4.14.1



Volume 4, Appendix 14.1 **Draft Marine Conservation Zone Assessment**



Executive summary

Purpose of this report

This draft Marine Conservation Zone (MCZ) Assessment has been produced for the purpose of providing evidence on whether the potential impacts of the Proposed Development will give rise to a significant risk of hindering the conservation objectives of MCZs identified in the report. This report also intends to inform the relevant authority in exercising its functions to further the conservation objectives stated for MCZs.

The MCZ Assessment has been carried out using the best available evidence at the time of writing and is based on the information included in the Preliminary Environmental Information Report (PEIR) and in reference to the PEIR Assessment Boundary.

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1. Introduction

This section gives a brief summary of the Rampion 2 Offshore Windfarm, introduces the Marine Conservation Zone (MCZ) Assessment as a requirement under the Marine and Coastal Access Act 2009 (MCAA) and outlines the purpose of this document.

1.1 Introduction to the Proposed Development

1.1.1 Rampion Extension Development (RED) ('the Applicant') is proposing to develop the Rampion 2 Offshore Windfarm ("Rampion 2"). Rampion 2 will be located adjacent to the existing Rampion Offshore Wind Farm located in the English Channel in the south of England. For the purposes of clarification, in this document, the existing Rampion Offshore Wind Farm is referred to as 'Rampion 1' hereon in to enable clear differentiation with Rampion 2. Rampion 2 will include both offshore and onshore infrastructure including an offshore wind farm, export cables to landfall, and connection to the electricity transmission network. The Preliminary Environmental Information Report (PEIR) study area combines the search areas for the onshore and offshore infrastructure.

1.2 Marine Conservation Zone Assessment

- 1.2.1 The MCAA Act 2009 came into force in 2009 and applies to the territorial waters around England and Wales. One of the provisions of MCAA was to designate new marine protected areas, known as MCZs, to increase biodiversity protection in United Kingdom (UK) waters by creating a network of sites that are well managed and support healthy ecosystem functioning. MCZs were designated to protect areas that are important for biodiversity on a national scale, with features consisting of rare, threatened and representative marine habitats, species, geology and geomorphology.
- 1.2.2 Consideration of MCZs is required for any Marine Licence or Development Consent Order (DCO) applications in English waters. Under Section 126 of MCAA, relevant authority, such as Marine Management Organisation (MMO) in case of Marine Licences, or the Secretary of State (SoS) for DCO applications, has specific duties in relation to MCZs and decision making.
- 1.2.3 Section 126 applies where:
 - (a) a public authority has the function of determining an application (whenever made) for authorisation of the doing of an act, and
 - (b) the act is capable of affecting (other than insignificantly)-
 - ▶ (i) the protected features of an MCZ;
 - (ii) any ecological or geomorphological process on which the conservation of any protected feature of an MCZ is (wholly or in part) dependent.



1.3 **Purpose of the Draft MCZ Assessment**

- 1.3.1 This draft MCZ Assessment has been produced to provide evidence on whether the potential impacts of Rampion 2 could give rise to a significant risk of hindering the conservation objectives of the following identified MCZs and allow the relevant authority to exercise its functions to further the conservation objectives stated for these MCZs (further discussed in **Section 4**):
 - Kingmere MCZ;
 - Selsey Bill and the Hounds MCZ;
 - Beachy Head West MCZ;
 - Beachy Head East MCZ;
 - Pagham Harbour MCZ;
 - Utopia MCZ;
 - Offshore Overfalls MCZ;
 - Bembridge MCZ; and
 - Offshore Brighton MCZ.
- 1.3.2 In drafting this document, RED has referred to the MMO guidance: "Marine conservation zones and marine licensing" published in 2013, as well as the advice from the Statutory Nature Conservation Bodies (SNCBs) received throughout the pre-application consultations (**Section 2**).
- 1.3.3 The draft MCZ Assessment has been undertaken based on the information detailed within PEIR Volume 2, Chapter 4: The Proposed Development. This document intends to inform the statutory duty of the Planning Inspectorate (PINS) on behalf of the SoS for conducting the formal MCZ Assessment under Section 126 of MCAA. However, the Applicant acknowledges that the relevant authority may follow a process that differs from the methodology set out in this document.

1.4 Document structure

- 1.4.1 This draft MCZ Assessment is structured as follows:
 - Section 1: Introduction;
 - Section 2: Consultation;
 - Section 3: MCZ Assessment methodology;
 - Section 4: MCZ Screening;
 - Section 5: MCZs considered in the Stage 1 assessment;
 - Section 6: Stage 1 assessment;
 - Section 7: Conclusion; and
 - Section 8: References.



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- 1.4.2 This draft MCZ Assessment should be read in conjunction with the following chapters of the PEIR (**Volume 2**), which contain relevant detail which have been drawn upon and referred to throughout this document:
 - Chapter 6: Coastal processes, and Appendix 6.1: Coastal processes technical report: Baseline description;
 - Chapter 8: Fish and shellfish ecology;
 - Chapter 9: Benthic subtidal and intertidal ecology; and
 - Appendix 11.3: Underwater noise assessment technical report.

2. Consultation

This section provides the consultation background pertinent to the draft MCZ Assessment as raised in the Evidence Plan process (EPP), Expert Topic Groups (ETGs) and the Scoping Opinion received from PINS in August 2020.

2.1 **Relevant consultation**

2.1.1 This MCZ Assessment has been informed by consultation responses received from the Planning Inspectorate as part of the Scoping Opinion (PINS, 2020) and feedback from key stakeholders on the Nature Conservation Method Statement, including the MMO, Natural England, The Wildlife Trusts (TWT) and through the Rampion 2 Coastal Processes (Water Quality), Benthic Ecology and Fish Ecology ETG as part of the EPP. On 17 September 2020, the first Coastal Processes, Benthic Ecology and Fish Ecology ETG Meeting was held with the additional 'catch-up' ETGs specific to Coastal Processes and Benthic Ecology held on 13 October 2020 and a Fish and Shellfish Ecology held on 21 October 2020. A second ETG meeting covering all three topics was held on 24 March 2021.

2.2 Consultation responses

- 2.2.1 Comments received to date, which are of relevance to this MCZ Assessment, were largely in response to the Nature Conservation Chapter of the Scoping Report and the Nature Conservation Method Statement. The consultees highlighted the need for inclusion of specific MCZs into the MCZ Assessment, which were initially proposed to be scoped out.
- 2.2.2 Discussions with the ETG focused on baseline characterisation, establishing agreement on data sources and methodology approach for the purposes of the PEIR and the MCZ Assessment. The relevant MCZs were characterised using a combination of desktop data sources and site-specific survey data (for example, geophysical data and benthic ecology data via grab and drop down video (DDV) sampling). Full details of the baseline characterisations of the relevant MCZ considered are presented in **Section 4** and these were discussed and agreed with the ETG throughout the pre-application phase of the Proposed Development.
- 2.2.3 One of the key stakeholder concerns raised during consultation and the ETG discussions with respect to the MCZ Assessment was in relation to the effect of noise on black seabream from Kingmere MCZ.

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Table 2-1 Summary of key comments and issues relevant to MCZs raised during pre-application consultation activities undertaken for Rampion 2

Date	Document	Consultee	Comment or issue raised	Details of change or response to comment
11/08/2020	Rampion 2 Scoping Opinion, 4.1.5	PINS, Natural England	The Environmental Statement (ES) should present a full list of designated sites that have the potential to be impacted in terms of coastal processes, including any effects on Beachy Head East MCZ and the Bembridge MCZ. The Joint Nature Conservation Committee (JNCC) should be consulted on whether Offshore Brighton MCZ should be scoped in.	The full list of MCZs considered in this assessment is presented in Section 1.3 .
11/08/2020	Rampion 2 Scoping Opinion, 4.4.7	PINS, MMO	The ES should include an assessment of the potential for the spread of non-indigenous species via the colonisation of hard substrates and for the Proposed Development to be used to reach the designated hard habitats in the adjacent Kingmere MCZ.	Impacts considered and those scoped in are listed in Section 4.2 .
11/08/2020	Rampion 2 Scoping Opinion, 4.10.3	PINS	Although that the requirements for standalone MCZ assessment(s) under the MCAA are separate to the Environmental Impact Assessment (EIA) process, the Inspectorate expects a coordinated approach to the assessment of effects on MCZs in the ES and any separate assessment under the MCAA.	This document has been prepared with due regard to the EIA assessment included in relevant PEIR chapters and these are referenced in Section 1.4 .

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Date	Document	Consultee	Comment or issue raised	Details of change or response to comment
04/08/2020	Rampion 2 Scoping Opinion	ММО	MMO note it is appropriate that the effects on black seabream as a designated feature of the Kingmere MCZ will be considered within the EIA and MCZ assessment.	The effects on black seabream are covered both in this MCZ Assessment and Chapter 8: Fish and shellfish ecology, Volume 2 of the PEIR.
			Support the use of geophysical survey data to inform the likely location of black seabream nesting areas, however, note that data from the aggregate industry is spatially limited to the monitoring area and does not identify whether there are black seabream nesting areas within/beyond the MCZ boundary and Rampion 2 search areas.	Baseline data sources, their coverage and limitations are outlined in Chapter 8, Volume 2.
04/08/2020	Rampion 2 Scoping Opinion	Natural England	Direct impact to designated sites, including the Offshore Overfalls MCZ and the Kingmere MCZ, has been scoped out. Natural England suggests this decision is kept under review, until a more detailed cable route is available. The applicant will still need to consider indirect impacts, such as noise, vibration and increased suspended sediment on these sites.	Offshore Overfalls MCZ and the Kingmere MCZ have been considered in this MCZ Assessment. Impacts considered and those scoped in are listed in Section 4.2 .
04/08/2020	Rampion 2 Scoping Opinion	Natural England	Black seabream from Kingmere MCZ has been assigned a recover target for population size and a restore target for nest abundance and distribution. Any negative impact from development on the MCZ would be in direct contravention to this advice.	Impacts considered and those scoped in are listed in Section 4.2 .



Date	Document	Consultee	Comment or issue raised	Details of change or response to comment
			Natural England therefore supports scoping in impacts of mortality, injury, behavioural changes and auditory masking arising from noise and vibration.	
04/08/2020	Rampion 2 Scoping Opinion	Natural England	 Short-snouted seahorse is a feature Beachy Head West MCZ, and Selsey Bill and the Hounds MCZ, Bembridge MCZ and Beachy Head East MCZ. The potential for indirect effects on short-snouted seahorses within these MCZ's should be considered. These effects include: 1) mortality, injury, behavioural changes and auditory masking arising from noise and vibration; and 2) changes in suspended sediment. 	Impacts considered and those scoped in are listed in Section 4.2 . Assessment of impacts on short-snouted seahorse is included in Section 6.4 .
11/02/2021	Nature Conservation Method Statement	Natural England	Direct habitat disturbance to all MCZs is currently scoped out. This should remain under review for Kingmere MCZ and Offshore Overfalls MCZ in relation to the construction methodology and the final location of the cable route.	The PEIR assessment takes into account the latest Proposed Development design envelope, which currently excludes any potential impact to areas outside of the PEIR Assessment Boundary.
11/02/2021	Method Statement Feedback	Natural England	It is suggested that Bembridge MCZ is only designated for benthic ecology features of interest and falls outside of the benthic ecology Zone of	Short-snouted seahorse feature of Bembridge MCZ has been scoped



Date	Document	Consultee	Comment or issue raised	Details of change or response to comment
			Influence (ZOI), therefore no impact is expected from the proposed development of Rampion 2. This is not the case as this site also contains fish and shellfish features.	in and potential impacts are assessed in Section 6.4 .
11/02/2021	Method Statement Feedback	Natural England	Pagham Harbour MCZ is scoped into the nature conservation assessment but is missing from the list of MCZ's considered in the MCZ Assessment.	Pagham Harbour MCZ is considered within this MCZ assessment.
11/02/2021	Method Statement Feedback	Natural England	The noise modelling has not yet been carried out. As some sites that at this stage fall outside of the study areas for ornithology, benthic, fish and shellfish ecology, but fall within the noise sensitivity study area, these should not be discounted as they may need to be scoped in for noise sensitive features at a later stage.	MCZs that include short-snouted seahorse (a noise sensitive feature) have been considered in this MCZ Assessment). The MCZ Assessment will be reviewed against any design changes and additional information that may become available, such as noise modelling outputs.
11/02/2021	Method Statement Feedback	Natural England	As Beachy Head West MCZ falls within the study area for fish and shellfish ecology, impacts on other shellfish features of this site (Blue mussel beds and Native oyster) should also be considered in this chapter.	Native oyster and blue mussel beds features of Beachy Head West MCZ have been scoped in and are assessed in Section 6.4 .
11/02/2021	Method Statement Feedback	Natural England	It is suggested that features of Bembridge MCZ (short-snouted seahorse, and native oyster) will be included in this assessment. Clarification	Features of Bembridge MCZ have been considered in this MCZ Assessment (Table 4-1).

Date	Document	Consultee	Comment or issue raised	Details of change or response to comment
			needs to be provided on whether it is expected that this site and its features will be impacted.	
11/02/2021	Method Statement Feedback	Natural England	The document states that the primary spawning season identified within the Kingmere MCZ Supplementary Advice is April to June. Seasonality in Natural England's conservation advice published in March 2021 has been updated to March to July.	Updated seasonality for black seabream has been acknowledged and taken into consideration in Chapter 8 , Volume 2 .
11/02/2021	Method Statement Feedback	Natural England	Evidence suggests that black seabream leave the site in July and that nests require constant maintenance to remain free of sediment. Geophysical surveys were undertaken between July and August 2020. Surveys undertaken at the very end of the breeding season and outside of it are not considered to provide a reliable indicator of presence or absence of black seabream nesting sites in a particular area during the entire season.	The updated seasonality information for Kingmere MCZ assumes black seabream being present up to and including July. Baseline characterisation and assessment included in Chapter 8, Volume 2 has followed a precautionary approach.
11/02/2021	Method Statement Feedback	Natural England	In relation to the site-specific data collected (geophysical and DDV) it is proposed that where nests are identified the data will be interpreted, and nests classified into the density classes assigned to the aggregates data. These density classes will be presented in figures, alongside the pre-existing aggregate monitoring data to enable a robust assessment of black seabream nesting	It is unclear if this is a general point of principle, or a specific response with regards the timing of the survey data. If with regards the timing of the site-specific survey the Applicant can confirm that the data will be used for context only, with a general



Date	Document	Consultee	Comment or issue raised	Details of change or response to comment
			areas across the Kingmere MCZ and the Rampion 2 offshore export cable corridor. Natural England strongly disagrees that this would enable a robust assessment of black seabream nesting areas.	assumption of nest presence being made in areas of likely thin sediment veneer for the purposes of assessment.
11/02/2021	Method Statement Feedback	Natural England	In relation to Kingmere MCZ we understand that there will be no direct loss of habitat within the MCZ. It is not considered that an understanding of the density and frequency of nests would be informative in relation to noise and sedimentation impacts. In relation to loss of essential fish habitat outside of the MCZ, the potential for nest presence or absence is key.	The Applicant recognises Natural England's position with regards the ability to interpolate or extrapolate the existing data beyond the bounds of the spatially limited aggregate dataset. It is considered relevant when assessing the relative importance of an area for fish spawning to draw on all available data.
11/02/2021	Method Statement Feedback	Natural England	At this point the Applicant has not collected appropriate data on black seabream during the peak nesting season, and so cannot interpret this using density classes. To robustly investigate nesting density would require, as a minimum, a multi-year dataset with comprehensive spatial coverage and replicate samples taken at peak black seabream spawning season. Natural England does not think such a dataset exists and furthermore questions why the Applicant is focussed on nest density when they have not yet ascertained the presence and extent of nesting	The Applicant can confirm that a general assumption of nest presence will be made across areas of potential spawning habitat (thin sediment veneer over bedrock). The Applicant has acquired adequate sub-bottom profile data to provide an extent of potential spawning grounds. This dataset will also be used alongside contextual British Geological Survey (BGS) data to

Date	Document	Consultee	Comment or issue raised	Details of change or response to comment
			black seabream habitat within their development area. Natural England has suggested an alternative approach in targeted habitat mapping to identify potential spawning habitats which can then be avoided.	identify the potential presence of black seabream nests at a site and regional scale. The Applicant would observe that it is entirely commonplace to undertake an assessment of ephemeral species presence through reference to a single dataset. Notwithstanding this, a precautionary approach to the assessment has been applied in Chapter 8, Volume 2.
11/02/2021	Method Statement Feedback	Natural England	Natural England has concerns over the developer's ability to determine the presence and extent of nesting black seabream, which could affect the outcome of the impact assessment based on sediment plume modelling and noise modelling. The model should only draw conclusions on nest presence and extent in areas which have been adequately surveyed and should not assume absence in nests where data is not available.	Chapter 8, Volume 2 presents the area in which there is nesting habitat potential at a site and regional scale. The assessment relies on a combination of high-resolution site-specific data and regional scale BGS data.
11/02/2021	Method Statement Feedback	Natural England	It should be noted that temporary localised increases in suspended sediment concentration (SSC) and smothering (Construction and Decommissioning) also need to be considered in relation to seahorses.	SSC and sediment deposition impacts have been considered (Section 4.2). Assessment of impacts on short-snouted seahorse is included in Section 6.4.

