Department for
Business, Energy
& Industrial Strategy

UK Offshore Energy Strategic Environmental Assessment

Government response to OESEA4 public consultation

September 2022

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1 Introduction

1.1 Consultation context

The Department for Business, Energy and Industrial Strategy (the Department) is undertaking a Strategic Environmental Assessment (OESEA4) of their draft plan/programme for offshore energy which includes further rounds of offshore wind farm leasing, and leasing of other marine renewables, further seaward rounds of oil and gas licensing, gas storage (including of carbon dioxide), and offshore hydrogen production, transport and storage. The draft plan/programme is expected to have a lifespan of approximately 4 years and variously covers relevant waters of the UK for reserved matters in relation to the above aspects of the draft plan/programme.

Public consultation on the Environmental Report was undertaken between 17th March 2022 and 27th May 2022. The Environmental Report was available to view or freely download on the SEA pages of the gov.uk website. Digital copies of the Environmental Report could also be ordered, if preferred, via email or by mail. Public notices were inserted in 24 national and regional newspapers to inform the wider public of the SEA consultation. Copies of the Environmental Report were sent to statutory consultation bodies and authorities in the UK and to neighbouring states.

This report (the Government Response) includes a summary[1] of the consultation feedback received during the public consultation period. Where appropriate, responses are given to provide factual and technical clarifications. It is not intended to publish a revised version of the Environmental Report, however, where relevant the Environmental Report should be read in light of the further clarifications provided by the Department in this Government Response (GR). A revised set of recommendations have been drafted to take account of the feedback received and these are listed Appendix 1.

There are many considerations which the Department will take into account in making a decision on the draft plan/programme; the Environmental Report and the comments received during consultation are important inputs to this process. The Government decision will be accompanied by a post adoption statement, describing *inter alia* how environmental considerations have been integrated into the plan or programme and how the Environmental Report and opinions expressed in response to the consultation have been taken into account in line with the requirements of the *Environmental Assessment of Plans and Programmes Regulations 2004* (as amended) (the SEA Regulations).

1.2 Consultation responses

Twenty eight responses were received from the following organisations:

- Crown Estate Scotland

[1] In addition to the summarised consultation feedback in this Government Response, full copies of the consultation feedback are document separately and is available on the OESEA4 consultation page of the gov.uk website.

- The Crown Estate
- Department for Environment, Food & Rural Affairs
- Marine Management Organisation
- NatureScot
- South Downs National Park Authority
- Department of Agriculture, Environment and Rural Affairs (Northern Ireland)
- Department for Communities Historic Environment Division (Northern Ireland)
- Historic England
- Natural Resources Wales
- Joint Nature Conservation Committee - joint response with Natural England
- Natural England - joint response with Joint Nature Conservation Committee
- Bat Conservation Trust
- The Wildlife Trusts
- Carbon Capture and Storage Association
- RWE
- ScottishPower Renewables
- EnerGeo Alliance
- Uplift
- Port of London Authority
- Norwegian Environment Agency
- Norwegian Coastal Administration
- Danish Department of Defence
- Environmental Protection Agency, Species and Nature Protection (Denmark)
- Stad Nieuwpoort, Belgium
- Offshore Energies UK

- Historic Environment Scotland
- Belgian authorities

Additionally, two responses were received from members of the public.

A separate document (UK Offshore Energy Strategic Environmental Assessment Consultation Feedback, September 2022) reproduces the comments received during the consultation in full (redacted as necessary), with the exception of one organisation who requested that their response was not published in its entirety.

2 Responses to the consultation and Government response

Due to the volume and diversity of consultation responses received, they have been categorised under a number of themes. The following section is structured around these themes which largely follow the headings of the Environmental Report.

2.1 The Environmental Report

A number of respondents indicated that the Environmental Report (ER) was well referenced and complemented the comprehensive nature of the baseline, assessment and recommendations. However, several responses commented on the length of the document and its appendices and questioned whether alternative ways of presenting the information could have been taken so that readers could quickly identify the report conclusions. The length of the ER reflects the broad nature of the draft plan/programme assessed and its wide geographic coverage, and it is considered that the non-technical summary provides a concise overview of the report and its conclusions. The points raised about considering alternative methods of presentation, including digital formats, will be considered for any future ER.

A number of editorial comments and suggestions for additional literature were made by respondents. The additional literature has been reviewed, and where relevant, is referred to in the GR below. Whilst these do not materially alter the outcome of the SEA, the editorial comments and additional literature are welcome and have been collated for input to relevant future publications.

2.2 The draft plan/programme and the energy policy context

A number of responses to the consultation were in relation to the geographic and technical scope of the draft plan/programme. In particular, that the SEA should cover all UK waters across all the energy related activities considered in the draft plan/programme, queries as to whether the draft plan/programme covers the production of ammonia or non-hydrogen power to gas offshore, that the plan either does not cover wave and tidal energy, or else that tidal barrages should be entirely discounted.

The geographic scope of the SEA is determined by the various devolved arrangements for energy development, in particular with Scotland, and covers matters which are all or in part reserved. This is set out in some detail in Section 1.5 of the ER. Where references have been made to areas in Northern Irish territorial waters e.g. Rathlin Island and Torr Head, this has only been to refer to studies of relevance to the SEA and it should not be inferred that the SEA covers leasing in these areas. The relevant legislative and planning frameworks relevant to the draft plan/programme, were variously outlined in Sections 2.2 and 2.4 of the ER.

The draft plan/programme does not cover the production of ammonia or any alternative fuels offshore, and it can be confirmed that both the plan and the SEA include a consideration of wave and tidal energy in relevant waters of the UK. For example, wave and tidal technologies

are variously assessed in Sections 5.4, 5.5, 5.6, 5.7 and 5.8 of the ER, amongst others. This includes assessment of the effects of tidal barrages, and their inclusion in the draft plan/programme should be read in the context of that assessment and Recommendation 17 of the ER.

The proposed scope of the draft plan/programme and the SEA was previously consulted on at the scoping stage. To clarify, the draft plan/programme was outlined in the ER on pages viii-x of the non-technical summary (NTS) and pages 23-24 of Section 2.3. The draft plan/programme is:

Renewable Energy:

Offshore Wind – to enable further offshore wind farm leasing in the relevant parts of the UK Exclusive Economic Zone and the territorial waters of England and Wales, to contribute to the UK target of up to 40GW of offshore wind generation capacity deployed by 2030 (including 1GW of floating offshore wind). The technologies covered will include fixed and tethered turbines. Tethered turbines will only be considered in waters up to 250m. The Scottish Renewable Energy Zone and the territorial sea limit of Scotland and Northern Ireland are not included in this part of the plan/programme.

Wave – future leasing in the relevant parts of the UK Exclusive Economic Zone[2] and the territorial waters of England and Wales. The Scottish Renewable Energy Zone[3] and the territorial sea limit of Scotland and Northern Ireland are not included in this part of the plan/programme. In view of the relatively early stage of technological development, a target generation capacity is not set in the draft plan/programme.

Tidal Stream – future leasing in the relevant parts of the UK Exclusive Economic Zone and the territorial and internal waters of England and Wales. The Scottish Renewable Energy Zone and the territorial sea limit of Scotland and Northern Ireland are not included in this part of the plan/programme. In view of the relatively early stage of technological development, a target generation capacity is not set in the draft plan/programme. Similarly, a minimum average tidal current velocity threshold is not proposed.

Tidal Range – future leasing in the internal and territorial waters of England and Wales. It is considered unlikely that there will be tidal range developments outside of territorial waters.

Oil & Gas:

Exploration and production – further Seaward Rounds of oil and gas licensing of the UK territorial sea and UK Continental Shelf (UKCS), subject to the outcome of periodic Climate Compatibility Checkpoints.

Hydrocarbon gas importation and storage – further licensing/leasing for unloading and underground storage of hydrocarbon gas in UK waters (territorial sea and the relevant parts of the UK Exclusive Economic Zone), including hydrocarbon gas storage in other geological formations/structures including constructed salt caverns, and the offshore unloading of hydrocarbon gas.

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[2] *The Exclusive Economic Zone Order 2013*
[3] *The Renewable Energy Zone (Designation of Area) (Scottish Ministers) Order 2005*

Carbon Dioxide:

Carbon dioxide (CO_2) transportation and storage – further licensing/leasing for underground storage of CO_2 gas in UK waters (the UK Exclusive Economic Zone and relevant territorial sea, excluding the territorial sea limit of Scotland[4]). The UK target is to have CCUS deployed in two industrial clusters by the mid-2020s, and a further two clusters by 2030, with an ambition to capture and store 20-30MtCO_2 per year by 2030. OESEA4 includes CO_2 storage in geological formations/structures including depleted reservoirs (and for enhanced oil recovery), saline aquifers and constructed salt caverns.

Hydrogen:

The offshore production and transport of hydrogen. This includes any offshore aspect of "power to gas" which uses excess renewable electricity and electrolysers to produce hydrogen (green hydrogen) and the offshore carbon dioxide transport and storage aspects of onshore hydrogen production from natural gas (blue hydrogen). An ambition of 5GW (equating to 42TWh) of low-carbon hydrogen production capacity by 2030 has been set, with the hope that 1GW capacity could be delivered by 2025. Storage of hydrogen in geological formations is not expected before 2030 but work to identify and prepare sites for storage could take place in advance of this.

In response to feedback received that the SEA should have covered onshore aspects of the various energy technologies assessed, it was indicated at the scoping stage that the implications of onshore infrastructure associated with projects which could relate to any future leasing/licensing are not covered by the draft plan/programme and would not be assessed in the SEA, nor would offshore grid. The effects associated with offshore cabling and pipeline installation was, however, assessed in the SEA. Onshore elements are in part covered in Section 5.14 Ancillary Development, however, the precision of the plan precludes the ability to identify or assess the specific locations of any potential future wind zones, cable routes or landfalls. The SEA reflects as far as possible at this stage the role of the Offshore Transmission Network Review (OTNR)[5] in taking a strategic approach to offshore transmission, considered holistically with the onshore network to deliver greater coordination and reduce cumulative effects through the work streams covering Early Opportunities, the Pathway to 2030 and the Enduring Regime. The Holistic Network Design (HND) is part of the Pathway to 2030 work stream published in July 2022[6]. The HND will largely relate to projects which are at an early development stage, including those from Round 4 and ScotWind leasing, and some in the Celtic Sea, with a total of 23GW of offshore wind being in scope. The HND makes recommendations on the potential location of infrastructure, which includes a mix of radial and coordinated connections. Detailed Network Design (DND) is due to follow on from the HND.

As noted by a number of respondents, some of the targets considered in the draft plan/programme does not reflect the ambitions set out in the British Energy Security Strategy

[4] *The Storage of Carbon Dioxide (Licensing etc.) (Scotland) Regulations 2011, The Storage of Carbon Dioxide (Amendment of the Energy Act 2008 etc.) Regulations 2011*
[5] https://www.gov.uk/government/groups/offshore-transmission-network-review
[6] https://www.nationalgrideso.com/future-energy/the-pathway-2030-holistic-network-design/hnd

(BESS)[7]. It should be noted that the BESS was published after the OESEA4 public consultation period had commenced. The relevant ambitions set out in the BESS are:

- An ambition to deliver up to 50GW of offshore wind generation capacity by 2030,including up to 5GW of floating offshore wind

- Doubling UK ambition for hydrogen production capacity to up to 10GW by 2030, with at least half of this from electrolytic hydrogen

More broadly, the BESS includes a number of policy initiatives which are relevant to the draft plan/programme and the SEA, including:

Oil and gas, and CCS

- The commitment to launch a further seaward licensing round for oil and gas exploration in autumn 2022, subject to the climate compatibility checkpoint

- To drive industry investment in electrifying offshore production to reduce the carbon intensity of domestic oil and gas

Renewables

- Reduce consent time from up to four years to one year

- Update the renewables National Policy Statements to reflect the importance of energy security and net zero

- Making environmental considerations at a more strategic level, allowing us to speed up the process while improving the marine environment

- Introducing strategic compensation environmental measures, including for projects already in the system, to offset environmental effects and reduce delays to projects

- Reviewing the way in which the Habitats Regulations Assessments are carried out for all projects making applications from late 2023 to maintain valued protection for wildlife

- Implementing a new Offshore Wind Environmental Improvement Package including an industry-funded Marine Recovery Fund and nature-based design standards (now termed Offshore Wind Environmental Standards) to accelerate deployment whilst enhancing the marine environment

- Working with the Offshore Wind Acceleration Task Force; a group of industry experts brought together to work with Government, Ofgem and National Grid on further cutting the consenting timeline

[7] https://www.gov.uk/government/publications/british-energy-security-strategy Note that following on from the publication of the BESS, the Energy Security Bill was introduced on the 6th of July 2022: https://www.gov.uk/government/news/plans-to-bolster-uk-energy-security-set-to-become-law

- Establishing a fast-track consenting route for priority cases where quality standards are met, by amending Planning Act 2008 so that the relevant Secretary of State can set shorter examination timescales

Hydrogen

- Aiming to run annual allocation rounds for electrolytic hydrogen, moving to price competitive allocation by 2025 as soon as legislation and market conditions allow, so that up to 1GW of electrolytic hydrogen is in construction or operational by 2025.

The ambitions for offshore wind and hydrogen set out in the BESS are unlikely to be achieved until later this decade. The plan/programme based on OESEA4 will have a lifespan of approximately 4 years. The Department, therefore, commits to refreshing the SEA in two to three years' time to account for the higher ambitions relating to offshore wind and hydrogen in the BESS that are expected to be delivered in the period 2026-2030 and any additional changes to the energy policy context, technology, and understanding of the environmental baseline and effects assessment.

In addition to the publication of the BESS, there are a number of other changes to the energy policy context or clarifications to the marine management context provided in consultation feedback, which are outlined below. Since the publication of the ER, the first offshore carbon storage licensing round[8] has commenced, inviting bids across areas in the east Irish Sea, northern North Sea, central North Sea and southern North Sea. As detailed in the ER, the leasing and licensing for carbon storage is variously the responsibility of the NSTA, The Crown Estate and Crown Estate Scotland, and the ongoing collaboration between these organisations[9] was announced at the same time as the licensing round. It is hoped that any licences granted as part of the round, in combination with those previously awarded, would make a significant contribution to the aim to store 20-30 million tonnes of carbon dioxide per year by 2030. Licences are anticipated to be granted in 2023 subject to technical, economic and habitats assessments.

One respondent noted that the final areas of search for Crown Estate Scotland's offshore wind leasing round for Innovation and Targeted Oil and Gas (INTOG) had been published[10]. The Department acknowledges that it is aware of the Initial Plan Framework and the target to commence leasing in August 2022[11], with plan options being subject to Sustainability Appraisal and Habitats Regulations Assessment (HRA). The Department also notes that since the publication of OESEA4, The Crown Estate have announced five areas of search for future floating wind leasing in the Celtic Sea which are due to be refined to development areas and offered to competitive tender in 2023.

There were a number of responses on marine planning and the marine management context. These include that there is a need for an integrated marine spatial plan with robust SEA and HRA that can effectively reduce the consenting risks for offshore wind at the project consenting

[8] https://www.nstauthority.co.uk/news-publications/news/2022/bids-invited-in-uk-s-first-ever-carbon-storage-licensing-round/
[9] https://www.nstauthority.co.uk/news-publications/news/2022/north-sea-transition-authority-the-crown-estate-and-crown-estate-scotland-announce-renewed-collaboration-to-unlock-the-potential-of-carbon-storage/
[10] https://www.gov.scot/publications/initial-plan-framework-sectoral-marine-plan-offshore-wind-innovation-targeted-oil-gas-decarbonisation-intog/
[11] https://www.crownestatescotland.com/news/summary-of-feedback-on-proposed-intog-leasing-published

stage, a need for marine spatial prioritisation, and that co-location issues should be addressed (also see Sections 2.12 and 2.13 below). While OESEA4 provides an assessment which can be used to support further licensing and leasing, it does not identify or assess the effects of leasing in specific offshore wind zones. While existing marine plan policies provide a level of safeguarding for other uses of the sea in English, Welsh and Scottish waters (note that the Marine Plan for Northern Ireland is due to have its second iteration in early 2023), it is acknowledged that these do not provide a level of prioritisation which is spatially or sector specific. It is considered that any integrated marine spatial plan would be most appropriately led by the plan making authorities in consultation with the Department and others. Defra are leading a programme of work on marine spatial prioritisation which has the aim of complementing existing marine policy. Awareness of the Recommendations of OESEA4 with the relevant marine plan makers is maintained by those organisations being members of the SEA steering group, and also consultees at the scoping and public consultation stages.

In their response to the consultation NRW wished to clarify a number of points in relation to Welsh responsibilities in the consenting of offshore renewables, for example, as covered in Section 2.4 of the ER. This includes that the Welsh Government is responsible for licences under Section 36 of the *Electricity Act* and that NRW are the Marine Licensing Authority for Welsh inshore and offshore waters acting on behalf of Welsh Ministers. The section in question does note the provisions of the *Wales Act 2017* in relation to energy consenting but not the relevant consenting bodies in Wales, however, it is acknowledged that this could have been made clearer.

In relation to the context to leasing and licensing, one respondent noted that infrastructure re-use was not considered for hydrogen projects. It is noted that such re-use was mentioned in relation to carbon dioxide transport and storage, however, this has previously been subject to a number of detailed considerations to provide a basis for such a discussion. The Scottish Government's' Infrastructure Investment Plan – 2021-22 to 2025-26, referred to in the consultation response, sets out an infrastructure hierarchy that highlights the need to maximise the use of existing assets, repurpose and co-locate assets where possible, before considering the construction of new infrastructure. The investment plan is acknowledged, and the Department would like to point out that such a hierarchy is already contained in the decommissioning guidance for offshore oil and gas infrastructure[12], such that decommissioning will be regarded as the last option after re-use of the facilities for energy or other projects has been ruled out (in discussion with the NSTA[13]). The timescales for asset decommissioning and the progression of new projects may not always result in re-use potential being realised, and re-use options may not always be suitable.

Comments were also received which called for decommissioning to be considered earlier within project planning and that installations which cannot be removed should no longer be used by the oil and gas industry. It should be noted that OSPAR Decision 98/3 on the Disposal of Disused Offshore Installations (the Decision) prohibits the dumping and leaving wholly or partly in place, of disused offshore installations within the maritime area. However, the Decision recognises that there may be difficulty in removing the "footings" of large steel jackets (weighing more than 10,000 tonnes) and concrete gravity-based structures and allows for derogation from the prohibition. The derogation provision only applies to those installations installed before the Decision came into effect (February 1999). All installations placed in the

[12] https://www.gov.uk/guidance/oil-and-gas-decommissioning-of-offshore-installations-and-pipelines#overview
[13] Also see the NSTA's Decommissioning Strategy: https://www.nstauthority.co.uk/media/7538/decommissioning-strategy-may-2021.pdf

maritime area after that date must be totally removed and legacy issues relating to oil and gas decommissioning are assessed on a case-by-case basis. In addition, provisions are in place to ensure that all significant offshore projects, including renewables, would have to be abandoned in accordance with legislative requirements at the time they are undertaken. In keeping with present EIA guidance for offshore energy developments, decommissioning must be considered as part of project proposals, and while there is no requirement to provide a detailed assessment of decommissioning proposals in project applications, it should be confirmed, for example, how the design and installation of a proposed project has taken into consideration the possible requirement for complete removal at the end of field life if that is a requirement of the legislation at that time[14].

