-backed gull are a designated feature of the Ailsa Craig SPA during the breeding bio-season and has been screened into the assessment based on sensitivity to collision risk during operation. Lesser black-backed gull were recorded in the AyM array area in only a single aerial digital survey (Volume 4, Annex 4.1), with estimated abundance of eight individuals in July 2020. Individuals were recorded during the migration-free breeding bio-season and zero individuals in the non-breeding bio-seasons. Although numbers recorded by surveys were low and will therefore lead to negligible outputs when apportioned, the results have been presented here on a precautionary basis, as discussed with NRW during the AyM ETGs (Table 1).

723 Results are presented on a seasonal basis as impact varies by season. Lesser black-backed gull outputs are therefore presented for the migration-free breeding season of May-July only, as no individuals were recorded in the non-breeding bio-seasons for this species.

724 During the breeding bio-season, when birds are limited in the distance and number of days over which they can forage by the need to return regularly to the nest site, it can be expected that the area in and around AyM will contain a high proportion of adult birds that can be attributed to those designated sites within foraging range. Ailsa Craig SPA lies within the mean maximum ± 1SD foraging range of lesser black-backed gull (127±109 km; Woodward *et al.*, 2019), along with a number of other designated and non-designated sites based on distances around land. Predicted collision mortality has therefore been apportioned to each of these sites following NatureScot (2018) (Annex 5: Ornithology Apportioning Note (application ref: 5.2.5)).

725 Due to small sample sizes of individuals from survey data, a generic population age proportion of lesser black-backed gulls has been used of 0.6 adults across all months of the year taken from Furness (2015).

Breeding

726 The predicted collision resultant mortality from the operation of AyM in the breeding bio-season (BO3) is 0.26 (0-1.03) individuals. Mortality during the breeding bio-season was apportioned to Ailsa Craig SPA following the NatureScot (2018) method. Following this method, 0.07% of birds subject to collision risk may be breeding age individuals from Ailsa Craig SPA. Table 22 presents the apportioning results for lesser black-backed gull at Ailsa Craig SPA.

Table 22: Breeding season apportioning results attributed for lesser black-backed gull screened in at Ailsa Craig SPA for collision risk.

COLLISION INDUCED MORTALITIES ATTRIBUTED TO SPA	SPA LESSER BLACK-BACKED GULL POPULATION		INCREASE IN BASELINE MORTALITY (%)	
	CITATION (2009)	SMP (2019)	CITATION (2009)	SMP (2019)
0.0001 (0-0.0005)	3,600	378	0.00003 (0-0.0001)	0.0003 (0-0.001)

Conclusion

727 The potential addition of 0.0001 (0-0.0005) breeding adult lesser black-backed gull mortalities per annum equates to less than 0.1% increase in baseline mortality for either citation or latest colony count. This increase would be indistinguishable from natural fluctuations in the population. There is, therefore, **no potential for an AEoI to the population conservation objective of the lesser black-backed gull feature of Ailsa Craig SPA in relation to collision risk effects from AyM alone. Therefore, subject to natural change, the lesser black-backed gull feature will be maintained in the long term with respect to the potential for collision risk.**

10.3.14 Ireland's Eye

Features and Effects for Assessment

728 Potential for LSE alone has been identified for the following for Ireland's Eye SPA:

- Kittiwake (breeding) – O&M Phase, collision risk;
- Guillemot (breeding) – C&D and O&M Phases, displacement; and
- Razorbill (breeding) – C&D and O&M Phases, displacement.

Assessment information

729 The conservation objective (as described in Annex 3) for Ireland's Eye SPA is to maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests for this SPA.

730 Based on the above conservation objective, the specific target for those screened in features of the SPA, in order for favourable conservation status to be achieved, is 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.

Construction and Decommissioning

Displacement

Guillemot

731 Guillemot has been screened into the assessment of the construction and decommissioning phase based on its sensitivity to the construction and decommissioning activities. In order to assess the potential impact on guillemot, a displacement effect distance was determined of the array area and 2 km buffer. The percentage of birds displaced and consequential mortality was determined, for guillemot the level of displacement was set of 25% and the consequential mortality of 1% during construction and decommissioning. Guillemot from Ireland's Eye SPA were screened into the assessment based on potential connectivity to AyM during the breeding season, therefore, guillemot have been screened in for the breeding bio-season of March to July, only (Furness, 2015).

732 In the breeding bio-season, the mean peak abundance of guillemot estimated to occur in the array area plus 2 km buffer is 1,569 individuals. During the breeding bio-season, when birds are limited in the distance and number of days over which they can forage by the need to return regularly to the nest site, it can be expected that the area in and around AyM will contain a high proportion of adult birds that can be attributed to those designated sites within foraging range. The Ireland's Eye SPA lies within the mean maximum (± SD) foraging range of guillemot (73.2±80.5 km; Woodward *et al*., 2019), along with a number of other designated and non-designated sites based on distances around land. Predicted displacement mortality has therefore been apportioned to each of these sites following NatureScot (2018) (Annex 5: Ornithology Apportioning Note (application ref: 5.2.5)).

733 As guillemot are not possible to age on surveys, a generic population age proportion has been used of 0.57 adults across all months of the year taken from Furness (2015).

Breeding

734 During the breeding bio-season, a peak abundance of 1,569 guillemot within the array area plus 2 km buffer are estimated to be at risk of displacement. Using a displacement rate of 25% and a mortality rate of 1% would result in 3.9 individuals being subject to mortality. Mortality during the breeding bio-season was apportioned to Ireland's Eye SPA following the NatureScot (2018) method. Following this method, 1.0% of birds subject to displacement may be breeding age individuals from Ireland's Eye SPA. On this basis, 0.02 breeding adults are predicted to suffer displacement mortality attributable to this SPA.

Conclusion

735 The potential impact of displacement on guillemots in the array area plus 2 km buffer during the Construction and Decommissioning Phases of AyM is a predicted consequent mortality of 0.02 adult birds from Ireland's Eye SPA during the breeding bio-season. When considering the potential impact of this loss to the Ireland's Eye SPA (with a classified guillemot population of 3,950 breeding adults and an annual background mortality of 241 breeding adults), then using the prediction of 0.02 breeding adults per annum suffering mortality as a consequence of displacement would represent a 0.009% increase in baseline mortality for guillemot at Ireland's Eye SPA.

736 The population of guillemots has increased since the citation population count, therefore it is also appropriate to assess the potential impact against the latest population count undertaken in 2015 (4,410 breeding adults and therefore a baseline mortality of 269 breeding adults). On this basis, 0.02 breeding adults, per annum, suffering displacement consequent mortality at Ireland's Eye SPA would represent a 0.008% increase in baseline mortality per annum.

737 The potential addition of 0.02 breeding adult guillemot mortalities per annum equates to less than 0.01% increase in baseline mortality for either citation or latest colony count. This increase would be indistinguishable from natural fluctuations in the population. Therefore, there would be **no potential for an AEoI to the population conservation objective of the guillemot feature at Ireland's Eye SPA in relation to potential adverse displacement effects from the construction and decommissioning phase of AyM alone. Therefore, subject to natural change, guillemot would be maintained as a feature in the long term.**

Razorbill

738 Razorbill has been screened into the assessment of the construction and decommissioning phases based on its sensitivity to construction and decommissioning activities. In order to assess the potential impact on razorbill, a displacement effect distance was determined of the array area and 2 km buffer. The percentage of birds displaced and consequential mortality was determined, for razorbill the level of displacement was set at 25% and the consequential mortality at 1% during construction and decommissioning. Razorbill from Ireland's Eye SPA were screened into the assessment based on potential connectivity to AyM during the breeding season, therefore, razorbill have been screened in for the breeding bio-season of April to July, only (Furness, 2015).

739 In the breeding bio-season, the mean peak abundance of razorbill estimated to occur in the array area plus 2 km buffer is 140 individuals. During the breeding bio-season, when birds are limited in the distance and number of days over which they can forage by the need to return regularly to the nest site, it can be expected that the area in and around AyM will contain a high proportion of adult birds that can be attributed to those designated sites within foraging range. The Ireland's Eye SPA lies within the mean maximum (± SD) foraging range of razorbill (88.7±75.9 km; Woodward *et al*., 2019), along with a number of other designated and non-designated sites based on distances around land. Predicted displacement mortality has therefore been apportioned to each of these sites following NatureScot (2018) (Annex 5: Ornithology Apportioning Note (application ref: 5.2.5)).

740 As razorbill are not possible to age on surveys, a generic population age proportion has been used of 0.57 adults across all months of the year taken from Furness (2015).

Breeding

741 During the breeding bio-season, a peak abundance of 140 razorbill within the array area plus 2 km buffer are estimated to be at risk of displacement. Using a displacement rate of 25% and a mortality rate of 1% would result in 0.4 individuals being subject to mortality. Mortality during the breeding bio-season was apportioned to Ireland's Eye SPA following the NatureScot (2018) method. Following this method, 2.8% of birds subject to displacement may be breeding age individuals from Ireland's Eye SPA. On this basis, 0.006 breeding adults are predicted to suffer displacement mortality attributable to this SPA.

Conclusion

742 The potential impact of displacement on razorbills in the array area plus 2 km buffer during the Construction and Decommissioning Phases of AyM is a predicted consequent mortality of 0.006 adult birds from Ireland's Eye SPA during the breeding bio-season. When considering the potential impact of this loss to the Ireland's Eye SPA (with a classified razorbill population of 920 breeding adults and an annual background mortality of 96.6 breeding adults), then using the prediction of 0.006 breeding adults per annum suffering mortality as a consequence of displacement would represent a 0.006% increase in baseline mortality for razorbill at Ireland's Eye SPA.

743 The population of razorbills has increased significantly since the citation population count, therefore it is also appropriate to assess the potential impact against the latest population count undertaken in 2015 (1,600 breeding adults and therefore a baseline mortality of 168 breeding adults). On this basis, 0.006 breeding adults, per annum, suffering displacement consequent mortality at Ireland's Eye SPA would represent a 0.003% increase in baseline mortality per annum.

744 The potential addition of 0.006 breeding adult razorbill mortalities per annum equates to less than 0.01% increase in baseline mortality for either citation or latest colony count. This increase would be indistinguishable from natural fluctuations in the population. Therefore, there would be **no potential for an AEoI to the population conservation objective of the razorbill feature at Ireland's Eye SPA in relation to potential adverse displacement effects from the construction and decommissioning phase of AyM alone. Therefore, subject to natural change, razorbill would be maintained as a feature in the long term.**

Operation and maintenance

Collision

Kittiwake

745 Kittiwake has been screened into the assessment of the O&M phase based on the density of birds in flight in the array area and its flight behaviour that places it at risk of collision with the turning blades of the WTGs. Kittiwake from Ireland's Eye SPA were screened into the assessment based on potential connectivity to AyM during the breeding season, therefore kittiwake has been screeded in for the migration-free breeding bio-season only of May to July.

746 During the breeding bio-season, when birds are limited in the distance and number of days over which they can forage by the need to return regularly to the nest site, it can be expected that the area in and around AyM will contain a high proportion of adult birds that can be attributed to those designated sites within foraging range. The Ireland's Eye SPA lies within the mean maximum (± SD) foraging range of kittiwake (156.1±144.5 km; Woodward *et al.*, 2019), along with a number of other designated and non-designated sites based on distances around land. Predicted collision mortality has therefore been apportioned to each of these sites following NatureScot (2018) (Annex 5: Ornithology Apportioning Note (application ref: 5.2.5)).

747 It is not possible to split adult kittiwakes from juvenile 2nd winter birds (majority of kittiwake breed for the first time at age four (Horswill and Robison, 2015)) from survey data. Therefore, kittiwake generic adult proportions of 0.53 were used in the assessment (Furness, 2015).

Breeding

748 The predicted collision resultant mortality from the operation of AyM in the breeding bio-season (BO2) is 12.3 (3.2-29.0) individuals. Mortality during the breeding bio-season was apportioned to Ireland's Eye SPA following the NatureScot (2018) method. Following this method, 1.0% of birds subject to collision risk may be breeding age individuals from Ireland's Eye SPA. On this basis, 0.07 (0.02-0.16) breeding adults are predicted to suffer collision mortality attributable to this SPA.

Conclusion

749 The potential impact of collision on kittiwakes in the array area during the O&M phase of AyM is a predicted consequent mortality of 0.07 (0.02-0.16) adult birds from Ireland's Eye SPA during the breeding bio-season. When considering the potential impact of this loss to the Ireland's Eye SPA (with a classified kittiwake population of 2,048 breeding adults and an annual background mortality of 299.0 breeding adults), then using the prediction of 0.07 (0.02-0.16) breeding adults per annum suffering mortality as a consequence of collision would represent a 0.02% (0.006-0.05%) increase in baseline mortality for kittiwake at Ireland's Eye SPA. The population of kittiwake has significantly increased since the citation population count, therefore it is also appropriate to assess the potential impact against the latest population count undertaken in 2015 (3220 breeding adults and therefore a baseline mortality of 470.1 breeding adults). On this basis, 0.07 (0.02-0.16) breeding adults, per annum suffering collision consequent mortality at Ireland's Eye SPA would represent a 0.015% (0.004-0.03%) increase in baseline mortality per annum.

750 The potential addition of 0.07 (0.02-0.16) breeding adult kittiwake mortalities per annum equates to less than 0.1% increase in baseline mortality for either citation or latest colony count. This increase would be indistinguishable from natural fluctuations in the population and therefore, there would be **no potential for an AEoI to the population conservation objective of the kittiwake feature at Ireland's Eye SPA in relation to potential adverse collision effects from the O&M phase of AyM alone. Therefore, subject to natural change, kittiwake would be maintained as a feature in the long term.**

Displacement

Guillemot

751 Guillemot has been screened into the assessment of the O&M phase based on its sensitivity to the presence of the WTGs. In order to assess the potential impact on guillemot, a displacement effect distance was determined of the array area and 2 km buffer. The percentage of birds displaced and consequential mortality was determined, for guillemot the level of displacement was set at 50% and the consequential mortality at 1% during O&M. Guillemot from Ireland's Eye SPA were screened into the assessment based on potential connectivity to AyM during the breeding season, therefore, guillemot have been screened in for the breeding bio-season of March to July (Furness, 2015).

752 In the breeding bio-season, the mean peak abundance of guillemot estimated to occur in the array area plus 2 km buffer is 1,569 individuals. During the breeding bio-season, when birds are limited in the distance and number of days over which they can forage by the need to return regularly to the nest site, it can be expected that the area in and around AyM will contain a high proportion of adult birds that can be attributed to those designated sites within foraging range. The Ireland's Eye SPA lies within the mean maximum (± SD) foraging range of guillemot (73.2±80.5 km; Woodward *et al*., 2019), along with a number of other designated and non-designated sites based on distances around land. Predicted displacement mortality has therefore been apportioned to each of these sites following NatureScot (2018) (Annex 5: Ornithology Apportioning Note (application ref: 5.2.5)).

753 As guillemots are difficult to age on surveys, a generic population age proportion has been used of 0.57 adults across all months of the year taken from Furness (2015).

Breeding

754 During the breeding bio-season, a peak abundance of 1,569 guillemot within the array area plus 2 km buffer are estimated to be at risk of displacement. Using a displacement rate of 50% and a mortality rate of 1% would result in 7.8 individuals being subject to mortality. Mortality during the breeding bio-season was apportioned to Ireland's Eye SPA following the NatureScot (2018) method. Following this method, 1.0% of birds subject to displacement may be breeding age individuals from Ireland's Eye SPA. On this basis, 0.04 breeding adults are predicted to suffer displacement mortality attributable to this SPA.

Conclusion

755 The potential impact of displacement on guillemots in the array area plus 2 km buffer during the O&M phase of AyM is a predicted consequent mortality of 0.04 adult birds from Ireland's Eye SPA during the breeding bio-season. When considering the potential impact of this loss to the Ireland's Eye SPA (with a classified guillemot population of 3,950 breeding adults and an annual background mortality of 241 breeding adults), then using the prediction of 0.04 breeding adults per annum suffering mortality as a consequence of displacement would represent a 0.02% increase in baseline mortality for guillemot at Ireland's Eye SPA.

756 The population of guillemots has increased since the citation population count, therefore it is also appropriate to assess the potential impact against the latest population count undertaken in 2015 (4,410 breeding adults and therefore a baseline mortality of 269 breeding adults). On this basis, 0.04 breeding adults, per annum, suffering displacement consequent mortality at Ireland's Eye SPA would represent a 0.02% increase in baseline mortality per annum.

757 The potential addition of 0.04 breeding adult guillemot mortalities per annum equates to less than 0.1% increase in baseline mortality for either citation or latest colony count. This increase would be indistinguishable from natural fluctuations in the population. Therefore, there would be **no potential for an AEoI to the population conservation objective of the guillemot feature at Ireland's Eye SPA in relation to potential adverse displacement effects from the O&M phase of AyM alone. Therefore, subject to natural change, guillemot would be maintained as a feature in the long term.**

Razorbill

758 Razorbill has been screened into the assessment of the O&M phase based on its sensitivity to the presence of the WTGs.

759 In order to assess the potential impact on razorbill, a displacement effect distance was determined of the array area and 2 km buffer. The percentage of birds displaced and consequential mortality was determined, for razorbill the level of displacement was set at 50% and the consequential mortality at 1% during O&M. Razorbill from Ireland's Eye SPA were screened into the assessment based on potential connectivity to AyM during the breeding season, therefore, razorbill have been screened in for the breeding bio-season of April to July (Furness, 2015).

760 In the breeding bio-season, the mean peak abundance of razorbill estimated to occur in the array area plus 2 km buffer is 140 individuals. During the breeding bio-season, when birds are limited in the distance and number of days over which they can forage by the need to return regularly to the nest site, it can be expected that the area in and around AyM will contain a high proportion of adult birds that can be attributed to those designated sites within foraging range. The Ireland's Eye SPA lies within the mean maximum (± SD) foraging range of Ireland's Eye (88.7±75.9 km; Woodward *et al.*, 2019), along with a number of other designated and non-designated sites based on distances around land. Predicted displacement mortality has therefore been apportioned to each of these sites following NatureScot (2018) (Annex 5: Ornithology Apportioning Note (application ref: 5.2.5)).

761 As razorbills are difficult to age on surveys, a generic population age proportion has been used of 0.57 adults across all months of the year taken from Furness (2015).

Breeding

762 During the breeding bio-season, a peak abundance of 140 razorbill within the array area plus 2 km buffer are estimated to be at risk of displacement. Using a displacement rate of 50% and a mortality rate of 1% would result in 0.7 individuals being subject to mortality. Mortality during the breeding bio-season was apportioned to Ireland's Eye SPA following the NatureScot (2018) method. Following this method, 2.8% of birds subject to displacement may be breeding age individuals from Ireland's Eye SPA. On this basis, 0.01 breeding adults are predicted to suffer displacement mortality attributable to this SPA.

Conclusion

763 The potential impact of displacement on razorbills in the array area plus 2 km buffer during the O&M phases of AyM is a predicted consequent mortality of 0.01 adult birds from Ireland's Eye SPA during the breeding bio-season. When considering the potential impact of this loss to the Ireland's Eye SPA (with a classified razorbill population of 920 breeding adults and an annual background mortality of 96.6 breeding adults), then using the prediction of 0.01 breeding adults per annum suffering mortality as a consequence of displacement would represent a 0.01% increase in baseline mortality for razorbill at Ireland's Eye SPA.

764 The population of razorbills has increased significantly since the citation population count, therefore it is also appropriate to assess the potential impact against the latest population count undertaken in 2015 (1,600 breeding adults and therefore a baseline mortality of 168 breeding adults). On this basis, 0.01 breeding adults, per annum, suffering displacement consequent mortality at Ireland's Eye SPA would represent a 0.007% increase in baseline mortality per annum.

765 The potential addition of 0.01 breeding adult razorbill mortalities per annum equates to less than 0.02% increase in baseline mortality for either citation or latest colony count. This increase would be indistinguishable from natural fluctuations in the population. Therefore, there would be **no potential for an AEoI to the population conservation objective of the razorbill feature at Ireland's Eye SPA in relation to potential adverse displacement effects from the O&M phase of AyM alone. Therefore, subject to natural change, razorbill would be maintained as a feature in the long term.**

10.3.15 Howth Head Coast SPA

Features and Effects for Assessment

766 Potential for LSE alone has been identified for the following for Howth Head Coast SPA:

- Kittiwake (breeding) – O&M Phase, collision risk.

Assessment information

767 The conservation objectives (as described in Annex 3) for Howth Head Coast SPA is to maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests for this SPA.

768 Based on the above conservation objective, the specific target for those screened in features of the SPA, in order for favourable conservation status to be achieved is 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.

Operation and maintenance

Collision

Kittiwake

769 Kittiwake has been screened into the assessment of the O&M phase based on the density of birds in flight in the array area and its flight behaviour that places it at risk of collision with the turning blades of the WTGs. Kittiwake from Howth Head Coast SPA only have connectivity to AyM during the breeding season, therefore kittiwake has been screeded in for the migration-free breeding bio-season only of May to July.

770 During the breeding bio-season, when birds are limited in the distance and number of days over which they can forage by the need to return regularly to the nest site, it can be expected that the area in and around AyM will contain a high proportion of adult birds that can be attributed to those designated sites within foraging range. The Howth Head Coast SPA lies within the mean maximum ± 1SD foraging range of kittiwake (156.1±144.5 km; Woodward *et al*., 2019), along with a number of other designated and non-designated sites based on distances around land. Predicted collision mortality has therefore been apportioned to each of these sites following NatureScot (2018) (Annex 5: Ornithology Apportioning Note (application ref: 5.2.5)).

771 It is not possible to split adult kittiwakes from juvenile 2nd winter birds (majority of kittiwake breed for the first time at age four (Horswill and Robison, 2015)) from survey data. Therefore, kittiwake generic adult proportions of 0.53 were used in the assessment (Furness, 2015).

Breeding

772 The predicted collision resultant mortality from the operation of AyM in the breeding bio-season (BO2) is 12.3 (3.2-29.0) individuals. Mortality during the breeding bio-season was apportioned to Howth Head Coast SPA following the NatureScot (2018) method. Following this method, 2.0% of birds subject to collision risk may be breeding age individuals from Howth Head Coast SPA. On this basis, 0.1 (0.03-0.3) breeding adults are predicted to suffer collision mortality attributable to this SPA.

Conclusion

773 The potential impact of collision on kittiwakes in the array area during the O&M phase of AyM is a predicted consequent mortality of 0.1 (0.03-0.3) adult birds from Howth Head Coast SPA during the breeding bio-season. When considering the potential impact of this loss to the Howth Head Coast SPA (with a classified kittiwake population of 4,538 breeding adults and an annual background mortality of 663 breeding adults), then using the prediction of 0.1 (0.03-0.3) breeding adults per annum suffering mortality as a consequence of collision would represent a 0.02% (0.005-0.05%) increase in baseline mortality for kittiwake at Howth Head Coast SPA. The population of kittiwake has increased significantly since the citation population count, therefore it is also appropriate to assess the potential impact against the latest population count undertaken in 2015 (6,162 breeding adults and therefore a baseline mortality of 899.7 breeding adults). On this basis, 0.1 (0.03-0.3) breeding adults, per annum suffering collision consequent mortality at Howth Head Coast SPA would represent a 0.015% (0.004-0.03%) increase in baseline mortality per annum.

774 The potential addition of 0.1 (0.03-0.3) breeding adult kittiwake mortalities per annum equates to less than 0.1% increase in baseline mortality for either citation or latest colony count. This increase would be indistinguishable from natural fluctuations in the population and therefore, there would be **no potential for an AEoI to the population conservation objective of the kittiwake feature at Howth Head Coast SPA in relation to potential adverse collision effects from the O&M phase of AyM alone. Therefore, subject to natural change, kittiwake would be maintained as a feature in the long term.**

10.3.16 Wicklow Head SPA

Features and Effects for Assessment

775 Potential for LSE alone has been identified for the following for Wicklow Head SPA:

- Kittiwake (breeding) – O&M Phase, collision risk.

Assessment information

776 The conservation objectives (as described in Annex 3) for Wicklow Head SPA is to maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests for this SPA.

777 Based on the above conservation objective, the specific target for those screened in features of the SPA, in order for favourable conservation status to be achieved, is 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.

Operation and maintenance

Collision

Kittiwake

778 Kittiwake has been screened into the assessment of the O&M phase based on the density of birds in flight in the array area and its flight behaviour that places it at risk of collision with the turning blades of the WTGs. Kittiwake from Wicklow Head SPA only have connectivity to AyM during the breeding season, therefore kittiwake has been screeded in for the migration-free breeding bio-season only of May to July.

779 During the breeding bio-season, when birds are limited in the distance and number of days over which they can forage by the need to return regularly to the nest site, it can be expected that the area in and around AyM will contain a high proportion of adult birds that can be attributed to those designated sites within foraging range. The Wicklow Head SPA lies within the mean maximum ± 1SD foraging range of kittiwake (156.1±144.5 km; Woodward *et al.*, 2019), along with a number of other designated and non-designated sites based on distances around land. Predicted collision mortality has therefore been apportioned to each of these sites following NatureScot (2018) (Annex 5: Ornithology Apportioning Note (application ref: 5.2.5)).

780 It is not possible to split adult kittiwakes from juvenile 2nd winter birds (majority of kittiwake breed for the first time at age four (Horswill and Robison, 2015)) from survey data. Therefore, kittiwake generic adult proportions of 0.53 were used in the assessment (Furness, 2015).

Breeding

781 The predicted collision resultant mortality from the operation of AyM in the breeding bio-season (BO2) is 12.3 (3.2-29.0) individuals. Mortality during the breeding bio-season was apportioned to Wicklow Head SPA following the NatureScot (2018) method. Following this method, 0.5% of birds subject to collision risk may be breeding age individuals from Wicklow Head SPA. On this basis, 0.04 (0.009-0.08) breeding adults are predicted to suffer collision mortality attributable to this SPA.

Conclusion

782 The potential impact of collision on kittiwakes in the array area during the O&M phase of AyM is a predicted consequent mortality of 0.04 (0.009-0.08) adult birds from Wicklow Head SPA during the breeding bio-season. When considering the potential impact of this loss to the Wicklow Head SPA (with a classified kittiwake population of 1912 breeding adults and an annual background mortality of 279.2 breeding adults), then using the prediction of 0.04 (0.009-0.08) breeding adults per annum suffering mortality as a consequence of collision would represent a 0.01% (0.003-0.03%) increase in baseline mortality for kittiwake at Wicklow Head SPA. The population of kittiwake has changed since the citation population count, therefore it is also appropriate to assess the potential impact against the latest population count undertaken in 2021 (1458 breeding adults and therefore a baseline mortality of 212.9 breeding adults). On this basis, 0.04 (0.009-0.08) breeding adults, per annum suffering collision consequent mortality at Wicklow Head SPA would represent a 0.017% (0.004-0.04%) increase in baseline mortality per annum.

783 The potential addition of 0.04 (0.009-0.08) breeding adult kittiwake mortalities per annum equates to less than 0.1% increase in baseline mortality for either citation or latest colony count. This increase would be indistinguishable from natural fluctuations in the population and therefore, there would be **no potential for an AEoI to the population conservation objective of the kittiwake feature at Wicklow Head SPA in relation to potential adverse collision effects from the O&M phase of AyM alone. Therefore, subject to natural change, kittiwake would be maintained as a feature in the long term.**

10.3.17 Skomer, Skokholm and the Seas off Pembrokeshire SPA

Features and Effects for Assessment

784 Potential for LSE alone has been identified for the following for Skomer, Skokholm and the Seas off Pembrokeshire SPA:

- Kittiwake (breeding and non-breeding) – O&M Phase, collision risk (assemblage feature only);
- Guillemot (non-breeding) - C&D and O&M Phases, displacement (assemblage feature only);
- Razorbill (non-breeding) - C&D and O&M Phases, displacement (assemblage feature only);
- Lesser black-backed gull (breeding and non-breeding) – O&M Phase, collision risk;
- Puffin (breeding) – C&D and O&M Phases, displacement;
- Manx shearwater (breeding and non-breeding) – C&D and O&M Phases, displacement; and
- Storm Petrel – Screened in.

Assessment information

785 The vision for the features of this SPA (as described in Annex 3) are for them to be in a favourable conservation status. Based on this conservation objective, the relevant conditions must be satisfied:

- The population of storm petrel will be at least 3,500 pairs within the SPA;

- During the breeding season the population of lesser black-backed gull will be at least 20,300 pairs within the SPA. This represents around 16.4% of the current breeding Western European/Mediterranean/ western African population;
- During the breeding season the population of Manx shearwater will be at least 150,000 pairs within the SPA (this represents around half of the current breeding population);
- During the breeding season the population of puffins will be at least 9,500 pairs within the SPA (this represents at least 1.1% of the current breeding population); and
- During the breeding season the SPA will regularly support at least 67,000 individual seabirds of razorbill, guillemot, kittiwake, puffin, lesser black-backed gull, Manx shearwater and storm petrel.

786 Although kittiwake, guillemot and razorbill are only named features of the seabird assemblage, for the purpose of this assessment they have been considered in a similar manner to qualifying species, though the conclusion is not whether an AEoI would result from AyM alone on each of these species as features, but more as an important component of the seabird assemblage.

Construction and Decommissioning

Displacement

Guillemot (non-breeding)

787 Guillemot has been screened into the assessment at Stage 2 on a precautionary basis, as discussed with NRW during the AyM ETGs (Table 1). Guillemot are potentially sensitive to displacement during the construction and decommissioning activities (Bradbury *et al.*, 2014). In order to assess the potential impact on guillemot, a displacement effect distance was determined of the array area and 2 km buffer. The percentage of birds displaced, and consequential mortality was determined, for guillemot the level of displacement was set of 25% and the consequential mortality of 1% during construction and decommissioning.

788 The population of birds in the area in and around AyM changes through the seasons. Therefore, the assessment is carried out on a seasonal basis as the potential impact on the Skomer, Skokholm and the Seas off Pembrokeshire SPA varies by season. Skomer, Skokholm and the Seas off Pembrokeshire SPA is beyond the mean maximum ± 1SD foraging range of guillemot (73.2±80.5 km; Woodward *et al*., 2019). Therefore, guillemot has been screened in on a precautionary basis during the non-breeding bio-season of August to February, only (Furness, 2015).

789 Outside the breeding bio-season, the population of guillemot contains a mix of individuals from UK breeding colonies and from further away, therefore, a much lower percentage of birds can be attributed to any particular breeding colony SPA population. During the non-breeding bio-season, the information on populations contained in Furness (2015) has been applied for the purpose of apportionment.

790 As guillemot are not possible to age on surveys, a generic population age proportion has been used of 0.57 adults across all months of the year taken from Furness (2015).

Non-Breeding

791 During the non-breeding bio-season, a peak abundance of 2,919 guillemot within the array area plus 2 km buffer are estimated to be at risk of displacement. Using a displacement rate of 25% and a mortality rate of 1% would result in 7.3 individuals being subject to mortality.

792 In the non-breeding bio-season these birds will have come from a range of seabird breeding colonies in the UK and overseas. The UK Western waters BDMPS population during the non-breeding bio-season is estimated to be 1,139,220 individuals (Furness, 2015). It is expected that 90% of guillemot adults from Skomer, Skokholm and the Seas off Pembrokeshire SPA will remain in the UK Western waters BDMPS throughout the non-breeding bio-season. As such, breeding adults from Skomer, Skokholm and the Seas off Pembrokeshire SPA are considered to contribute to 2.6% of the UK Western waters population during the non-breeding bio-season. On that basis, 0.19 breeding adults that suffer displacement consequent mortality during the non-breeding bio-season are attributed to Skomer, Skokholm and the Seas off Pembrokeshire SPA.

Conclusion

793 The potential impact of displacement on guillemots in the array area plus 2 km buffer during the construction and decommissioning phase of AyM is a predicted consequent mortality of 0.19 adult birds from Skomer, Skokholm and the Seas off Pembrokeshire SPA during the non-breeding bio-season. There is no classified guillemot population within the SPA citation document as guillemot is an assemblage feature. Therefore, assessing the potential impact against the latest population count undertaken from 2017-2020 for the three colonies within the SPA (16,644 breeding adults and therefore a baseline mortality of 1,015.3 breeding adults), 0.19 breeding adults, per annum, suffering displacement consequent mortality at Skomer, Skokholm and the Seas off Pembrokeshire SPA would represent a 0.02% increase in baseline mortality per annum.

794 This increase would be indistinguishable from natural fluctuations in the population. Therefore, there would be **no potential for an AEoI to the population conservation objective of the seabird assemblage, of which guillemot is a named feature of Skomer, Skokholm and the Seas off Pembrokeshire SPA in relation to potential adverse displacement effects from the construction and decommissioning phase of AyM alone. Therefore, subject to natural change, the seabird assemblage would be maintained as a feature in the long term.**

Razorbill (non-breeding)

795 Razorbill has been screened into the assessment at Stage 2 on a precautionary basis, as discussed with NRW during the AyM ETGs (Table 1). Razorbill are potentially sensitive to displacement during the construction and decommissioning activities (Bradbury *et al.*, 2014). In order to assess the potential impact on razorbill, a displacement effect distance was determined of the array area and 2 km buffer. The percentage of birds displaced, and consequential mortality was determined, for razorbill the level of displacement was set of 25% and the consequential mortality of 1% during construction and decommissioning.

796 The population of birds in the area in and around AyM changes through the seasons. Therefore, the assessment is carried out on a seasonal basis as the potential impact on the Skomer, Skokholm and the Seas off Pembrokeshire SPA varies by season. Skomer, Skokholm and the Seas off Pembrokeshire SPA is beyond the mean maximum ± 1SD foraging range of razorbill (88.7±75.9 km; Woodward *et al*., 2019). Therefore, razorbill has been screened in on a precautionary basis during the migratory bio-seasons of August to October and January to March and the migratory-free winter bio-season of November to December, only (Furness, 2015).

797 Outside the breeding bio-season, the population of razorbill contains a mix of individuals from UK breeding colonies and from further away, therefore, a much lower percentage of birds can be attributed to any particular breeding colony SPA population. During these non-breeding bio-seasons, the information on populations contained in Furness (2015) has been applied for the purpose of apportionment.

798 As razorbill are not possible to age on surveys, a generic population age proportion has been used of 0.57 adults across all months of the year taken from Furness (2015).

Migratory

799 During the post-breeding bio-season, a peak abundance of 66 razorbill within the array area plus 2 km buffer are estimated to be at risk of displacement and 336 razorbill during the return migration bio-season. Using a displacement rate of 25% and a mortality rate of 1% would result in 0.2 individuals being subject to mortality during the post-breeding bio-season and 0.8 in the return migration bio-season. In total, 1 individual is predicted to suffer displacement related mortality during the migratory bio-seasons.

800 In the migratory bio-season these birds will have come from a range of seabird breeding colonies in the UK and overseas. The UK Western waters BDMPS population during the post-breeding and return migration bio-seasons is estimated to be 606,914 individuals (Furness, 2015). It is expected that 98% of razorbill adults from Skomer, Skokholm and the Seas off Pembrokeshire SPA will remain in the UK Western waters BDMPS throughout the post-breeding bio-season and pre-breeding bio-season. As such, breeding adults from Skomer, Skokholm and the Seas off Pembrokeshire SPA are considered to contribute to 1.9% of the UK Western waters population during the migratory bio-seasons. On that basis, 0.003 breeding adults that suffer displacement consequent mortality during the post-breeding migration bio-season and 0.016 breeding adults during the pre-breeding season are attributed to Skomer, Skokholm and the Seas off Pembrokeshire SPA. Overall, 0.019 displacement consequent mortality during the migratory bio-seasons can be attributed to the SPA.

Winter

801 During the migration-free winter bio-season, a peak abundance of 150 razorbill within the array area plus 2 km buffer are estimated to be at risk of displacement. Using a displacement rate of 25% and a mortality rate of 1% would result in 0.4 individuals being subject to mortality.

802 In the migration-free winter bio-season these birds will have come from a range of seabird breeding colonies in the UK and overseas. The UK Western waters BDMPS population during the winter bio-season is estimated to be 341,422 individuals (Furness, 2015). It is expected that 30% of razorbill adults from Skomer, Skokholm and the Seas off Pembrokeshire SPA will remain in the UK Western waters BDMPS throughout the winter bio-season. As such, breeding adults from Skomer, Skokholm and the Seas off Pembrokeshire SPA are considered to contribute to 1.1% of the UK Western waters population during the winter bio-season. On that basis, 0.004 breeding adults that suffer displacement consequent mortality during the winter bio-season are attributed to Skomer, Skokholm and the Seas off Pembrokeshire SPA.

Conclusion

803 The total potential impact of displacement on razorbills in the array area plus 2 km buffer during the construction and decommissioning phase of AyM is a predicted consequent mortality of 0.023 adult birds from Skomer, Skokholm and the Seas off Pembrokeshire SPA during the migratory and winter bio-seasons. There is no classified razorbill population within the SPA citation document as razorbill is an assemblage feature. Therefore, assessing the potential impact against the latest population count undertaken from 2018 to 2020 for the three colonies within the SPA (8,595 breeding adults and therefore a baseline mortality of 902.5 breeding adults), 0.023 breeding adults, per annum, suffering displacement consequent mortality at Skomer, Skokholm and the Seas off Pembrokeshire SPA would represent a 0.003% increase in baseline mortality per annum.

804 This increase would be indistinguishable from natural fluctuations in the population. Therefore, there would be **no potential for an AEoI to the population conservation objective of the seabird assemblage, of which razorbill is a named feature of Skomer, Skokholm and the Seas off Pembrokeshire SPA in relation to potential adverse displacement effects from the construction and decommissioning phase of AyM alone. Therefore, subject to natural change, the seabird assemblage would be maintained as a feature in the long term.**

Puffin

805 Puffin has been screened into the assessment of the construction and decommissioning phases based on its sensitivity to construction and decommissioning activities. In order to assess the potential impact on puffin, a displacement effect distance was determined of the array area and 2 km buffer. The percentage of birds displaced and consequential mortality was determined, for puffin the level of displacement was set at 25% and the consequential mortality at 1% during construction and decommissioning. Puffin from Skomer, Skokholm and the Seas off Pembrokeshire SPA were screened into the assessment based on potential connectivity to AyM during the breeding season, therefore, puffin have been screened in for the breeding bio-season of April to July, only (Furness, 2015).

806 In the breeding bio-season, the mean peak abundance of puffin estimated to occur in the array area and 2 km buffer is 14 individuals. During the breeding bio-season, when birds are limited in the distance and number of days over which they can forage by the need to return regularly to the nest site, it can be expected that the area in and around AyM will contain a high proportion of adult birds that can be attributed to those designated sites within foraging range. The Skomer, Skokholm and the Seas off Pembrokeshire SPA lies within the mean maximum (± SD) foraging range of puffin (137.1±128.3 km; Woodward *et al*., 2019), along with a number of other designated and non-designated sites based on distances around land. Predicted displacement mortality has therefore been apportioned to each of these sites following NatureScot (2018) (Annex 5: Ornithology Apportioning Note (application ref: 5.2.5)).

807 Due to small sample sizes of individuals from survey data, a generic population age proportion of puffins has been used of 0.49 adults across all months of the year taken from Furness (2015) (calculated from 1.04 immatures per adult ratio).

Breeding

808 During the breeding bio-season, a peak abundance of 14 Puffin within the array area plus 2 km buffer are estimated to be at risk of displacement. Using a displacement rate of 25% and a mortality rate of 1% would result in 0.04 individuals being subject to mortality. Mortality during the breeding bio-season was apportioned to Skomer, Skokholm and the Seas off Pembrokeshire SPA following the NatureScot (2018) method. Following this method, 62.8% of birds subject to displacement may be breeding age individuals from Skomer, Skokholm and the Seas off Pembrokeshire SPA. On the basis, 0.01breeding adults are predicted to suffer displacement mortality attributable to this SPA.

Conclusion

809 The potential impact of displacement on puffins in the array area plus 2 km buffer during the Construction and Decommissioning Phases of AyM is a predicted consequent mortality of 0.01 adult birds from Skomer, Skokholm and the Seas off Pembrokeshire SPA during the breeding bio-season. When considering the potential impact of this loss to the Skomer, Skokholm and the Seas off Pembrokeshire SPA (with a classified puffin population of 19,000 breeding adults and an annual background mortality of 1,786 breeding adults), then using the prediction of 0.01 breeding adults per annum suffering mortality as a consequence of displacement would represent a 0.0006% increase in baseline mortality for puffin at Skomer, Skokholm and the Seas off Pembrokeshire SPA.

810 The population of puffins has increased significantly since the citation population count, therefore it is also appropriate to assess the potential impact against the latest population count undertaken between 2018 and 2019 for the two colonies within the SPA (38,342 breeding adults and therefore a baseline mortality of 3604.1 breeding adults). On this basis, 0.01 breeding adults, per annum, suffering displacement consequent mortality at Skomer, Skokholm and the Seas off Pembrokeshire SPA would represent a 0.0003% increase in baseline mortality per annum.

811 The potential addition of between 0.01 breeding adult puffin mortalities per annum equates to less than 0.01% increase in baseline mortality for either citation or latest colony count. This increase would be indistinguishable from natural fluctuations in the population. Therefore, there would be **no potential for an AEoI to the population conservation objective of the puffin feature at Skomer, Skokholm and the Seas off Pembrokeshire SPA in relation to potential adverse displacement effects from the construction and decommissioning phase of AyM alone. Therefore, subject to natural change, puffin would be maintained as a feature in the long term**.

Manx shearwater

812 Manx shearwater has relatively low vulnerability to vessel movement disturbance associated with construction and decommissioning activity (Furness *et al.*, 2013).

813 However, Manx shearwater was screened into assessment at Stage 2 on a precautionary basis for displacement during construction and decommissioning, as discussed with Natural Resources Wales during the AyM Environmental Technical Group Meeting (Table 1). Displacement impacts across all phases of development have been presented for Manx shearwater at Skomer, Skokholm and the Seas off Pembrokeshire SPA during the migration-free breeding bio-season of June to July and the migration bio-seasons of March to May and August to October.

814 AyM array area is within mean-maximum foraging range for Manx shearwater (1346.8±1018.7 km (Woodward *et al.*, 2019)) from Skomer, Skokholm and the Seas off Pembrokeshire SPA.

815 Manx shearwater were recorded in six of the 24 aerial digital surveys within the AyM array area plus 2 km buffer, with a peak estimated abundance of 417 individuals in August 2020. Manx shearwater densities ranged from 0.07 to 2.65 individuals/ km^2. Highest densities of Manx shearwater were recorded in May 2020 (2.17 individuals/ km^2) and August 2020 (2.65 individuals/ km^2). The mean peak abundance within the array area plus 2 km buffer was 177 individuals during the return (spring) migration, 26 individuals during the migration-free breeding bio-season and 214 individuals during the post-breeding (autumn) migration.

816 SNCBs consider that displacement and any consequential mortality rates in the assessment should be made using a range of values (SNCB, 2017). For Manx shearwater, the level of displacement was set at 15% to 35% during construction and decommissioning as discussed with NRW during the AyM ETG (Table 1). The Applicant deems it appropriate to use a 1% mortality rate, in line with all other species assessed for AyM. The displacement matrix (Volume 4, Annex 4.2) provides the annual total of Manx shearwaters predicted to be at risk of displacement from the AyM array area plus 2 km buffer when applying any value of displacement and mortality.

