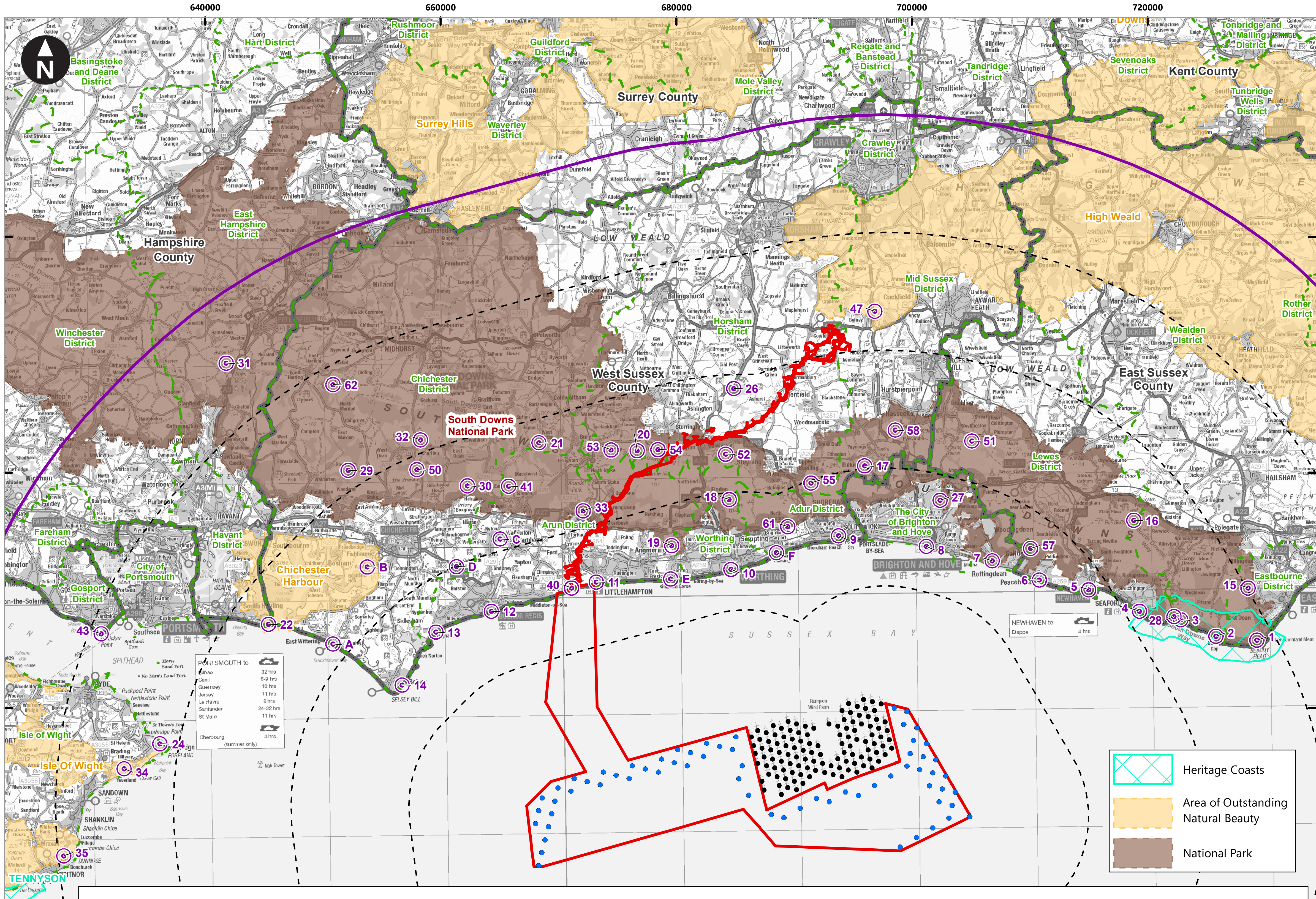
Rampion 2 Wind Farm

Category 7: Other Documents

Evidence Plan (Part 9 of 11)

Date: August 2023
Revision A

Document Reference: 7.21
Pursuant to: APFP Regulation 5 (2) (q)
Ecodoc number: 004866615-01



Key

- Proposed DCO Application Boundary
- 50km Study Area
- 10km Radii
- Indicative Rampion 2 WTG
- Operational Rampion 1 WTG
- Viewpoint
- County boundary
- District boundary
- Heritage Coasts
- Area of Outstanding Natural Beauty
- National Park

Viewpoints

1 - Beachy Head
2 - Birling Gap
3 - Seven Sisters Country Park
4 - Seaford Head
5 - Newhaven (Castle Hill)
6 - Peacehaven
7 - Beacon Hill, Rottingdean
8 - Brighton sea front promenade
9 - Shoreham/A259 coastal road
10 - Worthing sea front promenade
11 - Littlehampton sea front promenade
12 - Bognor Regis sea front promenade
13 - Pagham Beach
14 - Selsey sea front promenade
15 - Willingdon Hill
16 - Firle Beacon
17 - Devil's Dyke
18 - Cissbury Ring
19 - Highdown Hill
20 - Springhead Hill
21 - Bignor Hill
22 - Eastoke Point (Chichester Harbour AONB)
24 - Bembridge, Isle of Wight
26 - Low Weald (A24, near Ashington)
27 - Hollingbury Golf Course/Hill Fort
28 - Cuckmere Haven Beach
29 - Kingley Vale National Nature Reserve
30 - Halnaker Hill
31 - Butser Hill National Nature Reserve
32 - Levin Down
33 - Arundel Castle
34 - Bembridge Down
34 - Either Bembridge Fort
35 - St. Boniface Down above Ventnor
40 - Climping Beach
41 - Slindon Folly
43 - Gilkicker Point
47 - High Weald (near Bolney)
50 - The Trundle
51 - Ditchling Beacon
52 - Chanctonbury Ring
53 - Amberley Mount
54 - Chantry Hill
55 - Beeding Hill
57 - Telscombe Tye
58 - Wolstonbury Hill
61 - A27 near Lancing College
62 - Beacon Hill, South Downs Way
A - East Wittering
B - Chichester Harbour AONB (eastern edge)
C - Proposed A29, Eastergate
D - A259 between Chichester and Bognor
E - Ferring Gap
F - Lancing Beach

Rampion Extension Development

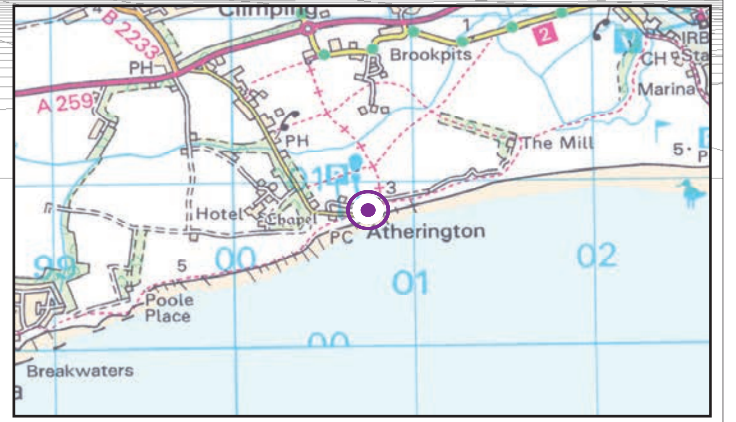
Rampion 2 Offshore Wind Farm

Figure 2 Viewpoints

Consulations

System Identifier:	Version:
191397_RMP_ETG_Fig2_Viewpoints	1.0

Company:	Drawn By:	Chk/Aprvd:	Drawn Date:	Status:
OPEN	JM	WOOD	04/02/2022	FINAL



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Distance:	15.9km		

Camera:	Canon EOS 6D
Lens:	50mm (Canon EF 50mm f/1.4)
Camera height:	1.5m AGL
Date and time:	16/08/2021 17:07

Development Parameters:

Rampion Offshore Wind Farm:	116 turbines at 140m blade tip height
Rampion 2 Offshore Wind Farm:	65 turbines at 325m blade tip height

Notes:
- Figure produced to accord with the Landscape Institute's Technical Guidance Note 6/19: Visual Representation of Development Proposals.
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- 100% Enlargement
- TYPE 4 VISUALISATION

Company:	OPEN	Drawn date:	17/03/2022
Drawn by:	TH	Status	FINAL
Chk/Aprvd:	SM	File:	191397_RMP2_ETG_WSussex_AddVP

Figure: 16.1a
Viewpoint 40 - Climping Beach
Rampion 2 Offshore Wind Farm
ETG Meeting

Location grid reference:	480452 E 96323 N	Paper size:	841mm x 297mm (half A1)	Camera:	Canon EOS 6D
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Horizontal field of view:	90° (cylindrical projection)	Principal distance:	522mm	Camera height:	1.5m AGL
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Development Parameters:

Rampion Offshore Wind Farm:	116 turbines at 140m blade tip height
Rampion 2 Offshore Wind Farm:	65 turbines at 325m blade tip height

Notes:
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- 100% Enlargement
- TYPE 4 VISUALISATION

Company:	OPEN	Drawn date:	17/03/2022
Drawn by:	TH	Status	FINAL
Chk/Aprvd:	SM	File:	191397_RMP2_ETG_WSussex_AddVP

Rampion 2 WIND FARM

Figure: 16.1b
Viewpoint A - East Wittering
Rampion 2 Offshore Wind Farm
ETG Meeting

Location grid reference:	482898 E 101353 N
Direction of view:	125°
Horizontal field of view:	90° (cylindrical projection)
Distance:	23.7km

Paper size:	841mm x 297mm (half A1)
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Principal distance:	522mm

Camera:	Canon EOS 6D
Lens:	50mm (Canon EF 50mm f/1.4)
Camera height:	1.5m AGL
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Development Parameters:

Rampion Offshore Wind Farm:	116 turbines at 140m blade tip height
Rampion 2 Offshore Wind Farm:	65 turbines at 325m blade tip height

Notes:
- Figure produced to accord with the Landscape Institute's Technical Guidance Note 6/19: Visual Representation of Development Proposals.
-
- 100% Enlargement
- TYPE 4 VISUALISATION

Company:	OPEN	Drawn date:	17/03/2022
Drawn by:	TH	Status	FINAL
Chk/Aprvd:	SM	File:	191397_RMP2_ETG_WSussex_AddVP

Rampion 2 WIND FARM

Figure: 16.1c
Viewpoint B1 - Chichester Marina (Chichester Harbour AONB)
Rampion 2 Offshore Wind Farm
ETG Meeting

Location grid reference: 483446 E 102849 N
Direction of view: 128°
Horizontal field of view: 90° (cylindrical projection)
Distance: 24.6km

Paper size: 841mm x 297mm (half A1)
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Principal distance: 522mm

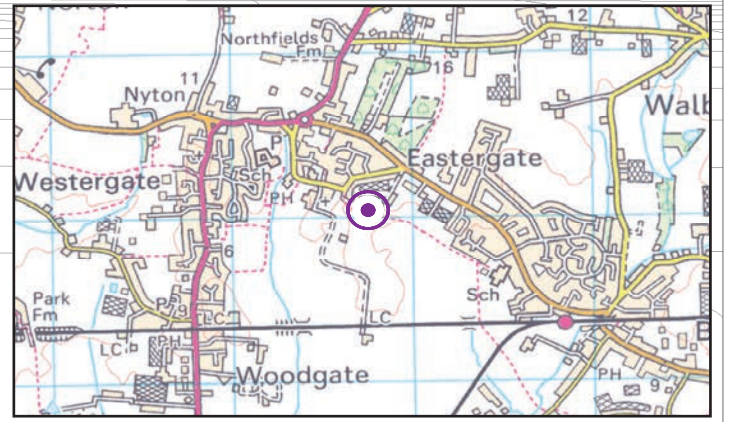
Camera: Canon EOS 6D
Lens: 50mm (Canon EF 50mm f/1.4)
Camera height: 1.5m AGL
Date and time: 16/08/2021 11:02

Development Parameters:
Rampion Offshore Wind Farm: 116 turbines at 140m blade tip height
Rampion 2 Offshore Wind Farm: 65 turbines at 325m blade tip height

Notes:
- Figure produced to accord with the Landscape Institute's Technical Guidance Note 6/19: Visual Representation of Development Proposals.
-
- 100% Enlargement
- TYPE 4 VISUALISATION

Company:	OPEN	Drawn date:	17/03/2022
Drawn by:	TH	Status	FINAL
Chk/Aprvd:	SM	File:	191397_RMP2_ETG_WSussex_AddVP

Figure: 16.1d
Viewpoint B2 - Dell Quay (Chichester Harbour AONB)
Rampion 2 Offshore Wind Farm
ETG Meeting



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Distance:	21.3km			Date and time:	16/08/2021 16:26

Development Parameters:

Rampion Offshore Wind Farm:	116 turbines at 140m blade tip height
Rampion 2 Offshore Wind Farm:	65 turbines at 325m blade tip height

Notes:
- Figure produced to accord with the Landscape Institute's Technical Guidance Note 6/19: Visual Representation of Development Proposals.
-
- 100% Enlargement
- TYPE 4 VISUALISATION

Company:	OPEN	Drawn date:	17/03/2022
Drawn by:	TH	Status	FINAL
Chk/Aprvd:	SM	File:	191397_RMP2_ETG_WSussex_AddVP

Figure: 16.1e
Viewpoint C - Proposed A29, Eastergate
Rampion 2 Offshore Wind Farm
ETG Meeting

Location grid reference:	490989 E 102769 N
Direction of view:	136°
Horizontal field of view:	90° (cylindrical projection)
Distance:	20.6km

Paper size:	841mm x 297mm (half A1)
Corrected print image size:	820mm x 130mm
Principal distance:	522mm

Camera:	Canon EOS 6D
Lens:	50mm (Canon EF 50mm f/1.4)
Camera height:	1.5m AGL
Date and time:	16/08/2021 15:35

Development Parameters:

Rampion Offshore Wind Farm:	116 turbines at 140m blade tip height
Rampion 2 Offshore Wind Farm:	65 turbines at 325m blade tip height

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- TYPE 4 VISUALISATION

Company:	OPEN	Drawn date:	17/03/2022
Drawn by:	TH	Status	FINAL
Chk/Aprvd:	SM	File:	191397_RMP2_ETG_WSussex_AddVP

Rampion 2 WIND FARM

Figure: 16.1f

Viewpoint D - Footpath between A259 and Colworth

Rampion 2 Offshore Wind Farm

ETG Meeting

Wireline drawing

Location grid reference:	509163 E 101488 N	Paper size:	841mm x 297mm (half A1)
Direction of view:	120°	Corrected print image size:	820mm x 130mm
Horizontal field of view:	90° (cylindrical projection)	Principal distance:	522mm
Distance:	14.3km		

Camera:	Canon EOS 6D
Lens:	50mm (Canon EF 50mm f/1.4)
Camera height:	1.5m AGL
Date and time:	17/08/2021 17:52

Development Parameters:

Rampion Offshore Wind Farm:	116 turbines at 140m blade tip height
Rampion 2 Offshore Wind Farm:	65 turbines at 325m blade tip height

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- TYPE 4 VISUALISATION

Company:	OPEN	Drawn date:	17/03/2022
Drawn by:	TH	Status	FINAL
Chk/Aprvd:	SM	File:	191397_RMP2_ETG_WSussex_AddVP

Figure: 16.1g
Viewpoint E - Ferring Gap
Rampion 2 Offshore Wind Farm
ETG Meeting

Location grid reference:	509163 E 101488 N	Paper size:	841mm x 297mm (half A1)	Camera:	Canon EOS 6D	Development Parameters:	
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Horizontal field of view:	90° (cylindrical projection)	Principal distance:	522mm	Camera height:	1.5m AGL	Rampion 2 Offshore Wind Farm:	65 turbines at 325m blade tip height
Distance:	14.3km			Date and time:	17/08/2021 17:52		

Notes:
- Figure produced to accord with the Landscape Institute's Technical Guidance Note 6/19: Visual Representation of Development Proposals.
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- 100% Enlargement
- TYPE 4 VISUALISATION

Company:	OPEN	Drawn date:	17/03/2022
Drawn by:	TH	Status	FINAL
Chk/Aprvd:	SM	File:	191397_RMP2_ETG_WSussex_AddVP

Rampion 2 WIND FARM

Figure: 16.1h
Viewpoint E - Ferring Gap
Rampion 2 Offshore Wind Farm
ETG Meeting

Location grid reference:	518176 E 103583 N	Paper size:	841mm x 297mm (half A1)	Camera:	Canon EOS 6D
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Development Parameters:

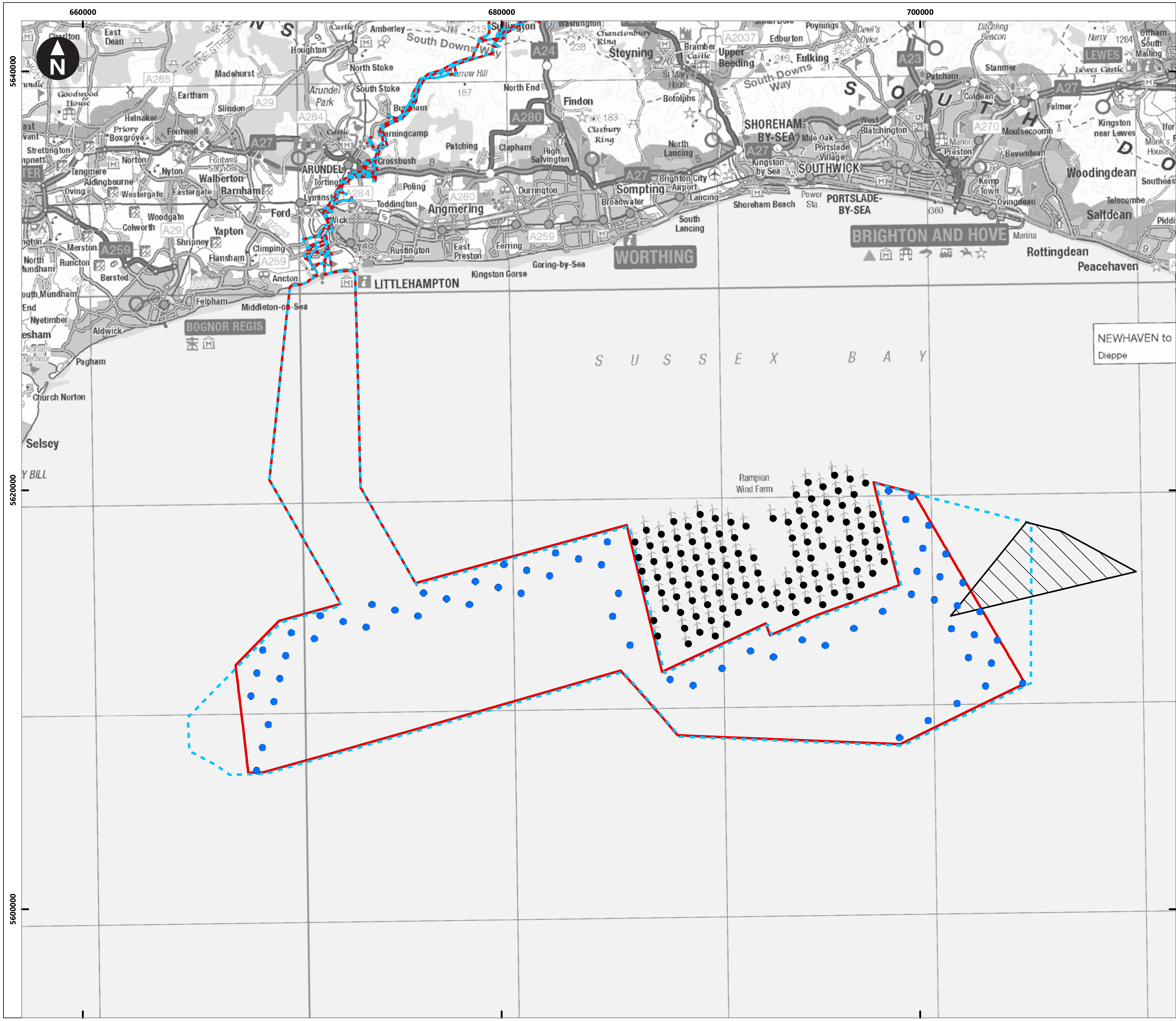
Rampion Offshore Wind Farm:	116 turbines at 140m blade tip height
Rampion 2 Offshore Wind Farm:	65 turbines at 325m blade tip height

Notes:
- Figure produced to accord with the Landscape Institute's Technical Guidance Note 6/19: Visual Representation of Development Proposals.
-
- 100% Enlargement
- TYPE 4 VISUALISATION

Company:	OPEN	Drawn date:	17/03/2022
Drawn by:	TH	Status	FINAL
Chk/Aprvd:	SM	File:	191397_RMP2_ETG_WSussex_AddVP

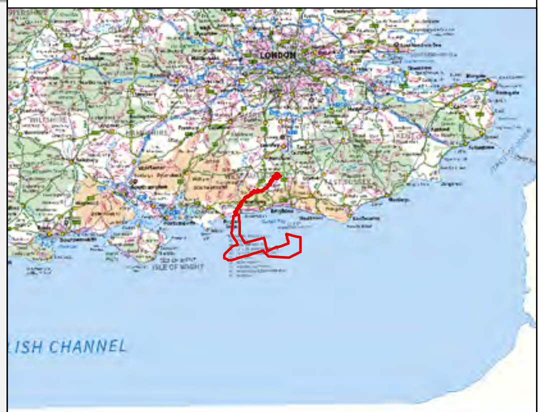
Rampion 2 WIND FARM

Figure: 16.1i
Viewpoint F - Lancing Beach
Rampion 2 Offshore Wind Farm
ETG Meeting



Key

- Proposed DCO Application Boundary
- PEIR Assessment Boundary
- Rampion 1 Structures Exclusion Zone
- Indicative Rampion 2 WTG
- Operational Rampion 1 WTG



Kilometres

0 1 2 4 6 8 10

1:175,000

WGS 1984 UTM Zone 30N Transverse Mercator

Rampion Extension Development

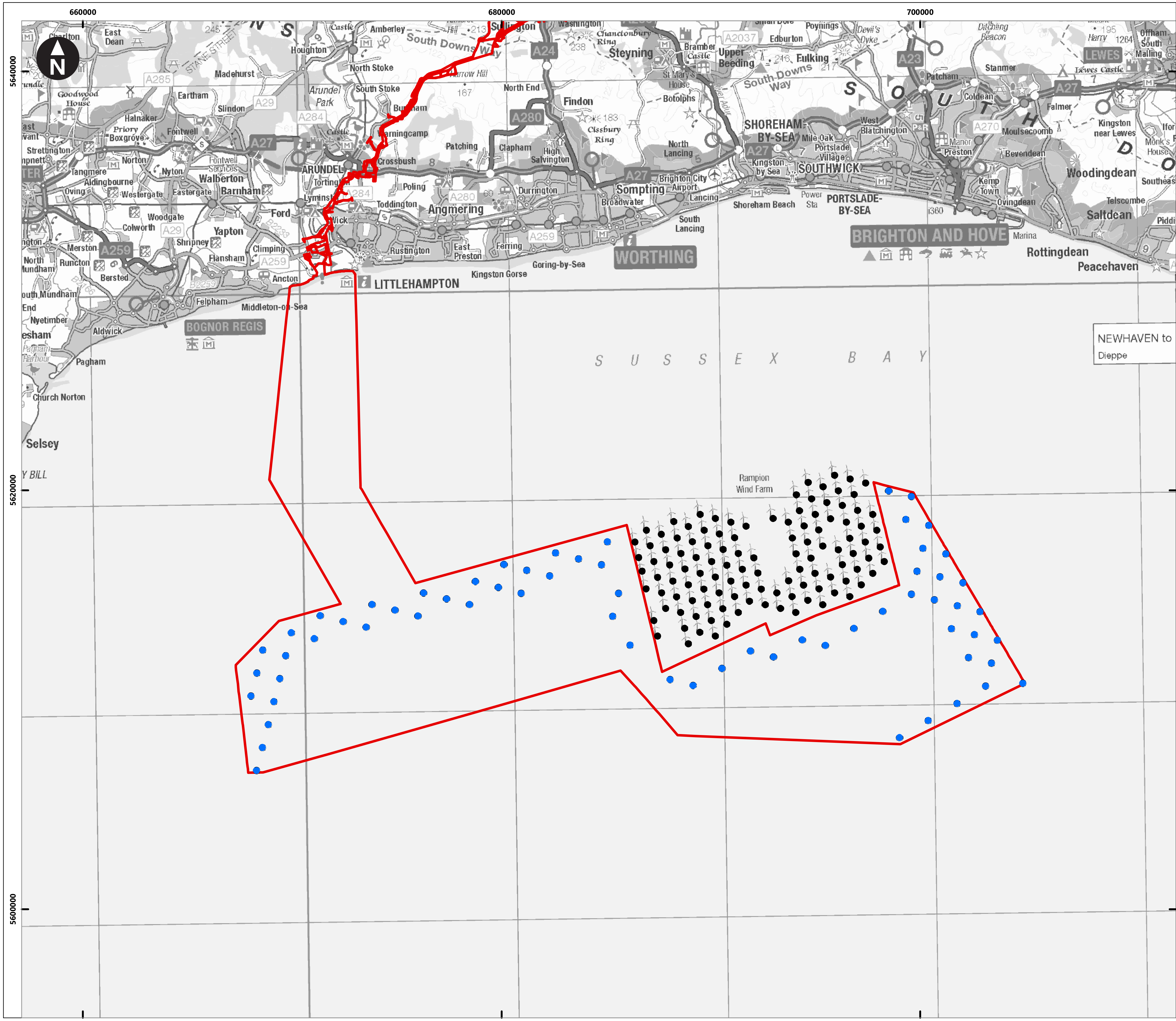
Rampion 2 WIND FARM

Rampion 2 Offshore Wind Farm

Figure 1 SLVIA Project design envelope

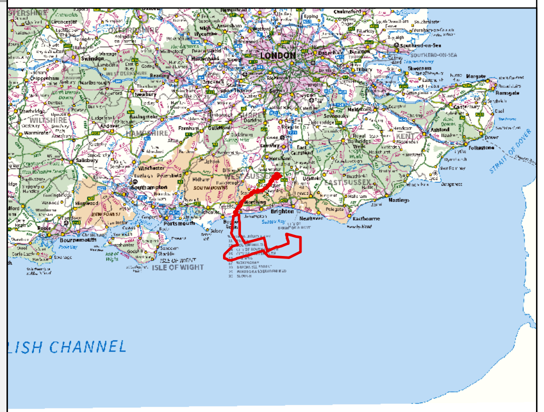
Consulations

System Identifier:				Version:
191397_RMP_ETG_Fig1_Study_Area				1.0
Company: OPEN	Drawn By: JM	Chk/Aprvd: WOOD	Drawn Date: 25/02/2022	Status: FINAL



Key

- Proposed DCO Application Boundary
- Indicative Rampion 2 WTG
- Operational Rampion 1 WTG



Kilometres

0 1 2 4 6 8 10

1:4,000,000

WGS 1984 UTM Zone 30N Transverse Mercator

Rampion Extension Development

Rampion 2 WIND FARM

Rampion 2 Offshore Wind Farm

Figure 1 SLVIA Project design envelope

Consulations

System Identifier:				Version:
191397_RMP_ETG_Fig1_Study_Area				1.0
Company: OPEN	Drawn By: JM	Chk/Aprvd: WOOD	Drawn Date: 04/02/2022	Status: FINAL

[redacted]
GoBe Consultants
5/2 Merchants House,
7 West George Street,
Glasgow
G2 1BA

8th April 2022

[redacted],

Rampion II Offshore Wind Farm – Draft Outline Marine Written Scheme of Investigation

Thank you for your emails of 11th and 17th March 2022 and for supplying us with the draft *Rampion 2 Wind Farm Outline Marine Written Scheme of Investigations* (Referenced: Volume 4, Appendix 16.2). We apologise for the delay in making this response to you, but as you will see from this letter we have produced a considerable amount of comments that require attention.

The proposed project

We understand that the proposed Rampion Extension Development (RED) Ltd, also known as "Rampion 2" could be located in the English Channel, approximately 13km to 25km off the Sussex coast and adjacent to the existing Rampion Offshore Wind Farm (known as "Rampion 1").

Summary of our advice

A draft Outline Marine Written Scheme of Investigations (WSI) should be designed to provide a framework for archaeological mitigation strategies to be applied in any marine area as relevant to the proposed Rampion 2 Offshore Wind Farm. However, it is apparent that the draft provided to us requires substantial revision which you may wish to do prior to any Development Consent Order (DCO) submission. We highlight the following:

- the approach advocated in the above referenced document is not compliant with how the historic environment is addressed within National Policy Statement EN-3 (Renewable Energy Infrastructure);
- the draft includes topics, such as historic seascape, for which no mitigation measures are described and it is not clear why this subject is included;
- the document has conflated information as relevant for inclusion within a WSI with survey-specific detail which should be provided through any subsequent method statement(s);
- the methodological approach to geoarchaeological data capture, analysis and reporting as we would expect to see in an outline WSI requires revision; and
- more figures are required to show locations of wreck and the application of AEZs which are also identifiable within an accompanying gazetteer included in this outline marine WSI.

We note the explanation that this draft outline marine WSI accompanies the following chapters and appendices in the Environmental Statement (ES) to be submitted in support of any subsequent Development Consent Order (DCO) application:
- Volume 2, Chapter 5 (Approach to the EIA);
- Volume 2, Chapter 16 (Marine Archaeology);
- Volume 2, Chapter 25 (Historic Environment);
- Volume 4, Appendix 16.1 (Marine archaeology technical report); and
- Volume 4, Appendix 25.1 (Gazetteer of heritage records).

<u>We must therefore state that any advice we offer here is without prejudice to any advice that we may subsequently offer regarding the above referenced ES chapters and appendices or any other chapters, appendices or accompanying documents</u>.

Comments on the draft Outline Marine Written Scheme of Investigations

Section 2.2 (Rampion Extension Development Limited: Implementation)
Paragraph 2.2.3 – The text states that "Any future archaeological works undertaken will require detailed Method Statements outlining methods and further environmental measures." We require this text to be amended in consideration that it is the purpose of a WSI to outline techniques and it is the purpose of a method statement to specify how any survey data acquisition programme or campaign will be conducted that best supports archaeological analysis and interpretation. It is also not entirely clear what "further environmental measures" means and must therefore be clearly defined and explained, which should be cross-referenced with Table 16.2.5 (Embedded environmental measures).

Paragraph 2.3.2 – We appreciate that the RED project will advise the Retained Archaeologist regarding other possible "scheme-wide documentation such as Environmental Management Plans." However, it should also be made clear what the relevance and application of such plans are to any agreed programme of archaeological investigation, protection or other means of mitigation.

Section 2.4 (Archaeological Curators: Implementation) – Individual curators should not be named; this Outline WSI is only to identify Historic England as the national curatorial body.

Chapter 3 (Proposed development details)
Paragraph 3.1.4 – We require confirmation that terms such as "seabed levelling" and "ground reinforcement" will be clearly defined and whether such terms are inclusive of dredging as may be required to support installation of any proposed infrastructure.

Section 5.7 (Historic Seascape Characterisation) – It is not clearly explained why this section is included within this draft Outline WSI. It is the purpose of a WSI to set out methodological approaches as necessary to inform and guide any post-consent survey programmes, so that those data produced may best support archaeological and geoarchaeological analysis to deliver mitigation. It is not clear from this section what further data capture and analysis is proposed to address matters as relevant to interpreting perceptions of change in historic seascape character.

Section 5.8 (Research frameworks) – The paragraphs in this section are to be revised to provide clarity which is presently absent. For example, paragraph 5.8.1 mentions that "Specific research questions will be included in the Method Statements for each campaign". However, Table 16.2.7 explains that "All survey works will be preceded by a specific Method Statement and include a research framework" whereas Section 9.3 mentions "specific objectives of archaeological works, including research frameworks" Paragraph 5.8.2 should identify past research projects that relate to the marine part of the scheme, such as Gupta S. et al. Arun valley work[1], which is not mentioned. The wider palaeo-environmental context provided by the research completed on the Sussex raised beaches is also relevant, for example Bates M. et al. Palaeolithic Archaeology of the Sussex/Hampshire Coastal Corridor[2]. The relevant research framework that includes coastal Sussex is the South East Research Framework: https://www.kent.gov.uk/leisure-and-community/history-and-heritage/south-east-research-framework.

Paragraph 5.8.3 – The capacity for this project to capture and contribute important new information should be acknowledged, which is a factor recognised in National Policy Statement EN-3. We acknowledge that analysis led by this proposed project can contribute new understanding about palaeo-environmental remains and buried sedimentary deposits, which should enhance public knowledge and understanding. Therefore, this paragraph should be reworded to state more clearly that a positive gain from the proposed project could be the improved understanding about past landscape evolution and the historic environment of this coastal/marine area. You may wish to highlight opportunities for public engagement, through promotion of findings as revealed by this proposed project, enabling us to learn more about our shared environment and the changes over time that have occurred.

Chapter 6 (Potential effects) – It is not clear why this chapter is included in this draft Outline WSI.