2.3 The Scope of the SEA

One respondent challenged the reasoning behind not including downstream emissions of further oil and gas exploration and production in the scope of the assessment in the ER. As noted in Section 3.6 of the ER, the Department considered carefully whether the degree of connection between developments that might come forward pursuant to the draft plan/programme and end use emissions was sufficient to make those emissions a likely significant effect of the draft plan/programme that needed to be included in the SEA. For example, any hydrocarbons extracted as a result of any further seaward licensing round covered by the draft plan/programme would undergo various processing stages following their initial extraction. These may include blending and refining and lead to numerous potential fossil fuel and non-fossil fuel end uses both domestically and internationally, and may also be subject to downstream processes which incorporate carbon capture and storage or blue hydrogen production. Whilst it is acknowledged that the processes and products associated with end use will result in greenhouse gas emissions, it was not considered that they were sufficiently closely causally connected to implementation of the draft plan/programme to be taken into account in the SEA and therefore do not constitute a likely significant effect of implementing the draft plan/programme itself.

Whilst the Department recognises that it is possible to make such an assessment (for example we note the reference to IPIECA[15] guidance), the exclusion of such an assessment was not made on methodological grounds but rather, as noted above, on the degree of connection with the draft plan/programme. It is emphasised however, that the levels of production that could result from future licensing are highly uncertain as any new project is based on the outcome of exploration/appraisal, and the volumes of oil and gas which may be discovered and produced are uncertain, though some assumptions may be made based on current projections for UKCS production towards 2050[16]. While downstream emissions are not considered in the ER, the consistency of current and projected UKCS production with a decline rate needed to meet net zero is discussed (see Section 5.12 of the ER, Climatic Factors, and Section 2.7 below).

[14] BEIS (2021). The Offshore Oil and Gas Exploration, Production, Unloading and Storage (Environmental Impact Assessment) Regulations 2020 – A Guide. Revision 3, 71pp + appendices.
[15] https://www.ipieca.org/resources/good-practice/estimating-petroleum-industry-value-chain-scope-3-greenhouse-gas-emissions-overview-of-methodologies/
[16] https://www.nstauthority.co.uk/data-centre/data-downloads-and-publications/production-projections/

2.4 Assessment: noise

One response noted that underwater noise has the potential to have behavioural and physiological effects on invertebrates as well as marine mammals, fish and birds. This is acknowledged and is covered in Section 5.3.3.5 of the ER.

A number of mitigation measures were noted in responses which were not specifically covered in the controls and mitigation section of the noise chapter in the ER, these include the use of low order Unexploded Ordnance (UXO) disposal, alternatives to seismic survey, and use of bubble curtains. Bubble curtains are referred to in Section 5.3.5 of the ER along with a range of other technical measures to reduce noise relating to pile driving, including isolation casings, cofferdams and hydro sound dampers, and alternative piling or foundation methods including, vibratory pile driving, foundation drilling, gravity base foundations, bucket foundations and floating turbines (noting that alternative foundations may not represent viable alternatives or mitigation methods). Low order UXO disposal is referred to in Section 5.3.5 and Recommendation 37 of the ER (see Appendix 1) indicates that the, "…preferred approach should be to use low-noise methods for disposal [of UXO] wherever possible, with clear justification provided where such methods are not proposed". The Department is fully aware of the Joint Interim Position Statement[17] on UXO clearance, and also refer to the research commissioned through the SEA programme to characterise the noise generated by UXO disposal (Robinson *et al.* 2020, in press). This programme of work included: a review of the scientific research in the field and current operational procedures for UXO clearance operations, provision of a guidance protocol for those undertaking UXO sound measurements at sea, an experimental study in a controlled environment (flooded quarry) to characterise the acoustic 'near-field' of explosives and to assess the effectiveness of mitigation methods (e.g. deflagration), collection and analysis of measurements made during a variety of UXO removals by developers, and sea trials of sound generation and long-range propagation during UXO clearance off Denmark using high- and low-order techniques. Further work is scheduled for 2022 which includes analysis of samples collected during UXO clearance to understand chemical contaminant release, and further quarry studies of the acoustic outputs of other UXO clearance techniques.

One respondent referred to the limited evidence on the nature of the sound output from sub-bottom profilers (SBPs), and while the respondent considered that the lower amplitude nature of the noise source is likely to have a lower impact on marine mammals than seismic survey, it was noted that the duration of such surveys could result in a larger temporal scale of effect. It was further noted that such surveys for renewables and cables does not have a formal consenting route, with submission to the Marine Noise Registry (MNR) being voluntary. The potential for geophysical surveys to cover large areas relating to offshore wind farms is acknowledged in the ER, and as noted in the response, the SEA provides a review of available information on the characteristic sound sources associated with SBPs, and notes that these data (in particular for parametric SBPs) and those on the responses of marine mammals or other noise sensitive species to various types of SBP, are limited. Another respondent indicated that the assessment assumed sound levels would drop off quickly from geophysical surveys, noting that there are limited empirical measurements of such noise sources. The work of Halvorsen & Heaney (2018) could have also been referred to, which involved measurements made in shallow (≤ 100m depth) open-water environments to investigate the propagation of sound from various high resolution geophysical survey (HRGS) sources. While

[17] https://www.gov.uk/government/publications/marine-environment-unexploded-ordnance-clearance-joint-interim-position-statement/marine-environment-unexploded-ordnance-clearance-joint-interim-position-statement

problems were encountered during the open-water testing resulting in a lack of calibration in the reported sound source levels (Labak 2019), some general patterns in Halvorsen & Heaney (2018) are noted. In all test environments, broadband received levels from all echosounder and side-scan sonar devices (along with SBP chirper devices) tested were rapidly attenuated with distance from source, with particularly pronounced fall-off for directional sources when the receiver was outside of the source's main beam. The greatest propagation was generally observed at the deepest test site (100m water depth) from sources generating low frequencies (<10kHz); by contrast, at 100m water depth, some of the highest frequency sources (>50kHz) experienced such attenuation that they were only weakly detectable or undetected by recording equipment. In all open-water test environments, broadband received levels did not exceed 160dB re 1µPa (rms)[18] beyond 200m from any echosounder or side-scan sonar device tested. While recognising that these results require refining, preliminary evidence suggests that these electromechanical HRGS (and SBP) sources generate a very limited sound field in the marine environment, and of a much lower magnitude than those generated by seismic airgun sources. It is therefore not considered that the expectation that noise levels would drop off quickly from such devices is an assumption.

The lack of data on the characteristics of certain noise sources and their effects on marine mammals and other noise sensitive species is recognised in the assessment, and the potential for significant effects is also acknowledged. Available evidence, combined with the controls and mitigation outlined in Section 5.3.5, are regarded to provide a suitable level of understanding and precaution across the oil and gas, renewables and, gas transportation and storage sectors. This is reflected in a number of recommendations in the ER, and in particular, Recommendation 23 (see updated recommendations in Appendix 1).

One respondent noted reference to Southall *et al.* (2007) rather than the updated Southall *et al.* (2019) in Section 5.3 of the ER with reference to injury thresholds. While this was the case in some places, the references were made for historical context, and reference was also made to the more recent Southall *et al.* (2019) injury thresholds and also Southall *et al.* (2021). It can be confirmed that the Department acknowledges that the thresholds in Southall *et al.* (2019) are those to be used, and those in Southall *et al.* (2007) are superseded for the purposes of assessment.

It was noted in a response that there are criticisms of the dBht metrics referred to in relation to fish in Section 5.3.3.2 of the ER. The ER noted that there are several limitations with the dBht approach, including that, "…Nedwell *et al.* (2007) used audiograms expressed only in terms of sound pressure so that validation with respect to particle motion is lacking; at present the quality of audiograms for many species is not satisfactory for calculation of dBht(Species) levels; reliance on audiograms may be appropriate for behavioural effects but should be considered with caution in respect to injury as also inaudible sounds can cause damage to tissues". Furthermore, Popper & Hawkins (2019) note that limitations associated with dBht include that: there are very few field data derived from wild fishes to support the levels chosen by Nedwell *et al.* (2007) above which there is strong avoidance responses in fish; the concept of dBht has not been accepted in the peer reviewed literature; defining response criteria applicable to all species is too simplistic; and that the data on hearing thresholds should ideally be based on accurate behavioural threshold determinations rather than measures of inner ear

[18] The 160dB re 1µPa (rms) isopleth represents the acoustic exposure criterion for behavioural disruption from impulsive noise as described by NMFS (2016), although this criterion is not universally adopted in policy or guidance elsewhere (such as the UK).

responses which are susceptible to flaws (Sisneros *et al.* 2016 as cited in Popper & Hawkins 2019).

A number of additional sources of information were referred to in responses. One source, Halvorsen & Heaney (2018), has been referred to above. With reference to noise on fish, while Slabbekoorn *et al.* (2010) was not referred to, reference to research and reviews of relevance to the effects of noise on fish were included, including Slabbekoorn *et al.* (2019). The modelling study of Gallagher *et al.* (2021) provides a useful framework for estimating population structure and seasonal variations in energetics, which was applied to harbour porpoise in relation to seismic survey. Such population consequences of disturbance frameworks have previously been proposed for the UK (e.g. the interim Population Consequences of Disturbance Model, iPCoD) and is referred to in Section 5.3.3.1 of the ER. For those other sources provided, these provide useful additional evidence for the nature of sound sources and the potential for effects on a range of receptors including marine mammals, though it is not considered they materially change the conclusions of the assessment. These will be considered in any future ER.

One respondent recommended a number of actions in relation to underwater noise and marine mammals, particularly in the context of harbour porpoise. These include the introduction of a noise limit across UK waters; the strategic monitoring of marine mammals to improve the evidence base including population-level impacts; transparent reporting on the area based thresholds used to manage underwater noise in harbour porpoise SACs; and guidance from regulators on the preferred technologies to reduce levels of underwater noise.

On the introduction of a noise limit across UK waters, it is not clear that sufficient evidence exists to support this, and the topic would not be for the Department alone. However, the Department and Defra are considering the subject through the Offshore Wind Enabling Actions Programme. With regards to the area-based thresholds[19], and in particular for the Southern North Sea SAC, the recommendations of the Review of Consents for the site[20] have been taken forward in relation to renewables, and for oil and gas, the SNS Regulators Working Group has been set up to share information on operations and work towards strategic planning and management of impulsive noise across sites, with an initial focus on the Southern North Sea SAC[21]. Furthermore, JNCC (2022) present impulsive noise in the Southern North Sea SAC for the years 2015-2020, though a number of caveats are noted, including non-licensable activity such as that referred to above not being recorded, with recommendations for an updated MNR to improve usability and transparency. With regards to the strategic monitoring of marine mammals, a number of previous surveys have been undertaken through the Small Cetaceans in European Atlantic waters and the North Sea (SCANS) initiative; SCANS III was completed in summer 2016 and the Department's SEA Research Programme is providing further funding towards the facilitation of SCANS IV, for which work is underway.

A range of technologies are available to reduce the noise levels relating to certain activities and these are referred to in Section 5.3. and 5.3.5 of the ER. While the assessment does not

[19] See: JNCC (2020). Guidance for assessing the significance of noise disturbance against Conservation Objectives of harbour porpoise SACs (England, Wales & Northern Ireland). JNCC Report No. 654, JNCC, Peterborough, ISSN 0963-8091: https://hub.jncc.gov.uk/assets/2e60a9a0-4366-4971-9327-2bc409e09784

[20] https://www.gov.uk/government/publications/review-of-consented-offshore-wind-farms-in-the-southern-north-sea-harbour-porpoise-special-area-of-conservation

[21] https://www.gov.uk/guidance/oil-and-gas-offshore-environmental-legislation#offshore-petroleum-activities-conservation-of-habitats-regulations-2001-as-amended

generally recommend any particular technology, Recommendation 37 does indicate that low-noise disposal methods should be the preferred approach for UXO disposal.

2.5 Assessment: physical damage/change to features and habitats

In response to some misinterpretation of the ER in feedback, we would like to clarify that the list on pages xxvi-xxviii of the NTS relate to all project phases and not just decommissioning. The potential source of effect on cultural heritage, "Physical damage to submerged heritage/archaeological contexts from infrastructure construction, vessel/rig anchoring etc and impacts on the setting of coastal historic environmental assets and loss of access" should be taken to apply to all project phases though it is accepted that the text implies that it only covers construction and operation. The update to the North Sea Prehistory Research and Management Framework[22] commissioned through the OWEC programme is noted, and the SEA team will maintain awareness for its future publication.

A number of comments were received in relation to the potential physical effects of tidal range schemes. The Department would like to clarify that tidal lagoons could have effects of a scale similar to that of barrages as they can enclose important rivers and estuaries, and that this would be strongly affected by their location. Additionally, it is agreed that wording related to lagoons in the ER which suggests that effects would be within an estuary or river channel is a simplification, but should be read in conjunction with Section 5.5 of the ER which covers the potential nature and scale of far field effects relating to tidal range technologies. One respondent noted that the suggestion in the ER that no measures would likely be able to mitigate the potential physical effects of tidal range schemes is very generic, and it was suggested that this should be assessed on a case-by-basis and not at a strategic level. This was also the finding of the SEA which is reflected in recommendation 17.

One respondent found the comparison between the scale of physical effect from elements of the draft plan/programme and those from other industries (e.g. fishing) to be unhelpful. It is not being suggested that the comparison diminishes the potential nature and scale of effect of activities associated with the draft plan/programme but it is considered that this does provide useful context to the broader range of activities resulting in physical effects across the UKCS. The effects from fishing may be more transitory than the installation of offshore energy developments, but some areas are fished on a regular basis which may reduce the transience of such effects. In response to a comment received on the regulation of fisheries, it is accepted that the description of trawling as being "effectively unregulated" outside of areas closed to certain fisheries in relation to conservation or stock management could have made reference to wider restrictions in the sector, for example in relation to gear requirements. It should not be interpreted that trawling could effectively take place anywhere on the UKCS, however, as noted above the intention of the section was to put into context the wider baseline of physical effects being generated from other activities, which is most notably fisheries.

It is noted in feedback that adverse effects on site integrity have been concluded against a number of sites and renewable energy projects as a result of physical effects on Annex I habitats. Feedback received on this topic emphasised a strong preference for site avoidance

[22] https://historicengland.org.uk/images-books/publications/ns-prehistory-research-manage-framework/10278_north_sea_prehistory_web/

with reference to the mitigation hierarchy. The mitigation hierarchy is already embedded in planning policy and assessment approaches for EIA and HRA, and the universal avoidance of benthic MPAs is not recommended on this basis (see Section 2.17 below). The need to identify benthic compensation measures at a strategic level, as well as strategic level investigations to update the condition information on site features to improve assessment and decision making, is recommended (see Section 2.17 below). Additionally, Defra are developing proposals for an Offshore Wind Environmental Improvement Package (OWEIP) as proposed in the BESS as part of a range of measures aimed at reducing the consenting time for offshore wind farms (without jeopardising environmental protection).

One respondent referred to the need for more post-installation monitoring data which should be undertaken at an appropriate time scale to understand habitat recovery, with one or two years not being sufficient to observe recovery. This information gap was noted in OESEA3, is noted again in OESEA4, and is captured in recommendation 10. The Department is aware of work underway to report on post-consent monitoring and also facilitate disseminating information from such monitoring, which is reflected in Section 2.17 of this GR. With reference to the query on the variation in scour monitoring suggested in MMO (2014) between sediment types, it is at post-construction and at yearly intervals after installation for thin sediments, and post-construction and at six month intervals for the first year after installation for thick sands and highly mobile bedforms, with monitoring generally being for three years. This does not limit monitoring to these timescales as it would be required for engineering purposes throughout the life of the project. As noted above and in the ER, an updated post-consent monitoring report is overdue.

A comment was made suggesting that the effects on seabird from sediment plumes had not been considered in the ER. Seabird species with a broad range of foraging habitats are unlikely to be significantly affected by the direct effects of sedimentation to their visual foraging success or the indirect effect on their food supply / prey species. Conversely, species which are constrained to short foraging ranges, are pursuit feeders and/or species which require clear water for visual foraging (e.g. terns) are likely to be more vulnerable to suspended sedimentation and the consequent potential reductions in local prey availability. Seabirds which prey upon bottom spawning fish such as herring and sandeels are likely to be indirectly affected by reduced prey abundances resulting from eggs being smothered by resuspended sediments (Cook & Burton 2010). The significance of the impacts will depend on the physical overlap of sedimentation with the foraging range of each seabird species and with the spawning area of their target prey species. It will also depend on the timing and duration of disturbance.

Clarification was sought on the definition of “significant cuttings pile” in the context of the post-decommissioning legacy effects of oil and gas. The paragraph in question considers OSPAR Recommendation 2006/5 on a management regime for offshore cuttings piles which is concerned with historic cuttings piles which may be contaminated with oil-based muds. The discharge of such oil-based mud cuttings has been prohibited since 2001 and any cuttings piles generated from future activity will not be significant in the context of this OSPAR Recommendation.

Responses were received which indicated that the SEA acknowledged the local effects of offshore energy projects but tended to conclude that they would not have effects at the regional scale. One response noted that it may be more appropriate to indicate that the potential regional scale of effects should be described as unknown as there are major information gaps (e.g. impacts on population connectivity) and that the duration of effects may

not necessarily be temporary. The ER notes the often local nature of direct physical effects for individual projects, but also notes the potential for projects individually or cumulatively to generate effects which may be regionally significant (e.g. see Section 5.5 of the ER) particularly as the number and scale of projects increases, and also in view of the targets associated with the draft plan/programme, in particular for offshore wind. The Department agrees that certain projects could, alone or in-combination, generate an effect which is regional in scale and that there are knowledge gaps in characterising this for a number of environmental topics, and acknowledges this with reference to ongoing consenting issues relating to seabirds and benthic habitats (e.g. as captured in recommendations 31 and 34).

2.6 Assessment: air quality

There were few responses on the air quality assessment. One respondent noted that a major source of air pollutants from the offshore energy industry is from supply vessels, and referred to lower emissions fuels such as Hydrotreated Vegetable Oil and Gas to Liquid as a short term mitigation measure. No recommendations for the use of such fuels is made in the ER, however, the reduction in emissions towards net zero must be made across all sectors, including shipping. This is covered in Section 5.12 of the ER, for example with reference to the Clean Maritime Plan[23] which sets out in more detail how the UK Government plans to transition the shipping industry towards net zero by 2050. Additionally, large ports (handling cargo in excess of 1 million tonnes per year) in England are being asked to produce Port Air Quality Strategies, to establish a minimum level of understanding of air quality in ports, and to reflect actions that the port is taking to address emissions under their control. Measures at the national and international level are progressing improvements in vessel emissions. For example, requirements on limits to the sulphur content of fuel oil and nitrogen oxide emissions are contained in Annex IV of MARPOL and are controlled at a domestic level through the *Merchant Shipping (Prevention of Air Pollution from Ships) and Motor Fuel (Composition and Content) (Amendment) Regulations 2014* and *the Merchant Shipping (Prevention of Air Pollution from Ships) (Amendment) Regulations 2021*. These are detailed in Section 5.11.2 and Appendix 2 of the ER.

2.7 Assessment: climatic factors

A number of respondents requested a reduction and eventual cessation of exploration for further oil and gas, and in particular, for hydrocarbon fuel use. Such a decline is expected as a consequence of the maturing of the UKCS hydrocarbon basins. In addition, various UK policies and targets seek to discourage the consumption of hydrocarbons in order to meet the net zero target by 2050. These were considered in Section 5.12 of the ER and a number of clarifications are provided below to points raised by consultees on this topic.

A number of the figures referenced in Section 5.12 of the ER have been challenged in consultation responses, primarily the rate at which UKCS oil and gas extraction is projected to decline and how that relates to what is required to meet climate change targets, in particular the chance of limiting global warming to 1.5°C, the compatibility of any further licensing in the context of a number of studies which indicate that no new oil and gas projects should be consented globally, and the way in which we have considered and presented the conclusions

[23] https://www.gov.uk/government/publications/clean-maritime-plan-maritime-2050-environment-route-map

of the ER. There were also a number of responses made about the potential accuracy of domestic oil and gas production projections, whether security of supply is within the remit of the SEA, and whether enhancing domestic supply through further licensing will have any effect on import dependency.