3. MCZ Assessment methodology

This section describes the MCZ Assessment methodology, including description of the staged approach to the MCZ Assessment following the relevant published guidelines, and how information presented in the PEIR has been used to support the assessment presented in this document.

3.1 Guidance and relevant information

- 3.1.1 The MCZ Assessment methodology has been largely informed by the guidance published by the MMO (2013). The document outlines the proposed procedure of undertaking MCZ Assessments in the context of marine licensing decisions. The document recommends a staged approach to the assessment, with three sequential stages:
 - Screening;
 - Stage 1 assessment; and
 - Stage 2 assessment.
- 3.1.2 Where specific activities, impacts or MCZs and their features are screened into the MCZ Assessment process, these are then considered within the Stage 1 assessment. Should a significant risk of the activity hindering the conservation objectives be identified within Stage 1, then specific impact receptor pathways need to be considered in Stage 2 assessment. Full details of each of these stages of the approach have been provided in the following sections.
- 3.1.3 The approach presented in this MCZ Assessment was informed by guidance published by the MMO (MMO, 2013) and refined based on the feedback from the ETG and scoping consultation responses. This included agreement on the baseline characterisation, development of the MCZ Assessment methodology and key concerns from stakeholders about the potential effects of Rampion 2 on MCZ features, and in particular, Kingmere MCZ and black seabream.

3.2 Screening

- 3.2.1 The MMO (2013) guidelines specify, that all marine licence applications need to be screened to determine if Section 126 should apply. It will apply if, through the course of screening, it is determined that:
 - the licensable activity is taking place within or near an area being put forward or already designated as an MCZ; and
 - the activity is capable of affecting (other than insignificantly) either (i) the protected features of an MCZ; or (ii) any ecological or geomorphological process on which the conservation of any protected feature of an MCZ is (wholly or in part) dependant.

- 3.2.2 To determine the "nearness" of an activity to individual MCZ and its features, the MMO propose a risk-based approach. This includes applying an appropriate buffer zone to the MCZ features under consideration as well as a consideration of risks which lie in activities further removed from features.
- In considering "insignificance", the likelihood of an activity causing an effect, the magnitude of the effect should it occur, and the potential risk any such effect may cause on either the protected features of an MCZ or any ecological or geomorphological process on which the conservation of any protected MCZ feature is, wholly or in part, dependant.
- 3.2.4 For the purposes of the Rampion 2 MCZ Screening, MCZs considered within the assessment were identified through the Scoping Report (RED, 2020), and further expanded based on the Scoping Opinion (PINS, 2020) and additional consultation feedback on the Nature Conservation Method Statement. The screening identified relevant MCZs based on proximity to Rampion 2, as follows:
 - sites with spatial overlap with Rampion 2;
 - sites within the study area defined as the PEIR Assessment Boundary together with the secondary ZOIs for individual technical disciplines:
 - benthic and fish and shellfish ZOI comprising of 15 kilometre (km) buffer from the array and 10km from the offshore export cable route; and
 - noise sensitivity ZOI consisting of 26km buffer of the PEIR Assessment Boundary, including the array and the export cable corridor, and noise modelling results associated with Chapter 8: Fish and shellfish ecology, Volume 2 and Appendix 11.3: Underwater noise assessment technical report, Volume 4.
- 3.2.5 The above approach has been established following the consultation feedback, which identified sensitivity of certain MCZ features to noise impacts (namely, short snouted seahorse). Consequently, the noise sensitivity study area was included as relevant to the MCZ assessment.
- 3.2.6 Baseline information from relevant chapters of the PEIR, Natural England MCZ conservation advice, and the details of Proposed Development design available at this stage have been reviewed to further refine the list of sites where Rampion 2 is capable of significantly affecting the protected/proposed features of those sites.
- 3.2.7 This included review of **Chapter 6: Coastal processes, Volume 2** to identify potential far field effects (such as increases in SSC). Individual impacts on designated features of the MCZs were also considered in the MCZ Screening. Some impacts identified and assessed in **Chapter 9: Benthic Subtidal and Intertidal Ecology, Volume 2** presented sufficiently low risk of resulting in a significant effect on protected MCZ features and have therefore been screened out. Screening out of impacts may have been a result of, for example, very limited extent and/or duration of the impact, a lack of receptor sensitivity to the impact, or due to control measures to be implemented by Rampion 2 that would greatly reduce the risk of the effect occurrence. Details and outcomes of MCZ Screening are provided in **Section 4**.



3.3 Stage 1 assessment methodology

- 3.3.1 The Stage 1 assessment, which is presented in **Section 6**, assesses the extent of the potential impact of Rampion 2 on the MCZs screened into the assessment. The MMO guidance (2013) sets out that Stage 1 assessment needs to consider whether the conditions in Section 126(6) of MCAA can be met. Using information supplied by the Applicant, advice from the SNCBs and any other relevant information, the relevant authority would determine whether:
 - there is no significant risk of the activity hindering the achievement of the conservation objectives stated for the MCZ; and
 - the relevant authority can exercise its functions to further the conservation objectives stated for the MCZ (in accordance with s.125(2)(a)).
- 3.3.2 If the condition in Section 126(6) cannot be met, the Stage 1 assessment also considers whether the condition in Section 127(7)(a) can be met, which requires the relevant authority to determine whether:
 - there is no other means of proceeding with the act which would create a substantially lower risk of hindering the achievement of the conservation objectives stated for the MCZ. This should include proceeding with it (a) in another manner, or (b) at another location.
- 3.3.3 In undertaking a Stage 1 assessment the relevant authority consults with SNCBs for a period of 28 days, unless the SNCB notifies the relevant authority that it need not wait, or the relevant authority determines that there is an urgent need to grant authorisation (in accordance with section 126(4) of the MCAA).
- 3.3.4 In Stage 1 the conservation objectives for the MCZ features need to be considered. The conservation objectives for MCZ features are high level criteria describing the desired condition of the MCZ features. While conservation objectives for individual MCZs or certain features are often site-specific, the two overarching conservation objectives defined for MCZs are:
 - to maintain a feature in favourable condition if it is already in favourable condition; or
 - to bring a feature into favourable condition if it is not already in favourable condition.
- 3.3.5 When considering whether an activity can "further" (for instance, increase the likelihood that the current status of a feature would be maintained or improve) or "hinder" the conservation objectives of a site, the relevant authority considers the direct impact of an activity upon a feature as well as any applicable indirect impacts. An indirect impact may include, for example, changing the effectiveness of a site-specific management measure put in place to further its conservation objectives.
- 3.3.6 With respect to "other means", the Applicant should be able to demonstrate that the proposed approach to development reduces the risk such that the activity no longer has a significant risk of hindering the conservation objectives of the site. Where sufficient mitigation to reduce the predicted impacts to an acceptable level cannot be implemented and there are no other means that substantially lower the

risk of hindering the achievement of conservation objectives, then a Stage 2 assessment would be required.

3.4 Stage 2 assessment methodology

- 3.4.1 The Stage 2 of the MCZ Assessment considers whether the conditions in Sections 126(7)(b) and (c) of the MCAA can be met. From the approach suggested by the MMO (2013), the relevant authority will use information supplied by the Applicant with the licence application, advice from the SNCBs and any other relevant information to determine whether:
 - the benefit to the public of proceeding with the proposed activity clearly outweigh the risk of damage to the environment that will be created by said activity; and, if so, then whether
 - the Applicant can satisfy the relevant authority that they will make arrangements for the undertaking of measures of equivalent environmental benefit (MEEB) to the damage which the activity is likely to have on the MCZ. The above determinations will be addressed in sequence, that is, if the public benefit test is not "passed" then a consideration of MEEB would not be made as the application would be rejected.
- 3.4.2 In determining "public benefit" benefits at a national, regional or local level will be considered by the relevant authority. Applications for activities that are of solely private benefit do not qualify as delivering a benefit to the public.
- 3.4.3 Guidance from the MMO on what constitutes MEEB suggests that "types of compensatory measures that might be considered under the Habitats Directive will also be appropriate¹, although consideration will not be confined to those measures alone".

¹ Although the EU Habitats Directive does no longer apply, compensatory measures that might be considered for European sites under The Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019, could be referred to in developing MEEB.

4. MCZ Screening

This section lists the MCZs considered in the MCZ Screening that were identified due to their location in relation to Rampion 2 nature conservation study area or based on feedback received as part of the Scoping Opinion.

4.1 MCZs relevant to Rampion 2

- 4.1.1 In addressing the following point of the MCZ screening process "*the licensable activity is taking place within or near an area being put forward or already designated as an MCZ*", MCZs in the vicinity of the Proposed Development were identified.
- 4.1.2 The Scoping Report (RED, 2020) listed a number of MCZs as having the potential to be affected by the Proposed Development. This list was reviewed in light of SNCB comments. Natural England identified several MCZs with features that could potentially be affected by the Proposed Development even where these fall outside the benthic and fish and shellfish ecology study areas identified in the Scoping Report. **Figure 4-1** shows those sites that have been considered as relevant to the Proposed Development.

4.2 Impacts considered

- 4.2.1 To assess, whether "the activity is capable of affecting (other than insignificantly) either (i) the protected features of an MCZ; or (ii) any ecological or geomorphological process on which the conservation of any protected feature of an MCZ is (wholly or in part) dependant", the conclusions of relevant PEIR sections were reviewed. Impacts that have the potential to affect designated MCZ features were identified as part of the EIA Screening (Chapter 6, Chapter 8 and Chapter 9, Volume 2).
- 4.2.2 **Figure 4-1** shows there is no direct overlap between the PEIR Assessment Boundary and any of the MCZs. On this basis, impacts that relate to direct effects from construction or operation activities have been screened out from MCZ assessment. These impacts are:
 - Construction:
 - temporary habitat disturbance within the PEIR Assessment Boundary;
 - direct disturbance resulting from construction within the array and the export cable route (fish and shellfish features); and
 - temporary increase in suspended sediment and sediment deposition within the PEIR Assessment Boundary array area and offshore export cable corridor.
 - Operation and maintenance:

- long-term habitat loss/ alteration from the presence of foundations, scour protection and cable protection;
- underwater noise as a result of operational wind turbine generators (WTGs);
- indirect disturbance arising from electromagnetic field (EMF) generated by the current flowing through the cables buried to less than 1.5m below the surface;
- temporary habitat disturbance from jack-up vessels and cable maintenance activities; and
- colonisation of the WTGs and scour/ cable protection.
- Decommissioning:
 - temporary habitat disturbance from decommissioning of foundations, cables and rock protection; and
 - direct disturbance resulting from decommissioning within the array and the export cable route (fish and shellfish features).
- 4.2.3 Impacts that were assigned a 'negligible' magnitude in the PEIR EIA assessment and have therefore been screened out based on "insignificance", include:
 - Construction:
 - direct and indirect seabed disturbances leading to the release of sediment contaminants;
 - increased risk of introduction or spread of marine invasive non-native species (Marine Invasive Non-Native Species (INNS));
 - indirect disturbance arising from the accidental release of pollutants; and
 - indirect disturbance from increased noise and vibration from construction activities (benthic habitats and species).
 - Operation and maintenance:
 - increased risk of introduction or spread of Marine INNS due to presence of infrastructure and vessel movements;
 - changes to seabed habitats arising from effects on physical processes; and
 - ▶ indirect disturbance arising from the accidental release of pollutants.
 - Decommissioning:
 - direct and indirect seabed disturbances leading to the release of sediment contaminants;
 - increased risk of introduction or spread of marine INNS; and
 - indirect disturbance arising from the accidental release of pollutants.
- 4.2.4 Impacts that are considered further in the MCZ Assessment include:
 - Construction:



- mortality, injury, behavioural changes and auditory masking arising from noise and vibration (fish and shellfish features); and
- ▶ temporary localised increases in SSC and sediment deposition.
- Operation and maintenance:
 - increased risk of introduction or spread of Marine INNS (due to presence of infrastructure and vessel movements).
- Decommissioning:
 - mortality, injury, behavioural changes and auditory masking arising from noise and vibration (fish and shellfish features); and
 - temporary increase in SSC and sediment deposition (from removal of foundations, cables and rock protection).
- 4.2.5 For the purposes of this MCZ Assessment, decommissioning impacts are assessed together with construction impacts, as it is assumed that effects arising during decommissioning will be much less than those resulting from construction. This approach is considered to be precautionary.

4.3 MCZ Screening

- 4.3.1 **Table 4-1** lists those MCZs where connectivity between the impacts arising from the Rampion 2 and MCZ features exists.
- 4.3.2 Chapter 8 and Chapter 9, Volume 2 include detailed assessments of impacts screened in above. For some of the MCZs it is only select features that have a potential to be affected, other than insignificantly, by the Proposed Development. Table 4-1 identifies certain features, which are proposed to be screened out at this stage due to a lack of receptor sensitivity to the impact, or due to control measures to be implemented by Rampion 2 that would greatly reduce the risk of the effect occurrence.





Figure 4-1 Marine Conservation Zone (MCZ) designations of relevance to the Proposed Development

Table 4-1MCZs of relevance to the Proposed Development.

Name	Location relative to Rampion 2 PEIR Assessment Boundary	Features screened out of further assessment	Features screened into Stage 1
Kingmere MCZ	Lies to the east and adjacent to the proposed offshore cable corridor; falls within the benthic, fish ecology and noise ZOI as defined in relevant chapters.	- -	Black seabream (<i>Spondyliosoma cantharus</i>) Infralittoral rock and thin mixed sediment Subtidal chalk
Offshore Overfalls MCZ	Lies 0.21km southwest from the proposed array area and falls within the benthic ecology ZOI.	Indirect impacts do not have the potential to affect: English Channel outburst flood features	Subtidal coarse sediment Subtidal mixed sediments Subtidal sand
Selsey Bill and the Hounds MCZ	Lies 10.43km west of the proposed cable corridor and falls within the benthic, fish ecology and noise ZOI. Partially overlaps with the coastal processes study area.	 Indirect impacts do not have the potential to affect: Bracklesham Bay geological feature Indirect impacts arising from the Proposed Development will only have insignificant effects on: 1) high energy infralittoral rock; 2) low energy infralittoral rock; 3) moderate energy circalittoral rock; 4) moderate energy infralittoral rock; 	Short-snouted seahorse (<i>Hippocampus</i> <i>hippocampus</i>)



Name	Location relative to Rampion 2 PEIR Assessment Boundary	Features screened out of further assessment	Features screened into Stage 1
		5) peat and clay exposures;	
		6) subtidal mixed sediments; and	
		7) subtidal sand.	
Pagham Harbour MCZ	Lies 10.41km west of the proposed cable corridor and falls within the benthic ecology ZOI.	-	Defolin's lagoon snail (<i>Caecum armoricum</i>)
			Lagoon sand shrimp (<i>Gammarus insensibilis</i>)
			Seagrass beds
Utopia MCZ	Lies 14.36km northwest of the proposed array area and falls within the benthic ecology ZOI.	Indirect impacts arising from the Proposed Development will only have insignificant effect on:	-
		Fragile sponge and anthozoan communities on subtidal rocky habitats	
		1) high energy circalittoral rock;	
		2) moderate energy circalittoral rock;	
		3) subtidal coarse sediment;	
		4) subtidal mixed sediments; and	
		5) subtidal sand.	



Name	Location relative to Rampion 2 PEIR Assessment Boundary	Features screened out of further assessment	Features screened into Stage 1	
Beachy Head West MCZ	Lies 12.6km north-northeast of the proposed array area and falls within the benthic, fish ecology and noise ZOI.	Indirect impacts arising from the Proposed Development will only have insignificant	Short snouted seahorse (<i>H. hippocampus</i>)	
		effect on:	Native oyster (<i>Ostrea</i>	
		 high energy circalittoral rock; 	edulis)	
		2) infralittoral muddy sand;	Blue mussel (Mytilus edulis)	
		3) infralittoral rock and thin sandy sediment;	beds	
		4) infralittoral sandy mud;		
		5) intertidal coarse sediment;		
		6) littoral chalk communities;		
		7) moderate energy circalittoral rock;		
		8) subtidal chalk;		
		9) subtidal mixed sediments;		
		10)subtidal mud; and		
		11)subtidal sand.		
Beachy Head East MCZ	Lies 24.32km northeast of the proposed array area. The site falls outside the benthic and fish ecology ZOI but within the noise ZOI.	Benthic features that lie outside the relevant study area:	Short snouted seahorse (<i>H. hippocampus</i>)	
		1) high energy circalittoral rock;		
		2) littoral chalk communities;		
		3) moderate energy circalittoral rock;		



Name	Location relative to Rampion 2 PEIR Assessment Boundary	Features screened out of further assessment	Features screened into Stage 1
		4) peat and clay exposures;	
		5) ross worm (Sabellaria spinulosa) reefs;	
		6) subtidal chalk;	
		7) subtidal coarse sediment; and	
		8) subtidal sand.	
Bembridge MCZ	Lies 22.03km west of the proposed array area. The site falls outside the benthic ecology and fish ZOI but within the noise ZOI.	Indirect impacts arising from the Proposed Development will only have insignificant effect on:	Short snouted seahorse (<i>H. hippocampus</i>)
		1) native oyster (O. edulis).	
		Benthic features that lie outside the relevant study area:	
		1) maerl beds;	
		2) peacock's tail (<i>Padina pavonica</i>);	
		3) seagrass beds;	
		 sea-pen and burrowing megafauna communities; 	
		5) sheltered muddy gravels;	
		6) stalked jellyfish (<i>Calvadosia campanulata</i>);	



Name	Location relative to Rampion 2 PEIR Assessment Boundary	Features screened out of further assessment	Features screened into Stage 1
		 7) stalked jellyfish (<i>Haliclystus</i> spp); 8) subtidal coarse sediment; 9) subtidal mixed sediments; 10)subtidal mud; and 11)subtidal sand. 	
Offshore Brighton MCZ	Lies 23.50km south of the proposed array area. The site falls outside the benthic ecology ZOI.	 Benthic features that lie outside the relevant study area: 1) high energy circalittoral rock; 2) subtidal coarse sediment; and 3) subtidal mixed sediments. 	-

5. Background information

This section provides a summary of the baseline information for each of the MCZ, and the specific features considered within the Stage 1 assessment.