Chapter 7 (Environmental measures)
Paragraph 7.1.3 – It states that a marine WSI could be developed in consultation e.g. with curators which provides an "…overarching approach to survey and archaeological investigations prior to pre-construction works commencing." It is therefore crucial that all parties understand how and when to apply any Outline WSI, as could be submitted

[1] Submerged Palaeo-Arun and Solent Rivers: Reconstruction of Prehistoric Landscapes (2008)
[2] The Palaeolithic Archaeology of the Sussex/Hampshire Coastal Corridor (2007)

in support of this proposed project. Paragraph 7.1.4 states that “Pre-construction any intrusive construction activities will be planned to avoid any identified marine heritage receptors and AEZs…” it would seem that “any intrusive construction activities” are not pre-construction, but part of a defined “construction” phase. It is essential that this document is clear about the timeframe of application of any Outline WSI, as could be used to guide archaeological assessment in the period between consent (should this be obtained) and construction starting. For any construction phase, the appropriate WSI should be prepared in consultation with the Regulator and Archaeological Curators. Paragraph 7.1.7 should seek to focus on known or potential sites and features of archaeological interest. It is the roll of curators to assess the importance of identifiable interest and to determine significance.

Graphic 16.2.1 (Flowchart summarising the embedded environmental measures) – Requires amendment, so that the detailed post-consent/pre-construction survey campaigns (should consent be obtained) informs the selection and spatial extent of any Archaeological Exclusion Zones (AEZs). For example, subsequent high-resolution investigation of anomalies as listed in Table 16.2.2, plus any which are presently unknown and are discovered.

Box “Potential outcome A” is to be deleted in consideration that it appears to follow on from anomalies or features which merit in-situ protection within AEZs. Box “Embedded mitigation C-57” appears to be duplicated without explanation. It is also apparent that the box including text about method statements should be moved to prior to embedded mitigation measures C-58 and C-59. It is important that survey programmes are set with objectives inclusive of acquisition of geophysical and geotechnical data etc to support archaeological interpretation; this is essential given the ambition that areas of geoarchaeological potential will be targeted.

The box discussing C-59 needs rewording as “full archaeological review” doesn’t echo the dual geoarchaeological/geotechnical purpose of the geotechnical campaigns. The text should be amended so that “…subject to full archaeological review…” is replaced by “…designed with geoarchaeological input….”

Table 16.2.5 (Embedded environmental measures) – We acknowledge that the text of embedded measure C-59 has been modified to reflect the need for geoarchaeological input to the design of the geotechnical survey, to address research questions and to enable samples specifically for geoarchaeological purposes to be collected from targeted locations. This means that the geoarchaeological investigation should now be proactive, rather than simply reacting to the geotechnical scope.

Section 7.2 (Mitigation for known wrecks and obstructions), paragraph 7.2.2 – All AEZs of 50m radius should be illustrated in accompanying figures. Paragraph 7.2.3 – The text should acknowledge that presently there are no designated heritage assets or other sites subject to the provisions of the Protection of Military Remains Act 1986. The text of this paragraph also requires revision to be clear that if archaeology receptors could be directly impacted by consented works and that removal from the seabed is required, that justification will be set out in a task-specific method statement, produced in consultation with Historic England, and agreed with the relevant competent authority.

Section 7.3 (Mitigation for unlocated marine heritage receptors), paragraph 7.3.2 – The statement made here is not compliant with National Policy Statement EN-3 in that the most effective form of protection should be achieved through use of exclusion zones. It must also be made clear that geoarchaeological investigations are done in tandem with geotechnical campaigns and do not follow them as is presently suggested.

Paragraph 7.3.3 does not adequately explain the function of a protocol system for archaeological discoveries i.e. it is not the purpose of a reporting protocol to provide protection from impact efficiently and effectively. It is designed to facilitate rapid communication between identified key stakeholders should the project encounter and/or recover unexpected material of possible archaeological interest.

Table 16.2.6 (Definition of archaeological potential) – More attention is necessary to demonstrate why a readily identifiable wreck is considered of "high" archaeological potential. It is apparent that such features are likely to represent 20th century losses whereas anomalies that provide a minimal geophysical signature, and presently considered to be "medium" archaeological potential, could be of considerable antiquity and therefore of major archaeological interest and significance.

Section 7.4 (Mitigation for geophysical anomalies of archaeological potential), paragraph 7.4.6 – The AEZs have been placed as a radius from the centre point of the feature. It is therefore essential that illustrations are provided to demonstrate how a convenient radius encompasses the entire identified wreck and any associated debris field. Paragraph 7.4.7 – A gazetteer is required for the 31 "high" potential anomalies assigned 100m AEZs and the 23 "medium" potential anomalies assigned 50 AEZs.

Figure 16.2.2 – Requires revision so that each AEZ is identified with a reference code linked to a gazetteer included within the WSI.

Figure 16.2.4 – The key includes "wreck" this data source should be identified e.g. UKHO and therefore if a "live" record. All the "wreck, seen in geophysical data" should be identified with references codes linked to a gazetteer included in the WSI.

Figure 16.2.5 – We appreciate that the preliminary geoarchaeology borehole locations are only indicative. However, it is our advice that geoarchaeological vibrocore transects should target any area of peat exposed on the seabed, as well as the various palaeochannels. We therefore recommend four transects rather than the two presently proposed. The production and consultation with Historic England of geoarchaeological method statements will be crucial to optimise corroboration between geophysical and geotechnical survey data acquisition programmes. It is the function of a WSI to facilitate such coordination and thereby target priority locations for further investigation as necessary to inform delivery of a consented project.

Section 7.5 (Mitigation for deposits of geoarchaeological potential), paragraph 7.5.3 – We note mention is made to "…a staged geoarchaeological approach…" While we appreciate that some professional archaeological consultants/contractors might employ such an approach, it is important that we direct your attention to Gribble J. and Leather S (2011) *Offshore Geotechnical Investigations and Historic Environment Analysis: Guidance for the Renewable Energy Sector*. In particular, the attention given to setting an overall objective to produce a geo-archaeological deposit model, which can be produced through agreed phases of analysis.

We therefore require this draft outline marine WSI to be revised to offer greater clarity about geoarchaeological mitigation. C-59 and supporting paragraphs (e.g. 7.5.3) suggest that obtaining the archaeological vibrocores and their assessment/analysis is the sum-total of the geoarchaeological mitigation. However, an end-point objective is necessary as represented by the production of a geo-archaeological deposit model. It is the case that assessment, analysis and completion of technical reports, using the usual range of dating and geoarchaeological/palaeo-environmental techniques is a basic requirement which should build towards the agreed objective. Depending on significance and impacts, the initial core examination might indicate a need for other or further mitigation. This might involve not only working on the initial cores obtained, but require further fieldwork (such as new cores, diving/lifting blocks of sediment for excavation onshore etc). The opportunity to obtain new cores to provide better coverage and more detailed information is suggested in paragraph 7.8.4 and Table 16.2.7. It is apparent that a general indication is given about further mitigation, but more detail is presently available which could be included e.g. to spatially set out where such work might take place within the overall ES development boundary, as revised.

Section 7.7 (Mitigation for unexpected archaeological discoveries), paragraph 7.7.8 mentions Temporary Exclusion Zones (TEZs), which can be used on discovery of seabed archaeological material and employed to prevent further disturbance. However, it is crucial that any retained archaeological advice service rapidly determines whether any TEZ should be adopted as an AEZ and therefore applicable for all activities associated with the wind farm construction, operation and maintenance and decommissioning phases. Paragraph 7.7.9 requires amendment accordingly and paragraphs 7.7.10 and 7.7.11 reordered to provide a logical structure.

Section 7.8 (Further archaeological works), paragraph 7.8.2 – The text must be amended to explain that any future method statements produced in consultation with the relevant curator/s will inform any operations and maintenance phase of this proposed project and not the Outline Marine WSI which is only applicable post-consent/pre-construction.

Table 16.2.7 (Further site-specific documents, works and surveys) – Must be amended as follows, in this order:

- an outline marine WSI is the document that should be submitted with any ES prepared in support of this proposed project and to address any post-consent/pre-construction phase of project planning;
- training project contractors/sub-contractors in the use of a reporting protocol;
- any geotechnical campaign to be conducted post-consent/pre-commencement should be guided by a method statement informed by the methodological approach set out in the outline marine WSI;
- an archaeological watching brief is not necessarily to "…monitor sites of potential archaeological significance" but is to be applied where it is thought likely that materials of archaeological interest might be encountered. For example, if foreshore open trenching is required at the electricity export cable(s) landfall location;
- a draft marine WSI is to be produced, in consultation with curators, which is based on the outline marine WSI and is to detail archaeological methodologies for the assessment of survey data as might be acquired on commencement of defined (i.e. intrusive construction) works; and

- archaeological post-construction monitoring plan to be produced ahead of any subsequent defined operations and maintenance phase.

Chapter 8 (Responsibilities and communication)
It is not the case that Historic England has curatorial responsibility for the proposed Rampion 2 project seaward of Mean High Water Springs (MHWS); this statement must be amended in recognition of terrestrial local authority planning jurisdiction.

Section 8.2 (Retained archaeologist) – This section requires amendment to clearly explain responsibility for ensuring project documentation is agreed with the competent authority in accordance with the timescales of any consent secured for this proposed project. To avoid the communication issues experienced on Rampion 1, it should be made clear that a Retained Archaeologist will be expected to maintain a log of cores collected and whether/where they are stored (and/or discarded), as well as responsibility for producing and circulating any technical reports relating to their recovery and assessment. In support of this matter, any retained archaeological service will list documents and reports issued, including when and to whom they were circulated.

Section 8.4 (Construction contractors) – Prior to implementing any project-specific PAD, contractors should ensure that all relevant staff receive the requisite training in its application.

Chapter 9 (Scheme of investigations)
Paragraph 9.1.2 – It is not the role of an outline marine WSI to include method statements, as might be prepared should consent be obtained. Furthermore, not all the references subsequently listed are relevant to the preparation of method statements as they are either out of date and/or focused on policy matters.

Section 9.3 (Method statements), paragraph 9.3.2 – The time period specified for submission of draft method statement to curators, for consultation, should recognise any formal requirement for agreement of such documents with the relevant competent authority. For example, as set out within any Deemed Marine Licence whereby agreement (before commencement) is required from the MMO.

Section 9.4 (Archaeological campaigns), paragraph 9.4.1 – It is our advice that the acquisition and archaeological analysis of new survey data directly contributes to effective planning of this proposed project. A WSI should provide an effective means to ensure avoidance of impacts to potential archaeology; therefore, incorporating archaeological advice during survey planning is not an "also" contribution. Paragraph 9.4.2 – This paragraph should be revised to be clear that the specification(s) of all proposed marine geophysical surveys regardless of primary aim is to include advice from a specialist archaeological contractor, so that survey objectives can be clearly set at the planning stage to derive maximum value from data capture programmes. Paragraph 9.4.3 – It should not be the case that archaeological objectives are "added" but embedded within the overall survey design. It must be entirely clear that, where necessary, there should always be the capacity to include the requisite professional archaeological expertise onboard during survey. It should be the role of such professionals to participate in survey campaigns, so that those data acquired best support archaeological results analysis and interpretation. These comments are also applicable to paragraphs 9.4.6 (geotechnical surveys) and 9.4.9 (diver/ROV surveys).

Paragraph 9.4.4 – The statement that survey specifications will be prepared by the retained archaeologist needs to be reconciled with the list of tasks set out in paragraphs 8.2.2 and 9.4.5 which mention use of archaeological contractor(s). Paragraph 9.4.6 – The detail here does not correspond with the approach set out in the Gribble and Leather 2011 guidance on offshore geotechnical investigations (as referenced above), which describes project phases and that it is the objective of each phase to produce or build towards an agreed outcome of a geo-archaeological deposit model.

Paragraph 9.4.10 – The statements lack clarity and require attention. It is essential that archaeological diver or ROV-based investigations are conducted, if agreed by all relevant and competent authorities, that it is not possible to protect an archaeological site through avoidance. It is also essential that all archaeological reporting complies with professional standards, as well as any published industry-specific guidance.

Paragraph 9.4.11 – An archaeological watching brief conducted by a professionally qualified archaeologist will be applicable where material of possible or known archaeological interest is to be moved or removed from the seabed.

Section 9.6 (Artefacts) – Detail must be added to explain the role of any retained archaeological service and associated responsibilities; such as liaison between any archaeological contractor(s) and local or national curators.

Section 9.7 (post-fieldwork assessment) – The role of any retained archaeological service must be made clear. Any agreement as to the scope of post-fieldwork assessment(s) agreed between RED and local or national curators, will only be possible following submission of investigation technical reports, as coordinated by a retained archaeological service.

Section 9.8 (Ordnance) – The brief detail provided here must be expanded to capture the key safety factors as detailed within The Crown Estate 2021 guidance; such that primary responsibility is with any UXO Contractor employing clear lines of communication with any retained archaeologist and/or the archaeological contractor.

Section 9.10 (aircraft) – The text requires revision to be entirely clear about securing permission, as required by the Protection of Military Remains Act 1986, prior to any (intrusive) investigation or recovery occurring.

Section 9.11 (wreck) – The text here is not sufficiently clear and requires amendment regarding the role of any retained archaeological service and the coordination of reporting any "wreck" as required by Merchant Shipping Act 1995. Additional detail is required to explain the role of any retained archaeological service in producing and completing an agreed disposal strategy of recovered material that is not accessioned.

Section 9.12 (conservation and storage) – A statement needs to be added to explain good practice for core storage as necessary to support geoarchaeological analysis.

Section 9.13 (Archiving) – Detail is to be added regarding accredited toolkits for digital data archiving, such as produced by CIfA (www.archaeologists.net/digdigital).

Section 10 (Arrangements for review of the WSI) – The process described requires revision as it is not clear. At this stage, we understand that a draft Outline Marine WSI has been produced based on the archaeological assessments undertaken to date to support preparation of the Rampion 2 DCO application. It is the function of an "Outline marine WSI" to set out the methodological basis for archaeological analysis and interpretation of survey data as should be produced post-consent and pre-construction; this is done through the detail of method statements which are produced in consultation with curatorial bodies. If consent is obtained for the proposed Rampion 2 project, the DCO should provide for a Marine WSI to be produced and applicable once the project commences, as defined by the DCO, and therefore applicable throughout any construction phase. Paragraph 10.1.3 – the text must be amended, any agreed AEZs will not be impacted.

Section 11 (Glossary of terms and abbreviations) – AEZs are spatially defines zones around identified marine heritage asset receptors that will be avoided during construction works by any seabed impacting infrastructure required by the consented project or associated plant employed in the construction programme.

Deemed marine licence – If a DCO is granted for this proposed project it will include deemed marine licences. Drop Down Video (DDV) – It should be explained if the use of DDV is also applicable during UXO survey. We noted the definition of "offshore" as being further than two miles from the coast. What is the basis for this definition and is the measurement statute or nautical miles? The definition of "significance" requires attention to explain how this term is used from a cultural heritage perspective i.e. how and for what reasons a heritage asset is considered to hold significance.

The draft outline marine WSI has not clearly demonstrated why seascape is included therefore these terms should be removed. Furthermore, in consideration of how seascape will be considered elsewhere in any submitted ES, it essential to be clear in the use of terms to describe and explain seascape. For example, in reference to how the term is used in NPS EN-3 (vis. inter-visibility between land and sea), the definition used in the UK Marine Policy Statement and the European Landscape Convention (ELC) definition. Add "environmental measures" and "Environmental Management Plans".

Annex A (Outline project-specific Protocol for Archaeological Discoveries (PAD))
Under "curators" reference should only be made to Historic England and not individual staff members. For any discoveries as may occur in the intertidal area, the primary point of contact is with the relevant local authority.