One respondent suggested that recent supply side literature has been overlooked. The conclusions of Welsby *et al.* (2022), amongst others (e.g. SEI *et al.* 2021), were referred to in the ER, for example in Section 5.12 of the ER that they, "…*suggest that globally no new fields are needed to meet hydrocarbon demand or emission levels consistent with limiting global average temperature increases to 1.5℃, and that further fields, including in the UK, would only be consistent with this goal if the equivalent production was curtailed elsewhere*." Welsby *et al.* (2022) indicate that for production decline rates consistent with a 50% chance of limiting global warming to 1.5°C, the oil and gas budgets for 2018-2050 are ~5.6Gboe and ~3.5Gboe respectively. Based on the most recent projections[24] of UK oil and gas production provided by the NSTA, the UK's domestic production for oil and gas will total ~5.6Gboe and ~3.3Gboe respectively for the period 2018-2050, with both these totals and the decline rate (~4-6% per year for oil and ~4-9% per year for gas over the period 2023-2050) broadly consistent with those of Welsby *et al.* (2022).

Several other publications as noted in consultation responses (Trout *et al.* 2022, Calverley & Anderson 2022) have emerged since the consultation commenced on the ER which go further and indicate that existing levels of global production and committed reserves of all hydrocarbons (oil, gas, coal) would exceed the remaining carbon budget that is consistent with 1.5°C of warming (see Canadell *et al.* 2021) and limit the ability to maintain temperatures below 2°C, suggesting that not only is new fossil fuel development incompatible with the Paris Agreement, but that existing commitments may need to be curtailed or decommissioned early. Both of these reports have underlying assumptions relating to the level of any abatement that would be associated with further emissions, for example, both studies exclude the contribution that Carbon Dioxide Removal (CDR) and Carbon Capture and Storage (CCS) could make to reduce emissions from these sources. The reasons for not including such technologies in the assumptions of these studies is acknowledged, but it is not consistent with current UK Government policy which seeks to progress their deployment. For example, this includes by 2030, annually storing 20-30MtCO_2 and capturing 5MtCO_2 using CDR technologies, targets which are comparable to, and greater than, those in the Climate Change Committee (CCC) Balanced Pathway scenario[25].

The CCC letter to the Secretary of State on the proposed Climate Compatibility Checkpoint[26] is referred to in Section 5.12 of ER, including the risks posed by new UKCS production (in the absence of supply side policy) to meeting the Paris Agreement targets since UKCS fields contribute to the global hydrocarbon market. This includes reference to Welsby *et al.* (2021) and the UN Environment Programme's Production Gap report. The CCC was not, however, able to establish the net impact of new UKCS oil and gas production on global emissions. It was further noted that some new oil and gas fields are included within the CCC's Sixth Carbon Budget, in keeping with the NSTA's projections, and that actions should be taken to reduce emissions including through electrification and methane reductions; both of these actions are covered below and are discussed in the ER.

[24] https://www.nstauthority.co.uk/data-centre/data-downloads-and-publications/production-projections/
[25] https://www.theccc.org.uk/publication/independent-assessment-the-uks-net-zero-strategy/
[26] https://www.theccc.org.uk/publication/letter-climate-compatibility-of-new-oil-and-gas-fields/

It is accepted that a fall in demand for oil and gas in the UK in keeping with the CCC's Balanced Pathway scenario, along with a decline in UKCS production noted above, would together mean that the effect on import dependency may not change significantly. One respondent commented with reference to the decision to discount Alternative 1a, not to undertake any further seaward oil and gas licensing rounds, should not have been made with reference to the security of supply as this is outside of the remit of the SEA. The issue of security of supply is firmly set within the objectives of the draft plan/programme and the wider policy context within which the SEA was undertaken, as noted in the high level outcome in Section 3.8 of the ER, and is relevant to the assessment; what is outside of the remit of the SEA in this context, is how relevant authorities make decisions on whether future seaward licensing rounds are offered.

A number of policies and strategies were noted in Section 5.12 of the ER which are related to decarbonising the offshore oil and gas industry including the NSTA Strategy and the North Sea Transition Deal (NSTD), both of which were referred to in consultation feedback and criticised in terms of their efficacy towards meeting net zero. One comment received related to the NSTD, and that it was previously advised by the NSTA (then the OGA) in a consultation response to its governance guidance[27] that its implementation was voluntary. The Department would like to clarify that the only part of the NSTD which is explicitly voluntary is an industry target of 50% local UK content across the lifecycle of new projects by 2030, including for decommissioning. It is, however, noted that the consultation response to the NSTA's governance guidance indicates that, "…the Guidance requires only that licensees give consideration, in taking decisions, to the commitments made within the [NSTD]; it does not create an obligation to carry out any activities." It should be further clarified that the terms of the NSTD have always been that the parties involved discharge its commitments in good faith; the overarching obligation for decarbonisation of upstream oil and gas is contained in the NSTA Strategy to which the NSTD contributes.

In terms of the aims of the NSTD, the Department acknowledges the advice of the CCC with regards to its ambitions, and refers to Section 5.12.3.6 of the ER which indicates that, "*There is a need for any future licensing, and related projects, to be consistent with scenarios (including levels of production) which achieve net zero and at least the upstream emissions targets associated with the NSTD including the contribution of upstream emissions to the relevant carbon budget periods".* The Department also acknowledges the recommendation made by the CCC (2021a, 2022) that further licensing decisions should be considered against a target of 68% emissions reductions by 2030, and that in view of the potentially long time period between licence issue and production, that by that time, there should be a presumption that upstream emissions from new developments are fully abated (also see below with reference to the CCC's latest progress report to Parliament[28]).

The arrangements for emissions reporting for offshore oil and gas installations were questioned, noting these required self-reporting of operational emissions through the Environmental Emissions and Monitoring System (EEMS), which is maintained by BEIS, and which is also reported to the National Atmospheric Emissions Inventory (NAEI). In particular, methane (CH_4) was referred to and it was noted that most of these emissions are calculated rather than measured directly. Feedback referred to Forster *et al.* (2019) who sought to

[27] https://www.nstauthority.co.uk/news-publications/publications/2022/oga-governance-guidance/, https://www.nstauthority.co.uk/news-publications/consultations/2022/consultation-response-on-oga-governance-guidance/

[28] https://www.theccc.org.uk/publication/2022-progress-report-to-parliament/

directly measure CH_4 from a number of installations on the UKCS in the central and southern North Sea, and to compare these detected levels to those reported through the NAEI, noting that CH_4 was emitted from the installations which was not reported. The Department is working with the oil and gas industry to address uncertainties in methane detection and reporting (see below on Methane Action Plan), but would like to make specific comments on the study referred to. The authors indicate that flaring and offshore unloading data reported to the NAEI were not being undertaken at the time the measurements took place. The Department would highlight that the authors do not define a pilot light as flaring, and also highlight that unloading only takes place for a limited number of the installations studied, based on their Figure 1. It should be noted that flaring generally takes place during process upsets and for safety reasons; the flare consent or reported flare figures would include any base flare (pilot light) which will account for a portion of any consented values. The Department would like to highlight the UK's commitment to the World Bank's 'Zero Routine Flaring by 2030' initiative, and will work with regulators towards eliminating routine flaring as soon as possible in advance of this date. Actions to reduce methane by at least 30% from 2020 levels by 2030 are required under the Global Methane Pledge[29] launched at COP26, which is supported by the UK and presently 118 other countries. The industry has adopted a Methane Action Plan[30], which will seek to accelerate compliance with the zero flaring initiative referred to above, and to reduce methane intensity to 0.2%.

One respondent suggested that Appendix 3: Existing Controls should have provided a legislative assessment. The Department would like to clarify that this appendix includes an overview of the main legislative provisions which allow for the licensing and leasing of offshore energy developments in waters relevant to the draft plan/programme, and also related legislation which provides for consenting, including where environmental assessment is required (e.g. how EIA and HRA are implemented for offshore energy). The Appendix provides no analysis of this legislative framework, it is merely provided as the framework within which offshore energy leasing/licensing and consenting takes place. The OESEA process has identified apparent legislative gaps in the past which have related to differences in how environment management and chemical risk assessment is undertaken for renewables and oil and gas projects, or where there are clear gaps in the consenting regime for elements of the draft plan under assessment, for example, previously for carbon dioxide transport and storage, and now for offshore hydrogen production and transport. In relation to net zero, the overarching legislative provision is the *Climate Change Act 2008* and its related orders, which are to be delivered through the policies of the UK Government and those of the devolved administrations, with advice from the Climate Change Committee. It is considered beyond the remit of the SEA to recommend that certain policy provisions be given a statutory basis. The NSTA, and the Departments Offshore Petroleum Regulator for Environment and Decommissioning (OPRED) as environmental regulator of the offshore oil and gas industry, work within the overarching framework of the Climate Change Act. With reference to the central obligation of the OGA (NSTA) Strategy, assisting the Secretary of State in meeting the net zero target is now part of its central obligation, noting that the Strategy has a statutory basis under the *Petroleum Act 1998*. To clarify the consultation feedback made in response to the compatibility of the net zero obligation with maximising economic recover (MER), the principle of MER is that, "*relevant persons are obliged to maximise the expected net value of economically recoverable petroleum from relevant UK waters, not the volume expected to be produced*".

[29] https://www.globalmethanepledge.org/
[30] https://oeuk.org.uk/product/methane-action-plan-2021/

The respondent also noted that *The Offshore Oil and Gas Exploration, Production, Unloading and Storage (Environmental Impact Assessment) Regulations 2020* did not account for the UK's statutory greenhouse gas emissions targets. These regulations transpose the amended EIA Directive and are part of retained EU law. It contains provisions on climate including, that environmental impact assessments should include an, "*assessment of the likely significant effects of the project on the environment, including those resulting from… the impact of the project on climate (for example the nature and magnitude of greenhouse gas emissions) and the vulnerability of the project to climate change*". This is the same for other consenting regimes across the UK for projects subject to EIA. The SEA made a number of recommendations both in Sections 5.12.3.6 and 6.1 of the ER in relation to furthering the need for upstream emissions from oil and gas projects to be consistent with the net zero target.

One response suggested that the regulatory system for offshore oil and gas was complex with "frequently overlapping regimes". The regulatory system, as summarised in Appendix 3 of the ER, is well established and the remit of organisational responsibilities is well defined. While the NSTA and the Department (OPRED) both have roles in authorising various oil and gas related activities, including flaring, in simple terms the NSTA have the power to grant licences and issue consents but only following relevant environmental considerations by the Department (OPRED) who maintain the environmental regulatory role.

A number of respondents welcomed the inclusion of blue carbon within the ER but one did not agree with the following statement due to the high levels of uncertainty in this area at present and in particular in relation to the unmapped area of blue carbon habitats in UK waters, "*The scale of such [blue carbon] loss [from the installation of infrastructure] relative to the carbon dioxide reductions the draft plan/programme seeks to contribute to is considered to be small, and also when considered in the context of the habitat provided by the structures and its potential contribution to blue carbon sequestration, however, there is a high level of uncertainty in this area*." It is acknowledged that it is challenging to quantify the balance between potential losses of carbon from seabed disturbance associated with the draft plan/programme, relative to the reduction in GHG emissions from fossil fuel sources from the production of renewable energy. Such quantification is made more complex through changes to the organic carbon flux to the seabed e.g. from the deposition of faecal pellets from filtering epifauna which colonise offshore structures (e.g. Ivanov *et al.* 2021, De Borger *et al.* 2021); the assessment conclusions should be read in this wider context. This high level of uncertainty is outlined in the ER, in particular see Appendix 1b, Section A1b.2.5, and since the publication of OESEA4, by the CCC in their briefing on blue carbon[31].

Following the publication of OESEA4 and the close of consultation, the CCC published their 2022 progress report to parliament[32]. The report refers to the publication of the BESS which includes the aim of having a further seaward oil and gas licensing round in Autumn 2022. From an upstream perspective the report emphasises the need to ensure that the emissions and emissions intensity of UKCS production was as low as possible through declining production, progress on methane venting and flaring, and platform electrification. The CCC continue to reflect their previous advice on the level of ambition of the NSTD on emissions reductions (as noted above and in Section 5.12.3 of the ER), and note that in the context of the BESS and the Energy Profits Levy[33], the 50% emissions reductions commitment is insufficient

[31] https://www.theccc.org.uk/publication/briefing-blue-carbon/
[32] https://www.theccc.org.uk/publication/2022-progress-report-to-parliament/
[33] https://www.gov.uk/government/publications/cost-of-living-support/energy-profits-levy-factsheet-26-may-2022

and that there are risks to its delivery. A number of recommendations are made which are relevant to the SEA which are:

- Clarify plans and responsibilities for electrification of oil and gas infrastructure through integration with the offshore wind planning process and/or onshore grid, so that by 2027 new oil and gas platforms can achieve zero emissions from operational energy use.

- Develop minimum emissions-intensity standards for domestic oil and gas production by the next licensing round. In development, seek to ensure a consistent measurement approach with emerging international measurement standards.

- Make data on oil and gas production and emissions-intensity publicly available in a way that is consistent with the UK greenhouse gas inventory and differentiates between new and existing assets.

The Department will consider the CCC recommendations separately, but notes that the SEA makes similar reference that any future licensing and related projects need to at least meet the targets set in the NSTD on upstream emissions, the zero routine flaring by 2030 initiative, and to ensure compliance with the NSTA Strategy in assisting the Secretary of State in meeting the net zero target (see Section 5.12.3.6 of the ER).

2.8 Assessment: accidental events

There were several responses suggesting that the assessment downplayed the risks and potential effects of accidental events, and in particular large hydrocarbon spills. Section 5.13 of the ER covers the potential nature and scale of spills including of large hydrocarbon spills from well blowouts. The potential scale of the effects which could result from such events and the various receptor groups which could be affected are set out in Section 5.13.3.2 of the ER. While the ER puts these effects into the context of their likelihood (which is low) and the mandatory control mechanisms which are in place, it does not diminish the significance of any effect that could result from such an event and the assessment of effects is focussed on such large spills.

One response suggested that the ER implied a reduction in spill risk through the interpretation of PON1 data. The ER includes data and the trends in accidental spill number and volume from PON1 reports. It was not implied that the spill data demonstrates any reduction in spill risk. It is agreed that the discussion of the PON1 data could have contained a caveat that the 2020 data may not be representative of the trend in spill number or frequency due to the effect of the COVID-19 pandemic, however, the data was selected as the most recent at the time of publication for consultation and there was no intent to suggest that such a reduction would have otherwise occurred nor that it represented a continued decline from 2018. Such a case would not have been made as these are too few years data to demonstrate any trend. To clarify, the lowest number of spills in the period 2011-2019 was in 2019, averaging 248 over the same period, and the number of spills reported for 2021 was 269. One respondent pointed out that PON1 data only covers UKCS activity. It is recognised that such spills are not restricted to the UKCS and occur through the wider North Sea oil and gas sector associated with adjacent states. OSPAR collects spill data from offshore oil and gas activities across the OSPAR region and publishes an annual report. It is recognised in the ER that spills have the potential for cumulative and transboundary effects.

One consultation response suggested that the low frequency of blowouts on the UKCS encourages a reactive rather than preventative approach to spill management. This is not considered to be the case. There are a number of technical and planning measures in place to reduce the risk of spills (see Section 5.13.4 of the ER and Appendix 3, Existing Controls) which are mandatory requirements for any exploration and production. The effects of the Deepwater Horizon oil spill are referred to in a number of locations throughout Section 5.13.4 of the ER, and while the regulatory environment in UK waters differs from that in the United States, lessons learned from that incident have led to additional technical, operational and regulatory measures which have been put in place to control the risk of a similar event in UKCS operations. This included the Offshore Safety Directive which is transposed into UK law (also see below) and the relevant measures are implemented together by the Health and Safety Executive (HSE) and the Department (OPRED) working in partnership as the Competent Authority.

Protected sites of UK coasts and waters were referred to in some consultation responses as key sensitivities to spills. The presence of numerous conservation sites in the North Sea and elsewhere in the UKCS is noted throughout the ER, and those relevant to the marine environment are summarised in Appendix 1j, Conservation. In relation to spills, the potential for effects on conservation sites is an established consideration in spill management, including the range of sites which could be affected, for example, based on spill modelling which informs Oil Pollution Emergency Plans (OPEPs). More recently, and following the Deepwater Horizon disaster in the Gulf of Mexico, the *Offshore Installations (Offshore Safety Directive) (Safety Case etc) Regulations 2015* introduced further requirements to assess the potential for major accidents that could result in a Major Environmental Incident (MEI)[34], including their environmental consequence. The importance of protected species and habitats is recognised in the above regulations which are referred to in Section 5.13.4 of ER, however, the section outlining the potential for effects on receptors is broader in its scope but is nonetheless relevant to the majority of qualifying interests within designated sites on the UKCS.

One respondent referred to a number of large oil spills including that of Exxon Valdez and Hebei Spirit, and referred to related studies which demonstrated long-tern impacts on benthic environments, and questioned why these studies were not referred to in the ER. While these spills were not covered in detail in the report, the potential for long-term impacts on the environment, including the benthic environment, was referred to, for example in relation to the Florida barge spill and also in relation to the Deepwater Horizon spill (pages 491-492 of the ER). It is also suggested that the SEA is vague on details, for example, with reference to the Braer spill it was indicated that the ER does not refer to the potential for mid-term impacts between studies undertaken following the initial spill and ten years later. Data was collected from a small number of stations in West Burra and south-east Fair Isle between 1993 and 2000, in addition to sampling in 2003 from West Burra and St. Magnus Bay. With regards to the specific decline in hydrocarbon concentrations recorded between the initial sampling in 1993/94 and 2003, a decrease in the Gullfaks oil equivalent concentrations was observed in the transect grab sediments sampled in 2003 with reductions ranging from 28.8% to 98%. Sampling in 1993/94 did not analyse for PAH and so no comparison can be made with 2003 data, however, total PAH concentrations were generally low (<150µg/kg^{-1} dry weight) in both West Burra and St. Magnus Bay, and individual PAH concentrations were below OSPAR's

[34] A MEI is defined as an incident which results, or is likely to result, insignificant adverse effects on the environment in accordance with Directive 2004/35/EC of the European Parliament and of the Council on environmental liability with regard to the prevention and remedying of environmental damage (the Environmental Liability Directive).

Background Assessment Concentrations (BACs) for PAHs in sediment. The potential for long-term contamination is recognised, for example, with reference to the Florida Barge and Macondo spills which have shown long-term persistence of spilled hydrocarbons, and that benthic recovery time could take decades within the footprint of acute impact.

The respondent also suggests that the ER plays down the risk associated with oil and gas chemicals and refers to the impacts of chemical dispersants on estuarine species in the USA. It should be noted that dispersant use in the UK is subject to a regulatory approval process and must pass toxicity testing relevant to where they could be used[35] and is highly unlikely to be approved in estuarine environments in the UK. Further feedback suggests that the ER indicates that impacts on species in the lower water column and seabed are expected to be low because chemical dispersants/oil would not penetrate these lower depths. The ER is in fact referring to the potential for oil to penetrate the water column, not dispersant, and acknowledges some spills will have a higher level of benthic deposition (e.g. Deepwater Horizon) and the potential for greater effects in shallow and enclosed waters (see Section 5.13.3.2 of the ER).

One comment queried why the spill section included text on UK birds largely relating to their diversity and seasonal presence rather than an assessment of potential effects on these specifically. This information was provided as context to the risk to such features from large spills in the UKCS, the impacts of spills on such features is provided in Section 5.13.3.2 of the ER with reference to number of studies relevant to large hydrocarbon spills. The potential impact on birds, including waterbirds, could be significant, and the ER details effects which includes death and oiled feathers affecting migration. Additional information on the vulnerability of birds to pollution is covered in Appendix 1a (see Sections A1a.5.1 and A1a.5.9 of the ER), which refers both to direct and indirect effects which include ingestion of contaminated prey, ingestion of oil during feather preening, as well as metabolic, endocrine and cardiotoxic effects from inhalation/consumption. The potential for effects on bird populations from a spill in UK waters are uncertain, with the potential effects of any spill being highly specific to its location, oil type, prevailing conditions and response measures. The ER considered the potential effects of spills at a level consistent with the definition of the draft plan/programme, which for further oil and gas licensing is also limited by its exploratory nature which does not allow for spatial definition at this stage. As noted above, a range of mandatory project level assessment and management measures are required to be in place prior to works being undertaken offshore that allow for the specific impacts relating to spill risks at each project level to be considered.