5.1 Kingmere MCZ

Site description

- 5.1.1 Kingmere MCZ lies between 5 and 10km offshore from the West Sussex coast, between Worthing and Littlehampton. The size of the MCZ is approximately 47.8 square kilometres (km²). The site contains excellent examples of rocky habitat and subtidal chalk outcropping reef systems that support a wide range of marine life, such as algae, sea squirts and sponges. Kingmere MCZ is one of the most important black seabream spawning sites within UK waters, as the rocky habitats and chalk outcrops provide ideal nesting grounds.
- 5.1.2 The site contains two Local Wildlife Sites (LWS): Kingmere Rocks and Worthing Lumps. These are non-statutory sites identified for local conservation and geological value by the local authorities and Sussex Seasearch.
- Chapter 9, Volume 2 provides characterisation of the benthic environment of the 5.1.3 offshore export cable corridor plus buffer, which lies adjacent to Kingmere MCZ. The information was compiled based of existing datasets and Rampion 2 site specific surveys (see Table 9-9, Chapter 9, Volume 2), as agreed with the consultees. Kingmere MCZ is named after Kingmere Rocks, which is a rocky and boulder reef running through the middle of the site, with areas of subtidal chalk, rock and mixed sediments. The benthic environment has been characterised using a predictive habitat model which was developed by Ocean Ecology Limited (OEL) to provide the most up to date full coverage knowledge on the distribution of sediments, biological zones and biotopes across the PEIR Assessment Boundary, using the newly acquired site specific acoustic data and wealth of existing groundtruthing data available. The full methodologies and results of the model are presented within Appendix 9.1: Predictive seabed mapping methods report, Volume 4. The key biotopes recorded from the predictive habitat mapping exercise note that the site includes S. spinulosa with kelp and red seaweeds on sand-influenced infralittoral rock; piddocks with a sparse associated fauna in sublittoral very soft chalk or clay.

Features screened into Stage 1 assessment

5.1.4 **Table 5-1** provides a description of the relevant features from Kingmere MCZ, which will be assessed in Stage 1, and includes the conservation objectives for these features. It should be noted, that Supplementary Advice on Conservation Objectives (SACOs) is also available for Kingmere MCZ and presents attributes which are ecological characteristics or requirements of the designated features within a site. These attributes are considered to best describe the site's ecological integrity and, if safeguarded, will enable achievement of the Conservation Objectives. Due regard to SACOs will be given as part of Stage 1 assessment.

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Feature sensitivity

5.1.5 As part of the conservation advice package, Natural England provides Advice on Operations (AOO), which identifies pressures associated with the most commonly occurring marine activities and provides a detailed assessment of the feature sensitivity to these pressures. The AOO can inform an initial assessment of whether a proposed activity may have an impact on a feature in the site. Pressures, associated with impacts scoped into this MCZ assessment (as listed in **Section 4.2**) and sensitivity of designated features is presented in **Table 5-2**.





Table 5-1Kingmere MCZ feature description and conservation objectives.

	Feature description	Conservation objective(s)
Infralittoral rock and thin mixed sediment	Infralittoral rock and thin mixed sediments covers over half the site but is absent from a patch in the south east corner and a corridor from the north-west to the south of the site. The uneven seabed is formed of outcrops of sandstone and mudstone exposures. The ground between the outcrops is covered with mixed sediments. Kingmere MCZ is a core record for this habitat type.	 To ensure that the protected habitats are: 1) maintained in favourable condition if they are already in
	At depths shallower than 8 meters (m) red algae dominates the upward facing surfaces of the rocks. As depth increases, algae are covered in a dense animal layer of primarily bryozoans. Encrusting coralline algae; sponges, sea squirts are present on the vertical rock faces. Tidal transport of sediments scours the area, and the bases of most rocky outcrops are kept free of any encrusting organisms. Crustaceans, including commercially important brown crab (<i>Cancer pagurus</i>) and European lobster (<i>Homarus gammarus</i>) are frequently found amongst the rocks	favourable condition, or2) brought into favourable condition if they are not already in favourable condition.
	The mixed sediments (cobble, pebble, gravel, shells and sand) support fan worms, in particular <i>Bispara volutacornis</i> . Due to the mobile nature of the sediments most of the associated species are mobile but occasional sessile species, such as keel worm (<i>Pomatoceros triqueter</i>) and dahlia anemone (<i>Urticina felina</i>) are present. The sediment provides a habitat for cuckoo rays (<i>Leucoraja naevus</i>) and nursery grounds for several commercially important fish species.	For each protected habitat feature, favourable condition means that, within a zone both: (a) its extent is stable or increasing; and (b) its





	Feature description	Conservation objective(s)
Subtidal chalk	Kingmere MCZ contains two prominent examples of subtidal chalk cliff (Worthing Lumps). These are present in the north-east corner of the site and represent the best exposure of subtidal chalk cliffs in Sussex. Bored by bivalve molluscs, the chalk is particularly species rich and used by a range of invertebrates, shellfish, worm species, bryozoans, coralline algae, sea squirts, sponges and sea stars.	structure and function, its quality, and the composition of its characteristic biological communities (including diversity and abundance of species forming part or inhabiting the habitat) are sufficient to ensure that it remains in a condition which is healthy and does not deteriorate.
	The chalk cliffs are sheer faces 1 to 4m proud of the seabed divided into three distinct habitats. The flat cliff tops, dominated by mixed sediment of sand and gravel have been stabilised by significant populations of foliaceous red algae, some foliaceous green algae and calcareous red algae. In some places the sheer cliff faces form narrow gullies, bored by piddocks (<i>Pholas dactylus</i>) and exposed to high tidal flows, the cliffs are relatively unstable, and colonisation of sessile species is limited. The unstable nature of the cliff faces results in an abundance of crevices, and these are widely used by mobile species such as European lobster, brown crab, conger eels (<i>Conger conger</i>), leopard-spotted goby (<i>Thorogobius ephippiatus</i>), and tompot blenny (<i>Parablennius gattorugine</i>). The base of the cliffs is characterised by exposed chalk and in places, a sparse cover of pebble and cobble. Due to the strong tidal flows channelled by the chalk cliffs, sessile species are typically absent.	
Black seabream (<i>S.</i> <i>cantharus</i>)	Kingmere MCZ protects the spawning stage of black seabream and is one of the longest studied black seabream breeding sites in the UK.	1) In relation to black seabream spawning
	Black seabream is commonly 35 centimetres (cm) in length but can grow up to 60cm. This is a long-lived species, with juveniles maturing at around 20cm in length as females, and later changing to become male. Adult black seabream exhibit a schooling behaviour and feed primarily on seaweed and invertebrates, in particular young cuttlefish, which can also be found in Kingmere MCZ.	habitat to (a) maintain the habitat in favourable condition if already in favourable condition, or (b) bring into favourable
	Black seabream migrate within the English Channel. They overwinter in the deeper (50 to 100m) waters of the western channel and as the water warms up they move to shallower inshore waters. They arrive and spawn in Kingmere in the spring/summer months, typically	condition if not already in favourable condition.





Feature description	Cor obje	servation ective(s)
between March and July. The spawning season has high variability betwe example in 2014 spawning black seabream were present in February. It i breeding and spawning behaviour are likely to be driven by changes in w Black seabream exhibit highly selective 'nesting behaviour', which require nesting habitat: near horizontal bedrock with a thin layer of sediment. Kin contains a substantial area of this habitat, particularly in the eastern half of ideal for nesting black seabream. The male fish clears an area of sedime roughly one metre in diameter for the female to lay her eggs directly onto males remain at the nest site guarding it from predators and keeping the sediment. The males remain in the vicinity to guard their nests until the ep hatching the larvae enter the plankton and the male abandons the nest. A adults disperse and can be found in a variety of habitats including seagra habitats down to 300m.	een years, for 2) is thought that the vater temperature. es very specific of the site, so it is ent to create a nest of clean bedrock. The eggs clear of ggs hatch. After After spawning the ass beds and sandy For of b the con hab qua ena spe to s nes egg	To ensure the black seabream population occurring in the MCZ be free of the disturbance of a kind ikely to significantly affect the survival of its members or their ability to aggregate, nest, or lay, fertilise or guard eggs during breeding. the spawning habitat lack seabream within MCZ, favourable dition means that the itat is of sufficient lity and quantity to ble individuals of this cies using the habitat urvive, aggregate, t, lay, fertilise or guard s during breeding.



Table 5-2 Kingmere MCZ feature sensitivity to pressures that may arise from impacts screened into Stage 1.

Pressures	Infralittoral rock and thin mixed sediment	Subtidal chalk	Black seabream (S. cantharus)
Physical change (to another sediment type)	not relevant	Sensitive	Insufficient evidence
Changes in suspended solids (water clarity)	Sensitive	Sensitive	not relevant
Deoxygenation	Sensitive	Insufficient evidence	Sensitive
Introduction or spread of invasive non-indigenous species	Sensitive	Sensitive	Insufficient evidence
Smothering and siltation rate changes (Light)	Sensitive	Sensitive	Sensitive
Smothering and siltation rate changes (Heavy)	Sensitive	Sensitive	Sensitive
Underwater noise changes, vibration	not relevant	not relevant	Sensitive

5.2 Offshore Overfalls MCZ

Site description

- 5.2.1 Offshore Overfalls MCZ is located in the eastern English Channel, approximately 18km south-east of the Isle of Wight. The seabed is predominantly coarse sediment with areas of sand, mixed sediments and exposed bedrock. The site protects 593km² of seabed, with a depth range between from 20 and 70m, the deeper areas coinciding with a valley system running through the site from the south to the north-east. The valley is part of the English Channel outburst flood features (Quaternary fluvio-glacial erosion features), which are protected within the site for their importance to the study of geomorphology (feature screened out of further assessment, see **Section 4**).
- 5.2.2 The variety of habitats found support a diverse range of species, including sponges, hydroids, bryozoans on the cobbles and boulders and crabs, sea stars and sea urchins. Burrowing worms live within the sediment alongside burrowing anemones and bivalves such as scallops.
- Chapter 9, Volume 2 provides characterisation of the benthic environment within 523 the PEIR Assessment Boundary and the 15km buffer, which lies adjacent to Offshore Overfalls MCZ. The information was compiled based of existing datasets and Rampion 2 site specific surveys, as agreed with the consultees. Offshore Overfalls MCZ lies adjacent to the Rampion 2 array area. Offshore Overfalls MCZ is designated for several broad-scale habitats including subtidal coarse sediment, subtidal mixed sediments, subtidal sand and English Channel outburst flood features. As noted in Section 5.1 the benthic environment has been characterised using a predictive habitat model with the full methodologies and results of the model presented within Appendix 9.1: Predictive seabed mapping methods report, Volume 4. The predictive habitat mapping exercise identified the key biotopes present at the site comprise infralittoral mobile clean sand with sparse fauna; Mediomastus fragilis, Lumbrineris species and venerid bivalves in circalittoral coarse sand or gravel; Spirobranchus triqueter with barnacles and bryozoan crusts on unstable circalittoral cobbles and pebbles; Crepidula fornicata with ascidians and anemones on infralittoral coarse mixed sediment: and Flustra foliacea and Hydrallmania falcata on tide-swept circalittoral mixed sediment.

Features screened into Stage 1

Table 5-3 provides a description of the relevant features from Offshore Overfalls MCZ, which will be assessed in Stage 1, and includes the conservation objectives for these features. There is currently no equivalent to Natural England's site-specific AOO produced by JNCC for Offshore Overfalls MCZ.
Table 5-3 Offshore Overfalls MCZ feature description and conservation objectives.

Feature description

Conservation objective(s)

Subtidal Subtidal sand can be found in two isolated patches that fringe the northern margin of the Northern Palaeovalley and is associated with marine bedforms that form a collection of sediment ripples and waves. These marine bedforms are predominantly comprised of sandy sediment although some coarse or mixed sediments may be present in the troughs of the sediment waves.

Subtidal coarse sediments are confined to the northeast of the MCZ. Evidence from 2012 survey shows bedrock structures visible at the seabed in this region, covered with a thin veneer of mixed sediments. Bedrock structures are sporadic along the south east of the site and in an area to the north-west known as the 'Overfalls'.

Subtidal coarse sediment is predominant within the MCZ, covering almost threequarters of the site. Most of the feature is located on the flanks and terraces of the Northern Palaeovalley and within the valley floor.

Offshore Overfalls MCZ is incredibly diverse with 278 infauna species and 45 epifauna species identified from the 2012 survey. Some of the biotopes are characterised by comparatively high numbers of the bristle worm (*Notomastus latericeus*), along with the pea urchin (*Echinocyamus pusillus*). The infauna biological communities appear to be dominated by a diverse range of burrowing worms (polychaetes). Bivalves such as the Queen scallop (*Aequipecten opercularis*) occur in smaller numbers along with the long-clawed porcelain crab (*Pisidia longicornis*) and the common brittlestar (*Ophiothrix fragilis*). The epifauna, living on top of the sediment, are dominated by hydroids and bryozonas and also include a range of sponges, sea anemones and sea stars. Various species of fish are also present including thornback ray (*Raja clavata*), red gurnard (*Chelidonichthys cuculus*), small-spotted catshark (*Scyliorhinus canicula*), and bib (*Trisopterus luscus*).

To ensure that the broadscale habitat remain in or are brought into favourable condition, such that its:

- 1) extent is stable or increasing; and
- structures and functions, its quality, and the composition of its characteristic biological communities are such as to ensure that it is in a condition which is healthy and not deteriorating.

5.3 Selsey Bill and the Hounds MCZ

Site description

- 5.3.1 Selsey Bill and the Hounds MCZ covers an area of approximately 16km² and is located by the town of Selsey in West Sussex on the south coast of England. The landward boundary is at Mean Low Water and the site adjoins the Bracklesham Bay Site of Special Scientific Interest. The MCZ lies within the Eastern Channel region of English waters.
- 5.3.2 Selsey Bill and the Hounds MCZ is well known for its high biodiversity and species richness, supported by a variety of different habitats ranging from rocky habitats to soft sandy sediments. The site provides additional protection for a series of geological interest features that are exposed on, and underlie, the foreshore within Bracklesham Bay. These rock features, known locally as "The Hounds", consist of outcrops of limestone and clay exposures and are representative of a coherent rock system stretching across the MCZ from the northwest corner to the southeast. These rock features provide a range of habitats that support a wide variety of species, with deeper or vertical rock faces dominated by animals such as anemones, sponges, and sea squirts. The rare and cryptic short-snouted seahorse (*H. hippocampus*) is known to be present along this area of coastline.
- 5.3.3 The site also protects one of the best examples of peat and clay exposures on the southeast coast. Within the southeast of the site is the Mixon Hole, a dramatic 20m drop in the seafloor exposing clay cliffs capped with limestone.

Features screened into Stage 1

- 5.3.4 Due to the lack of impact pathway (for Bracklesham Bay geological feature) or distance from the proposed activities, meaning any potential impacts arising from Rampion 2 may only result in insignificant effects, all the habitat features of Selsey Bill and the Hounds MCZ were screened out of further assessment (see Section 4).
- 5.3.5 Short-snouted seahorse is the only feature that has been screened in for Stage 1 assessment. **Table 5-4** provides an overarching description of the species, as it can be found in other nearby MCZs. There is no conservation advice available for Selsey Bill and the Hounds MCZ, however, the general management approach for this feature as outlined in the MCZ Factsheet, recommends to *'maintain in a favourable condition'*.

5.4 Beachy Head West MCZ

Site description

- 5.4.1 The Beachy Head West MCZ runs parallel to the East Sussex coastline, extending from Brighton to the Beachy Head cliffs near Eastbourne, and protects a total area of approximately 24km².
- 5.4.2 The Beachy Head West MCZ protects a multitude of habitat types and their associated species. The extensive intertidal wave cut chalk platforms and subtidal



chalk ridges present are considered to be among the best examples of chalk habitat in the south east. The MCZ includes an extensive intertidal wave cut chalk platform and subtidal chalk ridges, of which the surface is pitted with holes. These holes are created by burrowing molluscs (piddocks) and, once empty, can be inhabited by and provide shelter to animals such as crabs and anemones. Blue mussel (*M. edulis*) beds and native oysters (*O. edulis*) are found densely packed on the chalk ridges creating a mosaic of habitats.