Yours sincerely,

[redacted]

[redacted]
Head of Marine Planning

cc.[redacted] (Science Advisor, London and South East Region, Historic England)

ES Mitigation, Monitoring and Enhancement Register

To be included in ES								
ID #	**Commitment**	**Onshore/ Offshore**	**Project phase (pre-construction, construction, operation & maintenance, decommissioning)**	**How will the measure be secured**	**Source of commitment**	**Aspect(s)**	**Impact being mitigated**	**Mitigation, enhancement, compensation or monitoring?**
C - 57	A Marine Written Scheme of Archaeological Investigation (WSI) will be developed in accordance with the Outline Marine WSI. The Marine WSI will outline the Archaeological Exclusion Zones (AEZ's), the implementation of a Protocol for Archaeological Discoveries in accordance with 'Protocol for Archaeological Discoveries: Offshore Renewables Projects' (The Crown Estate, 2014) and future monitoring and assessment requirements.	Offshore		DCO requirements or DML conditions.	Standard/good practice			
C - 58	Offshore geophysical surveys (including Unexploded Ordnance (UXO) surveys) will be subject to full archaeological review where relevant in consultation with Historic England.	Offshore		DCO requirements or DML conditions.	Standard/good practice			
C - 59	Offshore geotechnical surveys prior to construction will be undertaken following early discussions with Historic England. The results of the geoarchaeological assessment will be presented in a staged geoarchaeological report inclusive of publication.	Offshore		DCO requirements or DML conditions.	Standard/good practice			

C - 60	All intrusive construction activities will be routed and microsited to avoid any identified marine heritage receptors pre-construction, with Archaeological Exclusion Zones (AEZs) (buffers) as detailed in the Outline Marine Written Scheme of Investigation (WSI) unless other mitigation is agreed with Historic England as per the WSI.	Offshore		DCO requirements or DML conditions.	Standard/good practice			
C - 111	A decommissioning plan will be prepared for the project in line with the latest relevant available guidance.	Crosscutting	Decommissioning	Outline COCP and DCO requirement	Scoping Opinion response request			
C-330	A post-construction monitoring plan as per Written Scheme of Archaeological Investigation (WSI) will be produced. The post-construction monitoring plan will recommend areas or sites of high archaeological significance and outline how post-construction monitoring campaigns will collect, assess and report on changes to marine heritage receptors that may have occurred during the construction phase.	Offshore	Operation & maintenance	WSI and DCO requirement	Good practice	Marine Archaeology	Impact on known and identified receptors	Monitoring

Internal information				
Project phase measure introduced	**Date requested (new ES commitments only)**	**Aspect, name of person requesting**	**PEIR Commitment - DO NOT EDIT**	**Changes made following review**
Scoping - updated at PEIR			A Marine Written Scheme of Archaeological Investigation (WSI) will be developed in accordance with the Outline Marine WSI. The Marine WSI will outline the Archaeological Exclusion Zones (AEZ's), the implementation of a Protocol for Archaeological Discoveries in accordance with 'Protocol for Archaeological Discoveries: Offshore Renewables Projects' (The Crown Estate, 2014) and future monitoring and assessment requirements.	
Scoping - updated at PEIR			Offshore geophysical surveys (including Unexploded Ordnance (UXO) surveys) will be subject to full archaeological review where relevant in consultation with Historic England.	C-97 (duplication of commitments) has been removed
Scoping - updated at PEIR			Offshore geotechnical surveys prior to construction will be undertaken following early discussions with Historic England. The results of the geoarchaeological assessment will be presented in a staged geoarchaeological report inclusive of publication.	Offshore geotechnical surveys prior to construction will be undertaken following early discussions with Historic England. Areas with geoarchaeological potential will be targeted during geotechnical sampling campaigns and the results of the geoarchaeological assessment will be presented in staged geoarchaeological reports inclusive of publication. The published results will aim to enhance the palaeogeographic knowledge and understanding of the area.

Scoping - updated at PEIR			All intrusive construction activities will be routed and microsited to avoid any identified marine heritage receptors pre-construction, with Archaeological Exclusion Zones (AEZs) (buffers) as detailed in the Outline Marine Written Scheme of Investigation (WSI) unless other mitigation is agreed with Historic England as per the WSI.	All intrusive activities undertaken during the life of the project will be routed and microsited to avoid any identified marine heritage receptors pre-construction, with Archaeological Exclusion Zones (AEZs) (buffers) as detailed in the Outline Marine Written Scheme of Investigation (WSI) unless other mitigation is agreed with Historic England as per the WSI. Micrositing and AEZs will further be applied to yet undiscovered marine archaeology receptors should they be located.
PEIR			A decommissioning plan will be prepared for the project in line with the latest relevant available guidance.	
ES	01/02/2022	Maritime Archaeology, [redacted]		

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[redacted]
Offshore Consents Manager

Your reference:
Our reference:
DCO/2019/00005

By email only

30 June 2022

Underwater noise monitoring survey method.

Thank you for your submission of the Underwater noise monitoring survey methodology which was shared with us by Natural England on 13 June 2022.

Following consultation with the Centre for Environment Fisheries and Aquaculture Science (Cefas) the Marine Management Organisation (MMO) has the following comments:

1. The MMO would like to reiterate that this survey work does not guarantee a way forward in terms of removing a seasonal working restriction. The MMO may still require further evidence and maintain the view that a seasonal restriction is required.

2. It is appropriate that a calibrated system will be used to obtain noise measurements. The general set up of the static monitoring equipment (see Figure 2 of the Method Statement) follows best practice guidance. The hydrophone will be placed approximately 2 m above the sea floor. It is generally recommended that in relatively shallow UK waters such as the English Channel and North Sea, the measuring hydrophone/recorder should be positioned in the lower half of the water column, ideally between ½ and ¾ of the total depth, measured from the sea surface (*Good Practice Guide for Underwater Noise Measurement*, 2014).

2. It will also be beneficial to record any auxiliary data and metadata that may be relevant, so these can be correlated with the measured noise levels during analysis

3. It should be recognised that the short term (i.e. 14 day) deployment in both June and July can only provide a snapshot of ambient noise levels within the vicinity. To comprehensively characterise the ambient noise levels in specific locations or regions, long-term measurements are required. Short- and medium-term deployments do not generally sample the whole range of values of the ambient noise (*Good Practice Guide for Underwater Noise Measurement*, 2014). Essentially, a short-term measure of the ambient noise should not be used as representative of the ambient noise at that location for any time other than the period of time during which the measurements were undertaken (*Good Practice Guide for Underwater*

Noise Measurement, 2014).

Your sincerely

[redacted]

[redacted]

Marine Licensing Case Officer

[redacted]

Copies to: [redacted]

References

Good Practice Guide for Underwater Noise Measurement, National Measurement Office, Marine Scotland, The Crown Estate, Robinson, S.P., Lepper, P. A. and Hazelwood, R.A., NPL Good Practice Guide No. 133, ISSN: 1368-6550, 2014.

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Our reference: DCO/2019/00005

18 May 2022

[redacted]

MMO Response to Cable Corridor Expert Topic Group minutes, technical note for sensitive features, Draft ES Appendix 6.1,6.3, 9.3 and information on alternative to floatation pits.

At this stage of the planning process, Rampion Extension Development Ltd (RED) are conducting environmental and technical surveys and undertaking consultation with regulatory bodies, stakeholders and communities.

The currently proposed development is sited adjacent to the southeast and west of the existing Rampion Offshore Wind Farm (OWF), approximately 13 kilometers (km) to 25km offshore, occupying an irregular elongated area. The wind farm array Area of Search has an approximate area of 315km^2. The scoping area for the offshore export cables to connect the offshore wind farm area to the shore is approximately 74km^2.

Rampion 2 OWF is expected to comprise of no more than 116 wind turbine generators (WTGs) with a total generating capacity of 1200 Mega Watts (MW). In addition, there will be up to three offshore substations and up to 4 export cables which will carry generated power to landfall at Climping, Sussex.

The Marine Management Organisation (MMO) and relevant Centre for Environment, Fisheries and Aquaculture Science (Cefas) advisors attended the Cable Corridor issues Expert Topic Group meeting (ETG) on 15 February 2022.

This ETG included a presentation of the main issues and an outline of the mitigation approach proposed. At the meeting RWE stated that updated draft Environmental Statement (ES) chapters on Coastal Processes (baseline technical report and impact assessment) would be provided with the minutes for review to address any remaining issues on sediment transport, along with a draft ES updated Benthic Habitat report to take into consideration the survey data which was not included at PEIR and which has a full explanation as to how that model was derived. MMO/NE also requested further information on proposed alternatives to floatation pits.

On 11 March 2022 the MMO received the minutes of this meeting along with this additional information. The MMO have consulted with Cefas on the following documents as part of the Evidence plan process:

220215_Rampion2_EPP_Targated-Meeting_Offshore-Cable-Corridor-Issues_Minutes_v1.0

Rampion 2 Cable routing for sensitive features Technical Note_v1.0

Rampion 2 Draft ES Appendix 6.1 Coastal processes baseline technical report

Rampion 2 Draft ES Appendix 6.3 Coastal processes impact assessment

Rampion 2 Draft ES Appendix 9.3 Subtidal habitats survey report

Text on the floatation pit alternative.doc

Please note the MMO is still in discussions with Natural England to ensure the advice is consistent. At this stage these comments are subject to change throughout the Evidence Plan Process.

The MMO can confirm the minutes accurately capture the discussions held. Please note, the incorrect spelling of the surname of the Shellfisheries advisor. This should read "Samantha Stott" rather than "Samantha Scott."

Benthic Ecology

1. After reviewing the cable routing document, the MMO is in agreement with the mitigation presented.
2. The MMO note the Rampion 2 Draft ES Appendix 9.3 Subtidal habitats survey report presents a though analysis of the data collected in 2020/21, with the results clearly presented.
3. The benthic survey presented in the report (paragraph 6) was used to update the predictive map previously presented in the Preliminary Environmental Information Report (PEIR). The report states that the new survey data resulted in some changes to the final map outputs previously presented but does not present a comparison of the two outputs.
4. The report also states that several new biotopes were introduced in the new models and notable increases in correctly classified pixels were observed throughout all maps. However, it is unclear which are the new biotopes, as the original predictive map has not been presented in the document for comparison. MMO require the inclusion of the original predictive map figures and details of the additional biotopes observed.
5. The document in paragraph 7 provides details on an alternative method to floatation pits (a method which Natural England has concerns with). As the cable lay vessel cannot suitably approach the Horizontal Directional Drilling (HDD) exit pits due to the depth of water (2-3mLAT), the cable will need to be handled either using several jack up barges or a CLB. The document does not however provide further information on what type of vessel a CLB is. Please expand this acronym and provide further information on this vessel type.
6. The CLB vessel will need to ground to enable works to be conducted. For grounding to be undertaken in a safe manner, the seabed must be suitable and not pose a risk to hull

integrity. Seabed preparation in the form of rock bags is therefore proposed over an area of 140 meters (m) x 40m. The vessel may potentially need to ground more than once. The document states that the nearshore seabed comprises exposed chalk with intermittent sediment cover but does not provide any information on the fauna that would be impacted. Further information is required.

Shellfish Ecology

7. No direct mitigation measures are in place for shellfish and shellfisheries, however mitigation measures outlined will indirectly benefit shellfish. MMO agree with this approach.

Fish Ecology

8. The minute contents accurately capture the discussion on identification of black seabream nests and mitigation proposed.

9. The mitigation options as described in paragraphs 7i-iv and 8 are welcomed. The proposed seasonal restriction from April-July encompasses the whole of the bream nesting season which is appropriate, and the mitigation options presented address a large proportion of our previously raised concerns and major comments. However, MMO do have some outstanding minor comments related to the refined cable routing.

Methodology – predictive modelling

10. **Minor technical comment**- Some of the Figures in the technical note, particularly Figures 4 and 5 are not of sufficient quality to fully interpret and it is difficult to interrogate individual data layers and view the legends. The MMO recognises that during the meeting higher quality figures from the cable route refinement options were presented and slightly better image quality has been included with the meeting minutes. However, providing a high-quality updated figure would be beneficial.

11. As previously advised, bream nesting areas have vast inter-annual variability as demonstrated by the aggregate monitoring data timeseries (2002-present) and do not have site specific nesting fidelity[1]. This variation in nesting area activity should be accounted for and considered when determining appropriate micro-siting mitigations, especially in relation to bream next distribution and predictive nest distribution. Further the limitations of the aggregate data including geographic extent should also be acknowledged and multi-year data should be used where appropriate.

12. In respect of predictive modelling, the MMO is in agreement with Natural England that clarity is required regarding the methodology and criteria used to define identification of nests and habitats in Figure 5 (annex 1), particularly in relation to the predicted/possible nest locations and any associated assumptions made. In order to confirm we are comfortable with the approach, we are seeking confidence in the methodology, and it is not clear how the 'possible biogenic reef or black bream nests' have been modelled and defined. It should be clarified whether this has been based purely in suitable habitat as a predictor and/or bathymetry contours. Also, including all multiyear data from the aggregate monitoring areas would improve confidence in the known bream nesting sites.

[1] The nesting areas fall broadly within the same geographic area and nesting grounds, though nesting does not necessarily occur annually on the exact same nesting beds.

Contributing data layers

13. The site specific geophysical survey that was undertaken between July and August 2020 across the offshore Assessment Boundary has limitations, as it was conducted after the period when most nest building, and nest guarding would have occurred (March – July). Consequently, MMO recommend that pre-construction geological and geophysical surveys be conducted across the entire cable route during the nest guarding season (full project boundary). Associated limitations and caveats related to this being a single year of data needs to be recognized and acknowledged, though it is noted this will be supplemented with aggregate monitoring data.

14. In terms of the aggregate monitoring data, it appears that Figure 5 is based on 2002, 2009, 2011 and 2020 data only. Given the inter-annual variability, all current and historic data from 2002 onwards should be included in defining the known nesting site locations and buffers. It would be useful to have these provided as shapefiles/interrogatable PDF layers in an updated Figure 5 along with a layer showing the aggregate monitoring areas and Marie Conservation Zones so these can be cross referenced. Regarding more recent aggregate data, there are some limitations to be mindful of. To the best of our knowledge, to date there have been inconsistencies in the timing of post June aggregate monitoring surveys. The 2017b surveys were undertaken on 31 May and 07 and 25 August. Thereafter, the surveys undertaken in 2018, 2019 and 2020 were completed between May and July, thus making the comparisons between the 2017 data and the July 2018-2020 data not appropriate.

Comments on draft ES appendix 9.3 subtidal habitats survey report.

15. This report has only been reviewed briefly. The figures (2 and 3) provided from the initial predicted habitat methods report may be useful to link into the refined cable routing information. The habitat sampling (grabs and drop-down video), Regional Seabed Monitoring Programme data and enhancing the aggregate nest monitoring data as requested above would provide further context. As the report has not been viewed in detail, MMO recognize this may already be the intention.

16. The MMO support the seasonal restriction to ensure cable installation activities within the export cable area are undertaken outside the black seabream breeding period (March-July), thereby avoiding any effects from installation works on black seabream nesting activiites during the breeding season. It should be noted that cable laying activities generally tend to be a lower risk activity in terms of underwater noise (compared to pile driving for example). Avoiding the sensitive breeding season will likely reduce the risk of behavioural effects (i.e. disturbance or displacement) on black seabream.

Coastal processes

17. The principal concerns with cable routing are related to benthic ecology and black bream nesting sites. In respect of actual changes to coastal processes, the impacts of cable routing vary with the degree of burial achieved versus the need for surficial cable protection measures, influencing post-lay seabed (habitat) recovery. These separate interests do not necessarily align exactly, and ecological and process impacts may conflict in some locations. It is the MMO's view that ecological concerns are more immediate and more significant and should be prioritised in the routing and mitigation applied.

18. The principal means of mitigation is avoidance of direct impacts (Section 3.1.3 of the routing report), but this aim is made more difficult by uncertainty over ephemeral nesting

area locations. From a coastal process perspective, avoidance would require avoidance of habitats which could not recover i.e., chalk and rock reef, either from ploughing or from loss beneath rock protection (3.1.5), or limiting of suspended sediment plumes during breeding periods (3.1.9).

19. The principal mitigation measures proposed are routing to avoid sensitive seabed features, use of specialized cable lay technology to minimize spatial impacts, and seasonal restrictions to avoid nesting periods. In respect of coastal process impacts, these measures will limit the long-term changes, and the shorter term impacts due to locally increased suspended sediment concentrations (SSC) as far as is practicable for a cable installation in this defined area.

20. Section 4.2.19 states that there is no potential for indirect impacts on black bream nesting sites from SSC long-term. MMO consider this to be true in respect of the coastal processes changes.

Appendix 6.1 Coastal process baseline technical report and 6.3 Coastal Process Impact Assessment

21. The baseline technical report provides detailed and relevant evidence for the assessment, which on rapid review also appears to be equally detailed and based on the evidence provided.

22. In coastal process terms, the proposed gravel bags option would appear to represent the minimum duration, extent (and hence magnitude) of potential impacts on native sediment, but this may result in some compression of the local sediment and so this should be discussed and assessed.

Conclusion

The MMO welcome the mitigation proposed in relation to the export cable corridor. However, there are still outstanding minor comments that need to be addressed.

Yours sincerely

[redacted]

[redacted]
Marine Licensing Case Officer

[redacted]

[redacted]

Date: 20 May 2022
Ref: 378574

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VIA WEBSITE ONLY

[redacted],

Discretionary Advice Service (Charged Advice)
Development proposal and location: Rampion 2 Offshore Windfarm, West Sussex

Thank you for your consultation. This advice is being provided as part of Natural England's Discretionary Advice Service. Rampion 2 has asked Natural England to provide advice upon:

Coastal processes (Annex 1)

- Rampion 2 Draft ES Appendix 6.1 - Coastal processes technical report: baseline description
- Rampion 2 Draft ES Appendix 6.3 - Coastal processes technical report: Impact assessment

Offshore ornithology (Annex 2)

- Rampion 2 Draft ES Appendix 12.1 - Offshore and intertidal ornithology baseline technical report
- Rampion 2 Draft ES Appendix 12.2 - Offshore ornithology displacement analysis
- Rampion 2 Draft ES Appendix 12.3 - Offshore ornithology collision risk modelling
- Rampion 2 Draft ES Appendix 12.4 - Offshore ornithology migratory collision risk model
- Rampion 2 Draft ES Appendix 12.4 - Offshore ornithology migratory collision risk model - Annex A screening matrix
- Rampion 2 Draft ES Appendix 12.5 - Offshore ornithology population viability analysis

Underwater noise – fish and shellfish (Annex 3)

- Rampion 2 Technical Note: Underwater noise mitigation for sensitive features (amended) (TN1)
- Rampion 2 Technical Note: Additional underwater noise modelling (TN2)

Cable corridor (Annex 4)

- Rampion 2 Technical Note: Cable Corridor area mitigation for sensitive features

Floatation Pits (Annex 5)

- Email with information of the options being considered, due to not using floatation pits.