Reference was made in feedback to the potential for changes in storm intensity to threaten the integrity of offshore infrastructure and that this should have been covered in the ER. The draft plan/programme covers future leasing and licensing and so this response only relates to activities which could take place following the adoption of the plan and does not cover existing infrastructure. There is a requirement in EIA to assess the vulnerability of projects to risks of major accidents or disasters, including those related to climate change. Similarly, taking account of the effects of climate change and the latest UK projections at the project level is also covered in the Marine Policy Statement and regional marine plans including the East Marine plans and Scotland's National Marine Plan. The latest guidance on the EIA under the *Offshore Oil and Gas Exploration, Production, Unloading and Storage (Environmental Impact*

[35] https://www.gov.uk/government/publications/approval-process-of-oil-spill-treatment-products-in-the-uk/approval-process-of-oil-spill-treatment-products-in-the-uk

Assessment) Regulations 2020[36] note that, "*Submissions relating to proposals to be undertaken within an area that is covered by an adopted marine plan, or proposals to be undertaken in an adjacent area where potential impacts are likely within the marine plan area, must include consideration of whether the proposals are in accordance with relevant marine plan policies*." Additionally, there are requirements under the *Offshore Installations (Offshore Safety Directive) (Safety Case etc.) Regulations 2015* that the meteorological and metocean conditions which an installation may foreseeably be subjected, are to be taken into account. There is also a requirement for a 5-yearly review of installation safety cases which includes a consideration installation ageing, and any changes to metocean conditions should be taken into account[37].

One respondent suggested that the section on carbon dioxide spills could be interpreted as indicating such events would be routine or expected. It can be confirmed that this is not the correct interpretation. As with all accidental events, the potential for their occurrence and the related effects are necessarily risk-based. The figures relating to such risks (installation and well leaks, and well "blowouts) outlined in the 2019 Zero Emissions Platform publication[38] are noted, and in view of the early nature of the industry, the characterisation and probability of the risks involved would expect to improve as projects progress.

2.9 Assessment: landscape and seascape

Responses on the landscape/seascape assessment were received in relation to the importance of strategic level landscape/seascape assessment, and the emphasis that should be placed on statutory designations as being highly sensitive to offshore wind development. Additionally, comments were received which challenged some of the assessment text particular with reference to the English Channel and Irish Sea.

One respondent noted that it was important not to dismiss strategic consideration of seascape issues as the selection of wind farm zones is a key form of mitigation, as after selection of new sites the scope for further mitigation is limited. This was in response to Section 5.8.2.5 of the ER on seascape sensitivity which noted that characteristics defining sensitivity are, "…highly variable at the regional and local scale and are difficult to account for in a comprehensive manner at a strategic level, particularly without any spatially explicit consideration of where future leasing will take place." The importance of strategic level seascape assessment, including of sensitivity, is not dismissed in the ER. For example this is recognised by reference to the strategic reports produced by White Consultants for Suffolk County Council and Suffolk Coast and Heaths Area of Outstanding Natural Beauty (AONB) Partnership and also NRW (see Section 5.8.3 of the ER). While a strategic level sensitivity assessment was not undertaken as part of the White Consultants assessment for OESEA4, that report does recognise the importance of sensitivity, with seascape value (in part reflected in designations including AONB and National Park) being a major contributor to sensitivity. Furthermore, the ER reflects that planning policy including the National Planning Policy Framework and the

[36] https://www.gov.uk/guidance/oil-and-gas-offshore-environmental-legislation#offshore-oil-and-gas-exploration-production-unloading-and-storage-environmental-impact-assessment-regulations-2020
[37] See guidance on the management of ageing and reviews of ageing installations: https://www.hse.gov.uk/offshore/safetycases.htm
[38] https://zeroemissionsplatform.eu/co2-storage-safety-in-the-north-sea-implications-of-the-co2-storage-directive/

Energy National Policy Statements (e.g. EN-1 and EN-3, subject to review), exact the highest degree of protection to designated areas (i.e. statutory designated areas such AONBs).

Feedback referred to the often overlapping nature of designations which is noted both in Section 5.8 and in Appendix 1c of the ER. One comment referred to the intervisibility between parts of the South Downs National Park and Chichester Harbour AONB and the Isle of Wight AONB which is not explicitly mentioned in the ER. It is considered that a number of the maps included in the ER (e.g. Figure 5.49) illustrate the potential scale of intervisibility in the areas described and also highlight the overlap between designations including Heritage Coast, AONB and National Parks, though intervisibility between all of the various designations may not be mentioned in the text of the report. The potential for visibility of certain areas of sea including from designated areas and also intervisibility is informed by work commissioned by the MMO, NRW and The Crown Estate (see Figures 5.48, 5.49, 5.82, 5.88, Figure A1c.2, A1c.6 of the ER, also see Figure 4.6 in White Consultants 2020).

Also in relation to seascape considerations on the south coast, one respondent indicated that they do not agree that there would be a "lower level of intrusion" at the eastern end of Regional Sea 3 compared to the west. The text referred to cannot be located in the ER, and the Department points to the consideration of Regional Sea 3 in Section 5.8 (see pages 392-393) and Section 5.15.7 (pages 531-532) of the ER. It is not considered that the text relating to Regional Sea 3 in Section 5.8, or between Regional Sea 3 and Regional Sea 4 of the ER, suggests any comparison between these areas in terms of sensitivity, or the creation of sub-areas within Regional Sea 3 which are compared in terms of the effects of the draft plan/programme.

We would like to correct that the first paragraph of Section 5.8.2.4 of the ER should have read, "*Considered in the context of 28 SVIAs undertaken for various Round 1, 2, 3 and Scottish territorial waters wind farm projects, the distance where a low magnitude of effect was found to occur is a maximum of 48.2km for turbines with a blade tip of 300m, reducing to 26.1km for smaller turbines of up to 145m in height (White Consultants 2020a). Average values were* ***40.6km*** *and 19.2km for these sizes of turbine respectively*." Also in relation to the concept of "coastal buffers", one respondent suggested that while a consideration of generic buffers may be too generalised an approach, studies, including for Wales, have used buffers and taken into account variables including anthropogenic and natural variations along the coast. The value of buffers as a strategic level tool is accepted in the ER, and the text which outlined their limitation was not meant to invalidate them but to indicate that their usefulness is limited and too generalised at the project level.

One response suggested that the landscape character assessments for protected landscapes with a coastline should have been included. The National Character Areas (NCAs) and Marine Character Areas (MCAs) were referred to as they were considered to be the most appropriate scale of assessment to consider given the broad nature and coverage of the draft plan/programme. Landscape Character Assessment was acknowledged in Appendix 1c of the ER, and will be considered in further detail in future environmental reports. One respondent requested reference to the statutory purposes of National Parks and AONBs. These and also the special qualities of National Parks, are summarised in Appendix 1c: Landscape and Seascale and Appendix 1j: Conservation of the ER.

One respondent referred to the limited discussion on aviation lighting in Section 5.8.2.2 of the ER and the importance of their consideration, in particular in relation to dark skies. The potential impact of aviation lighting is acknowledged in Section 5.8 for Regional Seas 2 and 6

of the ER, but it is accepted that this could have been more generally referred to as a potential impact from further offshore wind leasing. A review of lighting effects is presented in White Consultants (2020) which includes examples from offshore wind farm SVIAs, including those for Inch Cape, Seagreen and the Moray West offshore wind farms, for which there was still some visibility of aviation lighting at over 30km from viewpoints, subject to atmospheric conditions. Effects are greater for wind farms at closer distances to the coast, for example it was concluded from site visits to the North Wales coast that effects from a number of existing wind farms were significant (White Consultants 2020). Additionally, in wild and remote areas with high tranquillity, including in seas adjacent to certain designated sites, the effects of aviation lighting on dark night skies may be significant. This would be subject to project level assessment and there is the potential for mitigation to reduce the significance of effect.

There was one response in relation to landscape/seascape that tidal barrages should be discounted entirely. As noted above in relation to feedback on the draft plan/programme, the potential effects of tidal barrages are widely covered in the ER, and their inclusion in the draft plan/programme should be read in the context of that assessment and Recommendation 17 of the ER.

One respondent felt that the description of the Cumbrian coast received less attention than those of Welsh coasts covered for Regional Sea 6. The value of the West Cumbrian Coast is reflected in a number of designated landscape areas including the St Bees Heritage Coast and the Lake District National Park, and also the Frontiers of the Roman Empire (Hadrian's Wall) World Heritage Site. Additionally, the English Coastal Trail, Wainwright's Coast to Coast trail and Hadrian's cycleway all provide points of access and amenity use which take in expansive coastal views, incorporating elements of the Lake District, Irish Sea, Isle and Man and Scotland. The coastal character is highly varied from industrial and post-industrial, to agricultural and largely undeveloped, with areas of tranquillity remaining. In recent years the seascape has been influenced by energy developments including from offshore renewables such as Walney and Robin Rigg offshore wind farms. It is acknowledged that the text referencing Whitehaven and Workington was simplistic and could, for example, have made reference to the strong industrial heritage of the area, and that other heritage assets could have been referred to such Roman sites including forts at Ravenglass and Whitehaven. This feedback will be considered in any future ER.

2.10 Assessment: marine discharges

The marine discharges section indicates that, "In line with OSPAR requirements, sources of contamination from the oil and gas industry (e.g. oil based mud contaminated cuttings and oil and chemical discharges) have declined" and one respondent queried why this decline was not quantified or tested for statistical significance. The discharge of oil based muds and organic phase fluids were effectively banned from 2001 (e.g. see OSPAR Recommendation 2000/03 and also Appendix 3 of the ER). OSPAR Recommendation 2005/2 on environmental goals for the discharge by the offshore industry of chemicals that are, or contain added substances, listed in the OSPAR List of Chemicals for Priority Action led to the cessation of discharges of such chemicals by 2014. OSPAR Recommendation 2006/03 (as amended by Recommendation 2019/02) sets time frames for the cessation of the discharge of chemicals which are candidates for substitution. It is accepted that the trend in chemical discharge on the UKCS in recent years does not show a clear decline (see Figure 5.60 of the ER), and while the ER indicates that contaminants have declined, it does this with reference to historical data and makes no projections as to how this trend may change as more fields reach the end of their

lives. The ER does not present the data in any particular positive or negative light. In response to the comment that there would be ever increasing chemical use as fields mature, it is not clear this would be the case and any such discharges will progressively need to meet the more stringent chemical standards. The ER broadly covers the potential effects of discharges on the environment but does not present an assessment of, for example, the effects of historic annual discharges on the environment; chemical discharges are subject to assessment at the permitting stage.

Reports on the implementation of OSPAR Recommendation 2006/03 reflect progress on the phasing out of chemicals with substitution warnings[39]. The 2017 OSPAR intermediate assessment notes that for the wider OSPAR area[40]:

- The use of chemicals on OSPAR's List of Chemicals for Priority Action (LCPA) has reduced by over 90% since 2009, and in 2014 no LCPA chemicals were discharged.

- There has been a 30% decrease in the use of chemicals carrying substitution warnings, and a 40% decrease in their discharge between 2009 and 2014.

While chemical discharges will continue to be associated with oil and gas exploration and production, in keeping with the above OSPAR Recommendations, chemicals should continue to be a diminishing source of contamination from the offshore oil and gas industry. A further OSPAR Quality Status Report is due to be published in 2023[41]. The ER refers to the proportion of chemicals which are used and discharged that pose little or no risk (are PLONOR) and are therefore not subject to substitution. One respondent questioned that the "vast majority" of chemicals are PLONOR, referring to the figure in the ER that these accounted for 71% of discharges in 2020, suggesting that the remaining ~30% therefore needed a chemical permit. Irrespective of whether a chemical is categorised as PLONOR or otherwise, it requires a chemical permit, it is the detail of the supporting information that may differ. Outside of the PLONOR category, chemicals may also be categorised as Gold or OCNS Category E and D (i.e. they have no substitution or other warning); these are not risk assessed and make up a proportion of the remaining ~30% total, though some may require risk assessment. The proportion of chemicals which had a substation warning and were discharged in 2020 was 7%. The proportion of PLONOR chemicals in discharges has been relatively constant in recent years (e.g. 75% in 2019, 73% in 2018; see Figure 5.61 in the ER), and 2020 does not present a particular deviation from this trend.

Responses were received indicating that more clarity should have been provided on cementing and other chemicals used in decommissioning, which the consultee considered to be important given the increase in decommissioning activity forecast. While the SEA is strictly focussed on activities associated with further licensing, it is acknowledged that well plug and abandonment will be major feature of decommissioning UKCS oil and gas assets in the coming years. The language around the volume of cementing chemicals used for decommissioning is not considered to be particularly vague and reflects the project specific nature of chemical selection and the volumes used and discharged, with discharge typically being 10-20% of use.

[39] https://www.ospar.org/documents?v=7146, https://www.ospar.org/documents?v=7375
[40] https://oap.ospar.org/en/ospar-assessments/intermediate-assessment-2017/pressures-human-activities/trends-discharges-spills-and-emissions-offshore-oil-and-gas-inst/
[41] https://www.ospar.org/work-areas/cross-cutting-issues/qsr2023

One respondent suggested that publications or parts of their content were selectively used to downplay the potential effects of produced water on the marine environment, and in particular on fish. The nature and scale of produced water discharges are clearly set out in the ER, as are the potential for effects which are not discounted (e.g. see Section 5.9 or the ER) and continue to be subject to assessment and monitoring at a project level. With reference to the specific studies referred to in the consultee's response, the review of Beyer *et al.* (2020) makes some definitive conclusions about caged mussel experiments relating to produced water which are reflected in the SEA. While the SEA could have covered the aspects of the paper which discussed fish in addition to the existing text in Section 5.9.2.1 of the ER, its results were less certain about the attribution of produced water to effects, and in particular on the formation of PAH-DNA adducts referred to in the consultee's response. This was only found in wild populations, and while we note that the paper notes sources of the PAH could be produced water, drilling discharges and "other", the author indicates that the exact source is yet to be clarified. Similarly, while the study of Balk *et al.* (2011) referred to a number of effects on haddock and cod in the Norwegian sector of the North Sea, the individual contribution of produced water to these was not explicitly determined. The respondent noted a number of other relevant publications relevant to produced water and fish (Pérez-Casanova *et al.* 2010, Sundt & Björkblom 2011, Henrik Hansen *et al.* 2019) and suggested these should have been accounted for the ER. The ER acknowledged produced water as an ongoing source of contamination from oil and gas production and does not discount impacts of produced water on fish. It is acknowledged that the studies noted above experimentally demonstrate the potential for effects on fish from produced water and these will be considered for inclusion in any future ER, however, it is not regarded that they alter the conclusions of Section 5.9.

With reference to cuttings discharges, one response suggested that the duration of burial of *Lophelia pertusa* after which the coral could not recover referred to in Allers *et al.* (2013) should have been stated in the ER. Allers *et al.* (2013) note that complete burial of coral branches for more than 24 hours in reef sediment resulted in suffocation, and the paper also notes the results from a number of other studies in its discussion which show similar results. In keeping with the conclusions of Allers *et al.* (2013), while cuttings could theoretically cover reefs and lead to anoxia, this can be avoided through assessment of the benthic habitat and hydrodynamics in advance of activities taking place. Project level assessment must include a consideration of the potential impact of drilling discharges and are informed by benthic surveys which characterise seabed habitats, flora and fauna. Reef features such as *Lophelia* may be avoided through rig siting or mitigation such as zero discharge, subject to assessment.

2.11 Assessment: physical presence: ecological implications

A number of responses were received pointing out the current data gaps in our understanding of bat distribution and behaviour offshore and the potential impacts of wind farms on bats (e.g. collision risk) mainly associated with bats migrating across the southern North Sea. A number of areas of research were suggested to further understanding of tracking technologies which could be used, options for monitoring wind farm interactions and blade collisions, and likely impacts on bat populations. The paucity of evidence on the distribution of bats offshore and also the challenges in collecting data on direct mortality or injury from offshore wind farms (though widely acknowledged) was noted in Section 5.6.3.4 of the ER, though reference to Lagerveld *et al.* (2021) and Brabant *et al.* (2021) could have been made which provide some information on the timing and conditions of migration (including temperature, wind speed and direction).

Reference was made in feedback to the Borssele wind farm zone in the Netherlands for which operation is curtailed at certain times and conditions (e.g. wind speeds) to reduce the risk to bats and it was suggested that this could also be used as mitigation for UK offshore wind farm projects. The suggestion of Brabant *et al.* (2021) on the increase in cut-in speed which would allow avoidance of interaction with most bat activity is noted. It is not possible to make a recommendation at this stage to curtail UK wind power generation in view of the available evidence and the likelihood that some areas will be significantly more sensitive than others, such that a generic application of curtailment would not be appropriate. A number of the SEA recommendations related to further research, and following public consultation responses these have been updated to account for bats (see Section 2.17 below and Appendix 1).

Feedback noted that the text covering the ecological implications and mitigation measures in Section 5.6 of the ER for tidal devices was focussed on tidal stream rather than tidal range. To a certain extent this reflects current research and industry focus (although the renewed interest in the Swansea Bay lagoon is noted). The work of the Severn Tidal Feasibility Study in relation to tidal range projects is noted, including the significance of effects predicted in relation to migratory and estuarine fish for the options considered, and in particular for large barrages which encompass a number of rivers used by migratory species. Few tidal range projects have been subject to assessment, with only the Swansea Bay tidal lagoon having previously gained consent with an adaptive environmental management plan forming a key aspect of its mitigation in relation to migratory fish species. With respect to fish collision risk from potential tidal range projects, comparisons with research on fish passage through conventional hydropower turbines are useful. The design and operation of conventional hydropower turbines results in high flow velocities, abrupt changes in flow direction, relatively high runner rotational and blade speeds, rapid and significant changes in pressure, and the need for various structures throughout the turbine duct (e.g. walls, stay vanes, wicket gates, flow straighteners) (EPRI 2011). Turbine passage survival rates of fish for conventional hydropower projects generally range from about 70 to 97% (Franke *et al.* 1997, EPRI 1997, cited by EPRI 2011). The lower survival rates are representative of larger fish and/or Francis turbines (i.e. large number of blades and high rotational speeds) and the higher survival rates relate to smaller fish and/or Kaplan turbines (fewer blades and lower rotational speeds) (EPRI 2011). The turbine type proposed for the initial tidal lagoon at Swansea Bay was a bi-directional, low head, Kaplan bulb hydro turbine (Tidal Lagoon Power website[42]). Fish turbine passage modelling to inform the Tidal Lagoon Swansea Bay Environmental Statement, estimated single pass injury rates over the full tidal range (under ebb mode) for a fixed speed turbine of between 3% (salmon and sea rout smolt) and 50% (adult shad) (Turnpenny Horsfield Associates Ltd 2013). The proposed use of variable speed control resulting in lower average rotational speed was postulated as significantly reducing the potential injury to fish compared to the conventional fixed speed turbines (Tidal Lagoon Power website). OESEA4 Recommendation 17 was drafted to account for the highly site-specific and complex issues that need to be addressed in the assessment of individual tidal range projects, including those on migratory fish and how effects are mitigated.

With reference to tidal range technologies, one respondent noted that potential for far field effects were accounted for with reference to bird foraging ranges and hydrodynamic effects, but there was no reference to marine mammals. The use of Marine Mammal Management Units (MMMUs) was suggested as a means to define the marine mammal sites and populations that should be assessed against certain activities. MMMUs are described in

[42] http://www.tidallagoonpower.com/tidal-technology/turbine-technology/

Appendix A1a.8 of the ER. It is agreed that these can form a useful basis for the initial identification of conservation sites and species of relevance to individual projects.