5.4.3 The rare and cryptic short-snouted seahorse (*H. hippocampus*) is known to be present along this area of coastline. The habitats present support large areas of sea squirt beds and areas of *Pentapora foliacea* (a colonial bryozoan) are thought to be present. Black legged kittiwakes, common and sandwich terns regularly feed within the site.

Features screened into Stage 1

- 5.4.4 Due to distance from the proposed activities, meaning any potential impacts arising from Rampion 2 may only result in insignificant effects, all the habitat features of Beachy Head West MCZ were screened out of further assessment (see **Section 4**).
- **Table 5-4** provides a description of the relevant features from Beachy Head West MCZ, which will be assessed in Stage 1, and includes the conservation objectives for these features. The table also includes an overarching description of the short-snouted seahorse feature, which will also be applicable to other nearby MCZs. At this stage, detailed conservation advice is only available for Beachy Head West MCZ.
- 5.4.6 It should be noted that SACOs is also available for Beachy Head West MCZ and presents attributes which are ecological characteristics or requirements of the designated features within a site. These attributes are considered to best describe the site's ecological integrity and, if safeguarded, will enable achievement of the Conservation Objectives. Due regard to SACOs will be given as part of Stage 1 assessment.

Feature sensitivity

5.4.7 For Beachy Head West MCZ, Natural England AOO is also available. Pressures associated with impacts scoped into this MCZ assessment (as listed in Section 4.2) and sensitivity of features that have been screened into further assessment is presented in Table 5-5.



Table 5-4 Beachy Head West MCZ feature description and conservation objectives

	Feature description	Conservation objective(s)
Blue mussel (<i>M. edulis</i>) beds	Blue mussel beds are known to be present at Seaford Head and Beachy Head which are within the Seven Sisters Voluntary Marine Conservation Area in both the subtidal and intertidal zones, often densely packed on the chalk ridges. The rough, discontinuous chalk present in the Beachy Head West MCZ provides a suitable substrate for the settlement of the larval stages. Within the sites, settlement also occurs on broken shell or where sand and mud sediments are present as a thin veneer on a hard substrate.	To ensure that the protected habitats are 1. maintained in favourable condition if they are already in favourable condition, or 2. brought into favourable condition if they are not already in favourable condition. For each protected feature, favourable condition means that, within a zone (a) its extent is stable or increasing; and (b) its structure and functions, its quality, and the composition of its characteristic biological communities (including diversity and abundance of species forming part or inhabiting the habitat) are sufficient to ensure that its condition remains healthy and does not deteriorate. Any temporary deterioration in condition is to be disregarded if the habitat is sufficiently healthy and resilient to enable its recovery.
Native oyster (<i>O. edulis</i>)	Native oysters are present throughout the Beachy Head West MCZ but most notably at Peacehaven and Seaford bay where the hard chalk and rock substrates present are particularly suitable for settlement. They can however be found on a variety of seabed types, from bedrock to mud. At present all records have been of individual oysters and no beds or communities have been found.	 To ensure that the protected species are: 1) maintained in favourable condition if they are already in favourable condition; or 2) brought into favourable condition if they are not already in favourable condition.



	Feature description	Conservation objective(s)
Short snouted seahorse (<i>H.</i> hippocampus)	Short-snouted seahorse is one of only two species found in UK waters. They are usually brownish in colour, smooth and lack the fleshy "mane" seen in some other seahorse species. Seahorses have excellent eyesight and hunt for their food by sight. They feed on a variety of small crustaceans, such as shrimp, but do not have teeth so instead suck food up through their snouts. Seahorses require protection as they are particularly vulnerable to threats which cause damage to their habitat. Short snouted seahorses are found in shallow waters, often in estuaries or associated with seagrass meadows, particularly in the summer. For example, they have been recorded in the western zone of the Beachy Head West MCZ, in the east part of the Selsey Bill and the Hounds MCZ, and in shallow waters of Bembridge MCZ. During the winter	For each species of marine fauna, favourable condition means that the population within the MCZ is supported in numbers which enable it to thrive, by maintaining (a) the quality and quantity of its habitat; and (b) the number, age and sex ratio of its population. Any temporary reduction of numbers of a species is to be disregarded if the population is sufficiently thriving and resilient to enable its recovery. Any alteration to a feature brought about entirely by natural processes is to be disregarded when determining whether a protected feature is in favourable condition.
	months it is believed that short-snouted seahorses migrate out of the nearshore areas and into deeper and calmer waters in the English Channel.	

Table 5-5 Beachy Head West MCZ feature sensitivity that may arise from impacts screened into Stage 1

Pressure	Blue mussel (<i>M.</i> <i>edulis</i>) beds	Native oyster (<i>O.</i> edulis)	Short-snouted seahorse (<i>H. hippocampus</i>)
Physical change (to another sediment type)	Sensitive	Not sensitive	not relevant
Changes in suspended solids (water clarity)	Not sensitive	Sensitive	Sensitive
Introduction or spread of invasive non-indigenous species	Sensitive	Sensitive	Insufficient evidence
Smothering and siltation rate changes (Light)	Sensitive	Sensitive	not relevant
Smothering and siltation rate changes (Heavy)	Sensitive	Sensitive	not relevant
Underwater noise changes, vibration	not relevant	not relevant	Sensitive

5.5 Beachy Head East MCZ

Site description

- 5.5.1 Beachy Head East MCZ is an inshore site that covers an area of 195km² and is located along the coast near Eastbourne in East Sussex, in the Eastern Channel region.
- 5.5.2 Beachy Head East has a sandstone and chalk reef system which provides a home for a wide range of species. Between Beachy Head point and Holywell, a chalk reef extends from the subtidal area up to the coast and white cliffs forming sheltered rockpools at low tide. The soft chalk is pitted by holes created by rockboring piddocks. Once empty, these holes can also house crabs, sponges, anemones and worms. Chalk extending above the high water mark supports rich littoral chalk communities, dominated by seaweeds.
- 5.5.3 Short-snouted seahorses (*H. hippocampus*) and Ross worm (*S. spinulosa*) reefs are also found within this site. Ross worms build tubes from sand and shell fragments. Large colonies can form reefs, stabilising the seabed, providing shelter for other creatures and boosting the number and types of species in the area.
- 5.5.4 The site is also considered an important nursery area for herring, plaice and Dover sole. Plaice and Dover sole survive by camouflaging themselves in subtidal sand allowing them to avoid predators, whilst subtidal sand and coarse sediments provide a habitat for invertebrate species on which adult fish prey. High and moderate energy circalittoral rock features provide habitats for a wide variety of animals due to the varying conditions that can be found in these areas.

Features screened into Stage 1

- 5.5.5 Due to distance from the proposed activities, meaning any potential impacts arising from Rampion 2 may only result in insignificant effects, all the habitat features of Beachy Head East MCZ were screened out of further assessment (see **Section 4**).
- 5.5.6 Short-snouted seahorse is the only feature that has been screened in for Stage 1 assessment. **Table 5-6** provides an overarching description of the species, as it can be found in other nearby MCZs. There is no conservation advice available for Beachy Head East MCZ, however, the general management approach for this feature, as outlined in the MCZ Factsheet, recommends to '*maintain in a favourable condition*'.

5.6 Pagham Harbour MCZ

Site description

5.6.1 Pagham Harbour MCZ is one of the smallest designated MCZs which encompasses a total area of almost 3km², including the main harbour area, Ferry Pool lagoon and the shingle spits which form the mouth of the harbour. The longterm preservation of the harbour and surrounding habitats has allowed two



extremely rare invertebrate species to thrive here – Defolin's lagoon snail (*Caecum armoricum*) and Lagoon sand shrimp (*Gammarus insensibilis*) The MCZ also protects the intertidal seagrass beds in the harbour, conserving this valuable habitat in the face of global and national declines.

Features screened into Stage 1

- 5.6.2 **Table 5-6** provides a description of the relevant features from Pagham Harbour MCZ, which will be assessed in Stage 1, and includes the conservation objectives for these features.
- 5.6.3 It should be noted that SACOs is also available for Pagham Harbour MCZ and presents attributes which are ecological characteristics or requirements of the designated features within a site. These attributes are considered to best describe the site's ecological integrity and, if safeguarded, will enable achievement of the Conservation Objectives. Due regard to SACOs will be given as part of Stage 1 assessment.

Feature sensitivity

5.6.4 For Pagham Harbour MCZ, Natural England AOO is also available. Pressures associated with impacts scoped into this MCZ assessment (as listed in Section 4.2) and sensitivity of features that have been screened into further assessment is presented in Table 5-7.

Table 5-6 Pagham Harbour MCZ feature description and conservation objectives.

	Feature description	Conservation objective(s)
Defolin's lagoon snail (<i>C.</i> <i>armoricum</i>)	Some of the sheltered shingle areas of Pagham Harbour host colonies of Defolin's lagoon snail – an extremely small and rare snail, measuring only 2 millimetres (mm) long, with an unusual, tubular shell structure. Within the UK live colonies have only ever been located in three sites. Limited information is available on the lifecycle of this mollusc – it inhabits the interstitial spaces between loose shingle where seawater percolates through the pebbles. Colonies have been found to have up to 100,000 individuals per m ² . Although they can migrate between the layers of shingle to reach better conditions, the small size of the snails make it difficult to migrate across longer distances to other populations, making them vulnerable to habitat loss, and any change to isolated coastal lagoons may result in the loss of existing colonies.	 To ensure that the protected species are: 1) maintained in favourable condition if they are already in favourable condition; or 2) brought into favourable condition if they are not already in favourable condition. For each species of marine fauna, favourable condition means that the population within the MCZ is supported in numbers which enable it to thrive, by maintaining (a) the quality and quantity of its habitat; and (b) the number, age and sex ratio of its population.
Lagoon sand shrimp (<i>G.</i> <i>insensibilis</i>)	The lagoon sand shrimp is found only in Ferry Pool Lagoon. It is a nationally rare animal, and the coastal lagoons it inhabits are a priority 1 UK Biodiversity Action Plan (BAP) habitat. This small shrimp grows up to just 2cm long, and inhabits shallow brackish lagoons with fine sediments. The shrimp's life-cycle and the enclosed nature of lagoons, means that there is little opportunity for the species to spread beyond their home lagoon. Significant alteration to the lagoon habitat may result in the local extinction. Populations of the shrimp are often found associated with the 'spaghetti algae' <i>Chaetomorpha linum</i> , a filamentous seaweed which can form large mats, and is a predominant food source for the shrimp. The seaweed acts as a supporting habitat and should be considered in relation to the conservation objectives of the site.	Any temporary reduction of numbers of a species is to be disregarded if the population is sufficiently thriving and resilient to enable its recovery. Any alteration to a feature brought about entirely by natural processes is to be disregarded when determining whether a protected feature is in favourable condition.





	Feature description	Conservation objective(s)
Seagrass beds	Seagrass beds are globally threatened and/or declining habitats. Seagrass beds are rich, highly productive habitats which provide numerous ecosystem services. In Pagham harbour the rhizomes (equivalent of roots) stabilise the soft sediments while the canopy of leaves creates a diverse and productive habitat providing shelter for small animals, settlement space for encrusting organisms and a source of food for herbivores (specifically dark-bellied brent geese). Two intertidal seagrass beds exist in Pagham: one small transient bed in the eastern side of the harbour, and a larger, more permanent bed in the western side. Seagrass is also a useful indicator of environmental quality and is used as an indicator species in the Water Framework Directive (WFD).	 To ensure that the protected habitats are: 1) maintained in favourable condition if they are already in favourable condition, or 2) brought into favourable condition if they are not already in favourable condition. For each protected feature, favourable condition means that, within a zone (a) its extent is stable or increasing; and (b) its structure and functions, its quality, and the composition of its characteristic biological communities (including diversity and abundance of species forming part or inhabiting the habitat) are sufficient to ensure that its condition remains healthy and does not deteriorate. Any temporary deterioration in condition is to be disregarded if the habitat is sufficiently healthy and resilient to enable its recovery.

Table 5-7 Pagham Harbour MCZ feature sensitivity to pressures that may arise from impacts screened into Stage 1

Pressure	Seagrass beds	Defolin's lagoon snail (<i>C. armoricum</i>)	Lagoon sand shrimp (<i>G.</i> <i>insensibilis</i>)
Physical change (to another sediment type)	Sensitive	Sensitive	Not sensitive
Smothering and siltation rate changes (Light)	Sensitive	Sensitive	Sensitive
Changes in suspended solids (water clarity)	Sensitive	-	Sensitive
Introduction or spread of invasive non-indigenous species	Sensitive	Insufficient evidence	Sensitive
Smothering and siltation rate changes (Heavy)	Sensitive	Sensitive	Sensitive
Deoxygenation	Not sensitive	Sensitive	Sensitive
Water flow (tidal current) changes, including sediment transport considerations	Sensitive	Not sensitive	Sensitive
Underwater noise changes	-	-	Insufficient evidence

5.7 Bembridge MCZ

Site description

- 5.7.1 Bembridge MCZ is an inshore site that covers an area of approximately 75km². The site lies adjacent to the east coast of the Isle of Wight from Nettlestone Point in the north to Ventnor in the south. The site encompasses the intertidal and subtidal areas extending to the edge of the deep water channel approach into the Eastern Solent. The site overlaps with the South Wight Maritime Special Area of Conservation (SAC) and includes species and features not protected by the SAC.
- 5.7.2 The area within Bembridge MCZ is highly diverse and includes a wide range of habitats, from rocky shores and intertidal sediments to deep water habitats supporting features such as sea pens and burrowing megafauna. Several species, including the peacock's tail seaweed (*P. pavonica*), are at the most eastern edge of their distribution and are considered to seed other populations around the Isle of Wight.
- 5.7.3 The central area of the site is dominated by an extensive area of limestone and chalk bedrock providing a complex system of crevices, tunnels and pools supporting very diverse algae and invertebrate species such as crustaceans (crabs, lobsters and barnacles) and molluscs (mussels, oysters and cockles).
- 5.7.4 The large areas of subtidal mixed sediments act as a supporting substrate to several important features such as maerl beds. Maerl is a fragile, calcareous, red seaweed that forms large mats and provides shelter for many other species. It is highly sensitive to seabed activities and takes a long time to recover from damage.
- 5.7.5 The site also designated for the short-snouted seahorse (*H. hippocampus*) as well as two species of stalked jellyfish.

Features screened into Stage 1

5.7.6 Short-snouted seahorse is the only feature that has been screened in for Stage 1 assessment. **Table 5-6** provides an overarching description of the species, as it can be found in other nearby MCZs. There is no conservation advice available for Bembridge MCZ, however, the general management approach for this feature, as outlined in the MCZ Factsheet, recommends to '*maintain in a favourable condition*'.

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6. Stage 1 Assessment

This section presents a draft Stage 1 assessment of the effects of Rampion 2 construction, operation and decommissioning on the protected MCZ features as described in **Section 5**.

6.1 Assessment outline

- 6.1.1 Impacts identified in **Section 4.2** are discussed individually in light of their potential to affect MCZ features identified in **Section 5** and subsequently, hinder the conservation objectives of each MCZ.
- 6.1.2 The conclusions of Stage 1 assessment presented in this section rely on the best available information at the PEIR stage and will be updated further based on the PEIR consultation feedback, future ETG discussions and additional site-specific data gathered.
- 6.1.3 As the Supplementary Advice on Conservation Objectives (SACO) was available for Kingmere MCZ Beachy Head West MCZ and Pagham Harbour MCZ, a summary matrix was prepared for these sites and includes features and impacts screened in earlier in the MCZ assessment. Pressures identified in **Table 5-3**, **Table 5-5** and **Table 5-7** and included in Stage 1 assessment were those, that could result from the impacts screened in for the Proposed Development to which individual features were either:
 - Sensitive;
 - there was **Insufficient Evidence** to assess sensitivity for the site conservation advice package (best available evidence at the time of application will be considered); and
 - **Not Assessed** (while a sensitivity assessment was not carried out, best available evidence at the time of application will be considered).
- 6.1.4 **Table 6-1, Table 6-3** and **Table 6-4** present a summary matrix of specific feature attributes (where available) considered within Stage 1 assessment and the conclusions of the assessment. The sections that follow the table provide justification for the conclusions made.
- 6.1.5 In the absence of SACO for other sites, it was assumed that attributes listed for the short-snouted seahorse (*H. hippocampus*) in Beachy Head West MCZ could also be applied for Selsey Bill and the Hounds MCZ, Beachy Head East MCZ and Bembridge MCZ.
- 6.1.6 As detailed SACOs for Offshore Overfalls MCZ were not available, the draft Stage 1 Assessment was carried out in respect to the wider conservation objectives set out for the habitat features of the site.

6.2 Kingmere MCZ

Table 6-1 Attribute-impact pathway summary matrix for Stage 1 assessment for relevant features of the Kingmere MCZ.