Benthic habitats (Annex 6)

- Rampion 2 Draft ES Appendix 9.3 - Subtidal habitats survey report

This advice is provided under the current DAS contract referenced above.

In relation to the draft Environment Statement (ES) Appendices any comments are initial observations based on the data presented within the appendices only. Without sight of the full Environmental Statement chapters, it is not possible for us to comment on how this data has then been used within the assessment. Therefore, the comments in this response are provided without prejudice to further comments we may have when we have reviewed the full ES Chapters.

Detailed comments on the documents submitted are provided in Annex 1-6.

Yours sincerely

[redacted]

Sussex and Kent Team

[redacted]

☒ The advice provided in this letter has been through Natural England's Quality Assurance process

The advice provided within the Discretionary Advice Service is the professional advice of the Natural England adviser named below. It is the best advice that can be given based on the information provided so far. Its quality and detail is dependent upon the quality and depth of the information which has been provided. It does not constitute a statutory response or decision, which will be made by Natural England acting corporately in its role as statutory consultee to the competent authority after an application has been submitted. The advice given is therefore not binding in any way and is provided without prejudice to the consideration of any statutory consultation response or decision which may be made by Natural England in due course. The final judgement on any proposals by Natural England is reserved until an application is made and will be made on the information then available, including any modifications to the proposal made after receipt of discretionary advice. All pre-application advice is subject to review and revision in the light of changes in relevant considerations, including changes in relation to the facts, scientific knowledge/evidence, policy, guidance or law. Natural England will not accept any liability for the accuracy, adequacy or completeness of, nor will any express or implied warranty be given for, the advice. This exclusion does not extend to any fraudulent misrepresentation made by or on behalf of Natural England.

Annex 1

Coastal processes

	Document	**Section**	**Draft ES**	**Comments/Recommendations**
1	Appendix 6.1	3.6	Temperature, Salinity and Stratification	We welcome this new section to the Draft ES
2	Appendix 6.1	4.1.5-4.1.9	Landfall - Present Day Setting and Historic Evolution	We welcome the update to this section
3	Appendix 6.1	4.1.10-4.1.12	Landfall - Future Baseline	We would advise that, owing to uncertainty regarding the future evolution of the shoreline at landfall, the project should assume the worst-case scenario (WCS) for coastal change in the siting of buried and non-buried project infrastructure, taking into account not only coastal retreat, but also beach profile/intertidal elevation change, and climate change. This approach should also consider the project's operational life and any decommissioning period. Conversely, the WCS for the proposed development's vulnerability to coastal change should also be assessed.
4	Appendix 6.1	4.1.10-4.1.12	Landfall - Future Baseline	The implications of the proposed project on strategies for managing this section of the coast, as set out in Shoreline Management Plans (SMPs), flood and coastal defences capital programmes etc should also be considered.
5	Appendix 6.1	4.2.13	Export Cable Corridor - Future Baseline	We welcome the update to this section and the consideration of the future baseline for the Export Cable Corridor (ECC) Seabed Morphology. However, whilst it is stated that confidence 'in any future projections of change' is extremely low, we would advise that in part this is due to insufficient characterisation of seabed mobility, sediment transport pathways and sediment transport rates across the ECC. This is an important part of the baseline characterisation as it informs MDS for seabed preparation/levelling, cable exposure and/or protection measures, scour, and removal of seabed sediments. This needs to be considered over the lifetime of the project.

6	Appendix 6.1	5.7	Potential mobility due to tidal currents	An analysis of potential seabed mobility in response to tidal currents alone has been presented for the eastern/central areas of the Rampion 2 array area only. However, it is also stated (in Section 5.7.2), that [tidal] currents are faster in the western areas of the Rampion 2 array and, based on observed peak current speeds and empirical expressions, gravel-sized material has the potential to be mobilised during peak spring tides. Yet, no assessment of sediment mobility has been provided for the western array, ECR, or wider Zone of Influence. Sections 5.7.2-5.7.4 discuss potential sediment mobility in response to tidal currents across the western areas, ECR, and over ebb and flood tides, but no estimates have been provided or mapped. Therefore, an assessment of seabed mobility, sediment transport pathways and rates within the ZoI, offshore site and cable route, and nearby coast should be provided as part of the baseline characterisation. Storm surge conditions also need to be considered.
7	Appendix 6.1	5.8	Potential mobility due to waves	In 5.8.2, it is stated that near-bed orbital velocities associated with the waves observed during the Rampion 1 surveys were considered not to be strong enough to cause sediment mobility within offshore areas. Moreover, it is also suggested that wave-induced sediment transport across the wider study area only occurs approximately 5-20% of time during the year. The Applicant needs to show how and why this Rampion 1 evidence is directly relevant and applicable to the Rampion 2 ZoI, with particular consideration of shallower areas, wave-current interaction, and storm conditions.

8	Appendix 6.3	2.1	Changes to SSCs and bed levels	We refer the Applicant to our earlier comments on the PEIR regarding presentation of sediment plume model data for drilling and dredging. Alongside the tabulated model output, it would be extremely helpful to map the spatial and temporal variations in predicted SSCs above background concentrations due to drilling and dredging across the array, for different sediment sizes and different tidal conditions. Moreover, it would also be useful to map the spatial and temporal variation in sediment deposition thickness due to dredging and drilling across the array area.
9	Appendix 6.3	2.3	The spreadsheet based numerical model used to assess changes in SSC and bed levels uses a representative current speed for the Rampion 2 array area of 0.5m/s.	In Section 2.2, depth-averaged mean spring currents within the Rampion 2 array area are given as 0.75-1m/s, whilst within the ECC, speeds are described as 0.5-0.9m/s, where 0.5m/s is near to landfall. Can this point be clarified please?
10	Appendix 6.3	2.4.7	Changes to the MDS for Drilling WTG Monopile foundations/OSP jacket foundation pin piles: Drilling rate of 5m/hour, minimum spacing of 1130m between larger monopile type WTG foundations, and OSP drill diameter of 4.5m.	We note that the drilling rate for WTG monopile foundations and pin piles for jacket foundations has been updated from 0.5m/s in the PEIR, to 5m/s in this Draft ES. Moreover, the minimum spacing between larger WTG monopile foundations is now given as 1130m (instead of the 1720m previously quoted in the PEIR), along with a drilling diameter for the OSP jacket foundation pin piles of 4.5m now (instead of the 3.5m previously quoted in the PEIR).
11	Appendix 6.3	2.4.9	Table 6.3.1 Maximum Design Scenario for Sediment Release by Drilling WTG Monopiles	We note that the MDS for the number of WTG monopiles has been reduced from 75 to 65 larger WTG type. In turn, the MDS for the maximum number of WTG monopiles to be drilled is now 33 WTG monopiles.
12	Appendix 6.3	Table 6.3.2	Maximum design scenario for sediment release by drilling OSP jacket pin piles.	This is now 20m2 (Draft ES) updated from 10m2 (PEIR)

			Area over which sediment is released at or above the water surface	
13	Appendix 6.3	Table 6.3.5	Maximum and Average Thickness of Seabed Deposition due to Drilling 100% of the Volume of One Larger WTG Monopile Foundation (100% Drill Arisings as Gravel)	The maximum thickness of seabed deposition for 100% gravel arisings due to drilling for WTG Monopile Foundation has now been capped at 10m in the Draft ES, as opposed to 77.81m (in 13m water depth).
14	Appendix 6.3	Table 6.3.6	Example range of potential extents and thicknesses of sediment deposition as a result of drilling 100% of the volume of one larger WTG type monopile foundation (100% drill arisings as sands or gravels)	The maximum thickness of deposit is now 10m (compared with 17.5m in the PEIR), and the cone diameter is now 74m (compared with 56m in the PEIR).
15	Appendix 6.3	Page 24, Bullet Point 1	The potential array area (237.6km2)	We note that the potential array area has reduced from 269.4km2 to 237.6km2. Can the Applicant demonstrate how the array design has been changed?
16	Appendix 6.3	2.5.1	It is stated that dredging may also be used to clear sandwaves where they are present in the footprint of foundations and where they intersect array, interconnector and export cable routes in the array area. It is also stated that there are no sandwaves present in the	Whilst Section 4.2 of Appendix 6.1 does not show the presence of sandwaves in the ECC, it does show the presence of megaripples across the southern part of the ECR. Will clearance of megaripples (or other significant bedforms) across the ECR be cleared prior to cable installation? If so, this should be considered in the dredging calculations.

			export cable corridor (ECC).	
17	Appendix 6.3	2.5.5	The number of smaller WTG type jacket foundations that could potentially require seabed dredging has been reduced from 116 (Draft ES) to 90 (PEIR). The minimum spacing between smaller WTG jacket foundations has also increased from 860m to 950m.	Can the Applicant provide further details of this change in the MDS for the smaller WTG type jacket foundations?
18	Appendix 6.3	Table 6.3.7	Average depth of dredged area 1m	Is 1m a realistic WCS?
19	Appendix 6.3	Table 6.3.7	In Table 6.3.7, it states that the largest volume of sediment disturbed for ground preparation dredging for a single WTG foundation is due to the larger jacket foundation, whilst the maximum adverse scenario for the array area as a whole is attributed to 90 smaller WTG jacket. It is also stated that the maximum larger WTG jacket	This needs to be clarified. Moreover, the title of Table 6.3.7 is 'MDS for sediment release by ground preparation dredging for a single, and for all WTG jacket foundations', yet the table also refers to cables in the array area.

			dimensions at the seabed are 40 x 40m and dredging to 15m beyond the jacket foundation would lead to a dredge footprint of 70 x 70m. In Section 2.5.7, it states that both smaller and larger WTG types have the same dimensions, and in Section 2.5.5, it refers to a footprint of 60 x 60m.	
20	Appendix 6.3	Table 6.3.7	Equivalent number of dredging cycles to dredge sandwaves for all foundations and cables in the array area. No sandwaves in the export cable corridor.	What about seabed preparation where there are megaripples in the ECR? Can the Applicant confirm that there will be no seabed preparation by dredging (pre-sweeping) prior to cable installation in the ECR?
21	Appendix 6.3	Table 6.3.14	Example range of potential extents and thicknesses of sediment deposition as a result of overspill during dredging for foundation bed preparation	Section 2.5 discusses seabed preparation by dredging prior to foundation and cable installation. This covers dredging for foundation seabed preparation and sandwave clearance in the array area. Table 6.3.14 provides a range of possible value combinations for sediment deposition due to overspill during dredging for foundation bed preparation, however, there is no equivalent table for sandwave clearance. This is important as the areas for sandwave clearance dredging will not be the same as the areas for foundation bed preparation.
22	Appendix 6.4	2.6	Cable burial - MDS	It would be very useful to provide maps of settled sediment thickness and plume dispersion due to cable trenching for different locations along the ECC, over different tidal conditions and for different sediment types.

23	Appendix 6.3	Table 6.3.17	MDS for total length of all export cables is 170km. This MDS includes 80% contingency.	17km x 4 = 68km plus 80% contingency = 122.4km; plus, 40km interconnector cables = 162.4km. Can the Applicant clarify this? Moreover, can the Applicant explain the rationale for 80% contingency? 80% contingency is significantly higher than the contingency figures usually presented/accepted for projects such as this.
24	Appendix 6.3	Figure 6.3.4	Sediment Disturbance Effect Zones	It would be very useful if maps could be provided to show the extent to which seabed areas adjacent to the array, and at a number of locations along the ECC, might be affected by increases in SSC and sediment deposition due to construction activities, over a range of tidal conditions and for different sediment types. For example, maps of model output to show deposition footprint and plume dispersion extent due to monopile drilling, seabed preparation for jacket suction bucket foundations, and at different locations along the ECC due to cable burial/seabed preparation.
25	Appendix 6.3	3.3.7	Section 3.3.7 states that an indicative layout pattern for the smaller WTG type and areas of likely locations for the OSPs are used to identify three MDS layouts for the MDS type and number of foundations. However, in Section 3.3, the MDS is stated to be 65 larger type WTGs on jacket foundations with suction buckets. Figures 6.3.5-6.3.7 seems to show 65 WTGs with 3 OSPs, which ties in with the MDS stated in Section 3.3, rather than 90 smaller WTGs.	Can this be clarified?
26	Appendix 6.3	6.4.11	Tables 6.3.23 and 6.3.24 scour assessment results	Mapping of predicted deposition footprints due to scoured material across the array area should be provided for the WCS for both local and group scour.

27	Appendix 6.3	6.4.11		How applicable are the assumptions in the scour assessment for all areas of the Rampion 2 development?
28	Appendix 6.3	6.4.13	9th Bullet Point. The greatest total footprint of global scour is associated with an array of 65 x larger WTG jacket pin pile foundations with 3 x OSP jacket with pin pile foundations (Table 6.3.24), not 90 x smaller WTG type jacket with pin pile foundations.	This needs to be clarified.
29	Appendix 6.3	6.4.13	2nd Bullet Point. Sediment plumes potentially caused during more rapid early stages of the scouring process.	What is the WCS for the impact of scoured material from around the foundation structures in terms of elevated suspended sediment concentrations? Can representative plots of suspended sediment plumes due to scour around foundations be provided (for the different layouts of the array areas)?
30	Appendix 6.3	6.4.8	It is suggested it would take 60 days for equilibrium conditions to develop based on Harris et al (2011).	Could you calculate/estimate how long it is likely to take for the maximum equilibrium-depth scour pits to develop?

Annex 2

Offshore Ornithology

Updated CRM and Displacement results

CRM

- Based on an initial review of the CRM modelling, Vol 4, Annex 12.3, all the CRM parameters appear to be correct and in accordance with our advice, i.e., avoidance rates, flight speeds and nocturnal activity factors and the model appears to be being run as previously advised.
- We note there has been some movements in predicted impacts vs the PEIR for all species. Most movements are within a small range, except in relation to Kittiwake for which the mean predicted impacts are now 3.67 individual's vs 11. It is not clear what has driven this change and a reduction in c. 2/3rd of the previous impact? This should be checked and clarified.

Displacement

- Annex 12.2 appears to be in line with our advice. It details displacement for Gannet, Guillemot and Razorbill, both in the array and within a 2km buffer and presents a full range of impacts based on the advised ranges of displacement (Gannet 60-80%, GU & RA 30-70%) and a full range of mortality (1-10%).

Migratory CRM

- The correct methodologies have been applied, i.e., use of the APEM Migropath model, but also in addition the use of the WWT and MacArthur Green approach also recommended to address the 'broad front' for which terns are likely to migrate vs a point-to-point migratory path from mainland to mainland.
- We previously requested that any predicted impacts for Rampion 2 were presented alongside Rampion 1, i.e., two columns by species, with a total for both projects. We advise that this detail is presented in the final ES.

HRA Apportioning

- Natural England agree with the apportionment rates for Guillemot and Razorbill, both for Flamborough and Filey Coast SPA and for Lesser black-backed gull for the Alde-Ore Estuary SPA.
- However, Gannet appears to be underestimated and Kittiwake overestimated vs what we would expect from the use of Furness BDMPS, possibly based on the workings of individual population sizes and BDMPS seasons. It is important this is re-visited and the working shown in full. i.e., the SPA adult population present in the relevant BDMPS and the total population size of the BDMPS.

    - For Gannet, it is not evident what the workings are, since they are not detailed in full in the PEIR (only the total population appears to be specified), and we would expect the rates to be higher than those in the tables, i.e., 4.84 vs 3.71 presented for the autumn and 6.23 vs 4.77 presented for the spring. Clear full workings and calculations should be provided in the ES.
    - For Kittiwake, it appears that the incorrect BDMPS area has been applied in the calculations and that the apportionment estimates are overestimated due to using the UK North Sea waters BDMPS region (with higher apportionment values) vs the UK Western waters and Channel BDMPS region (with lower apportionment values). The rates anticipated should be 1.65 vs 5.44 in the autumn and 3.26 vs 7.19 in the spring. Applying the correct western waters and channel BDMPS will result in lowering any predicted impacts. Clear full workings and calculations should be provided in the ES.

- The apportionment rates presented in the meeting on the 12th of April appeared to have been corrected to the rates we would expect from applying Furness 2015. This differed to what was presented in the documents, so it is important that those shared in the ETG meeting are used in the ES.