With reference to the "high levels of precaution" referenced in Section 5.6.6 of the ER, one respondent commented that they did not believe levels of precaution in the assessment of bird collision/displacement risk were unduly precautious and may not be precautious enough given recent evidence. The precaution being described in the section is a result of a combination of the worst case scenarios used in wind farm assessment (see Section 5.6.3.4 of the ER which covers the Rochdale envelope) and ongoing uncertainty in the scale of effect largely driven by a lack of empirical data on the collision and mortality rates for birds passing through or foraging in wind farms. For example, the "headroom" as covered in Recommendation 8 (see Section 2.17 and Appendix 1) is a widely recognised issue resulting from the precaution built into project design. It is acknowledged that removing that headroom would reduce the precaution from the high levels suggested in Section 5.6.6 of the ER, and it is further recognised that for some species, particularly in relation to disturbance (e.g. red-throated diver, as covered in Section 5.6.7 of the ER), further evidence is suggesting displacement may be more significant than previously thought, though evidence is still lacking on mortality and population level effects. The Department note that a joint SNCB interim displacement advice note on red-throated diver[43] was published after the OESEA4 consultation commenced and reflects much of the evidence presented in Section 5.6 of the ER (also see Recommendation 9, Section 2.17 and Appendix 1).

The need for greater understanding of seabird distribution throughout the year was raised in feedback, with the need for further strategic bird survey work in areas offered for offshore wind development to ensure important areas are avoided. This information gap is recognised in the SEA and informs Recommendation 20 (see Section 2.17 and Appendix 1).

A number of additions were suggested for Table 5.22 which lists SPAs and associated species for which evidence is a priority and which could present further consenting risk. These are:

- Guillemot and puffin (the later a named component of the seabird assemblage feature) at Farne Islands SPA; puffin (a named assemblage component) from Coquet Island SPA, and puffin at Flamborough & Filey Coast SPA (part of the seabird assemblage).

- Isles of Scilly SPA features (including its seabird assemblage) may pose consenting risks depending on the scale/location of floating wind in the future.

Additionally, it was suggested that guillemot and razorbill should be added to the lists of species considered to be particularly vulnerable to further offshore wind development for Regional Seas 1 and 2 (see page 323 of the ER).

Both suggestions are accepted, and will be considered further in any future OESEA.

There were a number of queries relating to compensation stations as a potential source of EMF effects from, and also potential effects on crabs from EMF more generally.

[43] https://data.jncc.gov.uk/data/9aecb87c-80c5-4cfb-9102-39f0228dcc9a/interim-sncb-advice-rtd-displacement-buffer.pdf

Compensation stations may be located onshore, on an offshore platform, or within a subsea structure. While an offshore subsea HVAC booster station is yet to be constructed, maximum design parameters for such a station have been estimated (e.g. for the Hornsea 3) with a footprint of 50m x 50m and height of 15m. As subsea booster / compensation stations are currently only in the planning phases, there is no direct evidence for the scale of EMFs or the extent of impacts from EMFs generated by subsea electrical compensation equipment. Although subsea booster/compensation station present a larger localised footprint than an AC cable, the potential EMF impacts that they could cause are considered to be of a similar magnitude as those of submarine power cables. These impacts are described in detail in Section 5.6 of the ER, with potential impacts from surface laid cables considered to be low to invertebrates, fish and marine mammals, and medium to elasmobranchs and diadromous fish, with medium to high levels of uncertainty in the assessment due to the limitations in the data (Taormina *et al.* 2018).

Several papers were highlighted indicating the potential for effects from EMF on crabs (Scott *et al.* 2021, Harsanyi *et al.* 2022). Such effects on the edible crab, *Cancer pagurus*, were covered in Section 5.6.3.7 of the ER with reference to Scott *et al.* (2018). Scott *et al.* (2021) supported the results of the earlier study and showed evidence of a strength-dependent response to EMF exposure. For example, exposure to low levels, 250 µT, of EMF did not result in negative behavioural or physiological impacts. While exposure to 500 µT and 1000 µT were found to disrupt the L-Lactate and D-Glucose circadian rhythm and alter total haemocyte count, as well as changing sheltering behaviour in exposed individuals which significantly favoured EMF exposed shelters and spent significantly less time roaming.

Harsanyi *et al.* (2022) presents the results of a study investigating the chronic exposure of ovigerous female American lobster, *Homarus americanus*, and the edible crab, *C. pagurus*, to 2.8 mT EMF and the subsequent effects on their early life history. Results indicated significantly smaller larval parameters in both EMF exposed species, while a larger percentage of larval deformities and lower swimming test success rate were observed in lobster larvae, suggesting that EMF may negatively impact larval mortality, recruitment and dispersal. Other parameters including embryonic development time, hatching and vertical swimming speed were not impacted by EMF exposure in either species. The study concludes that EMF emissions from subsea power cables could have a measurable impact on the early life history and consequently the population dynamics of the two species. Further, the differences in the effects of EMF on early development of both species highlights the importance of specie-specific sensitivity to anthropogenic EMF.

2.12 Assessment: physical presence and other users

Feedback received questioned whether the SEA sufficiently covered the co-location issues between offshore wind and carbon dioxide storage, particularly given the potential increase in the scale of CO_2 transport and storage likely into the 2030s and beyond. The potential for co-location issues between these technologies is noted in the ER (see Section 5.7.3), particularly given the overlap in key resource areas for offshore wind and carbon dioxide storage both in the southern North Sea and Irish Sea. The output of Robertson & McAreavey (2021) and its recommendations is referred to, including the formation of the Offshore Wind and CCUS Co-location Forum[44] of which the Department is a member. At this stage, it is considered that the

[44] https://www.thecrownestate.co.uk/en-gb/what-we-do/on-the-seabed/energy/offshore-wind-and-ccus-co-location/

forum provides a suitable basis to frame the work needed to understand the potential nature of co-location issues and how these might be resolved; The Department is also aware of the ongoing dialogue between OWF and carbon dioxide storage developers in the southern North Sea as part of project examination. Connected with this issue, the Department refers to the ongoing work of Defra on marine spatial prioritisation, which is a separate process to that of the draft plan/programme and OESEA4. In view of the above work, and the role of marine spatial planning and the NPSs in providing policy direction on co-location, it is not considered appropriate at this stage to develop guidance on how energy projects resolve potential conflicts, as suggested in consultation feedback.

One respondent commented that maps in the ER lacked the latest carbon dioxide storage licensing position and also the wider areas of prospectivity for carbon dioxide storage. The latest carbon dioxide licensing position and the nominations for the carbon dioxide storage licensing round were not available at the time of publication of the ER, however, these have been mapped and are shown in Figure 1 below. With reference to locations on the UKCS where CCS is prospective, the CO_2Stored database is referred to in Section 2.5.5 of the ER along with a general overview of the types and locations of prospective areas. Additionally, it was not considered to be practical to use the database in the overall spatial consideration (Section 5.15 or the ER and also see Section 2.13 below), nor was it considered appropriate to recommend a high level safeguarding for carbon dioxide storage sites given their wide geographical spread and high level of uncertainty at this stage as to which areas may be developed. At present, a level of safeguarding of carbon dioxide storage sites is provided by East Marine Plan Policy CCS2 (note that other marine plans for English waters and those of devolved administrations have no similar sector specific policy but do have more general co-location policies), and the current overarching National Policy Statement for Energy (EN-1)[45], indicates that the Planning Inspectorate must "have regard to… any applicable Marine Plans in taking any decision", noting that the NPS prevails over these plans in the event of any conflict between the documents.

One respondent queried whether the sections covering fisheries considered the impacts during wind farm operation; this can be confirmed and it is the main focus of discussion. One respondent noted that the example of using concrete mattresses instead of rock placement to help facilitate co-existence between fisheries and wind farms may not always be appropriate, for example, depending on the fishing gear used, and alternatives such as frond mats may be more appropriate in some circumstances. The list of co-location measures on page 348 of the ER were meant as examples, and the Department agrees with the respondent that consultation between developers and fisheries should help to inform the assessment of impacts of cable protection methods. With regards to wider mitigation of the impacts on fisheries from renewables deployment, one respondent indicated that the references used in the ER were old. While the 2010 work of Blyth-Skyrme was referred to, this was augmented with a number of more recent other sources under headings spanning pages 347-349 of the ER. The SEA team continues to be part of the Fishing Liaison with Offshore Wind and Wet Renewables (FLOWW) Group and maintain awareness of projects and outputs from other groups and research including that of the Offshore Wind Evidence and Change Programme (OWEC). The Department is aware that the potential for co-location of offshore wind and fisheries is in part a function of the type of fishery in an area and array design, and

[45] Note that the NPSs are presently under review: https://www.gov.uk/government/consultations/planning-for-new-energy-infrastructure-review-of-energy-national-policy-statements, however, Section 104(2)(aa) of the *Planning Act 2008* (as amended) requires the Secretary of State to have regard to any appropriate marine policy documents when making a decision on an application for a development consent order where an NPS has effect.

acknowledges the issues raised at the scoping stage in relation to the potential to preclude fisheries from fixed and floating offshore wind farms, as covered in Section 5.7.2.2 of the ER.

A number of respondents queried what a recognised important fishing ground was in relation to Recommendation 4 (also see the updated recommendations in Appendix 1). It is expected that such areas would be identified in consultation between developers and fisheries in the absence of definitive information on areas of highest effort/value across the fishing fleet, including smaller and inshore vessels which are not currently reflected in VMS data. The intent of the recommendation is to help ensure that the importance of fisheries is recognised, and in the first instance to avoid impacts. This is broadly consistent with marine plan policies, e.g. FISH1 of the East Marine Plans and FISH-2 of the marine plans covering all other English inshore and offshore waters. It is understood that programmes of work are ongoing that may inform future assessment of fisheries displacement, which include those being led by Marine Scotland through their ScotMER programme[46], and that in the future iVMS data could be instructive in understanding aspects of UK fishing which are poorly resolved at present. The potential for financial support to form part of mitigation measures for fisheries was noted in the ER, but the SEA and the Department make no recommendations as to how this could be secured. There was a suggestion that the text on page 345 of the ER covering the presence of foreign vessels in the 6-12nm zone was too definitive, i.e. that, "many foreign vessels operate in this area", as it may include such vessels subject to access rights. The suggested revision that the 6-12nm zone, "depending on access rights may include many foreign vessels" is accepted and will be considered in any future ER.

One respondent queried that the reduction of effort within wind farms would have beneficial effects on fish stocks and reduce ecological effects from trawling, noting that most commercial fish species are highly mobile and any measures to improve stocks would need to be at a suitable scale. The statement queried is further qualified on page 345 of the ER that, "…*exclusion in some areas is likely to result in negative effects on other fishing grounds through displacement of effort. A "reef effect" has been noted for oil platforms (Løkkeborg et al. 2002, Soldal et al. 2002, Coolen et al. 2020) and offshore wind farms (Linley et al. 2008, Reubens et al. 2014, Stenberg et al. 2015, Degraer et al. 2020). It is not fully understood to what extent reef effects might increase commercial fish stocks outside the vicinity of offshore structures. Reubens et al. (2014) noted that, while juvenile cod and whiting were attracted to turbines and OWFs, there was no evidence that this translates into a regional-scale increase in recruitment*." It is, therefore, accepted that the reduction of effort within wind farms will not necessarily translate to an increase in fish stocks.

Two respondents pointed out that sailing routes for international traffic between Great Britain and other countries must be taken into consideration in the further development of offshore energy. Section 5.7 of the ER includes a consideration of the potential for effects on navigation routes of offshore wind deployment. This includes consideration of historical changes to shipping routes as offshore wind farm deployment has increased, and also how shipping routes are reflected in marine plan policies. The potential for effects on shipping, including international shipping, is recognised and is reflected in Recommendation 3 of the SEA (see Section 2.17 below and Appendix 1). The recommendation suggests an update to previous work undertaken on behalf of the Southern North Sea Offshore Wind Forum on the cumulative effects of offshore wind on navigation for the southern North Sea, and where necessary, that important navigation routes could be treated as "Clearways" in the siting and

[46] https://www.thecrownestate.co.uk/media/3990/owec-november-2021-newsletter.pdf and https://www.gov.scot/policies/marine-renewable-energy/science-and-research/

consenting of marine developments. It is acknowledged that the creation of such clearways would require agreement for all waters of the British Isles as well as international coordination for transboundary routes.

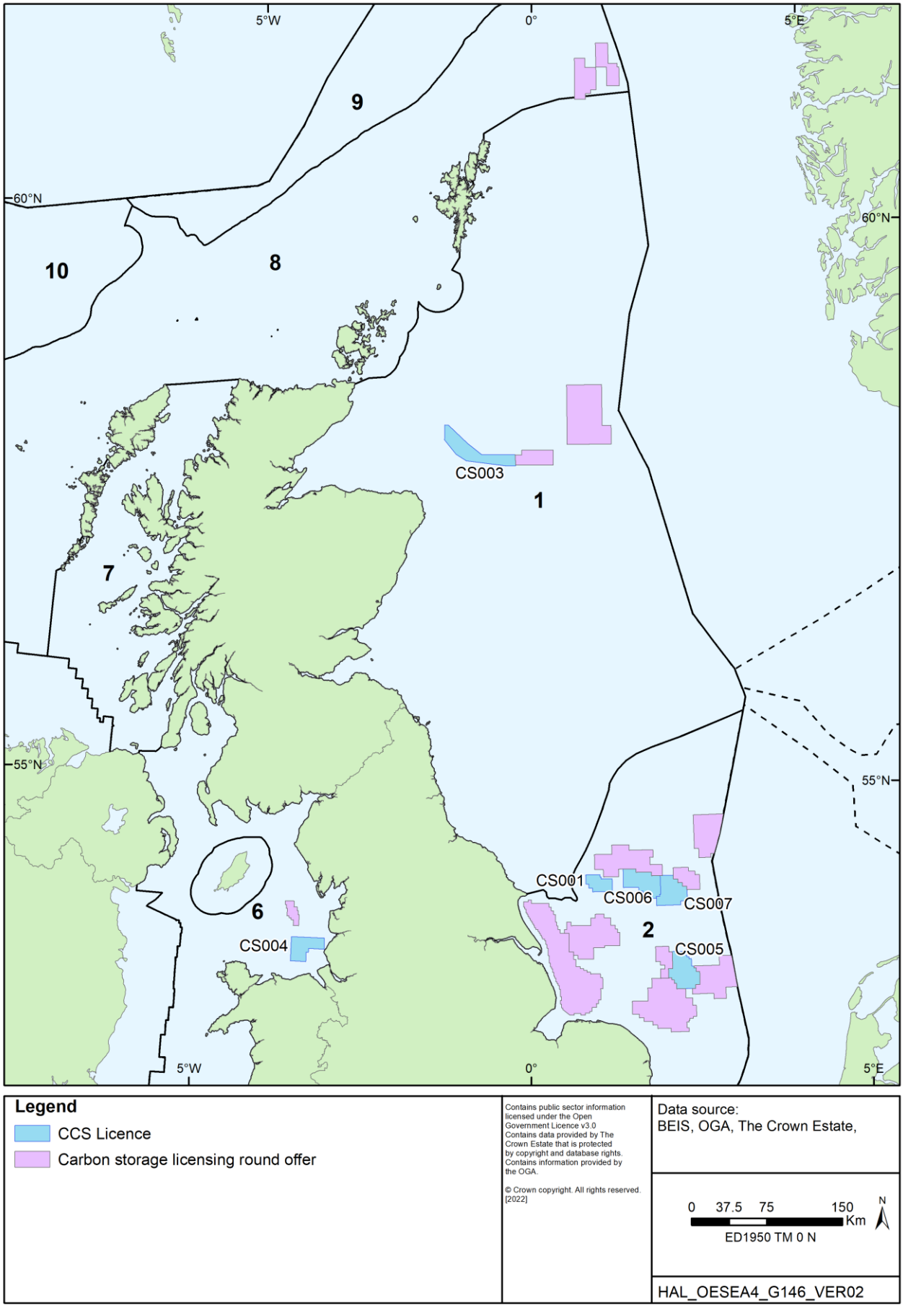
2.13 Assessment: overall spatial consideration

There was some concern in responses that the maps produced as part of the overall spatial consideration might be used to inform spatially explicit policy considerations for future wind farm leasing. The objectives of the overall spatial consideration were to consider the potential available technical resource in relevant UK waters for the various renewables technologies covered by the draft plan/programme in the context of a range of constraints and to use this to understand the theoretical remaining capacity in the absence of more detailed considerations. This is a high level exercise to understand how such a theoretical capacity figure relates to the targets referred to in the draft plan/programme, in particular for offshore wind, and also those targets referred to in scenarios for what could be required by 2050 (e.g. those of the CCC under its Balanced Pathway).

The spatial consideration is not a marine spatial planning exercise, does not recommend any form of definitive spatial restriction and is in no way intended to be used by The Crown Estate for any future leasing round decisions. However, as outlined in Section 5.15.3.1 of the ER, a range of other similar exercises were reviewed, noting that they have varying objectives, which included work undertaken for Round 4[47]. The Department would also like to draw attention to the limitations of this and similar studies which are outlined throughout Section 5.15 of the ER, including the time limited nature of such an exercise.

[47] e.g. The Crown Estate (2018). Resource and Constraints Assessment for Offshore Wind. Methodology Report. 38255-TCE-REP-024 - Version 1.2, 31pp. + appendices.

Figure 1: Carbon dioxide licensing; existing licences and licensing round offers



The Department is cognisant of the recommendations of the Future Offshore Wind Scenarios work, and in particular that on integrated marine spatial planning as noted in consultation feedback. Connected with this, some respondents indicated that the ER should reflect Defra's marine spatial prioritisation work where possible, and that there is a need for consistent guidance across relevant programmes, policies and plans on how spatial prioritisation could work and how best to manage activities that are currently unable to co-locate.

The Department is actively engaged with Defra's marine spatial prioritisation programme, but the timescales of that work are such that it will not be possible to consider it for OESEA4. There is already a significant level of policy direction contained in the English marine plans and those of the devolved administrations but the Department does acknowledge those plans are not particularly spatially explicit (see Sections 2.2.5 and 5.15.1 of the ER) and that some form of spatial prioritisation may be required in future marine planning (which will be informed by Defra's marine spatial prioritisation work), for which the MMO are the plan making body.

In addition to the theoretical capacity figures which are largely influenced by the extent of hard constraints, a range of other potential constraints were considered, however, in view of the detailed level of assessment required to meaningfully account for these (e.g. fisheries, conservation sites and species and in particular mobile species, landscape and seascape), these were only considered in a high level and in a narrative way, with some accompanying maps for illustrative purposes. The summaries of potential constraints for each Regional Sea reflect current knowledge of the main consenting issues facing offshore wind in each area and, therefore, where new project development may be more challenging, however, as noted above, this does not serve to definitively restrict areas for development, but are relevant considerations for further leasing.

Following on from a similar comment received during scoping, a minimum capacity of areas outside of hard constraints was chosen (400MW for standalone projects or 300MW for project extensions to current consented or in planning wind farms) in order to eliminate the potential for many very small but unviable areas to significantly contribute to the overall theoretical capacity figures. It is understood that projects smaller than this, including demonstration projects, could still have significant environmental effects, however, the above figures were chosen based on recent minimum project application scales and are considered to be reasonable minimum scales for the purposes of this exercise.