817 Manx shearwater are difficult to age on surveys, therefore, a generic population age proportion has been used of 0.54 adult across all months of the year taken from Furness (2015).

Breeding

818 During the migration-free breeding bio-season 26 individuals were recorded within the array area plus 2 km buffer. This resulted in an estimated 0.04-0.09 individuals being subjected to displacement induced mortality during construction and decommissioning. Using the NatureScot (2018) apportioning tool, 0.02-0.04 displacement induced mortalities of breeding adults have been attributed to Aberdaron Coast and Bardsey Island SPA during construction and decommissioning.

Migratory bio-seasons

819 During the migratory bio-seasons 177 individuals were recorded within the array area plus 2 km buffer during the return migration and 214 during the post-breeding migration. In total, this resulted in an estimated 0.6-1.4 individuals being subjected to displacement induced mortality during the migratory bio-seasons during construction and decommissioning. Using data from Furness (2015), 0.3-0.6 displacement induced mortalities of breeding adults have been attributed to Skomer, Skokholm and the Seas off Pembrokeshire SPA during construction and decommissioning.

Conclusion

820 Overall, 0.3-0.6 displacement induced mortalities of breeding adults per annum have been attributed to Skomer, Skokholm and the Seas off Pembrokeshire SPA during construction and decommissioning.

821 Table 23 presents the apportioning results for Manx shearwater at Skomer, Skokholm and the Seas off Pembrokeshire SPA during all bio-seasons during construction and decommissioning.

Table 23: Annual apportioning results during construction and decommissioning attributed for Manx shearwater screened in at Skomer, Skokholm and the Seas off Pembrokeshire SPA for displacement risk.

DISPLACEMENT INDUCED MORTALITIES ATTRIBUTED TO SPA	SPA MANX SHEARWATER POPULATION		INCREASE IN BASELINE MORTALITY (%)	
	CITATION (2008)	SMP (2018)	CITATION (2008)	SMP (2018)
0.3-0.6	300,000	910,312	0.0007-0.002	0.0002-

DISPLACEMENT INDUCED MORTALITIES ATTRIBUTED TO SPA	SPA MANX SHEARWATER POPULATION		INCREASE IN BASELINE MORTALITY (%)	
	CITATION (2008)	SMP (2018)	CITATION (2008)	SMP (2018)
				0.0005

822 It should be noted that the apportioning was undertaken using Manx shearwater colonies within UK and the Republic of Ireland only as data was unavailable at the time of writing this report to include all other countries. Therefore, numbers apportioned to Skomer, Skokholm and the Seas off Pembrokeshire SPA would be expected to be lower than those presented in this report for Manx shearwater apportioning.

823 To conclude, the potential addition of 0.3-0.6 breeding adult Manx shearwater mortalities per annum during construction and decommissioning equates to less than 0.1% increase in baseline mortality for either citation or latest colony count. This increase would be indistinguishable from natural fluctuations in the population. There is, therefore, **no potential for an AEoI to the population conservation objective of the Manx shearwater feature of Skomer, Skokholm and the Seas off Pembrokeshire SPA in relation to construction and decommissioning displacement effects from AyM alone. Therefore, subject to natural change, the Manx shearwater feature will be maintained in the long term with respect to the potential for displacement risk.**

Disturbance from vessel movements

Storm petrel

824 This species/ SPA was screened into assessment at Stage 2 on a precautionary basis, as discussed with Natural Resources Wales during the AyM Environmental Technical Group Meeting (Table 1). The approach represents an initial high-level assessment, to determine the need for more detailed assessment, which will follow if further evidence is required to enable a robust conclusion on potential for an adverse effect on integrity (AEoI) to be ruled out.

825 A small proportion of the AyM array area is within mean-maximum foraging range for storm petrel (336 km (Woodward *et al*., 2019)) from Skomer, Skokholm and the Seas off Pembrokeshire SPA.

826 Storm petrel were not recorded by the aerial digital surveys within the AyM array area. Eight birds were estimated within the 4 km buffer at a density of 0.03 birds per km^2. The abundance of storm petrel within the array area plus 2 km buffer would be smaller than that presented here for the array plus 4 km buffer, therefore the impact will also be smaller.

827 Storm petrel has relatively low vulnerability to vessel movement disturbance associated with construction and decommissioning activity (Furness *et al*., 2013). Based on the low vulnerability of storm petrel to vessel movements, and the spatial and temporal coverage of construction activities being short term, intermittent and temporary and being limited to low frequencies of vessel, there is **no potential for an AEoI to the population conservation objective of the storm petrel feature of Skomer, Skokholm and the Seas off Pembrokeshire SPA from AyM alone or in-combination with other plans or projects. Therefore, with respect to the potential for disturbance and displacement, the storm petrel feature, subject to natural change, will be maintained in the long term at Skomer, Skokholm and the Seas off Pembrokeshire SPA.**

Operation and Maintenance

Displacement

Guillemot (non-breeding)

828 Guillemot has been screened into the assessment at Stage 2 on a precautionary basis, as discussed with NRW during the AyM ETGs (Table 1). Guillemot are potentially sensitive to displacement during the O&M activities (Bradbury *et al*., 2014; Dierschke *et al*., 2016). In order to assess the potential impact on guillemot, a displacement effect distance was determined of the array area and 2 km buffer. The percentage of birds displaced, and consequential mortality was determined, for guillemot the level of displacement was set of 50% and the consequential mortality of 1% during O&M.

829 The population of birds in the area in and around AyM changes through the seasons. Therefore, the assessment is carried out on a seasonal basis as the potential impact on the Skomer, Skokholm and the Seas off Pembrokeshire SPA varies by season. Skomer, Skokholm and the Seas off Pembrokeshire SPA is beyond the mean maximum ± 1SD foraging range of guillemot (73.2±80.5 km; Woodward *et al*., 2019). Therefore, guillemot has been screened in on a precautionary basis during the non-breeding bio-season of August to February, only (Furness, 2015).

830 Outside the breeding bio-season, the population of guillemot contains a mix of individuals from UK breeding colonies and from further away, therefore, a much lower percentage of birds can be attributed to any particular breeding colony SPA population. During these non-breeding bio-seasons, the information on populations contained in Furness (2015) has been applied for the purpose of apportionment.

831 As guillemot are not possible to age on surveys, a generic population age proportion has been used of 0.57 adults across all months of the year taken from Furness (2015).

Non-Breeding

832 During the non-breeding bio-season, a peak abundance of 2,919 guillemot within the array area plus 2 km buffer are estimated to be at risk of displacement. Using a displacement rate of 50% and a mortality rate of 1% would result in 14.6 individuals being subject to mortality.

833 In the non-breeding bio-season these birds will have come from a range of seabird breeding colonies in the UK and overseas. The UK Western waters BDMPS population during the non-breeding season is estimated to be 1,139,220 individuals (Furness, 2015). It is expected that 90% of guillemot adults from Skomer, Skokholm and the Seas off Pembrokeshire SPA will remain in the UK Western waters BDMPS throughout the non-breeding bio-season. As such, breeding adults from Skomer, Skokholm and the Seas off Pembrokeshire SPA are considered to contribute to 2.6% of the UK Western waters population during the non-breeding season. On that basis, 0.38 breeding adults that suffer displacement consequent mortality during the non-breeding bio-season are attributed to Skomer, Skokholm and the Seas off Pembrokeshire SPA.

Conclusion

834 The potential impact of displacement on guillemots in the array area plus 2 km buffer during the O&M phase of AyM is a predicted consequent mortality of 0.38 adult birds from Skomer, Skokholm and the Seas off Pembrokeshire SPA during the non-breeding bio-season. There is no classified guillemot population within the SPA citation document as guillemot is an assemblage feature. Therefore, assessing the potential impact against the latest population count undertaken from 2017-2020 for the three colonies within the SPA (16,644 breeding adults and therefore a baseline mortality of 1,015.3 breeding adults), 0.38 breeding adults, per annum, suffering displacement consequent mortality at Skomer, Skokholm and the Seas off Pembrokeshire SPA would represent a 0.04% increase in baseline mortality per annum.

835 This increase would be indistinguishable from natural fluctuations in the population. Therefore, there would be **no potential for an AEoI to the population conservation objective of the seabird assemblage, of which guillemot is a named feature of Skomer, Skokholm and the Seas off Pembrokeshire SPA in relation to potential adverse displacement effects from the O&M phase of AyM alone. Therefore, subject to natural change, the seabird assemblage would be maintained as a feature in the long term.**

Razorbill (non-breeding)

836 Razorbill has been screened into the assessment at Stage 2 on a precautionary basis, as discussed with NRW during the AyM ETGs (Table 1). Razorbill are potentially sensitive to displacement during the O&M activities (Bradbury *et al*., 2014; Dierschke *et al*., 2016). In order to assess the potential impact on razorbill, a displacement effect distance was determined of the array area and 2 km buffer. The percentage of birds displaced, and consequential mortality was determined, for razorbill the level of displacement was set of 50% and the consequential mortality of 1% during O&M.

837 The population of birds in the area in and around AyM changes through the seasons. Therefore, the assessment is carried out on a seasonal basis as the potential impact on the Skomer, Skokholm and the Seas off Pembrokeshire SPA varies by season. Skomer, Skokholm and the Seas off Pembrokeshire SPA is beyond the mean maximum ± 1SD foraging range of razorbill (88.7±75.9 km; Woodward *et al*., 2019). Therefore, razorbill has been screened in on a precautionary basis during the migratory bio-seasons of August to October and January to March and the migratory-free winter bio-season of November to December, only (Furness, 2015).

838 Outside the breeding bio-season, the population of razorbill contains a mix of individuals from UK breeding colonies and from further away, therefore, a much lower percentage of birds can be attributed to any particular breeding colony SPA population. During these non-breeding bio-seasons, the information on populations contained in Furness (2015) has been applied for the purpose of apportionment.

839 As razorbill are not possible to age on surveys, a generic population age proportion has been used of 0.57 adults across all months of the year taken from Furness (2015).

Migratory

840 During the post-breeding bio-season, a peak abundance of 66 razorbill within the array area plus 2 km buffer are estimated to be at risk of displacement and 336 razorbill during the return migration bio-season. Using a displacement rate of 50% and a mortality rate of 1% would result in 0.3 individuals being subject to mortality during the post-breeding bio-season and 1.7 in the return migration bio-season. In total, 2 individuals are predicted to suffer displacement related mortality during the migratory bio-seasons.

841 In the migratory bio-season these birds will have come from a range of seabird breeding colonies in the UK and overseas. The UK Western waters BDMPS population during the post-breeding and return migration bio-seasons is estimated to be 606,914 individuals (Furness, 2015). It is expected that 98% of razorbill adults from Skomer, Skokholm and the Seas off Pembrokeshire SPA will remain in the UK Western waters BDMPS throughout the post-breeding bio-season and pre-breeding bio-season. As such, breeding adults from Skomer, Skokholm and the Seas off Pembrokeshire SPA are considered to contribute to 1.9% of the UK Western waters population during the migratory bio-seasons. On that basis, 0.006 breeding adults that suffer displacement consequent mortality during the post-breeding migration bio-season and 0.033 breeding adults during the pre-breeding season are attributed to Skomer, Skokholm and the Seas off Pembrokeshire SPA. Overall, 0.039 displacement consequent mortality during the migratory bio-seasons can be attributed to the SPA.

Winter

842 During the migration-free winter bio-season, a peak abundance of 150 razorbill within the array area plus 2 km buffer are estimated to be at risk of displacement. Using a displacement rate of 50% and a mortality rate of 1% would result in 0.8 individuals being subject to mortality.

843 In the migration-free winter bio-season these birds will have come from a range of seabird breeding colonies in the UK and overseas. The UK Western waters BDMPS population during the winter bio-season is estimated to be 341,422 individuals (Furness, 2015). It is expected that 30% of razorbill adults from Skomer, Skokholm and the Seas off Pembrokeshire SPA will remain in the UK Western waters BDMPS throughout the winter bio-season. As such, breeding adults from Skomer, Skokholm and the Seas off Pembrokeshire SPA are considered to contribute to 1.1% of the UK Western waters population during the winter bio-season. On that basis, 0.008 breeding adults that suffer displacement consequent mortality during the winter bio-season are attributed to Skomer, Skokholm and the Seas off Pembrokeshire SPA.

Conclusion

844 The total potential impact of displacement on razorbills in the array area plus 2 km buffer during the O&M phase of AyM is a predicted consequent mortality of 0.047 adult birds from Skomer, Skokholm and the Seas off Pembrokeshire SPA during the migratory and winter bio-seasons. There is no classified razorbill population within the SPA citation document as razorbill is an assemblage feature. Therefore, assessing the potential impact against the latest population count undertaken from 2018 to 2020 for the three colonies within the SPA (8,595 breeding adults and therefore a baseline mortality of 902.5 breeding adults), 0.047 breeding adults, per annum, suffering displacement consequent mortality at Skomer, Skokholm and the Seas off Pembrokeshire SPA would represent a 0.005% increase in baseline mortality per annum.

845 This increase would be indistinguishable from natural fluctuations in the population. Therefore, there would be **no potential for an AEoI to the population conservation objective of the seabird assemblage, of which razorbill is a named feature of Skomer, Skokholm and the Seas off Pembrokeshire SPA in relation to potential adverse displacement effects from the O&M phase of AyM alone. Therefore, subject to natural change, the seabird assemblage would be maintained as a feature in the long term.**

Puffin

846 Puffin has been screened into the assessment of the O&M phase based on its sensitivity to the presence of the WTGs. In order to assess the potential impact on puffin, a displacement effect distance was determined of the array area and 2 km buffer. The percentage of birds displaced and consequential mortality was determined, for puffin the level of displacement was set at 50% and the consequential mortality at 1% during O&M. Puffin from Skomer, Skokholm and the Seas off Pembrokeshire SPA were screened into the assessment based on potential connectivity to AyM during the breeding season, therefore, puffin have been screened in for the breeding bio-season of April to July (Furness, 2015).

847 In the breeding bio-season, the mean peak abundance of puffin estimated to occur in the array area and 2 km buffer is 14 individuals. During the breeding bio-season, when birds are limited in the distance and number of days over which they can forage by the need to return regularly to the nest site, it can be expected that the area in and around AyM will contain a high proportion of adult birds that can be attributed to those designated sites within foraging range. The Skomer, Skokholm and the Seas off Pembrokeshire SPA lies within the mean maximum (± SD) foraging range of puffin (137.1±128.3 km; Woodward *et al.*, 2019), along with a number of other designated and non-designated sites based on distances around land. Predicted displacement mortality has therefore been apportioned to each of these sites following NatureScot (2018) (Annex 5: Ornithology Apportioning Note (application ref: 5.2.5)).

848 Due to small sample sizes of individuals from survey data, a generic population age proportion of puffins has been used of 0.49 adults across all months of the year taken from Furness (2015) (calculated from 1.04 immatures per adult ratio).

Breeding

849 During the breeding bio-season, a peak abundance of 14 puffin within the array area plus 2 km buffer are estimated to be at risk of displacement. Using displacement a rate of 50% and a mortality rate of 1% would result in 0.07 individuals being subject to mortality. Mortality during the breeding bio-season was apportioned to Skomer, Skokholm and the Seas off Pembrokeshire SPA following the NatureScot (2018) method. Following this method, 62.8% of birds subject to displacement may be breeding age individuals from Skomer, Skokholm and the Seas off Pembrokeshire SPA. On the basis, 0.02breeding adults are predicted to suffer displacement mortality attributable to this SPA.

Conclusion

850 The potential impact of displacement on puffins in the array area plus 2 km buffer during the O&M phases of AyM is a predicted consequent mortality of 0.02 adult birds from Skomer, Skokholm and the Seas off Pembrokeshire SPA during the breeding bio-season. When considering the potential impact of this loss to the Skomer, Skokholm and the Seas off Pembrokeshire SPA (with a classified puffin population of 19,000 breeding adults and an annual background mortality of 1,786 breeding adults), then using the prediction of 0.02 breeding adults per annum suffering mortality as a consequence of displacement would represent a 0.001% increase in baseline mortality for puffin at Skomer, Skokholm and the Seas off Pembrokeshire SPA.

851 The population of puffins has increased significantly since the citation population count, therefore it is also appropriate to assess the potential impact against the latest population count undertaken 2018 to 2019 for the two colonies in the SPA (38,342 breeding adults and therefore a baseline mortality of 3604.1 breeding adults). On this basis, 0.02 breeding adults, per annum, suffering displacement consequent mortality at Skomer, Skokholm and the Seas off Pembrokeshire SPA would represent a 0.0006% increase in baseline mortality per annum.

852 The potential addition of 0.02 breeding adult puffin mortalities per annum equates to less than 0.01% increase in baseline mortality for either citation or latest colony count. This increase would be indistinguishable from natural fluctuations in the population. **Therefore, there would be no potential for an AEoI to the population conservation objective of the puffin feature at Skomer, Skokholm and the Seas off Pembrokeshire SPA in relation to potential adverse displacement effects from the O&M phase of AyM alone. Therefore, subject to natural change, puffin would be maintained as a feature in the long term.**

Manx shearwater

853 Bradbury *et al*. (2014) assessed regularly occurring UK seabirds to determine their vulnerability to a number of impacts. Their assessment determined Manx shearwater to have very low vulnerability to displacement with offshore wind turbines during operation. This very low likelihood of sensitivity to displacement also infers a highly unlikely chance of barrier effects for commuting Manx shearwater associated with the SPAs. Furthermore, Manx shearwater have very low vulnerability to collision risk with offshore wind turbines (Bradbury *et al*., 2014, Furness *et al*., 2013) due to their low flight heights.

854 However, Manx shearwater was screened into assessment at Stage 2 on a precautionary basis for displacement during O&M, as discussed with Natural Resources Wales during the AyM Environmental Technical Group Meeting (Table 1). Displacement impacts across all phases of development have been presented for Manx shearwater at Skomer, Skokholm and the Seas off Pembrokeshire SPA during the migration-free breeding bio-season of June to July and the migration bio-seasons of March to May and August to October.

855 AyM array area is within mean-maximum foraging range for Manx shearwater (1346.8±1018.7 km (Woodward *et al*., 2019)) from Skomer, Skokholm and the Seas off Pembrokeshire SPA.

856 Manx shearwater were recorded in six of the 24 aerial digital surveys within the AyM array area plus 2 km buffer, with a peak estimated abundance of 417 individuals in August 2020. Manx shearwater densities ranged from 0.07 to 2.65 individuals/ km2. Highest densities of Manx shearwater were recorded in May 2020 (2.17 individuals/ km2) and August 2020 (2.65 individuals/ km2). The mean peak abundance within the array area plus 2 km buffer was 177 individuals during the return (spring) migration, 26 individuals during the migration-free breeding bio-season and 214 individuals during the post-breeding (autumn) migration.

857 SNCBs consider that displacement and any consequential mortality rates in the assessment should be made using a range of values (SNCB, 2017). For Manx shearwater, the level of displacement was set at 30% to 70% during O&M as discussed with NRW during the AyM ETG (Table 1). The Applicant deems it appropriate to use a 1% mortality rate, in line with all other species assessed for AyM. The displacement matrix (Volume 4, Annex 4.2) provides the annual total of Manx shearwaters predicted to be at risk of displacement from the AyM array area plus 2 km buffer when applying any value of displacement and mortality.

858 Manx shearwater are difficult to age on surveys, therefore, a generic population age proportion has been used of 0.54 adults across all months of the year taken from Furness (2015).

Breeding

859 During the migration-free breeding bio-season 26 individuals were recorded within the array area plus 2 km buffer. This resulted in an estimated 0.08-0.2 individuals being subjected to displacement induced mortality during O&M. Using the NatureScot (2018) apportioning tool, 0.03-0.08 displacement induced mortalities of breeding adults have been attributed to Skomer, Skokholm and the Seas off Pembrokeshire SPA during O&M.

Migratory bio-seasons

860 During the migratory bio-seasons 177 individuals were recorded within the array area plus 2 km buffer during the return migration and 214 during the post-breeding migration. In total, this resulted in an estimated 1.2-2.7 individuals being subjected to displacement induced mortality during the migratory bio-seasons during O&M. Using data from Furness (2015), 0.5-1.2 displacement induced mortalities of breeding adults have been attributed to Skomer, Skokholm and the Seas off Pembrokeshire SPA during O&M.

Conclusion

861 Overall, 0.6-1.3 displacement induced mortalities of breeding adults per annum have been attributed to Skomer, Skokholm and the Seas off Pembrokeshire SPA during O&M.

862 Table 24 presents the apportioning results for Manx shearwater at Skomer, Skokholm and the Seas off Pembrokeshire SPA during all bio-seasons during O&M.

Table 24: Annual apportioning results during O&M attributed for Manx shearwater screened in at Skomer, Skokholm and the Seas off Pembrokeshire SPA for displacement risk.

DISPLACEMENT INDUCED MORTALITIES ATTRIBUTED TO SPA	SPA MANX SHEARWATER POPULATION		INCREASE IN BASELINE MORTALITY (%)	
	CITATION (2008)	SMP (2018)	CITATION (2008)	SMP (2018)
0.6-1.3	300,000	910,312	0.001-0.003	0.0005-0.001

863 It should be noted that the apportioning was undertaken using Manx shearwater colonies within UK and the Republic of Ireland only as data was unavailable at the time of writing this report to include all other countries. Therefore, numbers apportioned to Skomer, Skokholm and the Seas off Pembrokeshire SPA would be expected to be lower than those presented in this report for Manx shearwater apportioning.

864 To conclude, the potential addition of 0.6-1.3 breeding adult Manx shearwater mortalities per annum during O&M equates to less than 0.1% increase in baseline mortality for either citation or latest colony count. This increase would be indistinguishable from natural fluctuations in the population. There is, therefore, **no potential for an AEoI to the population conservation objective of the Manx shearwater feature of Skomer, Skokholm and the Seas off Pembrokeshire SPA in relation to O&M displacement effects from AyM alone. Therefore, subject to natural change, the Manx shearwater feature will be maintained in the long term with respect to the potential for displacement risk.**

Disturbance and Displacement and Barrier Effect

Storm petrel

865 This species/ SPA was screened into assessment at Stage 2 on a precautionary basis, as discussed with NRW during the AyM ETGs (Table 1). The approach represents an initial high-level assessment, to determine the need for more detailed assessment, which will follow if further evidence is required to enable a robust conclusion on potential for an AEoI to be ruled out.

866 A small proportion of the AyM array area is within mean-maximum foraging range for storm petrel (336 km (Woodward *et al*., 2019)) from Skomer, Skokholm and the Seas off Pembrokeshire SPA. Storm petrel were not recorded by the aerial digital surveys within the AyM array area. Eight birds were estimated within the 4 km buffer at a density of 0.03 birds per km^2 during the digital aerial surveys. The abundance of storm petrel within the array area plus 2 km buffer would be smaller than that presented here for the array plus 4 km buffer, therefore the impact will also be smaller.

867 Bradbury *et al*. (2014) assessed regularly occurring UK seabirds to determine their vulnerability to a number of impacts. Their assessment determined storm petrels to have very low vulnerability to displacement with offshore wind turbines. This very low likelihood of sensitivity to displacement also infers a highly unlikely chance of barrier effects for commuting storm petrels associated with the SPA. Furthermore, site specific digital aerial survey data recorded extremely low numbers of storm petrel within the offshore area of the proposed AyM site.

868 Therefore, in relation to disturbance and displacement effects and barrier effects, there is **no potential for an AEoI to the conservation objectives of the storm petrol feature of Skomer, Skokholm and the Seas off Pembrokeshire SPA from AyM alone or in-combination with other plans or projects. Therefore, with respect to the potential for disturbance and displacement and barrier effects, the storm petrel feature, subject to natural change, will be maintained in the long term at Skomer, Skokholm and the Seas off Pembrokeshire SPA.**

Collision

Kittiwake

869 Kittiwake has been screened into the assessment of the O&M phase based on the density of birds in flight in the array area and its flight behaviour that places it at risk of collision with the turning blades of the WTGs. The population of birds in the area in and around AyM changes through the seasons. Therefore, the assessment is carried out on a seasonal basis as the potential impact on the Skomer, Skokholm and the Seas off Pembrokeshire SPA varies by season. Kittiwake has, therefore, been screened in for the migration-free breeding season of May to July, the post-breeding season of August to December and the pre-breeding season of January to April in relation to Skomer, Skokholm and the Seas off Pembrokeshire SPA.

870 During the breeding bio-season, when birds are limited in the distance and number of days over which they can forage by the need to return regularly to the nest site, it can be expected that the area in and around AyM will contain a high proportion of adult birds that can be attributed to those designated sites within foraging range. The Skomer, Skokholm and the Seas off Pembrokeshire SPA lies within the mean maximum ± 1SD foraging range of kittiwake (156.1±144.5 km; Woodward *et al.*, 2019), along with a number of other designated and non-designated sites based on distances around land. Predicted collision mortality has therefore been apportioned to each of these sites following NatureScot (2018) (Annex 5: Ornithology Apportioning Note (application ref: 5.2.5)).

871 Outside the breeding bio-season, the population of kittiwake contains a mix of individuals from UK breeding colonies and from further away, therefore, a much lower percentage of birds can be attributed to any particular breeding colony SPA population. During these non-breeding bio-seasons, the information on populations contained in Furness (2015) has been applied for the purpose of apportionment.

872 It is not possible to split adult kittiwakes from juvenile 2nd winter birds (majority of kittiwake breed for the first time at age four (Horswill and Robison, 2015)) from survey data. Therefore, kittiwake generic adult proportions of 0.53 were used in the assessment (Furness, 2015).

Breeding

873 The predicted collision resultant mortality from the operation of AyM in the breeding bio-season is (BO2) 12.3 (3.2-29.0) individuals. Mortality during the breeding bio-season was apportioned to Skomer, Skokholm and the Seas off Pembrokeshire SPA following the NatureScot (2018) method. Following this method, 0.4% of birds subject to collision risk may be breeding age individuals from Skomer, Skokholm and the Seas off Pembrokeshire SPA. On this basis, 0.02 (0.006-0.06) breeding adults are predicted to suffer collision mortality attributable to this SPA.

Migratory

874 The predicted collision resultant mortality as a result of the operation of AyM in the return migration bio-season (BO2) is 28.4 (8.4-70.7) individuals and in the post-breeding migration bio-season (BO2) is 13.1 (2.01-38.3) individuals (there is no migration free winter bio-season). In total, 41.6 (10.4-109.0) individuals are predicted to suffer collision related mortality during the migratory bio-season.

875 In the migratory bio-season these birds will have come from a range of seabird breeding colonies in the UK and overseas. The UK Western waters plus Channel BDMPS population during the post-breeding season is estimated to be 911,586 individuals (Furness, 2015). During the return migration, an estimated 691,526 individuals are present in the UK Western waters plus Channel BDMPS region (Furness, 2015). It is expected that 60% of kittiwake adults from Skomer, Skokholm and the Seas off Pembrokeshire SPA will remain in the UK Western waters plus Channel BDMPS throughout the post-breeding bio-season and 80% during the pre-breeding bio-season. As such, breeding adults from Skomer, Skokholm and the Seas off Pembrokeshire SPA are considered to contribute to 0.1% of the UK Western waters and Channel population during the post-breeding migration and 0.2% during the pre-breeding season migration. On that basis 0.02 (0.003-0.1) breeding adults that suffer collision consequent mortality during the post-breeding migration bio-season and 0.07 (0.02-0.2) breeding adults during the pre-breeding season are attributed to Skomer, Skokholm and the Seas off Pembrokeshire SPA. Overall, 0.09 (0.02-0.2) collision consequent mortality during the migratory bio-season can be attributed to the SPA.

Conclusion

876 The potential impact of collision on kittiwakes in the array area during the O&M phase of AyM is a predicted consequent mortality of 0.02 (0.006-0.06) adult birds from Skomer, Skokholm and the Seas off Pembrokeshire SPA during the breeding bio-season and 0.09 (0.02-0.2) during the migratory bio-seasons. This equates to 0.11 (0.03-0.3) breeding adult birds per annum for the planned duration of operational and maintenance activities. There is no classified kittiwake population within the SPA citation document as kittiwake is an assemblage feature. Therefore, assessing the potential impact against the latest population count undertaken in 2018 for the SPA (2472 breeding adults and therefore a baseline mortality of 360.9 breeding adults), 0.11 (0.03-0.3) breeding adults, per annum, suffering collision consequent mortality at Skomer, Skokholm and the Seas off Pembrokeshire SPA would represent a 0.03% (0.008-0.08%) increase in baseline mortality per annum.

877 The potential addition of 0.11 (0.03-0.3) breeding adult kittiwake mortalities per annum equates to less than 0.1% increase in baseline mortality for the latest colony count. This increase would be indistinguishable from natural fluctuations in the population. Therefore, there would be **no potential for an AEoI to the population conservation objective of the seabird assemblage, of which kittiwake is a named feature of Skomer, Skokholm and the Seas off Pembrokeshire SPA in relation to potential adverse collision effects from the O&M phase of AyM alone. Therefore, subject to natural change, the seabird assemblage would be maintained as a feature in the long term.**

Lesser black-backed gull

878 Skomer, Skokholm and the Seas off Pembrokeshire SPA was screened into assessment as the AyM array area is within the mean-max + 1SD foraging range (236 km) (Woodward *et al*., 2019) of lesser black-backed gull from the marine boundary of the Skomer, Skokholm and the Seas off Pembrokeshire SPA. However, the colony specific maximum foraging range of tracked lesser black-backed gull breeding at Skomer, Skokholm and the Seas off Pembrokeshire SPA is 151 km (Woodward *et al*., 2019). AyM array area is beyond the maximum foraging range for this species from this SPA. Therefore, there is no connectivity of lesser black-backed gull from Skomer, Skokholm and the Seas off Pembrokeshire SPA to AyM during the breeding bio-season.

879 Lesser black-backed gull has been screened into the assessment at Stage 2 on a precautionary basis for the non-breeding season as discussed with NRW during the AyM ETGs (Table 1). However, during the aerial surveys, zero individuals were recorded during the non-breeding bio-seasons, within the array area. Therefore, adverse effects can be discounted as there is no pathway for effects. Consequently, there is **no potential for an AEoI to the population conservation objective of the lesser black-backed gull feature of Skomer, Skokholm and the Seas off Pembrokeshire SPA in relation to collision effects from AyM alone.**

Storm petrel

880 This species/ SPA was screened into assessment at Stage 2 on a precautionary basis, as discussed with Natural Resources Wales during the AyM Environmental Technical Group Meeting (Table 1). The approach represents an initial high-level assessment, to determine the need for more detailed assessment, which will follow if further evidence is required to enable a robust conclusion on potential for an AEoI to be ruled out.

881 A small proportion of the AyM array area is within mean-maximum foraging range for storm petrel (336 km (Woodward *et al*., 2019)) from Skomer, Skokholm and the Seas off Pembrokeshire SPA. Storm petrel were not recorded by the aerial digital surveys within the AyM array area. Eight birds were estimated within the 4 km buffer at a density of 0.03 birds per km^2.

882 During the operational phase of the Project, seabirds flying through the array area may be at risk of collision with WTGs. This risk will be present throughout the whole array area for the entirety of the project's operational period. During the assessment process it is assumed that all collisions will be fatal.

883 However, storm petrel have low vulnerability to collision risk with offshore wind turbines (Bradbury *et al*., 2014, Furness *et al*., 2013) due to their low flight heights. Furthermore, no storm petrel were recorded within the AyM array area during site specific digital aerial surveys. Therefore, in relation to collision risk effects, there is **no potential for an AEoI to the population conservation objective of the storm petrel feature of Skomer, Skokholm and the Seas off Pembrokeshire SPA from AyM alone with other plans or projects. Therefore, with respect to the potential for collision risk, the storm petrel feature, subject to natural change, will be maintained in the long term at Skomer, Skokholm and the Seas off Pembrokeshire SPA.**

10.3.18 Rathlin Island SPA

Features and Effects for Assessment

884 Potential for LSE alone has been identified for the following for Rathlin Island SPA:

- Puffin (breeding) – C&D and O&M Phases, displacement (assemblage feature only).

Assessment information

885 The conservation objectives (as described in Annex 3) for Rathlin Island SPA are to maintain each feature in favourable condition.

886 The SPA selection feature objectives are as follows:

- To maintain or enhance the population of the qualifying species;
- Fledging success sufficient to maintain or enhance population;
- To maintain or enhance the range of habitats utilised by the qualifying species;
- To ensure that the integrity of the site is maintained;
- To ensure there is no significant disturbance of the species; and
- To ensure 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; and
- Structure, function and supporting processes of habitats supporting the species.

887 Based on the above conservation objectives, to achieve favourable condition are as follows:

- Puffin breeding population – no significant decrease in population against national trends; and
- Meak population greater than 790 (i.e. within 50% of 2000 population) or above minimum historical count.

888 Although puffin are only named features of the seabird assemblage, for the purpose of this assessment they have been considered in a similar manner to qualifying species, though the conclusion is not whether an AEoI would result from AyM alone on each of these species as features, but more as an important component of the seabird assemblage.

Construction and Decommissioning

Displacement

Puffin

889 Puffin has been screened into the assessment of the construction and decommissioning phases based on its sensitivity to construction and decommissioning activities. In order to assess the potential impact on puffin, a displacement effect distance was determined of the array area and 2 km buffer. The percentage of birds displaced and consequential mortality was determined, for puffin the level of displacement was set at 25% and the consequential mortality at 1% during construction and decommissioning. Puffin from Rathlin Island SPA were screened into the assessment based on potential connectivity to AyM during the breeding season, therefore, puffin have been screened in for the breeding bio-season of April to July, only (Furness, 2015).

890 In the breeding bio-season, the mean peak abundance of puffin estimated to occur in the array area and 2 km buffer is 14 individuals. During the breeding bio-season, when birds are limited in the distance and number of days over which they can forage by the need to return regularly to the nest site, it can be expected that the area in and around AyM will contain a high proportion of adult birds that can be attributed to those designated sites within foraging range. The Rathlin Island SPA lies within the mean maximum (± SD) foraging range of puffin (137.1±128.3 km; Woodward *et al*., 2019), along with a number of other designated and non-designated sites based on distances around land. Predicted displacement mortality has therefore been apportioned to each of these sites following NatureScot (2018) (Annex 5: Ornithology Apportioning Note (application ref: 5.2.5)).

891 Due to small sample sizes of individuals from survey data, a generic population age proportion of puffins has been used of 0.49 adults across all months of the year taken from Furness (2015) (calculated from 1.04 immatures per adults ratio).

Breeding

892 During the breeding bio-season, a peak abundance of 14 puffin within the array area plus 2 km buffer are estimated to be at risk of displacement. Using a displacement rate of 25% and a mortality rate of 1% would result in 0.04 individuals being subject to mortality. Mortality during the breeding bio-season was apportioned to Rathlin Island SPA following the NatureScot (2018) method. Following this method, 1.7% of birds subject to displacement may be breeding age individuals from Rathlin Island SPA. On this basis, 0.0003 breeding adults are predicted to suffer displacement mortality attributable to this SPA.

Conclusion

893 The potential impact of displacement on puffins in the array area plus 2 km buffer during the Construction and Decommissioning Phases of AyM is a predicted consequent mortality of 0.0003 adult birds from Rathlin Island SPA during the breeding bio-season. When considering the potential impact of this loss to the Rathlin Island SPA (with a classified puffin population of 2,398 breeding adults and an annual background mortality of 225.4 breeding adults), then using the prediction of 0.0003 breeding adults per annum suffering mortality as a consequence of displacement would represent a 0.0001% increase in baseline mortality for puffin at Rathlin Island SPA.

894 The population of puffins has changed since the citation population count, therefore it is also appropriate to assess the potential impact against the latest population count undertaken in 2016 to 2021 for the two colonies in the SPA (415 breeding adults and therefore a baseline mortality of 39 breeding adults). On this basis, 0.0003 breeding adults, per annum, suffering displacement consequent mortality at Rathlin Island SPA would represent a 0.0007% increase in baseline mortality per annum.

895 The potential addition of 0.0003 breeding adult puffin mortalities per annum equates to less than 0.01% increase in baseline mortality for either citation or latest colony count. This increase would be indistinguishable from natural fluctuations in the population. Therefore, there would be **no potential for an AEoI to the population conservation objective of the seabird assemblage, of which puffin is a named feature of Rathlin Island SPA in relation to potential adverse displacement effects from the construction and decommissioning phase of AyM alone. Therefore, subject to natural change, the seabird assemblage would be maintained as a feature in the long term.**

Operation and Maintenance

Displacement

Puffin

896 Puffin has been screened into the assessment of the O&M phase based on its sensitivity to the presence of the WTGs. In order to assess the potential impact on puffin, a displacement effect distance was determined of the array area and 2 km buffer. The percentage of birds displaced and consequential mortality was determined, for puffin the level of displacement was set at 50% and the consequential mortality at 1% during O&M. Puffin from Rathlin Island SPA were screened into the assessment based on potential connectivity to AyM during the breeding season, therefore, puffin have been screened in for the breeding bio-season of April to July (Furness, 2015).

897 In the breeding bio-season, the mean peak abundance of puffin estimated to occur in the array area and 2 km buffer is 14 individuals. During the breeding bio-season, when birds are limited in the distance and number of days over which they can forage by the need to return regularly to the nest site, it can be expected that the area in and around AyM will contain a high proportion of adult birds that can be attributed to those designated sites within foraging range. The Rathlin Island SPA lies within the mean maximum (± SD) foraging range of puffin (137.1±128.3 km; Woodward *et al.*, 2019), along with a number of other designated and non-designated sites based on distances around land. Predicted displacement mortality has therefore been apportioned to each of these sites following NatureScot (2018) (Annex 5: Ornithology Apportioning Note (application ref: 5.2.5)).

898 Due to small sample sizes of individuals from survey data, a generic population age proportion of puffins has been used of 0.49 adults across all months of the year taken from Furness (2015) (calculated from 1.04 immatures per adult ratio).

Breeding

899 During the breeding bio-season, a peak abundance of 14 puffin within the array area plus 2 km buffer are estimated to be at risk of displacement. Using a displacement rate of 50% and a mortality rate of 1% would result in 0.07 individuals being subject to mortality. Mortality during the breeding bio-season was apportioned to Rathlin Island SPA following the NatureScot (2018) method. Following this method, 1.7% of birds subject to displacement may be breeding age individuals from Rathlin Island SPA. On this basis, 0.0006 breeding adults are predicted to suffer displacement mortality attributable to this SPA.

Conclusion

900 The potential impact of displacement on puffins in the array area plus 2 km buffer during the O&M phases of AyM is a predicted consequent mortality of 0.0006 adult birds from Rathlin Island SPA during the breeding bio-season. When considering the potential impact of this loss to the Rathlin Island SPA (with a classified puffin population of 2,398 breeding adults and an annual background mortality of 225.4 breeding adults), then using the prediction of 0.0006 breeding adults per annum suffering mortality as a consequence of displacement would represent a 0.0003% increase in baseline mortality for puffin at Rathlin Island SPA.

901 The population of puffins has changed since the citation population count, therefore it is also appropriate to assess the potential impact against the latest population count undertaken 2016 to 2021 for the two colonies in the SPA (415 breeding adults and therefore a baseline mortality of 39 breeding adults). On this basis, 0.0006 breeding adults, per annum, suffering displacement consequent mortality at Rathlin SPA would represent a 0.001% increase in baseline mortality per annum.

902 The potential addition of 0.0006 breeding adult puffin mortalities per annum equates to less than 0.01% increase in baseline mortality for either citation or latest colony count. This increase would be indistinguishable from natural fluctuations in the population. Therefore, there would be **no potential for an AEoI to the population conservation objective of the seabird assemblage, of which puffin is a named feature of Rathlin SPA in relation to potential adverse displacement effects from the O&M phase of AyM alone. Therefore, subject to natural change, the seabird assemblage would be maintained as a feature in the long term**.

10.3.19 Saltee Islands SPA

Features and Effects for Assessment

903 Potential for LSE alone has been identified for the following for Saltee Islands SPA:

- Kittiwake (breeding) – O&M Phase, collision risk;
- Lesser black-backed gull (breeding) – O&M Phase, collision risk; and
- Puffin (breeding) – C&D and O&M Phases, displacement.

Assessment information

904 The conservation objective (as described in Annex 3) is to maintain the favourable conservation condition of kittiwake, lesser black-backed gull and puffin in the Saltee Islands SPA, which is defined by the following list of attributes and targets:

- No significant decline in breeding population abundance: apparently occupied nests (AONs);
- No significant decline in productivity rate;
- No significant decline in distribution: breeding colonies;
- No significant decline in prey biomass available;
- No significant increase in barriers to connectivity; and
- No significant increase in disturbance at the breeding site.

905 Additionally puffin is defined by the following list of attributes and targets:

- No significant increase in disturbance at marine areas immediately adjacent to the colony; and
- Absent or under control occurrence of mammalian predators.

906 Based on the above conservation objective, the specific target for those screened in features of the SPA, in order for favourable conservation status to be achieved, is 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.

Construction and Decommissioning

Displacement

Puffin

907 Puffin has been screened into the assessment of the construction and decommissioning phases based on its sensitivity to construction and decommissioning activities. In order to assess the potential impact on puffin, a displacement effect distance was determined of the array area and 2 km buffer. The percentage of birds displaced and consequential mortality was determined, for puffin the level of displacement was set at 25% and the consequential mortality at 1% during construction and decommissioning. Puffin from Saltee Islands SPA were screened into the assessment based on potential connectivity to AyM during the breeding season, therefore, puffin have been screened in for the breeding bio-season of April to July, only (Furness, 2015).

908 In the breeding bio-season, the mean peak abundance of puffin estimated to occur in the array area and 2 km buffer is 14 individuals. During the breeding bio-season, when birds are limited in the distance and number of days over which they can forage by the need to return regularly to the nest site, it can be expected that the area in and around AyM will contain a high proportion of adult birds that can be attributed to those designated sites within foraging range. The Saltee Islands SPA lies within the mean maximum (± SD) foraging range of puffin (137.1±128.3 km; Woodward *et al*., 2019), along with a number of other designated and non-designated sites based on distances around land. Predicted displacement mortality has therefore been apportioned to each of these sites following NatureScot (2018) (Annex 5: Ornithology Apportioning Note (application ref: 5.2.5)).

909 Due to small sample sizes of individuals from survey data, a generic population age proportion of puffins has been used of 0.49 adults across all months of the year taken from Furness (2015) (calculated from 1.04 immatures per adult ratio).

Breeding

910 During the breeding bio-season, a peak abundance of 14 puffin within the array area plus 2 km buffer are estimated to be at risk of displacement. Using a displacement rate of 25% and a mortality rate of 1% would result in 0.04 individuals being subject to mortality. Mortality during the breeding bio-season was apportioned to Saltee Islands SPA following the NatureScot (2018) method. Following this method, 2.2% of birds subject to displacement may be breeding age individuals from Saltee Islands SPA. On this basis, 0.0004 breeding adults are predicted to suffer displacement mortality attributable to this SPA.