Population size and mortality rates

- The presented mortality rates concur with those that we advise using and are derived from the survival rates published in Horswell and Robinson (2015).
- The suggested individual feature colony population estimates have been revised and we are recommending using for Flamborough and Filey Coast SPA the most recent published count detailed in the NE publication, Flamborough and Filey Coast pSPA Seabird Monitoring Programme, Aitken et al (2017). In all cases the population estimates are higher, which is likely to reduce any predicted impact apportioned. For Lesser black-back gull at Alde-Ore Estuary SPA, we now advise using an estimate of 4,000 individuals based on 5 year mean (2012-2016) estimate.

Gannet displacement and use of 70% avoidance rate in CRM calculations

- For Gannet we recommend using 70%, but that a range of 60-80% avoidance or reduction in flux is modelled and presented in the ES, so that when the SNCB note is issued this working and an associated level of impact already exists in the ES. This should not be the only working, but just another scenario, in potential anticipation of revised advice. This would help minimise the requirement for re-workings at a later date. As discussed in the ETG we would encourage the presentation of this <u>additional</u> scenario.

We strongly advise that the standard template previously issued is used for the assessment. This allows for clear, succinct presentation of all the correct parameters for the assessment and the range of impacts and confidence intervals etc.

Offshore Ornithology HRA

<u>Adverse Effects on Integrity (AEoI)</u>

- A table in the presentation stated that the 'Current appropriate assessment conclusions' are for no AEoI for
    - Alde-Ore Estuary SPA, Lesser black-backed gull
    - Flamborough and Filey Coast SPA, Gannet, Kittiwake, Guillemot and Razorbill

- The above does not state whether this is ALONE or In-COMBINATION
- At this stage we generally agree that no AEoI is expected ALONE, but we will provide final comments on this when we see the final ES.
- Based on the PEIR and revised appendices it is possible that there could be AEoI In-Combination, especially for Kittiwake and potentially Lesser black-backed gull, which cannot be commented on further until we see the full ES.

<u>Transboundary site re-assessments</u>

- In reference to the slide presented referring to correspondence and requests from the French authorities, it is to be welcomed that they are engaging in those conversations, however they will not have a bearing on Natural England's advice.
- We would not want to see the BDMPS population apportioning matrixes (based on Furness (2015)), revised by incorporating new estimates of population sizes from France. The Furness (2015) BDMPS represents a moment in time when all individual colony sizes were appraised, and it would not be appropriate to now revise in part some of those colony estimates without re-visiting all colony estimates and we would advise no attempt to do so should be made.
- We strongly advise the use of the Furness (2015) apportionment only.

Compensation

- Clarification has been sought around describing impacts as de-minimus, especially for Kittiwake where the in-combination impact for Flamborough and Filey Coast SPA is predicted at 0.61 birds annually.
- The advice has been consistently that all impacts, in particular for in-combination, need to be recorded regardless of their magnitude and that none are 'negligible' or de-minimus.
- We have advised that the Applicant watches closely for rulings by the Secretary of State (SoS) for EA1N and EA2, where predicted impacts are also low in value. The recent SoS ruling for EA1N and EA2 at the end of March 2022 is that **SoS** has required compensation for the following impact levels:
    - Kittiwake/ Flamborough and Filey Coast SPA – 0.7 birds from EA1N; 0.8 birds from EA2
    - Lesser black backed gull/Alde-Ore SPA – 0.3 birds from EA1N; 1.6 birds from EA2

- In recognition of the above it is advised that Rampion 2 continue to consider the need for compensation, especially if there are predicted impacts in-combination.
- We have advised exploration of compensatory measures is undertaken in collaboration with the other RWE projects i.e., North Falls and Five Estuaries.
- Whilst there is a driver with the industry to move towards more strategic level compensation in the future, no existing agreement on the mechanisms or measures to do so has yet been determined.
- As discussed and agreed in the ETG, a separate targeted meeting should be set up to discuss the approach to compensation in more detail.

Annex 3

Underwater noise – fish and shellfish

Black seabream (*Spondyliosoma cantharus*)

Black seabream are a feature of Kingmere MCZ. Underwater noise has the potential to impact on the behaviour of black seabream within the MCZ during the breeding season. Part of the second conservation objective for Kingmere MCZ in relation to Black seabream is:

'the population (whether temporary or otherwise) of that species occurring in the zone be free of the disturbance of a kind likely to significantly affect the survival of its members or their ability to aggregate, nest, or lay, fertilise or guard eggs during breeding'.

The breeding season in the conservation advice for Black seabream within Kingmere MCZ was updated in 2021 to March to July (inclusive).

As presented in our PEIR response, underwater noise from the piling of the turbine foundations during the breeding season has the potential to create disturbance that could significantly affect the survival of Black seabream or their ability to aggregate, nest, or lay, fertilise or guard eggs during breeding. In the absence of suitable mitigation measures being put in place this therefore has the potential to undermine the conservation objectives of the site.

The worst-case noise contours for all three hearing thresholds are provided in Figures 4 to 6 (TN2). It is clear from these figures that all three thresholds cover Kingmere MCZ almost entirely form the northwest location, from the south location all contours interact with this site, and from the east all apart from the 147 dB contour interact with the site. This shows that during the breading season there is a potential for seabream to be disturbed within the site. Given the uncertainties around an appropriate noise threshold for behavioural disturbance within black seabream, it is Natural England's view based on the information provided that piling restriction during the entirety of the breeding season is the only approach that provides certainty that this feature will not be subject to behavioural disturbance, and that the conservation objectives are not hindered.

Threshold for behavioural disturbance to breeding Black Seabream

It is proposed in the papers provided that 147dB is a suitable threshold for disturbance to black seabream. Natural England have some concerns regarding the suitability of this threshold. These are:

- The Bruintjes et al. (2016) paper presented is not sufficient to determine an appropriate threshold for breading bream
- Seabass are not an appropriate proxy species for black seabream

The Bruintjes et al. (2016) paper

In the recent targeted meeting on the 24th of February the Bruintjes et al. (2016), was presented to us as a key piece of evidence used to inform the PEIR, having referred to the PEIR documents the only mention of this paper is here:

Sensitivity or value of receptor

8.9.36 Black seabream (Group 3) spawning, and nursery are present within the PEIR Assessment Boundary fish and shellfish study area, specifically within the proposed offshore export cable corridor, which is located adjacent to the Kingmere MCZ. Black seabream are considered sensitive to underwater noise associated with piling, with Bruintjes et al. (2016) identifying an increase in oxygen uptake during impact piling. The increased oxygen uptake suggests heightened stress during exposure to pile driving

(Barton, 2002). The sensitivity of black seabream to noise impacts is therefore considered to be high.

The Applicant did not mention Bruintjes et al. (2016) at all in TN1 submitted prior to the meeting, therefore the audit trail of how this came to be a key piece of evidence in relation to justify the behavioural thresholds selected is somewhat unclear. Had the Applicant made it clear that this was key to the discussion prior to the meeting this would have aided a more useful discussion.

This study is now explored in TN2 sent after the meeting. The study looks at whether there is an increase in oxygen uptake between ambient conditions (SELcum of 159.33 dB re 1 μPa2) and pile driving exposure (cumulative Sound Exposure Level (SELcum) of 184.41 dB re 1 μPa2). This study demonstrates that adult fish perceive/reacts to 184.41 dB SELcum, in pulses that were 25dB higher than the ambient noise. This caused a secondary stress response in bream, immobilised in a box. The Applicant has suggested the average ambient noise in the Rampion 2 survey area is 117dB. Using the 117dB and the +25dB from the Bruintjes study still gives a threshold of 142dB.

However, this study has a number of limitations that mean Natural England is concerned about it being used to determine a threshold. A key one being that it studies bream in an immobilised box, rather than whilst they are exhibiting breeding behaviours including nest guarding which can already be energetically taxing. The study was also conducted with an on/off impact, and within a highly controlled environment (former shipbuilding dock). Therefore, we do not think a suitable threshold can confidently be gained from this paper.

Seabass as an appropriate proxy species for black seabream

It is suggested in the papers that there is extensive literature on seabass, which can be used as a proxy for black seabream. Whilst we acknowledge that that literature suggests that black seabream and seabass are anatomically and physiologically similar, they do not display the same breeding behaviours. Breeding behaviours such as nest clearing and guarding are already energetically taxing and so disturbance due to underwater noise has the potential to add to this existing pressure. Therefore, it is our view that the literature that exists in relation to seabass cannot provide a reliable threshold for behavioural impacts in Black seabream.

The Kastelein et al. 2017 paper suggests that in sea bass a ‘50% initial response threshold occurred at an SELss of 131 dB re 1 μPa2 s for 31 cm fish and 141 dB re 1 μPa2 s for 44 cm fish; the small fish thus reacted to lower SELss than the large fish’ This study suggests that the size of the fish is important in determining threshold at which a response may occur. Consideration therefore needs to be given to the size of breeding black seabream, and the potential for them to be smaller than the seabass used in this study.

Mitigation measures

The Applicant has put forward a number of mitigation measures that they propose could be used to reduce noise levels to a level below the thresholds they have identified for black seabream within Kingmere MCZ. The paper presents figures of the levels of attenuation that these measures could achieve, but no evidence has been provided to support these figures. References should be provided to support these figures. Consideration also needs to be given as to whether these measures would be effective in the prevailing conditions in the location of Rampion 2. Evidence should be provided of these measures working successfully in locations where the conditions are similar and what noise attenuation levels were achieved. This would give more confidence that suitable mitigation measures exist in relation to this project.

The Applicant has suggested an option of combined offshore piling noise mitigation technologies to deliver noise attenuation. It appears that in many incidences this is the only approach that would reduce the noise within the MCZ to the kinds of thresholds the Applicant is suggesting. No information is provided on what measures would be combined to reach the levels stated, or if there is any evidence of such measures being successfully combined. We therefore do not have confidence that even if a suitable threshold could be agreed it could be attained.

Overall, in the absence of a reliable behavioural disturbance threshold, we cannot comment on the suitability of these measures, and we would not wish to advise the Applicant does additional work in this area, if ultimately there is not a suitable threshold.

Specific comments

TN1 - 6.2.24 - suggested that‘it should be noted that the double large bubble curtains system has been shown to have limited effectiveness in high current locations. Consideration should be given to whether the Rampion 2 development area is considered to be a high current location.

TN1 - figure 12 - The proposed zoning approach is reliant on modelling and a defined noise threshold. Both of these aspects involve significant uncertainties. A very small change to any aspect of the project could alter the level of noise attenuation required to achieve the numbers stated within the MCZ. Where there is so much uncertainty we would advise that the maximum level of noise attenuation that can be achieved should be proposed over the whole development site, rather than aiming for the minimum required.

TN2 – The additional noise modelling presented for 135 dB SELss and 141 dB SELss is helpful. However, we note that the various mitigation options are only considered for 147 dB SELss. Therefore, we cannot comment on the potential impacts from noise attenuation measures.

Rampion 1 Mitigation

The issue of disturbance of black seabream within Kingmere MCZ was also considered as part of the Rampion 1 development. The following conditions were included in the Deemed Marine License for Rampion 1:

Black bream spawning

18.— (1) No pile driving works for monopile foundations shall be carried out by or on behalf of the undertaker as part of or in relation to the authorised scheme between 15 April and 30 June each year, unless the MMO provides written confirmation to the undertaker beforehand that such works can take place in all or in a specified part of the Order limits, or during this period or part of this period.

(2) No pile driving works for jacket foundations (pin piles) shall be carried out by or on behalf of the undertaker as part of or in relation to the authorised scheme between 15 April and 30 June each year within the black bream restriction zone unless the MMO provides written confirmation to the undertaker beforehand that such works can take place in all or in a specified part of the zone, or during this period or part of this period.

(3) In considering whether to provide the confirmation referred to in (1) or (2) above, the MMO shall have regard to any report or reports provided to the MMO by or on behalf of the undertaker relating to such matters as additional baseline information piling management measures, installation techniques or noise propagation modelling.

(4) In this condition, “black bream restriction zone” means the area shaded blue on the piling restriction plan whose coordinates are set out below—

During the construction of Rampion 1, RWE sought a licence variation to this condition, however Natural England’s position was there was not sufficient evidence to allow this to occur. In the time since Rampion 1 was constructed it does not appear from what the Applicant has presented that substantiative new evidence has been found to confidently ascertain a behavioural threshold specific to black seabream. Therefore, Natural England are still of the view that the piling restriction that was used for Rampion 1 (updated to reflect the current Conservation Objectives) is the most appropriate way to ensure the conservation objectives of the MCZ in relation to Black seabream are not hindered.

Additional points

TN2 - It is suggested that the average ambient noise in the Rampion 2 survey area is 117dB. No information is provided as to when and how this measurement was taken, whether it was taken in the same area black seabream breed, or if this represents the worst-case scenario.

TN1 - point 6.2.1 states that 'There are procedural measures that can be taken in order to manage noise emission impacts during offshore construction. This includes a 'soft-start' process where the hammering operations are commenced at a very low energy and low blow rate in order to enable sensitive species to move away from the affected area. The soft start procedure acts as a warning and has been accepted as a mitigation measure in UK waters to date'. This statement does not consider bream nesting behaviour during the breading season and the requirements under the conservation objectives.

TN2 – figures - we note that the modelling provided for 135 dB SELss and 141 dB SELss does not included the western location.

TN 1 - point 5.2.17 – presents an argument that bream nests could form somewhat of a physical barrier to noise propagation. No literature has been provided to support this point.

TN1 - point 1.1.2 states that 'Depending on the strength of the response and the duration of the impact, there is the potential for some of these responses to lead to significant effects at an individual level (for example reduced fitness, increased susceptibility to predation) or at a population level (for example avoidance or delayed migration to key spawning grounds), although these may also result in short-term, intermittent changes in behaviour that have no wider effect, particularly once acclimatisation to the noise source is taken into account'. No evidence is presented that breeding black seabream would be able to acclimatise to the noise in a way that would not affect their breeding behaviours. Additionally, point 5.2.16 suggests peer reviewed studies 'provide some comfort that at the lower level (141 dB SEL_{ss}) acclimation is likely over periods of 8-12 weeks'. This statement fails to take into account the impact that 8-12 weeks acclimation time during the breading season could have on breeding success.

Short- snouted seahorses (*Hippocampus hippocampus*) and herring (*Clupea harengus*)

We understand that the key focus of the technical note is on black seabream (*Spondyliosoma cantharus*) specifically. However, some reference has been made to herring (*Clupea harengus*) and seahorse (*Hippocampus* sp.), which we have briefly commented on below.

Short- snouted seahorses (*Hippocampus hippocampus*)

TN1 - point 3.1.1 suggest that the PEIR was the first-time underwater noise impact on seahorses were raised. This was raised in our scoping response in August 2020, and the PEIR was the first-time noise modelling was provided. RWE are also aware of issues surrounding seahorses from Rampion 1.

TN1 – point 2.2.13 - it is stated that 'both spiny and short-snouted seahorses are known to frequent the south coast of England; however, they do not appear in any commercial landings data'. The Applicant should consider this may be because there is no requirement to record their presence or absence as part of commercial landings data. As Natural England have pointed out in our PEIR response there is insufficient evidence to suggest spiny and short-snouted seahorses are present in the immediate area of the development in 'low numbers'. The data is only sufficient to suggest they have been found in the area.

TN1 – point 2.2.14 -The Applicant states that 'Short-snouted seahorse are designated features at four MCZs in the area, Bembridge MCZ, Selsey Bill and the Hounds MCZ, Beachy Head East MCZ and Beachy Head West MCZ'. We note that the figures provided show some MCZ's, but that Pagham Harbour MCZ, Utopia MCZ and Selsey Bill and the Hounds MCZ are missing from the maps. Selsey Bill and the

Hounds is designated for short-snouted seahorses and is in a location that has the potential to be impacted by underwater noise, so this should be shown. It is currently hard to distinguish if the unmitigated scenario in figure 6 and 10 overlaps with the site. Looking at these figures we would question whether there is a modelling location in the northeast of the site that may have more overlap with this site.

TN1 – point 2.2.14 - it is suggested that Bembridge MCZ, the Selsey Bill and the Hounds MCZ, Beachy Head East MCZ and Beachy Head West MCZ, are located at approximately 20.4km, 10km, 13km and 21km distance from the Proposed Development respectively. These figures should be checked, as Beachy Head West MCZ is close than Beachy Head East. Additionally, these distances highlight the importance of including Selsey Bill and the Hounds in the figures as this is potentially the closest MCZ designated for seahorses to the development.

TN1 – figure 4 and figure 8 - in relation to Beachy Head West MCZ a clear overlap is seen with this site in the unmitigated situation shown in figure 4 (TTS) and figure 8 (potential disturbance). Therefore, in the absence of reliable mitigation there is the potential for underwater noise to have impacts on seahorses within this MCZ.