One respondent queried why the exercise did not consider repowering of existing wind leasing areas. It is unclear how this could be meaningfully assessed other than temporally by assuming project lifetimes and a sequence of repowering to 2050 and beyond. The treatment of wind leasing areas as hard constraints reflects their current status and in no way suggests that re-powering of those areas is precluded in the future, subject to any assessment requirements at the time of repowering. As noted in consultation feedback, the footprint of repowered sites may not be the same as the current lease areas, and while the approach taken for the purposes of analysis in Section 5.15 of the ER may be simplistic, at this time it is not considered possible to make any assumptions around the potential space use for repowering in these areas. The need for repowering is acknowledged in Section 2.5.1 of the ER, and with some assumptions around project construction and lifespans it was noted that all currently operational and consented capacity would need to be renewed to meet 2050 targets, and that this would include either new or repowered sites. As noted in Section 5.15.3.3 of the Overall Spatial Consideration in the ER, all such spatial exercises are time limited as the areas used to underpin the constraints analysis are not static and the level of constraint presented by

some receptors (both hard and soft constraints) may change; additionally, the nature of the technologies which could be deployed may significantly change.

There was some concern in feedback that the methodology for generating the weighted constraints layer shown in Figure 5.85 and 5.91 was not provided in the ER. The high level basis of the weighting was provided in a footnote on page 523 of the ER, with each "other" constraint being given a weighting based on that scale. The constraints and their weights were applied to a 5x5km grid across the seas of the UK relevant to the SEA for renewables. It is acknowledged that the as each constraint was individually weighted and the exercise relied on a simple additive approach to the constraint scoring, that the values presented in the legend for the maps are hard to interpret. The overall pattern of constraint shown is considered to appropriately represent the underlying data and potential constraint levels, however, as noted above, this was part of a wider exercise to illustrate of the level of constraint at a high level in the various relevant Regional Seas; these maps are not intended to directly spatially inform leasing or project planning decisions. Additionally, it was questioned what the basis was for the marking of areas of "likely higher constraint levels" in some maps (e.g. Figure 5.85 of the ER). These areas were selected for a number of reasons which are mainly set out in Recommendation 2 with the addition of a few areas which were considered to have higher constraint levels due to their proximity to IMO vessel routeing measures given their strategic importance.

Responses were received suggesting that there should be presumption against development in Marine Protected Areas (MPAs) (also see the Recommendations in Section 2.17 below). As noted in Section 5.15 of the ER these were not treated as hard constraints as there are well-established mechanisms in place to assess for the likelihood of significant effects on such sites (SPAs, SACs, MCZs, NCMPAs). This included the potential that development consent may be refused if the relevant tests cannot be met (note, where relevant, this includes aspects of HRA relating to derogation). The SEA made a number of recommendations relating to strategic level protection of conservation features (e.g. see Recommendations 8, 9, 10, 31, 34, 35) which seek to address certain potential consenting issues. Additionally, the Department are aware of the consultation on a set of proposed Highly Protected Marine Areas (HMPAs) in English waters[48]. In the absence of available proposals these could not be accounted for in OESEA4. Of the sites subject to consultation, there is a small overlap with the area of technical resource remaining for floating offshore wind and North East of Farnes Deep cHPMA, and a larger overlap with the remaining fixed offshore wind technical resource for Lindisfarne and Allonby Bay cMPMAs. In the latter case, these areas were already considered to present a higher consenting risk including due to their proximity to the coast and existing conservation designations. The consultation process for these sites is ongoing, but in view of the overlap between the resource areas for offshore wind and sites, it is not considered that they would represent a substantial decrease in the ability to deliver the targets contained in the draft plan/programme if offshore wind related activity is precluded from within the site boundaries.

It was noted in feedback that the presentation of VMS data only for 2019 may not be representative of the inter-annual variation in fisheries activities. It is acknowledged that an averaged dataset over several years may have been more useful to map but this was not available; data for landings into key ports by Regional Sea, UK fleet size and capacity and effort are provided for longer time series in Appendix 1h: Other Users of the ER. Following on from the earlier response in this GR in relation to the mapping of potential carbon dioxide

[48] https://jncc.gov.uk/our-work/highly-protected-marine-areas/, https://consult.defra.gov.uk/hpma/consultation-on-highly-protected-marine-areas/

storage sites (also see Figure 1), some of the licence areas and nominations were not available for use in the SEA at the time of publication and it was not considered appropriate or possible to consider all potentially prospective areas (e.g. after CO_2Stored) within such a high level spatial analysis. While not making any inference about the potential for co-location, those carbon dioxide storage licence/lease areas available to include in the exercise were considered in a precautionary manner as hard constraints to other energy projects.

2.14 Assessment: alternatives

Of the responses received which mentioned the alternatives to the draft plan/programme, six positively supported the selection of alternative 3: to restrict the areas offered for leasing and licensing temporally or spatially. One respondent welcomed the breaking out of the alternatives into the different aspects of the plan, as requested at the scoping stage. One respondent considered that alternative 2 should be selected, as any restriction as part of alternative 3 could restrict the available resource area with impacts on policies relating to security of supply and decarbonisation. In view of the scale of restrictions suggested in OESEA4, it is considered highly unlikely that these would limit the ability of the plan/programme to meet its objectives. Another response suggested that no further oil and gas licensing rounds should take place (alternative 1a) and two others made a general recommendation for a reduction and cessation in exploitation activity and reliance on fossil fuels. The remaining responses did not directly address the alternatives to the draft plan/programme.

2.15 Assessment: cumulative effects

There were few comments on the section covering cumulative effects. One respondent noted that the section on transboundary effects should have made mention of ScotWind, INTOG, and wave and tidal leasing in Scotland in addition to reference to adjacent states. In view of the coverage of the renewables elements of the draft plan/programme (i.e. England and Wales), it is accepted that Scottish waters should have been mentioned in this context although this would not have altered the conclusions reached.

2.16 Monitoring

A number of research programmes were mentioned as being relevant to SEA monitoring, including the Offshore Wind Evidence and Change (OWEC) Programme and ORJIP offshore wind and Ocean Energy. The Offshore Wind Environmental Evidence Register was also noted as important sources for understanding the effects of the plan. The Department operates a continuing SEA research programme, part of which involves maintaining awareness of the activities of these and other groups to ensure that effort is not being duplicated and also to understand where there could be potential for collaboration.

2.17 Recommendations

There was a large degree of support for the recommendations, though there were also a number of responses seeking further definition in some areas, or which made suggestions for edits to the existing recommendations or additional recommendations. The following sets out

responses to the key areas of feedback received and a set of revised recommendations in contained in Appendix 1.

Recommendation 2: a difference in the wording of Recommendation 2 (Section 6.2 of the ER) and text in the NTS was noted in feedback, the difference being that in the NTS it is recommended that, "…new offshore wind generation capacity should be sited away from the coast, generally outside 12 nautical miles", whereas recommendation 2 indicates, "…Some developments may not be compatible with a particular nearshore location…". For clarity, it is the conclusion of the SEA that siting offshore wind farms away from the coast reduces the potential for conflict with some but not all other users and environmental sensitivities. Territorial waters are not considered as a limit outside of which effects are suddenly less significant, for example, effects on landscape/seascape may be diminished at such distances, but the scale of offshore wind development is such that some areas of coast may still be sensitive to such effects. For this reason reference in the NTS to 12nm was made in error, and this is corrected here and in the update to the spatial considerations recommendations below.

Recommendation 7: it should be noted that this recommendation is focussed on socio-economic issues. It is accepted that the various planning policies referred to in the recommendation includes those which cover environmental issues, in keeping with the MPS and its High Level Marine Objectives. These aspects are covered elsewhere in the recommendations and in the wider ER.

Recommendation 8: one respondent referred to the need to consider "headroom" for a broader set of receptors and technologies. It is recognised this could be an emerging issue, however, this recommendation is specifically focussed on "headroom" as an issue that has arisen due to a mismatch between the consented parameters of projects which are those accepted to be used in cumulative effects assessment for collision risks to birds, and the as-built parameters which generally present a lower risk, in the absence of a legal mechanism to secure these "as built" parameters in extant consents. For future projects, there are presently proposals in the revised NPS for renewable energy to address this. One respondent indicated that post-construction monitoring and empirical data collection were the most effective way of reducing headroom but that there are difficulties in securing this through project-specific monitoring. It is noted that the OWEIP as proposed in the BESS is considering strategic monitoring.

Recommendation 9: several respondents welcomed the proposals that further impacts on red-throated diver habitat should be avoided, with further data collection and monitoring undertaken. It is acknowledged that the recommendation did not define red-throated diver habitat. At present, effects on the species are generally considered on the basis of the distance between a development and an SPA boundary, these boundaries having been defined in whole or part by the distribution of red-throated diver in the site across several years. Available data often indicate large differences inter annually in population and distribution, and the intent of the recommendation was to reflect this, but it is acknowledged that it could have been clearer. The recommendation has been updated (see Appendix 1).

One respondent objected to the recommendation on the basis that it potentially precluded development on the basis of a lack of information rather than evidence, which is disproportionate and not consistent with the application of the precautionary principle. It may be interpreted that the recommendation reflects a strong application of the precautionary principle, however, its intent was to address how the precaution and uncertainty surrounding this issue is presently being addressed at a consenting level, and encourages policy level discussion as well as additional data collection to achieve a resolution. The recommendation

does not specify what is meant by impinging on red-throated diver habitat (though see the updated recommendation in Appendix 1) as it is understood that the range of evidence that exists on the level and distance of displacement for the species is highly variable. The Department accepts that several projects were recently consented under a derogation in relation to the Outer Thames Estuary SPA, but also notes that the projects required a change to their layout to provide confidence that the compensatory measures suggested would be acceptable. The recommendation seeks to try and reduce the risk of compensatory measures or changes to project design until there is closer agreement between parties as to the level of displacement and mortality risk wind farms present to red-throated diver, and what that means for the integrity of relevant sites.

In keeping with the clarification provided in relation to the overall spatial consideration (Section 2.14 above), the recommendations of OESEA4 are part of an independent assessment for the Department, they are not Government policy.

One response on Recommendation 9 wanted to ensure that the following text should not be interpreted to mean that conservation objectives should be adjusted to reduce constraints on development, "*At a wider MPA level such issues require policy level discussion to ensure that the UK's conservation objectives can be met without unnecessarily constraining energy related or other economic activities*." That is not the intent of the wording. Many conservation objectives are highly generic though the features they protect can be very diverse. The review suggested would be to ensure that such a generic approach does not have unintended consequences for the assessment of energy or other developments.

Recommendation 10: it was noted in consultation feedback that Recommendation 10 links directly to the Offshore Wind Evidence and Knowledge Hub project which is being progressing under the OWEC programme. The project is intended to provide a platform for the evidence and learning gathered to date from offshore wind impact assessments, mitigation measures and post-consent monitoring in order to develop guidance for the assessment and management of specific topics in offshore wind EIA. It was further noted that MMO are working with Defra on an updated review of post consent monitoring at offshore wind farms the outputs of which will make recommendations for future work.

Recommendation 16: it was noted that Recommendation 16 aligned with an action identified through the Offshore Wind and CCUS Co-location Forum to consider the impacts from saline water discharges.

Recommendation 20: one respondent indicated in relation to Recommendation 20 that the lack of modern survey data noted for seabirds also applies to marine mammals. The respondent referred to the SCANS and ObSERVE surveys, both of which have provided relatively recent survey coverage of marine mammals in UK and adjacent state waters. The Department's SEA Research Programme is providing further funding towards the facilitation of SCANS IV, for which work is underway. The Planning Offshore Wind Strategic Environmental Impact Decisions (POSEIDON) project was referred to in feedback which is led by Natural England and is being delivered under OWEC. The project involves collating existing seabird data for incorporation into mapping and modelling and three survey campaigns starting in autumn 2022 and running through 2023 and 2024.

Recommendation 26: one respondent noted that the understanding of the condition of protected habitats and species should go beyond that of just sites, specifically where there are ecological gaps in the MPA network, as without this, the ability to assess cumulative effects

and identify compensatory measures is reduced. It should be noted that the recommendation focussed on the site level as it is assessment against these specific features that is presenting significant consenting risk, however, the wider point on the need to improve the understanding of habitats and species is noted, including in the context of climate change.

It was noted by Natural England that they conduct a rolling programme of MPA feature monitoring, with significant marine evidence collection being planned through the 3-year Defra lead marine Natural Capital Ecosystem Assessment.

Recommendation 27: one respondent welcomed the recommendation but also noted that it cannot be assumed that monitoring data from small arrays will be transferrable to larger commercial arrays. A phased approach was suggested with reference to the Morlais tidal development. The risks of using monitoring from small arrays to inform large commercial arrays is acknowledged, but the wording of the recommendation reflects the likely immediate scale of many projects and the importance of gathering information from these.

Recommendation 28: the SEA has previously encouraged the sharing of data from project level assessments across a range of topics, and this is captured again for OESEA4 in Recommendation 28. The Online Access to the Index of Investigations (OASIS[49]) was highlighted in consultee feedback as a UK initiative for reporting, publishing and archiving reports on heritage investigations which includes those for the marine environment. It is understood that OASIS data may be discovered via the MEDIN portal.

Recommendation 30: consultation feedback indicated that it was often beyond the scope of individual developers to undertake the large scale ecological assessment required to understand the cumulative impacts of the introduction of hard substrates to MPAs, resulting in challenging assessments with a high level of uncertainty. It was further suggested that a strategic level assessment of the regional ecological impact of rock protection should be undertaken. It was suggested that a spatial database of rock/hard substate deposits on the seabed should be recommended in the ER (also see the Recommendations section below) as a resource for future cumulative effects assessment. The Department highlights that this has been completed to a limited extent for the oil and gas industry for deposits covering the years 2011-2016[50]. It is unclear whether data would be available to account for all historical deposits, including removals (e.g. as part of decommissioning), and also the current status of such deposits which may be buried in areas with mobile sediments. Recommendation 31 acknowledges this issue further. A Natural England commissioned study to provide recommendations for a system to host and map the as laid positions of hard substrate was referred to in feedback as due to report soon. The Department will consider these recommendations once the report has been published.

Recommendation 29: one respondent wanted to highlight the Joint Cetacean Data Programme[51] (JCDP) as a further database to which developers are encouraged to submit marine mammal data. This feedback is noted.

[49] https://oasis.ac.uk/

[50] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1050281/Technical_Note__Review_of_rock_and_other_protective_materials.pdf

[51] Joint Cetacean Data Programme | JNCC - Adviser to Government on Nature Conservation

Recommendation 31: both this recommendation and Recommendation 34 relate to the development of compensatory measures. Several respondents referred to the mitigation hierarchy, i.e. to avoid, reduce and mitigate, with compensatory measures always being the last resort. This approach is already embedded in planning policy and assessment approaches for EIA and HRA, though its recent relevance to biodiversity net gain is noted. While the mitigation hierarchy is recognised, these recommendations acknowledge there is the potential for strategic compensation measures to be required if adverse effects cannot be avoided, and reflect current consenting issues for offshore wind farms for which further research is required to address. It is considered that the recommendations cover the current issues relating to the need for strategic compensation, i.e. for seabirds and Annex I habitats and recognised in the OWEIP. However, the Department acknowledges that as more development takes place offshore, further work on other receptor groups (e.g. marine mammals) may be required. One respondent noted the difficulty in creating "like for like" benthic compensation and that the removal of other existing pressures could provide compensation, but only at a strategic level. The removal of other pressures of relevance is noted, for example in Recommendation 34 in relation to restricting sandeel fisheries. While not directly related to the plan, it is noted that the MMO are pursuing fisheries restrictions through bylaws for certain conservation sites/features which will reduce/remove the pressure from that source of effect[52].

There was a suggestion that the use of cable corridors and fisheries/anchoring exclusion could mean that cables are left unburied such that the use of protection materials could be avoided. As noted elsewhere in this GR, the SEA did not consider offshore grid and this is separately being considered by the OTNR. There is not presently the mechanism to impose statutory safety zones around cables or cable corridors, and though they could be charted this does not guarantee that interactions will not occur. Protection materials are largely related to interactions with other users but they may also be required for stability.

The BESS refers to a number of measures to reduce the consenting timescale of offshore wind farms which are relevant to Recommendations 26, 31, 35 and 38 which are: strategic compensation environmental measures, including for projects already in the system, to offset environmental effects and reduce delays to projects and, implementing a new Offshore Wind Environmental Improvement Package including an industry-funded Marine Recovery Fund and Offshore Wind Environmental Standards to accelerate deployment whilst enhancing the marine environment. It is the ambition of UK Government to implement these measures from 2023, but it is too early to consider their implications for the draft/plan programme in this SEA. The OESEA4 recommendations are widely consulted on with the statutory consultees and other relevant stakeholders. It is considered that those organisations implementing e.g. the OWEIP and Marine Recovery Fund would understand which of the recommendations are within their remit to consider further.

Recommendation 32: it was noted in feedback that in addition to using the minimum necessary protection materials required for cables, pipelines and scour protection, minimising the number of cables needed through better coordination of an offshore grid should be referred to. As noted elsewhere in this GR, and in the GR to OESEA4 scoping, offshore grid was not covered

[52] https://www.gov.uk/guidance/marine-conservation-byelaws#new-mmo-byelaws, https://consult.defra.gov.uk/mmo/call-for-evidence-stage-2/

in the assessment. The Department refer to the ongoing work of the OTNR in addressing offshore grid coordination[53].

One respondent indicated that Recommendation 32 suggests the minimisation of rock protection and removal, which contradicts the Natural England commissioned Scour and Cable Protection Decommissioning Study (Peritus International Ltd 2022)[54], indicating that it recommends scour protection made from eco-friendly materials left *in situ*. The Department would like to clarify that the intent of the recommendation in OESEA4 is to minimise the volume of rock required but not to the extent that it would no longer perform its technical function. Removal of rock is not recommended, instead, it is recommended that those protection materials that are more easily removed on decommissioning should be considered at the installation stage to minimise the potential for permanent habitat change. Furthermore, it was noted in consultation feedback from JNCC and Natural England that their expectation is that cable protection within MPAs will be of a nature that allows it to be removed at the decommissioning stage. The recommendations in Peritus International Ltd (2022) are more broadly that protection materials should, "…produce minimal to no negative environmental impact…" which would allow for *in situ* decommissioning. It is further noted that in the ranking of protection measures provided in the report was in descending order rock bags, concrete mattresses, grout bags, fronded mattresses, bitumen mattresses, and lastly rock dump. The recommendations of the SEA and Peritus International Ltd (2022) are not mutually exclusive, as the reason for suggesting selecting easily removable protection methods is to avoid permanent habitat change. The selection of protection materials on the basis that they can be left *in situ* due to a lack of effect (alone or in combination) would need to be subject to assessment at the time of project consenting, but also taking account of the prevailing legislation and policy at the time of decommissioning.

Recommendation 33: one response suggested that areas such as maerl beds and cold-water coral should be avoided due to the extremely slow recovery of these, and the limited or absent ability to compensate for such habitats. See updated recommendations in Appendix 1.

Recommendation 35: the text quoted in the recommendation from the conservation advice for sites in English waters was to emphasise the point about how the status of some site features is poorly understood and it should not be taken to imply that the recommendation is only relevant to England, as a similar situation may be encountered for sites within waters of the devolved administrations.

One respondent suggested that the conservation objectives of sites should be revised, and that except in cases of critically endangered species, there should be a move away from the objective to "maintain" population levels as potential minor impacts need to be assessed irrespective of scale even where there is little prospect of population level effects. Another respondent suggested that the SEA should have set out how the recommendation should be implemented. The recommendation makes no proposals about the mechanisms or timescales for updates to site information to improve the data underpinning site status or the approach to the interpretation or assessment against conservation objectives, nor does it provide any analysis of what such a process would mean for site management. This is because the recommendation was made in the context of the current framework of site management and

[53] The Holistic Network Design was recently published as part of the OTNR: https://www.gov.uk/government/groups/offshore-transmission-network-review#documents This is covered in more detail in Section 2.2 of this Government Response.
[54] http://publications.naturalengland.org.uk/publication/5938793965420544

assessment, recognising the practical constraints on the scale and frequency of site monitoring that can be achieved, and that it would be expected that any priorities and actions arising from it would be handled by the relevant organisations (e.g. SNCB) with the remit to do so. There are key features/sites presenting consenting issues through a level of precaution which could be reduced by further investigations, and it is this issue that the recommendation sought to address.