Conclusion

911 The potential impact of displacement on puffins in the array area plus 2 km buffer during the Construction and Decommissioning Phases of AyM is a predicted consequent mortality of 0.0004 adult birds from Saltee Islands SPA during the breeding bio-season. When considering the potential impact of this loss to the Saltee Islands SPA (with a classified puffin population of 3,644 breeding adults and an annual background mortality of 342.5 breeding adults), then using the prediction of 0.0004 breeding adults per annum suffering mortality as a consequence of displacement would represent a 0.0001% increase in baseline mortality for puffin at Saltee Islands SPA.

912 The population of puffins has changed since the citation population count, therefore it is also appropriate to assess the potential impact against the latest population count undertaken in 1999 to 2000 for the two colonies in the SPA (1,822 breeding adults and therefore a baseline mortality of 171.3 breeding adults). On this basis, 0.0004 breeding adults, per annum, suffering displacement consequent mortality at Saltee Islands SPA would represent a 0.0002% increase in baseline mortality per annum.

913 The potential addition of 0.0004 breeding adult puffin mortalities per annum equates to less than 0.01% increase in baseline mortality for either citation or latest colony count. This increase would be indistinguishable from natural fluctuations in the population. Therefore, there would be **no potential for an AEoI to the population conservation objective of the puffin feature at Saltee Islands SPA in relation to potential adverse displacement effects from the construction and decommissioning phase of AyM alone. Therefore, subject to natural change, puffin would be maintained as a feature in the long term.**

Operation and maintenance

Collision

Kittiwake

914 Kittiwake has been screened into the assessment of the O&M phase based on the density of birds in flight in the array area and its flight behaviour that places it at risk of collision with the turning blades of the WTGs. Kittiwake from Saltee Islands SPA were screened into the assessment based on potential connectivity to AyM during the breeding season, therefore kittiwake has been screeded in for the migration-free breeding bio-season only of May to July.

915 During the breeding bio-season, when birds are limited in the distance and number of days over which they can forage by the need to return regularly to the nest site, it can be expected that the area in and around AyM will contain a high proportion of adult birds that can be attributed to those designated sites within foraging range. The Saltee Islands SPA lies within the mean maximum ± 1SD foraging range of kittiwake (156.1±144.5 km; Woodward *et al.*, 2019), along with a number of other designated and non-designated sites based on distances around land. Predicted collision mortality has therefore been apportioned to each of these sites following NatureScot (2018) (Annex 5: Ornithology Apportioning Note (application ref: 5.2.5)).

916 It is not possible to split adult kittiwakes from juvenile 2nd winter birds (majority of kittiwake breed for the first time at age four (Horswill and Robison, 2015)) from survey data. Therefore, kittiwake generic adult proportions of 0.53 were used in the assessment (Furness, 2015).

Breeding

917 The predicted collision resultant mortality from the operation of AyM in the breeding bio-season (BO2) is 12.3 (3.2-29.0) individuals. Mortality during the breeding bio-season was apportioned to Saltee Islands SPA following the NatureScot (2018) method. Following this method, 0.2% of birds subject to collision risk may be breeding age individuals from Saltee Islands SPA. On this basis, 0.01 (0.004-0.03) breeding adults are predicted to suffer collision mortality attributable to this SPA.

Conclusion

918 The potential impact of collision on kittiwakes in the array area during the O&M phase of AyM is a predicted consequent mortality of 0.01 (0.004-0.03) adult birds from Saltee Islands SPA during the breeding bio-season. When considering the potential impact of this loss to the Saltee Islands SPA (with a classified kittiwake population of 4,250 breeding adults and an annual background mortality of 621 breeding adults), then using the prediction of 0.01 (0.004-0.03) breeding adults per annum suffering mortality as a consequence of collision would represent a 0.002% (0.0006-0.006%) increase in baseline mortality for kittiwake at Saltee Islands SPA.

919 The population of kittiwake has changed since the citation population count, therefore it is also appropriate to assess the potential impact against the latest population count undertaken between 2015-2018 for the Great Saltee Island colony from Saltee Islands SPA within MMF+1SD of AyM (2,076 breeding adults and therefore a baseline mortality of 303.1 breeding adults). On this basis, 0.015 (0.004-0.03) breeding adults, per annum suffering collision consequent mortality at Saltee Islands SPA would represent a 0.005% (0.001-0.01) increase in baseline mortality per annum.

920 The potential addition of 0.01 (0.004-0.03) breeding adult mortalities per annum equates to less than 0.1% increase in baseline mortality for either citation or latest colony count. This increase would be indistinguishable from natural fluctuations in the population and therefore, there would be **no potential for an AEoI to the population conservation objective of the kittiwake feature at Saltee Islands SPA in relation to potential adverse collision effects from the O&M phase of AyM alone. Therefore, subject to natural change, kittiwake would be maintained as a feature in the long term.**

Lesser black-backed gull

921 Saltee SPA was initially screened into assessment as the AyM array area is within the mean-max + 1SD foraging range (Woodward *et al*., 2019) of lesser black-backed gull from the marine boundary of the SPA. However, further investigation of SPA shows that the colony is beyond the mean-max +1SD foraging range (Woodward *et al*., 2019). As a result, there is no connectivity between the lesser black-backed gull feature of Saltee SPA during the breeding season. Therefore, adverse effects can be discounted as there is no pathway for effects.

Displacement

Puffin

922 Puffin has been screened into the assessment of the O&M phase based on its sensitivity to the presence of the WTGs. In order to assess the potential impact on puffin, a displacement effect distance was determined of the array area and 2 km buffer. The percentage of birds displaced and consequential mortality was determined, for puffin the level of displacement was set at 50% and the consequential mortality at 1% during O&M. Puffin from Saltee Islands SPA were screened into the assessment based on potential connectivity to AyM during the breeding season, therefore, puffin have been screened in for the breeding bio-season of April to July (Furness, 2015).

923 In the breeding bio-season, the mean peak abundance of puffin estimated to occur in the array area and 2 km buffer is 14 individuals. During the breeding bio-season, when birds are limited in the distance and number of days over which they can forage by the need to return regularly to the nest site, it can be expected that the area in and around AyM will contain a high proportion of adult birds that can be attributed to those designated sites within foraging range. The Saltee Islands SPA lies within the mean maximum (± SD) foraging range of puffin (137.1±128.3 km; Woodward *et al*., 2019), along with a number of other designated and non-designated sites based on distances around land. Predicted displacement mortality has therefore been apportioned to each of these sites following NatureScot (2018) (Annex 5: Ornithology Apportioning Note (application ref: 5.2.5)).

924 Due to small sample sizes of individuals from survey data, a generic population age proportion of puffins has been used of 0.49 adults across all months of the year taken from Furness (2015) (calculated from 1.04 immatures per adult ratio).

Breeding

925 During the breeding bio-season, a peak abundance of 14 puffin within the array area plus 2 km buffer are estimated to be at risk of displacement. Using a displacement rate of 50% and a mortality rate of 1% would result in 0.07 individuals being subject to mortality. Mortality during the breeding bio-season was apportioned to Saltee Islands SPA following the NatureScot (2018) method. Following this method, 2.2% of birds subject to displacement may be breeding age individuals from Saltee Islands SPA. On this basis, 0.0008 breeding adults are predicted to suffer displacement mortality attributable to this SPA.

Conclusion

926 The potential impact of displacement on puffins in the array area plus 2 km buffer during the Operational and Maintenance Phases of AyM is a predicted consequent mortality of 0.0008 adult birds from Saltee Islands SPA during the breeding bio-season. When considering the potential impact of this loss to the Saltee Islands SPA (with a classified puffin population of 3,644 breeding adults and an annual background mortality of 342.5 breeding adults), then using the prediction of 0.0008 breeding adults per annum suffering mortality as a consequence of displacement would represent a 0.0002% increase in baseline mortality for puffin at Saltee Islands SPA.

927 The population of puffins has changed since the citation population count, therefore it is also appropriate to assess the potential impact against the latest population count undertaken in 1999 to 2000 for the two colonies in the SPA (1,822 breeding adults and therefore a baseline mortality of 171.3 breeding adults). On this basis, 0.0008 breeding adults, per annum, suffering displacement consequent mortality at Saltee Islands SPA would represent a 0.0004% increase in baseline mortality per annum.

928 The potential addition of 0.0008 breeding adult puffin mortalities per annum equates to less than 0.01% increase in baseline mortality for either citation or latest colony count. This increase would be indistinguishable from natural fluctuations in the population. Therefore, there would be **no potential for an AEoI to the population conservation objective of the puffin feature at Saltee Islands SPA in relation to potential adverse displacement effects from the operational and maintenance phase of AyM alone. Therefore, subject to natural change, puffin would be maintained as a feature in the long term.**

10.3.20 Helvick Head to Ballyquin SPA

Features and Effects for Assessment

929 Potential for LSE alone has been identified for the following for Helvick Head to Ballyquin SPA:

- Kittiwake (breeding) – O&M Phase, collision risk.

Assessment information

930 The conservation objective (as described in Annex 3) for Helvick Head to Ballyquin SPA is to maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests for this SPA.

931 Based on the above conservation objective, the specific target for those screened in features of the SPA, in order for favourable conservation status to be achieved, is when:

932 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.

933 Helvick Head to Ballyquin SPA was initially screened into assessment as the AyM array area is within the mean-max + 1SD foraging range (Woodward *et al*., 2019) of kittiwake from the marine boundary of the SPA. However, further investigation of specific kittiwake colony locations within the SPA indicate that the colonies are outside of mean-maximum foraging range + 1SD of the AyM array area. Therefore, there is no connectivity between the kittiwake feature of Helvick Head to Ballyquin SPA during the breeding season. Therefore, adverse effects can be discounted as there is no pathway for effects. Consequently, there is **no potential for an AEoI to the population conservation objective of the kittiwake feature of Helvick Head to Ballyquin SPA in relation to collision risk effects from AyM alone.**

10.3.21 Grassholm SPA

Features and Effects for Assessment

934 Potential for LSE alone has been identified for the following for Grassholm SPA:

- Gannet (breeding) – O&M Phase, risk of collision and displacement, C&D displacement.

Assessment information

935 The conservation objective (as described in Annex 3) for Grassholm SPA is for the gannet feature 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.

Construction and Decommissioning

Displacement

Gannet (breeding)

936 Gannet has been screened into the assessment of the construction and decommissioning phase based on its sensitivity to construction and decommissioning activities. In order to assess the potential impact on gannet, a displacement effect distance was determined of the array area plus 2 km buffer. The percentage of birds displaced and consequential mortality was determined, for gannet the level of displacement was set at 30-40% and the consequential mortality at 1% during construction and decommissioning. Gannet from Grassholm SPA were screened into the assessment based on potential connectivity to AyM during the breeding bio-season only, therefore, gannet have been screened in for the migration-free breeding bio-season of April to August, only (Furness, 2015).

937 In the migration-free breeding bio-season, the mean peak abundance of gannet estimated to occur in the array area plus 2 km buffer is 328 individuals. During the breeding bio-season, when birds are limited in the distance and number of days over which they can forage by the need to return regularly to the nest site, it can be expected that the area in and around AyM will contain a high proportion of adult birds that can be attributed to those designated sites within foraging range. The Grassholm SPA lies within the mean maximum (± SD) foraging range of gannet (315.2±194.2 km; Woodward *et al*., 2019), along with a number of other designated and non-designated sites based on distances around land. Predicted displacement mortality has therefore been apportioned to each of these sites following NatureScot (2018) (Annex 5: Ornithology Apportioning Note (application ref: 5.2.5)).

938 Age proportion for gannet has been determined from site specific data. An adult age proportion has been used of 0.94 across the breeding bio-season. Apportioning for the non-breeding bio-seasons have been undertaken using Furness (2015), therefore no additional age ratio is required in these bio-seasons.

Breeding

939 During the migration-free breeding bio-season, a peak abundance of 328 gannets within the array area plus 2 km buffer are estimated to be at risk of displacement. Using displacement rates between 30 – 40% and a mortality rate of 1% would result in between 1.0-1.3 individuals being subject to mortality. Mortality during the breeding bio-season was apportioned to Grassholm SPA following the NatureScot (2018) method. Following this method, 36.7% of birds subject to displacement may be breeding age individuals from Grassholm SPA. On the basis, between 0.3 to 0.5 breeding adults are predicted to suffer displacement mortality attributable to this SPA.

Conclusion

940 The potential impact of displacement on gannets in the array area during the Construction and Decommissioning phases of AyM is a predicted consequent mortality of between 0.3 to 0.5 adult birds from Grassholm SPA during the breeding bio-season. When considering the potential impact of this loss to the Grassholm SPA (with a classified gannet population of 66,000 breeding adults and an annual background mortality of 5,346 breeding adults), then using the prediction of between 0.3 and 0.5 breeding adults per annum suffering mortality as a consequence of displacement would represent a 0.006% to 0.008% increase in baseline mortality for gannet at Grassholm SPA.

941 The population of gannets has significantly increased since the citation population count, therefore it is also appropriate to assess the potential impact against the latest population count undertaken in 2015 (72,022 breeding adults and therefore a baseline mortality of 5833.8 breeding adults). On this basis, between 0.3 and 0.5 breeding adults, per annum, suffering displacement consequent mortality at Grassholm SPA would represent a 0.006% to 0.008% increase in baseline mortality per annum.

942 The potential addition of between 0.3 and 0.5 breeding adult gannet mortalities per annum equates to less than 0.01% increase in baseline mortality for either citation or latest colony count. This increase would be indistinguishable from natural fluctuations in the population and therefore, there would be **no potential for an AEoI to the population conservation objective of the gannet feature at Grassholm SPA in relation to potential adverse displacement effects from the construction and decommissioning phase of AyM alone. Therefore, subject to natural change, gannet would be maintained as a feature in the long term.**

Operation and maintenance

Displacement

Gannet (breeding)

943 Gannet has been screened into the assessment of the O&M phase based on its sensitivity to the presence of the WTGs. In order to assess the potential impact on gannet, a displacement effect distance was determined of the array area plus 2 km buffer. The percentage of birds displaced and consequential mortality was determined, for gannet the level of displacement was set at 60-80% and the consequential mortality at 1% during O&M phase. Gannet from Grassholm SPA only have connectivity to AyM during the migration-free breeding season, therefore, gannet have been screened in for the migration-free breeding bio-season of April to August, only (Furness, 2015).

944 In the migration-free breeding bio-season, the mean peak abundance of gannet estimated to occur in the array area is 328 individuals. During the breeding bio-season, when birds are limited in the distance and number of days over which they can forage by the need to return regularly to the nest site, it can be expected that the area in and around AyM will contain a high proportion of adult birds that can be attributed to those designated sites within foraging range. The Grassholm SPA lies within the mean maximum (± SD) foraging range of AyM (315.2±194.2 km; Woodward *et al*., 2019), along with a number of other designated and non-designated sites based on distances around land. Predicted displacement mortality has therefore been apportioned to each of these sites following NatureScot (2018) (Annex 5: Ornithology Apportioning Note (application ref: 5.2.5)).

945 Age proportion for gannet has been determined from site specific data. An adult age proportion has been used of 0.94 across the breeding bio-season. Apportioning for the non-breeding bio-seasons have been undertaken using Furness (2015), therefore no additional age ratio is required in these bio-seasons.

Breeding

946 During the migration-free breeding bio-season, a peak abundance of 328 gannets within the array area plus 2 km buffer are estimated to be at risk of displacement. Using displacement rates between 60 – 80% and a mortality rate of 1% would result in between 2.0 and 2.6 individuals being subject to mortality. Mortality during the breeding bio-season was apportioned to Grassholm SPA following the NatureScot (2018) method. Following this method, 36.7% of birds subject to displacement may be breeding age individuals from Grassholm SPA. On this basis, between 0.7 and 0.9 breeding adults are predicted to suffer displacement mortality attributable to this SPA.

Conclusion

947 The potential impact of displacement on gannets in the array area during the O&M phase of AyM is a predicted consequent mortality of between 0.7 and 0.9 adult birds from Grassholm SPA during the breeding bio-season. When considering the potential impact of this loss to the Grassholm SPA (with a classified gannet population of 66,000 breeding adults and an annual background mortality of 5,346 breeding adults), then using the prediction of between 0.7 and 0.9 breeding adults per annum suffering mortality as a consequence of displacement would represent a 0.01% to 0.02% increase in baseline mortality for gannet at Grassholm SPA.

948 The population of gannets has significantly increased since the citation population count, therefore it is also appropriate to assess the potential impact against the latest population count undertaken in 2015 (72,022 breeding adults and therefore a baseline mortality of 5,834 breeding adults). On this basis, between 0.7 and 0.9 breeding adults, per annum, suffering displacement consequent mortality at Grassholm SPA would represent a 0.01% to 0.02% increase in baseline mortality per annum.

949 The potential addition of between 0.7 and 0.9 breeding adult gannet mortalities per annum equates to less than 0.02% increase in baseline mortality for either citation or latest colony count. This increase would be indistinguishable from natural fluctuations in the population and therefore, there would be **no potential for an AEoI to the population conservation objective of the gannet feature at Grassholm SPA in relation to potential adverse displacement effects from the O&M phase of AyM alone. Therefore, subject to natural change, gannet would be maintained as a feature in the long term.**

Collision

Gannet

950 Gannet has been screened into the assessment of the O&M phase based on the density of birds in flight in the array area plus 2 km buffer and its flight behaviour that places it at risk of collision with the turning blades of the WTGs. Gannet from Grassholm SPA only have connectivity to AyM during the breeding season, therefore, gannet been screened in for the migration-free breeding bio-season only of April to August (Furness, 2015).

951 During the breeding bio-season, when birds are limited in the distance and number of days over which they can forage by the need to return regularly to the nest site, it can be expected that the area in and around AyM will contain a high proportion of adult birds that can be attributed to those designated sites within foraging range. The Grassholm SPA lies within the mean maximum (± SD) foraging range of gannet (315.2±194.2 km; Woodward *et al*., 2019), along with a number of other designated and non-designated sites based on distances around land. Predicted collision mortality has therefore been apportioned to each of these sites following NatureScot (2018) (Annex 5: Ornithology Apportioning Note (application ref: 5.2.5)).

952 Age proportion for gannet has been determined from site specific data. An adult age proportion has been used of 0.94 across the breeding bio-season. Apportioning for the non-breeding bio-seasons have been undertaken using Furness (2015), therefore no additional age ratio is required in these bio-seasons.

Breeding

953 The predicted collision resultant mortality from the operation of AyM in the breeding bio-season (BO2) is 12.2 (1.7-34.9) individuals. Mortality during the breeding bio-season was apportioned to Grassholm SPA following the NatureScot (2018) method. Following this method, 36.7% of birds subject to collision risk may be breeding age individuals from Grassholm SPA. On this basis, 4.2 (0.6-12.1) breeding adults are predicted to suffer collision mortality attributable to this SPA.

Conclusion

954 The potential impact of collision on gannets in the array area during the O&M phase of AyM is a predicted consequent mortality of 4.2 (0.6-12.1) adult birds from Grassholm SPA during the breeding bio-season. When considering the potential impact of this loss to the Grassholm SPA (with a classified gannet population of 66,000 breeding adults and an annual background mortality of 5,346 breeding adults), then using the prediction of 4.2 (0.6-12.1) breeding adults per annum suffering mortality as a consequence of collision would represent a 0.08% (0.01-0.2%) increase in baseline mortality for gannet at Grassholm SPA.

955 The population of gannets has significantly increased since the citation population count, therefore it is also appropriate to assess the potential impact against the latest population count undertaken in 2015 (72,022 breeding adults and therefore a baseline mortality of 5,833.8 breeding adults). On this basis, 4.2 (0.6-12.1) breeding adults, per annum suffering collision consequent mortality at Grassholm SPA would represent a 0.07% (0.01-0.2%) increase in baseline mortality per annum.

956 The potential addition of 4.2 (0.6-12.1) breeding adult gannet mortalities per annum equates to less than 1% increase in baseline mortality for either citation or latest colony count. This increase would be indistinguishable from natural fluctuations in the population and therefore, there would be **no potential for an AEoI to the population conservation objective of the gannet feature at Grassholm SPA in relation to potential adverse collision effects from the O&M phase of AyM alone. Therefore, subject to natural change, gannet would be maintained as a feature in the long term.**

Combined gannet impacts during operation and maintenance

957 As gannet are deemed to be potentially sensitive to both displacement and collision risk, impacts during the operational phase of the project need to be summed. While this results in some degree of double counting, it provides a precautionary approach and is in line with assessing displacement effects as provided in SNCB *et al* (2017). During O&M it is predicted that 0.7 to 0.9 individuals will suffer displacement consequent mortality, whilst 4.2 (0.6-12.1) will suffer collision consequent mortality. This gives a combined 4.9 to 5.1 using 60-80% displacement combined with mean CRM output (1.3-12.8 using 60% displacement combined with minimum and maximum CRM outputs and 1.5-13.0 using 80% displacement combined with minimum and maximum CRM outputs) individuals suffering mortality as a result of AyM during the breeding season attributed to Grassholm SPA.

958 When considering the potential impact of this loss to the Grassholm SPA (with a classified gannet population of 66,000 breeding adults and an annual background mortality of 5,346 breeding adults), then using the prediction of 4.9 to 5.1 (and a range of 1.3 to 13.0) breeding adults per annum suffering mortality as a consequence of collision and displacement would represent a 0.09 to 0.10% (and a range of 0.01 to 0.1%) increase in baseline mortality for gannet at Grassholm SPA.

959 The population of gannets has significantly increased since the citation population count, therefore it is also appropriate to assess the potential impact against the latest population count undertaken in 2015 (72,022 breeding adults and therefore a baseline mortality of 5,834 breeding adults). On this basis, 4.9 to 5.1 (and a range of 1.3 to 13.0) breeding adults, per annum suffering collision and displacement consequent mortality at Grassholm SPA would represent a 0.08% to 0.09% (and a range of 0.02 to 0.2%) increase in baseline mortality per annum.

960 The potential addition of 4.9 to 5.1 (and a range of 1.3 to 13.0) breeding adult gannet mortalities per annum equates to less than 0.3% increase in baseline mortality for either citation or latest colony count. This increase would be indistinguishable from natural fluctuations in the population and therefore, there would be **no potential for an AEoI to the population conservation objective of the gannet feature at Grassholm SPA in relation to potential adverse combined collision and displacement effects from the O&M phase of AyM alone. Therefore, subject to natural change, gannet would be maintained as a feature in the long term.**

961 Gannets are pelagic seabirds with a wide foraging range. Wakefield *et al*. (2013) undertook a foraging study using high-resolution satellite tracking data from 184 chick-rearing northern gannets. Data was taken from 12 of the 26 colonies in the British Isles representing around 80% of the region's breeding population. Tracks from individuals and percentage utilisation distributions showed between-colony variation and spatial segregation, both within and across years. The study determined that the cause of spatial segregation was likely to be due to density-dependent competition, rather than territoriality.

962 Grassholm SPA has been screened in for assessment on request by NRW (Table 1). However, this study demonstrates that breeding gannets from Grassholm SPA forage predominately off the coast of south-west Wales, spreading across to the south of the Republic of Ireland and the west coast of England, with no tracking data overlapping the AyM area. Whereas, gannets from Ailsa Craig SPA are more likely to forage closer to the AyM site, although no tracks overlapped with the offshore windfarm or buffer zone. As gannets have been shown to display spatial segregation between colonies, it is therefore, more likely that gannets within the AyM array area and buffer are attributed to Ailsa Craig SPA, rather than Grassholm SPA during the breeding season. Therefore, impacts from this assessment are deemed highly precautionary for Grassholm SPA and impacts are more likely to be lower than those presented.

10.3.22 Glannau Aberdaron ac Ynys Enlli/ Aberdaron Coast and Bardsey Island SPA

Features and Effects for Assessment

963 Potential for LSE alone has been identified for the following for Aberdaron Coast and Bardsey Island SPA:

- Manx shearwater (breeding and non-breeding) – C&D and O&M Phases, displacement.

964 The relevant conservation objectives (as described in Annex 3) for Aberdaron Coast and Bardsey Island SPA are to maintain or restore the favourable conservation condition of the SPA interest features in favourable condition.

965 Based on the above conservation objective, the specific target for the Manx shearwater feature of the SPA, in order for favourable conservation status to be achieved, is when:

- Breeding population of Manx shearwater (confined to Ynys Enlli) is table or increasing (sustaining a breeding population of at least 10,000 pairs).

Displacement

Manx shearwater

966 Manx shearwater has relatively low vulnerability to vessel movement disturbance associated with construction and decommissioning activity (Furness *et al*., 2013). Additionally, Bradbury *et al*. (2014) assessed regularly occurring UK seabirds to determine their vulnerability to a number of impacts. Their assessment determined Manx shearwater to have very low vulnerability to displacement with offshore wind turbines during operation. This very low likelihood of sensitivity to displacement also infers a highly unlikely chance of barrier effects for commuting Manx shearwater associated with the SPAs. Furthermore, Manx shearwater have very low vulnerability to collision risk with offshore wind turbines (Bradbury *et al*., 2014, Furness *et al*., 2013) due to their low flight heights.

967 However, Manx shearwater was screened into assessment at Stage 2 on a precautionary basis for displacement during construction and decommissioning and O&M, as discussed with Natural Resources Wales during the AyM Environmental Technical Group Meeting (Table 1). Displacement impacts across all phases of development have been presented for Manx shearwater at Aberdaron Coast and Bardsey Island SPA during the migration-free breeding bio-season of June to July and the migration bio-seasons of March to May and August to October.

968 AyM array area is within mean-maximum foraging range for Manx shearwater (1346.8±1018.7 km (Woodward *et al*., 2019)) from Aberdaron Coast and Bardsey Island SPA.

969 Manx shearwater were recorded in six of the 24 aerial digital surveys within the AyM array area plus 2 km buffer, with a peak estimated abundance of 417 individuals in August 2020. Manx shearwater densities ranged from 0.07 to 2.65 individuals/ km^2. Highest densities of Manx shearwater were recorded in May 2020 (2.17 individuals/ km^2) and August 2020 (2.65 individuals/ km^2). The mean peak abundance within the array area plus 2 km buffer was 177 individuals during the return (spring) migration, 26 individuals during the migration-free breeding bio-season and 214 individuals during the post-breeding (autumn) migration.

970 SNCBs consider that displacement and any consequential mortality rates in the assessment should be made using a range of values (SNCB, 2017). For Manx shearwater, the level of displacement was set at 30% to 70% during O&M (and 15% to 35% during construction and decommissioning) as discussed with NRW during the AyM ETG (Table 1). The Applicant deems it appropriate to use a 1% mortality rate, in line with all other species assessed for AyM. The displacement matrix (Volume 4, Annex 4.2) provides the annual total of Manx shearwaters predicted to be at risk of displacement from the AyM array area plus 2 km buffer when applying any value of displacement and mortality.

971 Manx shearwater are difficult to age on surveys, therefore, a generic population age proportion has been used of 0.54 adults across all months of the year taken from Furness (2015).

Breeding

972 During the migration-free breeding bio-season 26 individuals were recorded within the array area plus 2 km buffer. This resulted in an estimated 0.08-0.18 individuals being subjected to displacement induced mortality during O&M and 0.04-0.09 during construction and decommissioning. Using the NatureScot (2018) apportioning tool, 0.005-0.01 displacement induced mortalities of breeding adults have been attributed to Aberdaron Coast and Bardsey Island SPA during O&M (and 0.003-0.006 during construction and decommissioning).

Migratory bio-seasons

973 During the migratory bio-seasons 177 individuals were recorded within the array area plus 2 km buffer during the return migration and 214 during the post-breeding migration. In total, this resulted in an estimated 1.2-2.7 individuals being subjected to displacement induced mortality during the migratory bio-seasons during O&M and 0.6-1.4 during construction and decommissioning. Using data from Furness (2015), 0.02-0.06 displacement induced mortalities of breeding adults have been attributed to Aberdaron Coast and Bardsey Island SPA during O&M (and 0.01-0.03 during construction and decommissioning).

Conclusion

974 Overall, 0.03-0.07 displacement induced mortalities of breeding adults per annum have been attributed to Aberdaron Coast and Bardsey Island SPA during O&M (and 0.01-0.03 during construction and decommissioning).

975 Table 25 and Table 26 presents the apportioning results for Manx shearwater at Aberdaron Coast and Bardsey Island SPA during all bio-seasons during O&M and construction/decommissioning, respectively.

Table 25: Annual apportioning results during O&M attributed for Manx shearwater screened in at Aberdaron Coast and Bardsey Island SPA for displacement risk.

DISPLACEMENT INDUCED MORTALITIES ATTRIBUTED TO SPA	SPA MANX SHEARWATER POPULATION		INCREASE IN BASELINE MORTALITY (%)	
	CITATION (2008)	SMP (2001)	CITATION (2008)	SMP (2001)
0.03-0.07	20,000	32,366	0.001-0.003	0.0007-0.002

Table 26: Annual apportioning results during construction and decommissioning attributed for Manx shearwater screened in at Aberdaron Coast and Bardsey Island SPA for displacement risk.

DISPLACEMENT INDUCED MORTALITIES ATTRIBUTED TO SPA	SPA MANX SHEARWATER POPULATION		INCREASE IN BASELINE MORTALITY (%)	
	CITATION (2008)	SMP (2001)	CITATION (2008)	SMP (2001)
0.01-0.03	20,000	32,366	0.0006-0.001	0.0004-0.0008

976 It should be noted that the apportioning was undertaken using Manx shearwater colonies within UK and the Republic of Ireland only as data was unavailable at the time of writing this report to include all other countries. Therefore, numbers apportioned to Aberdaron Coast and Bardsey Island SPA would be expected to be lower than those presented in this report for Manx shearwater apportioning.

977 To conclude, the potential addition of 0.03-0.07 breeding adult Manx shearwater mortalities per annum during O&M and 0.01-0.03 during construction and decommissioning equates to less than 0.1% increase in baseline mortality for either citation or latest colony count. This increase would be indistinguishable from natural fluctuations in the population. There is, therefore, **no potential for an AEoI to the population conservation objective of the Manx shearwater feature of Aberdaron Coast and Bardsey Island SPA in relation to displacement effects from AyM alone. Therefore, subject to natural change, the Manx shearwater feature will be maintained in the long term with respect to the potential for displacement risk.**

10.3.23 Copeland Island SPA

Features and Effects for Assessment

978 Potential for LSE alone has been identified for the following for Copeland Island SPA:

- Manx shearwater (breeding and non-breeding) – C&D and O&M Phases, displacement.

979 The relevant conservation objectives (as described in Annex 3) for Copeland Island SPA are to maintain each feature in favourable condition.

980 The SPA selection feature objectives are as follows:

- To maintain or enhance the population of the qualifying species;
- Fledging success sufficient to maintain or enhance population;
- To maintain or enhance the range of habitats utilised by the qualifying species;
- To ensure that the integrity of the site is maintained;
- To ensure there is no significant disturbance of the species; and
- To ensure 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; and
  - Structure, function and supporting processes of habitats supporting the species.

981 For each relevant feature there are a number of component objectives which are outlined below:

- Manx shearwater breeding population – no significant decrease in population against national trends; and
- Manx shearwater breeding population – fledging success sufficient to maintain or enhance population.

982 Based on the above conservation objective, the specific relevant target for the Manx shearwater feature of the SPA, in order to achieve favourable condition, is when there is:

- Manx shearwater breeding population – No significant decrease in Manx shearwater breeding population against national trends; and
- Ideally the population will be maintained above 1% of the national population.

Displacement

Manx shearwater

983 Manx shearwater has relatively low vulnerability to vessel movement disturbance associated with construction and decommissioning activity (Furness *et al*., 2013). Additionally, Bradbury *et al*. (2014) assessed regularly occurring UK seabirds to determine their vulnerability to a number of impacts. Their assessment determined Manx shearwater to have very low vulnerability to displacement with offshore wind turbines during operation. This very low likelihood of sensitivity to displacement also infers a highly unlikely chance of barrier effects for commuting Manx shearwater associated with the SPAs. Furthermore, Manx shearwater have very low vulnerability to collision risk with offshore wind turbines (Bradbury *et al*., 2014, Furness *et al*., 2013) due to their low flight heights.

984 However, Manx shearwater was screened into assessment at Stage 2 on a precautionary basis for displacement during construction and decommissioning and O&M, as discussed with Natural Resources Wales during the AyM Environmental Technical Group Meeting (Table 1). Displacement impacts across all phases of development have been presented for Manx shearwater at Copeland Island SPA during the migration-free breeding bio-season of June to July and the migration bio-seasons of March to May and August to October.

985 AyM array area is within mean-maximum foraging range for Manx shearwater (1346.8±1018.7 km (Woodward *et al*., 2019)) from Copeland Island SPA.

986 Manx shearwater were recorded in six of the 24 aerial digital surveys within the AyM array area plus 2 km buffer, with a peak estimated abundance of 417 individuals in August 2020. Manx shearwater densities ranged from 0.07 to 2.65 individuals/ km^2. Highest densities of Manx shearwater were recorded in May 2020 (2.17 individuals/ km^2) and August 2020 (2.65 individuals/ km^2). The mean peak abundance within the array area plus 2 km buffer was 177 individuals during the return (spring) migration, 26 individuals during the migration-free breeding bio-season and 214 individuals during the post-breeding (autumn) migration.

987 SNCBs consider that displacement and any consequential mortality rates in the assessment should be made using a range of values (SNCB, 2017). For Manx shearwater, the level of displacement was set at 30% to 70% during O&M (and 15% to 35% during construction and decommissioning) as discussed with NRW during the AyM ETG (Table 1). The Applicant deems it appropriate to use a 1% mortality rate, in line with all other species assessed for AyM. The displacement matrix (Volume 4, Annex 4.2) provides the annual total of Manx shearwaters predicted to be at risk of displacement from the AyM array area plus 2 km buffer when applying any value of displacement and mortality.

988 Manx shearwater are difficult to age on surveys, therefore, a generic population age proportion has been used of 0.54 adults across all months of the year taken from Furness (2015).

Breeding

989 During the migration-free breeding bio-season 26 individuals were recorded within the array area plus 2 km buffer. This resulted in an estimated 0.08-0.2 individuals being subjected to displacement induced mortality during O&M and 0.04-0.09 during construction and decommissioning. Using the NatureScot (2018) apportioning tool, 0.0005-0.001 displacement induced mortalities of breeding adults have been attributed to Copeland SPA during O&M (and 0.0003-0.0006 during construction and decommissioning).

Migratory bio-seasons

990 During the migratory bio-seasons 177 individuals were recorded within the array area plus 2 km buffer during the return migration and 214 during the post-breeding migration. In total, this resulted in an estimated 1.2-2.7 individuals being subjected to displacement induced mortality during the migratory bio-seasons during O&M and 0.6-1.4 during construction and decommissioning. Data from Furness (2015) was used to apportion impacts during the migratory bio-seasons. Copeland Island SPA, was not a named designated site within the Furness (2015) data, therefore, apportioning calculations were completed using the BDMPS population within Furness (2015) alongside the SPA citation population and assuming 100% of Manx shearwater remained in the BDMPS region during the migratory bio-seasons. Therefore, 0.007-0.02 displacement induced mortalities of breeding adults have been attributed to Copeland Island SPA during O&M (and 0.004-0.008 during construction and decommissioning).

Conclusion

991 Overall, 0.008-0.02 displacement induced mortalities of breeding adults per annum have been attributed to Copeland SPA during O&M (and 0.004-0.009 during construction and decommissioning).

992 Table 27 and Table 28 presents the apportioning results for Manx shearwater at Copeland Island SPA during all bio-seasons during O&M and construction/decommissioning, respectively.

Table 27: Annual apportioning results during O&M attributed for Manx shearwater screened in at Copeland Island SPA for displacement risk.

DISPLACEMENT INDUCED MORTALITIES ATTRIBUTED TO SPA	SPA MANX SHEARWATER POPULATION		INCREASE IN BASELINE MORTALITY (%)	
	CITATION (2010)	SMP (2007)	CITATION (2010)	SMP (2007)
0.008-0.02	9,600	9,700	0.0006-0.001	0.0006-0.001

Table 28: Annual apportioning results during construction and decommissioning attributed for Manx shearwater screened in at Copeland Island SPA for displacement risk.

DISPLACEMENT INDUCED MORTALITIES ATTRIBUTED TO SPA	SPA MANX SHEARWATER POPULATION		INCREASE IN BASELINE MORTALITY (%)	
	CITATION (2010)	SMP (2007)	CITATION (2010)	SMP (2007)
0.004-0.009	9,600	9,700	0.0003-0.0007	0.0003-0.0007

993 It should be noted that the apportioning was undertaken using Manx shearwater colonies within UK and the Republic of Ireland only as data was unavailable at the time of writing this report to include all other countries. Therefore, numbers apportioned to Copeland Island SPA would be expected to be lower than those presented in this report for Manx shearwater apportioning.

994 To conclude, the potential addition of 0.008-0.02 breeding adult Manx shearwater mortalities per annum during O&M and 0.004-0.009 during construction and decommissioning equates to less than 0.1% increase in baseline mortality for either citation or latest colony count. This increase would be indistinguishable from natural fluctuations in the population. There is, therefore, **no potential for an AEoI to the population conservation objective of the Manx shearwater feature of Copeland Island SPA in relation to displacement effects from AyM alone. Therefore, subject to natural change, the Manx shearwater feature will be maintained in the long term with respect to the potential for displacement risk.**

SNCBs advised mortality rates

995 SNCBs advise using a range of mortality rates of 1-10% for all species screened in for displacement and disturbance during the alone assessment. The Applicant deems it appropriate to assess using 1% mortality rate for all designated species in the array area plus buffer and 0.5% for cable installation impacts. These impacts are presented above. However, as SNCBs have requested the assessment using a range of mortality values (Table 1)

996 Table 29 presents the increase in baseline mortality for each designated feature compared to their citation population using a 10% mortality rate and worst-case displacement rates for each species for all screened in features assessed in the array area plus buffer and 5% mortality for impacts in the cable corridor. Mortality rate used in the cable corridor is less than used for assessment in the array area as mortality is expected to be less during cable installation compared to construction and operation in the array area as the impacts are temporary and intermittent. Where citation populations are not available, latest count has been used as a proxy.

Table 29: Increase in baseline mortality using SNCBs advised 10% mortality rate (5% for cable installation impact) for all species screened in for disturbance and displacement impacts.

DESIGNATED SITE	PHASE	SPECIES	IMPACT	CITATION POPULATION SIZE	INCREASE IN BASELINE MORTALITY
Liverpool Bay SPA	Construction and Decommissioning	Red-throated diver	Cable route installation	1,171	0.5%
			Array plus buffer	1,171	2.2%
			Combined construction impacts	1,171	2.7%
		Common scoter	Cable route installation	56,679	1.3%
			Array plus 4 km buffer	56,679	0.01%
			Combined construction impacts	56,679	1.3%
	Operation and Maintenance	Red-throated diver	Array plusbuffer	1,171	4.3%
		Common scoter	Array plus 4 km buffer	56,679	0.02%

DESIGNATED SITE	PHASE	SPECIES	IMPACT	CITATION POPULATION SIZE	INCREASE IN BASELINE MORTALITY
Lambay Island SPA	Construction and Decommissioning	Guillemot	Disturbance/ Displacement	77,998	0.09%
		Razorbill	Disturbance/ Displacement	7,610	0.05%
		Puffin	Disturbance/ Displacement	418	0.005%
	Operation and Maintenance	Guillemot	Disturbance/ Displacement	77,998	0.2%
		Razorbill	Disturbance/ Displacement	7,610	0.09%
		Puffin	Disturbance/ Displacement	418	0.009%
Ailsa Craig SPA	Construction and Decommissioning	Gannet	Disturbance/ Displacement	46,000	0.2%
	Operation and Maintenance	Gannet	Disturbance/ Displacement	46,000	0.3%
		Gannet	Combined Disturbance/ Displacement and	46,000	0.8%

DESIGNATED SITE	PHASE	SPECIES	IMPACT	CITATION POPULATION SIZE	INCREASE IN BASELINE MORTALITY
			Collision Risk		
Ireland's Eye SPA	Construction and Decommissioning	Guillemot	Disturbance/ Displacement	3,950	0.1%
		Razorbill	Disturbance/ Displacement	920	0.08%
	Operation and Maintenance	Guillemot	Disturbance/ Displacement	3,950	0.3%
		Razorbill	Disturbance/ Displacement	920	0.2%
Skomer, Skokholm and the Seas off Pembrokeshire SPA	Construction and Decommissioning	Guillemot	Disturbance/ Displacement	16,644 (SMP 2017-2020)*	0.3%
		Razorbill	Disturbance/ Displacement	8,595 (SMP 2018-2020)*	0.04%
		Puffin	Disturbance/ Displacement	19,000	0.01%
		Manx shearwater	Disturbance/ Displacement	300,000	0.02%
	Operation and	Guillemot	Disturbance/	16,644 (SMP	0.5%

DESIGNATED SITE	PHASE	SPECIES	IMPACT	CITATION POPULATION SIZE	INCREASE IN BASELINE MORTALITY
	Maintenance		Displacement	2017-2020)*	
		Razorbill	Disturbance/ Displacement	8,595 (SMP 2018-2020)*	0.07%
		Puffin	Disturbance/ Displacement	19,000	0.02%
		Manx shearwater	Disturbance/ Displacement	300,000	0.03%
Rathlin Island SPA	Construction and Decommissioning	Puffin	Disturbance/ Displacement	2,398	0.002%
	Operation and Maintenance	Puffin	Disturbance/ Displacement	2,398	0.004%
Saltee Islands SPA	Construction and Decommissioning	Puffin	Disturbance/ Displacement	3,644	0.002%
	Operation and Maintenance	Puffin	Disturbance/ Displacement	3,644	0.003%
Grassholm SPA	Construction and Decommissioning	Gannet	Disturbance/ Displacement	66,000	0.08%
	Operation and	Gannet	Disturbance/	66,000	0.2%

DESIGNATED SITE	PHASE	SPECIES	IMPACT	CITATION POPULATION SIZE	INCREASE IN BASELINE MORTALITY
	Maintenance		Displacement		
		Gannet	Combined Disturbance/ Displacement and Collision Risk	66,000	0.4%
Aberdaron Coast and Bardsey Island SPA	Construction and Decommissioning	Manx shearwater	Disturbance/ Displacement	20,000	0.01%
	Operation and Maintenance	Manx shearwater	Disturbance/ Displacement	20,000	0.03%
Copeland Island SPA	Construction and Decommissioning	Manx shearwater	Disturbance/ Displacement	9,600	0.007%
	Operation and Maintenance	Manx shearwater	Disturbance/ Displacement	9,600	0.01%

*No citation population available, most recent count has been used as a proxy.

Migratory tern species

997 The common, Arctic, Sandwich and roseate tern features of a number of designated sites have been screened in for the assessment of the O&M phase to assess the impacts from collision from AyM alone during the migratory bio-seasons. The designated sites screened in are as follows:

- Liverpool Bay/ Bae Lerpwl SPA (little tern and common tern);
- The Dee Estuary SPA (Sandwich tern, common tern and little tern); and
- Angleysey Terns/ Morwenoliaid Ynys Mon SPA (Sandwich tern, common tern, Arctic tern and roseate tern).

998 The conservation objectives for each of these sites can be found in Annex 3 (application ref: 5.2.3).

999 It is recognised that migratory terns may on some occasions transit via the AyM array area during migratory movements which may not be captured by site specific surveys. Those birds may subsequently collide or be barriered by the AyM array which can result in mortality (due to collision) (Furness *et al*., 2013) or increased energy expenditure (for birds barriered by the array) (Masden *et al* 2009).