	Construction and I	Operation	
Attribute	Mortality, injury, behavioural changes and auditory masking arising from noise and vibration	Temporary localised increases in SSC and sediment deposition	Increased risk of introduction or spread of Marine INNS
Black seabream (Spondyliosom	a cantharus)		
Nest abundance	No pathway	Non-significant effect	No pathway
Population: age/size frequency	Potential for significant effect	Non-significant effect	No pathway
Population: population size	Potential for significant effect	Non-significant effect	No pathway
Population: recruitment and reproductive capability	Potential for significant effect	Non-significant effect	No pathway
Presence and spatial distribution of the species	Potential for significant effect	Non-significant effect	No pathway
Structure and function: biological connectivity	Potential for significant effect	Non-significant effect	No pathway
Structure: Non-native species and pathogens	No pathway	No pathway	No pathway
Supporting habitat: extent and distribution	No pathway	Non-significant effect	No pathway

	Construction and D	Operation		
Attribute	Mortality, injury, behavioural changes and auditory masking arising from noise and vibration	Temporary localised increases in SSC and sediment deposition	Increased risk of introduction or spread of Marine INNS	
Supporting habitat: food availability	No pathway	No pathway	No pathway	
Supporting processes: physico- chemical properties	No pathway	No pathway	No pathway	
Supporting processes: sediment movement and hydrodynamic regime	No pathway	No pathway	No pathway	
Supporting processes: water quality - contaminants	No pathway	No pathway	No pathway	
Supporting processes: water quality - dissolved oxygen	No pathway	Non-significant effect	No pathway	
Supporting processes: water quality - nutrients	No pathway	No pathway	No pathway	
Supporting processes: water quality - turbidity	No pathway	Non-significant effect	No pathway	
Infralittoral rock and thin mixed sediment				
Distribution: presence and spatial distribution of biological communities	No pathway	Non-significant effect	Non-significant effect	

	Construction and I	Operation	
Attribute	Mortality, injury, behavioural changes and auditory masking arising from noise and vibration	Temporary localised increases in SSC and sediment deposition	Increased risk of introduction or spread of Marine INNS
Extent and distribution	No pathway	Non-significant effect	Non-significant effect
Structure and function: presence and abundance of key structural and influential species	No pathway	Non-significant effect	Non-significant effect
Structure: non-native species and pathogens	No pathway	No pathway	Non-significant effect
Structure: physical structure of rocky substrate	No pathway	No pathway	No pathway
Structure: sediment composition and distribution	No pathway	Non-significant effect	Non-significant effect
Structure: species composition of component communities	No pathway	Non-significant effect	Non-significant effect
Supporting processes: energy / exposure	No pathway	No pathway	No pathway
Supporting processes: physico- chemical properties	No pathway	No pathway	No pathway
Supporting processes: sediment contaminants	No pathway	No pathway	No pathway

	Construction and I	Operation	
Attribute	Mortality, injury, behavioural changes and auditory masking arising from noise and vibration	Temporary localised increases in SSC and sediment deposition	Increased risk of introduction or spread of Marine INNS
Supporting processes: sediment movement and hydrodynamic regime	No pathway	No pathway	No pathway
Supporting processes: sedimentation rate	No pathway	Non-significant effect	No pathway
Supporting processes: water quality - contaminants	No pathway	No pathway	No pathway
Supporting processes: water quality - dissolved oxygen	No pathway	Non-significant effect	No pathway
Supporting processes: water quality - nutrients	No pathway	No pathway	No pathway
Supporting processes: water quality - turbidity	No pathway	Non-significant effect	No pathway
Subtidal chalk			
Distribution: presence and spatial distribution of biological communities	No pathway	Non-significant effect	Non-significant effect
Extent and distribution	No pathway	No pathway	Non-significant effect

	Construction and I	Operation	
Attribute	Mortality, injury, behavioural changes and auditory masking arising from noise and vibration	Temporary localised increases in SSC and sediment deposition	Increased risk of introduction or spread of Marine INNS
Structure and function: presence and abundance of key structural and influential species	No pathway	Non-significant effect	Non-significant effect
Structure: non-native species and pathogens	No pathway	No pathway	Non-significant effect
Structure: physical structure of rocky substrate	No pathway	No pathway	No pathway
Structure: species composition of component communities	No pathway	Non-significant effect	Non-significant effect
Supporting processes: energy / exposure	No pathway	No pathway	No pathway
Supporting processes: physico- chemical properties	No pathway	No pathway	No pathway
Supporting processes: sedimentation rate	No pathway	Non-significant effect	No pathway
Supporting processes: water quality - contaminants	No pathway	No pathway	No pathway
Supporting processes: water quality - dissolved oxygen	No pathway	Non-significant effect	No pathway

	Construction and I	Operation	
Attribute	Mortality, injury, behavioural changes and auditory masking arising from noise and vibration	Temporary localised increases in SSC and sediment deposition	Increased risk of introduction or spread of Marine INNS
Supporting processes: water quality - nutrients	No pathway	No pathway	No pathway
Supporting processes: water quality - turbidity	No pathway	Non-significant effect	No pathway

Construction and decommissioning

Mortality, injury, behavioural changes and auditory masking arising from noise and vibration

Overview

- 6.2.1 Construction activities, particularly the pile-driving of foundations for offshore structures, will result in high levels of underwater noise that will be audible to fish over several kilometres around the Proposed Development (Chapter 9, Volume 2). The extent to which intense underwater sound might cause adverse impacts in species is dependent upon the incident sound level, source frequency, duration of exposure, and/or repetition rate of an impulsive sound (see, for example, Hastings and Popper, 2005). As a result, scientific interest in the hearing abilities of aquatic species has increased. Studies are primarily based on evidence from high level sources of underwater noise such as blasting or impact piling, as these sources are likely to have the greatest immediate environmental impact and therefore the clearest observable effects, although interest in chronic noise exposure is increasing.
- 6.2.2 At the highest levels of noise, sub-lethal and lethal effects may occur, resulting in injury and in extreme cases, the death of exposed fish. The impacts of underwater sound on marine species can be broadly summarised as follows:
 - mortality and mortal injury;
 - recoverable injury;
 - Temporary Threshold Shift (TTS) a temporary reduction in hearing sensitivity caused by exposure to intense sound; and
 - behavioural impacts and auditory masking.
- 6.2.3 A detailed assessment has been carried out and is presented in **Chapter 9**, **Volume 2**. The assessment was informed by predictive underwater noise modelling at three representative locations, with consideration of the key parameters associated with these two scenarios (for example hammer energies and pile diameters). Full details of the modelling undertaken are presented in **Appendix 11.2: Marine mammal quantitative underwater noise impact assessment, Volume 4**.
- 6.2.4 Sound measurements underwater are usually expressed using the decibel (dB) scale. The sound pressure level (SPL) is normally used to characterise noise and vibration of a continuous nature, such as drilling, boring, continuous wave sonar, or background sea and river noise levels. Peak SPLs are often used to characterise transient sound from impulsive sources, such as percussive impact piling. SPL_{peak} is calculated using the maximum variation of the pressure from positive to zero within the wave. This represents the maximum change in positive pressure (differential pressure from positive to zero) as the transient pressure wave propagates. A further variation of this is the peak-to-peak SPL (SPL_{peak-to-peak}) where the maximum variation of the pressure from positive to negative is considered.

- 6.2.5 When considering the noise from transient sources, the issue of the duration of the pressure wave is often addressed by measuring the total acoustic energy of the wave. This form of analysis was used by Bebb and Wright (1953, 1954a, 1954b, 1955), and later by Rawlins (1987), to explain the apparent discrepancies in the biological effect of short and long-range blast waves on human divers. More recently, this form of analysis has been used to develop criteria for assessing injury ranges for fish and marine mammals from various noise sources (Popper *et al.,* 2014 and Southall *et al.,* 2019). The Sound Exposure Level (SEL) sums the acoustic energy over a measurement period, and effectively takes account of both the SPL of the sound and the duration it is present in the acoustic environment. This is typically used in the form of SEL_{cum} meaning, cumulative sound exposure level.
- 6.2.6 The modelling results for SEL_{cum} assume a fleeing animal, with the receptor fleeing from the source at a constant rate of 1.5 meters per second (ms⁻¹). This is considered relatively slow in relation to data from Hirata (1999) and thus is considered conservative, however throughout the assessment a 'static receptor model' is also considered for the purposes of undertaking a precautionary assessment.
- 6.2.7 The large number of, and variation in, fish species leads to a challenge in production of a generic noise criterion, or range of criteria, for the assessment of noise impacts. Whereas previous studies applied broad criteria based on limited studies of fish that are not present in UK waters (for example, McCauley *et al.*, 2000) or measurement data not intended to be used as criteria (Hawkins *et al.*, 2014), the publication of Popper *et al.* (2014) provides an authoritative summary of the latest research and guidelines for fish exposure to sound and uses categories for fish that are representative of the species present in UK waters. The Popper *et al.* (2014) study groups species of fish by whether they possess a swim bladder, and whether it is involved in its hearing.
- 6.2.8 The maximum design scenario considered with respect to underwater noise from piling is 116 monopiles being driven with a 4,400 kilojoules (kJ) hammer energy. The hammer energy will only be raised to 4,400kJ when absolutely necessary. Hammer energies will likely start at low levels (soft start/ramp up) and gradually increase to the maximum required installation energy. The temporal maximum design scenario represents the longest duration of effects from subsea noise and assumes a scenario whereby piled jacket foundations are used for all offshore structures. The temporal scenario includes a conservative estimate of maximum hammer energy of 2,500kJ for pin-pile installation and a maximum total duration of piling of 3,000 hours.
- 6.2.9 Activities resulting in vibration may relate to dredging, for example, for seabed preparation, foundation drilling and piling. Vibration produced by vessels has been assumed not to be significant. Most vibration transmitted into the water column will radiate as underwater noise, most vibration is transmitted through the ground/seabed. The impacts of vibration are assumed not to exceed those of underwater noise that has been assessed in greater detail.

Black seabream (S. cantharus)

- 6.2.10 Black seabream is likely to use acoustic cues to inform their behaviour (predator avoidance, hunting and communication). However, specific studies on the effects of noise for black seabream are not available. Black seabream could be potentially at a greater risk of disturbance by underwater noise during the breeding period, particularly for nest-guarding males. The breeding season for black seabream from Kingmere MCZ is typically between March and July.
- 6.2.11 Consideration been given to the results of the underwater noise modelling and the conclusions of Appendix 11.2, Volume 4, as black seabream is a noise-sensitive species. Chapter 9, Volume 2 has grouped black seabream with 'Fishes with swim bladders that are close, but not intimately connected to the ear.' Table 6-2 summarises the noise levels for two criteria that were used for black seabream.

Potential effect	Noise level (dB re 1 μPa SPL/ dB re 1 μPa2 s SE	
	SLP _{peak}	SEL _{cum}
Mortality and mortal injury	>207	207
Recoverable injury	>207	203
TTS	-	186
Behavioural impacts, auditory masking	163	-

Table 6-2Black seabream noise assessment criteria.

- 6.2.12 Black seabream feature is considered to be sensitive to noise and vibration pressure (**Table 5-2**). Black seabream spawning and nesting grounds are located within the noise contours of piling within the Rampion 2 array area. Taking into consideration the locations of black seabream spawning and nesting grounds relative to the piling locations and the limited temporal impacts, the magnitude of the impact that construction activities relating to Rampion 2 will have on black seabream is considered to range from **very low** for injurious effects to **medium** for TTS and behavioural effects.
- 6.2.13 The following attributes relevant to black seabream MCZ feature may be impacted by noise and vibration:
 - population age size frequency;
 - population size;
 - population recruitment and reproductive capability;
 - presence and spatial distribution of the species; and
 - structure and function: biological connectivity.
- 6.2.14 For mortality and mortal injury, recoverable injury and TTS there is limited interaction with the areas of primary importance for breeding black seabream and

therefore these effects will be of **minor** significance (**non-significant**) and **will not hinder** the conservation targets of the above attributes.

- 6.2.15 The interaction with the Kingmere MCZ and areas of highest spawning activity the magnitude for behavioural effects is considered to be **medium**. In the absence of mitigation, potential noise impact on black seabream behaviour, particularly during the breeding season, may result in a **moderate adverse effect** and therefore has the potential to **hinder** the conservation targets of the above attributes and the conservation objectives of the MCZ.
- 6.2.16 Whilst a specific mitigation measure has not been embedded into the design of the Proposed Development at this stage, there are a suite of suitable measures currently being considered. Such measures provide a demonstrable reduction in magnitude and therefore reduce the overall significance to below moderate significance (and therefore non-significant for the purposes of the MCZ Assessment). The potential measures include noise abatement at source, through multiple different technology options, or a seasonal restriction on piling activity. Mitigation options will be investigated and defined through the ES process, and therefore available to reduce the effect and as such it is not considered likely that a significant effect will be realised. At this stage it is assumed that Stage 2 assessment will not be required for black seabream feature from Kingmere MCZ.
- 6.2.17 The magnitude of impacts arising during decommissioning is expected to be **low**, which will result in **non-significant** effects for black seabream with regards to mortality and mortal injury, recoverable injury, TTS and behavioural effects, and will and **will not hinder** the conservation targets of the above attributes.

Infralittoral rock and thin mixed sediment, and subtidal chalk

- 6.2.18 Noise and vibration impacts have been screened out for benthic species and habitats (see **Section 4.2**).
- 6.2.19 In addition, Advise on Operations (AOO) does not indicate any sensitivity of the two habitat features of the MCZ to underwater noise changes or vibration. Therefore, this impact has not been assessed as no pathway exists to affect any of the conservation attributes of the habitat features.

Temporary localised increases in suspended sediment concentrations (SSC) and sediment deposition

Overview

6.2.20 During seabed preparation for foundation installation and cable burying, sediment re-suspension will occur followed by subsequent re-deposition on the seabed. The siltation rates will depend on the hydrological conditions and the sediment particle size distribution. Though modern equipment and techniques reduce the resuspension of sediment during cable burial, repair or removal, the magnitude of SSC increase will also depend on the equipment and methodology used. A greater sediment dispersion distance means the sediment will be more thinly dispersed over a wider area, whilst a smaller sediment dispersion distance gives a high deposition depth over a smaller distance. For example, ploughing on chalk may

result in a wide-spreading suspended sediment plume, while dredged up gravelly sand will settle close to the source.

- 6.2.21 Three main sources of SSC and sediment deposition may arise from Rampion 2: drilling for foundations, trenching for cables, and seabed preparation activities (such as seabed levelling for gravity base foundations and sandwave clearance). **Chapter 9, Volume 2** concludes that sediment plumes caused by seabed preparation and installation activities are expected to go beyond the 15km tidal excursion buffer, with plumes expected to occur over a maximum distance of 16km (spring) from the source. Sediment plumes are expected to quickly dissipate after cessation of the activities, due to settling and wider dispersion with the concentrations reducing quickly over time to background levels. Sediment deposition will consist primarily of coarser sediments deposited close to the source, with a small proportion of silt deposition (reducing exponentially from source).
- 6.2.22 Increased SSC and deposition are likely to occur where the offshore export cable corridor is in relatively close proximity to the Kingmere MCZ. Any fine material being dispersed by construction works is likely to be widely distributed and will quickly form part of the background concentration of Suspended Particulate Matter (SPM) in the nearshore and therefore is unlikely to settle in measurable thickness locally. The magnitude of impact on these protected features is therefore, considered to be **minor**.
- 6.2.23 Taking the above into consideration, the impact of increased SSC and deposition from construction activities is expected to be short-term, intermittent and of relatively localised extent (approximately one tidal excursion) and reversible.

Black seabream

- 6.2.24 Adult fish would normally be able to detect significantly elevated levels of suspended sediment and avoid the affected area (ABP Research, 1999; EMU Limited, 2004). Juvenile fish are generally considered to be more sensitive to suspended sediment plumes than adults (Wilber and Clarke, 2001). This may arise as a consequence of their reduced mobility compared to adults and increased biological susceptibility (for instance smaller gill surface areas (ABP Research, 1999)). The Proposed Development fish and shellfish study area (Chapter 8, Volume 2) was identified as supporting both foraging and nursery grounds for a number of commercially and ecologically important species. These species are expected to be resilient to any increase in SSC as winter storm events in their natural environment cause temporary increases in suspended sediment concentration of a similar magnitude to that which will be produced by the construction operations.
- 6.2.25 **Table 5-2** states that black seabream feature is **sensitive** to pressures that may arise from temporary localised increases in SSC and sediment deposition. Black seabream spawn on the seabed. Eggs and larvae do not have the same capacity to avoid increased SSCs as juvenile or adult fish as they are either passively drifting in the water column or present on/ attached to benthic substrates. The redeposition of sediments may affect fish eggs and larvae through smothering. There is currently no evidence of black seabream nests being impacted from

suspended sediment from nearby aggregate extraction work (EMU Limited, 2012a).