TN1 point 2.3.4 – we understand that the focus of the mitigation design is on the MCZ sites where seahorse are a designated feature. However, it is stated that piling noise attenuation measures will also minimise the risks of noise impacts to seahorse when they are thought to be overwintering offshore. Natural England would suggest that this is very dependent on the location of the overwintering seahorses, in relation to the piling activity. We remind the Applicant that outside of designated sites spiny and short-snouted seahorses are still protected under The Wildlife and Countryside Act (1981).

TN1 point - 7.1.8 states 'it is also apparent that overlap with the coastal MCZs at which seahorse are a designated feature can also be avoided at this threshold level, which will mitigate the likelihood of effects arising on seahorse in the summer period'. It is not explained why the Applicant posits it is appropriate to apply the same threshold levels to seahorses when Table 1 shows they fall within the Group 4 hearing category as set out in Popper et al., 2014, rather than Group 3 which the Applicant is asserting black seabream would fall within. Further justification of the thresholds in relation to seahorses needs to be provided to understand if these are appropriate.

Herring (*Clupea harengus*)

TN1 - point 2.3.5 states that 'with regard to herring, the PEIR Assessment Boundary has a spatially limited interaction with a small portion of the IHLS larval heatmap area and no direct overlap with recorded spawning grounds'. It would be helpful is the IHLS larval heatmap area was shown on the noise modelling presented. Where there is spatial overlap with this area the impacts should still be considered even if the Applicant considers the area of overlap to be 'limited' and adequate mitigation should be put in place. As with seahorses, herring are within the Group 4 hearing category as set out in Popper et al., 2014, rather than Group 3 which the Applicant is asserting black seabream would fall within. This needs to be recognised.

Annex 4

Cable corridor

Point 1.1.3 - we understand that the Applicant is committed to ensuring 'offshore cable routeing and micro-siting within the offshore export cable corridor area delivers avoidance of known sensitive features as far as practicable'. A key factor of this approach will be ensuring that the methodology used to identify sensitive features is sufficiently robust and transparently presented to provide confidence any sensitive features present have been identified and avoided.

Point 1.1.3 - we understand that the Applicant has committed to ensuring 'offshore cable routeing is designed to maximise the potential to achieve cable burial'. We support this measure in relation to minimising the need for cable protection and the additional footprint that this would have. Whilst this measure is important for minimising the long-term impact, it should be considered that where chalk is trenched it cannot recover, and it should not be assumed that the seabed in sediment habitats will always recover. Detailed justification and evidencing of any statements on recoverability should be provided in the ES.

Point 1.1.3 - we support the Applicants commitment to 'adoption of specialist offshore cable laying and installation techniques to minimise the direct and indirect (secondary) seabed disturbance footprint to reduce impacts' in principle'. However, we do not at this stage know the final cable laying technique that will be used and therefore we cannot comment on whether the final methodology selected will represent the most minimal impact.

Point 1.1.3 - we support the Applicants commitment to adhere 'to a seasonal restriction to ensure cable installation activities within the export cable area are undertaken outside the black seabream breeding period (March-July)'. Whilst we agree this will avoid direct impacts from the cable corridor installation works during the breeding season, consideration needs to be given to the recoverability of suitable breeding habitats after the works. We understand that the Applicant intends to microsite around known nesting sites to avoid direct impacts to theses, but indirect impacts such as increased sediment deposition in nesting areas, which has the potential to persist after the works will need to be considered. Recoverability of any unknown nesting habitat within the cable corridor should be considered in the ES.

Point 1.1.5 – We cannot comment definitively on whether the measures discussed in the paper will allow a conclusion of 'no significant residual effects on the relevant sensitive features within the Rampion 2 offshore export cable corridor area as a result of the installation of the Rampion 2 export cables' until we are presented with all the information in the ES.

Point 2.2.6 - it is important that the benthic habitats baseline mapping seeks to identify any features protected under Section 41 of the Natural Environment and Rural Communities (NERC) Act 2006 present in the area. It is unclear if the habitats list represents all the Section 41 habitats that were found in the survey or just the habitats that are being considered. All Section 41 habitats should be considered.

Point 2.2.10 - have details on Kingmere Rocks and Worthing Lumps been sought from the local biodiversity records centre?

Point 3.1.1 - concerns around impacts on NERC (UK BAP) reef habitats were raised at the scoping stage prior to the PEIR.

Point 4.2.4 – 4.2.19 This paragraph suggests rapid recoverability within four months and that sediments will be reworked by natural processes to revert to baseline condition in weeks, with no long-term changes to the nature of the seabed expected. Links to where this is evidenced clearly within the coastal processes chapter will need to be provided in the relevant ES Chapters. We have still not seen the type of illustrative sediment plume modelling we asked for at the PEIR. In order to understand the impacts on potential bream nesting areas, we need to see this modelling in relation to known nesting sites and also Kingmere MCZ. If known bream nesting areas cannot be avoided, then consideration would need to be given to whether rock directly impacted by trenching could recover to suitable nesting habitat. At this point without the full ES Chapters, it is too early to definitively state there is 'no potential for indirect impacts to continue to affect the nature of the seabed long term or cause any issue outside of a period when black seabream might be actively spawning during the cable installation works'.

Point 4.2.6 suggests that *Sabellaria* recovery will be "rapid". The available research and evidence for impacts and recoverability of *Sabellaria* is weak, but it can vary from a year, 2-5 years to no recovery at all. There might be instances where recovery is faster, but this is likely to be variable based on factors such as the size of impact, time of year of disturbance and available sediment input as well as availability of local reefs which can significantly aid recovery. A more thorough review of the available literature and any uncertainties should be presented and acknowledged in the ES.

Point 4.2.6 – 4.2.7 We understand that the Applicant has committed to micrositing to avoid any known areas of *Sabellaria* reef and that the baseline surveys to date have shown that except for a small area of potential biogenic reef, there is no prominent *Sabellaria* reef.

Point 4.2.6 In relation to micrositing to avoid *Sabellaria*, it will be important that pre-construction data is gathered to confirm whether any reef structures are present closer to the time of construction. The micrositing may need to be adjusted at that point to account for any new areas of reef that may have developed.

Point 4.3.5- we understand that at this stage the Applicant is committing to mitigation measures and not the equipment used to achieve them.

Figure 5- overall this figure is not of a scale where it is easy to comprehend. However, we have the following points from what is distinguishable:

- We note that the potential barge grounding area is substantial in size, what is the footprint of this area? Will efforts be made to minimise the requirement for grounding over this area?
- We note that a number of techniques have been identified with mechanical cutting being identified as required in the nearshore and at points on the route, mechanical cutting/jetting being identified to the south of this and then for the majority of the cable route closer to the array, with an area of jetting in the middle of the cable corridor. Information to justify the assessment of the methodology of trenching to be required should be provided in the ES.
- In areas where mechanical cutting/ or mechanical cutting/jetting has been proposed in the southern half of the cable route and in a small area in the northern section rock dumping is either likely or possible with an allowance for 30% of the route. The methodology for identification of these areas and impacts on underlying habitats where protection may be required should be detailed in the ES.
- It is not possible to make out the contents of the table of notes.
- Climping Beach SSSI is still in the red line boundary, yet the Applicant has committed to avoiding this site. Is this because the HDD could go under it? If so any impacts on the SSSI from possible slumping etc. would need to be considered.

Point 4.4.5 - we understand that black bream nesting sites were mapped using 'historic desk studies and the most recent survey data, drawn from the aggregates industry surveys and from the geophysical survey of the Rampion 2 PEIR boundary carried out in 2020'. The timings and spatial limitation of these surveys will need to be clearly recognised as a limitation to their use in identifying nesting sites within the ES. Opportunities to enhance this data with suitably timed pre-construction surveys should be explored, whilst recognising this would not account for interannual variation.

Figure 6 – as discussed in the meeting it would be useful to see a copy of this study. There is no clear explanation of what scenario A and B refer to. Scenario B does appear to go through known bream nesting sites.

Point 4.4.8 – 4.4.10 - as noted in our PEIR response we would like to see this mapped illustratively, so that we can clearly understand the depths expected in known nesting areas and within the MCZ's. In identifying a buffering distance, it should still be recognised that fines have the potential to travel significantly further than gravels. This is even more pertinent in the areas identified where the spacing is likely to be less than 200m. Any details from the coastal processes section that are used to support arguments in other ES chapters, should be clearly cross referenced. The assertions within this report are not evidenced or cross referenced.

Point 4.4.10, 4.4.13 we note that two pinch points have been identified where the trenching works could be within 150m and 175m of black bream nesting sites or biogenic reef. It is stated that these areas 'would not be subject to significant deposition effects'. The text in point 4.4.8 does suggest 'that for sands there could be a depositional depth range of 3-6cm over an area up to 100 to 200m downstream of the active trenching location as installation proceeds along the length of the trench'. It would be useful to understand exactly where these pinch points are located and the sediment conditions in these areas. Any assertions made in relation to there not being any significant settling of sediments in known nesting areas/ areas of biogenic reef need to be clearly linked to evidence of this in the coastal process chapter within the ES.

Point 4.4.11 -4.4.12 In relation to targeting paleochannels, has consideration also been given to any potential challenges associated with utilising paleochannels? Such as the potentially unpredictable nature of the channel infill substrate and localised hydrodynamics, and the potential for sediments in paleochannels to be mobile or poorly consolidated? Do you envisage this being a problem?

Point 4.5.1 - 4.5.2 – whilst we support the Applicants approach of 'considering techniques, approaches and equipment to minimise the direct (footprint) and indirect (SSC and deposition) effects', we cannot comment on whether the mitigation is appropriate to reduce 'impact risks to non-significant levels for NERC (UK BAP) reef features and potential (unknown) black seabream nesting locations' until we see all the information presented in the ES chapter.

Point 4.5.7 - it is suggested that in total '2.35km of route length (per cable) may require a level of alternative protection, such as rock dumping. Overall, the engineering study has identified that a mechanical cutting trencher is necessary for up to 54% of the route length, of which 13% is considered likely to require further protection with rock placement'. It is important that a realistic worst-case scenario is assessed in the ES in relation to the habitats this cable protection could effect.

4.7.2 In relation to the uncertainty around unknown black bream nesting locations outside of the MCZ, we support the adoption of the installation methodologies that minimise the footprint of impact and the amount of SSC/deposition. Consideration should be given in the first instance to the methodology available at the time of construction that minimises this as far as possible.

As raised in our PEIR response 'in light of the new Nearshore Trawling Byelaw 2019 which came into effect on 22 March 2021, and the associated ongoing Sussex Kelp Restoration Project, the potential for cable corridor work to impact upon restoration efforts in this area should be considered'. Representatives from the project were present at the cable corridor targeted meeting. Conversations in the meeting focused on the impacts of the cable works, however we would like to see the developer having conversations with this group about potential opportunities for net gain in relation to kelp as part of the Rampion 2 proposals.

Annex 5

Floatation pits

Natural England are supportive of the Applicants commitment to not use floatation pits, as we had concerns about the further permanent losses of marine chalk this option would have resulted in. As requested at the meeting on the 15th of February the Applicant has now sent further information on alternatives that may be used to potentially overcome the issues posed in relation to grounding vessels in the nearshore.

A key consideration is that should an option that involves the placement of material on the seabed be utilised, the Applicant would need to confidently demonstrate that this would be in place for as short a time as possible and would be easily fully removed. In relation to options that explore the placement of material on the seabed we would therefore have a preference for bagged or caged material to be used as opposed to loose material. It is important that the footprint of any material placement is minimised as far as possible. We have concerns regarding placement of loose material on the seabed due to the challenges in removing this after construction and the likelihood of this material getting dispersed by natural process and therefore potentially impacting a wider area.

The Applicant has suggested 'that a cable lay vessel cannot approach within a suitable distance of the HDD exit point and either handling of the cable via several jack-up barges or a CLB must be used'. Natural England would like to understand, which of these options would have minimal footprint on the seabed?

We understand that the example 'CLB 'Boka Constructor' has two legs that can be used, however the footprint of seabed preparation this would require appears to include the footprint of the entire vessel, so it is assumed that the legs cannot be used at this depth? The Applicant states that 'even a shallow draft CLB (~3.5m draft) will not be able to approach the immediate HDD exit point to perform the cable pull-in without grounding out at seabed and that there may be other nearshore areas where the water depth is too shallow to allow vessels to float'. It is important that the maximum area where any preparation is required is assessed. How does this relate to the vessel grounding area in the cable corridor paper, which is presumably much larger than this? As we raised in our PEIR response the option of extending the use of HDD to deeper water to avoid the requirement for vessel grounding should be explored.

It is suggested that the Applicants current leading option for seabed preparation is the use of rock filter bags. In relation to this option, we wish to understand if the bagging will be suitably robust to avoid being damaged by grounding vessels, which could result in the material becoming loose. It would be useful to understand if this methodology has been used on other projects for this purpose and if full removal of all material was successful. It will be important that the pre-construction surveys pay particular attention to the habitats present in the area to be impacted and that these bags are not placed on any other Section 41 habitats e.g., *Sabellaria* reefs.

Natural England are aware that remote burial devices have been utilised on other projects that can be controlled by an installation barge further offshore. The paper presents two representatives remotely operated devices but suggests that both options still require support vessels in the nearshore area. Consideration should be given to whether there are any remote burial device options that do not require a support vessel to be grounded in the nearshore.

Annex 6

Benthic habitats

Point 1.2.2 - it is noted that the Applicant has identified that the following habitats protected under Section 41 of the NERC Act 2006 that have the potential to be located within the ES Assessment Boundary:

- Stony Reef
- Bedrock reef
- *Sabellaria spinulosa* reef
- Fragile Sponge and Anthozoan Communities on Subtidal Rocky Habitats
- Peat and Clay Exposures
- Subtidal Sands and Gravels
- Subtidal Chalk

Have other NERC habitats such as blue mussel beds or native oyster reefs been considered?

Point 2.2 - Acoustic Survey Data 2020 – it is important that the differences in benthic habitats are considered in relation to potential impacts, such as suspended/deposited sediments from cable laying works or piling of turbine foundations.

Point 2.2.- Black Seabream Nest Mapping – the limitations of the timings of this part of the survey needs to be recognised (i.e. at the end/outside of the nesting season).

Point 2.2 - Initial Rampion 2 Predictive Habitat Map Methods Report (2021) – it is stated that 'potential reef habitat from the predictive model was identified as occurring in low density throughout the composite and broad scale maps, particularly in the nearshore and west of the survey area. The series of models did not predict the presence of species of conservation importance'. We would expect *Sabellaria spinulosa* to be present in the wider area off the Sussex coast therefore it would be useful to understand why the predictive habitat modelling did not suggest this. Where potential *Sabellaria* reef was found does this correspond with the predictive mapping? If not then is there confidence that the mapping has adequately identified any areas? We have previously raised questions around the multibeam settings. If the multibeam was set up to survey broadscale bathymetry, then there is a risk it may not detect finer-scale structures like Sabellaria reefs.

Point 4.1 – In general the optimal time to undertake benthic surveys (particularly the ground-truthing) is in spring or early summer (May/June) where the maximum plant and faunal growth can be observed. We note that the subtidal surveys were undertaken between 7th December 2020 and the 28th February 2021. We raised concerns in our advice prior to the surveys being undertaken that the timing of the surveys risked poor quality images being gathered and that this might result in insufficient data being gained. It is important that sufficient resolution is recorded by surveys for subsequent analysis, otherwise this can affect the reliability of the results. Point 6.1 suggests the video aspect of the survey was not of sufficient quality due to turbidity and therefore the main assessment was conducted using stills. Consideration needs to be given to the limitations of not having acquired suitable video data and to whether the quality of the stills is also a limiting factor. Pre-construction surveys will need to be carefully timed to ensure that the maximum opportunity is created to collect video data at a high enough resolution. The Applicant should consider this limitation (and others such as the limited number of successful grabs within the ES boundary) and whether further surveys at a more appropriate times of year could increase how robust and rigorous the baseline data is going into toward submission. Given the current limtiations of the data, Natural England are not currenlty in a postion to endorse the findings of the surveys, and advise further surevys are undertaken to inform the baseline data set.

Figure 2 – as we have mentioned previously it would be helpful if descriptions were provided next to the bio cluster groups.

Figure 3 – we note that a significant amount of the survey points are now outside of the assessment

boundary. Is the Applicant confident that sufficient coverage of the ES boundary is still provided?

Point 5.6 -predictive habitat/ biotope mapping – as covered in our PEIR comments 'When producing the habitat model, it is assumed that not all datasets were analogous. Therefore, how was it decided what data should take precedent? It is assumed that where up to date site specific data is available that this would take precedence over older, more general datasets'?

Point 5.6.2 - Physical Variables - The backscatter raster was omitted from the final maps due to strong differences in acoustic signatures between the nearshore and offshore areas, which had the potential to significantly influence the final model predictions. We understand that multibeam data can be set to focus on bathymetry or seabed discrimination. It would be helpful to know what these settings were in the field, and whether this could explain the differences in the nearshore and offshore? The Applicant should provide details of any limitations in the reliability of the data that may be presented due to the backscatter data being omitted. It is possible that bathymetry data may not detect finer-scale structures like *Sabellaria* reefs.