1000 Common tern and Sandwich tern are both UK-breeding birds and birds which use UK waters on passage to overwinter in west Africa. Arctic terns are UK-breeding birds and are birds which use UK waters on passage to migrate past the west of Africa to wintering sites around the Antarctic. Details of migratory routes for common, Sandwich and Arctic terns are uncertain, but birds are found all around UK waters. These were both recorded within the AyM array area on migration. On this basis, a migratory CRM has been undertaken for these tern species. Results are presented for both Band Option 1 and 2 for terns using 98% avoidance rate. Details can be found in Annex 4.4 Migratory CRM (application ref: 6.4.4.4). This approach is presented on a SPA and designated feature basis in Table 30.

1001 A small number of roseate terns breeding in the UK, and those birds migrate southwards to wintering sites on the west coast of Africa. This no doubt includes passage through the Irish Sea. Many birds from colonies around the Irish Sea stage in Dublin Bay prior to onward migration, which may mean they are less likely to use the area around AyM. Therefore, there is **no potential for an AEoI to the population conservation objectives of the roseate tern feature of Angleysey Terns/ Morwenoliaid Ynys Mon SPA in relation to collision risk effects during migration from AyM alone.**

1002 Little tern has a wide breeding range. Across its range, little tern breeds on the coast and at inland waterways. However, in Britain and Ireland the species is strictly coastal. Little terns are highly migratory across their northern range with most western European breeding birds migrating to winter in near-shore areas off the west coast of Africa (Wernham et al., 2002; Furness, 2015). Post-breeding migration can be relatively rapid. Birds ringed at Scottish colonies have been recovered in Denmark, in comparison to English birds which have mostly been recovered in the Netherlands, suggesting Scottish little terns may cross the North Sea eastward from Scotland rather than moving south (Wernham et al., 2002; Furness, 2015).

1003 It is largely unknown whether other breeding little terns pass through UK waters on migration. It is assumed that Irish breeding little terns must pass through UK waters during migration between Ireland and West Africa (Furness, 2015). Large numbers are known to breed in Fennoscandia, the Baltic states, Germany and the Netherlands (Mitchell et al., 2004), however there is no evidence of these populations crossing the North Sea into UK waters.

1004 An assessment of little tern migration concluded that the majority of little tern migration is likely to track coastlines in a narrow band from 0 to 10 km from shore (WWT & MacArthur Green, 2014). The BDMPS for little tern is 1,602 for both migratory season in UK western waters (Furness, 2015). During the 24 months of site-specific aerial digital video surveys conducted for AyM (Annex 4.1: Offshore Ornithology Baseline Characterisation Report (application ref: 6.4.4.1)), no little terns were recorded in AyM array area plus 4 km buffer. Based on the above information little terns are highly unlikely to be passing through AyM array area on migration. Therefore, there is **no potential for an AEoI to the population conservation objectives of the little tern feature of any screened in SPA in relation to collision risk effects during migration from AyM alone.**

Table 30: Approach to assessment of migratory terns.

SPA/ RAMSAR SITE	RELEVANT DESIGNATED FEATURES	POTENTIAL FOR AEOI?	JUSTIFICATION
Liverpool Bay/ Bae Lerpwl SPA	Common tern	No	The citation population contributes to 5.8% of the migration population (citation population is 360 individual adults). It is predicted that 0.15 individuals suffer mortality as a consequence of collision per annum during the migratory bio-seasons (BO2), of which 0.009 are attributed to Liverpool Bay SPA. The number of mortalities represent 0.002% of the SPA population. If using a background mortality rate of 0.117 (Horswill and Robinson, 2015), the increase in baseline mortality rate for this SPA is 0.02%. If using BO1 output of 0.53 mortalities, 0.03 would be attributed to this SPA. This would represnt 0.008% of the SPA population and would lead to an increase in baseline mortality rate of 0.07%.

SPA/ RAMSAR SITE	RELEVANT DESIGNATED FEATURES	POTENTIAL FOR AEOI?	JUSTIFICATION
The Dee Estuary SPA	Sandwich tern	No	The citation population contributes to 22.1% of the migration population (citation population is 957 individual adults). It is predicted that 0.1 individuals suffer mortality as a consequence of collision per annum during the migratory bio-seasons (BO2), of which 0.02 are attributed to The Dee Estuary SPA. The number of mortalities represent 0.002% of the SPA population. If using a background mortality rate of 0.102 (Horswill and Robinson, 2015), the increase in baseline mortality rate for this SPA is 0.02%. If using BO1 output of 0.11 mortalities, 0.02 would be attributed to this SPA. This would represnt 0.003% of the SPA population and would lead to an increase in baseline mortality rate of 0.02%.
	Common tern	No	The citation population contributes to 12.6% of the migration population

SPA/ RAMSAR SITE	RELEVANT DESIGNATED FEATURES	POTENTIAL FOR AEOI?	JUSTIFICATION
			(citation population is 784 individual adults). It is predicted that 0.15 individuals suffer mortality as a consequence of collision per annum during the migratory bio-seasons (BO2), of which 0.02 are attributed to The Dee Estuary SPA. The number of mortalities represent 0.002% of the SPA population. If using a background mortality rate of 0.117 (Horswill and Robinson, 2015), the increase in baseline mortality rate for this SPA is 0.02%. If using BO1 output of 0.53 mortalities, 0.07 would be attributed to this SPA. This would represnt 0.008% of the SPA population and would lead to an increase in baseline mortality rate of 0.07%.
Angleysey Terns/ Morwenoliaid Ynys Mon SPA	Sandwich tern	No	The citation population contributes to 21.3% of the migration population (citation population is 920 individual adults). It is predicted that 0.1 individuals

SPA/ RAMSAR SITE	RELEVANT DESIGNATED FEATURES	POTENTIAL FOR AEOI?	JUSTIFICATION
			suffer mortality as a consequence of collision per annum during the migratory bio-seasons (BO2), of which 0.02 are attributed to Angleysey Terns/ Morwenoliaid Ynys Mon SPA. The number of mortalities represent 0.002% of the SPA population. If using a background mortality rate of 0.102 (Horswill and Robinson, 2015), the increase in baseline mortality rate for this SPA is 0.02%. If using BO1 output of 0.11 mortalities, 0.02 would be attributed to this SPA. This would represnt 0.003% of the SPA population and would lead to an increase in baseline mortality rate of 0.02%.
	Common tern	No	The citation population contributes to 6.1% of the migration population (citation population is 378 individual adults). It is predicted that 0.15 individuals suffer mortality as a

SPA/ RAMSAR SITE	RELEVANT DESIGNATED FEATURES	POTENTIAL FOR AEOI?	JUSTIFICATION
			consequence of collision per annum during the migratory bio-seasons (BO2), of which 0.009 are attributed to Angleysey Terns/ Morwenoliaid Ynys Mon SPA. The number of mortalities represent 0.002% of the SPA population. If using a background mortality rate of 0.117 (Horswill and Robinson, 2015), the increase in baseline mortality rate for this SPA is 0.02%. If using BO1 output of 0.53 mortalities, 0.03 would be attributed to this SPA. This would represnt 0.008% of the SPA population and would lead to an increase in baseline mortality rate of 0.07%.
	Arctic tern	No	The citation population contributes to 6.1% of the migration population (citation population is 2580 individual adults). It is predicted that 0.45 individuals suffer mortality as a consequence of collision per annum

SPA/ RAMSAR SITE	RELEVANT DESIGNATED FEATURES	POTENTIAL FOR AEOI?	JUSTIFICATION
			during the migratory bio-seasons (BO2), of which 0.03 are attributed to Angleysey Terns/ Morwenoliaid Ynys Mon SPA. The number of mortalities represent 0.001% of the SPA population. If using a background mortality rate of 0.163 (Horswill and Robinson, 2015), the increase in baseline mortality rate for this SPA is 0.007%. If using BO1 output of 0.79 mortalities, 0.05 would be attributed to this SPA. This would represnt 0.002% of the SPA population and would lead to an increase in baseline mortality rate of 0.01%.

1005 The above potential additional breeding tern mortalities per annum for each SPA equates to less than 1% increase in baseline mortality for each of the citation populations. This increase would be indistinguishable from natural fluctuations in the population for each designated site. There is, therefore, **no potential for an AEoI to the population conservation objectives of the tern features of each screened in SPA in relation to collision risk effects from AyM alone during the migratory bio-seasons. Therefore, subject to natural change, the tern features will be maintained in the long term with respect to the potential for collision risk during migration.**

Migratory non-seabirds

1006 During the ETG process for AyM, NRW requested in their Pre-application Consultation Response (September 2020, Revision: A) (Table 1) the inclusion of Welsh wintering SPAs and their designated wintering features are screening into Stage 2 of the assessment. Table 31 below provides a summary of those site screened into assessment, the relevant designated features, and their distance from the array area of AyM.

Table 31: Wintering estuarine designated sites.

SITE CODE	SPA/ RAMSAR SITE	RELEVANT DESIGNATED FEATURES	DISTANCE FROM ARRAY (KM)
UK9013011	Dee Estuary SPA	Bar-tailed godwit– Wintering Redshank– Passage/ Wintering Shelduck– Wintering Teal – Wintering Pintail– Wintering Oystercatcher– Wintering Grey Plover– Wintering Knot– Wintering Dunlin– Wintering Black-tailed godwit– Wintering Curlew– Wintering Waterbird Assemblage – Wintering	21
UK11082	Dee Estuary Ramsar Site	Criterion 5 Waterbird Assemblage – Wintering Criterion 6 Redshank – Wintering Shelduck – Wintering Teal – Wintering	21

SITE CODE	SPA/ RAMSAR SITE	RELEVANT DESIGNATED FEATURES	DISTANCE FROM ARRAY (KM)
		- Pintail – Wintering - Oystercatcher – Wintering - Grey plover – Wintering - Knot – Wintering - Dunlin – Wintering - Black-tailed godwit – Wintering - Curlew – Wintering - Bar-tailed godwit – Wintering	
UK9013031	Traeth Lafan/ Lavan Sands, Conway Bay SPA	- Oystercatcher – Wintering	21.3
UK9020284	Dyfi Estuary/ Aber Dyfi SPA	- Greenland white-fronted goose– Wintering	95.2
UK9015011	Burry Inlet SPA	- Shelduck – Wintering - Wigeon– Wintering - Teal ¬– Wintering - Pintail – Wintering - Shoveler – Wintering - Oystercatcher – Wintering - Grey plover – Wintering	195.7

SITE CODE	SPA/ RAMSAR SITE	RELEVANT DESIGNATED FEATURES	DISTANCE FROM ARRAY (KM)
		Knot – Wintering Dunlin – Wintering Curlew – Wintering Redshank – Wintering Turnstone – Wintering Whimbrel – Passage Greenshank – Passage Waterbird Assemblage – Wintering	
UK14001	Burry Inlet Ramsar Site	Criterion 3a Waterbird Assemblage – Wintering Criterion 3c Pintail – Wintering Oystercatcher – Wintering Knot – Wintering Redshank – Wintering	195.7
UK9015022	Severn Estuary SPA	Bewick's swan– Wintering Dunlin – Wintering Gadwall– Wintering Greater white-fronted goose – Wintering	204.7

SITE CODE	SPA/ RAMSAR SITE	RELEVANT DESIGNATED FEATURES	DISTANCE FROM ARRAY (KM)
		- Redshank – Wintering - Shelduck – Wintering - Waterbird assemblage – Wintering	
UK11082	Severn Estuary Ramsar Site	- Criterion 5 - Waterbird Assemblage – Wintering - Criterion 6 - Bewick's swan – Wintering - Dunlin – Wintering - Gadwall – Wintering - Greater white-fronted goose – Wintering - Redshank – Wintering - Shelduck – Wintering - Pintail – Wintering - Teal – Wintering - Ringed plover– Passage	204.7

1007 No migratory waterfowl or waders were recorded flying within the survey area by site specific surveys (Volume 4, Annex 4.1). Despite this, it is recognised that migratory waterbirds may on some occasions transit via the AyM array area during migratory movements which may not be captured by site specific surveys. Those birds may subsequently collide or be barriered by the AyM array which can result in mortality (due to collision) (Furness *et al*., 2013) or increased energy expenditure (for birds barriered by the array) (Masden *et al* 2009).

1008 On this basis, a migratory CRM has been undertaken for those species, in particular non-seabirds. Results are presented for Band Option 1 for migratory non-seabirds using 98% avoidance rate. Details can be found in Annex 4.4 Migratory CRM (application ref: 6.4.4.4). Impacts were apportioned to designated sites based on citation populations as a proportion of regional populations (presented in Annex 4.4 Migratory CRM (application ref: 6.4.4.4)) for each species. This approach is presented on a SPA and designated feature basis in Table 32, with the justification of assessment conclusion provided in Table 33.

Table 32: Approach to assessment of migratory non-seabirds

SPA/ RAMSAR SITE[lx] (DISTANCE TO SITE)	RELEVANT DESIGNATED FEATURES	POTENTIAL FOR AEOI?	JUSTIFICATION
Liverpool Bay/ Bae Lerpwl SPA (0.1)	Red-breasted merganser	No	There is no citation population available, therefore, the mean of the peak population of 160 individuals taken from Lawson *et al*., 2016 has been used in this assessment. The population contributes to 1.5% of the migration population. It is predicted that 0.04 individuals suffer mortality as a consequence of collision per annum during the migratory bio-seasons (BO1), of which 0.0006 are attributed to Liverpool Bay SPA. The number of mortalities represent 0.0004% of the SPA population.
Dee Estuary SPA and Ramsar site (21)	Bar-tailed godwit – Wintering	No	CRM was not undertaken for this species as less than 1% of the UK population pass through AyM array area annually. Therefore no AEoI is likely for this species. Additionally, Justification: 1, 2 & 3 in Table 33 provide further detail on the

[lx] Note: A number of Ramsar sites linked to the SPAs identified by NRW have been included in this report.

SPA/ RAMSAR SITE[lx] (DISTANCE TO SITE)	RELEVANT DESIGNATED FEATURES	POTENTIAL FOR AEOI?	JUSTIFICATION
			determination of no AEoI for this species.
	Redshank - Wintering	No	There is no indication within the citation documentation of which redshank race winters in the Dee Estuary SPA and Ramsar. It is expected that the majority of British breeding redshank (*britannica*) move south to France during the migration period. Therefore for the purposes of this assessment, both *robusta* and *totanus* have been assessed. The citation population of *robusta* contributes to between 1.3-3.5% of the migration population (citation population of 5,293 individuals). It is predicted that between 0.58 and 1.53 individuals suffer mortality as a consequence of collision per annum during the migratory bio-seasons (BO1), of which 0.02 are attributed to Dee Estuary SPA and Ramsar. The number of mortalities represent 0.0004% of the SPA/Ramsar population.

SPA/ RAMSAR SITE[lx] (DISTANCE TO SITE)	RELEVANT DESIGNATED FEATURES	POTENTIAL FOR AEOI?	JUSTIFICATION
			The citation population of *totanus* contributes to 21.2% of the migration population (citation population of 5,293 individuals). It is predicted that 0.06 individuals suffer mortality as a consequence of collision per annum during the migratory bio-seasons (BO1), of which 0.01 are attributed to Dee Estuary SPA/Ramsar. The number of mortalities represent 0.0002% of the SPA/Ramsar population.
	Shelduck – Wintering	No	CRM was not undertaken for this species as less than 1% of the UK population pass through AyM array area annually. Therefore no AEoI is likely for this species. Additionally, Justification: 1, 2 & 3 in Table 33 provide further detail on the determination of no AEoI for this species.
	Teal – Wintering	No	
	Pintail – Wintering	No	
	Oystercatcher – Wintering	No	The citation population contributes to 7.4% of the migration population (citation

SPA/ RAMSAR SITE[lx] (DISTANCE TO SITE)	RELEVANT DESIGNATED FEATURES	POTENTIAL FOR AEOI?	JUSTIFICATION
			population is 22,677 individuals). It is predicted that 1.11 individuals suffer mortality as a consequence of collision per annum during the migratory bio-seasons (BO1), of which 0.08 are attributed to Dee Estuary SPA/Ramsar. The number of mortalities represent 0.0004% of the SPA/Ramsar population.
	Grey plover – Wintering	No	CRM was not undertaken for this species as less than 1% of the UK population pass through AyM array area annually. Therefore no AEoI is likely for this species. Additionally, Justification: 1, 2 & 3 in Table 33 provide further detail on the determination of no AEoI for this species.
	Knot – Wintering	No	The citation population contributes to 4.7% of the migration population (citation population is 12,394 individuals). It is predicted that 0.57 individuals suffer mortality as a consequence of collision

SPA/ RAMSAR SITE[lx] (DISTANCE TO SITE)	RELEVANT DESIGNATED FEATURES	POTENTIAL FOR AEOI?	JUSTIFICATION
			per annum during the migratory bio-seasons (BO1), of which 0.03 are attributed to Dee Estuary SPA/Ramsar. The number of mortalities represent 0.0002% of the SPA/Ramsar population.
	Dunlin – Wintering	No	CRM was not undertaken for this species as less than 1% of the UK population pass through AyM array area annually. Therefore no AEoI is likely for this species. Additionally, Justification: 1, 2 & 3 in Table 33 provide further detail on the determination of no AEoI for this species.
	Black-tailed godwit – Wintering	No	The citation population contributes to 4.3% of the migration population (citation population is 1,747 individuals). It is predicted that 0.28 individuals suffer mortality as a consequence of collision per annum during the migratory bio-seasons (BO1), of which 0.01 are attributed to Dee Estuary SPA/Ramsar.

SPA/ RAMSAR SITE[lx] (DISTANCE TO SITE)	RELEVANT DESIGNATED FEATURES	POTENTIAL FOR AEOI?	JUSTIFICATION
			The number of mortalities represent 0.0007% of the SPA/Ramsar population.
	Curlew – Wintering	No	The citation population contributes to 2.8% of the migration population (citation population is 3,899 individuals). It is predicted that 0.47 individuals suffer mortality as a consequence of collision per annum during the migratory bio-seasons (BO1), of which 0.01 are attributed to Dee Estuary SPA/Ramsar. The number of mortalities represent 0.0003% of the SPA/Ramsar population.
Dee Estuary SPA only (21)	Redshank – passage	No	There is no indication within the citation documentation of which redshank race are designated as passage features of the Dee Estuary SPA, therefore all have been assessed here. The citation population of *britannica* contributes to 20.0% of the migration

SPA/ RAMSAR SITE[lx] (DISTANCE TO SITE)	RELEVANT DESIGNATED FEATURES	POTENTIAL FOR AEOI?	JUSTIFICATION
			population (citation population of 8,795 individuals). It is predicted that 0.16 individuals suffer mortality as a consequence of collision per annum during the migratory bio-seasons (BO1), of which 0.03 are attributed to Dee Estuary SPA. The number of mortalities represent 0.0004% of the SPA population. The citation population of *robusta* contributes to between 2.2-5.9% of the migration population (citation population of 8,795 individuals). It is predicted that between 0.58 and 1.53 individuals suffer mortality as a consequence of collision per annum during the migratory bio-seasons (BO1), of which 0.03 are attributed to Dee Estuary SPA. The number of mortalities represent 0.0004% of the SPA population. The citation population of *totanus* contributes to 35.2% of the migration population (citation population of 8,795

SPA/ RAMSAR SITE[lx] (DISTANCE TO SITE)	RELEVANT DESIGNATED FEATURES	POTENTIAL FOR AEOI?	JUSTIFICATION
			individuals). It is predicted that 0.06 individuals suffer mortality as a consequence of collision per annum during the migratory bio-seasons (BO1), of which 0.02 are attributed to Dee Estuary SPA. The number of mortalities represent 0.0002% of the SPA population.
	Waterbird Assemblage – Wintering Including great crested grebe, cormorant, shelduck, wigeon, teal, pintail, oystercatcher, grey plover, lapwing, knot, sanderling, dunlin, black-tailed godwit, bar-tailed godwit, curlew and redshank.	No	There are 120,726 individual waterbirds that contribute to the waterbird assemblage feature. The impacts are very small for those species screened in for CRM as detailed in Annex 4 (application ref: 6.4.4.4). Therefore, no AeoI is expected to the waterbird assemblage feature of this SPA. Additionally, Justification: 1, 2 & 3 in Table 33 provide further detail on the determination of no AEoI for this feature.
Dee Estuary Ramsar site only (21)	Waterbird Assemblage – Wintering Bewick's swan, white-fronted goose, dunlin, shelduck,	No	There are 120,726 individual waterbirds that contribute to the waterbird assemblage feature. The impacts are very small for those species screened in

SPA/ RAMSAR SITE[lx] (DISTANCE TO SITE)	RELEVANT DESIGNATED FEATURES	POTENTIAL FOR AEOI?	JUSTIFICATION
	gadwall, wigeon, teal, pintail, pochard, tufted duck, grey plover, curlew, whimbrel, lapwing, mallard, shoveler.		for CRM as detailed in Annex 4 (application ref: 6.4.4.4). Therefore, no AEoI is expected for the waterbird assemblage feature of this Ramsar. Additionally, Justification: 1, 2 & 3 in Table 33 provide further detail on the determination of no AEoI for this feature.
Traeth Lafan/Lavan Sands, Conway Bay SPA (21.3)	Oystercatcher - Wintering	No	The citation population contributes to 1.3% of the migration population (citation population is 4,000 individuals). It is predicted that 1.11 individuals suffer mortality as a consequence of collision per annum during the migratory bio-seasons (BO1), of which 0.01 are attributed to Traeth Lafan/Lavan Sands, Conway Bay SPA. The number of mortalities represent 0.0004% of the SPA population.
	Curlew	No	There is no citation population available, therefore, the population of 1,500 individuals from the Natura 2000

SPA/ RAMSAR SITE[lx] (DISTANCE TO SITE)	RELEVANT DESIGNATED FEATURES	POTENTIAL FOR AEOI?	JUSTIFICATION
			standard data form has been used in this assessment. The population contributes to 1.1% of the migration population. It is predicted that 0.47 individuals suffer mortality as a consequence of collision per annum during the migratory bio-seasons (BO1), of which 0.005 are attributed to Traeth Lafan/Lavan Sands, Conway Bay SPA. The number of mortalities represent 0.0003% of the SPA population.
	Great crested grebe	No	Details of migratory movements of great crested grebe are poorly understood, however bird moving from Holarctic breeding grounds to overwinter in Britain, Ireland and Europe may use any of the waters around the UK. Additionally, Justification: 1, 2 & 3 in Table 33 provide further detail on the determination of no AEoI for this species.

SPA/ RAMSAR SITE[lx] (DISTANCE TO SITE)	RELEVANT DESIGNATED FEATURES	POTENTIAL FOR AEOI?	JUSTIFICATION
	Red-breasted merganser	No	There is no citation population available, therefore, the population of 120 individuals from the Natura 2000 standard data form has been used in this assessment. The population contributes to 1.1% of the migration population. It is predicted that 0.04 individuals suffer mortality as a consequence of collision per annum during the migratory bio-seasons (BO1), of which 0.0004 are attributed to Traeth Lafan/Lavan Sands, Conway Bay SPA. The number of mortalities represent 0.0004% of the SPA population.
Dyfi Estuary/ Aber Dyfi SPA (95.2)	Greenland white-fronted goose – Wintering	No	CRM was not undertaken for this species as less than 1% of the UK population pass through AyM array area annually. Therefore no AEoI is likely for this species. Additionally, GPS tracking data from birds tagged at Dyfi Estuary show migration routes between breeding

SPA/ RAMSAR SITE[lx] (DISTANCE TO SITE)	RELEVANT DESIGNATED FEATURES	POTENTIAL FOR AEOI?	JUSTIFICATION
			locations in Greenland and their wintering location at Dyfi Estuary SPA (WWT & RSPB Wales, 2020). All migratory movements occur along the west Wales coast in a northwestern direction as it is the shortest route to migration stop over sites in Mull and the Outer Hebrides. No GPS routes were found to the east of Bangor. Therefore, there is no evidence of connectivity between Dyfi Estuary SPA and AyM.
Burry Inlet SPA and Ramsar site (195.7)	Pintail - Wintering	No	CRM was not undertaken for this species as less than 1% of the UK population pass through AyM array area annually. Therefore no AEoI is likely for this species. Additionally, Justification: 1, 2 & 3 in Table 33 provide further detail on the determination of no AEoI for this species.
	Oystercatcher – Wintering	No	The citation population contributes to 4.5% of the migration population (citation

SPA/ RAMSAR SITE[lx] (DISTANCE TO SITE)	RELEVANT DESIGNATED FEATURES	POTENTIAL FOR AEOI?	JUSTIFICATION
			population is 13,590 individuals). It is predicted that 1.11 individuals suffer mortality as a consequence of collision per annum during the migratory bio-seasons (BO1), of which 0.05 are attributed to Burry Inlet SPA/Ramsar. The number of mortalities represent 0.0004% of the SPA/Ramsar population.
	Knot – Wintering	No	The citation population contributes to 0.8% of the migration population (citation population is 2,153 individuals). It is predicted that 0.57 individuals suffer mortality as a consequence of collision per annum during the migratory bio-seasons (BO1), of which 0.005 are attributed to Burry Inlet SPA/Ramsar. The number of mortalities represent 0.0002% of the SPA/Ramsar population.
	Redshank – Wintering	No	There is no indication within the citation

SPA/ RAMSAR SITE[lx] (DISTANCE TO SITE)	RELEVANT DESIGNATED FEATURES	POTENTIAL FOR AEOI?	JUSTIFICATION
			documentation of which redshank race winters in the Burry Inlet SPA/Ramsar. It is expected that the majority of British breeding redshank (*britannica*) move south to France during the migration period. Therefore for the purposes of this assessment, both *robusta* and *totanus* have been assessed. The citation population of *robusta* contributes to between 0.2-0.4% of the migration population (citation population of 616 individuals). It is predicted that between 0.58 and 1.53 individuals suffer mortality as a consequence of collision per annum during the migratory bio-seasons (BO1), of which 0.002 are attributed to Burry Inlet SPA/Ramsar. The number of mortalities represent 0.0004% of the SPA/Ramsar population. The citation population of *totanus* contributes to 2.5% of the migration

SPA/ RAMSAR SITE[lx] (DISTANCE TO SITE)	RELEVANT DESIGNATED FEATURES	POTENTIAL FOR AEOI?	JUSTIFICATION
			population (citation population of 616 individuals). It is predicted that 0.06 individuals suffer mortality as a consequence of collision per annum during the migratory bio-seasons (BO1), of which 0.001 are attributed to Burry Inlet SPA/Ramsar. The number of mortalities represent 0.0002% of the SPA/Ramsar population.
Burry Inlet SPA only(195.7)	Shelduck – Wintering	No	CRM was not undertaken for this species as less than 1% of the UK population pass through AyM array area annually. Therefore no AEoI is likely for this species. Additionally, Justification: 1, 2 & 3 in Table 33 provide further detail on the determination of no AEoI for this species.
	Wigeon – Wintering	No	
	Teal – Wintering	No	
	Shoveler – Wintering	No	
	Grey plover – Wintering	No	CRM was not undertaken for this species as less than 1% of the UK population pass through AyM array area annually. Therefore no AEoI is likely for this species.

SPA/ RAMSAR SITE[lx] (DISTANCE TO SITE)	RELEVANT DESIGNATED FEATURES	POTENTIAL FOR AEOI?	JUSTIFICATION
			Additionally, Justification: 1, 2 & 3 in Table 33 provide further detail on the determination of no AEoI for this species.
	Dunlin – Wintering	No	CRM was not undertaken for this species as less than 1% of the UK population pass through AyM array area annually. Therefore no AEoI is likely for this species. Additionally, Justification: 1, 2 & 3 in Table 33 provide further detail on the determination of no AEoI for this species.
	Curlew – Wintering	No	There was no citation population available, the following analysis is based on the Natura 2000 standard data form population of 1500 birds. The population contributes to 1.1% of the migration population. It is predicted that 0.47 individuals suffer mortality as a consequence of collision per annum during the migratory bio-seasons (BO1), of which 0.005 are attributed to Burry Inlet SPA. The number of mortalities

SPA/ RAMSAR SITE[lx] (DISTANCE TO SITE)	RELEVANT DESIGNATED FEATURES	POTENTIAL FOR AEOI?	JUSTIFICATION
			represent 0.0003% of the SPA population.
	Turnstone – Wintering	No	There is no citation population available, therefore, the population of 470 individuals taken from Natura 2000 standard data form has been used in this assessment. The population contributes to 1.1% of the migration population. It is predicted that 0.11 individuals suffer mortality as a consequence of collision per annum during the migratory bio-seasons (BO1), of which 0.001 are attributed to Burry Inlet SPA. The number of mortalities represent 0.0003% of the SPA population.
	Waterbird Assemblage – Wintering Including curlew, dunlin, grey plover, knot, oystercatcher, pintail, redshank, shelduck, shoveler, teal, turnstone and	No	There are 34,962 individual waterbirds (Natura 2000 standard data form) that contribute to the waterbird assemblage feature. The impacts are very small for those species screened in for CRM as detailed in Annex 4 (application ref: 6.4.4.4). Therefore, no AEoI is expected

SPA/ RAMSAR SITE[lx] (DISTANCE TO SITE)	RELEVANT DESIGNATED FEATURES	POTENTIAL FOR AEOI?	JUSTIFICATION
	wigeon.		for the waterbird assemblage feature of this SPA. Additionally, Justification: 1, 2 & 3 in Table 33 provide further detail on the determination of no AEoI for this feature.
Burry Inlet Ramsar Site only (195.7)	Waterbird Assemblage (no names) – Wintering	No	There are 34,962 individual waterbirds (Natura 2000 standard data form) that contribute to the waterbird assemblage feature. There are no named components of the waterbird assemblage feauure, however all impacts are very small for those species screened in for CRM as detailed in Annex 4 (application ref: 6.4.4.4). Therefore, no AEoI is expected for the waterbird assemblage feature of this Ramsar. Additionally, Justification: 1, 2 & 3 in Table 33 provide further detail on the determination of no AEoI for this feature.
Severn Estuary SPA and Ramsar site (204.7)	Bewick's swan – Wintering	No	Bewick's swan was not screened in for migropath assessment as only a small number of birds cross from Britain to overwinter in Ireland, in winter 2020/21

SPA/ RAMSAR SITE[lx] (DISTANCE TO SITE)	RELEVANT DESIGNATED FEATURES	POTENTIAL FOR AEOI?	JUSTIFICATION
			only 12 individuals, so unlikely that this species is at risk from AyM due to collision risk. Additionally, Justification: 1, 2 & 3 in Table 33 provide further detail on the determination of no AEoI for this species.
	Dunlin – Wintering	No	CRM was not undertaken for this species as less than 1% of the UK population pass through AyM array area annually. Therefore no AEoI is likely for this species. Additionally, Justification: 1, 2 & 3 in Table 33 provide further detail on the determination of no AEoI for this species.
	Gadwall – Wintering	No	
	Greater white-fronted goose – Wintering	No	
	Shelduck	No	
	Redshank – Wintering	No	There is no indication within the citation documentation of which redshank race winters in the Seven Estuary SPA/Ramsar. It is expected that the majority of British breeding redshank (*britannica*) move south to France during the migration

SPA/ RAMSAR SITE[lx] (DISTANCE TO SITE)	RELEVANT DESIGNATED FEATURES	POTENTIAL FOR AEOI?	JUSTIFICATION
			period. Therefore for the purposes of this assessment, both *robusta* and *totanus* have been assessed. The citation population of *robusta* contributes to between 0.5-1.3% of the migration population (citation population of 2,013 individuals). It is predicted that between 0.58 and 1.53 individuals suffer mortality as a consequence of collision per annum during the migratory bio-seasons (BO1), of which 0.008 are attributed to Severn Estuary SPA/Ramsar. The number of mortalities represent 0.0004% of the SPA/Ramsar population. The citation population of *totanus* contributes to 8.1% of the migration population (citation population of 2,013 individuals). It is predicted that 0.06 individuals suffer mortality as a consequence of collision per annum during the migratory bio-seasons (BO1),

SPA/ RAMSAR SITE[lx] (DISTANCE TO SITE)	RELEVANT DESIGNATED FEATURES	POTENTIAL FOR AEOI?	JUSTIFICATION
			of which 0.005 are attributed to Severn Estuary SPA/Ramsar. The number of mortalities represent 0.0002% of the SPA/Ramsar population.
Severn Estuary SPA only (204.7)	Waterbird assemblage – Wintering Bewick's swan, Shelduck, Gadwall, Dunlin, Redshank	No	There are 68,026 individual waterbirds that contribute to the waterbird assemblage feature. The impacts are very small for those species screened in for CRM as detailed in Annex 4 (application ref: 6.4.4.4). Therefore, no AEoI is expected for the waterbird assemblage feature of this SPA. Additionally, Justification: 1, 2 & 3 in Table 33 provide further detail on the determination of no AEoI for this feature.
Severn Estuary Ramsar Site only (204.7)	Pintail – Wintering	No	CRM was not undertaken for this species as less than 1% of the UK population pass through AyM array area annually. Therefore no AEoI is likely for this species. Additionally, Justification: 1, 2 & 3 in Table 33 provide further detail on the
	Teal – Wintering	No	

SPA/ RAMSAR SITE[lx] (DISTANCE TO SITE)	RELEVANT DESIGNATED FEATURES	POTENTIAL FOR AEOI?	JUSTIFICATION
			determination of no AEoI for this species.
	Ringed plover – Passage	No	The citation population during spring passage is 442 and during autumn passage is 1,573. The averaged population contributes to 2.4% of the migration population. It is predicted that 0.14 individuals suffer mortality as a consequence of collision per annum during the migratory bio-seasons (BO1), of which 0.003 are attributed to Severn Estuary Ramsar. The number of mortalities represent 0.0003% of the Ramsar population.
	Waterbird Assemblage – Wintering Bewick's swan, dunlin, redshank, white-fronted goose, shelduck, gadwall, wigeon, whimbrel, teal,	No	There are 68,026 individual waterbirds that contribute to the waterbird assemblage feature. The impacts are very small for those species screened in for CRM as detailed in Annex 4 (application ref: 6.4.4.4). Therefore, no

SPA/ RAMSAR SITE[lx] (DISTANCE TO SITE)	RELEVANT DESIGNATED FEATURES	POTENTIAL FOR AEOI?	JUSTIFICATION
	pintail, pochard, ringed plover, grey plover, curlew, spotted redshank, tufted duck.		AEoI is expected for the waterbird assemblage feature of this Ramsar. Additionally, Justification: 1, 2 & 3 in Table 33 provide further detail on the determination of no AEoI for this feature.

Table 33: Justification for assessment conclusions

JUSTIFICATION	OVERVIEW	DETAILS
Justification 1	The proportion of population that will be in contact with the proposed windfarm is inadequate to impact the population.	WWT Consulting undertook a detailed evaluation of the impact of all Scottish offshore windfarms on migratory bird species (WWT, 2014). Using migratory routed identified in Wright *et al*. (2012), proportions of the populations likely to pass the windfarm sites were estimated and used to determine collision risk using the Band model (Band, 2012). (The Band model estimates the number of individuals likely to collide with turbine blades by combining bird metrics e.g., flight height, flight speed, avoidance rate, with wind farm data e.g., number of turbines, turbine height, as well as information on day length). The study concluded that non-seabird species have very low collision estimates in relation to their populations. As cautious metrics were used (over-estimated), the collision risk is likely to be even lower than suggested. In response to the impact of the proposed windfarm, the above study

JUSTIFICATION	OVERVIEW	DETAILS
		accounted for all Scottish offshore windfarms – therefore the impact of the singular windfarm proposed will have even less of an impact on the population. The AyM windfarm will therefore not have a detrimental impact on the species in question.
Justification 2	The energy expenditure of birds avoiding the windfarm during their migration is negligible, therefore will not cause any detrimental effects.	Migratory birds may pass windfarms during their migrations; however, the impact is vastly different to species that may have come into contact with windfarms daily (e.g., central place foragers during the breeding season). Migratory species are consequently less at risk from adverse impacts caused by the "barrier effect". The costs of one-off avoidances during migration are trivial, accounting for less than 2%3 of available fat reserves (Masden *et al*., 2009 – common eider; Speakman *et al*., 2009 – red-throated diver, whooper swan, common scoter, Sandwich tern). The impacts on birds that only migrate through the AyM windfarm are therefore considered to be negligible.
Justification 3	Significant distance from SPA/ Ramsar reduces significance of effect.	The significance of effects at a population level is considered to decrease with distance and the severity of the effect experienced locally. For these species, the likelihood and or severity of the effect experienced locally is considered to be low and small to negligible. The lack of this species recorded flying through the array by site specific surveys reduces the likelihood of exposure and severity of effects that might occur at population level to this SPA or Ramsar site. It is determined that significant effects would not therefore manifest on this

JUSTIFICATION	OVERVIEW	DETAILS
		distant SPA/ Ramsar after the likelihood and severity of effects on the SPA have been diluted over distance and impacts have been apportioned to all SPAs within foraging range.

1009 Based on the justifications provided above which highlight the very low anticipated effect of collision to migratory features associated with the above designated sites, and the significant distance between the AyM array and designated sites, **there would be no potential for an AEoI to the Conservation Objectives of wintering features at the above SPAs and Ramsar sites in relation to potential adverse effects of AyM alone and or in-combination with other plans or projects.**

10.4 Onshore Ecology

1010 No sites have been screened in for onshore ecology and therefore **no assessment of potential AEoI alone is required.**

10.5 Migratory Fish

1011 A description of the significance of project level effects upon the receptors grouped under 'migratory fish', as relevant to the designated site and its associated features screened in for LSE (as summarised in Table 4), is provided below.

1012 Two sites have been screened in for migratory fish. The sites and relevant features of those sites for the migratory fish assessment are as follows:

- Dee Estuary/ Aber Dyfrdwy (UK) SAC:
  - Sea lamprey; and
  - River lamprey.
- River Dee and Bala Lake/ Afon Dyfrdwy a Llyn Tegid SAC:
  - Atlantic salmon;
  - Sea lamprey; and
  - River lamprey.

1013 The conservation objectives for the Dee Estuary/ Aber Dyfrdwy (UK) SAC (Natural England, 2018a) and for the river Dee and Bala Lake/ Afon Dyfrdwy a Llyn Tegid SAC (Natural England, 2018b) with regard the natural habitats and/or species for which the site has been designated, and subject to natural change are to ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the Favourable Conservation Status of its Qualifying Features, by maintaining or restoring:

- The extent and distribution of qualifying natural habitats and habitats of qualifying species;
- The structure and function (including typical species) of qualifying natural habitats;
- The structure and function of the habitats of qualifying species;
- The supporting processes on which qualifying natural habitats and the habitats of qualifying species rely;
- The populations of qualifying species; and,
- The distribution of qualifying species within the site.

1014 The key point for migratory fish under the current assessment relates to the array and ECC and therefore to the features at sea and in relation to entry/exit at the mouth of the Dee Estuary. The assessment is therefore made jointly for the two sites, in the context of the relevant sites objectives, condition and the addition of Atlantic salmon to the River Dee and Bala Lake/ Afon Dyfrdwy a Llyn Tegid SAC.

1015 The effects screened in for both sites and all features are as follows:

- Construction and Decommissioning:
- Underwater noise;
- Suspended sediment and deposition; and
- Pollution.
- O&M:
- Pollution; and
- EMF.

10.5.1 Underwater Noise (Construction, Decommissioning)

1016 Effects on migratory fish from noise are most likely to occur during the construction phase, with any effects during decommissioning expected to be less. As detailed in ES Volume 2, Chapter 6, there are several activities that have the potential to introduce an effect receptor pathway for underwater noise. These can be broadly characterised as underwater noise associated with: foundation installation; general seabed clearance; cable installation (including HDD and cofferdam installation) and vessel operations; and UXO specific seabed clearance. The relevance to migratory fish species is discussed in detail in Volume 2, Chapter 6 and summarised below.

1017 Underwater noise can potentially have a negative impact on fish species ranging from physical injury/mortality to behavioural impacts to masking of communication. In general, biological damage as a result of underwater noise is either related to a large pressure change (barotrauma) or to the total quantity of sound energy received by a receptor. Barotrauma injury can result from exposure to a high intensity sound even if the sound is of short duration (i.e. UXO clearance or a single strike of a piling hammer). However, when considering injury due to the energy of an exposure, the duration of the exposure and total energy received by the receptor becomes important. Fish are also considered to be sensitive to the particle motion element of underwater noise.

1018 Fish receptors can be grouped into the Popper *et al*. (2014) categories (see Table 4 of ES Volume 4, Annex 6.2: Subsea Noise Technical Report (application ref: 6.4.6.2)) based on their hearing system:

- Fish with no swim bladder or other gas chamber – which includes lamprey, and are sensitive only to particle motion and show sensitivity only to a narrow band of frequencies.
- Fish with swim bladders in which hearing does not involve the swim bladder or other gas volume – which includes salmonids, such as Atlantic salmon, and are more sensitive to particle motion than sound pressure (Popper *et al*. (2014).
- Fish in which hearing involves a swim bladder or other gas volume – e.g. clupeids such as shad species are primarily sensitive to sound pressure, although they also detect particle motion (Hawkins and Popper, 2016).

1019 The extent to which intense underwater sound might cause an adverse environmental impact in a particular fish species is dependent upon the level of sound pressure or particle motion, its frequency, duration and/or repetition (Hastings and Popper, 2005). The range of potential effects from intense sound sources, such as pile driving and explosions, includes immediate death, permanent or temporary tissue damage and hearing loss, behavioural changes and masking effects (Popper *et al*., 2014). Tissue damage can result in eventual death or may make the fish less fit until healing occurs, resulting in lower survival rates. Hearing loss can also lower fitness until hearing recovers.

1020 The potential for mortality or mortal injury is likely to only occur in close proximity to the sound source, although for impact piling the risk of this occurring will be reduced by use of soft start techniques at the start of the piling sequence. This means that fish near to piling operations will likely move outside of the impact range, before noise levels reach a level likely to cause irreversible injury. Whilst ADDs would be used prior to a UXO detonation, the reaction of free-swimming fish to ADDs is unknown and, based on anecdotal evidence from UXO campaigns where records have been made of fish floating at the surface after an explosion, it is possible that some fish will experience these mortality and injurious impacts.

1021 Recoverable injury is a survivable injury with full recovery occurring after exposure, although decreased fitness during this recovery period may result in increased susceptibility to predation or disease (Popper *et al*. 2014). The impact ranges for recoverable injury and mortality/ potential mortal injury are more or less the same due to the thresholds used.

1022 Temporary threshold shift (TTS) is a temporary reduction in hearing sensitivity caused by exposure to intense sound. TTS results from temporary changes in sensory hair cells of the inner ear and/or damage to auditory nerves. However, sensory hair cells are constantly added to fish and are replaced when damaged and therefore the extent of TTS is of variable duration and magnitude, with no potential for this to lead to permanent effects. Normal hearing ability returns following cessation of the noise causing TTS. When experiencing TTS, fish may have decreased fitness due to a reduced ability to communicate, detect predators or prey, and/ or assess their environment. Volume 4, Annex 6.2 presents the ranges at which TTS in fish may occur as a result of piling operations during the AyM construction phase. There are no available thresholds for TTS effects from other noise sources, however, any impacts are likely to be localised, and for single sound sources such as that from UXO explosions, effects are likely to be within that from cumulated piling exposure.