Recommendation 38: One respondent noted this recommendation had an English focus, noting that the plan had wider application. It is acknowledged that the provisions of the *Environment Act 2021* which cover net gain are only applicable to England. The *Environment (Wales) Act 2016* includes provision for the maintenance and enhancement of biodiversity to promote the resilience of ecosystems, which is also reflected in the Welsh National Marine Plan Policy ENV_01, i.e. that proposals that contribute to the protection, restoration and/or enhancement of marine ecosystems are encouraged. While the latter provides the opportunity to consider project level contributions to "net gain", it is considered that the former may result in a future requirement for such measures, which is what underpinned the reasoning for making the recommendation. It is, however, accepted that such measures may also be used for projects in Wales and in general could be a way of reducing the overall impact of offshore energy projects, and that any evidence collection would be useful in promoting net gain in both England and Wales. See the updated recommendations in Appendix 1.

It was noted in feedback that a project was recently commissioning through the OWEC programme to look at strategic net gain targets for coastal and marine environments. The respondent indicated that links should be made with OWEC on any follow up to this recommendation to ensure effort was not duplicated. The Department and the SEA team already have links to OWEC and similar initiatives, with the specific objective of facilitating coordination of research and avoidance of duplication of effort.

A number of additional suggestions were made for recommendations covering the following topics.

Tidal range: a response noted that the updated decommissioning guidance for renewables now covers tidal lagoon technologies such that decommissioning should be considered at the time of consent, however, the respondent noted that all options for decommissioning should remain open until nearer the time of decommissioning. As noted elsewhere in this GR, it is well established that decommissioning should take account of the policy, guidance and legislation prevailing at the time. While decommissioning options should be considered at the consenting stage, this does not preclude further considerations at a later date. Additionally, it was suggested that the recommendations could reflect that further work is required to understand how derogations may be delivered for tidal range given the potential for these under the Water Framework and Habitats Regulations. The potential scale of effects from tidal range technologies, uncertainties associated with these, their very site-specific nature and the feasibility of compensatory measures are acknowledged in Recommendation 17.

Floating offshore wind: it was indicated that floating offshore wind farms would occupy deeper areas with habitats and species more sensitive to their impacts and that baseline information should be gathered to understand this sensitivity. Such data collection is a routine part of the EIA process for offshore wind development and it is not considered that an additional recommendation is required.

The Rochdale Envelope[55]: a response called on the OESEA4 to recommend a review of the use of the Rochdale Envelope in offshore wind consenting. That the approach adds precaution and complicates cumulative effects assessment, exemplified by the seabird headroom issue (see Recommendation 8), is well noted in the ER. The Rochdale Envelope still provides a useful means of progressing environmental assessment and consenting where long consent times mean detailed project design elements are likely to change by the time of consent, however, this should be countered by a range of realistic scenarios, and the defining of the as built scenario in the Development Consent Order on project completion. This is the intent of the revised NPSs, though these are yet to be published in their final form.

Integrated Marine Spatial Planning: several respondents suggested that OESEA4 should recommend more integrated marine spatial planning given multiple and potentially conflicting activities and policies. The conclusions of the Future Offshore Wind Scenarios (FOWS) project are noted. The potential role of marine spatial planning in future offshore wind leasing is noted, but such planning requires the consideration of a wide range of users other than just offshore wind. The role of the marine plan making bodies in England and those of the devolved administrations is outlined in the ER, and it is understood that further work is being undertaken in this area both in Wales (e.g. Strategic Resource Areas) and England (e.g. Defra's marine spatial prioritisation work).

Taking the recommendations forward: it was suggested that the recommendations could go further by identifying organisational responsibilities. The recommendations in the ER are made to the Department and are widely consulted on with the statutory consultees and other relevant stakeholders both through the public consultation and the SEA steering group (which has broad organisational representation). It is considered that those organisations would understand which of the recommendations would be within their remit to consider further, and some of the recommendations, in particular in relation to research, will in part be taken forward by the Department through the ongoing SEA research programme. Progress on the recommendations is monitored as part of the ongoing SEA process.

It was suggested that the SEA should recommend that The Crown Estate and other relevant organisations should undertake robust plan level SEA and HRA for future leasing rounds in order to allow for the avoidance of significant environmental constraints and to provide greater confidence in proceeding through consenting, and at a faster pace. It was further suggested this should involve spatial analysis that would be subject to consultation. OESEA4 covers further leasing for offshore wind but does not specify areas for offshore wind (see earlier responses in relation to the overall spatial consideration in Section 2.14 above) which to date have been subject to identification by The Crown Estate and/or individual developers, though these areas are subject to plan level HRA by The Crown Estate (e.g. those for the recent project extensions and that which is ongoing for Round 4). The BESS outlines a number of measures including, the revision of the NPS, identification of strategic compensation measures, changes to HRA, and improving consenting timelines which, along with the marine spatial prioritisation project, have the ambition of reducing consenting risks and timelines.

Connected with the above, one respondent suggested the SEA should recommend that The Crown Estate complete an independent review of Round 4 leasing with any findings implemented in future leasing rounds, as well as setting out a long term leasing strategy to

[55] The Rochdale Envelope approach is used where some aspects of a proposed project are not well-defined when the application for consent is submitted and so flexibility is used to address the uncertainty. This tends to result in the assessment of a “worst case scenario” development.

meet net zero. As the plan/programme covered by OESEA4 concerns future leasing, The Crown Estate should be mindful of its content and recommendations. It is not within the remit of the SEA to instruct or direct The Crown Estate to take particular actions, but the Department will continue to maintain close liaison with them.

Additional research: a number of suggestions were made for additional research which include:

- Bats: there is a need to review the types of technologies that could be used to improve information on bats in the offshore environment including tracking which could inform spatial and temporal distribution, a need for more information on bat behaviour on and around offshore wind farms, and wind farm collision detection. This is reflected in a new recommendation (see Appendix 1).

- Blue carbon: one respondent referred to the large degree of uncertainty about how offshore development affects both the mobilisation and sequestration of blue carbon (also see Section 2.8, above), and that a recommendation could be included on the need for better understand these processes so that they could be considered in project level assessments. This is reflected in a new recommendation (see Appendix 1).

- Sound sources: there is limited knowledge of the sound output from sub-bottom profilers (SBPs), how the noise from these propagates and their effects on marine mammals. Further research should be undertaken to fill this evidence gap.

- Noise abatement technology: development of such technologies has so far taken place in shallow North Sea waters. There is a need to improve understanding about the applicability of this evidence to deeper waters in the Irish Sea and Celtic Sea.

2.18 Environmental Baseline

A number of editorial points and minor clarifications were made in feedback. These have been noted and will be used to inform any future ER. All such comments are documented in the consultation feedback which is reproduced alongside this GR.

Appendix 1a.2: Benthos

One respondent referred to surveys which have been undertaken for numerous MPAs[56] to strengthen site understanding and monitor the condition of the sites. These will be reviewed and considered alongside any further surveys in any future ER.

Two comments were received in relation to *Sabellaria spinulosa* reefs. The first noted that *S. spinulosa* reefs are known to be ephemeral and that it is not known whether this is a result of natural process or anthropogenic activity. Secondly, the report by Pearce & Kimber (2020) was noted, with video and digital still photography at five sites off the Aberdeenshire coast, four of which supported significant areas of reef, with a new sub-type identified at the fifth. This sub-type, termed “bommies”, had a tendency to aggregate in isolated clumps on cobbles and

[56] https://jncc.gov.uk/our-work/mpa-monitoring-survey-reports/

boulders as a well-developed reef in an otherwise featureless soft-bottomed habitat. Both comments are noted.

It was questioned whether any contact had been made with industry, particular oil and gas, to access survey data for these regions collected as part of permitting processes. These data are often not made publicly available in full (i.e. survey reports are generally not available) other than in summaries presented in Environmental Statements to which the SEA team has a comprehensive access, however, the faunal, contaminant and basic sediment fraction data from such surveys are generally available via the UKBenthos database.

One respondent referred to bylaws which came into force in June 2022 that prohibit the use of bottom towed gear at four sites: Dogger Bank SAC, Inner Dowsing, Race Bank and North Ridge SAC, South Dorset MCZ and The Canyons MCZ. These were announced following the start of the OESEA4 consultation period and are noted here; it is also understood that there was a recent call for evidence covering management options for a further 13 MPAs[57].

Appendix 1a.5: Birds

It was noted in feedback that the section does not describe the current level of impact from renewables. However, it should be noted that this was covered in Section 5.6 of the ER with references to the sources of effect on birds from the physical presence of the various technologies covered by the plan/programme. This also informs a number of the SEAs recommendations. Additionally, while Biologically Defined Minimum Population Scales (BDMPS) were not mentioned in the baseline, in terms of assessment, it is understood that BDMPS are important in the assessment of offshore wind farms, for example the apportioning of impacts in the non-breeding season, and these will be referred to in any future ER.

Appendix 1a.7: Bats

A number of responses were received on the evidence presented for bats, and to a number of additional sources of information. While not referred to in the main baseline (Appendix 1a.7 of the ER), the summary baseline (Section 4.2.1.7 of the ER) indicates that small numbers of Nathusius' pipistrelle bat occur seasonally over UK waters on migrations between the UK and mainland Europe. The modelled estimates of Limpens *et al.* (2017) provide a central estimate of 40,000 Nathusius' pipistrelle crossing the southern North Sea each year. The “bandwidth” of the estimate is between 100 and 1,000,000, and the authors note that more must be done to improve the accuracy of the assessment. The output of this report is acknowledged as is the current level of uncertainty over the numbers of bats migrating across the southern North Sea. Any further update to the understanding of bat migration offshore will be incorporated into any future ER.

There was agreement that there is poor understanding of bat flight heights and the conditions which may influence these, though Lagerveld *et al.* (2021) was referred to in feedback who suggest that low flight altitudes may be restricted to coastal waters with higher heights further offshore (e.g. Hatch *et al.* 2013). These publications provide useful context but also reflect a continued lack of empirical data to support robust estimates of flight heights to better inform impact assessment (see Section 2.17 above).

The reference to Nathusius' pipistrelle as an Annex II species was made in error, it is an Annex IV species and is therefore subject to protection under *The Conservation of Habitats and*

[57] https://consult.defra.gov.uk/mmo/call-for-evidence-stage-2/

Species Regulations 2017 (as amended) and equivalent legislation of Scotland and Northern Ireland.

Appendix 1a.8: Marine mammals

One respondent referred to increased sightings of bottlenose dolphin in the waters of north east England which are linked to the Moray Firth SAC population, and that such sightings are more than "occasional" as indicated in the ER (e.g. Aynsley 2017). It is understood that the Sea Mammal Research Unit at the University of St Andrews is running a project, citizenfins, which is combining research and citizen science to improve the understanding of the movements of bottlenose dolphin along the north east coast. Output from this project will be accounted for in any future ER. Generally, however, the wider text of Section A1a.8.6 of the ER extensively reflects the wide ranging movements of the east coast bottlenose dolphin population. Additionally, we are aware of the recently updated abundance estimates for bottlenose dolphin (IAMMWG 2022) and reference therein to a new population estimate for the Coastal West Channel management unit based on the photo-ID masters thesis of Corr (2020).

A decrease in the east coast harbour seal population was highlighted by one respondent, including the links between this decline and the Wash & North Norfolk SAC. This is covered in Section A1a.8.7 of the ER with reference to SCOS (2020).

Appendix 1h: Other users

A number of comments were received in relation to the fisheries section of the other users baseline. Where these are minor clarifications or corrections, they have been noted and will be taken into account for any future ER. Responses to other comments are provided below.

In response to a comment on fishing effort with respect to mobile and static gears, it was noted that total fishing effort for UK vessels >15m appears to be generally greater among vessels using mobile gears (e.g. Figure A1h.33 which shows 2019 data). The qualification of this statement to vessels >15m is noted. Section A1h.17.2 of the OESEA4 baseline indicated that the ≤10m fleet comprises almost 80% of the total UK fleet by numbers, with landings data for 2019 (Figures A1h.34 and A1h.35) indicating that most fishing activity takes place in coastal waters, for both static and mobile gears. However, the general paucity of data with respect to these smaller, inshore vessels makes it difficult to compare the intensity of fishing effort for mobile and static gears. Breen *et al.* (2015) used sightings-per-unit-effort (SPUE) estimates calculated from fisheries enforcement data to describe the distribution and intensity of inshore fishing activity off the coasts of England and Wales. Data for vessels <15m sighted between January 2007 and December 2009 suggested higher relative fishing effort for mobile gears compared to static gears, although the age of the data is noted.

As noted above, bylaws came into force in June 2022 prohibiting the use of bottom towed gear at four sites, Dogger Bank SAC, Inner Dowsing, Race Bank and North Ridge SAC, South Dorset MCZ and The Canyons MCZ, this was after the publication of OESEA4, and a call for evidence for potential further fisheries management is ongoing.

It was noted that there was no discussion of the *Fisheries Act 2020* in the baseline. The Act represents the approach to UK fisheries management following the UK's exit from the EU and the Common Fisheries Policy. The Act describes eight objectives;(a) the sustainability objective, (b) the precautionary objective, (c) the ecosystem objective, (d) the scientific evidence objective, (e) the bycatch objective, (f) the equal access objective, (g) the national

benefit objective, and (h) the climate change objective[58]. Section 2 of the Act requires the production of a Joint Fisheries Statement (JFS); a draft JFS has been prepared by the UK Government, Northern Ireland Executive, Scottish Government, and Welsh Government. The draft JFS sets out policies towards achieving the fisheries objectives contained in the Act, which includes listing existing or proposed Fisheries Management Plans, which set out policies designed to restore one or more stocks of fish, or to maintain them at sustainable levels. The draft JFS was subject to consultation which ended in April 2022.

Appendix 1i: Cultural heritage

One respondent indicated it was important to recognise how marine plans reflect that there are few cultural heritage site designations relative to the scale of the resource. The current framework for heritage protection is outlined in Appendix 1i and also in Appendix 2 of the ER, which covers statutory protections including for wreck on non-wreck cultural heritage sites and items. At the highest level, the Marine Policy Statement (MPS) recognises that "heritage assets" are not just sites or areas which have been designated, "*The absence of designation for such assets does not necessarily indicate lower significance and the marine plan authority should consider them subject to the same policy principles as designated heritage assets (including those outlined) based on information and advice from the relevant regulator and advisors*. " Regional marine planning is required to be in keeping with the MPS and so policies within these reflect this requirement, for example policy SOC2 of the East Marine Plans and HER-1 policies of the other English Marine Plans. This is noted in the NTS of the ER, "National scale policies contained in the Marine Policy Statement (MPS), and now regional marine plans, emphasise the importance of non-designated sites…", and also less explicitly in the assessment section (e.g. 5.4.3.2 of the ER) which discusses the potential for effects on cultural heritage without reference to designations.

[58] The overall intent of the act is summarised here: https://www.gov.uk/government/news/flagship-fisheries-bill-becomes-law

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Appendix 1: Updated OESEA4 Recommendations

A revised set of recommendations are provided below. New recommendations are listed at the end to preserve the original recommendation numbering from the OESEA4 ER.

Spatial considerations

1. Existing and future[59] SPAs, SACs and MCZ/MPA sites are not intended or treated as strict no-go areas for other activities (noting that highly protected marine areas are due to be designated in 2022), competent authorities have a responsibility to secure compliance with the requirements of the Habitats Regulations and Offshore Habitats Regulations, and the Marine and Coastal Access Act 2009. It is recommended that applicants are made aware at the licensing/leasing round stage that sites which are part of the national site network may, subject to the conclusions of any Habitats Regulations or MCZ/MPA Assessment, preclude development, necessitate suitable mitigation measures so as to reduce the potential for or avoid adverse effects on a designated site or species, or in some circumstance, would require derogation and compensatory measures. This includes making potential applicants aware of the risks to mobile species which may range far from site boundaries but are nonetheless subject to protection. This recommendation is linked to others below on managing environmental risk, in particular for ornithology, but is also relevant to other conservation features including marine mammals, fish and habitats.

2. The importance of territorial waters and adjacent coasts is reflected in numerous, often overlapping designations to protect their scenic, geological, ecological and cultural features, and designations or use for recreational, shellfishery, fishery, navigational, commercial and other activities. The environmental sensitivity of coastal areas is not uniform and the intensity of designations and uses typically declines further offshore away from the coast. All activities and developments covered by the draft plan/programme require site-specific information gathering and stakeholder consultation to inform consenting decisions. In addition to marine spatial plan requirements, the particular sensitivity of the coastal zone must be taken into account during site selection for proposed developments, which includes those within territorial waters, and depending on the scale of development, at further distances. Some developments may not be compatible with a particular nearshore location, for example adjacent to a World Heritage Site, and the limited potential to mitigate landscape/seascape effects in such locations should be recognised early in project selection.

3. Important navigation routes were previously identified for the SEA process and as part of the first marine plans in England, primarily in territorial waters, and as part of the Welsh National Marine Plan. In view of the number of offshore wind consents now issued and those projects at a pre-planning stage (including Round 4 projects) in the southern North Sea and eastern Irish Sea, an update to the studies undertaken in 2011 and 2013 on cumulative navigational effects of offshore wind farms, on behalf of the Southern North Sea Offshore Wind Forum, would seem timely[60]. This would ensure an

[59] Aa small number of MCZs are being identified in Welsh waters.

[60] Consultation responses noted that there is an Offshore Wind Evidence and Change project progressing with Trinity House and the Maritime and Coastguard Agency to understand the cumulative effects of offshore wind development on navigation safety, and also that this recommendation will be considered by the SNSOWF Group following finalization of OESEA4.

up-to-date understanding on the potential strategic level effects on shipping routes and traffic for future developments to consider, and could form part of future marine planning cycles. Where necessary, important navigation routes could be treated as "Clearways" in the siting and consenting of marine developments. These would require agreement for all waters of the British Isles as well as international coordination for transboundary routes since there are wind farm and other development proposals in the waters of adjacent states.

4. To date, there has been little experience of fisheries adaptation and co-location with offshore wind farms, and at a strategic level caution is required with regard to the siting of a major expansion of offshore infrastructure to ensure fishing activities and skills of local cultural and economic importance are not inadvertently lost, through the prevention or significant hindrance of fishing activity for a generation or more during the lifetime of the developments. While planning policy indicates that developers and decision makers must consider displacement issues, including of fisheries, the cumulative and incremental effect on the fisheries sector from increasing offshore development is not well understood and is challenging to assess due to a lack of spatial data covering a large part of the fishing fleet, and the lack of tools to consider displacement individually or cumulatively. Developments should aim to avoid occupying recognised important fishing grounds in coastal or offshore areas unless there is agreement that successful co-location between the industries can be achieved. Such fishing grounds should be identified variously through available spatial datasets covering fishing effort and value, and consultation with relevant fisheries organisations.

5. Safety zones are either automatically applied, or may be applied for, in the offshore oil and gas sector (and by extension for CCS and gas storage) to ensure the safety of installations and subsea infrastructure. While smaller operational safety zones may be applied around renewables, these are seldom applied. The need for these should be further explored in the context of the potential for multiple anchors to be located at some distance from floating wind turbines and the potential future use of subsea sub-stations.

6. For the area to the west of the Hebrides it is recommended that blocks west of 14 degrees west should continue to be withheld from oil and gas licensing. This recommendation also applies to the deeper parts of the Southwest Approaches, beyond the shelf break, in waters >200m deep. This is in view of the paucity of information on many potentially vulnerable components of the marine environment, and other considerations. Once further information becomes available, the possible licensing in these areas can be revisited. The potential for collaborative investigations in the areas is recognised reflecting the cost and difficulty of studies in distant, deep waters. However, the potential for future licensing in these (and other) areas may be contingent on the outcome of periodic climate compatibility checkpoints, see recommendation 12 below.