- 6.2.26 **Chapter 8, Volume 2** concludes that temporary localised increase in SSC and sediment deposition associated with cable and foundation installation may affect black seabream nesting grounds. However, any interaction will inherently be of short-term duration.
- 6.2.27 The following attributes relevant to black seabream MCZ feature (may be impacted by the increase in SSC and sediment deposition:
 - nest abundance;
 - population age size frequency;
 - population size;
 - population recruitment and reproductive capability;
 - presence and spatial distribution of the species;
 - structure and function: biological connectivity;
 - supporting habitat: extent and distribution;
 - supporting processes: water quality dissolved oxygen; and
 - supporting processes: water quality turbidity.
- 6.2.28 With respect to the above attributes, due to **minor** magnitude, the short-term duration of the potential impacts and existing baseline environment conditions, the effect will be **non-significant**. The Proposed Development is **will not hinder** the conservation targets of these attributes or the overall conservation objectives of the black seabream feature of Kingmere MCZ.

Infralittoral rock and thin mixed sediment

- 6.2.29 The faunal and algal communities within Kingmere MCZ are likely to have a certain tolerance to particles suspended in the water column. A range of background suspended sediment concentrations have been observed temporally within the vicinity of the site. Significant fluctuations could have a negative impact should the communities be at the limit of their tolerance in natural conditions. Sedimentation on benthic habitats can influence community composition, alter species growth rates and potentially affect reproductive success, reducing larval recruitment.
- 6.2.30 Table 5-2 states that infralittoral rock and thin mixed sediment feature is sensitive to pressures that may arise from temporary localised increases in SSC and sediment deposition. Characteristic biotopes associated with the infralittoral rock and thin mixed sediments feature of the MCZ are assessed in Chapter 9, Volume 2. Most biotopes are naturally subject to sedimentation and scour and characterising species are therefore likely to tolerate intermittent episodes of sediment movement and deposition. Where heavy deposition is likely to occur, this would result in complete burial of the characterising species and the effect of this pressure will be mediated by the length of exposure to the deposit, however, this is

only likely to occur in small discreet areas close which are not expected to overlap with the MCZ.

6.2.31 The following attributes relevant to the infralittoral rock and thin mixed sediment MCZ feature be impacted by the increase in SSC and sediment deposition:

- distribution: presence and spatial distribution of biological communities;
- extent and distribution;
- structure and function: presence and abundance of key structural and influential species;
- structure: sediment composition and distribution;
- structure: species composition of component communities;
- supporting processes: sedimentation rate;
- supporting processes: water quality dissolved oxygen; and
- supporting processes: water quality turbidity.
- 6.2.32 With respect to the above attributes, due to **minor** magnitude, the short-term duration of the potential impacts and existing baseline environment conditions, the effect will be **non-significant**. The Proposed Development **will not hinder** the conservation targets of the above attributes or the overall conservation objectives of the infralittoral rock and thin mixed sediment feature of Kingmere MCZ.

Subtidal Chalk

- 6.2.33 **Table 5-2** states that subtidal chalk is **sensitive** to pressures that may arise from temporary localised increases in SSC and sediment deposition. Subtidal chalk feature includes a key representative biotope 'piddocks with a sparse associated fauna in sublittoral very soft chalk or clay (A4.231)', which has been assessed in **Chapter 9, Volume 2.** This biotope has been identified as having a 'medium' sensitivity in EIA terms to both light and heavy smothering, as per the MarESA assessment. Piddocks are essentially sedentary and as siphons are relatively short, siltation from fine sediments that add to existing silt layers could be lethal. However, they are expected to fully recover within 2 to 10 years where the resource has not been completely impacted.
- 6.2.34 The following attributes relevant to the subtidal chalk MCZ feature may be impacted by the increase in SSC and sediment deposition:
 - distribution: presence and spatial distribution of biological communities;
 - structure and function: presence and abundance of key structural and influential species;
 - structure: species composition of component communities;
 - supporting processes: sedimentation rate;
 - supporting processes: water quality dissolved oxygen; and
 - supporting processes: water quality turbidity.



6.2.35 With respect to the above attributes, due to **minor** magnitude, the short-term duration of the potential impacts and existing baseline environment conditions, the effect will be **non-significant.** The Proposed Development **will not hinder** the conservation targets of the above attributes or the overall conservation objectives of the subtidal chalk feature of Kingmere MCZ.

Operation

Increased risk of introduction or spread of Marine INNS

- 6.2.36 There is a risk that the introduction of hard substrate into a sedimentary habitat will enable the colonisation of the introduced substrate by Marine INNS that might otherwise not have had a suitable habitat for colonisation, thereby enabling their spread. Aquatic organisms may be transferred to new locations as biofouling. All craft have some biofouling, even if recently cleaned or anti-fouled. Moreover, thousands of marine species can be carried in ships' ballast water. Movement of operation and maintenance vessels in and out of the PEIR Assessment Boundary has the potential to impact upon benthic ecology and biodiversity of benthic habitats.
- 6.2.37 Non-native species may become invasive and displace native organisms by preying on them or out-competing them for resources such as food, space or both. In some cases this has led to the loss of indigenous species from certain areas (JNCC, 2004). A pathogen causes disease or illness to its host. Pathogens include bacteria, viruses, protozoa and fungi. Within Kingmere MCZ, chains of live slipper limpet (*Crepidula fornicata*) and heaps of dead shells have been observed on the mixed sediment areas (Fugro EMU Ltd., 2013) in the vicinity of Kingmere MCZ.
- 6.2.38 Embedded environmental measures, which include a biosecurity plan, will ensure that the risk of potential introduction and spread of Marine INNS from increased vessel traffic will be minimised. The magnitude of the impact of the introduction or spread of Marine INNS is considered to be **minor**, indicating that there may only be a discernible change for any length of time, over a small area of the receptor that does not threaten benthic subtidal ecology features, undermine regional ecosystem functions or diminish biodiversity.

Infralittoral rock and thin mixed sediment and Subtidal chalk

6.2.39 **Table 5-2** states that both habitat features from Kingmere MCZ are **sensitive** to pressures that may arise from introduction or spread of Marine INNS. **Chapter 9**, **Volume 2** evaluated sensitivity of two key biotopes that are associated with the habitat features of Kingmere MCZ. These are A5.141 '*Spirobranchus triqueter* with barnacles and bryozoan crusts on unstable circalittoral cobbles and pebbles' and A4.231 'Piddocks with a sparse associated fauna in sublittoral very soft chalk or clay'. These two characteristic biotopes are expected to be not sensitive to Marine INNS based on a high resistance and high resilience. The confidence of this assessment is low as the assessment is based on expert judgement, as no baseline data is available.

- 6.2.40 The following attributes relevant to both infralittoral rock and thin mixed sediment and subtidal chalk features may be impacted by Marine INNS:
 - extent and distribution;
 - distribution: presence and spatial distribution of biological communities;
 - structure and function: presence and abundance of key structural and influential species;
 - structure: non-native species and pathogens; and
 - structure: species composition of component communities.
- 6.2.41 In addition, the following attribute of infralittoral rock and thin mixed sediment may be sensitive to Marine INNS:
 - structure: sediment composition of component communities.
- 6.2.42 With respect to the above attributes, due to **minor** magnitude and existing baseline environment conditions, the effect will be **non-significant.** The Proposed Development **will not hinder** the conservation targets of the above attributes or the overall conservation objectives of the infralittoral rock and thin mixed sediment or the subtidal chalk features of Kingmere MCZ.

6.3 Offshore Overfalls MCZ

Overview

- 6.3.1 Three broad-scale habitats of the Offshore Overfalls MCZ were scoped into Stage 1 assessment: subtidal sand, subtidal mixed sediments and subtidal coarse sediments. Description of these features and conservation objectives for the site are provided in **Table 5-3**.
- 6.3.2 Due to the nature of these designated features and the site location in relation to Rampion 2 the effects of the proposed activities on protected habitats would be expected to be similar to those impacting the infralittoral rock and thin mixed sediment feature of the Kingmere MCZ. The expected nature and magnitude of the impacts have therefore been described in **Section 6.2**. The following section will provide feature-specific sensitivity information, where available, and assess the potential for the impacts to hinder the overarching conservation objectives for the site.

Construction and decommissioning

Mortality, injury, behavioural changes and auditory masking arising from noise and vibration

6.3.3 Noise and vibration impacts have been screened out for benthic species and habitats (see **Section 4.2**). In addition, for broad-scale habitat features of Kingmere MCZ no pathway for noise impacts to affect the feature was identified, based on Natural England' AOO indicating no interaction with said pressures. The

same approach to sensitivity has been assumed for habitat features of Offshore Overfalls MCZ.

Temporary localised increases in suspended sediment concentrations (SSC) and sediment deposition

- 6.3.4 A range of background suspended sediment concentrations have been observed temporally within the vicinity of the site. Significant fluctuations could have a negative impact should the communities be at the limit of their tolerance in natural conditions. Sedimentation on benthic habitats can influence community composition, alter species growth rates and potentially affect reproductive success, reducing larval recruitment.
- 6.3.5 Offshore Overfalls MCZ site description suggests that A5.142 '*Mediomastus fragilis, Lumbrineris* spp. and venerid bivalves in circalittoral coarse sand or gravel' biotope is the most characteristic of the site. This biotope is assessed in **Chapter 9, Volume 2**, which suggests that this biotope is likely to be naturally subject to sedimentation and scour, therefore characterising species are likely to tolerate intermittent episodes of sediment movement and deposition. Where heavy deposition is likely to occur, this would result in complete burial of the characterising species and the effect of this pressure will be mediated by the length of exposure to the deposit, however, this is only likely to occur in small discreet areas close which are not expected to overlap with the MCZ. In the absence of MCZ-specific pressure-sensitivity matrix, sensitivity of broad-scale habitat features was assumed from **Chapter 9, Volume 2** and is considered to be **low** for all three habitat features.
- 6.3.6 **Section 6.2** describes the magnitude of temporary localised increases in SSC and sediment deposition as **minor**. The effect arising from increased SSC and deposition will therefore be **non-significant**. The Proposed Development will not hinder the conservation objectives of the broad-scale habitat features of Offshore Overfalls MCZ.

Operation

Increased risk of introduction or spread of Marine INNS

- 6.3.7 In the absence of MCZ-specific pressure-sensitivity matrix, sensitivity of broadscale habitat features was assumed from **Chapter 9**, **Volume 2**. Biotope A5.142 *'M. fragilis, Lumbrineris* spp. and venerid bivalves in circalittoral coarse sand or gravel' is the most prevalent in Offshore Overfalls MCZ and has **high** sensitivity to Marine INNS based on low resilience and no resistance.
- 6.3.8 **Section 6.2** describes the magnitude of the impact of the introduction or spread of Marine INNS to be **minor**, indicating that there may only be a discernible change for any length of time, over a small area of the receptor that does not threaten benthic subtidal ecology features, undermine regional ecosystem functions or diminish biodiversity. Based on **high** sensitivity and **minor** magnitude of potential impact the effect arising from introduction of Marine INNS will be **non-significant**. The Proposed Development **will not hinder** the conservation objectives of the broad-scale habitat features of Offshore Overfalls MCZ.

6.4 Beachy Head West MCZ, Selsey Bill and the Hounds MCZ, Beachy Head East MCZ and Bembridge MCZ

Table 6-3 Attribute-impact pathway summary matrix for Stage 1 assessment for relevant features of the Beachy Head West MCZ, Selsey Bill and the Hounds MCZ, Beachy Head East MCZ and Bembridge MCZ

	Construction and Decommissioning		Operation
Attribute	Mortality, injury, behavioural changes and auditory masking arising from noise and vibration	Temporary localised increases in SSC and sediment deposition	Increased risk of introduction or spread of Marine INNS
Short-snouted seahorse (<i>H. hippocampus</i>)			
Population: population size	Non-significant effect	No pathway	No pathway
Population: recruitment and reproductive capability	Non-significant effect	No pathway	No pathway
Presence and spatial distribution of the species	Non-significant effect	No pathway	No pathway
Structure and function: biological connectivity	Non-significant effect	No pathway	No pathway
Structure: Non-native species and pathogens	No pathway	No pathway	Non-significant effect
Supporting habitat: extent and distribution	No pathway	Non-significant effect	No pathway



	Construction and Decommissioning		Operation
Attribute	Mortality, injury, behavioural changes and auditory masking arising from noise and vibration	Temporary localised increases in SSC and sediment deposition	Increased risk of introduction or spread of Marine INNS
Supporting processes: physico-chemical properties	No pathway	No pathway	No pathway
Supporting processes: sediment movement and hydrodynamic regime	No pathway	No pathway	No pathway
Supporting processes: water quality - contaminants	No pathway	No pathway	No pathway
Supporting processes: water quality - dissolved oxygen	No pathway	Non-significant effect	No pathway
Supporting processes: water quality - nutrients	No pathway	No pathway	No pathway
Supporting processes: water quality - turbidity	No pathway	Non-significant effect	No pathway
Native oyster (<i>O. edulis</i>)			
Population: population size	No pathway	Non-significant effect	No pathway
Population: recruitment and reproductive capability	No pathway	Non-significant effect	No pathway
Presence and spatial distribution of the species	No pathway	Non-significant effect	Non-significant effect



	Construction and Decommissioning		Operation
Attribute	Mortality, injury, behavioural changes and auditory masking arising from noise and vibration	Temporary localised increases in SSC and sediment deposition	Increased risk of introduction or spread of Marine INNS
Structure: Non-native species and pathogens	No pathway	No pathway	Non-significant effect
Supporting habitat: extent and distribution	No pathway	Non-significant effect	No pathway
Supporting processes: physico-chemical properties	No pathway	No pathway	No pathway
Supporting processes: sediment movement and hydrodynamic regime	No pathway	No pathway	No pathway
Supporting processes: water quality - contaminants	No pathway	No pathway	No pathway
Supporting processes: water quality - dissolved oxygen	No pathway	Non-significant effect	No pathway
Supporting processes: water quality - nutrients	No pathway	No pathway	No pathway
Supporting processes: water quality - turbidity	No pathway	Non-significant effect	No pathway
Blue mussel (<i>M. edulis</i>) beds			
Extent and distribution	No pathway	No pathway	Non-significant effect



	Construction and Decommissioning		Operation
Attribute	Mortality, injury, behavioural changes and auditory masking arising from noise and vibration	Temporary localised increases in SSC and sediment deposition	Increased risk of introduction or spread of Marine INNS
Extent of subtidal biogenic reef	No pathway	No pathway	Non-significant effect
Extent of supporting habitat	No pathway	Non-significant effect	No pathway
Structure and function: presence and abundance of key structural and influential species	No pathway	Non-significant effect	Non-significant effect
Structure: age / size frequency	No pathway	No pathway	No pathway
Structure: non-native species and pathogens	No pathway	No pathway	Non-significant effect
Structure: population density	No pathway	No pathway	No pathway
Structure: species composition of the community	No pathway	Non-significant effect	Non-significant effect
Supporting processes: areas with conditions suitable for reef formation	No pathway	Non-significant effect	No pathway
Supporting processes: physico-chemical properties	No pathway	No pathway	No pathway
Supporting processes: sedimentation rate	No pathway	Non-significant effect	No pathway



	Construction and Decommissioning		Operation	
Attribute	Mortality, injury, behavioural changes and auditory masking arising from noise and vibration	Temporary localised increases in SSC and sediment deposition	Increased risk of introduction or spread of Marine INNS	
Supporting processes: water movement and energy	No pathway	No pathway	No pathway	
Supporting processes: water quality - contaminants	No pathway	No pathway	No pathway	
Supporting processes: water quality - dissolved oxygen	No pathway	Non-significant effect	No pathway	
Supporting processes: water quality - nutrients	No pathway	No pathway	No pathway	
Supporting processes: water quality - turbidity	No pathway	Non-significant effect	No pathway	

Construction and decommissioning

Mortality, injury, behavioural changes and auditory masking arising from noise and vibration

Overview

6.4.1 **Section 6.2** includes a detailed description of potential impacts of noise and vibration, as well as provides a description of the worst case scenario and the approach to assessing this impact with a reference to **Chapter 9, Volume 2**.