1023 Behavioural effects in response to construction related underwater noise include a wide variety of responses including startle responses (C-turn), strong avoidance behaviour, changes in swimming or schooling behaviour, or changes of position in the water column (e.g. Hawkins *et al*. 2014). Depending on the strength of the response and the duration of the impact, there is the potential for some of these responses to lead to significant effects at an individual level (e.g. reduced fitness, increased susceptibility to predation) or at a population level (e.g. avoidance or delayed migration to key spawning grounds). Popper *et al*. (2014) provide qualitative behavioural criteria for fish from a range of sources. These behavioural criteria are summarised in Table 7 of ES Volume 4, Annex 6.2.

1024 Table 34 below summarises the maximum predicted impact ranges for mortality, injury, TTS and behavioural effects described above, in Atlantic salmon and lamprey spp. for pile driving using a 15 m diameter pile. UXO detonations are considered to have a lower likelihood of triggering a population level effect than that associated from piling operations, due to the significantly reduced temporal footprint that would arise from UXO operations, therefore effects are likely to be within that from cumulated piling exposure.

Table 34: Summary of the maximum modelled impact ranges for 15 m diameter piles for Atlantic salmon and lamprey sp.

IMPACT	FEATURE	MAXIMUM PREDICTED IMPACT RANGES FROM PILING ACTIVITY.
Mortality and mortal injury (piling)	Sea lamprey	Spatial MDS Stationary receptor –– 2,000 m from the NW piling location and 1,500 m from the SE location ($SEL_{cum}^{(static)}$). Noise impacts on fleeing receptors are expected to be significantly less (<100 m) and within the immediate vicinity of the piling activity. Temporal MDS Stationary receptors - 1,300 m from the NW location and 980 m from the SE location ($SEL_{cum\text{-}(static)}$). Fleeing receptors from both locations are expected are expected to be significantly less
	River lamprey	

IMPACT	FEATURE	MAXIMUM PREDICTED IMPACT RANGES FROM PILING ACTIVITY.
		(<100 m) and within the immediate vicinity of the piling activity.
	Atlantic Salmon[i]	Fleeing receptor <100 m from the NW piling location and <100 m from the SE location.
Recoverable injury	Sea lamprey River lamprey	Spatial MDS Stationary receptors - 3,000 m from the NW piling location and up to 2,200 m from the SE location ($SEL_{cum}^{(static)}$). Fleeing receptors from both locations are expected to be significantly less (<100 m) and within the immediate vicinity of the piling activity. Temporal MDS Stationary receptors - 2,000 m from the NW location and 1,500 m from the SE location ($SEL_{cum}^{(static)}$). Fleeing receptors are expected to be significantly less (<100 m) and within the immediate vicinity of the piling activity.
	Atlantic Salmon[i]	Fleeing receptor 120 m from the NW piling location and <100 m from the SE piling location (Spatial MDS). Fleeing receptor <100 m from the NW and the SE piling locations.
Temporary threshold shift (TTS)	Sea lamprey River lamprey	Spatial MDS Stationary receptors - 36,000 m from the NW location and 29,000 m from the SE piling location ($SEL_{cum}^{(static)}$). Fleeing receptors 17,000 m from the NW location and 11,000 m from the piling SE location. Temporal MDS Stationary receptors - 31,000 m from the NW location and 25,000 m from the SE piling location ($SEL_{cum}^{(static)}$). Fleeing receptors 13,000 m from the NW

IMPACT	FEATURE	MAXIMUM PREDICTED IMPACT RANGES FROM PILING ACTIVITY.
		location and 8,100 m from the piling SE locations.
	Atlantic Salmon[i]	Spatial MDS Fleeing receptors 17,000 m from the NW location and 11,000 m from the piling SE location. Temporal MDS Fleeing receptors 13,000 m from the NW location and 8,100 m from the piling SE locations.
Behavioural effects	Sea lamprey	Near field behavioural impacts are considered likely to be fully contained within TTS.
	River lamprey	
	Atlantic Salmon	

[i] As outlined in Volume 2, Chapter 6, Atlantic Salmon have been assessed as a fleeing receptor only because salmon are a highly mobile species and are likely to be transient receptors within the site (i.e. migrating). The conclusion for salmon smolts is considered appropriate as while it is likely that the true impact range is somewhere between stationary and fleeing due to their reduced speed, it is noted that migratory instincts in the smolts will ensure that they act as a fleeing receptor.

Sea Lamprey and River Lamprey

1025 Sea lamprey *Petromyzon marinus* and river lamprey *Lampetra fluviatilis* use the Dee estuary as part of a migratory route to the River Dee and Bala Lake/ Afon Dyfrdwy a Llyn Tegid SAC and the Dee Estuary/ Aber Dyfdwy SAC. Sea and river lampreys spend their adult life in the sea or estuaries respectively but spawn and spend the juvenile part of their life cycle in rivers.

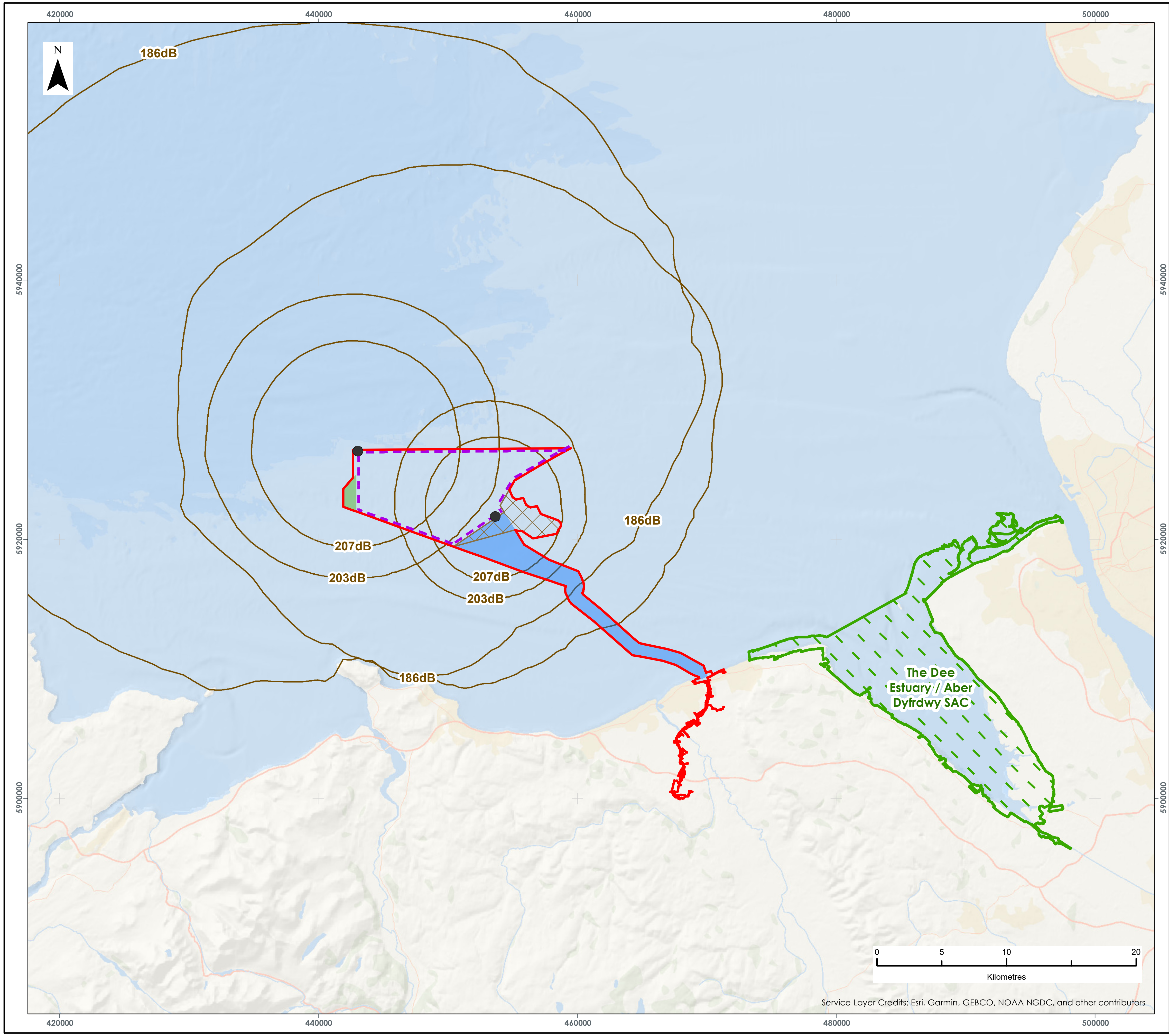
1026 Sea and river lamprey lack a swim bladder and are therefore considered less sensitive to underwater noise than fish with a swim bladder. The ES concluded that river and sea lamprey are deemed to be of low vulnerability and medium recoverability. The sensitivity of these receptors to mortality, potential mortal injury, recoverable injury, TTS and hearing damage from exposure to underwater noise is considered to be low. Considering the Popper *et al*. (2014) criteria, any risk of behavioural effects or auditory masking in lamprey from piling are also expected to be low in the intermediate field.

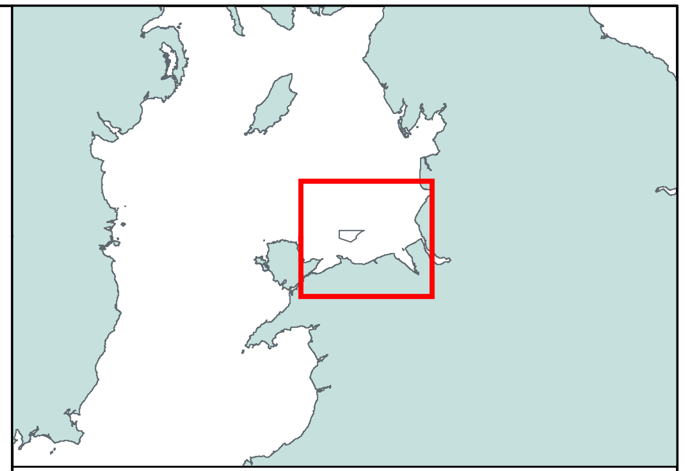
1027 River lamprey typically remain within estuarine environments during their adult life stages (Maitland, 2003) and therefore are unlikely to be present close to any noisy activities from AyM, within no potential barrier to migration from noise between the fish and the river.

1028 Sea lamprey are a much more widely distributed species when out of the natal rivers, and have been found within shallow coastal waters and deep offshore waters (Maitland, 2003). Sea lamprey are not thought to specifically migrate back to their natal rivers (Bergstedt and Seelye 1995; Waldman *et al*. 2008); instead, they are thought to return to rivers within the regional area, navigating primarily by detection of larval pheromones to identify suitable rivers (i.e. those with pre-existing larvae) (reviewed in Hansen *et al*., 2016). This flexibility in homing behaviour of this anadromous fish, combined with the low sensitivity of this species to underwater noise suggests that noise effects would only have a very localised effect.

1029 Piling in the array will not result in mortality, mortal injury or recoverable injury given the distance of the array to the entrance to the Dee Estuary SAC (20.9 km). As detailed in Table 34 above, for a stationary receptor, mortality and mortal injury would occur 0.98 km (Temporal MDS) and 1.3 km (Spatial MDS) from the SE piling location and recoverable injury would occur out to 1.5 km (Temporal MDS) and 2.2 km (Spatial MDS) from the SE piling location. Mortality and injury on Fleeing receptors from piling are expected to be significantly less (<100 m) and within the immediate vicinity of the piling activity.

1030 For a stationary receptor, TTS was modelled to be 25 km (Temporal MDS) and 29 km (Spatial MDS) from the piling locations in the SE and 11 km (Spatial MDS) and 8.1 km (Temporal MDS) for a fleeing receptor. Figure 8, detailing the modelled noise outputs for the Popper *et al.* (2014) impact threshold criteria for stationary receptors, shows that there is no overlap between the TTS (186 dB) noise modelling contour and the mouth of the estuary.





LEGEND

- Order Limits
- Array Area
- Offshore Export Cable Corridor
- Other Wind Farm Infrastructure Zone
- GyM Interlink Zone
- Noise Modelling Location
- Noise Modelling Contours
- The Dee Estuary / Aber Dyfrdwy SAC

Data Source:
SACs from JNCC

PROJECT TITLE:

AWEL Y MÔR OFFSHORE WINDFARM

FIGURE TITLE: Spatial MDS for underwater noise (stationary receptor)

VER	DATE	REMARKS	Drawn	Checked
1	28/07/2021	For Issue For PEIR	BPHB	PN
2	03/03/2022	For Issue For ES	BPHB	KJ

FIGURE NUMBER:

Figure 8

SCALE:	PLOT SIZE:	DATUM:	PROJECTION:
1:300,000	A3	WGS84	UTM30N

Fferm Wynt Alltraeth
AWEL Y MÔR
Offshore Wind Farm

G:\GIS\GIS_Projects\0141 AyM\GIS\Figures\ES\RIAA\AYM_RIAA_Fig8_Noise_Stationary_Dee_Estuary_SAC.mxd

1031 UXO clearance is expected to result in mortality, mortal injury, recoverable injury, TTS and disturbance to receptor species, depending on the proximity of the individuals to the UXO location and the size of the UXO. Detonation of UXO would represent a short-term (seconds) increase in underwater noise and while noise levels will be elevated such that this may result in injury or behavioural effects, UXO detonations are considered to have a lower likelihood of triggering a population level effect than that associated from piling operations, due to the significantly reduced temporal footprint that would arise from UXO operations, therefore effects are likely to be within that from cumulated piling exposure. It is important to note that the Applicant is not applying for a Marine Licence for UXO clearance as part of the DCO application and therefore no formal assessment has been made.

1032 As part of the HDD works within the nearshore, up to three cofferdams may be required to be installed up to 1,600 m seaward of MHWS. The cofferdam structure will be constructed from sheet piles which may be installed using percussive piling, vibropiling or impact piling. The modelling outputs for the installation of the cofferdam, detailed in ES Volume 2, Chapter 6, show that the onset range for mortality and potential injury, recoverable injury (fleeing and stationary) and TTS (fleeing) in lamprey receptors only occur in the immediate vicinity of the piling works (<100 m). The TTS onset range for a stationary lamprey receptor is 1,300 m. The extent of TTS is of variable duration and magnitude, with no potential for this to lead to permanent effects. Normal hearing ability returns following cessation of the noise causing TTS. Due to the limited number, localised source and short duration of the installation, it is not anticipated that noise from cofferdam installation will have a significant impact on lamprey receptors.

1033 Taking into account the distance of the Dee Estuary and the River Dee and Bala Lake/ Afon Dyfrdwy a Llyn Tegid SAC from the array (>20 km at its nearest point), the short-term and localised nature of the impact arising during construction, the likelihood of the instinct for migration overriding any potential disturbance effects from noise and no noise from AyM activities entering the River Dee and Bala Lake/ Afon Dyfrdwy a Llyn Tegid SAC, it is not anticipated that underwater noise will have a significant effect on the distribution of lamprey within the sites. Underwater noise will also not result in any mortality or injury of the receptors within the SACs, furthermore, underwater noise from the project will not result in a barrier effect preventing the receptors from accessing the site to breed, there will therefore be no effect on the populations of the receptors within the sites.

1034 There is, therefore, **no potential for an AEoI to the conservation objectives of the river and sea lamprey feature of the Dee Estuary/ Aber Dyfrdwy (UK) SAC and the River Dee and Bala Lake/ Afon Dyfrdwy a Llyn Tegid SAC in relation to underwater noise from AyM alone. Therefore, subject to natural change, these features will be maintained in the long term in terms of the range, distribution and population of the species within the site.**

Atlantic Salmon

1035 Atlantic salmon have a swim bladder which is not involved in hearing and therefore fall within the "Group 2" species as per the Popper *et al*. (2014) criteria. This species group are considered to be more sensitive to particle motion than sound pressure, however, due to the presence of the swim bladder are more sensitive to noise than species such as lamprey.

1036 As outlined in Volume 2, Chapter 6, Atlantic salmon are a highly mobile species and are likely to be transient receptors within the site and as such, with regard to the noise modelling this species has been assessed as a fleeing receptor only. Volume 2, Chapter 6 presents the modelling ranges of the varied noise impacts detailed above, these have also been summarised in Table 34. Mortality, mortal injury and recoverable injury impacts are all modelled to occur within the immediate vicinity (<100 m) of the piling activity. TTS could occur up to 8.1 km from the SE piling location (Temporal MDS) and up to 11 km from the SE piling location (Spatial MDS) based on the modelling of the 186 dB SEL_{cum} threshold, however as identified in the Popper *et al*. (2014) guidance, for Group 2 species, the TTS onset SEL is considered to be "greater than 186 dB SEL_{cum}", rather than at 186 dB SEL_{cum} threshold. As such, any TTS effects on salmon will be closer to the piling locations than the modelled value. The array is a distance of 20.9 km from the Dee Estuary and 46.1 km from the River Dee and Bala Lake/ Afon Dyfrdwy a Llyn Tegid SAC, noise produced during piling operations will therefore not have an effect on salmon receptors in the SACs.

1037 Migrating Atlantic salmon are thought to generally follow the coast, remaining within coastal waters rather than passing directly through the AyM site (as reviewed in the Fish and Shellfish Ecology Technical Baseline) and so are unlikely to be within range of any injurious effects (mortality or physical injury) from piling noise within the array area. Whilst the TTS 186 dB SEL_{cum} contour within the noise modelling meets the coast in a number of locations, the modelling is considered to underestimate the shallow water attenuation of the sound within this area, with received sound levels likely to be much reduced (as discussed in ES Volume 2, Chapter 6).

1038 As described in Popper *et al*. (2014), behavioural impacts on fish from underwater noise should be assessed qualitatively. When fish are involved in key biological behaviours (e.g. feeding or spawning), the response to external (potentially adverse) stimulus is reduced (Skaret *et al*., 2005), with migratory instincts expected to be similarly strong biological drivers so as to override any potential deterrence effects from underwater noise. Wardle *et al*. (2001) noted that even where fish were startled by an air gun source initially, where the sound source was not visible the fish returned to the original swim path following initial reaction. This suggests that even if migratory fish were momentarily startled by piling noise, migration would continue either immediately or following cessation of the noise. As such, it can be determined that Atlantic salmon will likely be unaffected by noise from piling within the array and UXO clearance when migrating.

1039 Volume 2, Chapter 6 of the ES concluded that Atlantic salmon are deemed to be of low vulnerability, medium recoverability and international importance. The sensitivity of this receptor to mortality, potential mortal injury, recoverable injury, TTS and hearing damage from underwater noise is considered to be low. Considering the Popper *et al*. (2014) criteria, any risk of behavioural effects or auditory masking in Atlantic salmon from piling are also expected to be low in the intermediate field.

1040 UXO clearance has the potential to result in mortality, mortal injury, recoverable injury, TTS and disturbance to receptor species, depending on the proximity of the individuals to the UXO location and the size of the UXO. Detonation of UXO would represent a short-term (seconds) increase in underwater noise and while noise levels will be elevated such that this may result in injury or behavioural effects, UXO detonations are considered to have a lower likelihood of triggering a population level effect than that associated from piling operations, due to the significantly reduced temporal footprint that would arise from UXO operations. Therefore, effects are likely to be within that from cumulated piling exposure. It is important to note that the Applicant is not applying for a Marine Licence for UXO clearance as part of the DCO application and therefore no formal assessment has been made.

1041 As part of the HDD works within the nearshore, up to three cofferdams may be required to be installed up to 1,600 m seaward of MHWS. The cofferdam structure will be constructed from sheet piles which may be installed using percussive piling or vibropiling. ES Volume 4, Annex 6.2 provides details of the noise modelling of the sheet piles.

1042 The noise modelling for cofferdam installation assumed the cofferdam is at 1,600 m from MHWS to result in the greatest propagation. The duration to install one sheet pile, including a soft start and ramp up was modelled as 60 minutes, with a maximum installation of eight piles per day. As noted previously, salmon are a highly mobile species and are likely to be transient receptors (i.e. migrating) and therefore should be assessed as a fleeing receptor only. The modelled onset range for mortality and potential injury, recoverable injury and TTS for a salmon fleeing receptor is <100 m.

1043 The extent of TTS is of variable duration and magnitude, with no potential for this to lead to permanent effects. Normal hearing ability returns following cessation of the noise causing TTS (the effect is, by definition, temporary). Atlantic Salmon on migration are thought to generally follow the coast and are therefore likely to occur within coastal waters rather than passing directly through the AyM site. Whilst the cofferdam works, with relatively high source levels could be along the migration route for the salmon following the coast from the west of the Dee Estuary, the associated piling will be short-term (days) and intermittent during the installation period. As such, a few days of noise within a localised area, which a highly mobile species such as salmon is capable of swimming around, will not result in anything more than a temporary, localised and non-physical barrier to migration. Even if a number of individuals are temporarily blocked during the period of the works, they can be expected to recommence migration towards the estuary following the cessation of the piling (e.g. Wardle *et al*. (2001) demonstrated that after an initial startle reaction to a noise source, fish returned to their original path). Due to the limited number, localised source and short duration of the installation, it is not anticipated that cofferdam installation will have a significant impact on salmon receptors from the Dee Estuary/ Aber Dyfrdwy (UK) SAC and the River Dee and Bala Lake/ Afon Dyfrdwy a Llyn Tegid SAC.

1044 Taking into account the distance of the Dee Estuary and the River Dee and Bala Lake/ Afon Dyfrdwy a Llyn Tegid SAC from the Array (>20 km at its nearest point), the short-term and localised nature of the impact arising during construction, the preference for salmon to remain in coastal waters while migrating, the likelihood of the instinct for migration overriding any potential disturbance effects or migration occurring between noisy activities and no noise from AyM activities entering the River Dee and Bala Lake/ Afon Dyfrdwy a Llyn Tegid SAC, it is not anticipated that significant impacts in relation to underwater noise effects from piling within the array will occur on Atlantic salmon, with no impacts to the population or distribution of the salmon within the SAC. There is, therefore, **no potential for an AEoI to the conservation objectives of the salmon feature of the River Dee and Bala Lake/ Afon Dyfrdwy a Llyn Tegid SAC in relation to underwater noise from AyM alone. Therefore, subject to natural change, this feature will be maintained in the long term in terms of the range, distribution and population of the species**.

10.5.2 Suspended Sediment and Deposition (Construction, Decommissioning)

1045 Temporary localised increases in suspended sediment concentration (SSC) and associated sediment deposition and smothering are expected from the foundation and cable installation works (including HDD works) and seabed preparation works (including sandwave clearance) during construction, with effects during decommissioning expected to be less than that during construction. Volume 2, Chapter 2: and Volume 4, Annex 2.1 provides the detailed offshore physical environment assessment (including project specific modelling of sediment plumes).

1046 SSCs in the Irish Sea vary widely both spatially and temporally, with a general pattern of an inshore to offshore gradient in SSC. SSC's also vary with proximity to the seabed, coastline and are also dependent upon meteorological conditions. Mean "normal" (non-surge/storm events) SSC background levels in measures at Burbo Bank (c. 20 km north east of AyM) have been reported in the range of 5 to 20 mg/l within surface waters, increasing to circa 150 mg/l near the seabed (Dong Energy, 2013).

1047 The MDS for SSC and deposition during the construction phase of AyM would result in the total release of approximately 18,311,507 m^3 of sediment in the array area and offshore ECC. To summarise the information presented in the project specific hydrodynamic modelling undertaken (Volume 4, Annex 2.3: Modelling Report), sediment plumes caused by seabed preparation and installation activities are expected to be restricted to well-within the tidal excursion, with plumes expected to occur over a maximum distance of 12 km from the source within the array, and 8.5 km within the ECC. Sediment plumes are expected to quickly dissipate after cessation of the activities, due to settling and wider dispersion with the concentrations reducing quickly over time to background levels (within 1 or 2 tidal cycles). Sediment deposition will consist primarily of coarser sediments deposited close to the source, with a small proportion of silt deposition (reducing exponentially from source). Any fine material being dispersed by construction works is likely to be widely distributed and will quickly form part of the background concentrations; deposition of 1 mm will be restricted to <1 km from the order limits.

1048 ES Volume 2, Chapter 6 identified that impacts from SSC and sediment deposition will be short-lived and, outside of the immediate area of the works (a few hundred metres), SSCs would approach levels seen during storm events and as such will be within natural variation. As all migratory fish species have to spend part of their lifecycle either in or navigating through turbid waters it is considered that they have a high tolerance to this impact pathway. Where conditions are particularly adverse, the mobile nature of fish species will generally allow them to avoid such areas (ABPmer, 2020). Hence, such impacts will be unlikely to significantly affect a population provided such conditions are temporary.

1049 Taking into account the wide distribution of the migratory fish species across the Dee Estuary/ Aber Dyfrdwy (UK) SAC and the River Dee and Bala Lake/ Afon Dyfrdwy a Llyn Tegid SAC, and the short-term and localised nature of the impact arising during construction and decommissioning, it is not anticipated that significant impacts in relation to SSC effects will occur on Annex II migratory species.

1050 There is, therefore, **no potential for an AEoI to the conservation objectives of the site in relation to suspended sediment and deposition effects from AyM alone. Therefore, subject to natural change, all features will be maintained in the long term with respect to the potential for suspended sediment and deposition.**

10.5.3 Pollution (Construction, O&M, Decommissioning)

1051 As noted in Table 3 (mitigation measures), a PEMP is proposed to be produced as a pre-construction marine licence mitigation measure to ensure that the potential for contaminant release is strictly controlled. The purpose of the PEMP is to provide protection to marine life across all phases of the life of the wind farm. The PEMP will incorporate plans to cover accidental spills, potential contaminant release and include key emergency contact details. Typical measures will include: only using chemicals approved under the Offshore Chemicals Regulations 2002; storage of all chemicals in secure designated areas with impermeable bunding (generally to 110% of the volume); and double skinning of pipes and tanks containing hazardous materials.

1052 Further, Volume 2, Chapter 5 reported on contaminant surveys undertaken in both the array and ECC, which reported no pollutants with concentrations above their respective ERL values. All metals concentrations were also less than their respective Cefas guideline Action Levels (AL1 and AL2). Total two to six ring PAH concentrations were broadly comparable to the median concentration recorded during the Strategic Environmental Assessment (SEA6 area) Irish Sea surveys.

1053 Given the low background levels of contaminants in sediment that may be disturbed, lack of significant connectivity between such sediment and the entrance to the SACs (the estuary mouth) and the mitigation afforded by the PEMP, there is, therefore, **no potential for an AEoI to the conservation objectives of the sites in relation to pollution effects from AyM alone. Therefore, subject to natural change, all features will be maintained in the long term with respect to the potential for pollution**.

10.5.4 EMF (O&M)

1054 The potential for EMF to cause a disturbance to features of the Dee Estuary/ Aber Dyfrdwy (UK) SAC and the River Dee and Bala Lake/ Afon Dyfrdwy a Llyn Tegid SAC is limited to the O&M phase only.

1055 EMF are generated by the current that passes through an electric cable. It is known that EMF can be detected by fish and elasmobranchs, with some species having developed specialised organs to facilitate this. Three types of fields are generated by underwater electric cables: E-fields, B-fields and iE-fields. Standard industry practice is for the cables used to have sufficient shielding to contain the E-fields generated and the cable system descriptions for the inter-array and export cables have abided by this (Volume 2, Chapter 1). Shielding and/ or burial does not reduce the B-fields and it is these fields that allow the formation of iE-fields. As such, further reference here to EMF is limited to B-fields and associated iE-fields.

1056 Migratory fish are likely to encounter EMFs from subsea cables either during the adult movement phases of life or their early life stages during migration within shallow, coastal waters adjacent to natal rivers (Gill *et al*. 2012). The potential impact of EMFs on migrating fish will likely be closely linked to the position of fish in the water column relevant to the EMF source (Gill and Barlett, 2010). It should be noted in this context that magnetic fields are strongest directly over the cables and decrease rapidly with vertical and horizontal distance from the cables (Normandeau *et al*., 2011). As a result, effects associated with EMFs will be restricted to discrete areas in the immediate proximity of the cables and fish may only be affected when/ if transiting these areas.

1057 The proximity of a project site to natal rivers is also considered likely to have a significant bearing on the potential exposure of migratory fish to EMFs (Gill and Barlett, 2010). Impacts from changes in EMFs arising from cables are not considered to result in a significant effect on migratory fish, with the range between any cable associated with AyM and the Dee Estuary/ Aber Dyfrdwy (UK) SAC and the River Dee and the Bala Lake/ Afon Dyfrdwy a Llyn Tegid SAC being at least 3.4 km to the mouth of the estuary (the entry/ exit point for both SACs). Although burial (in the sediment or using cable protection) does not mask EMFs it increases the distance between species that may be affected by EMFs and the source. As the cable will be buried or protected, any received EMFs will be reduced.

1058 Whilst migratory fish (including salmonids) are known to be able to detect EMFs (e.g. Tricas & Gill, 2011), studies to date at offshore wind farms and around cables (Hvidt *et al*., 2004; MMO, 2014) have not recorded any broadscale changes to behaviour or distribution of fish species. Interestingly, there appears to be a difference in sensitivity of fish (European eel) to EMFs from either direct current (DC) or AC cabling, with reactions to EMFs of 5 µT from DC cables (Westerberg, 2000; Ohman *et al*., 2007) and no observable effects from EMFs of 9.6 µT from AC cables (Orpwood *et al*., 2015), suggesting that there may be differences in effects between DC and AC cabling (AyM will use AC cabling). Even where studies have shown reactions in migratory fish to EMFs, these reactions have not been sufficient to be considered to be causing a barrier to migration or severe enough to result in any interruption to migration (Westerberg, 2000; Ohman *et al*., 2007).

1059 Implementation of standard mitigation, such as cable burial/ protection, will ensure that these species are not exposed to the highest EMFs, further ensuring that significant impacts to this feature do not arise (Table 3).

1060 There is, therefore, **no potential for an AEoI to the conservation objectives of the sites in relation to EMF from AyM alone and therefore, subject to natural change, all features will be maintained in the long term with respect to EMF.**

11 Assessment of Adverse Effect In-combination

1061 Screening for designated sites and features in-combination is presented in Section 7, essentially identifying the plans and projects to be considered for assessment. The assessment presented here builds on the assessment alone (Section 10) and draws on that presented within relevant topic specific chapters of the ES, tailored for the requirements of the RIAA, to enable the determination of AEoI in-combination to the features and effects screened in.

1062 Following the identification of the plans and projects with the potential to result in an AEoI in-combination with AyM, the assessment is made below. The information is presented according to the following receptor groupings:

- Subtidal and Intertidal Benthic Ecology;
- Marine Mammals;
- Offshore and Intertidal Ornithology;
- Onshore Ecology; and
- Migratory Fish.

1063 It should be noted that:

- For AyM to contribute to an in-combination effect, the assessment alone (Section 10) needs to have concluded a contribution from or connectivity to AyM (i.e. >0, noting that the potential for inconsequential impacts remains); and
- There needs to be a plan or project with the potential to contribute to an in-combination effect with AyM (on a temporal and/ or spatial basis).

11.1 Subtidal and Benthic Intertidal Habitats

1064 The potential for an in-combination effect upon the designated sites grouped under 'subtidal and intertidal benthic ecology', as relevant to features and effect pathways screened in for LSE (as summarised in Table 4 and Table 5), is provided below.

11.1.1 Y Fenai a Bae Conwy/ Menai Strait and Conwy Bay (UK) SAC

1065 The potential for an AEoI in-combination on the Y Fenai a Bae Conwy/ Menai Strait and Conwy Bay (UK) SAC relates to the features and effect pathways considered in Section 10 for the project alone. These are as follows:

- Suspended sediment and deposition;
- Pollution;
- Marine INNS;
- Changes to physical processes; and
- EMF.

1066 The plans and projects screened in for assessment in-combination are summarised in Table 3534 below. Key to the determination of a project to contribute to an in-combination effect is whether or not it forms part of the baseline and whether it would contribute to an effect in-combination with AyM, with these considered below. The Natura 2000 Standard Data Form for the site was initially compiled in 2001, updated in 2015[lxi].

[lxi] https://jncc.gov.uk/jncc-assets/SAC-N2K/UK0030202.pdf

Table 35: Summary of projects screened in for in-combination and associated effects for the Y Fenai a Bae Conwy/ Menai Strait and Conwy Bay (UK) SAC supporting habitats.

PLAN OR PROJECT	TIER	SUSPENDED SEDIMENT AND DEPOSITION	POLLUTION	INNS	CHANGES TO PHYSICAL PROCESSES	EMF	INCLUSION IN-COMBINATION
Gwynt y Môr	1	Project is operational and located to the east of AyM; therefore potential for contribution to an in-combination effect is considerably less than that from AyM. The ES concluded short term and temporary sediment release and settlement, with negligible significance. Monitoring reviews show no large-scale effects on benthos[lxii].	PEMP or similar is a standard requirement and therefore no potential for any in-combination effect	No evidence of any contribution to INNS from GyM.	Project is operational and located to the east of AyM; therefore potential for contribution to an in-combination effect is considerably less than that from AyM. ES concluded short term and temporary disturbance of habitats, with negligible to low significance. Monitoring reviews show no large-scale effects on benthos[lxiii].	Project is operational and located to the east of AyM; therefore potential for contribution to an in-combination effect is considerably less than that from AyM.	Location of GyM relative to the SAC, combined with no evidence of significant effect since the project was constructed, result in at most a negligible contribution to any in-combination effect.
Rhyl Flats	1	Project is operational and located to the south and east of AyM; therefore potential for contribution to an in-combination effect is less than that from AyM. ES concluded short term and temporary sediment release and settlement, with no significance. Monitoring reviews show no large-scale effects on benthos[lxiv].	PEMP or similar is a standard requirement and therefore no potential for any in-combination effect	No evidence of any contribution to INNS from Rhyl Flats.	Project is operational and located to the south and east of AyM; therefore potential for contribution to an in-combination effect is considerably less than that from AyM. ES concluded short term and temporary sediment disturbance, with no significance. Monitoring reviews show no large-scale effects on benthos[lxv].	Project is operational and located to the south and east of AyM; therefore potential for contribution to an in-combination effect is less than that from AyM.	Location of Rhyl Flats relative to the SAC, combined with no evidence of significant effect since the project was constructed, result in at most a negligible contribution to any in-combination effect.
North Hoyle	1	Project is operational and	PEMP or similar is a	No evidence of	Project is operational	Project is	Location of North Hoyle

[lxii] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/317787/1031.pdf
[lxiii] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/317787/1031.pdf
[lxiv] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/317787/1031.pdf
[lxv] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/317787/1031.pdf

PLAN OR PROJECT	TIER	SUSPENDED SEDIMENT AND DEPOSITION	POLLUTION	INNS	CHANGES TO PHYSICAL PROCESSES	EMF	INCLUSION IN-COMBINATION
		located to the east of AyM; therefore potential for contribution to an in-combination effect is considerably less than that from AyM. ES (Innogy & National Wind Power, 2002) concluded no appreciable release of sediment.	standard requirement and therefore no potential for any in-combination effect	any contribution to INNS from North Hoyle.	and located to the east of AyM; therefore potential for contribution to an in-combination effect is considerably less than that from AyM. ES concluded localised and temporary effects only.	operational and located to the east of AyM; therefore potential for contribution to an in-combination effect is considerably less than that from AyM.	relative to the SAC, combined with no evidence of significant effect since the project was constructed, result in at most a negligible contribution to any in-combination effect.
Geo-Eirgrid interconnector	1	Power cable. Understood to have been in operation since 2012. Expected planned maintenance however, no project level information on maintenance activities. Minimal potential to contribute to an in-combination assessment, with no public domain data to include.					
Outfall MTF_ INDUSTRIAL. 23044 and 23045	1	Existing licensed outfalls, predating 2011 (the available update). Will be subject to existing licensing to address risk to the receiving environment. No project information available to assess quantitatively.					

Suspended sediment and deposition

1067 The conclusions for AyM alone were for a lack of connectivity between the effect and all designated features of the SAC. Therefore, AyM cannot contribute to any in-combination effect, if indeed any exist.

1068 There is, therefore, **no potential for an AEoI to the conservation objectives of the designated features of the Y Fenai a Bae Conwy/ Menai Strait and Conwy Bay (UK) SAC in relation to suspended sediment and deposition from AyM in-combination and therefore, subject to natural change, the designated features will be maintained in the long term with respect to the potential for suspended sediment and deposition.**

Pollution

1069 The conclusions for AyM alone were a lack of connectivity between suspended sediments and the designated features together with the PEMP to mitigate any risk of pollution incidents. It is expected that all projects in-combination would be required to have a PEMP (or similar documentation) should there be a risk of a pollution incident. Therefore, there is no potential for any in-combination effect.

1070 There is, therefore, **no potential for an AEoI to the conservation objectives of the designated features of the Y Fenai a Bae Conwy/ Menai Strait and Conwy Bay (UK) SAC in relation to pollution from AyM in-combination and therefore, subject to natural change, the designated features will be maintained in the long term with respect to the potential for pollution.**

Marine INNS

1071 The conclusion of no AEoI for AyM alone is based on a lack of evidence of any such effect in the area resulting from the presence of OWF, the distance between AyM and the designated features and the mitigation afforded by the PEMP. That lack of evidence is at least partly informed by monitoring at several of the projects included in-combination and therefore applies equally to the in-combination assessment. Together with the greater distance between the SAC boundary and most of the in-combination projects, and the expectation that all projects in-combination would be required to have a PEMP (or similar documentation) should there be a risk of marine INNS, informs the conclusion of no potential for any in-combination effect.

1072 There is, therefore, **no potential for an AEoI to the conservation objectives of the designated features of the Y Fenai a Bae Conwy/ Menai Strait and Conwy Bay (UK) SAC in relation to INNS from AyM in-combination and therefore, subject to natural change, the designated features will be maintained in the long term with respect to INNS.**

Changes to Physical Processes

1073 The conclusions for AyM alone were for a lack of connectivity between the effect and all designated features of the SAC. Therefore, AyM cannot contribute to any in-combination effect, if indeed any exist.

1074 There is, therefore, **no potential for an AEoI to the conservation objectives of the designated features of the Y Fenai a Bae Conwy/ Menai Strait and Conwy Bay (UK) SAC in relation to a change in physical processes from AyM in-combination and therefore, subject to natural change, the designated features will be maintained in the long term with respect to a change in physical processes.**

EMF

1075 The conclusions for AyM alone were for a lack of direct connectivity between the effect and all designated features of the SAC, with a lack of any significant behavioural change in mobile species. Given that none of the cabling associated with projects in-combination falls between AyM cabling and the SAC, there can be no in-combination effect on mobile species between AyM and the SAC. Therefore, AyM cannot contribute to any in-combination effect, if indeed any exist.

1076 There is, therefore, **no potential for an AEoI to the conservation objectives of the designated features of the Y Fenai a Bae Conwy/ Menai Strait and Conwy Bay (UK) SAC in relation to EMF from AyM in-combination and therefore, subject to natural change, the designated features will be maintained in the long term with respect to EMF.**

11.1.2 Liverpool Bay SPA

1077 The potential for an AEoI in-combination on the supporting habitats of the Liverpool Bay SPA relates to the effect pathways considered in Section 10 for the project alone. These are as follows:

- Physical loss of supporting habitat;

- Smothering; and
- Physical damage to supporting habitat.

1078 The plans and projects screened in for assessment in-combination are summarised in Table 36 below. Key to the determination of a project to contribute to an in-combination effect is whether or not it forms part of the baseline and whether it would contribute to an effect in-combination with AyM, with these considered below. The Liverpool Bay SPA was initially designated in 2010 and re-designated in 2017[lxvi].

[lxvi] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/566840/liverpool-bay-bae-lerpwl-spa-boundary-map.pdf

Table 36: Summary of projects screened in for in-combination and associated effects for the Liverpool Bay SPA supporting habitats.

PLAN OR PROJECT	TIER	PHYSICAL LOSS OF SUPPORTING HABITATS?	SMOTHERING OF SUPPORTING HABITATS	PHYSICAL DAMAGE TO SUPPORTING HABITATS?	INCLUSION IN-COMBINATION
Gwynt y Môr	1	Falls partially within the SPA boundary. ES (RWE Group and Npower renewables, 2005) concluded a maximum habitat loss of 0.44 km^2 (not all of which would fall within the SPA), with negligible significance. Monitoring reviews show no large-scale effects on benthos[lxvii].	ES (RWE Group and Npower renewables, 2005) concluded short term and temporary sediment release and settlement, with negligible significance. Monitoring reviews show no large-scale effects on benthos[lxviii].	ES (RWE Group and Npower renewables, 2005) concluded short term and temporary disturbance of habitats, with negligible to low significance. Monitoring reviews show no large-scale effects on benthos[lxix].	Habitat loss only as insufficient information to include other parameters within assessment
Rhyl Flats	1	The ES (COWL, 2002) concluded a habitat loss of 630 m^2. Monitoring reviews show no large-scale effects on benthos[lxx].	ES (COWL, 2002) concluded short term and temporary sediment release and settlement, with no significance. Monitoring reviews show no large-scale effects on benthos[lxxi].	ES (COWL, 2002) concluded short term and temporary sediment disturbance, with no significance. Monitoring reviews show no large-scale effects on benthos[lxxii].	Insufficient information to include within assessment
North Hoyle	1	Offshore construction complete (2003) prior to data collection (commenced 2004) for the SPA and therefore forms part of the baseline.	ES (Innogy & National Wind Power, 2002) concluded no appreciable release of sediment.	ES (Innogy & National Wind Power, 2002) concluded localized and temporary effects only.	Insufficient information to include or predates the citation (baseline)
Aggregate Exploration & Option Area 1808	1	Area is for exploration only therefore no environmental information to include for an in-combination assessment on habitat loss, smothering or habitat disturbance.			

[lxvii] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/317787/1031.pdf
[lxviii] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/317787/1031.pdf
[lxix] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/317787/1031.pdf
[lxx] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/317787/1031.pdf
[lxxi] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/317787/1031.pdf
[lxxii] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/317787/1031.pdf

PLAN OR PROJECT	TIER	PHYSICAL LOSS OF SUPPORTING HABITATS?	SMOTHERING OF SUPPORTING HABITATS	PHYSICAL DAMAGE TO SUPPORTING HABITATS?	INCLUSION IN-COMBINATION
Aggregate Area 392 & 393	1	The HRA for both projects determined no potential for LSE for any site[lxxiii], with the EIA consent decision noting that 'the application area is sited partly within the Liverpool Bay SPA, however due to the relatively small area affected, the abundance of other suitable habitat, and in the context of the existing dredging activity, the effects are predicted to be not significant' Insufficient information to include within an in-combination assessment with AyM.			
Aggregate Area 457	1	No project level information sourced to support an assessment and therefore not included in-combination. Licence area located outside the SPA boundary, with potential for effect on the supporting habitat therefore likely to be less than that for Areas 392 and 393 as noted above.			
Geo-Eirgrid interconnector	1	Telecommunications cable. Understood to have been in operation for some time. No project level information. Minimal potential to contribute to an in-combination assessment, with no public domain data to include.			
Western HVDC Link	1	Telecommunications cable. Understood to have been in operation for some time. No project level information. Minimal potential to contribute to an in-combination assessment, with no public domain data to include.			
Pipelines	1	15 pipelines identified within 12 km of the SPA, all understood to be currently active. No project data to inform an assessment, with minimal contribution to any in-combination effect on benthic supporting habitats from an installed pipeline.			
Oil & Gas (Douglas DA)	1	Douglas Field brought on stream in 1996[lxxiv] and therefore forms part of the baseline for the Liverpool Bay SPA.			
Oil & Gas (Douglas DP)	1				
Oil & Gas (Douglas DW)	1				
Outfall MTF_INDUSTRIAL.23044	1	Existing licensed outfalls, predating 2011 (the available update). Will be subject to existing licensing to address risk to the receiving environment. No project information available to assess quantitatively.			
Outfall MTF_INDUSTRIAL.23045	1				

[lxxiii] Referenced within [redacted]

Physical loss of supporting habitat

1079 Of the projects screened in in-combination, only GyM and Rhyl Flats have a quantified level of habitat loss at least partially within the SPA boundary. The area for GyM will be an overestimate as the Array boundary falls partially outside the SPA, with both likely to be an overestimate as they represented the Rochdale envelope at the time of assessment. Further, the strategic review of OWF monitoring data[lxxv] (which included both projects) concluded no large-scale effects on the benthos.