7. It is recommended that leasing/licensing and any subsequent consenting of activities should ensure the minimisation of disruption, economic loss and safety risks to other users of the sea and the UK as a whole. It is recognised that individual projects will be assessed on a case by case basis through the relevant planning process, and will therefore be subject to planning policy which is specific to projects of national significance and/or those of the UK's regional marine plans. Recognising the policies of these plans (in particular those relating to the "safeguarding" of certain resources and activities), and the overarching policy in the UK Marine Policy Statement and the

Overarching National Policy Statement for Energy (EN-1) and relevant National Policy Statements, and in addition to those more detailed recommendations above, developments (individually or cumulatively) should aim to:

- avoid impingement on major commercial navigation routes where this could significantly increase collision risk or lead to appreciably longer transit times, this includes within the water column where under-keel clearance could be significantly reduced;
- avoid causing alteration to the ease and safety of navigation in port approaches or reduce the commercial attractiveness of the ports e.g. through increases in vessel insurance premiums;
- avoid potential disruption of existing and potential future aggregate supplies;
- avoid interference with civilian aviation operations necessary to ensure aviation safety, efficiency and capacity, including radar systems, unless the impacts can be mitigated, are deemed acceptable, are temporary or can be reversed;
- avoid jeopardising national security for example through interference with radar systems or unacceptable impact on training areas unless the impacts can be appropriately mitigated or are deemed acceptable in consultation with MoD;
- avoid causing significant detriment to tourism, recreation, amenity and wellbeing as a consequence of deterioration in valued attributes such as landscape, tranquillity, biodiversity and hydrographic features;
- explore opportunities for co-location which could mitigate potential spatial conflicts with existing users.

Further marine planning is underway in Wales (Strategic Resource Areas[61]) and England (Defra marine spatial prioritisation project) with the objective of providing additional policy direction on spatial prioritisation.

Managing environmental risk

8. To date, cumulative and in-combination assessments for wind farms are based on the legally-secured consented wind farm parameters, which for more recent wind farm projects in England and Wales generally reflect a worst case, in part related to the application of the Rochdale Envelope approach. The difference in the number of turbines in a wind farm consent compared to that constructed can be large (approximately one third to one half), such that there is also likely to be a significant difference in the estimated bird mortality between these scenarios. This “headroom” is enhancing the significance of effect concluded for ongoing and future in-combination effects assessment as part of project consenting. Building on work already undertaken as part of The Crown Estate’s Offshore Wind Evidence and Change programme[62], it is recommended that further work be undertaken to define the magnitude of the collision

[61] https://gov.wales/strategic-resource-areas-guidance
[62] https://www.marinedataexchange.co.uk/details/3488/2021-womble-bond-dickinson-offshore-wind-evidence-and-change-programme-headroom-in-cumulative-offshore-windfarm-impacts-for-seabirds-a-report-for-the-crown-estate/packages

risk mortality headroom that exists, to determine whether agreement can be reached on the level of this mortality as a baseline for further offshore wind development for Round 4 and beyond, and that the variation of consents by existing operators to reflect the as-built parameters of projects is encouraged to facilitate a legal basis to draw down the headroom.

9. Evidence suggests that wind farms can result in a high level of displacement for overwintering red-throated diver, though this does not appear to result in complete displacement, and the level of displacement appears to be variable between locations. Evidence is lacking on any related level of mortality and population level effects for wintering sites in the UK. It is recommended that until further information is available on the scale of habitat degradation/loss across operational wind farms in areas designated for red-throated diver, and it is understood how this loss translates into population level effects for the species, future rounds of offshore leasing should avoid impinging on sites for which red-throated diver are a qualifying interest. To support this, and also to clarify the variation in population and distribution within sites between years, it is also recommended that scientifically robust monitoring be undertaken to understand recent site populations and distributions of the species to facilitate the consideration of the issue at a strategic and project level (also see below in relation to improving the marine management information base). Without this new evidence, with the conservation objectives for sites designated for red-throated diver as written and in particular "by maintaining or restoring:…the distribution of qualifying features within the site" could mean that no further windfarm or other development will be possible in or immediately adjacent to such sites. At a wider MPA level such issues require policy level discussion to ensure that the UK's conservation objectives can be met without unnecessarily constraining energy related or other economic activities. This recommendation does not prejudice any project level assessment undertaken in keeping with the Habitats Regulations, but the risks relating to further development in such sites should be noted.

10. A comprehensive strategic review of post-consent wind farm monitoring is required to inform the environmental assessment, consenting of future developments and identification of important evidence gaps (also see Recommendation 29).

11. Modelling has suggested the potential for hydrodynamic effects, including on sediment transport and deposition, stratification timing and strength, primary production and effects at higher trophic levels, from the widespread deployment of offshore renewables in the waters relevant to this SEA and those of other UK constituent countries and adjacent states. This includes from interactions with devices generating electricity directly through energy removal such as tidal stream, tidal range and wave devices, but also from the deployment of wind turbines which have foundations that interact with thermally stratified waters. Currently available models do not account for all potential parameters of effect, are poorly validated, need realistic scenarios of the location, timing and nature of future renewables deployment, and also need to account for the effects of climate change on the marine environment over the same timescales which will also influence, for example, stratification timing and strength. There is a clear need to continue to improve modelling capability and to improve model validation.

12. The Government has recently consulted on a potential climate compatibility checkpoint which will be used to assess whether any future licensing rounds remain in keeping with our climate goals, including net zero. In addition, it is recommended that new oil & gas developments including those resulting from future licensing rounds should be designed to meet the targets set in the North Sea Transition Deal on upstream emissions and the zero routine flaring by 2030 initiative, and to comply with the NSTA Strategy so that they assist the Secretary of State in meeting the net zero target. Additional targets may emerge during the currency of this SEA since it is recognised that the CCC progress report on reducing UK emissions (June 2022), recommended accelerated emission reductions in the oil and gas sector (a 68% reduction by 2030), and electrification of oil and gas infrastructure so that by 2027 new oil and gas platforms can achieve zero emissions from operational energy use. Other considerations (beyond the remit of this SEA) such as security of energy supply may also influence future decisions by the NSTA on the launching of new licensing rounds.

13. Beaked whales are very sensitive to anthropogenic noise (particularly to powerful sonar but potentially also to seismic survey) and their behaviour makes them difficult to observe visually or acoustically as part of implementation of standard seismic survey mitigation procedures. In recognition of this, it is recommended that opportunities to enhance mitigation measures for beaked whales beyond those in the JNCC guidelines for minimising the risk of injury and disturbance to marine mammals from seismic surveys should be considered during deep water seismic survey planning and implemented during operations.

14. A range of chemicals are used in marine renewables developments and during operations, a proportion of which are discharged to sea. On the UKCS all chemicals used in the exploration and production of offshore hydrocarbons (and de facto CCS and gas storage) are controlled through the Offshore Chemical Notification Scheme, reflecting the OSPAR Harmonised Mandatory Control Scheme. Since most of the chemicals used by the renewables industry are similar to those used in the oil and gas industry there seems a logic to standardise their control and reporting (including those chemicals listed by OSPAR for priority action or candidates for substitution), but it is noted that the majority of chemicals used are in closed systems and discharges are likely to be minor.

15. The number of offshore energy structures and associated sacrificial anodes used for corrosion protection has risen in recent years, with concerns raised over the consequent release of aluminium and other metals. To understand the scale of this concern, data on anode use and replacement should be collected and collated by developers, regulators or trade associations, or a study of a representative project be undertaken. Alternative technologies such as impressed current cathodic protection are available. Paint and coatings for structural protection could reduce anode use, but many of these replacements are plastic based and the implications for their long term use is unknown.

16. The injection of carbon dioxide into saline aquifers for storage is likely to lead to discharge of hypersaline water through water production to control pressure within the

aquifer. Brines with the potential to be discharged should be characterised chemically to assist in the engineering of effective treatment and dispersion e.g. through diffusers, and to allow appropriate monitoring of plume dispersion and potential environmental effects in the water column and seabed. Pressure increases in the aquifer resulting from the injection of carbon dioxide may lead to seepage of brines at the seabed via naturally occurring outcrops of the relevant geological formation; monitoring and appropriate control measures should be implemented where such seepage may occur to reduce the potential scale of such seepage and to document the scale and effects on the environment.

17. The nature and uses of the range of estuaries and embayments in which tidal range developments have been and may be proposed vary widely. Similarly there is a wide diversity in the type and location of installations proposed to exploit tidal range. Consequently it is recommended that site specific assessments are undertaken before decisions can be taken on the desirability and acceptability of individual projects, and that successive tidal range proposals should consider the potential for local, regional and wider far-field effects to be generated cumulatively. Such assessments will require a broad subject, spatial and temporal consideration e.g. coastal defence trends and plans, local and regional nutrient flows and siltation patterns, feasibility of compensatory measures for effects on the national site network, effects on endangered diadromous fish, and the importance for waterbirds the UK assumes during extreme cold winters. A critical first step will be to define the geographic scope of potential effects on physical processes including the wave climate, tidal flows and sediment transport. This work would ideally be undertaken at the pre-application stage of development.

18. The subject of cumulative effects assessment (CEA) is challenging at project, industry and strategic levels, and is frequently raised by stakeholders as an issue. At all levels of assessment, guidance on the spectrum of certainty and the point beyond which CEA is considered conjectural would be useful.

19. Unlike natural gas and carbon dioxide, there is currently no consenting route for projects transporting hydrogen by offshore pipeline, or its storage in geological formations, and similarly, the consenting route for hydrogen generation offshore requires definition. Both of these points require clarification to help facilitate offshore green hydrogen production, transport and storage.

Improving the marine management information base

Although the information base continues to improve, there remain a number of subject areas for which information is limited and should be enhanced to support appropriate development site selection and project-specific consenting. These information gaps include aspects of the natural world and human uses, with regional context and long-term trend data notably lacking.

20. Although there has recently been significant boat based and aerial survey effort in coastal waters, there is a general lack of modern survey data on waterbirds in offshore areas. Adequate data on waterbird distribution and abundance is a prerequisite to effective environmental management of activities, for example, in timing of operations to

avoid periods of particular sensitivity. A comprehensive analysis of the European Seabirds at Sea (ESAS) database was undertaken to identify possible marine SPAs but gaps in spatial coverage necessitated the use of interpolation to estimate values for un-surveyed areas. These data, amongst others, also informed a wider seasonal modelling study as part of the Marine Ecosystems Research Programme (MERP), however, while the outputs can usefully inform broadscale understanding, more information will be required to draw conclusions in relation to environmental management. The development of high-precision tracking devices has led to a recent upsurge in bird tracking studies, and for some species several hundreds of individuals have been tracked from numerous colonies around the UK, allowing the marine distribution of some species to be predicted from tracking data. It is recommended that the results of cross-validations of models of marine distribution derived from tracking individual birds with those from at-sea survey are assessed to inform decisions on the nature and location of waterbird distributional research.

21. Deep-diving cetaceans, particularly beaked whales, continue to remain poorly understood due to the challenges associated with their typically offshore distribution and limited time spent at the surface for observation. Should there be potential interest in deep water hydrocarbon exploration to the west of the Hebrides, improved understanding of the ecology and location of important areas for beaked whales should be obtained to underpin assessments of effects and identification of mitigation measures.

22. To support the assessment of potential effects of proposed activities (in conservation sites and beyond), improved understanding of harbour porpoise (and other marine mammal species) ecology is needed, along with that of their prey and interspecific interactions (such information will assist in the management of the population(s) in UK waters).

23. Whilst the information base has improved in recent years, further data are required on the spatial scale at which marine mammals and their prey respond to well characterised noise sources, and whether this varies according to individual characteristics, behavioural state or other environmental variables, and whether the scale of effects is sufficient to cause significant adverse effects at an individual or population scale. There also remains the need to further characterise noise sources including those related to geophysical sources such as sub-bottom profilers.

24. There is a need for enhanced, strategic level understanding of biodiversity and its patterns in UK waters, in particular for the species (e.g. the bivalve *Arctica*) and features (e.g. habitats characterised as seapens and burrowing megafauna communities or burrowed mud) used as the bases for MCZ/MPA identification and designation, to inform considerations of site integrity and the assessment of proposed activities impinging on sites.

25. While risks to marine life from EMFs associated with submarine power cables are not considered to constitute a major impact, and are regularly not taken beyond the scoping

stage in wind farm environmental assessments, there remain significant data gaps with regards to its biological impacts such that a meaningful risk assessment cannot be conducted. Developing standards for appropriate *in situ* measurements of anthropogenic EMF environments, along with increased *in situ* measurements of EMFs and the local geomagnetic field will improve understanding of the factors that influence EMFs, which would complement a modelling study being commissioned as part of the OESEA process. The effects knowledge base needs to be expanded using model species to determine sensitivity thresholds, encounter rates, long-term impact studies and population level impacts. Finally, an understanding of potential cumulative effects will become more important, specifically the impact of potentially encountering differently oriented power cables, how biological behavioural and physiological effects may interact, and the potential for effects experienced during early life history influence later life stages.

26. The conservation status of sites and their related features are not available for a number of SACs and SPAs or the data informing site status may be old. An up to date understanding of the conservation status of these sites and their features is important, as without it, conclusions on the presence or absence of adverse effects from projects may be erroneous.

27. There is currently little information available on the interaction of birds, marine mammals and fish with surface and submerged wave and tidal devices and the SEA recommends that for the deployment of single devices and small arrays, appropriately focussed surveys of animal activity and behaviour should be undertaken to inform commercial scale deployment risk assessments and consenting. Similarly, there is currently little information on the potential interaction of fish and marine megafauna with the moorings of floating offshore wind farms at the scale likely from future leasing. A strategic and coordinated approach to such research is recommended since the results will be of wider application; research results should be made publicly available where ever possible.

28. For some areas there is excellent data on seabed topography and texture from multibeam mapping undertaken under various auspices including by the MCA, BGS and the SEA programme. The NERC Marine Environmental Mapping Programme (MAREMAP) and the scoping study for a UK National Seabed Mapping Programme are noted, however, significant gaps in coverage remain, and continued effort should be focussed on developing comprehensive coverage of the UKCS, prioritising areas of industrial and conservation interest.

29. The information collected by offshore renewables and oil industry site surveys and studies is valuable in increasing the understanding of UK waters. The initiatives such as the Marine Data Exchange and UKBenthos databases ensure that such information is archived for potential future use should be continued and actively promoted during the consenting processes. Similarly, there should be encouragement for the analysis of this information to a credible standard and its wider dissemination, including via the Marine Environmental Data and Information Network (MEDIN).

Best practice/mitigation

30. The SEA notes post-consent changes made to cable installation techniques, remedial works and additional cable protection which have resulted in habitat disturbance and loss/ modification within MPAs that has not been assessed as part of the consent application process[63]. The SEA recommends that while some flexibility may remain for effects to be considered at the marine licensing stage, which may include changes to the national site network between the date of consent and construction, developers must ensure that realistic worst case levels of impacts and where possible impact location, particularly those associated with cable installation and protection in sensitive MPAs, are assessed as part of their submissions at the consenting stage.

31. The SEA recommends that the development of appropriate benthic compensatory measures with respect to cable protection is reviewed at a strategic level for relevant Annex I habitats, which includes sandbank and subtidal reef (as supported by JNCC and Natural England[64]) to focus research in this area. Better definition of the nature and extent of existing introduced hard substrates within MPAs designated for sandbanks is required to improve understanding of the conservation status of these qualifying features, and characterise how the static hard substrates interact with the mobile features over time. Previous attempts have not been the catalyst for the collection of specific industry information on hard deposits in relevant MPAs required to reduce uncertainty in this area, or have been limited by available data. As part of future permitting and licensing, data on the nature, scale and location of hard substrate deposition should be recorded and disseminated.

32. Connected with the above, the volumes of rock used, for example, in cable armouring, foundation scour protection and pipeline protection and upheaval buckling prevention, must be the minimum required to provide the necessary protection in order to minimise permanent habitat change and to ensure areas developed as a result of the current draft plan/programme are left fit for other uses after decommissioning. Alternative methods of protection/control (e.g. those that are more easily removed on decommissioning) should be considered to minimise the potential for permanent habitat change.

33. In areas with vulnerable habitats and species such as maerl beds and cold water coral reefs, mitigation may be required for physically damaging activities such as rig/vessel anchoring, discharges of drilling wastes and cable, pipeline or umbilical installation (from hydrocarbon, gas storage or renewable energy related activities). Prior to decisions on activity consenting in such areas, developers should provide a detailed assessment and seabed information so that appropriate site specific mitigation can be defined.

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[63] e.g. https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010080/EN010080-001240-Natural%20England%20-%20Offshore%20Cabling%20paper%20July%202018.pdf

[64] https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010080/EN010080-003633-EN010080_Hornse%20Three_SBIP_SNCB%20comments%20letter%20Final.pdf

Developers should be aware that in some particularly sensitive areas, mitigation may not be possible and compensatory measures may not be available.

34. Given the focus in UK OWF assessments and consent deliberations on various seabirds which feed extensively on sandeels, and in the context of the energy transition towards net zero by 2050, strategic compensation through selective restriction or closure of sandeel fisheries should be given consideration at a policy level.

35. A number of large marine protected areas established for seabed features such as sandbanks are judged to be in unfavourable conservation status. Such sites typically overlap with areas with OWF development potential. The conservation objectives for such MPAs generally advise a restore objective and note "Our confidence in this objective would be improved with longer term monitoring and access to better information on the activities taking place within the site."; while this wording is particular to sites in English waters though the issue is also of relevance to Welsh sites. In the context of the energy transition towards net zero by 2050 and to avoid potentially unwarranted precaution, it is recommended that a programme of strategic investigations is initiated for relevant MPAs to provide the necessary evidence to inform consenting advice and decisions. Such evidence would also allow management and mitigation efforts to focus on the more damaging pressures affecting the sites.

36. Whilst it is recognised that most developers in the marine environment have Health, Safety & Environmental management systems in place, it is recommended that companies involved in the planning, undertaking and control of marine activities resulting from the current draft plan/programme operate Environmental Management Systems which are consistent with an international standard.

37. Site surveys for marine developments can identify unexploded ordnance (UXO), which is either left *in situ* or rendered harmless through disposal. Human safety is paramount in such decisions, but the potential to minimise the impacts and cumulative effects of the percussive noise on marine mammals (and other fauna) should be given due weight, in particular in relation to conservation sites established or proposed for seals or cetaceans in areas of relatively high UXO occurrence e.g. the southern North Sea. The preferred approach should be to use low-noise methods for disposal wherever possible, with clear justification provided where such methods are not proposed.

38. Application of net gain to offshore projects (excepting onshore and intertidal components of such projects) is not presently a mandatory requirement in England and Wales, but marine plan policies do encourage or support such enhancement. In England, provisions of the *Environment Act 2021* allow for net gain to be formally applied to the marine environment and are currently being consulted upon https://www.gov.uk/government/consultations/consultation-on-the-principles-of-marine-net-gain. In advance of any requirement, and in recognition of existing marine plan policy, further evidence is required to support the potential for offshore energy installations to generate net gain.

New recommendations

39. It is not presently possible to provide a robust assessment of the effects of offshore energy developments on blue carbon resources as their current nature, size and the effects on these of sediment disturbance and habitat change (e.g. through placing hard substrate and vertical structures in the water column) is poorly understood. As information increases there could be a need to account for this at the project level.

40. The migration periods for bats, and in particular Nathusius' pipistrelle, is likely to represent a key sensitivity in the southern North Sea. The potential impact of offshore wind farms on bats (collision, barotrauma) is widely acknowledged but there is a paucity of information on bat distribution and behaviour on which to undertaken robust assessment. Further research is required to understand the potential implications of offshore wind farm expansion on species of migratory bat and to inform potential mitigation measures.

This publication is available from: https://www.gov.uk/guidance/offshore-energy-strategic-environmental-assessment-sea-an-overview-of-the-sea-process

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