Short-snouted seahorse (*H. hippocampus*)

- Little is known about hearing in seahorses, it is, therefore, difficult to assess the 6.4.2 potential effects of anthropogenic sound on these animals. Studies on other seahorse species suggest, they may be sensitive to noise disturbance. There is limited literature and research on the effects of underwater noise on seahorse. A study by Anderson et al. (2011) examined the behavioural response of the lined seahorse (Hippocampus erectus) exposed to 123dB to 137dB root mean square (rms) re 1µPa in a tank for one month. Seahorses responded both behaviourally and physiologically, displaying a chronic stress response. Seahorse exposed to loud noises showed a behavioural response such as irritation and distress, and a physiological response, including lower weight, worse body condition, higher plasma cortisol and other blood measures indicative of stress, and more parasites in their kidneys. In addition to the primary and secondary stress indices in the blood and plasma, seahorses exhibited tertiary indices (for example growth, behaviour, and mortality) (Anderson et al., 2011). However, the study found that some of the variability in these measures (such as time spent mobile) subsided after the first week, presumably due to habituation. It is important to note that Radford et al. (2016) recorded shipping sound levels of 124dB rms re 1 pascal (µPa), seismic survey noise levels at 131dB rms, and pile driving at 141dB rms; in this context seahorses can be expected to habituate to the noise levels that may be experienced during piling for the Proposed Development. A study conducted by Hastings et al. (2010) determined hearing thresholds of lined seahorse (H. erectus) using exposures to tone bursts between 50 hertz (Hz) and 21.6 kilohertz (kHz). At low frequencies the seahorses have thresholds similar to bony fishes, however, at frequencies above 2kHz, their auditory sensitivity was similar to that of clupeiform species (such as herring) (Hastings et al., 2020).
- 6.4.3 As such short-snouted seahorse was grouped with 'Fishes that have special structures mechanically linking the swim bladder to the ear' for the purposes of assessment in **Chapter 9**, **Volume 2**. These fishes are sensitive primarily to sound pressure, although they also detect particle motion. These species have a wider frequency range, extending to several kHz and generally show higher sensitivity to sound pressure than fishes. The same assessment criteria were used for Group 4 fishes and as Group 3, thus noise levels presented in **Table 5-4** for black seabream were also applied to short-snouted seahorse.
- 6.4.4 Short-snouted seahorse feature is considered to be **sensitive** to noise and vibration pressure (**Table 5-4**). Taking into consideration the locations of MCZs

where short-snouted seahorse is a designated feature relative to the piling locations, the magnitude of the impact is considered to be **low** for all the potential effects arising from noise and vibration impacts during construction (mortality and mortal injury, recoverable injury, TTS, and behavioural impacts and auditory masking). The following attributes relevant to short-snouted seahorse MCZ feature may be impacted by noise and vibration:

- population size;
- population recruitment and reproductive capability;
- presence and spatial distribution of the species; and
- structure and function: biological connectivity.
- 6.4.5 With respect to the above attributes, due to **low** magnitude and temporary duration of the potential impacts, the effect will be **non-significant**. The Proposed Development is **will not hinder** the conservation targets of these attributes or the overall conservation objectives of the short-snouted seahorse feature of Beachy Head West MCZ, Selsey Bill and the Hounds MCZ, Beachy Head East MCZ and Bembridge MCZ.

Native oyster (O. edulis) and Blue mussel (M. edulis) beds

- 6.4.6 There are no specific criteria currently published in respect of shellfish species. Shellfish are considered a potential sensitive receptor to particle motion from piling, due to typically having low motility, and therefore are considered unlikely to be able to vacate the area at the onset of 'soft -start piling'. **Chapter 9, Volume 2** assesses the magnitude of effect on shellfish receptors from impacts associated with piling within the array area as being **Iow**.
- 6.4.7 Roberts (2015) suggested that vibroacoustic stimuli may elicit and affect antipredator responses, such as startle response in crabs and valve closure in mussels. Such responses will effectively be distractions from routine activities such as feeding. Studies of marine bivalves (blue mussels) exposed to a single airgun at a distance of 0.5m have shown no effects after exposure (Kosheleva, 1992). However, behavioural changes in mussels have also been observed in response to simulated pile-driving, with increased filtration rates observed in blue mussels (Spiga *et al.*, 2016).
- 6.4.8 Reactions to noise and vibrations are not likely to interfere with the ecological function of shellfish, with some mobile mollusc species likely to return to the area after the impact activity has stopped. However, Natural England's AOO (Table 5-5) indicates that noise and vibration pressures are not relevant to either blue mussel beds or native oyster features of Beachy Head West MCZ (not sensitive for the purposes of this assessment). Therefore, this impact has been assessed as non-significant and the Proposed Development is will not hinder the conservation objectives of the native oyster (*O. edulis*) or blue mussel (*M. edulis*) beds features of Beachy Head West MCZ.
Temporary localised increases in suspended sediment concentrations (SSC) and sediment deposition

Overview

6.4.9 The nature of activities resulting in increases in SSC and sediment deposition during construction is described in **Section 6.2**. Further details of the worst case scenario assessment can be found in **Chapter 9**, **Volume 2**.

Short-snouted seahorse (*H. hippocampus*)

- 6.4.10 Short-snouted seahorse and long-snouted are unlikely to be affected by an increase in suspended sediment and smothering from construction activities as they are mobile and are able to slowly swim away from the affected area. Moreover, habitat preference is within shallow water, amongst seagrass and algae, although short-snouted seahorse can also be found in rocky areas to a depth of 77m (Sabatini and Ballerstedt, 2007). It is considered, that intolerance to smothering is low, with high recoverability for both species (Neish, 2007; Sabatini and Ballerstedt, 2007). Short-snouted seahorse feature is considered to be **sensitive** to changes in suspended solids (water clarity) a pressure that may arise from increased SSC (**Table 5-5**).
- 6.4.11 Temporary sediment deposition from increased SSC may result in indirect effects to seahorses as a result of potential habitat disturbance. Taking into consideration the locations of MCZs where short-snouted seahorse is a designated feature, which are on the far end of the coastal processed study area relative to the PEIR Assessment Boundary, the magnitude of the impact is considered to be **negligible**. The following attributes relevant to short-snouted seahorse MCZ feature may be impacted by increases in SSC and sediment deposition:
 - supporting habitat: extent and distribution;
 - water quality dissolved oxygen; and
 - water quality turbidity.
- 6.4.12 With respect to the above attributes, due to **negligible** magnitude and temporary duration of the potential impacts, the effect will be **non-significant**. The Proposed Development is **will not hinder** the conservation targets of these attributes or the overall conservation objectives of the short-snouted seahorse feature of Beachy Head West MCZ, Selsey Bill and the Hounds MCZ, Beachy Head East MCZ and Bembridge MCZ.

Native oyster (O. edulis)

- 6.4.13 Native oyster feature is considered to be **sensitive** to pressures that may arise from increases in SSC and sediment deposition, namely: changes in suspended solids (water clarity) and smothering and siltation rate changes (**Table 5-5**).
- 6.4.14 The following attributes relevant to native oyster MCZ feature may be impacted by increases in SSC and sediment deposition:
 - population size;

- recruitment and reproductive capability;
- presence and spatial distribution of the species;
- supporting habitat: extent and distribution;
- water quality dissolved oxygen; and
- water quality turbidity.

Blue mussel (*M. edulis*) beds

- 6.4.15 Blue mussel beds feature is considered to be **sensitive** to pressures that may arise from increases in SSC and sediment deposition, namely, physical change to another seabed type and smothering and siltation rate changes (**Table 5-5**).
- 6.4.16 The following attributes relevant to blue mussel beds MCZ feature may be impacted by increases in SSC and sediment deposition:
 - presence and abundance of key structural and influential species;
 - species composition of the community;
 - supporting processes: areas with conditions suitable for reef formation;
 - extent of supporting habitat;
 - supporting processes: sedimentation rate;
 - water quality dissolved oxygen; and
 - water quality turbidity.
- 6.4.17 Due to the distance between the Rampion 2 PEIR Assessment Boundary and Beachy Head West MCZ, which is located over 12km from the Proposed Development, the magnitude of impact from an increase in SSC from construction within the array area and offshore export cable corridor is assessed as **negligible**.
- 6.4.18 With respect to the above attributes for both native oyster and blue mussel beds, due to **negligible** magnitude and temporary duration of the potential impacts, the effect will be **non-significant**. The Proposed Development **will not hinder** the conservation targets of these attributes or the overall conservation objectives of the native oyster and blue mussel beds features of Beachy Head West MCZ.

Operation

Increased risk of introduction or spread of Marine INNS

Overview

6.4.19 **Section 6.2** summarises the nature of activities that may result in an increased risk of introduction or spread of Marine INNS (such as presence of infrastructure and ballast water from vessels). Further details of the worst case scenario assessment can be found in Chapter 9: Benthic subtidal and intertidal ecology.



- 6.4.20 Embedded environmental measures, which include a biosecurity plan, will ensure that the risk of potential introduction and spread of Marine INNS from increased vessel traffic will be minimised. The magnitude of the impact of the introduction or spread of Marine INNS is considered to be **minor**, indicating that there may only be a discernible change for any length of time, over a small area of the receptor that does not threaten benthic subtidal ecology features, undermine regional ecosystem functions or diminish biodiversity.
- 6.4.21 The direct or indirect introduction of invasive non-indigenous species, for example, Chinese mitten crabs, slipper limpets, Pacific oyster and their subsequent spreading and out-competing of native species. Natural England's AOO suggests that both native oyster and blue mussel beds are **sensitive** to introduction or spread of Marine INNS (**Table 5-5**).

Native oyster (O. edulis)

- 6.4.22 The following attributes relevant to native oyster feature of Beachy Head West MCZ may be impacted by Marine INNS:
 - Presence and spatial distribution of the species
 - Structure: Non-native species and pathogens

Blue mussel (M. edulis) beds

- 6.4.23 The following attributes relevant to blue mussel beds of Beachy Head West MCZ may be impacted by Marine INNS:
 - extent and distribution;
 - extent of subtidal biogenic reef;
 - structure and function: presence and abundance of key structural and influential species;
 - structure: non-native species and pathogens; and
 - structure: species composition of the community.
- 6.4.24 With respect to the above attributes, due to **minor** magnitude and existing baseline environment conditions, the effect on both the native oyster and blue mussel beds will be **non-significant.** The Proposed Development **will not hinder** the conservation targets of the above attributes or the overall conservation objectives of the native oyster and blue mussel beds features of Beachy Head West MCZ.

6.5 Pagham Harbour MCZ

Table 6-4 Attribute-impact pathway summary matrix for Stage 1 assessment for relevant features of the Pagham Harbour MCZ

	Construction and Decommissioning		Operation
Attribute	Mortality, injury, behavioural changes and auditory masking arising from noise and vibration	Temporary localised increases in SSC and sediment deposition	Increased risk of introduction or spread of Marine INNS
Seagrass beds			
Distribution: presence and spatial distribution of biological communities	No pathway	No pathway	Non-significant effect
Extent and distribution	No pathway	No pathway	No pathway
Extent of supporting habitat	No pathway	Non-significant effect	No pathway
Structure and function: presence and abundance of key structural and influential species	No pathway	Non-significant effect	Non-significant effect
Structure: biomass	No pathway	Non-significant effect	No pathway
Structure: non-native species and pathogens	No pathway	No pathway	Non-significant effect
Structure: rhizome structure and reproduction	No pathway	No pathway	No pathway



	Construction and Decommissioning		Operation
Attribute	Mortality, injury, behavioural changes and auditory masking arising from noise and vibration	Temporary localised increases in SSC and sediment deposition	Increased risk of introduction or spread of Marine INNS
Structure: sediment composition and distribution	No pathway	Non-significant effect	No pathway
Structure: species composition of component communities	No pathway	Non-significant effect	Non-significant effect
Supporting processes: energy / exposure	No pathway	No pathway	No pathway
Supporting processes: light levels	No pathway	Non-significant effect	No pathway
Supporting processes: morphology	No pathway	No pathway	No pathway
Supporting processes: physico-chemical properties	No pathway	No pathway	No pathway
Supporting processes: sediment contaminants	No pathway	No pathway	No pathway
Supporting processes: sedimentation rate	No pathway	Non-significant effect	No pathway
Supporting processes: water quality - contaminants	No pathway	No pathway	No pathway
Supporting processes: water quality - dissolved oxygen	No pathway	Non-significant effect	No pathway



	Construction and Decommissioning		Operation
Attribute	Mortality, injury, behavioural changes and auditory masking arising from noise and vibration	Temporary localised increases in SSC and sediment deposition	Increased risk of introduction or spread of Marine INNS
Supporting processes: water quality - nutrients	No pathway	No pathway	No pathway
Supporting processes: water quality - turbidity	No pathway	Non-significant effect	No pathway
Defolin's lagoon snail (<i>C. armoricum</i>)			
Population: population size	No pathway	Non-significant effect	No pathway
Population: recruitment and reproductive capability	No pathway	Non-significant effect	No pathway
Presence and spatial distribution of the species	No pathway	Non-significant effect	Non-significant effect
Structure: Non-native species and pathogens	No pathway	No pathway	Non-significant effect
Supporting habitat: extent and distribution	No pathway	Non-significant effect	No pathway
Supporting habitat: sediment composition and distribution	No pathway	Non-significant effect	No pathway
Supporting habitat: structure of supporting habitats	No pathway	No pathway	No pathway



	Construction and Decommissioning		Operation
Attribute	Mortality, injury, behavioural changes and auditory masking arising from noise and vibration	Temporary localised increases in SSC and sediment deposition	Increased risk of introduction or spread of Marine INNS
Supporting processes: physico-chemical properties	No pathway	No pathway	No pathway
Supporting processes: sediment movement and hydrodynamic regime	No pathway	No pathway	No pathway
Supporting processes: water quality - contaminants	No pathway	No pathway	No pathway
Supporting processes: water quality - dissolved oxygen	No pathway	Non-significant effect	No pathway
Supporting processes: water quality - nutrients	No pathway	No pathway	No pathway
Supporting processes: water quality - turbidity	No pathway	Non-significant effect	No pathway
Lagoon sand shrimp (G. insensibilis)			
Population: population size	No pathway	Non-significant effect	No pathway
Population: recruitment and reproductive capability	No pathway	Non-significant effect	No pathway
Presence and spatial distribution of the species	No pathway	Non-significant effect	Non-significant effect



	Construction and Decommissioning		Operation
Attribute	Mortality, injury, behavioural changes and auditory masking arising from noise and vibration	Temporary localised increases in SSC and sediment deposition	Increased risk of introduction or spread of Marine INNS
Structure and function: biological connectivity	No pathway	No pathway	No pathway
Structure: Non-native species and pathogens	No pathway	No pathway	Non-significant effect
Supporting habitat: extent and distribution	No pathway	Non-significant effect	No pathway
Supporting habitat: sediment composition and distribution	No pathway	Non-significant effect	No pathway
Supporting habitat: structure of supporting habitats	No pathway	No pathway	No pathway
Supporting processes: physico-chemical properties	No pathway	No pathway	No pathway
Supporting processes: sediment movement and hydrodynamic regime	No pathway	No pathway	No pathway
Supporting processes: water quality - contaminants	No pathway	No pathway	No pathway
Supporting processes: water quality - dissolved oxygen	No pathway	Non-significant effect	No pathway



	Construction and Decommissioning		Operation
Attribute	Mortality, injury, behavioural changes and auditory masking arising from noise and vibration	Temporary localised increases in SSC and sediment deposition	Increased risk of introduction or spread of Marine INNS
Supporting processes: water quality - nutrients	No pathway	No pathway	No pathway
Supporting processes: water quality - turbidity	No pathway	Non-significant effect	No pathway

Construction and decommissioning

Mortality, injury, behavioural changes and auditory masking arising from noise and vibration

6.5.1 Noise and vibration impacts have been screened out for benthic species and habitats (see **Section 4.2**). In addition, for broad-scale habitat features of Pagham Harbour MCZ no pathway for noise impacts to affect the feature was identified for seagrass beds and Defolin's lagoon snail features, based on Natural England's AOO indicating no interaction with said pressures (**Table 5-7**). With respect to lagoon sand shrimp, there is currently 'insufficient evidence' whether it might be affected by noise and vibration, however, due to isolated location of Pagham Lagoon MCZ there will be no pathway for any noise and vibration impacts to affect this feature.

Temporary localised increases in suspended sediment concentrations (SSC) and sediment deposition

Overview

6.5.2 The nature of activities resulting in increases in SSC and sediment deposition during construction is described in **Section 6.2**. Further details of the worst case scenario assessment can be found in **Chapter 9**, **Volume 2**. Pagham Harbour MCZ is located over 10km from the Proposed Development, at the furthest extent of the secondary ZOI (as defined in **Chapter 9**, **Volume 2**). The magnitude of temporary increase in suspended sediment and sediment deposition relating from construction activities at the Proposed Development is considered to be **minor**, indicating that the potential is for localised disturbance and/or loss of habitat that does not threaten the long-term viability of the resource.

Seagrass beds

- 6.5.3 Seagrass can colonise a wide variety of sediments, from sheltered gravel to sand or mud (JNCC, 2014), but requires a substrate soft enough for rhizomes to elongate and fasten. Sediment composition is important in determining the biological communities supported by the seagrass. There is a relationship between seagrass density and sediment composition that can vary across the seagrass bed, increasing the diversity of communities present. Seagrass relies on sediment but the seagrass rhizomes also help to bind sediment and prevent erosion. A change to sediment composition can result in a loss or change to seagrass distribution and character.
- 6.5.4 The rate of sediment deposition is known to influence the status of habitats and / or their associated communities. Beds are usually in more sheltered areas where suspended sediments tend to settle, providing suitable conditions for colonisation. If suspended sediment is artificially high due to human activity, this may smother seagrass beds.
- 6.5.5 In coastal environments turbidity levels can rise and fall rapidly as a result of biological, physical (for example, storm events) or human factors. Prolonged



changes in turbidity may influence the amount of light reaching the seabed, affecting the primary production.