1080 Given the conclusions for AyM alone, being highly localised and small scale with no significant effect on supporting habitats, together with the lack of any apparent significant effects resulting from the construction of both GyM and Rhyl Flats on the wider benthos, there is, therefore, **no potential for an AEoI to the conservation objectives of the supporting habitats of the Liverpool Bay SPA in relation to habitat loss from AyM in-combination and therefore, subject to natural change, the supporting habitats will be maintained in the long term with respect to the potential for habitat loss.**

Smothering

1081 The conclusions for AyM alone were for a temporary, short term and affect, extending to a very small proportion of habitat across the SPA with no significant effect on supporting habitats. For projects in-combination, all are in operation with the potential for sediment release to be highly limited and localised. With respect to the aggregate sites, the associated HRA concluded no LSE for all sites. There is, therefore, **no potential for an AEoI to the conservation objectives of the supporting habitats of the Liverpool Bay SPA in relation to smothering from AyM in-combination and therefore, subject to natural change, the supporting habitats will be maintained in the long term with respect to the potential for smothering.**

[lxxv] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/317787/1031.pdf

Physical damage to supporting habitats

1082 The conclusions for AyM alone were for a temporary and localised affect, extending to a very small proportion of habitat across the SPA with no significant effect on supporting habitats. For projects in-combination, all are in operation with the potential for physical damage being highly limited and localised. With respect to the aggregate sites, the associated HRA concluded no LSE for all sites. There is, therefore, **no potential for an AEoI to the conservation objectives of the supporting habitats of the Liverpool Bay SPA in relation to physical damage from AyM in-combination and therefore, subject to natural change, the supporting habitats will be maintained in the long term with respect to the potential for physical damage.**

11.1.3 Dee Estuary Ramsar, SPA and SAC

1083 The potential for an AEoI in-combination on the supporting habitats of the Dee Estuary SPA and designated habitat features of the Dee Estuary Ramsar and SAC relates to the benthic habitat features and effect pathways considered at Dee Estuary Ramsar, SPA and SAC for the project alone. These are as follows:

- Suspended sediment and deposition;
- Pollution; and
- Marine INNS.

1084 The plans and projects screened in for assessment in-combination are summarised in Table 37 below. Key to the determination of a project to contribute to an in-combination effect is whether or not it forms part of the baseline and whether it would contribute to an effect in-combination with AyM. The Natura 2000 Standard Data Form for the Dee Estuary SAC[lxxvi] states that the form was initially compiled in 2007 and updated in 2015. The RIS for the Dee Estuary Ramsar[lxxvii] states the site was designated in 1985 and updated in 2012. The citation for the Dee Estuary SPA[lxxviii] states the site was classified in 1985, updated in 2009 and with bird counts from the period up to 1999.

[lxxvi] https://jncc.gov.uk/jncc-assets/SAC-N2K/UK0030131.pdf

[redacted]

Table 37: Summary of projects screened in for in-combination and associated effects for the Dee Estuary SPA supporting habitats and for the Dee Estuary Ramsar and SAC designated habitat features.

PLAN OR PROJECT	TIER	SUSPENDED SEDIMENT & DEPOSITION	POLLUTION	INNS	CHANGES TO PHYSICAL PROCESSES	EMF	CONCLUSION IN-COMBINATION
Gwynt y Môr (array and cable)	1	Project is operational therefore potential for contribution to an in-combination effect is considerably less than that from AyM. Monitoring reviews show no large- scale effects on benthos[lxxix].	PEMP or similar is a standard requirement and therefore no potential for any in-combination effect	No evidence of any contribution to INNS from GyM.	Project is operational, with monitoring reviews showing no large-scale effects on benthos[lxxx].	Project is operational, with monitoring reviews showing no large-scale effects on benthos[lxxxi].	The at most small and localized level of effect, together with the lack of any evidence of significant effect since the project was constructed, result in at most a negligible contribution to any in-combination effect.
North Hoyle (array and cable)	1	Project is operational and therefore potential for contribution to an in-combination effect is less than that from AyM. Monitoring reviews show no large-scale effects on benthos[lxxxii].	PEMP or similar is a standard requirement and therefore no potential for any in-combination effect	No evidence of any contribution to INNS from Rhyl Flats.	Project is operational. ES concluded short term and temporary sediment disturbance, with no significance. Monitoring reviews show no large-scale effects on benthos[lxxxiii].	Monitoring reviews show no large-scale effects on benthos[lxxxiv].	The lack of any evidence of significant effect since the project was constructed, result in at most a negligible contribution to any in-combination effect.
North Hoyle OWF Export Cable	1	Project is operational and therefore potential for contribution to an in-combination effect is considerably less than that from AyM.	PEMP or similar is a standard requirement and therefore no potential for any in-combination	No evidence of any contribution to INNS from North Hoyle.	Project is operational. ES concluded no appreciable release of sediment with localized and	Monitoring reviews show no large-scale effects on benthos[lxxxvi].	The lack of any evidence of significant effect since the project was constructed, result in at most a negligible contribution to any in-combination effect.

[lxxix] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/317787/1031.pdf
[lxxx] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/317787/1031.pdf
[lxxxi] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/317787/1031.pdf
[lxxxii] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/317787/1031.pdf
[lxxxiii] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/317787/1031.pdf
[lxxxiv] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/317787/1031.pdf
[lxxxvi] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/317787/1031.pdf

PLAN OR PROJECT	TIER	SUSPENDED SEDIMENT & DEPOSITION	POLLUTION	INNS	CHANGES TO PHYSICAL PROCESSES	EMF	CONCLUSION IN-COMBINATION
			effect		temporary sediment disturbance. Monitoring reviews show no large-scale effects on benthos[lxxxv].		
Aggregate Areas 392 and 393	1	Insufficient information to include within an in-combination assessment with AyM.					
Aggregate Area 393	1						
Geo-Eirgrid interconnector	1	Telecommunications cable. Understood to have been in operation for some time. No project level information. Minimal potential to contribute to an in-combination assessment, with no public domain data to include.					
Western HVDC Link	1	Telecommunications cable. Understood to have been in operation for some time. No project level information. Minimal potential to contribute to an in-combination assessment, with no public domain data to include.					
Pipelines	1	3 pipelines identified within 12 km SAC, Ramsar and SPA (DD-POA Gas Export, POA-DD Methanol, POA-DD Concensate), all understood to be currently active. No project data to inform an assessment, with minimal contribution to any in-combination effect on benthic supporting habitats from an installed pipeline.					

[lxxxv] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/317787/1031.pdf

Suspended sediment and deposition

1085 The conclusions for AyM alone were for a lack of significant effect for all designated features of the SAC and Ramsar and supporting habitats of the SPA, with the potential for deposition of sediment being so small as to be immeasurable and within natural variation. It would be insufficient to result in any change to the extent, distribution, structure, function or supporting processes for any of the features as a result of suspended sediment and deposition from AyM. Therefore, AyM cannot contribute in any meaningful way to any in-combination effect, if indeed any exist.

1086 There is, therefore, **no potential for an AEoI to the conservation objectives of the designated features of the Dee Estuary SAC and Ramsar or supporting habitats of the Dee Estuary SPA in relation to suspended sediment and deposition from AyM in-combination and therefore, subject to natural change, the features will be maintained in the long term with respect to the potential for suspended sediment and deposition.**

Pollution

1087 The conclusions for AyM alone were for a lack of any measurable effect between deposition and the designated features which, together with the PEMP (Table 3) to mitigate any risk of pollution incidents combined to result in not AEoI. It is expected that all projects in-combination would be required to have a PEMP (or similar documentation) should there be a risk of a pollution incident. Therefore, there is no potential for any in-combination effect.

1088 There is, therefore, **no potential for an AEoI to the conservation objectives of the designated features of the Dee Estuary SAC and Ramsar or supporting habitats of the Dee Estuary SPA in relation to pollution from AyM in-combination and therefore, subject to natural change, the features will be maintained in the long term with respect to the potential for pollution.**

Marine INNS

1089 As noted in Table 3 (mitigation measures) and described above in Y Fenai a Bae Conwy/ Menai Strait and Conwy Bay (UK) SAC, both a PEMP and biosecurity plan (following relevant best practice guidelines e.g. Natural England and Natural Resources Wales Biosecurity Planning guidance (Cook *et al*., 2014)) are proposed to be produced as a pre-construction mitigation measures to ensure that the potential for INNS is strictly controlled. The conclusion of no AEoI for AyM alone is based on a lack of evidence for any stepping stone effect in the area resulting from the presence of OWF, the distance between AyM and the designated features and the mitigation afforded by the PEMP and biosecurity plan. That lack of evidence is at least partly informed by monitoring at several of the projects included in-combination and therefore applies equally to the in-combination assessment. Together with the distance between the SAC, SPA or Ramsar boundary and most of the in-combination projects, and the expectation that all projects in-combination would be required to have a PEMP (or similar documentation) should there be a risk of marine INNS, informs the conclusion of no potential for any in-combination effect.

1090 There is, therefore, **no potential for an AEoI to the conservation objectives of the designated features of Dee Estuary SAC and Ramsar or supporting habitats of the Dee Estuary SPA in relation to INNS from AyM in-combination and therefore, subject to natural change, the features will be maintained in the long term with respect to marine INNS.**

Changes to Physical Processes

1091 The conclusions for AyM alone were for a lack of connectivity between the effect and all designated features of the SAC or Ramsar and supporting habitats of the SPA. Therefore, AyM cannot contribute to any in-combination effect, if indeed any exist.

1092 There is, therefore, **no potential for an AEoI to the conservation objectives of the designated features of the Dee Estuary SAC and Ramsar or supporting habitats of the Dee Estuary SPA in relation to INNS and therefore, subject to natural change, the features will be maintained in the long term with respect to a change in physical processes.**

EMF

1093 The conclusions for AyM alone were for a lack of direct connectivity between the effect and all designated features of the SAC and Ramsar and supporting habitats of the SPA, with a lack of any significant behavioural change in mobile species. Given that project monitoring has revealed no significant effect on the benthos from the projects included in-combination, it is concluded that there can be no significant in-combination effect on mobile species between AyM and the SAC. Therefore, AyM cannot contribute to any in-combination effect, if indeed any exist.

1094 There is, therefore, **no potential for an AEoI to the conservation objectives of the designated features of the Dee Estuary SAC and Ramsar or supporting habitats of the Dee Estuary SPA in relation to INNS from AyM in-combination and therefore, subject to natural change, the features will be maintained in the long term with respect to INNS.**

11.2 Marine Mammals

1095 The potential for an in-combination effect upon the designated sites grouped under 'marine mammals', as relevant to features and effect pathways screened in for LSE (as summarised in Table 4), is provided below.

11.2.1 Underwater Noise

1096 The potential for an AEoI in-combination on marine mammals as a consequence of underwater noise relates to the sites, features and effects considered in Section 10 for the project alone. The plans and projects screened in for assessment in-combination for harbour porpoise, bottlenose dolphin and grey seal within ES apply equally here (as the MUs applied are the same):

- North Hoyle OWF, Tier 1, all sites and all three species, decommissioning planned;
- Erebus Floating Offshore Wind, Tier 3, all sites and all three species, construction noise and vessel disturbance;
- Dublin Array, Tier 5, all sites and all three species, construction noise;

- Arklow Bank Phase 2, Tier 5, all sites and all three species, vessel disturbance only; and
- WestWave Demo, Tier 2, all sites and all three species, vessel disturbance only.

11.2.2 Onset of PTS

1097 The assessment alone (Section 10) considers the potential for the construction and decommissioning of AyM to result in PTS-onset for all sites and features screened in. The conclusion drawn in all cases is that the requirement for project level mitigation will reduce the risk of PTS-onset resulting from any project activities to negligible levels and therefore no potential for adverse effect will result (specifically in the context of the viability of the species).

1098 All the projects identified for in-combination assessment fall within UK or Irish waters and therefore the requirements of the Habitats Directive (or relevant national transposing legislation) apply. With respect to EPS (which includes all species of cetacean), it is an offence to deliberately injure a cetacean unless an EPS licence has been granted. Typically, projects implement a MMMP (similar to that proposed for AyM, Table 3) to reduce the risk of injury to negligible. However, in certain circumstances a project may apply for an EPS licence; the process requires 3 tests to be met, the third being to maintain the population of the species concerned at favourable conservation status in their natural range (and would therefore deliver on the conservation objectives of the sites).

1099 Therefore, it can be confidently concluded that for all projects in-combination, should any carry the risk of PTS-onset for marine mammals, at most there would be a negligible potential for any affect to result from an individual project (in the context of conservation status) and there would be no potential for any in-combination effect for any of the sites and features screened in.

1100 There is, therefore, **no potential for an AEoI to the conservation objectives of the harbour porpoise, bottlenose dolphin and grey seal features of any of the sites screened in, in relation to PTS-onset from AyM in-combination and therefore, subject to natural change, the harbour porpoise, bottlenose dolphin and grey seal features will be maintained in the long term with respect to the potential for PTS-onset.**

11.2.3 Disturbance

1101 For a project or plan to act in-combination with respect to disturbance resulting from underwater noise, there needs to be temporal overlap between the activities. While the entire construction period for AyM covers a five-year period (Figure 3), Year 1 (2026) is expected to be onshore construction activity only. Offshore construction work is not expected to commence until Year 2 (2027), and foundation installation activities (including UXO clearance and piling) could occur any time between 2027 and 2029 inclusive, but only for a 12-month period within that three-year window (expected indicative date is 2028).

1102 Therefore, the underwater noise impact from UXO and piling for AyM is limited to 2027-2029 inclusive. Further, for the harbour porpoise sites in the UK there is a seasonal element to the designation (see Table 12) with the closest such site to AyM (the North Anglesey Marine/ Gogledd Môn Forol (UK) SAC) being considered important for the summer months only (April to September inclusive). Therefore, the in-combination assessment considers the 2027-2029 timeframe only in line with the ES (with the season caveat for the UK harbour porpoise SACs) and assumes relevant activity at AyM could occur at any point in that window (see Volume 2, Chapter 7).

1103 It is acknowledged that a number of methods are available to determine the potential for significant disturbance to marine mammals, which means individual project assessments are not directly comparable. For the ES (see Volume 2, Chapter 7), to standardise the assessment, the advice provided in JNCC (2020) for harbour porpoise is applied for piling and UXO clearance for all marine mammals (in the absence of similar advice for other marine mammal species). The approach therefore follows the 26 km EDR (as applied here for the harbour porpoise sites in the assessment alone). For the ES, the assessment estimated the number of animals within that range.

1104 Potential for an in-combination effect to result for marine mammals with connectivity to SACs screened in is considered in Table 38 below.

Table 38: Potential for an in-combination effect to manifest on a site-by-site basis.

DESIGNATED SITE	FEATURE(S) SCREENED IN	ASSESSMENT ALONE	POTENTIAL FOR IN-COMBINATION
North Anglesey Marine/ Gogledd Môn Forol (UK) SAC	Harbour porpoise	Maximum contribution to daily or seasonal thresholds of 0.84% No additional significant disturbance to occur within the SAC	North Hoyle: decommissioning only Located to the east of AyM and therefore beyond the 26 km range to the SAC. No potential for an in-combination effect on the disturbance thresholds within the SAC. Erebus Offshore Wind apportioned no impacts (alone or in-combination) to any of the sites identified within this in-combination assessment, and therefore it can be concluded that there is no in-combination impact to be considered from this project. All remaining projects screened in are located at still greater distance from the SAC and therefore no potential for any in-combination effect.

DESIGNATED SITE	FEATURE(S) SCREENED IN	ASSESSMENT ALONE	POTENTIAL FOR IN-COMBINATION
Bristol Channel Approaches/ Dynesfeydd Môr Hafren (UK) SAC	Harbour porpoise	No potential for disturbance to occur within the site and therefore no contribution to the thresholds.	AyM will have no contribution to any in-combination effect at these sites
North Channel (UK) SAC	Harbour porpoise		
West Wales Marine/ Gorllewin Cymru Forol (UK) SAC	Harbour porpoise		
21 Transboundary SACs	Harbour porpoise		
Cardigan Bay/ Bae Ceredigion (UK) SAC	Bottlenose dolphin	No long-term effect to species range No direct disturbance of individuals within the SAC No significant effect on individuals displaced and therefore no adverse effect	Decommissioning activities at North Hoyle likely to involve cutting, which is unlikely to disturb any species of marine mammal (Volume 2, Chapter 7). Erebus Offshore Wind apportioned no impacts (alone or in-combination) to any of the sites identified within this in-combination assessment, and therefore it can be concluded that there is no in-combination impact to be considered from this project. Piling at Dublin Array anticipated in
Pen Llŷn a`r Sarnau/ Lleyn Peninsula and the Sarnau (UK) SAC)	Bottlenose dolphin		
Pen Llŷn a`r Sarnau/ Lleyn Peninsula and the Sarnau (UK) SAC	Grey seal		
Cardigan Bay/ Bae Ceredigion (UK) SAC	Grey seal		
Pembrokeshire Marine (UK) SAC	Grey seal		

DESIGNATED SITE	FEATURE(S) SCREENED IN	ASSESSMENT ALONE	POTENTIAL FOR IN-COMBINATION
Saltee Islands (Ireland) SAC	Grey seal		2025 (outwith the timeframe for in-combination effect with AyM) (Volume 2, Chapter 7). Localised vessel disturbance associated with Arklow Bank Phase 2 and WestWave Demo only (Volume 2, Chapter 7). Therefore, no potential for a significant in-combination effect to arise with respect to disturbance of bottlenose dolphin or grey seal.
Lambay Island (Ireland) SAC	Grey seal		

1105 There is, therefore, **no potential for an AEoI to the conservation objectives of all marine mammal features screened in for all sites in relation to underwater noise disturbance effects from AyM in-combination and therefore, subject to natural change, all marine mammal features will be maintained in the long term with respect to the potential for disturbance from underwater noise.**

11.3 Offshore and Intertidal Ornithology

1106 The screening process for in-combination effects on ornithological features has been based on the species and their associated population designation (i.e., breeding species, over-wintering species and passage species) enabling a zone of influence to be defined in which in-combination effects may occur.

1107 In-combination effects on seabird ornithological receptors with schemes other than offshore wind farms and tidal energy projects are considered to be unlikely due the to the specific impacts (i.e. collision and displacement) generated by turbine arrays in the offshore environment.

1108 For those breeding seabirds that have been screened into the in-combination assessment, a foraging range approach has been used to determine the potential for in-combination effects on a designated site during the breeding bio-season. Any wind farm and tidal energy project which falls within the mean-maximum foraging range + 1SD (Woodward *et al*., 2019 (Table 39) for a relevant species from a designated site included in the alone assessment above (Section 10.3) have been included within the in-combination assessment, excluding Manx shearwater. Manx shearwater mean-maximum foraging range + 1SD is 1346.8±1018.7 km, however impacts are unlikely to occur at this distance. As numbers recorded within the site-specific surveys for AyM were small, impacts are deemed negligible alone. Therefore, it has been deemed more appropriate to include any wind farm project and tidal energy project that falls into the BDMPS UK Western waters plus Channel and along the east coast of Ireland for Manx shearwater in-combination assessment.

1109 The offshore wind farm and tidal energy projects considered for in-combination assessment for each species at each screened in designated site during the breeding bio-season are therefore presented in two parts across Table 40 and Table 41. The tiers/sub-tiers are given in brackets for each wind farm considered, with the tiering system presented in Table 6.

1110 During the non-breeding bio-season, plans and projects within the BDMPS region for each species has been considered in-combination with AyM. The BDMPS for each species is as follows:

- Guillemot, razorbill, puffin, gannet, herring gull, lesser black-backed gull – UK Western Waters; and
- Kittiwake and Manx shearwater – UK Western Waters plus Channel.

1111 The following plans and projects are within the UK Western Waters BDMPS:

- Pentland;
- The West of Orkney Windfarm;
- Scottish Sectoral Marine Plan - N1;
- Scottish Sectoral Marine Plan - N2;
- Northland Power N2;
- Magnora - Technip N3;
- Scottish Sectoral Marine Plan - N3;
- Northland Power N4;
- Scottish Sectoral Marine Plan;
- Shearwater One;
- MachairWind;
- Gwynt y Môr;
- Burbo Bank;
- Burbo Bank Extension;
- North Hoyle;
- Rhyl Flats;
- Walney I & II;
- Barrow;
- Robin Rigg;
- West of Duddon Sands;
- Ormonde;

- Walney Extension;
- TwinHub;
- Valorous;
- Erebus;
- Draig y Môr;
- Morlais;
- Isle of Man;
- Llŷr 1;
- Llŷr 2;
- Petroc;
- White Cross;
- Gwynt Glas;
- Llywelyn;
- Morgan;
- Morecambe; and
- Mona.

1112 Alongside the plans and projects listed above, the following are within the UK Western Waters plus Channel BDMPS:

- Rampion I; and
- Rampion II.

1113 Currently, a number of projects off the eastern coast of Ireland and the west coast of England and Wales have been proposed. However, these projects are yet to produce PEIR (or equivalent for the member state) and as a result, they cannot be included in this in-combination assessment beyond Table 40 and Table 41 as no potential impact has yet been quantified (i.e., CRM). As a result, a number of designated sites have no other impacts attributed to their designated features, therefore, the assessment has been conducted on a species-by-species basis for the in-combination assessment, rather than designated site, to reduce repetition.

Table 39: Foraging ranges for relevant species.

SPECIES	MEAN MAX FORAGING RANGE (KM) THAXTER *ET AL.* (2012)	MAX FORAGING RANGE (KM) THAXTER *ET AL.* (2012)	MEAN MAX FORAGING RANGE + 1 S.D. (KM) WOODWARD *ET AL.* (2019)
Guillemot	84.2	135	153.7
Razorbill	48.5	95	164.6
Puffin	105.4	200	265.4
Gannet	229.4	590	509.4
Kittiwake	60	120	300.6
Herring Gull	61.1	92	85.6
Lesser black-backed gull	141	181	236
Manx shearwater	>330	>330	2365.5

Table 40: Offshore wind farm and tidal energy plans and projects to assess in-combination during the breeding bio-season for ornithological features part 1 (Tier of the project written in brackets).

SPECIES	DESIGNATED SITE	BURBOBANK (1A)	BURBO BANK EXTENSION (1A)	GWYNT Y MÔR (1A)	NORTH HOYLE (1A)	RHYL FLATS (1A)	WALNEY I & II (1A)	BARROW (1A)	ROBIN RIGG (1A)	WEST OF DUDDON SANDS (1A)	ORMONDE (1A)	WALNEY EXTENSION (1A)	ARKLOW BANK (1A)	TWINHUB (1C)	EMERALD (3A)	INIS EALGA MARINE ENERGY PARK (3C)	NORTH CELTIC SEA (3C)	SSE RENEWABLES CELTIC SEA (3C)	VALOROUS (3C)	EREBUS (1D)	SHELMALERE (3C)	SOUTH IRISH SEA (3A)	KILMICHAEL POINT (3C)	CODLING (3A)	DUBLIN ARRAY (3A)	NORTH IRISH SEA ARRAY (3A) (NISA)	CAILLEACH (3C)
Gannet	Ailsa Craig SPA	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	Grassholm SPA	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Herring gull	Morecambe Bay and Duddon Estuary SPA	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
	Morecambe Bay and Duddon Estuary SPA	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Kittiwake	Lambay Island SPA	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	Ailsa Craig SPA	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N	N	N	N	N	N	N	Y	Y	Y	Y	Y	Y
	Ireland's Eye SPA	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	Howth Head Coast SPA	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

SPECIES	DESIGNATED SITE	BURBOBANK (1A)	BURBO BANK EXTENSION (1A)	GWYNT Y MÔR (1A)	NORTH HOYLE (1A)	RHYL FLATS (1A)	WALNEY I & II (1A)	BARROW (1A)	ROBIN RIGG (1A)	WEST OF DUDDON SANDS (1A)	ORMONDE (1A)	WALNEY EXTENSION (1A)	ARKLOW BANK (1A)	TWINHUB (1C)	EMERALD (3A)	INIS EALGA MARINE ENERGY PARK (3C)	NORTH CELTIC SEA (3C)	SSE RENEWABLES CELTIC SEA (3C)	VALOROUS (3C)	EREBUS (1D)	SHELMALERE (3C)	SOUTH IRISH SEA (3A)	KILMICHAEL POINT (3C)	CODLING (3A)	DUBLIN ARRAY (3A)	NORTH IRISH SEA ARRAY (3A) (NISA)	CAILLEACH (3C)
	Wicklow Head SPA	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	Skomer, Skokholm and the Seas off Pembrokeshire SPA	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	Saltee Islands SPA	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Guillemot	Lambay Island SPA	N	N	Y	N	Y	N	N	N	N	N	Y	Y	N	N	N	N	N	N	N	Y	Y	Y	Y	Y	Y	Y
	Ireland's Eye SPA	N	N	N	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	Y	Y	Y	Y	Y	Y	Y
Razorbill	Lambay Island SPA	N	N	Y	N	Y	N	N	N	N	N	Y	Y	N	N	N	N	N	N	N	Y	Y	Y	Y	Y	Y	Y
	Ireland's Eye SPA	N	N	Y	N	Y	N	N	N	N	N	Y	Y	N	N	N	Y	N	N	N	Y	Y	Y	Y	Y	Y	Y

SPECIES	DESIGNATED SITE	BURBOBANK (1A)	BURBO BANK EXTENSION (1A)	GWYNT Y MÔR (1A)	NORTH HOYLE (1A)	RHYL FLATS (1A)	WALNEY I & II (1A)	BARROW (1A)	ROBIN RIGG (1A)	WEST OF DUDDON SANDS (1A)	ORMONDE (1A)	WALNEY EXTENSION (1A)	ARKLOW BANK (1A)	TWINHUB (1C)	EMERALD (3A)	INIS EALGA MARINE ENERGY PARK (3C)	NORTH CELTIC SEA (3C)	SSE RENEWABLES CELTIC SEA (3C)	VALOROUS (3C)	EREBUS (1D)	SHELMALERE (3C)	SOUTH IRISH SEA (3A)	KILMICHAEL POINT (3C)	CODLING (3A)	DUBLIN ARRAY (3A)	NORTH IRISH SEA ARRAY (3A) (NISA)	CAILLEACH (3C)
Puffin	Skomer, Skokholm and the Seas off Pembrokeshire SPA	Y	Y	Y	Y	Y	N	N	N	N	N	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	Saltee Islands SPA	N	Y	Y	Y	Y	N	N	N	N	N	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	Rathlin Island SPA	N	N	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	N	N	N	N	N	N	N	N	N	N	Y	Y	Y	Y
	Lambay Island SPA	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Manx shearwater	Skomer, Skokholm and the Seas off Pembrokeshire SPA	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	Aberdaron Coast and Bardsey Island SPA	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Table 41: Plans and projects to assess in-combination during the breeding bio-season for ornithological features part 2 (Tier of the windfarm project written in brackets).

SPECIES	DESIGNATED SITE	SSE RENEWABLES BRAYMORE (3A)	COOLEY POINT (3A)	CLOGHER HEAD (3A)	ORIEL (3A)	DRAIG Y MÔR (3C)	MORLAIS (1C)	ISLE OF MAN (3C)	LLYR 1 (3C)	LLYR 2 (3C)	WHITE CROSS (3C)	PETROC (3C)	GWYNT GLAS (3C)	LLYWELYN (3C)	SHEARWATER ONE (3C)	MORGAN (3C)	MONA (3C)	MORECAMBE (3C)	SEA STACKS (3C)	INIS EAST 1 (3C)	GREYSTONES (3C)	INIS EAST 2 (3C)	LATITUDE 52 (3C)	BLACKWATER (3C)	RAMPION (1A)	RAMPION 2 (3C)
Gannet	Ailsa Craig SPA	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N
	Grassholm SPA	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N
Herring gull	Morecambe Bay and Duddon Estuary SPA	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	Y	Y	Y	N	N	N	N	N	N	N	N
	Morecambe Bay and Duddon Estuary SPA	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	Y	Y	Y	N	N	N	N	N	N	N	N
Kittiwake	Lambay Island SPA	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N
	Ailsa Craig SPA	Y	Y	Y	Y	Y	Y	Y	N	N	N	N	N	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N	N
	Ireland's Eye SPA	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N
	Howth Head Coast SPA	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N
	Wicklow Head SPA	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N
	Skomer, Skokholm and the Seas off Pembrokeshire SPA	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N

SPECIES	DESIGNATED SITE	SSE RENEWABLES BRAYMORE (3A)	COOLEY POINT (3A)	CLOGHER HEAD (3A)	ORIEL (3A)	DRAIG Y MÔR (3C)	MORLAIS (1C)	ISLE OF MAN (3C)	LLYR 1 (3C)	LLYR 2 (3C)	WHITE CROSS (3C)	PETROC (3C)	GWYNT GLAS (3C)	LLYWELYN (3C)	SHEARWATER ONE (3C)	MORGAN (3C)	MONA (3C)	MORECAMBE (3C)	SEA STACKS (3C)	INIS EAST 1 (3C)	GREYSTONES (3C)	INIS EAST 2 (3C)	LATITUDE 52 (3C)	BLACKWATER (3C)	RAMPION (1A)	RAMPION 2 (3C)
	Saltee Islands SPA	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N
Guillemot	Lambay Island SPA	Y	Y	Y	Y	Y	Y	Y	N	N	N	N	N	N	N	Y	Y	N	Y	Y	Y	Y	Y	N	N	N
	Ireland's Eye SPA	Y	Y	Y	Y	Y	Y	Y	N	N	N	N	N	N	N	Y	Y	N	Y	Y	Y	Y	Y	N	N	N
Razorbill	Lambay Island SPA	Y	Y	Y	Y	Y	Y	Y	N	N	N	N	N	N	N	Y	Y	Y	Y	Y	Y	Y	Y	N	N	N
	Ireland's Eye SPA	Y	Y	Y	Y	Y	Y	Y	N	N	N	N	N	N	N	Y	Y	Y	Y	Y	Y	Y	Y	N	N	N
Puffin	Skomer, Skokholm and the Seas off Pembrokeshire SPA	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N
	Saltee Islands SPA	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	N	Y	Y	N	Y	Y	Y	Y	Y	Y	N	N
	Rathlin Island SPA	Y	Y	Y	Y	Y	Y	Y	N	N	N	N	N	N	Y	Y	Y	Y	Y	Y	Y	N	Y	N	N	N
	Lambay Island SPA	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N
Manx shearwater	Skomer, Skokholm and the Seas off Pembrokeshire SPA	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

SPECIES	DESIGNATED SITE	SSE RENEWABLES BRAYMORE (3A)	COOLEY POINT (3A)	CLOGHER HEAD (3A)	ORIEL (3A)	DRAIG Y MÔR (3C)	MORLAIS (1C)	ISLE OF MAN (3C)	LLYR 1 (3C)	LLYR 2 (3C)	WHITE CROSS (3C)	PETROC (3C)	GWYNT GLAS (3C)	LLYWELYN (3C)	SHEARWATER ONE (3C)	MORGAN (3C)	MONA (3C)	MORECAMBE (3C)	SEA STACKS (3C)	INIS EAST 1 (3C)	GREYSTONES (3C)	INIS EAST 2 (3C)	LATITUDE 52 (3C)	BLACKWATER (3C)	RAMPION (1A)	RAMPION 2 (3C)
	Aberdaron Coast and Bardsey Island SPA	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

1114 For all other species taken through for in-combination assessment, including red-throated diver and common scoter, it is relevant to assess, in-combination, all plans and projects in addition to offshore wind farms and tidal energy projects including dredging activities within a relevant zone as discussed within each species section below.

1115 A description of the significance of project level effects upon the receptors grouped under ‘offshore ornithology’, as relevant to the designated sites and their associated features screened in for LSE is provided below.

11.3.1 Construction and Decommissioning

1116 A review of potential impacts from AyM to intertidal and offshore ornithological receptors during construction and decommissioning is provided in Table 42 to aid determination on the designated sites and features required to be assessed in-combination with other plans and projects.

1117 All features that have been assessed alone have been considered for in-combination assessment. Table 42 shows which of these features have been taken through for in-combination assessment with rationale for those not included.

Table 42: Summary of the sites and features considered for a disturbance and disaplcement assessment during construction and decommissioning phases for AyM in-combination.

DESIGNATED SITE	OFFSHORE AND INTERTIDAL ORNITHOLOGY FEATURE(S) SCREENED IN	PROGRESSED TO IN-COMBINATION?	RATIONALE
Liverpool Bay/ Bae Lerpwl SPA	Red-throated diver	Yes	>0 individual contribution
	Common scoter	Yes	>0 individual contribution
	Red-breasted merganser (assemblage feature only)	No	No pathway for effect
The Dee Estuary SPA (offshore)	Sandwich tern	No	Non-breeding terns may pass through or visit the AyM array area during the non-breeding season and were considered for assessment, but due to a thinning of the potential risk when considering birds from multiple designated sites, the relative impact on a specific SPA or Ramsar population is considered to be inconsequential. Therefore, no migratory terns were screened in for in-combination.
The Dee Estuary SPA (onshore)	Little tern Sandwich tern	No	
Lambay Island SPA	Guillemot	Yes	>0 individual contribution
	Razorbill	Yes	>0 individual contribution
	Puffin	Yes	>0 individual contribution
Ailsa Craig SPA	Gannet	Yes	>0 individual contribution
Ireland's Eye SPA	Guillemot	Yes	>0 individual contribution
	Razorbill	Yes	>0 individual contribution
Aberdaron Coast and Bardsey Island/ Glannau Aberdaron ac Ynys Enlli SPA	Manx shearwater	Yes (upon request by NRW)	>0 individual contribution
Copeland Islands SPA	Manx shearwater	No	No pathway for effect
Skomer, Skokholm and the Seas off Pembrokeshire/ Sgomer, Sgogwm a Moroedd Penfro	Puffin	Yes	>0 individual contribution
	Guillemot (assemblage feature only)	Yes (upon request by NRW)	>0 individual contribution
	Razorbill (assemblage feature only)	Yes (upon request by NRW)	>0 individual contribution
	Manx shearwater	Yes (upon request by NRW)	>0 individual contribution
	Storm petrel	No	No pathway for effect
Raithlin Island SPA	Puffin (assemblage feature only)	Yes	>0 individual contribution
Saltee Island SPA	Puffin	Yes	>0 individual contribution
Grassholm SPA	Gannet	Yes	>0 individual contribution
Ynys Seiriol/ Puffin Island SPA	Cormorant	No	No pathway for effect

Red-throated diver

1118 For non-breeding over-wintering features such as red-throated diver, the spatial extent of in-combination effects is defined as the area within the Liverpool Bay SPA for which the species is a designated feature, this includes GyM, Burbo Bank, Burbo Bank Extension, North Hoyle and Rhyl Flats offshore wind farms.

1119 No offshore wind farms plans or projects have construction impacts that may act in-combination with AyM construction phase. This is due to either the projects being already fully operational or the plans have yet to assess impacts and attribute these back to designated sites. There are however, a number of wind farms that are operational that may act in-combination with the construction impacts from AyM. These are assessed in-combination below.

1120 Additionally, a review of other industries impacts which may act in-combination with potential impacts from the Project was undertaken to determine quantitative data which would permit assessment. Other industries investigated include aggregates and how the presence and transit of dredging vessels may act in-combination with cable laying and operational vessel movements to disturb sensitive bird species, such as red-throated diver and common scoter. Additionally, there were no impacts from Morlais tidal energy project on red-throated diver as this project does not overlap with Liverpool Bay SPA.

1121 As was found to be the case with historic offshore wind development, the majority of other industries do no provide a quantitative assessment of impacts. It is not appropriate to re-assess another Projects impacts if impacts were not provided by the developer. Therefore, and where available, information on a qualitative basis has been gleaned from other industries to enable a qualitative in-combination assessment.

1122 Within the Liverpool Bay region (north west) there is a small-scale aggregates industry which operates to the west of the Project, comprising Area 392, 393 and 457. All three areas are within the Liverpool Bay SPA.

1123 Area 457 licence period is active from 2010 to 2025, with baseline surveys undertaken in 2009. However, due to the cessation of the aggregate licence in 2025 there will be no in-combination impact as construction works for AyM will not be initiated until 2026. Therefore Area 457 cannot act in-combination to disturb features of the Liverpool Bay SPA.

1124 Area 392 and 393 (also known as Hilbre Swash) are considered under the same licence. Dredging has been undertaken within the 392/393 zones and wider area since 1959 and any potential disturbance associate with dredging activity can therefore be considered as part of the Liverpool Bay SPA baseline. The active licence period for Area 392 and 393 spans from 2014 to 2029 which will therefore overlap with the construction phase of the AyM project. Quantitative information on impacts to sensitive bird species has not been calculated by the aggregates project which therefore restricts the in-combination assessment to a qualitative level.

1125 The EIA consent approval granted by Natural Resources Wales stated that the licence area lies out with the main areas of known concentrations for most seabird species within Liverpool Bay, and the wider Liverpool Bay contains abundant alternative foraging habitat to that within the application area. In the context of the ongoing dredging activity, the small area involved in the proposed dredging and the low level of vessel activity compared to other sources of vessel activity within Liverpool Bay, the overall, effects to the regional populations of seabirds including red-throated diver, common scoter, auks, gulls and terns were considered to be not significant. With regard to the SPA, the regulator determined no significant impact to red-throated diver, common scoter, gulls, terns and auks from both direct impacts as a result of the dredging activity and disturbance from vessels transiting back and forth from the dredging area.

1126 Based on the above EIA consent decision, the historic levels of dredging activity which forms part of the Liverpool Bay SPA baseline, and the fact that the dredging areas of Area 392 and 393 are a significant distance (> 20 km) from the proposed cable laying activities, there is no likelihood of an in-combination level effect upon the features of the Liverpool Bay SPA.

1127 For the construction phase, Table 43 shows the predicted mortality of individuals resulting from disturbance and displacement from each of the wind farm developments that may act in-combination with AyM. Red-throated diver are screened into the assessment during the non-breeding bio-season, however previous wind farm assessments have focused on the potential impact during the migration-free winter bio-season therefore data is unavailable or inconsistent for impacts in other bio-seasons. In addition, effects outside of the winter bio-season are unlikely to be significant as birds move elsewhere (to northern breeding grounds). Therefore, there are lower densities in the region resulting in lower competition for food resources, meaning displaced birds are less likely to suffer mortality during these additional bio-seasons. Therefore, this in-combination assessment is focused on the migration-free winter bio-season, only, from other projects and plans in-combination with the impacts from AyM during the migration-free breeding bio-season and migratory bio-seasons.

1128 A 1% mortality rate for the array area plus 4-8km buffer and 0.5% mortality rate for the cable construction has been used in-line with the AyM alone assessment approach for red-throated diver (Section 10.3).

Table 43: Predicted mortality rate of red-throated diver resulting from disturbance and displacement from projects considered in-combination during construction.

DEVELOPMENT NAME	PREDICTED MORTALITY (NON-BREEDING)
Burbo Bank Extension	0.3
Burbo Bank	0.11
Gwynt y Môr	0.35
North Hoyle	0
Rhyl Flats	0.24
Awel y Môr	0.7
Total	1.7

1129 The in-combination predicted mortality within the Liverpool Bay SPA totals 1.7, 0.15% of the Liverpool Bay SPA citation population. With a classified red-throated diver population of 1,171 individuals (an annual background mortality of 272.8), on the basis of 1.7 individual mortalities per annum suffering displacement consequent mortality during construction and decommissioning of AyM at Liverpool Bay SPA would represent a 0.6% increase in baseline mortality per annum.

1130 The potential total of 1.7 mortalities at Liverpool Bay SPA per annum equates to less than 1% increase in baseline mortality for either citation or latest colony count. This increase would be indistinguishable from natural fluctuations in the population.

1131 Alongside population conversation objectives, supporting habitat conservation objectives must also be considered. Section 11.1 considers impacts on subtidal and benthic intertidal habitats at Liverpool Bay SPA for red-throated diver, common scoter and the waterbird assemblage. It concluded that given the conclusions for AyM alone, being temporary, highly localised and small scale, extending to a very small proportion of habitat across the SPA with no significant effect on supporting habitats, together with the lack of any apparent significant effects resulting from the construction of both GyM and Rhyl Flats on the wider benthos, there is **no potential for AEoI to physical loss of supporting habitats in-combination. Additionally, it concluded that for projects in-combination, all are in operation with the potential for physical damage being highly limited and localised. With respect to the aggregate sites, the associated HRA concluded no LSE for all sites. Therefore, no AEoI was concluded for physical damage to supporting habitats in-combination.**

1132 Therefore, there would be **no potential for an AEoI to the population and habitat conservation objectives of the red-throated diver feature at Liverpool Bay SPA in relation to potential adverse collision effects from the construction and decommissioning phase of AyM alone. Therefore, subject to natural change, red-throated diver would be maintained as a feature in the long term.**

Common scoter

1133 For non-breeding over-wintering features such as common scoter, the spatial extent of in-combination effects is defined as the area within the Liverpool Bay SPA for which the species is a designated feature, this includes GyM, Burbo Bank, Burbo Bank Extension, North Hoyle and Rhyl Flats offshore wind farms.

1134 A review of other industries impacts which may act in-combination with potential impacts from the Project was undertaken to determine quantitative data which would permit assessment. Other industries investigated include aggregates and how the presence and transit of dredging vessels may act in-combination with cable laying and operational vessel movements to disturb sensitive bird species, such as red-throated diver and common scoter. Additionally, there were no impacts from Morlais tidal energy project on common scoter as this project does not overlap with Liverpool Bay SPA.

1135 A review of other industries impacts which may act in-combination with potential impacts from the Project was undertaken to determine quantitative data which would permit assessment. Other industries investigated include aggregates and how the presence and transit of dredging vessels may act in-combination with cable laying and operational vessel movements to disturb sensitive bird species, such as red-throated diver and common scoter. Additionally, there were no impacts from Morlais tidal energy project on common scoter as this project does not overlap with Liverpool Bay SPA.

1136 As was found to be the case with historic offshore wind development, the majority of other industries do no provide a quantitative assessment of impacts. It is not appropriate to re-assess another Projects impacts if impacts were not provided by the developer. Therefore, and where available, information on a qualitative basis has been gleaned from other industries to enable a qualitative in-combination assessment.

1137 Within the Liverpool Bay region (north west) there is a small-scale aggregates industry which operates to the west of the Project, comprising Area 392, 393 and 457. All three areas are within the Liverpool Bay SPA.

1138 Area 457 licence period is active from 2010 to 2025, with baseline surveys undertaken in 2009. However, due to the cessation of the aggregate licence in 2025 there will be no in-combination impact as construction works for AyM will not be initiated until 2026. Therefore Area 457 cannot act in-combination to disturb features of the Liverpool Bay SPA.

1139 Area 392 and 393 (also known as Hilbre Swash) are considered under the same licence. Dredging has been undertaken within the 392/393 zones and wider area since 1959 and any potential disturbance associate with dredging activity can therefore be considered as part of the Liverpool Bay SPA baseline. The active licence period for Area 392 and 393 spans from 2014 to 2029 which will therefore overlap with the construction phase of the AyM project. Quantitative information on impacts to sensitive bird species has not been calculated by the aggregates project which therefore restricts the in-combination assessment to a qualitative level.

1140 The EIA consent approval granted by Natural Resources Wales stated that the licence area lies out with the main areas of known concentrations for most seabird species within Liverpool Bay, and the wider Liverpool Bay contains abundant alternative foraging habitat to that within the application area. In the context of the ongoing dredging activity, the small area involved in the proposed dredging and the low level of vessel activity compared to other sources of vessel activity within Liverpool Bay, the overall, effects to the regional populations of seabirds including red-throated diver, common scoter, auks, gulls and terns were considered to be not significant. With regard to the SPA, the regulator determined no significant impact to red-throated diver, common scoter, gulls, terns and auks from both direct impacts as a result of the dredging activity and disturbance from vessels transiting back and forth from the dredging area.

1141 Based on the above EIA consent decision, the historic levels of dredging activity which forms part of the Liverpool Bay SPA baseline, and the fact that the dredging areas of Area 392 and 393 are a significant distance (> 20 km) from the proposed cable laying activities, there is no likelihood of an in-combination level effect upon the features of the Liverpool Bay SPA.

1142 For the construction and decommissioning phase, Table 44 shows the expected morality of individuals resulting from disturbance and displacement from each of the wind farm developments that may act in-combination with AyM. Common scoter are only screened in during the non-breeding bio-season, therefore this species has only been assessed during this bio-season.

Table 44: Predicted mortality rate of common scoter resulting from distrubance and displacement from projects considered in-combination during construction and decommissioning.

DEVELOPMENT NAME	PREDICTED MORTALITY (NON-BREEDING) (BASED ON DEVELOPER MORTALITY RATES)
Burbo Bank Extension	4
Burbo Bank	0
Gwynt y Môr	0
North Hoyle	0.1
Rhyl Flats	1.3
Awel y Môr	17.5
Total	22.9

1143 The in-combination predicted mortality within the Liverpool Bay SPA totals 22.9, 0.04% of the Liverpool Bay SPA citation population. With a classified common scoter population of 56,679 individuals (an annual background mortality of 13,490) on the basis of 22.9 individual mortalities per annum suffering displacement consequent mortality during construction and decommissioning at Liverpool Bay SPA would represent a 0.17% increase in baseline mortality per annum.

1144 The potential total of 22.9 mortalities at Liverpool Bay SPA per annum equates to less than 1% increase in baseline mortality for either citation or latest colony count. This increase would be indistinguishable from natural fluctuations in the population.

1145 Alongside population conversation objectives, supporting habitat conservation objectives must also be considered. Section 11.1 considers impacts on subtidal and benthic intertidal habitats at Liverpool Bay SPA for red-throated diver, common scoter and the waterbird assemblage. It concluded that given the conclusions for AyM alone, being temporary, highly localised and small scale, extending to a very small proportion of habitat across the SPA with no significant effect on supporting habitats, together with the lack of any apparent significant effects resulting from the construction of both GyM and Rhyl Flats on the wider benthos, there is **no potential for AEoI to physical loss of supporting habitats in-combination. Additionally, it concluded that for projects in-combination, all are in operation with the potential for physical damage being highly limited and localised. With respect to the aggregate sites, the associated HRA concluded no LSE for all sites. Therefore, no AEoI was concluded for physical damage to supporting habitats in-combination.**

1146 Therefore, there would be **no potential for an AEoI to the population and habitat conservation objectives of the common scoter feature at Liverpool Bay SPA in relation to potential adverse collision effects from the construction and decommissioning phase of AyM alone. Therefore, subject to natural change, common scoter would be maintained as a feature in the long term.**

Breeding seabirds

1147 Plans and projects considered for an in-combination assessment (Table 40 and Table 41) with AyM during construction and decommissioning have been based on the mean-maximum foraging + 1SD ranges (Woodward *et al*., 2019) of seabird species (Table 39) during the breeding bio-season and based on BDMPS regions during the non-breeding bio-seasons. From the plans and projects whose construction period overlap with AyM construction, none have assessed impacts during the construction phase attributed to the features for the SPAs screened into the AyM assessment. Therefore, only operational impacts may act in-combination with AyM construction impacts.

1148 The operational impacts of offshore wind farm projects are deemed worse than those during construction. Therefore, those plans and projects considered in-combination which have existing data for impacts during the operation and maintenance phase have been assessed in-combination with operation and maintenance impacts for AyM for each species. This provides the Applicants worse case in-combination assessment. Any in-combination impacts that may arise from AyM during construction and decommissioning with operational impacts from other plans or projects will be less than the in-combination impacts presented below for AyM during the operation and maintenance phase.

11.3.2 Operation and Maintenance

1149 A review of potential impacts from AyM to intertidal and offshore ornithological receptors during O&M is provided in Table 45 to aid determination on the designated sites and features required to be assessed in-combination with other plans and projects.

1150 All features that have been assessed alone have been considered for in-combination assessment.

1151 Table 45 shows which of these features have been taken through for in-combination assessment with rationale for those not included.

1152 The in-combination assessment during operation and maintenance includes all plans and projects which may act in-combination with AyM. Many of these offshore wind farm projects are in the planning stage and therefore, no assessment has yet been undertaken to determine impacts. Additionally, a number of projects have CRM and abundance data available, however have not apportioned impacts to designated sites within mean-maximum foraging range +1SD. The Applicant does not deem it appropriate to reassess/reapportion operational project impacts. Therefore, where impacts have not been apportioned or assessed, these have not been included in the in-combination assessment for each species.

Table 45: Summary of the sites and features considered for a distrubance and displacement assessment during O&M phases for AyM in-combination.

DESIGNATED SITE	OFFSHORE AND INTERTIDAL ORNITHOLOGY FEATURE(S) SCREENED IN	PROGRESSED TO IN-COMBINATION?	RATIONALE
Liverpool Bay/ Bae Lerpwl SPA	Red-throated diver (operation vessel movement during O&M)	No	No quantitative assessment could be made for this impact, therefore a qualitative alone assessment was undertaken. Additionally, there was no information from other projects available for an in-combination assessment to be undertaken.
	Red-throated diver (all other impacts)	Yes	>0 individual contribution
	Common scoter (operation vessel movement during O&M)	No	No quantitative assessment could be made for this impact, therefore a qualitative alone assessment was undertaken. Additionally, there was no information from other projects available for an in-combination assessment to be undertaken.
	Common scoter (all other impacts)	Yes	>0 individual contribution
	Red-breasted merganser (assemblage feature only) (operation vessel movement during O&M)	No	No quantitative assessment could be made for this impact, therefore a qualitative alone assessment was undertaken. Additionally, there was no information from other projects available for an in-combination assessment to be undertaken.
	Red-breasted merganser (assemblage feature only) (all other impacts)	No	No pathway for effect
	Little gull	No	No little gull recorded by site specific survey data therefore no pathway for effect determined
	Common tern Little tern	No	Non-breeding terns or waterbirds may pass through or visit the AyM array area during the non-breeding season and were considered for assessment, but due to a thinning of the potential risk when considering birds from multiple designated sites, the relative impact on a specific SPA or Ramsar population is considered to be inconsequential. Therefore, no migratory terns or waterbirds were screened in for in-combination.
The Dee Estuary SPA (offshore)	Sandwich tern Common tern Little tern Waterbirds	No	
The Dee Estuary SPA (onshore)	Little tern Sandwich tern Migratory waterbirds	No	
Dee Estuary Ramsar (onshore)	Migratory waterbirds	No	
Anglesey Terns/ Morwenoliaid Ynys Mon SPA	Sandwich tern Roseate tern Common tern	No	No pathway for effect for roseate tern, common tern and Arctic tern. Zero Sandwich terns were recorded in the array and trivial numbers in the 2 km buffer. Assessment alone concluded potential for a

DESIGNATED SITE	OFFSHORE AND INTERTIDAL ORNITHOLOGY FEATURE(S) SCREENED IN	PROGRESSED TO IN-COMBINATION?	RATIONALE
	Arctic tern		trivial and inconsequential level of effect, that would be well within the error margins of the assessment, and therefore no potential for any contribution for an in-combination effect.
Ribble and Alt Estuaries SPA	Lesser black-backed gull	No	Less than 0.2 individual mortalities are attributed to this SPA. Assessment alone concluded potential for a trivial and inconsequential level of effect, that would be well within the error margins of the assessment, and therefore no potential for any meanicontribution for an in-combination effect.
Ribble and Alt Estuaries Ramsar	Lesser black-backed gull	No	Less than 0.2 individual mortalities are attributed to this Ramsar. Assessment alone concluded potential for a trivial and inconsequential level of effect, that would be well within the error margins of the assessment, and therefore no potential for any contribution for an in-combination effect.
Morecambe Bay and Duddon Estuary SPA	Lesser black-backed gull	No	Less than 0.01 individual mortalities are attributed to this SPA. Assessment alone concluded potential for a trivial and inconsequential level of effect, that would be well within the error margins of the assessment, and therefore no potential for any contribution for an in-combination effect.
	Herring gull	Yes	>0 individual contribution
	Great black-backed gull	No	No pathway for effect
Morecambe Bay Ramsar	Herring gull	Yes	>0 individual contribution
	Lesser black-backed gull	No	Less than 0.01 individual mortalities are attributed to this Ramsar. Assessment alone concluded potential for a trivial and inconsequential level of effect, that would be well within the error margins of the assessment, and therefore no potential for any contribution for an in-combination effect.
Bowland Fells SPA and pSPA	Lesser black-backed gull	No	Less than 0.3 individual mortalities are attributed to this SPA. Assessment alone concluded potential for a trivial and inconsequential level of effect, that would be well within the error margins of the assessment, and therefore no potential for any contribution for an in-combination effect.
Lambay Island SPA	Kittiwake	Yes	>0 individual contribution
	Lesser black-backed gull	No	Less than 0.01 individual mortalities are attributed to this SPA. Assessment alone concluded potential for a trivial and inconsequential level of effect, that would be well within the error margins of the assessment, and therefore no potential for any contribution for an in-combination effect.

DESIGNATED SITE	OFFSHORE AND INTERTIDAL ORNITHOLOGY FEATURE(S) SCREENED IN	PROGRESSED TO IN-COMBINATION?	RATIONALE
	Guillemot	Yes	>0 individual contribution
	Razorbill	Yes	>0 individual contribution
	Puffin	Yes	>0 individual contribution
Ailsa Craig SPA	Lesser black-backed gull	No	Less than 0.001 individual mortalities are attributed to this SPA. Assessment alone concluded potential for a trivial and inconsequential level of effect, that would be well within the error margins of the assessment, and therefore no potential for any contribution for an in-combination effect.
	Kittiwake (assemblage feature only)	Yes	>0 individual contribution
	Gannet	Yes	>0 individual contribution
Ireland's Eye SPA	Kittiwake	Yes	>0 individual contribution
	Guillemot	Yes	>0 individual contribution
	Razorbill	Yes	>0 individual contribution
Howth Head Coast SPA	Kittiwake	Yes	>0 individual contribution
Wicklow Head	Kittiwake	Yes	>0 individual contribution
Aberdaron Coast and Bardsey Island/ Glannau Aberdaron ac Ynys Enlli SPA	Manx shearwater	Yes (upon request by NRW)	>0 individual contribution
Copeland Islands SPA	Manx shearwater	No	No pathway for effect
Skomer, Skokholm and the Seas off Pembrokeshire/ Sgomer, Sgogwm a Moroedd Penfro SPA	Kittiwake (assemblage feature only)	Yes	>0 individual contribution
	Lesser black-backed gull	No	No lesser black-backed gull recorded by site specific survey data in the non-breeding season therefore no pathway for effect determined.
	Puffin	Yes	>0 individual contribution
	Guillemot (assemblage feature only)	Yes (upon request by NRW)	>0 individual contribution
	Razorbill (assemblage feature only)	Yes (upon request by NRW)	>0 individual contribution
	Manx shearwater	Yes (upon request by NRW)	>0 individual contribution
	Storm petrel	No	No pathway for effect
Raithlin Island SPA	Puffin (assemblage feature only)	Yes	>0 individual contribution
Saltee Islands SPA	Kittiwake	Yes	>0 individual contribution

DESIGNATED SITE	OFFSHORE AND INTERTIDAL ORNITHOLOGY FEATURE(S) SCREENED IN	PROGRESSED TO IN-COMBINATION?	RATIONALE
	Lesser black-backed gull	No	Less than 0.001 individual mortalities are attributed to this SPA. Assessment alone concluded potential for a trivial and inconsequential level of effect, that would be well within the error margins of the assessment, and therefore no potential for any contribution for an in-combination effect.
	Puffin	Yes	>0 individual contribution
Wexford Harbour and Slobs SPA	Lesser black-backed gull	No	No pathway for effect
Helvick Head to Ballyquin SPA	Kittiwake	No	No pathway for effect
Grassholm SPA	Gannet	Yes	>0 individual contribution
Ynys Seiriol/ Puffin Island SPA	Cormorant	No	No pathway for effect
Traeth Lafan/ Layan Sands, Conway Bay SPA	Migratory waterbirds	No	Non-breeding terns or waterbirds may pass through or visit the AyM array area during the non-breeding season and were considered for assessment, but due to a thinning of the potential risk when considering birds from multiple designated sites, the relative impact on a specific SPA or Ramsar population is considered to be inconsequential. Therefore, no migratory terns or waterbirds were screened in for in-combination.
Dyfi Estuary/ Aber Dyfi SPA	Migratory waterbirds	No	
Burry Inlet SPA	Migratory waterbirds	No	
Burry Inlet Ramsar	Migratory waterbirds	No	
Severn Estuary SPA	Migratory waterbirds	No	
Severn Estuary Ramsar	Migratory waterbirds	No	

Collision In-combination

1153 For many of the Round 1 and Round 2 sites present within the Liverpool Bay and the Irish Sea, limited data are available to inform the assessment, particularly in reference to bird densities and CRM. Table 46 provides an overview of the availability of CRM data for the wind farm sites screened into the in-combination assessment.

Table 46: Data availiability for OWFs screened in-combination.

DESIGNATED SITE	STAGE (TIER)	CRM DATA AVAILABLE
Burbo Bank	Operational (1a)	N
Burbo Bank Ext	Operational (1a)	Y
Gwynt y Môr	Operational (1a)	N
North Hoyle	Operational (1a)	N
Rhyl Flats	Operational (1a)	N
Walney I & II	Operational (1a)	Y
Barrow	Operational (1a)	N
Robin Rigg	Operational (1a)	N
West of Duddon Sands	Operational (1a)	Y
Ormonde	Operational (1a)	Y
Walney Extension	Operational (1a)	Y
Rampion	Operational (1a)	Y
Arklow Bank	Consented (1c)	N
TwinHub	Consented (1c)	N
Erebus	Submitted applications, whether under the Planning Act 2008 or other regimes, but not yet determined (1d)	Y
Morlais	Consented (1c)	Y
Emerald	Concept/Early Planning (3b)	N
Inis Ealga Marine Energy Park	Concept/Early Planning (3c)	N
North Celtic Sea	Concept/Early Planning (3c)	N
SSE Renewables Celtic Sea	Concept/Early Planning (3c)	N

DESIGNATED SITE	STAGE (TIER)	CRM DATA AVAILABLE
Valorous	Concept/Early Planning (3c)	N
Shelmalere	Concept/Early Planning (3c)	N
South Irish Sea	Concept/Early Planning (3a)	N
Kilmichael Point	Concept/Early Planning (3c)	N
Codling	Concept/Early Planning (3a)	N
Dublin Array	Concept/Early Planning (3a)	N
North Irish Sea Array (NISA)	Concept/Early Planning (2)	N
Cailleach	Concept/Early Planning (3c)	N
SSE Renewables Braymore Point	Concept/Early Planning (3a)	N
Cooley Point	Concept/Early Planning (3a)	N
Clogher Head	Concept/Early Planning (3a)	N
Oriel	Concept/Early Planning (3a)	N
Draig y Môr	Concept/Early Planning (3c)	N
Isle of Man	Concept/Early Planning (3c)	N
Llyr 1	Concept/Early Planning (3c)	N
Llyr 2	Concept/Early Planning (3c)	N
White Cross	Concept/Early Planning (3c)	N
Petroc	Concept/Early Planning (3c)	N
Gwynt Glas	Concept/Early Planning (3c)	N
Llywelyn	Concept/Early Planning (3c)	N
Shearwater One	Concept/Early Planning (3c)	N
Morgan	Concept/Early Planning (3c)	N
Mona	Concept/Early Planning (3c)	N
Morecambe	Concept/Early Planning (3c)	N

DESIGNATED SITE	STAGE (TIER)	CRM DATA AVAILABLE
Sea Stacks	Concept/Early Planning (3c)	N
Inis East 1	Concept/Early Planning (3c)	N
Greystones	Concept/Early Planning (3c)	N
Inis East 2	Concept/Early Planning (3c)	N
Latitude 52	Concept/Early Planning (3c)	N
Blackwater	Concept/Early Planning (3c)	N
Rampion 2	Concept/Early Planning (3c)	N

Red-throated Diver

1154 For non-breeding over-wintering features such as red-throated diver, the spatial extent of in-combination effects is defined as the area within the Liverpool Bay SPA for which the species is a designated feature, this includes GyM, Burbo Bank, Burbo Bank Extension, North Hoyle and Rhyl Flats offshore wind farms.

1155 A review of other industries impacts which may act in-combination with potential impacts from the Project was undertaken to determine quantitative data which would permit assessment. Other industries investigated include aggregates and how the presence and transit of dredging vessels may act in-combination with cable laying and operational vessel movements to disturb sensitive bird species, such as red-throated diver and common scoter. Additionally, there were no impacts from Morlais tidal energy project on red-throated diver as this project does not overlap with Liverpool Bay SPA.

1156 As was found to be the case with historic offshore wind development, the majority of other industries do not provide a quantitative assessment of impacts. It is not appropriate to re-assess another Projects impacts if impacts were not provided by the developer. Therefore, and where available, information on a qualitative basis has been gleaned from other industries to enable a qualitative in-combination assessment.

1157 Within the Liverpool Bay region (north west) there is a small-scale aggregates industry which operates to the west of the Project, comprising Area 392, 393 and 457. All three areas are within the Liverpool Bay SPA.

1158 Area 457 licence period is active from 2010 to 2025, with baseline surveys undertaken in 2009. However, due to the cessation of the aggregate licence in 2025 there will be no in-combination impact as construction works for AyM will not be initiated until 2026. Therefore Area 457 cannot act in-combination to disturb features of the Liverpool Bay SPA.

1159 Area 392 and 393 (also known as Hilbre Swash) are considered under the same licence. Dredging has been undertaken within the 392/393 zones and wider area since 1959 and any potential disturbance associate with dredging activity can therefore be considered as part of the Liverpool Bay SPA baseline. The active licence period for Area 392 and 393 spans from 2014 to 2029 which will therefore overlap with the construction phase of the AyM project. Quantitative information on impacts to sensitive bird species has not been calculated by the aggregates project which therefore restricts the in-combination assessment to a qualitative level.

1160 The EIA consent approval granted by Natural Resources Wales stated that the licence area lies out with the main areas of known concentrations for most seabird species within Liverpool Bay, and the wider Liverpool Bay contains abundant alternative foraging habitat to that within the application area. In the context of the ongoing dredging activity, the small area involved in the proposed dredging and the low level of vessel activity compared to other sources of vessel activity within Liverpool Bay, the overall, effects to the regional populations of seabirds including red-throated diver, common scoter, auks, gulls and terns were considered to be not significant. With regard to the SPA, the regulator determined no significant impact to red-throated diver, common scoter, gulls, terns and auks from both direct impacts as a result of the dredging activity and disturbance from vessels transiting back and forth from the dredging area.

1161 Based on the above EIA consent decision, the historic levels of dredging activity which forms part of the Liverpool Bay SPA baseline, and the fact that the dredging areas of Area 392 and 393 are a significant distance (> 20 km) from the proposed cable laying activities, there is no likelihood of an in-combination level effect upon the features of the Liverpool Bay SPA.

1162 For the operational and maintenance phase, Table 47 shows the expected mortality of individuals resulting from disturbance and displacement from each of the wind farm developments that may act in-combination with AyM. Red-throated diver are screened into the assessment during the non-breeding bio-season, however previous wind farm assessments have focused on the potential impact during the migration-free winter bio-season therefore data is unavailable or inconsistent for impacts in other bio-seasons. In addition, effects outside of the winter bio-season are unlikely to be significant as birds move elsewhere (to northern breeding grounds). Therefore, there are lower densities in the region resulting in lower competition for food resources, meaning displaced birds are less likely to suffer mortality during these additional bio-seasons. Therefore, this in-combination assessment is focused on the migration-free winter bio-season, only, from other projects and plans in-combination with the impacts from AyM during the migration-free breeding bio-season and migratory bio-seasons.

1163 A 1% mortality rate has been used in-line with the AyM alone assessment approach for red-throated diver (Section 10.3).

Table 47: Predicted mortality rate of Red-throated diver resulting from disturbance and displacement from projects considerd in-combination during operation and maintenance.

DEVELOPMENT NAME	PREDICTED MORTALITY (NON-BREEDING) (1%)
Burbo Bank Extension	0.3
Burbo Bank	0.11
Gwynt y Môr	0.35
North Hoyle	0
Rhyl Flats	0.24
Awel y Môr	1.2
Total	2.2

1164 The in-combination predicted mortality within the Liverpool Bay SPA totals 2.2, 0.19% of the Liverpool Bay SPA citation population. With a classified red-throated diver population of 1,171 individuals (an annual background mortality of 272.8), on the basis of 2.2 individual mortalities per annum suffering displacement consequent mortality during operation and maintenance of AyM at Liverpool Bay SPA would represent a 0.8% increase in baseline mortality per annum.

1165 The potential total of 2.2 mortalities at Liverpool Bay SPA per annum equates to less than 1% increase in baseline mortality for either citation or latest colony count. This increase would be indistinguishable from natural fluctuations in the population.

1166 The red-throated diver distribution evidence note (Annex 8, application ref 5.2.8) presents information on potential displacement effects from AyM on red-throated diver, by looking at displacement effects caused by other offshore wind farm projects including GyM, and Rhyl Flats. It was concluded from this report that the GyM site was not of high relative importance to RTD either before or after the construction of the OWF, and that the recorded distribution of RTD within the survey areas suggests that the proposed AyM site is also not of high relative importance to RTD. Furthermore, the displacement results from GyM and Rhyl Flats monitoring are more likely to represent what might be seen for AyM, given the proximity of GyM and Rhyl Flats to AyM, which would suggest the sensitivity in this location is not as high as that seen in the examples that influence the recent guidance (JNCC, 2022), which states a displacement of 10 or more km and use of 100% displacement in at least the array area of a wind farm. For full details on the surveys, monitoring, and analysis undertaken to reach this conclusion please see Annex 8: Abundance and Distribution of Red Throated Diver in Gwynt y Môr Offshore Wind Farm and Wider Area (application ref: 5.2.8).

1167 Alongside population conversation objectives, supporting habitat conservation objectives must also be considered. Section 11.1.2 considers impacts on subtidal and benthic intertidal habitats at Liverpool Bay SPA for red-throated diver, common scoter and the waterbird assemblage. It concluded that given the conclusions for AyM alone, being temporary, highly localised and small scale, extending to a very small proportion of habitat across the SPA with no significant effect on supporting habitats, together with the lack of any apparent significant effects resulting from the construction of both GyM and Rhyl Flats on the wider benthos, there is **no potential for AEoI to physical loss of supporting habitats in-combination. Additionally, it concluded that for projects in-combination, all are in operation with the potential for physical damage being highly limited and localised. With respect to the aggregate sites, the associated HRA concluded no LSE for all sites. Therefore, no AEoI was concluded for physical damage to supporting habitats in-combination.**

1168 Therefore, there would be **no potential for an AEoI to the population and habitat conservation objectives of the red-throated diver feature at Liverpool Bay SPA in relation to potential adverse collision effects from the O&M phase of AyM alone. Therefore, subject to natural change, red-throated diver would be maintained as a feature in the long term.**

Common scoter

1169 For non-breeding over-wintering features such as common scoter, the spatial extent of in-combination effects is defined as the area within the Liverpool Bay SPA for which the species is a designated feature, this includes GyM, Burbo Bank, Burbo Bank Extension, North Hoyle and Rhyl Flats offshore wind farms.

1170 A review of other industries impacts which may act in-combination with potential impacts from the Project was undertaken to determine quantitative data which would permit assessment. Other industries investigated include aggregates and how the presence and transit of dredging vessels may act in-combination with cable laying and operational vessel movements to disturb sensitive bird species, such as red-throated diver and common scoter. Additionally, there were no impacts from Morlais tidal energy project on common scoter as this project does not overlap with Liverpool Bay SPA.

1171 As was found to be the case with historic offshore wind development, the majority of other industries do no provide a quantitative assessment of impacts. It is not appropriate to re-assess another Projects impacts if impacts were not provided by the developer. Therefore, and where available, information on a qualitative basis has been gleaned from other industries to enable a qualitative in-combination assessment.

1172 Within the Liverpool Bay region (north-west) there is a small-scale aggregates industry which operates to the west of the Project, comprising Area 392, 393 and 457. All three areas are within the Liverpool Bay SPA.

1173 Area 457 licence period is active from 2010 to 2025, with baseline surveys undertaken in 2009. However, due to the cessation of the aggregate licence in 2025 there will be no in-combination impact as construction works for AyM will not be initiated until 2026. Therefore Area 457 cannot act in-combination to disturb features of the Liverpool Bay SPA.

1174 Area 392 and 393 (also known as Hilbre Swash) are considered under the same licence. Dredging has been undertaken within the 392/393 zones and wider area since 1959 and any potential disturbance associate with dredging activity can therefore be considered as part of the Liverpool Bay SPA baseline. The active licence period for Area 392 and 393 spans from 2014 to 2029 which will therefore overlap with the construction phase of the AyM project. Quantitative information on impacts to sensitive bird species has not been calculated by the aggregates project which therefore restricts the in-combination assessment to a qualitative level.

1175 The EIA consent approval granted by Natural Resources Wales stated that the licence area lies out with the main areas of known concentrations for most seabird species within Liverpool Bay, and the wider Liverpool Bay contains abundant alternative foraging habitat to that within the application area. In the context of the ongoing dredging activity, the small area involved in the proposed dredging and the low level of vessel activity compared to other sources of vessel activity within Liverpool Bay, the overall, effects to the regional populations of seabirds including red-throated diver, common scoter, auks, gulls and terns were considered to be not significant. With regard to the SPA, the regulator determined no significant impact to red-throated diver, common scoter, gulls, terns and auks from both direct impacts as a result of the dredging activity and disturbance from vessels transiting back and forth from the dredging area.

1176 Based on the above EIA consent decision, the historic levels of dredging activity which forms part of the Liverpool Bay SPA baseline, and the fact that the dredging areas of Area 392 and 393 are a significant distance (> 20 km) from the proposed cable laying activities, there is no likelihood of an in-combination level effect upon the features of the Liverpool Bay SPA.

1177 For the operational and maintenance phase, Table 48 shows the expected morality of individuals resulting from disturbance and displacement from each of the wind farm developments that may act in-combination with AyM. Common scoter are only screened in during the non-breeding bio-season, therefore this species has only been assessed during this bio-season.

Table 48: Predicted mortality rate of Common Scoter resulting from disturbance and displacement from projects considerd in-combination.

DEVELOPMENT NAME	PREDICTED MORTALITY (NON-BREEDING) (BASED ON DEVELOPER MORTALITY RATES)
Burbo Bank Extension	4
Burbo Bank	0
Gwynt y Môr	0
North Hoyle	0.1
Rhyl Flats	1.3
Awel y Môr	0.3
Total	5.7

1178 The in-combination predicted mortality within the Liverpool Bay SPA totals 5.7, 0.01% of the Liverpool Bay SPA citation population. With a classified common scoter population of 56,679 individuals (an annual background mortality of 13,490) on the basis of 5.7 individual mortalities per annum suffering displacement consequent mortality during operation and maintenance at Liverpool Bay SPA would represent a 0.04% increase in baseline mortality per annum.

1179 The potential total of 5.7 mortalities at Liverpool Bay SPA per annum equates to less than 1% increase in baseline mortality for either citation or latest colony count. This increase would be indistinguishable from natural fluctuations in the population.

1180 Alongside population conversation objectives, supporting habitat conservation objectives must also be considered. Section 11.1.2 considers impacts on subtidal and benthic intertidal habitats at Liverpool Bay SPA for red-throated diver, common scoter and the waterbird assemblage. It concluded that given the conclusions for AyM alone, being temporary, highly localised and small scale, extending to a very small proportion of habitat across the SPA with no significant effect on supporting habitats, together with the lack of any apparent significant effects resulting from the construction of both GyM and Rhyl Flats on the wider benthos, there is **no potential for AEoI to physical loss of supporting habitats in-combination. Additionally, it concluded that for projects in-combination, all are in operation with the potential for physical damage being highly limited and localised. With respect to the aggregate sites, the associated HRA concluded no LSE for all sites. Therefore, no AEoI was concluded for physical damage to supporting habitats in-combination.**

1181 Therefore, there would be **no potential for an AEoI to the population and habitat conservation objectives of the common scoter feature at Liverpool Bay SPA in relation to potential adverse collision effects from the O&M phase of AyM alone. Therefore, subject to natural change, common scoter would be maintained as a feature in the long term.**

Guillemot, razorbill and puffin

1182 Table 39 shows that based on the mean-maximum foraging range +1SD of guillemot, razorbill and puffin (Woodward *et al.*, 2019) from their respective SPAs assessed above, numerous offshore wind farm projects are within range. Only Erebus offshore wind farm has apportioned impacts to guillemot, razorbill and puffin for the following screened in SPAs during all bio-seasons:

- Skomer, Skokholm and the Seas off Pembrokeshire SPA

1183 Additionally, Erebus has apportioned impacts to the following SPAs, however apportioned impacts were only available for the breeding bio-season for these designated sites, therefore assessment for these SPAs have been based on the breeding season only:

- Saltee Islands SPA

1184 No plans or projects considered in-combination with AyM for guillemot, razorbill or puffin assessed and apportioned impacts to the following SPAs:

- Rathlin Island SPA;
- Lambay Island SPA; and
- Ireland's Eye SPA.

1185 Lack of data is due to projects off the eastern coast of Ireland (and in close proximity to all SPAs listed above) not yet having produced PEIR (or equivalent documentation) and as a result no potential impact to guillemot, razorbill and puffin has yet been quantified.

1186 Furthermore, the majority of projects located within the Liverpool Bay/ Irish Sea area either did not apportion impacts to designated sites or used mean-maximum foraging ranges from Thaxter *et al*. (2012) to determine the proportion of impact relevant to each SPA (i.e., the apportioning approach undertaken by each OWF). As shown in Table 39, the mean-maximum foraging ranges used by AyM during this assessment are significantly greater than the Thaxter *et al*. (2012) ranges, and therefore distant projects to the Irish and single Welsh SPAs listed above did not include those sites within their assessment. Although abundance data is available for a number of plans and projects for guillemot, razorbill and puffin, it would not be appropriate to reassess impacts for these designated sites. Therefore, only impacts from Erebus have been considered in-combination with AyM.

1187 Additionally, Morlais, expected to begin construction offshore in 2023, is within the mean-max + 1SD foraging range of a number of screened in sites for guillemot, razorbill and puffin. However, no impacts from the Morlais project are expected to impact guillemot, razorbill and puffin at the following SPAs:

- Skomer, Skokholm and the Seas off Pembrokeshire SPA;
- Saltee Islands SPA;
- Rathlin Island SPA;

- Lambay Island SPA; and
- Ireland's Eye SPA.

11.3.3 Skomer, Skokholm and the Seas off Pembrokeshire SPA

Table 49: Predicted annual mortality of guillemot, razorbill and puffin at Skomer, Skokholm and the Seas off Pembrokeshire SPA from projects considered in-combination (mortality rate used for AyM impacts shown in brackets).

DEVELOPMENT NAME	**MORTALITY IN-COMBINATION DURING OPERATION (1%)**		
	Guillemot	Razorbill	Puffin
Erebus*	98.5	3.7	15.7
Awel y Môr	0.38	0.047	0.02
All other projects	No information	No information	No information
Total	98.9	3.7	15.7
Increase in baseline mortality	9.7% (using recent population count of 16,644 – no citation population available)	0.4% (using recent population count of 8595 – no citation population available)	0.9% using citation population of 19,000 and 0.4% using using recent count of 38,342

*Note that displacement and mortality rates used are taken from Erebus assessment and not reassessed using AyM rates.

1188 The potential 0.38 guillemot mortalities from AyM contribute only 0.38% of all mortalities attributed to this SPA. Therefore, AyM impacts are inconsequential in-combination. Razorbill and puffin increase in baseline mortality is <1%. Therefore, there is **no potential for an AEoI to the population conservation objectives of the guillemot, razorbill and puffin features at Skomer, Skokholm and the Seas off Pembrokeshire SPA in relation to potential adverse effects from the O&M phase of AyM in-combination with other plans and projects. Therefore, subject to natural change, guillemot, razorbill and puffin would be maintained as a feature in the long term.**

11.3.4 Saltee Islands SPA

Table 50: Predicted annual mortality of guillemot, razorbill and puffin at Saltee Islands SPA from projects considered in-combination (mortality rate used for AyM impacts shown in brackets).

DEVELOPMENT NAME	MORTALITY IN-COMBINATION DURING OPERATION (1%)
	Puffin
Erebus*	0.02
Awel y Môr	0.0008
All other projects	No information
Total	0.02
Increase in baseline mortality	0.005% using citation population of 3,644 and 0.010% using using recent count of 1,822

1189 *Note that displacement and mortality rates used are taken from Erebus assessment and not reassessed using AyM rates. Only breeding season apportioning data was available for Saltee Islands SPA.

1190 Puffin increase in baseline mortality is <1%. Therefore, there is **no potential for an AEoI to the population conservation objectives of the puffin features at Saltee Islands SPA in relation to potential adverse effects from the O&M phase of AyM in-combination with other plans and projects. Therefore, subject to natural change, puffin would be maintained as a feature in the long term.**

11.3.5 Other designated sites

1191 Remaining cognisant of the lack of data outlined above, and no impacts from Morlais attributed to SPAs screened in for assessment, the contribution that AyM would have in relation to the displacement mortality of guillemot, razorbill and puffin from the relevant SPAs listed in Table 40 and Table 41 is less than 1 individual at each SPA per annum when considering a precautionary 70% displacement rate and 1% mortality. A full account of the displacement impacts alone are present in Section 10.3.

1192 Therefore, based on zero contribution of impacts from Morlais and the absence of data in relation to OWF within mean-maximum foraging range + 1SD of the SPAs screened in for assessment and recognising that the contribution AyM would make to any future in-combination assessment would be small enough to be considered inconsequential alone, there would be **no potential for an AEoI to the population conservation objectives of auk features at Rathlin, Ireland's Eye and Lambay Island SPAs in relation to potential adverse displacement effects of AyM alone or in-combination. Therefore, subject to natural change, auks would be maintained as features in the long term at the above SPAs.**

Manx shearwater

1193 Table 40 and Table 41 show that numerous offshore wind farm projects are within the UK Western waters plus Channel BDMPS and the eastern coast of Ireland for Manx shearwater. These have been included in the in-combination assessment for AyM. Erebus offshore wind farm has apportioned impacts to Manx shearwater for Skomer, Skokholm and the Seas off Pembrokeshire SPA during all bio-seasons. Whilst Morlais tidal energy project has apportioned impacts to Manx shearwater for both Skomer, Skokholm and the Seas off Pembrokeshire SPA and Aberdaron Coast and Bardsey Island SPA during all bio-seasons.

1194 Additionally, Erebus has apportioned impacts to Aberdaron Coast and Bardsey Island SPA, however apportioned impacts were only available for the breeding bio-season for these designated sites, therefore assessment has been based on the breeding season only for Erebus impacts to Aberdaron Coast and Bardsey Island SPA.

1195 No other plans or projects considered in-combination with AyM for Manx shearwater assessed and apportioned impacts to these SPAs. This is due to many projects within the Manx shearwater BDMPS Western waters plus Channel and off the eastern coast of Ireland (and in close proximity to all SPAs listed above) not yet having produced PEIR (or equivalent documentation) and as a result no potential impact to Manx shearwater has yet been quantified.

1196 Furthermore, the majority of projects located within the Liverpool Bay/ Irish Sea area did not assess Manx shearwater as being vulnerable to displacement impacts. Although abundance data is available for a number of plans and projects for Manx shearwater, it would not be appropriate to reassess impacts for these designated sites. Therefore, only impacts from Erebus have been considered in-combination with AyM.

1197 Morlais tidal energy project assessed Manx shearwater, they found that 1 (0-2) individuals are estimated to suffer collision induced mortality under a 40MW scenario annually. The consented project was 12MW, therefore impacts have been taken as 0.3 of that of the assessed, resulting in 0.3 (0-0.6) mortalities for Manx shearwater. 55.88% of these were attributed to Skomer, Skokholm and the Seas off Pembrokeshire SPA and 41.56% attributed to Aberdaron Coast and Bardsey Island SPA. This results in 0.17 (0-0.34) mortalities attributed to Skomer, Skokholm and the Seas off Pembrokeshire SPA under the 12 MW scenario and 0.12 (0-0.25) mortalities attributed to Aberdaron Coast and Bardsey Island SPA.

11.3.6 Skomer, Skokholm and the Seas off Pembrokeshire SPA

Table 51: Predicted mortality rate of Manx shearwater at Skomer, Skokholm and the Seas off Pembrokeshire SPA from projects considered in-combination (mortality rate used for AyM impacts shown in brackets).

DEVELOPMENT NAME	MAX MORTALITY IN-COMBINATION DURING OPERATION (1%)	IMPACT
Morlais*	0.17	Underwater collision
Erebus*	1.9	Displacement
Awel y Môr	1.3	Displacement
All other projects	No information	No information
Total	3.4	Combined impacts

*Note that displacement and mortality rates used are taken from Erebus and Morlais assessments and not reassessed using AyM rates.

1198 For Skomer, Skokholm and the Seas off Pembrokeshire SPA during the operation of AyM, 3.4 mortalities may be attributed to the SPA in-combination. With a classified Manx shearwater population of 300,000 breeding adults (an annual background mortality of 39,000 breeding adults), on the basis of 3.4 breeding adult mortalities per annum suffering mortality at Skomer, Skokholm and the Seas off Pembrokeshire SPA, this would represent a 0.009% increase in baseline mortality per annum.

1199 The population of Manx shearwaters has significantly increased since the citation population count, therefore it is also appropriate to assess the potential impact against the latest population count undertaken in 2018 of 910,312 breeding adults (baseline mortality of 118,341 breeding adults). On this basis, 3.4 breeding adults per annum suffering mortality at Skomer, Skokholm and the Seas off Pembrokeshire SPA would represent a 0.003% increase in baseline mortality per annum.

1200 The potential total of 3.4 breeding adult Manx shearwater mortalities during O&M at Skomer, Skokholm and the Seas off Pembrokeshire SPA per annum equates to less than 1% increase in baseline mortality for either citation or latest colony count. This increase would be indistinguishable from natural fluctuations in the population and therefore, there would be **no potential for an AEoI to the population conservation objectives of the Manx shearwater feature at Skomer, Skokholm and the Seas off Pembrokeshire SPA in relation to potential adverse effects from the O&M phase of AyM in-combination with other plans and projects. Therefore, subject to natural change, Manx shearwater would be maintained as a feature in the long term.**

11.3.7 Glannau Aberdaron ac Ynys Enlli / Aberdaron Coast and Bardsey Island SPA

Table 52: Predicted mortality rate of Manx shearwater at Aberdaron Coast and Bardsey Island SPA from projects considered in-combination.

DEVELOPMENT NAME	MAX MORTALITY IN-COMBINATION DURING OPERATION (10%)	IMPACT
Morlais*	0.12	Underwater collision
Erebus*	0.005	Displacement

DEVELOPMENT NAME	MAX MORTALITY IN-COMBINATION DURING OPERATION (10%)	IMPACT
Awel y Môr	0.07	Displacement
All other projects	No information	No information
Total	0.2	Combined impacts

*Note that displacement and mortality rates used are taken from Erebus and Morlais assessment and not reassessed using AyM rates. Only breeding season apportioning data was available for Erebus.

1201 For Aberdaron Coast and Bardsey Island SPA during the operation of AyM, 0.2 mortalities may be attributed to the SPA in-combination. With a classified Manx shearwater population of 20,000 breeding adults (an annual background mortality of 2,600 breeding adults), on the basis of 0.2 breeding adult mortalities per annum suffering mortality at Aberdaron Coast and Bardsey Island SPA, this would represent a 0.008% increase in baseline mortality per annum.

1202 The population of Manx shearwaters has significantly increased since the citation population count, therefore it is also appropriate to assess the potential impact against the latest population count undertaken in 2001 of 32,366 breeding adults (baseline mortality of 4,208 breeding adults). On this basis, 0.2 breeding adults per annum suffering mortality at Aberdaron Coast and Bardsey Island SPA would represent a 0.005% increase in baseline mortality per annum.

1203 The potential total of 0.2 breeding adult Manx shearwater mortalities during O&M at Aberdaron Coast and Bardsey Island SPA per annum equates to less than 1% increase in baseline mortality for either citation or latest colony count. This increase would be indistinguishable from natural fluctuations in the population and therefore, there would be **no potential for an AEoI to the population conservation objectives of the Manx shearwater feature at Aberdaron Coast and Bardsey Island SPA in relation to potential adverse effects from the O&M phase of AyM in-combination with other plans and projects. Therefore, subject to natural change, Manx shearwater would be maintained as a feature in the long term.**

Gannet

1204 During the O&M phase, displacement and collision impacts are attributed to Grassholm SPA and Ailsa Craig SPA from AyM. The in-combination assessment therefore combines these impacts, alongside impacts from other plans and projects within mean-maximum foraging range + 1SD (Woodward *et al*., 2019) attributed to Grassholm SPA and Ailsa Craig SPA.

1205 Table 39 shows that based on the mean-maximum foraging range + 1SD of gannet (Woodward *et al*., 2019) from their respective SPAs assessed above, numerous offshore wind farm projects are within range.