- 6.5.6 Seagrass beds feature is considered to be **sensitive** to pressures that may arise from increases in SSC and sediment deposition, namely: smothering and siltation rate changes, physical change to another seabed type and changes in suspended solids (water clarity) (**Table 5-7**).
- 6.5.7 The following attributes relevant to seagrass beds MCZ feature may be impacted by increases in SSC and sediment deposition:
 - extent of supporting habitat;
 - structure and function: presence and abundance of key structural and influential species;
 - structure: biomass;
 - structure: sediment composition and distribution;
 - structure: species composition of component communities;
 - supporting processes: light levels;
 - supporting processes: sedimentation rate;
 - water quality dissolved oxygen; and
 - water quality turbidity.
- 6.5.8 With respect to the above attributes, due to **minor** magnitude and temporary duration of the potential impacts, the effect will be **non-significant**. The Proposed Development **will not hinder** the conservation targets of these attributes or the overall conservation objectives of the seagrass beds feature of Pagham Harbour MCZ.

Defolin's lagoon snail (C. armoricum) and Lagoon sand shrimp (G. insensibilis)

- 6.5.9 Defolin's lagoon snail inhabits loose shingle where sea water percolates and where soft flocculent silty material is present but leaving plenty space subject to gently flowing water. Therefore, increases in fine sediments might reduce the suitability of the habitat to support this species (Little *et al.*, 1989).
- 6.5.10 Changes in suspended solids are not likely to directly affect the lagoon sand shrimp. However, limited water movement in the closed lagoon habitat where this species is found could result in any sediment deposits remaining in-situ, causing smothering.
- 6.5.11 Both species are considered to be **sensitive** to pressures that may arise from increases in SSC and sediment deposition (**Table 5-7**).
- 6.5.12 The following attributes relevant to Defolin's lagoon snail and lagoon sand shrimp may be impacted by increases in SSC and sediment deposition:
 - population size;
 - recruitment and reproductive capability;



- presence and spatial distribution of the species;
- supporting habitat: extent and distribution;
- supporting habitat: sediment composition and distribution;
- water quality dissolved oxygen; and
- water quality turbidity.
- 6.5.13 With respect to the above attributes of both Defolin's lagoon snail and lagoon sand shrimp, due to **minor** magnitude and temporary duration of the potential impacts, the effect will be **non-significant**. The Proposed Development **will not hinder** the conservation targets of these attributes or the overall conservation objectives of the Defolin's lagoon snail and lagoon sand shrimp features of Pagham Harbour MCZ.

Operation

Increased risk of introduction or spread of Marine INNS

Overview

- 6.5.14 **Section 6.2** summarises the nature of activities that may result in an increased risk of introduction or spread of Marine INNS (such as presence of infrastructure and ballast water from vessels). Further details of the worst-case scenario assessment can be found in **Chapter 9**, **Volume 2**.
- 6.5.15 Embedded environmental measures, which include a biosecurity plan, will ensure that the risk of potential introduction and spread of Marine INNS from increased vessel traffic will be minimised. The magnitude of the impact of the introduction or spread of Marine INNS is considered to be **minor**, indicating that there may only be a discernible change for any length of time, over a small area of the receptor that does not threaten benthic subtidal ecology features, undermine regional ecosystem functions or diminish biodiversity.
- 6.5.16 Non-native species may become invasive and displace native organisms by preying on them or out-competing them for resources such as food, space or both. In some cases this has led to the loss of indigenous species from certain areas.

Seagrass beds

- 6.5.17 Seagrass beds feature is considered to be **sensitive** to introduction or spread of Marine INNS (**Table 5-7**). The following attributes relevant to seagrass beds MCZ feature may be impacted:
 - presence and spatial distribution of biological communities;
 - presence and abundance of key structural and influential species;
 - non-native species and pathogens; and
 - species composition of component communities.



6.5.18 With respect to the above attributes, due to **minor** magnitude of the potential impacts, the effect will be **non-significant**. The Proposed Development **will not hinder** the conservation targets of these attributes or the overall conservation objectives of the seagrass beds feature of Pagham Harbour MCZ.

Defolin's lagoon snail (C. armoricum) and Lagoon sand shrimp (G. insensibilis)

- 6.5.19 Lagoon sand shrimp is considered to be **sensitive** to pressures that may arise from introduction or spread of Marine INNS and there is not sufficient evidence to assess the pressure for Defolin's lagoon snail (**Table 5-7**). As a precautionary approach, both species have been assessed as **sensitive**.
- 6.5.20 The following attributes relevant to Defolin's lagoon snail and lagoon sand shrimp form Pagham Harbour MCZ may be impacted by introduction or spread of Marine INNS:
 - presence and spatial distribution of the species; and
 - structure: Non-native species and pathogens.
- 6.5.21 With respect to the above attributes of both Defolin's lagoon snail and lagoon sand shrimp, due to **minor** magnitude of the potential impacts, the effect will be **non-significant**. The Proposed Development **will not hinder** the conservation targets of these attributes or the overall conservation objectives of the Defolin's lagoon snail and lagoon sand shrimp features of Pagham Harbour MCZ.



7. Conclusions

- 7.1.1 MCZ that have the potential to be affected by the Proposed Development have been identified. A screening exercise was carried out to:
 - a) identify impacts that will not have a direct overlap with any of the MCZs and screen those out;
 - b) review relevant sections of **Chapter 8**, **Volume 2** and **Chapter 9**, **Volume 2** and identify impacts that have been assigned a 'negligible' magnitude in the EIA assessment and screen those out on the basis of "insignificance"; and
 - c) screen the full list of designated features of each MCZ and identify those that have the potential to be affected by those impacts that were screened in.
- 7.1.2 Five impacts were screened in for Stage 1 assessment:
 - mortality, injury, behavioural changes and auditory masking arising from noise and vibration (fish and shellfish features during construction);
 - temporary localised increases in suspended sediment concentrations (SSC) and sediment deposition (during construction);
 - increased risk of introduction or spread of Marine INNS (due to presence of infrastructure and vessel movements during operation);
 - mortality, injury, behavioural changes and auditory masking arising from noise and vibration (fish and shellfish features during decommissioning); and
 - temporary increase in SSC and sediment deposition from removal of foundations, cables and rock protection (during decommissioning).
- 7.1.3 For the purposes of this MCZ Assessment, decommissioning impacts were assessed together with construction impacts.
- 7.1.4 Based on Stage 1 assessment of relevant features it can be concluded that there is no significant risk of the Proposed Development hindering the achievement of the conservation objectives stated for the following MCZs:
 - Offshore Overfalls MCZ;
 - Beachy Head West MCZ;
 - Beachy Head East MCZ;
 - Selsey Bill and the Hounds MCZ;
 - Bembridge MCZ; and
 - Pagham Harbour MCZ.
- 7.1.5 For Kingmere MCZ the assessment concluded that there is no significant risk of the Proposed Development hindering the achievement of the conservation objectives stated for the following features:
 - infralittoral rock and thin mixed sediment; and



• subtidal chalk.

7.1.6 In case of:

- black seabream
- 7.1.7 Stage 1 assessment currently concludes there is a risk of hindering the achievement of conservation objectives as a result of disturbance effects arising from noise and vibration during construction. At this stage it is assumed that Stage 2 assessment will not be required for black seabream feature from Kingmere MCZ after embedded mitigation is proposed (currently a suite of suitable measures is being considered). Mitigation options will be investigated and defined through the ES process, and therefore available to reduce the effect and as such it is not considered likely that a significant effect will be realised.

7.2 Glossary of terms and abbreviations

Term (acronym)	Definition
A00	Advice on Operations
Aspect	Used to refer to the individual environmental topics.
ВАР	Biodiversity Action Plan
Baseline	Refers to existing conditions as represented by latest available survey and other data which is used as a benchmark for making comparisons to assess the impact of development.
Benthic ecology	Benthic ecology encompasses the study of the organisms living in and on the sea floor, the interactions between them and impacts on the surrounding environment.
BGS	British Geological Survey
Coastal processes	The processes that interact to control the physical characteristics of a natural environment, for example: winds, waves, currents, water levels, sediment transport, turbidity, coastline, beach and seabed morphology.
cm	Centimetre
Compensation	Loss of value is remedied or offset by a corresponding compensatory action on the same site or elsewhere, determined through the process of Environmental Impact Assessment.
Crustacea	Arthropod of the large, mainly aquatic group Crustacea, such as a crab, lobster, shrimp, or barnacle.

Table 7-1 Glossary of terms and abbreviations



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Term (acronym)	Definition
dB	Decibel
Decommissioning	The period during which a development and its associated processes are removed from active operation.
Development Consent Order (DCO)	This is the means of obtaining permission for developments categorised as Nationally Significant Infrastructure Projects, under the Planning Act 2008.
Development Consent Order (DCO) Application	An application for consent to undertake a Nationally Significant Infrastructure Project made to the Planning Inspectorate who will consider the application and make a recommendation to the Secretary of State, who will decide on whether development consent should be granted for the Proposed Development.
Drop Down Video (DDV)	A survey method in which imagery of habitat is collected, used predominantly to survey marine environment.
Electromagnetic field (EMF)	An electromagnetic field is an electric and magnetic force field that surrounds a moving electric charge.
Embedded environmental measures	Equate to 'primary environmental measures' as defined by Institute of Environmental Management and Assessment (2016). They are measures to avoid or reduce environmental effects that are directly incorporated into the preferred masterplan for the Proposed Development.
Environmental Impact Assessment (EIA)	The process of evaluating the likely significant environmental effects of a proposed project or development over and above the existing circumstances (or 'baseline').
Environmental Statement (ES)	The written output presenting the full findings of the Environmental Impact Assessment.
ETG	Expert Topic Group
European site	European sites are those that are designated through the Habitats Directive and Birds Directive (via national legislation as appropriate). Within England additional sites designated through international convention are given the same protection through policy – overall all of these are referred to as European sites. European sites in England are considered to be SPAs, SACs, candidate SACs and Sites of Community Importance (SCI). Potential SPAs (pSPA), possible SACs (pSACs), Ramsar sites

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Term (acronym)	Definition
	(designated under international convention) and proposed Ramsar sites.
Evidence Plan Process (EPP)	A voluntary consultation process with specialists' stakeholders to agree the approach, the information to support, the EIA and HRA for certain aspects.
Feature	Particularly prominent or eye-catching elements in the landscape such as tree clumps, church towers or wooded skylines OR a particular aspect of the Proposed Development.
Geophysical	Relating to the physical properties of the earth.
Hz	Hertz
Impact	The changes resulting from an action.
Indirect effects	Effects that result indirectly from the Proposed Development as a consequence of the direct effects, often occurring away from the site, or as a result of a sequence of interrelationships or a complex pathway. They may be separated by distance or in time from the source of the effects. Often used to describe effects on landscape character that are not directly impacted by the Proposed Development such as effects on perceptual characteristics and qualities of the landscape.
INNS	Invasive Non-Native Species
Inshore	The sea up to two miles from the coast.
Intertidal	The area of the shoreline which is covered at high tide and uncovered at low tide.
Joint Nature Conservation Committee (JNCC)	JNCC is the public body that advises the UK Government and devolved administrations on UK-wide and international nature conservation.
kHz	Kilohertz
kJ	Kilojoules
km	Kilometre
km²	Squared Kilometre



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Term (acronym)	Definition
Level of effect	Determined through the combination of sensitivity of the receptor and the proposed magnitude of change brought about by the development.
LWS	Local Wildlife Sites
m	Metre
Magnitude (of change)	A term that combines judgements about the size and scale of the effect, the extent of the area over which it occurs, whether it is reversible or irreversible and whether it is short term or long term in duration'. Also known as the 'degree' or 'nature' of change.
Marine aggregate	Marine dredged sand and/or gravel.
Marine Conservation Zone (MCZ)	Marine Conservation Zone (MCZ) is a type of marine nature reserve in UK waters. They were established under the Marine and Coastal Access Act (2009) and are areas designated with the aim to protect nationally important, rare or threatened habitats and species.
Marine Management Organisation (MMO	MMO is an executive non-departmental public body, sponsored by the Department for Environment, Food & Rural Affairs. MMO license, regulate and plan marine activities in the seas around England so that they're carried out in a sustainable way.
MCAA	Marine and Coastal Access Act 2009
MEEB	Measures of Equivalent Environmental Benefit
mm	Millimetres
ms ⁻¹	Meters per Second
Natural England	The government advisor for the natural environment in England.
Nursery habitat	Habitats where high numbers of juveniles of a species occur, having a greater level of productivity per unit area than other juvenile habitats.
OEL	Ocean Ecology Limited
Offshore	The sea further than two miles from the coast.
Offshore Wind Farm	An offshore wind farm is a group of wind turbines in the same location (offshore) in the sea which are used to produce electricity.



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Term (acronym)	Definition
PEIR Assessment Boundary	The PEIR Assessment Boundary combines the search areas for the offshore and onshore infrastructure associated with the Proposed Development. It is defined as the area within which the Proposed Development and associated infrastructure will be located, including the temporary and permanent construction and operational work areas
Planning Inspectorate (PINS)	The Planning Inspectorate deals with planning appeals, national infrastructure planning applications, examinations of local plans and other planning-related and specialist casework in England and Wales.
Preliminary Environmental Information Report (PEIR)	The written output of the Environmental Impact Assessment undertaken to date for the Proposed Development. It is developed to support formal consultation and presents the preliminary findings of the assessment to allow an informed view to be developed of the Proposed Development, the assessment approach that has been undertaken, and the preliminary conclusions on the likely significant effects of the Proposed Development and environmental measures proposed.
Proposed Development	The development that is subject to the application for development consent, as described in Chapter 4.
Rampion 1	The existing Rampion Offshore Wind Farm located in the English Channel in the south of England.
Receptor	These are as defined in Regulation 5(2) of The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 and include population and human health, biodiversity, land, soil, water, air, climate, material assets, cultural heritage and landscape that may be at risk from exposure to pollutants which could potentially arise as a result of the Proposed Development.
Recoverable injury	Recoverable injury is a survivable injury with full recovery occurring after exposure.
RED	Rampion Extension Development Limited
rms	Root Mean Square
SACO	Supplementary Advice on Conservation Objectives





Term (acronym)	Definition
Scoping Opinion	A Scoping Opinion is adopted by the Secretary of State for a Proposed Development.
Scoping Report	A report that presents the findings of an initial stage in the Environmental Impact Assessment process.
Scour	A localised sediment erosion feature caused by local enhancement of flow speed and turbulence due to interaction with an obstacle.
Secretary of State (SoS)	The body who makes the decision to grant development consent.
Sediment deposition	Settlement of sediment in suspension back to the seabed, causing a localised accumulation.
Sediment transport	The movement of sediment by natural processes, as individual grains or as a collective volume.
SEL	Sound Exposure Level
Sensitivity	This boundary was used to inform the Scoping Report by combining the areas of search for the offshore and onshore infrastructure at the Scoping stage of the project.
Significance	A measure of the importance of the environmental effect, defined by criteria specific to the environmental aspect.
Significant effects	It is a requirement of the EIA Regulations to determine the likely significant effects of the development on the environment which should relate to the level of an effect and the type of effect. Where possible significant effects should be mitigated.
	The significance of an effect gives an indication as to the degree of importance (based on the magnitude of the effect and the sensitivity of the receptor) that should be attached to the impact described.
	Whether or not an effect should be considered significant is not absolute and requires the application of professional judgement.
	Significant – 'noteworthy, of considerable amount or effect or importance, not insignificant or negligible'. The Concise Oxford Dictionary. Those levels and types of landscape and visual effect likely to have a major or important/noteworthy or special effect of which a decision maker should take particular note.



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Term (acronym)	Definition
SNCB	Statutory Nature Conservation Body
Spatial Scope	Spatial scope is the area over which changes to the environment are predicted to occur as a consequence of a Proposed Development.
Spawning	The release or deposition of eggs and sperm, usually into water, by aquatic animals.
Special Area of Conservation (SAC)	International designation implemented under the Habitats Regulations for the protection of habitats and (non-bird) species. Sites designated to protect habitats and species on Annexes I and II of the Habitats Directive. Sufficient habitat to maintain favourable conservation status of the particular feature in each member state needs to be identified and designated.
SPL	Sound Pressure Level
SPM	Suspended Particulate Matter
Stakeholder	Person or organisation with a specific interest (commercial, professional or personal) in a particular issue.
Study area	Area where potential impacts from the Proposed Development could occur, as defined for each aspect.
Subtidal	The region of shallow waters which are below the level of low tide.
Susceptibility	The ability of a defined landscape or visual receptor to accommodate the specific Proposed Development without undue negative consequences.
Suspended sediment concentration (SSC)	The mass concentration (mass/volume) of sediment in suspension.
Temporal Scope	The temporal scope covers the time period over which changes to the environment and the resultant effects are predicted to occur and are typically defined as either being temporary or permanent.
Temporary Threshold Shift (TTS)	A temporary reduction in an animals sensitivity to sound.
The Applicant	Rampion Extension Development Limited (RED)
The Proposed Development/Rampion 2	The onshore and offshore infrastructure associated with the offshore wind farm comprising of installed capacity of



Term (acronym)	Definition
	up to 1200 MW, located in the English Channel in the south of England
Tidal excursion buffer	The greatest distance and direction that water carrying an impact might be carried during one mean spring tide, from a given location or area.
тwт	The Wildlife Trust
UK	United Kingdom
μPa	Pascal
WFD	Water Framework Directive
WTG	Wind Turbine Generator
Zone of Influence (ZOI)	The area surrounding the Proposed Development which could result in likely significant effects.



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