1206 Only Erebus offshore wind farm has apportioned displacement impacts to gannet for Grassholm SPA.

1207 No other plans or projects identified in Table 40 and Table 41 above assessed displacement impacts to gannet at Ailsa Craig SPA.

1208 This is due to projects off the eastern coast of Ireland (and in close proximity to all SPAs listed above) not yet having produced PEIR (or equivalent documentation) and as a result no potential impact to gannet has yet been quantified. Furthermore, the majority of projects located within the Liverpool Bay/ Irish Sea area either did not apportion impacts to designated sites or used mean-maximum foraging ranges from Thaxter *et al*. (2012) to determine the proportion of impact relevant to each SPA (i.e., the apportioning approach undertaken by each OWF). As shown in Table 39, the mean-maximum foraging ranges used by AyM during this assessment are significantly greater than the Thaxter *et al*. (2012) ranges, and therefore distant projects to the SPAs listed above did not include those sites within their assessment. Although abundance data is available for a number of plans and projects for gannet it would not be appropriate to reapportion displacement impacts for these designated sites. Therefore, only impacts from Erebus and Morlais have been considered in-combination with AyM.

1209 Where gannet has been screened in for one of the above SPAs in other plans or projects, it has been screened in for a collision risk impact, as opposed to displacement effects. Of those plans and projects identified in Table 40 and Table 41 only four projects have assessed collision impacts to gannet. These projects are the following;

- Burbo Bank Extension (apportioning not available for Grassholm or Ailsa Craig SPAs, therefore this has not been considered in-combination with AyM)
- Walney Extension (Ailsa Craig SPA)
- Morlais (Grassholm SPA and Ailsa Craig SPA)
- Erebus (Grassholm SPA)

1210 On review of the collision risk modelling supporting the Erebus impact assessments for cumulative assessment in Volume 2, Chapter 4 Offshore Ornithology (application ref: 2.4), a number of anomalies were noted. These include issues with the site-specific flight heights, that introduce a high level of uncertainty with regards to the output values provided, particularly when using Band Option 1 of the CRM. As the majority of other current assessments of collision risk for UK OWFs rely on Band Option 2 for gannet and kittiwake and either Band Option 2 or 3 for large gull species (including AyM), the Applicant considers these values, where available from Erebus, to be more reliable and in keeping with other projects to allow a level playing field assessment for cumulative collision risk. In order to align approaches, Band Option 2 outputs have also been used in the in-combination assessment presented below. These numbers were apportioned using proportions presented in the Erebus assessment. Where apportioning was not available, these numbers have not been included in-combination.

1211 Morlais tidal energy project assessed gannet from Grassholm SPA and Ailsa Craig SPA, they found that 0 individuals would suffer collision induced mortality under a 40MW scenario. Therefore, under the consented 12MW project there would be zero impact on either SPA.

11.3.8 Grassholm SPA

Table 53: Predicted mortality rate of gannet at Grassholm SPA from projects considered in-combination (mortality rate used for AyM impacts shown in brackets).

DEVELOPMENT NAME	MAX MORTALITY IN-COMBINATION DURING OPERATION (1%)	IMPACT
Morlais	0	Collision

DEVELOPMENT NAME	MAX MORTALITY IN-COMBINATION DURING OPERATION (1%)	IMPACT
Erebus	24.8	Displacement and collision
Awel y Môr*	5.1	Displacement and collision
All other projects	No information	No information
Total	29.9	Combined impacts

*Using 80% displacement and mean CRM.

1212 For Grassholm SPA during the operation of AyM, 29.9 mortalities may be attributed to the SPA in-combination. With a classified gannet population of 66,000 breeding adults (an annual background mortality of 5,346 breeding adults), on the basis of 29.9 breeding adult mortalities per annum suffering mortality at Grassholm SPA, this would represent a 0.6% increase in baseline mortality per annum.

1213 The population of gannets has significantly increased since the citation population count, therefore it is also appropriate to assess the potential impact against the latest population count undertaken in 2015 of 72,022 breeding adults (baseline mortality of 5,834 breeding adults). On this basis, 29.9 breeding adults per annum suffering mortality at Grassholm SPA would represent a 0.5% increase in baseline mortality per annum.

1214 The potential total of 29.9 breeding adult gannet mortalities during O&M at Grassholm SPA per annum equates to less than 1% increase in baseline mortality for either citation or latest colony count. This increase would be indistinguishable from natural fluctuations in the population. Additionally, tracking data of gannets from Grassholm SPA show that tracked individuals remain in the south west region of Wales and England, spreading out to southern Republic of Ireland (Wakefield *et al.*, 2013). Gannets show foraging segregation between colonies (Wakefield *et al.*, 2013) so gannets found at AyM are more likely to come from Alisa Craig SPA than Grassholm SPA. The impact attributed to AyM is likely to be an overestimate of the actual impact, therefore, the total mortalities from AyM would have an inconsequential impact in-combination. Therefore, there would be **no potential for an AEoI to the population conservation objectives of the gannet feature at Grassholm SPA in relation to potential adverse effects from the O&M phase of AyM in-combination with other plans and projects. Therefore, subject to natural change, gannet would be maintained as a feature in the long term.**

11.3.9 Ailsa Craig SPA

Table 54: Predicted mortality rate of gannet at Ailsa Craig SPA from projects considered in-combination.

DEVELOPMENT NAME	MAX MORTALITY IN-COMBINATION DURING OPERATION (1%)	IMPACT
Awel y Môr	7.4	Displacement and collision
Morlais	0	Collision
Walney Extension	25	Collision
All other projects	No information	No information
Total	32.4	Combined impacts

1215 For Ailsa Craig SPA during the operation of AyM, 32.4 mortalities may be attributed to the SPA in-combination. With a classified gannet population of 46,000 breeding adults (an annual background mortality of 3,726 breeding adults), on the basis of 32.4 breeding adult mortalities per annum suffering mortality at Ailsa Craig SPA, this would represent a 0.9% increase in baseline mortality per annum.

1216 The population of gannets has significantly increased since the citation population count, therefore it is also appropriate to assess the potential impact against the latest population count undertaken in 2014 of 66,452 breeding adults (baseline mortality of 5,383 breeding adults). On this basis, 32.4 breeding adults per annum suffering mortality at Ailsa Craig SPA would represent a 0.6% increase in baseline mortality per annum.

1217 The potential total of 32.4 breeding adult gannet mortalities during O&M at Ailsa Craig SPA per annum equates to less than 1% increase in baseline mortality for either citation or latest colony count. This increase would be indistinguishable from natural fluctuations in the population and therefore, there would be **no potential for an AEoI to the population conservation objectives of the gannet feature at Ailsa Craig SPA in relation to potential adverse effects from the O&M phase of AyM in-combination with other plans and projects. Therefore, subject to natural change, gannet would be maintained as a feature in the long term.**

Herring gull

1218 Table 39 shows that based on the mean-maximum foraging range +1SD of herring gull (Woodward *et al.*, 2019) from their respective SPAs assessed above, numerous offshore wind farm projects are within range.

1219 Of those plans and projects identified in Table 40 and Table 41 only two of the projects have assessed collision impacts to herring gull at Morecambe Bay and Duddon Estuary SPA/ Morecambe Bay Ramsar. These projects are the following;

- Burbo Bank Extension; and
- Walney Extension.

1220 Alongside impacts from other offshore wind farm projects, impacts from Morlais tidal energy project (expected to begin construction offshore in 2023) must be considered in-combination with AyM. However, no impacts from the Morlais project are expected to impact herring gull at Morecambe Bay and Duddon Estuary SPA and Morecambe Bay Ramsar.

1221 Burbo Bank Extension had a total of 4 collision consequent mortalities attributed to Morecambe Bay and Duddon Estuary SPA/ Morecambe Bay Ramsar and Walney extension, a total of 29. For AyM there was a total of 0.04 adult collision consequent mortalities attributed to this SPA. The in-combination collision figure therefore totals, 33.04, 0.17% of the Morecambe Bay and Duddon Estuary SPA citation population and 2.04% of the most up to date SPA count and 0.16% of the Morecambe Bay Ramsar citation and 2.05% of the most up to date Ramsar count.

1222 The SPA site has a classified herring gull population of 20,000 breeding adults (an annual background mortality of 3,320 breeding adults), on the basis of 33.04 breeding adult mortalities per annum suffering collision consequent mortality at Morecambe Bay and Duddon Estuary SPA would represent a 0.995% increase in baseline mortality per annum. The population of herring gull has changed since the citation population count, therefore it is also appropriate to assess the potential impact against the latest population count undertaken between 2016 and 2020 of 1616 breeding adults (baseline mortality of 268 breeding adults). On this basis, 33.04 breeding adults per annum suffering collision consequent mortality at Morecambe Bay and Duddon Estuary SPA would represent a 12.3% increase in baseline mortality per annum.

1223 The Ramsar site has a classified herring gull population of 20,862 breeding adults (an annual background mortality of 3,463 breeding adults), on the basis of 33.04 breeding adult mortalities per annum suffering collision consequent mortality at Morecambe Bay Ramsar would represent a 0.95% increase in baseline mortality per annum. The population of herring gull has changed since the citation population count, therefore it is also appropriate to assess the potential impact against the latest population count undertaken between 2016 and 2020 of 1614 breeding adults (baseline mortality of 268 breeding adults). On this basis, 33.04 breeding adults per annum suffering collision consequent mortality at Morecambe Bay Ramsar would represent a 12.3% increase in baseline mortality per annum. Both Burbo Bank Extension and Walney Extension[lxxxvii] were consented with an AA that concluded no adverse effect for all sites and features.

1224 Although the total in-combination mortalities of herring gull from Morecambe Bay SPA and Ramsar equates to 33.04 birds, the AyM project only contributes 0.04 individuals to this (0.12%). Further, tracking data of Herring gulls from Morecambe Bay show that tracked individuals remain along the coast close to Morecambe Bay and Duddon Estuary SPA with no birds within proximity of AyM (Thaxter *et al*., 2018). Small numbers of individuals have been apportioned to Morecambe Bay and Duddon Estuary SPA and Ramsar (less than half a bird) and tracking data does not suggest connectivity, therefore the contribution by AyM to an in-combination impact of Herring gull at Morecambe Bay and Duddon Estuary SPA/ Ramsar is inconsequential. Subsequently, there would be **no potential for an AEoI to the population conservation objectives of herring gull features at the above sites in relation to potential adverse displacement effects of AyM alone or in-combination. Therefore, subject to natural change, herring gull would be maintained as features in the long term at the above sites.**

[lxxxvii] https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010027/EN010027-000013-Habitats%20Regulations%20Assessment.pdf

Kittiwake

1225 Table 39 shows that based on the mean-maximum foraging range +1SD of kittiwake (Woodward *et al*., 2019) from their respective SPAs assessed above, numerous offshore wind farm projects are within range. Only Erebus offshore wind farm has apportioned impacts to kittiwake for the following screened in SPAs during all bio-seasons:

- Skomer, Skokholm and the Seas off Pembrokeshire SPA

1226 Additionally, Erebus has apportioned impacts to the following SPAs, however apportioned impacts were only available for the breeding bio-season for these designated sites, therefore assessment for these SPAs has been based on the breeding season only:

- Lambay Island SPA;
- Ireland's Eye SPA;
- Howth Head Coast SPA;
- Wicklow Head SPA; and
- Saltee Islands SPA.

1227 No plans or projects considered in-combination with AyM for kittiwake assessed and apportioned impacts to Ailsa Craig SPA.

1228 On review of the collision risk modelling supporting the Erebus impact assessments for cumulative assessment in Volume 2, Chapter 4 Offshore Ornithology (application ref: 2.4), a number of anomalies were noted. These include issues with the site-specific flight heights, that introduce a high level of uncertainty with regards to the output values provided, particularly when using Band Option 1 of the CRM. As the majority of other current assessments of collision risk for UK OWFs rely on Band Option 2 for gannet and kittiwake and either Band Option 2 or 3 for large gull species (including AyM), the Applicant considers these values, where available from Erebus, to be more reliable and in keeping with other projects to allow a level playing field assessment for cumulative collision risk. In order to align approaches, Band Option 2 outputs have also been used in the in-combination assessment presented below. These numbers were apportioned using proportions presented in the Erebus assessment. Where apportioning was not available, these numbers have not been included in-combination.

1229 Lack of data is due to projects off the eastern coast of Ireland (and in close proximity to all SPAs listed above) not yet having published any quantified collision modelling outputs. Furthermore, the majority of projects located within the Liverpool Bay/ Irish Sea area either did no apportion impacts to designated sites or used mean-maximum foraging ranges from Thaxter *et al*. (2012) to determine the proportion of impact relevant to each SPA (i.e., the apportioning approach undertaken by each OWF). As shown in Table 39, the mean-maximum foraging ranges used by AyM during this assessment are significantly greater than the Thaxter *et al*. (2012) ranges, and therefore distant projects to SPAs listed above did not include those sites within their assessment. There are consequently no collision analysis results from other plans or projects available to undertake an in-combination assessment for kittiwake in relation to AyM. Although EIA level CRM is available for some of the plans and projects for kittiwake, it would not be appropriate to reassess impacts for these designated sites. Therefore, only impacts from Erebus have been considered in-combination with AyM.

1230 Alongside impacts from other offshore wind farm projects, impacts from Morlais tidal energy project (expected to begin construction offshore in 2023) must be considered in-combination with AyM. However, no kittiwake individuals are expected to be impacted from the Morlais project therefore, this project will not contribute in-combination.

1231 The following assesses the in-combination impact of Erebus and AyM for Skomer, Skokholm and the Seas off Pembrokeshire SPA, Lambay Island SPA, Ireland's Eye SPA, Howth Head Coast SPA, Wicklow Head SPA and Saltee Islands SPA.

Table 55: Predicted annual mortality of kittiwake from projects considered in-combination (mortality rate used for AyM impacts shown in brackets) for Skomer, Skokholm and the Seas off Pembrokeshire SPA (SSSP), Lambay Island SPA (LI), Ireland's Eye SPA (IE), Howth Head Coast SPA (HHC), Wicklow Head SPA (WH) and Saltee Islands SPA (SI).

DEVELOPMENT NAME	MORTALITY IN-COMBINATION DURING OPERATION (1%)					
	SSSP	LI	IE	HHC	WH	SI
Erebus*	0.28	0.008	0.004	0.009	0.004	0.01
Awel y Môr	0.11	0.15	0.07	0.1	0.04	0.01
All other projects	No information					
Total	0.39	0.15	0.07	0.14	0.04	0.027
Increase in baseline mortality compared to citation population	No data available	0.01	0.02	0.02	0.01	0.004
Increase in baseline mortality compared to latest count	0.1	0.02	0.02	0.02	0.02	0.009

1232 *Note that displacement and mortality rates used are taken from Erebus assessment and not reassessed using AyM rates. Only breeding season apportioning data was available for Lambay, Ireland's Eye, Howth Head Coast, Wicklow Head and Saltee Islands SPAs.

1233 The increase in baseline mortality compared to both citation and latest counts for Skomer, Skokholm and the Seas off Pembrokeshire SPA, Lambay Island SPA, Ireland's Eye SPA, Howth Head Coast SPA, Wicklow Head SPA and Saltee Islands SPA are all below 1%. Therefore, there is **no potential for an AEoI to the population conservation objectives of the kittiwake features at any of these SPAs in relation to potential adverse effects from the O&M phase of AyM in-combination with other plans and projects. Therefore, subject to natural change, kittiwake would be maintained as a feature in the long term.**

11.3.10 Ailsa Craig SPA

1234 Remaining cognisant of the lack of data outlined above, and no impacts from Morlais attributed to SPAs screened in for assessment, the contribution that AyM would have in relation to the collision mortality of kittiwake from the relevant SPAs listed in Table 45 is less than 1 bird at each SPA each year. A full account of the collision impacts alone are present in Section 10.3.

1235 Therefore, based on no contribution of impacts from Morlais in-combination with SPAs screened in for assessment; the absence of data in relation to OWF within mean-maximum foraging range + 1SD of the SPAs screened in for assessment and recognising that the contribution AyM would make to any future in-combination assessment would be small enough to be considered inconsequential alone, there would be **no potential for AyM to contribute to any AEoI to the conservation objectives of kittiwake features at Ailsa Craig SPA in relation to potential adverse displacement effects of AyM alone or in-combination. Therefore, subject to natural change, kittiwake would be maintained as features in the long term at the above SPAs.**

11.4 Onshore Ecology

1236 No sites have been screened in for onshore ecology and therefore **no assessment of potential AEoI in-combination is required.**

11.5 Migratory Fish

1237 The potential for an in-combination effect upon the designated sites grouped under 'migratory fish', as relevant to features and effect pathways screened in for LSE (as summarised in Table 56), is provided below.

Table 56: Projects considered for in-combination assessment of migratory fish.

PLAN OR PROJECT	TIER	UNDERWATER NOISE	SUSPENDED SEDIMENT AND DEPOSITION	POLLUTION	EMF	CONCLUSION IN-COMBINATION
Gwynt y Môr (array and cable)	1	Project is operational, with monitoring reviews showing no large-scale effects on fish[lxxxviii].	Project is operational therefore potential for contribution to an in-combination effect is considerably less than that from AyM. Monitoring reviews show no large- scale effects on fish[lxxxix].	PEMP or similar is a standard requirement and therefore no potential for any in-combination effect.	Project is operational, with monitoring reviews showing no large-scale effects on fish[xc].	The at most small and localized level of effect, together with the lack of any evidence of significant effect since the project was constructed, result in at most a negligible contribution to any in-combination effect.
North Hoyle (array and cable)	1	Project is operational, with monitoring reviews showing no large-scale effects on fish[xci].	Project is operational and therefore potential for contribution to an in-combination effect is less than that from AyM. Monitoring reviews show no large-scale effects on fish[xcii].	PEMP or similar is a standard requirement and therefore no potential for any in-combination effect	Project is operational, with monitoring reviews showing no large-scale effects on fish[xciii].	The lack of any evidence of significant effect since the project was constructed, result in at most a negligible contribution to any in-combination effect.
North Hoyle OWF Export Cable	1	Project is operational and therefore potential for contribution to an in-combination effect is considerably less than that	Project is operational and therefore potential for contribution to an in-combination effect is considerably less than that	PEMP or similar is a standard requirement and therefore no potential for any in-combination effect	Project is operational, with monitoring reviews showing no large-scale effects on fish[xciv].	The lack of any evidence of significant effect since the project was constructed, result in at most a

[lxxxviii] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/317787/1031.pdf
[lxxxix] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/317787/1031.pdf
[xc] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/317787/1031.pdf
[xci] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/317787/1031.pdf
[xcii] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/317787/1031.pdf
[xciii] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/317787/1031.pdf
[xciv] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/317787/1031.pdf

PLAN OR PROJECT	TIER	UNDERWATER NOISE	SUSPENDED SEDIMENT AND DEPOSITION	POLLUTION	EMF	CONCLUSION IN-COMBINATION
		from AyM.	from AyM.			negligible contribution to any in-combination effect.
Aggregate Areas 392 and 393	1	Insufficient information to include within an in-combination assessment with AyM.				
Aggregate Area 1808	1					
Geo-Eirgrid interconnector	1	Understood to have been in operation for some time. No project level information. Minimal potential to contribute to an in-combination assessment, with no public domain data to include.				
Western HVDC Link	1	Understood to have been in operation for some time. No project level information. Minimal potential to contribute to an in-combination assessment, with no public domain data to include.				
Pipelines	1	3 pipelines identified within 12 km of SAC (DD-POA Gas Export, POA-DD Methanol, POA-DD Condensate), all understood to be currently active. No project data to inform an assessment, with minimal contribution to any in-combination effect on migratory fish from an installed pipeline.				
EnBW and BP 1 and 2 – Round 4	3	Insufficient information to include within an in-combination assessment with AyM.				
Cobra & Flotation Energy – Round 4	3	Insufficient information to include within an in-combination assessment with AyM.				
North Wales Tidal Energy Project	3	Insufficient information to include within an in-combination assessment with AyM.				
Mostyn Tidal Lagoon	3	Insufficient information to include within an in-combination assessment with AyM.				

11.5.1 Underwater Noise (Construction, Decommissioning)

1238 The conclusions for AyM alone were for a lack of significant effect for all designated migratory fish features of the SACs, with underwater noise impacts not predicted to have any impact on migratory behaviour and so no impacts on the populations or distribution of the designated features within the sites. There are no other relevant projects which have been screened into the in-combination assessment and as such there is no potential for an in-combination effect.

1239 There is, therefore, **no potential for an AEoI to the conservation objectives of the designated features of the Dee Estuary/ Aber Dyfrdwy (UK) SAC or River Dee and Bala Lake/ Afon Dyfrdwy a Llyn Tegid SAC in relation to underwater noise from AyM in-combination and therefore will not prevent the restoration of the features within the sites with respect to the potential for underwater noise.**

11.5.2 Suspended Sediment and Deposition (Construction, Decommissioning)

1240 The conclusions for AyM alone were for a lack of significant effect for all designated features of the SAC, with the potential for deposition of sediment being so small as to be immeasurable and within natural variation. It would be insufficient to result in any change to the distribution or population for any of the features as a result of suspended sediment and deposition from AyM. Therefore, AyM cannot contribute in any meaningful way to any in-combination effect, if indeed any exist.

1241 There is, therefore, **no potential for an AEoI to the conservation objectives of the designated features of the Dee Estuary/ Aber Dyfrdwy (UK) SAC or River Dee and Bala Lake/ Afon Dyfrdwy a Llyn Tegid SAC in relation to suspended sediment and deposition from AyM in-combination and therefore will not prevent the restoration of the features within the sites with respect to the potential for suspended sediment and deposition.**

11.5.3 Pollution (Construction, O&M, Decommissioning)

1242 The conclusions for AyM alone were for a lack of any measurable effect between deposition and the designated features which, together with the PEMP (Table 3) to mitigate any risk of pollution incidents combined to result in not AEoI. It is expected that all projects in-combination would be required to have a PEMP (or similar documentation) should there be a risk of a pollution incident. Therefore, there is no potential for any in-combination effect.

1243 There is, therefore, **no potential for an AEoI to the conservation objectives of the designated features of the Dee Estuary/ Aber Dyfrdwy (UK) SAC or River Dee and Bala Lake/ Afon Dyfrdwy a Llyn Tegid SAC in relation to pollution from AyM in-combination and therefore will not prevent the restoration of the features within the sites with respect to the potential for pollution.**

11.5.4 EMF (O&M)

1244 The conclusions for AyM alone were for a lack of significant effect for all designated features of the SAC, with the expected low-level EMFs produced by AyM, burial of the cables increasing the distance between the cable and the receptor and the existing evidence demonstrating that EMFs from wind farm cabling does not lead to any changes in abundances or distributions of fish (e.g. MMO, 2014) combining to result in no AEoI. Numerous reviews have identified that power cables in general do not result in any significant effects to fish (e.g. Tricas and Gill, 2011), and even those studies which identified a reaction in fish from EMF, noted that these reactions were not expected to impact on migration (Westerberg, 2000; Ohman *et al*., 2007) and will not result in changes to the populations of the sites or the distribution of the fish within the site. Therefore, there is no potential for any in-combination effect.

1245 There is, therefore, **no potential for an AEoI to the conservation objectives of the designated features of the Dee Estuary/ Aber Dyfrdwy (UK) SAC or River Dee and Bala Lake/ Afon Dyfrdwy a Llyn Tegid SAC in relation to pollution from AyM in-combination and therefore will not prevent the restoration of the features within the sites with respect to the potential for EMF.**

12 Transboundary Statement

1246 The screening process has identified 21 marine mammal transboundary sites and seven sites for ornithology for assessment, with these sites being as follows (including the relevant designated species screened in):

- Rockabill to Dalkey Island SAC (IE) SAC (harbour porpoise);
- Nord Bretagne DH (FR) SAC (harbour porpoise);
- Roaringwater Bay and Islands SAC (IE) SAC (harbour porpoise);
- Récifs et landes de la Hague (FR) SAC (harbour porpoise);
- Anse de Vauville (FR) SAC (harbour porpoise);
- Banc et récifs de Surtainville (FR) SAC (harbour porpoise);
- Blasket Islands SAC (IE) SAC (harbour porpoise);
- Tregor Goëlo (FR) SAC (harbour porpoise);
- Côte de Granit rose-Sept-Iles (FR) SAC (harbour porpoise);
- Mers Celtiques - Talus du golfe de Gascogne (FR) SAC (harbour porpoise);
- Chausey (FR) SAC (harbour porpoise);
- Cap d'Erquy-Cap Fréhel (FR) SAC (harbour porpoise);
- Baie de Morlaix (FR) SAC (harbour porpoise);
- Abers - Côtes des legends (FR) SAC (harbour porpoise);
- Baie du Mont Saint-Michel (FR) SAC (harbour porpoise);
- Baie de Saint-Brieuc – Est (FR) SAC (harbour porpoise);
- Baie de Lancieux, Baie de l'Arguenon, Archipel de Saint Malo et Dinard (FR) SAC (harbour porpoise);
- Estuaire de la Rance (FR) SAC (harbour porpoise);
- Ouessant-Molène (FR) SAC (harbour porpoise);
- Côtes de Crozon (FR) SACI (harbour porpoise);
- Chaussée de Sein (FR) SAC (harbour porpoise);
- Lambay Island (IE) SPA (kittiwake, lesser black-backed gull, guillemot, razorbill and puffin);
- Ireland’s Eye (IE) SPA (kittiwake, guillemot and razorbill);
- Howth Head Coast (IE) SPA (kittiwake);
- Wicklow Head (IE) SPA (kittiwake);

- Saltee Islands (IE) SPA (kittiwake, lesser black-backed gull and puffin);
- Wexford Harbour and Slobs (IE) SPA (lesser black-backed gull); and
- Helvick Head to Ballyquin (IE) SPA (kittiwake).

1247 Consideration of the potential for an AEoI alone has been addressed in Section 10.2 for marine mammals and Section 10.3 for ornithology, including in relation to the above sites where marine mammals and ornithological features are highlighted, with all conclusions being no AEoI. The assessment in-combination with other plans or projects (including transboundary projects) has been addressed in Section 11.2 for marine mammals and Section 11.3 for ornithology, with all conclusions similarly being no AEoI.

1248 It can therefore be concluded that there is, therefore, **no potential for an AEoI to the conservation objectives of the transboundary sites in relation to AyM alone and or in-combination and therefore, subject to natural change, the designated sites will be maintained in the long term.**

13 Conclusions of the Assessment

1249 A summary of the assessment is presented below in Table 57, providing the designated sites (together with the relevant feature(s)) screened in for effect in relation to AyM alone and in-combination, and the relevant conclusion on AEoI.

Table 57: Summary of the potential for adverse effect from AyM alone and in-combination.

<table>
<tr><th rowspan="2">DESIGNATED SITE</th><th rowspan="2">FEATURE(S) ASSESSED</th><th colspan="3">EFFECTS ASSESSED</th><th rowspan="2">POTENTIAL FOR ADVERSE EFFECT ALONE AND IN-COMBINATION</th></tr>
<tr><th>CONSTRUCTION</th><th>O&M</th><th>DECOMMISSIONING</th></tr>
<tr><td rowspan="2">Y Fenai a Bae Conwy/ Menai Strait and Conwy Bay (UK) SAC</td><td>Sandbanks which are slightly covered by sea water all the time
Reefs
Large shallow inlets and bays
Submerged or partially submerged sea caves</td><td>Physical habitat loss/ disturbance
Suspended sediment and deposition
Pollution
Marine INNS
Changes to physical processes</td><td>Physical habitat loss/ disturbance
Suspended sediment and deposition
Pollution
Marine INNS
EMF
Changes to physical processes</td><td>Physical habitat loss/ disturbance
Suspended sediment and deposition
Pollution
Marine INNS
Changes to physical processes</td><td>No AEoI</td></tr>
<tr><td>Mudflats and sandflats not covered by seawater at low tide</td><td>Suspended sediment and deposition
Pollution
Marine INNS
Changes to physical processes</td><td>Suspended sediment and deposition
Pollution
Marine INNS
Changes to physical processes</td><td>Suspended sediment and deposition
Pollution
Marine INNS
Changes to physical processes</td><td>No AEoI</td></tr>
<tr><td>Liverpool Bay/ Bae Lerpwl (UK) SPA</td><td colspan="4">Supporting habitat only (designated features addressed separately under offshore and intertidal ornithology, see Table 5).
The potential for effect is considered in the context of the designated features, taking account of the role of supporting habitat.</td><td>No AEoI</td></tr>
<tr><td>The Dee Estuary (UK) SPA</td><td colspan="4">Supporting habitat only (designated features addressed separately under offshore and intertidal ornithology, see Table 5).
The potential for effect is considered in the context of the designated features, taking account of the role of supporting habitat.</td><td>No AEoI</td></tr>
<tr><td>Dee Estuary Ramsar[xcv]</td><td>Criterion 1: Extensive intertidal mud and sand flats with large expanses of saltmarsh</td><td>Suspended sediment and deposition
Pollution
Marine INNS
Changes to physical processes</td><td>Suspended sediment and deposition
Pollution
Marine INNS
EMF
Changes to physical processes</td><td>Suspended sediment and deposition
Pollution
Marine INNS
Changes to physical processes</td><td>No AEoI</td></tr>
</table>

xcv Note – remaining Ramsar criteria (criterion 5 and 6) relate to birds and are addressed separately in the ornithological note

DESIGNATED SITE	FEATURE(S) ASSESSED	EFFECTS ASSESSED			POTENTIAL FOR ADVERSE EFFECT ALONE AND IN-COMBINATION
		CONSTRUCTION	O&M	DECOMMISSIONING	
Dee Estuary/ Aber Dyfrdwy (UK) (England/ Wales] SAC	- Mudflats and sandflats not covered by seawater at low tide - *Salicornia* and other annuals colonizing mud and sand - Atlantic salt meadows (Glauco-Puccinellietalia maritimae) - Estuaries	- Suspended sediment/ deposition - Pollution - Marine INNS	- Suspended sediment/ deposition - Pollution - Marine INNS - EMF - Changes to physical processes	- Suspended sediment/ deposition - Pollution - Marine INNS	No AEoI
	- Sea lamprey - River lamprey	- Underwater noise - Suspended sediment and deposition - Pollution	- Pollution - EMF	- Underwater noise - Suspended sediment and deposition - Pollution	No AEoI
River Dee and Bala Lake/ Afon Dyfrdwy a Llyn Tegid SAC	- Atlantic salmon - Sea lamprey - River lamprey	- Underwater noise - Suspended sediment and deposition - Pollution	- Pollution - EMF	- Underwater noise - Suspended sediment and deposition - Pollution	No AEoI
North Anglesey Marine/ Gogledd Môn Forol (UK) SAC	- Harbour porpoise	- Underwater noise	N/A	- Underwater noise	No AEoI
Bristol Channel Approaches/ Dynesfeydd Môr Hafren (UK) SAC	- Harbour porpoise	- Underwater noise	N/A	- Underwater noise	No AEoI
Cardigan Bay/ Bae Ceredigion (UK) SAC	- Grey seal - Bottlenose dolphin	- Underwater noise	N/A	- Underwater noise	No AEoI
North Channel (UK) SAC	- Harbour porpoise	- Underwater noise	N/A	- Underwater noise	No AEoI
Pen Llŷn a`r Sarnau/ Lleyn Peninsula and the Sarnau (UK) SAC	- Bottlenose dolphin - Grey seal	- Underwater noise	N/A	- Underwater noise	No AEoI
Rockabill to Dalkey Island SAC (IE) SAC	- Harbour porpoise	- Underwater noise	N/A	- Underwater noise	No AEoI
West Wales Marine/	- Harbour porpoise	- Underwater noise	N/A	- Underwater noise	No AEoI

DESIGNATED SITE	FEATURE(S) ASSESSED	EFFECTS ASSESSED			POTENTIAL FOR ADVERSE EFFECT ALONE AND IN-COMBINATION
		CONSTRUCTION	O&M	DECOMMISSIONING	
Gorllewin Cymru Forol (UK) SAC					
Pembrokeshire Marine SAC	Grey seal	Underwater noise	N/A	Underwater noise	No AEoI
The Saltee Islands (Ireland)	Grey seal	Underwater noise	N/A	Underwater noise	No AEoI
Lambay Island (Ireland).	Grey seal	Underwater noise	N/A	Underwater noise	No AEoI
Nord Bretagne DH (FR) SAC	Harbour porpoise	Underwater noise	N/A	Underwater noise	No AEoI
Roaringwater Bay and Islands SAC (IE) SAC	Harbour porpoise	Underwater noise	N/A	Underwater noise	No AEoI
Récifs et landes de la Hague (FR) SAC	Harbour porpoise	Underwater noise	N/A	Underwater noise	No AEoI
Anse de Vauville (FR) SAC	Harbour porpoise	Underwater noise	N/A	Underwater noise	No AEoI
Banc et récifs de Surtainville (FR) SAC	Harbour porpoise	Underwater noise	N/A	Underwater noise	No AEoI
Blasket Islands SAC (IE) SAC	Harbour porpoise	Underwater noise	N/A	Underwater noise	No AEoI
Tregor Goëlo (FR) SAC	Harbour porpoise	Underwater noise	N/A	Underwater noise	No AEoI
Côte de Granit rose-Sept-Iles (FR) SAC	Harbour porpoise	Underwater noise	N/A	Underwater noise	No AEoI
Mers Celtiques - Talus du golfe de Gascogne (FR) SAC	Harbour porpoise	Underwater noise	N/A	Underwater noise	No AEoI
Chausey (FR) SAC	Harbour porpoise	Underwater noise	N/A	Underwater noise	No AEoI
Cap d'Erquy-Cap Fréhel (FR) SAC	Harbour porpoise	Underwater noise	N/A	Underwater noise	No AEoI
Baie de Morlaix (FR) SAC	Harbour porpoise	Underwater noise	N/A	Underwater noise	No AEoI
Liverpool Bay/ Bae Lerpwl (UK) SPA	Common scoter (non-breeding)	Direct disturbance and displacement	Direct disturbance and displacement Barrier effect	Direct disturbance and displacement	No AEoI

DESIGNATED SITE	FEATURE(S) ASSESSED	EFFECTS ASSESSED			POTENTIAL FOR ADVERSE EFFECT ALONE AND IN-COMBINATION
		CONSTRUCTION	O&M	DECOMMISSIONING	
	- Red-throated diver (non-breeding) - Red-breasted merganser (non-breeding)*				
	- Red-breasted merganser (non-breeding)* - Common tern (passage) - Little tern (passage)	N/A	- Risk of collision on migration	N/A	No AEoI
	- Little gull (non-breeding)	N/A	- Risk of collision	N/A	No AEoI
The Dee Estuary (UK) SPA (offshore)	- Sandwich tern (passage)	N/A	- Direct disturbance and displacement - Risk of collision - Barrier effect	N/A	No AEoI
	- Common tern (passage) - Little tern - Bar-tailed godwit - Redshank - Shelduck - Teal - Pintail - Oystercatcher - Grey plover - Knot - Dunlin - Black-tailed godwit - Curlew - Waterbird assemblage	N/A	- Risk of collision on migration	N/A	No AEoI
The Dee Estuary (UK) SPA (onshore)	- Little tern - Sandwich tern - Bar-tailed godwit - Redshank - Shelduck	- Visual and/ or noise disturbance to species	- Visual and/ or noise disturbance to species	- Visual and/ or noise disturbance to species	No AEoI

DESIGNATED SITE	FEATURE(S) ASSESSED	EFFECTS ASSESSED			POTENTIAL FOR ADVERSE EFFECT ALONE AND IN-COMBINATION
		CONSTRUCTION	O&M	DECOMMISSIONING	
	- Teal - Pintail - Oystercatcher - Grey plover - Knot - Dunlin - Black-tailed godwit - Curlew - Waterbird assemblage				
Dee Estuary (UK) Ramsar	- Redshank - Shelduck - Teal - Pintail - Oystercatcher - Grey plover - Knot - Dunlin - Black-tailed godwit - Curlew - Bar-tailed godwit - Waterbird assemblage	- Visual and/ or noise disturbance to species (onshore)	- Visual and/ or noise disturbance to species (onshore) - Risk of collision on migration (offshore)	- Visual and/ or noise disturbance to species (onshore)	No AEoI
Anglesey Terns/ Morwenoliaid Ynys Mon (UK) SPA	- Sandwich tern (breeding) - Roseate tern (breeding)	N/A	- Direct disturbance and displacement - Risk of collision - Barrier effect	N/A	No AEoI
	- Common tern - Arctic tern	N/A	- Risk of collision - Barrier effect	N/A	No AEoI
Ribble and Alt Estuaries (UK) SPA	- Lesser black-backed gull (breeding and non-breeding)	N/A	- Risk of collision	N/A	No AEoI

DESIGNATED SITE	FEATURE(S) ASSESSED	EFFECTS ASSESSED			POTENTIAL FOR ADVERSE EFFECT ALONE AND IN-COMBINATION
		CONSTRUCTION	O&M	DECOMMISSIONING	
Ribble and Alt Estuaries (UK) Ramsar	Lesser black-backed gull (breeding and non-breeding)	N/A	Risk of collision	N/A	No AEoI
Morecambe Bay and Duddon Estuary (UK) SPA	Lesser black-backed gull (breeding and non-breeding) Herring gull (breeding and non-breeding) Great black-backed gull	N/A	Risk of collision	N/A	No AEoI
Morecambe Bay (UK) Ramsar	Herring gull (breeding and non-breeding) Lesser black-backed gull (breeding and non-breeding)	N/A	Risk of collision	N/A	No AEoI
Bowland Fells (UK) SPA and pSPA	Lesser black-backed gull (breeding and non-breeding)	N/A	Risk of collision	N/A	No AEoI
Lambay Island (IE) SPA	Kittiwake (breeding) Lesser black-backed gull (breeding)	N/A	Risk of collision	N/A	No AEoI
	Guillemot (breeding) Razorbill (breeding) Puffin (breeding)	Direct disturbance and displacement	Direct disturbance and displacement	Direct disturbance and displacement	No AEoI
Ailsa Craig (UK) SPA	Lesser black-backed gull (breeding and non-breeding) Kittiwake (breeding and non-breeding)*	N/A	Risk of collision	N/A	No AEoI
	Gannet (breeding and non-breeding)	Direct disturbance and displacement	Direct disturbance and displacement Risk of collision	Direct disturbance and displacement	No AEoI
Ireland's Eye (IE) SPA	Kittiwake (breeding)	N/A	Risk of collision	N/A	No AEoI
	Guillemot (breeding) Razorbill (breeding)	Direct disturbance and displacement	Direct disturbance and displacement	Direct disturbance and displacement	No AEoI

DESIGNATED SITE	FEATURE(S) ASSESSED	EFFECTS ASSESSED			POTENTIAL FOR ADVERSE EFFECT ALONE AND IN-COMBINATION
		CONSTRUCTION	O&M	DECOMMISSIONING	
Howth Head Coast (IE) SPA	Kittiwake (breeding)	N/A	Risk of collision	N/A	No AEoI
Wicklow Head (IE) SPA	Kittiwake (breeding)	N/A	Risk of collision	N/A	No AEoI
Glannau Aberdaron ac Ynys Enlli/ Aberdaron Coast and Bardsey Island (UK) SPA	Manx shearwater	Screened in for displacement on a precautionary basis as requested (Table 1)	Screened in for displacement on a precautionary basis as requested (Table 1)	Screened in for displacement on a precautionary basis as requested (Table 1)	No AEoI
Copeland Islands (UK) SPA	Manx shearwater	Screened in for displacement on a precautionary basis as requested (Table 1)	Screened in for displacement on a precautionary basis as requested (Table 1)	Screened in for displacement on a precautionary basis as requested (Table 1)	No AEoI
Skomer, Skokholm and the Seas off Pembrokeshire/ Sgomer, Sgogwm a Moroedd Penfro (UK) SPA	Kittiwake (breeding and non-breeding)* Lesser black-backed gull (breeding and non-breeding)	N/A	Risk of collision	N/A	No AEoI
	Puffin (breeding) Guillemot (non-breeding)* Razorbill (non-breeding)*	Direct disturbance and displacement	Direct disturbance and displacement	Direct disturbance and displacement	No AEoI
	Manx shearwater	Screened in on a precautionary basis as requested (Table 1)	Screened in on a precautionary basis as requested (Table 1)	Screened in on a precautionary basis as requested (Table 1)	No AEoI
	Storm petrel	Screened in on a precautionary basis as requested (Table 1)	Screened in on a precautionary basis as requested (Table 1)	Screened in on a precautionary basis as requested (Table 1)	No AEoI
Rathlin Island (UK) SPA	Puffin (breeding)*	Direct disturbance and displacement	Direct disturbance and displacement	Direct disturbance and displacement	No AEoI
Saltee Islands (IE) SPA	Kittiwake (breeding) Lesser black-backed gull (breeding)	N/A	Risk of collision	N/A	No AEoI
	Puffin (breeding)	Direct disturbance and displacement	Direct disturbance and displacement	Direct disturbance and displacement	No AEoI
Wexford Harbour and Slobs (IE) SPA	Lesser black-backed gull	N/A	Risk of collision	N/A	No AEoI

DESIGNATED SITE	FEATURE(S) ASSESSED	EFFECTS ASSESSED			POTENTIAL FOR ADVERSE EFFECT ALONE AND IN-COMBINATION
		CONSTRUCTION	O&M	DECOMMISSIONING	
Helvick Head to Ballyquin (IE) SPA	Kittiwake	N/A	Risk of collision	N/A	No AEoI
Grassholm (UK) SPA	Gannet (breeding)	Direct disturbance and displacement	Direct disturbance and displacement Risk of collision	Direct disturbance and displacement	No AEoI
Ynys Seiriol/ Puffin Island (UK) SPA	Cormorant	Screened in on a precautionary basis as requested (Table 1)	Screened in on a precautionary basis as requested (Table 1)	Screened in on a precautionary basis as requested (Table 1)	No AEoI
Traeth Lafan/ Layan Sands, Conway Bay (UK) SPA	Oystercatcher Curlew Great crested grebe Red-breasted merganser	N/A	Risk of collision on migration	N/A	No AEoI
Dyfi Estuary/ Aber Dyfi (UK) SPA	Greenland white-fronted goose	N/A	Risk of collision on migration	N/A	No AEoI
Burry Inlet (UK) SPA	Shelduck Wigeon Teal Pintail Shoveler Oystercatcher Grey plover Knot Dunlin Curlew Redshank Turnstone Waterbird assemblage	N/A	Risk of collision on migration	N/A	No AEoI
Burry Inlet (UK) Ramsar	Pintail Oystercatcher Knot Redshank Waterbird assemblage	N/A	Risk of collision on migration	N/A	No AEoI

DESIGNATED SITE	FEATURE(S) ASSESSED	EFFECTS ASSESSED			POTENTIAL FOR ADVERSE EFFECT ALONE AND IN-COMBINATION
		CONSTRUCTION	O&M	DECOMMISSIONING	
Severn Estuary (UK) SPA	Bewick's swan Dunlin Gadwall Greater white-fronted goose Redshank Shelduck Waterbird assemblage	N/A	Risk of collision on migration	N/A	No AEoI
Severn Estuary (UK) Ramsar	Bewick's swan Dunlin Gadwall Greater white-fronted goose Redshank Shelduck Pintail Teal Ringed plover Waterbird assemblage	N/A	Risk of collision on migration	N/A	No AEoI

*Assemblage features only

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