Table 9 – some areas of medium rocky reef have been identified. Will consideration be given to avoiding such areas by micrositing?

Table 10 – We recognise that the *Sabellaria spinulosa* reef identified as low reefiness, but this does not diminish the need to consider mitigation. Particularly, given the limitations highlighted in the data and the confidence levels this gives in the classification of reefiness.

Table 10 – when comparing this document to the incomplete version submitted as part of the PEIR there appear to be differences in where *Sabellaria spinulosa* were recorded. In the PEIR version it is stated that 'Some localised Sabellaria *spinulosa* tube aggregations were recorded in several still images at transects T018, T027, T036, and T_038, and DDV station 02'. In the draft ES version it is stated that *Sabellaria spinulosa* reef was identified in 15 images along transects T_024 and T_027. An explanation should be provided as to why this difference has occurred. We also note that figure 4 appears to show it also being present at T025 and figure 5 T036 and T038. We currently lack confidence in this data, due to the apparent inconsistencies.

Figure 4 – due to the stacked nature of the data points on this figure it is hard to distinguish individual points, particularly where stony reef is medium or low. This data needs to be presented in a way that all the points are more visible. We understand that this is the data from the transects, but did the geophysical data also show any areas of potential reef? It would be useful to include this information on one figure.

Figure 4- it does not appear that all transects have been labelled.

Figure 5 – consideration should be given to avoiding Features of Conservation Importance (FOCI) habitats identified in this figure when selecting the cable route. It would be useful to understand in this figure, if what was found matches habitats predicted in the model at these points?

Figure 4 and 5 – these figures show the locations where Annex I reef and Habitats of Conservation Importance (HOCI) have been identified, but not the extent of these habitats. It is unclear how they can be avoided without mapping their extent.

Point 6.2 - we note that only 27 of the 39 grab sample were successful, this represents a limitation in the ground truthing of the model which needs to be recognised. Particularly as some of these points are now outside of the ES boundary.

Figure 8 – the differences in the sediment types within the ES boundary need to be recognised in the coastal process modelling in relation to suspended and deposited sediments, and therefore the potential impacts on Kingmere MCZ and Offshore Overfalls MCZ. Figure 10 shows that sand is present in high % contribution at a number of stations.

Point 6.3 - we defer to the Environment Agency and Cefas in relation to potential contamination.

Figure 15 – do the grab samples where *Sabellaria spinulosa* was identified correspond with the DDV and predictive mapping? It appears to be the 3rd most abundant microbenthic taxa, which seems at odds with the prediction that it would not be present in the area, and only appears in limited DDV images at low reefiness. It was also present as the 3rd most common habitat in the maximum and average densities of the microbenthic taxa identified and presented. It would be helpful to understand more of the microbenthic taxa identified rather than just to top 10, particularly where they may be protected under Section 41 of the NERC Act.

Table 1 – it would be helpful to include a figure of where *Sabellaria spinulosa* was present in the grab samples. Where this does not correspond with the transects, what level of confidence is there in relation to the reefiness of these areas?

6.6 Model Validation

In relation to the predictive mapping model, we have some concerns about the reliablity of the modelling. The report highlights the greatest percentage of correctly classified pixels occurred within sublittoral coarse sediment (A5.1) with 77.5% of pixels classified correctly. However, it apepars that for the majority of the pixels the % that were correctly classified was significantly lower than this. Within the all EUNIS classification levels A5.4 and A5.2 were 39.5 and 37.5 respectively, but the remaining 8 EUNIS classification levels were between 12.5 and 0.5 percent. It is suggested that the 'greatest percentage of miss-classifications occurred within the map displaying all levels (Figure 22) whilst miss-classification was largely reduced in all single level maps (Figure 23 - Figure 25)' This statement should be justified as there still appears to be a significant level of misidentification identified in the confusion matrices for the single level maps. It is suggested that the Cohen's Kappa score of agreement per predictive map is non/poor level of agreement (all EUNIS levels) to moderate/good (Level 4 and level 5). It would be useful if the Applciant detailed the parameters of the classfications that have been used and attribtued the methdology to the relevant literature. Our understanding is that 0.10 (all) is none to slight, and 0.25 (broadscale), 0.38 (level 4), 0.35 (level 5) would be fair. All these figures are significantly less than 1, which would be perfect agreement. Irrespective of the classification, this appears to suggest across all maps there was significantly more disagreement than agreement. The Applicant needs to clearly acknowlage this and provide a detailed exaplaintion of why this is the case. The report suggests that there has been 'a reduction in the percentage of correct predictions and overall accuracy since the PEIR and this 'can be explained by the small increase in multiple classifications coupled with the size of the survey area', but no detailed decision is offered. Based on what is currently presented we do not have sufficent confidence in the reliability of the predicted modelling.

A fundermetal element of any modelling is adquate ground truthing as rasied above in realtion to point 6.2, we undetsand only 27 of the 39 grabs were sucessful, and as rasied in relation to point 4.1 the video aspects of the DDV was not of sufficient quality. Given the current questions over the relaiblity of the modelling and limtiations of the data, Natural England are not currenlty in a postion to endorse the results of this modelling. One approach to address the current realiability issues would be to conduct futher ground truthing at a more appropriate time of year (ie. this summer), which could improve how robust and rigorous the baseline data is going into towards submission.

Figure 22- Figure 25 – these figures need to include descriptions in the key. It would be helpful if a figure was included that showed the areas were based on the predictive mapping key Section 41 habitats could be present.

Point 7.1 - habitat assessment - observations of discrete *Sabellaria* reef habitats were deemed to be of low 'reefiness' across the development site and representative of A5.611 - *Sabellaria spinulosa* on stable circalittoral mixed sediment and A4.221 - *Sabellaria spinulosa* encrusted circalittoral rock. This is based on a limited number of sampling points. It is unclear whether the geophysical data has been analysed to look for potential areas of reef? It is not possible to comment fully when this report is just a part of the full dataset that will be presented in the ES.

From: [redacted]
Sent: Thursday, June 16, 2022 3:53:03 PM
To: [redacted]
Subject: RE: Rampion 2 Underwater noise monitoring survey method statement

[redacted]

Thank you for the opportunity to review the Method Statement for the Rampion 2 Underwater noise monitoring survey. Given the limited timeframe allowed for review of this document we have provided some high level initial observations below. We advise you also seek the advice of the underwater noise specialists at Cefas, who may be able to provide further detailed advice relevant to their specialism in this area.

Whilst we understand that the Applicant seeks to progress discussions with the aim of achieving agreement on an appropriate way to define a threshold for disturbance, and whilst it would be helpful to understand more about the background noise, we would highlight the risk that this work does not guarantee a way forward in terms of removing a seasonal working restriction. Any attempt to determine a threshold would still need to be referenced with suitable literature, particularly where noise levels within the MCZ are predicted to be above the ambient level. Additionally, sufficient evidence would need to be provided to have confidence in the level of noise attenuation being achieved from any mitigation measures proposed.

The data gained from this survey would be a helpful indication of ambient noise levels but has limitations in that it will be conducted over the end segment of one breeding season. More confidence could be gained from a dataset over an entire season (March – July), over multiple years. This limitation will need to be recognised. Noise levels are likely to be highly variable, so it is important that data collection is as comprehensive as possible.

We understand that two locations will be monitored, one in close proximity to Kingmere MCZ, and one in close proximity to Beachy Head West MCZ. We note the limitation of only having two sampling points, with only one relating to black seabream within Kingmere MCZ. Have these locations been selected based on them being the closest points in the MCZ to any proposed piling activity?

In relation to the period of time that the hydrophone will be deployed we note that this will include continuous monitoring for a period of two weeks in June, with a second follow up survey proposed in July for a 14-day period. Is there a reason why the hydrophone could not be left in situ, from mid-June until the end of July, to gather more data?

We note that a survey location at Beachy Head West MCZ has been included. Short snouted seahorse (*Hippocampus hippocampus*) are a feature of Beachy Head West MCZ. Detailed discussions to date have focused on Black seabream, with limited discussion/information provided from the Applicant with regards to how the ES will considered the assessment of seahorses and any potential mitigation. Without an understanding of how the Applicant intends on using this data in relation to seahorses we cannot provide further comment on how useful this may be.

We understand that the entire proposed 'Static Monitoring Equipment Set-up' will stand at 9m tall, with the hydrophone approximately 2m above the sea floor. We advise you seek advice from Cefas in relation to the appropriateness of this set up for collecting the data required.

We understand that the weight (1.5 * 1.5 m (2.25m2)) will be deployed outside of the MCZ's. This should not be placed on any known Black seabream nesting areas or any known areas of Section 41 habitats protected under the NERC Act. We wish to clarify that in the recovery phase all deployed equipment including the weight will be removed from the seabed?

Is there any way that you could also measure associated/background levels of particle motion as part of the survey effort?

Natural England are aware that there is currently a telemetry array in the area. We advise a buffer of 100m should be kept from the receivers. If the hydrophone picks up pings from any tagged fish, can the data be made available to FishIntel/University of Plymouth? Also please note UoPKingmere CS has an f-pod attached to detect cetaceans. We understand that the locations of this array are approximately as stated below, but you may wish to contact the University of Plymouth to fully understand any potential interactions.

Location (dd)	Station ID
X: 506801.526417796, Y: 93118.2461088692, Z: NaN	UoPKingmere SW
X: 506853.369661285, Y: 93286.6113130309, Z: NaN	UoPKingmere NW
X: 507063.287921451, Y: 93030.8251821931, Z: NaN	UoPKingmere CS
X: 507091.012716847, Y: 93131.9546468094, Z: NaN	UoPKingmere CC
X: 507113.128721737, Y: 93255.2175559865, Z: NaN	UoPKingmere CN
X: 507312.205891376, Y: 93177.4268352861, Z: NaN	UoPKingmere NE
X: 507283.295443445, Y: 93013.8655616497, Z: NaN	UoPKingmere SE

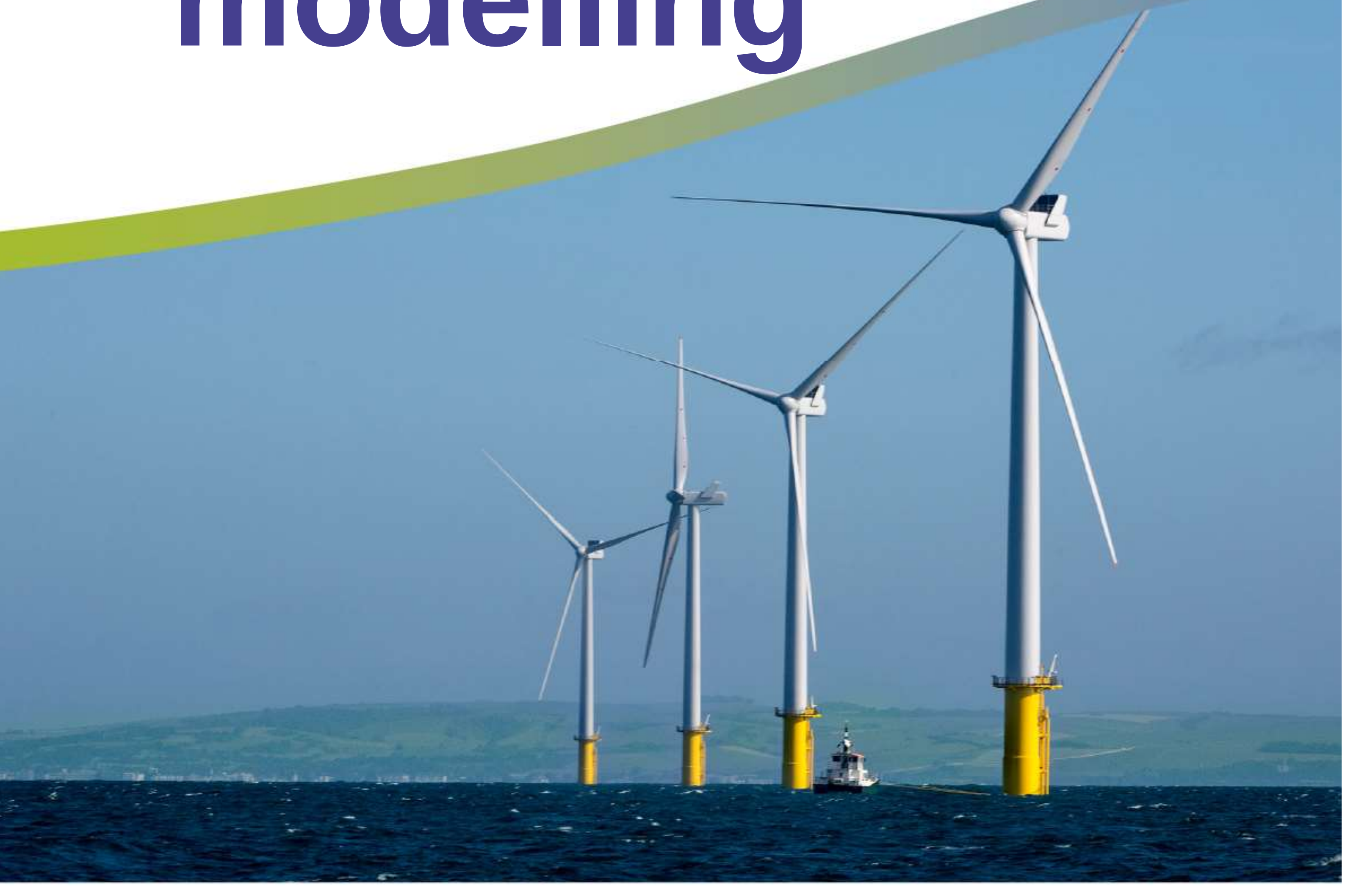
We understand that it is possible that further hydrophone work may be carried out next year. Should this be Rampion's intention, then you may wish to discuss this with local academic institutions, such as the University of Portsmouth and the University of Brighton, who may have some interest in this work. We understand that the timeframes for data collection this year have not allowed a more detailed discussion to be undertaken. Should work be planned for next year then Natural England would welcome a more detailed discussion on this with the Applicant and the MMO/Cefas.

Kind regards

[redacted]

[redacted]
Marine Lead Advisor
Sussex and Kent Team
Natural England
Worthing, West Sussex

Rampion 2 Technical Note: Additional underwater noise modelling



Project title	Rampion 2 Technical Note: Additional underwater noise modelling
Project number	P267
Author(s)	[redacted]
Company	Subacoustech Environmental Ltd.
Report number	P267N0404
Date of issue	17 March 2022

Summary reports are intended to provide rapid information to a limited distribution list. The data presented are not subject to the full quality approval and detailed analysis which pertains with external reports. Data used in this report may be selected to be typical, representative or indicative, or may be drawn from larger data sets which have not been fully analysed. Hence, conclusions drawn from this data should be regarded as tentative and may be amended in later reports.

Introduction

Additional underwater noise modelling has been undertaken following the Rampion 2 Evidence Plan Process (EPP) Targeted Meeting for noise mitigation for black seabream on 24 February 2022. For information, the noise contours for 135 dB SEL_{ss} and 141 dB SEL_{ss} have been modelled in INSPIRE Light to compare with those run for 147 dB SEL_{ss}. These use the worst-case modelling scenario parameters for the three locations, NW (monopile), E (monopile) and S (jacket pile), for the highest energy (4400 kJ for monopiles and 2500 kJ for jackets) as presented in the Underwater Noise Technical Appendix. All SEL_{ss} values are re. 1 µPa²s.

Results have been presented for unmitigated noise, as well as mitigation measures covering 4 dB, 9 dB, 15 dB and 25 dB reductions in source level.

The plots and associated impact ranges for 147 dB, 141 dB and 135 dB SEL_{ss} are presented on the following pages, but these ranges are repeated here together to aid comparison.

Table 1 – Collected summary of unweighted single strike SEL noise contours for noise modelling locations at Rampion 2 (unmitigated)

Unweighted SEL_{ss}	NW monopile			E monopile			S pin pile		
	147 dB	141 dB	135 dB	147 dB	141 dB	135 dB	147 dB	141 dB	135 dB
Max range	24 km	34 km	45 km	35 km	47 km	61 km	34 km	46 km	60 km
Min range	9.9 km	11 km	13 km	15 km	15 km	15 km	19 km	21 km	23 km
Mean range	16 km	21 km	27 km	25 km	30 km	36 km	27 km	34 km	41 km

Table 2 – Collected summary of unweighted single strike SEL noise contours for noise modelling locations at Rampion 2 (-4 dB mitigation)

Unweighted SEL_{ss}	NW monopile			E monopile			S pin pile		
	147 dB	141 dB	135 dB	147 dB	141 dB	135 dB	147 dB	141 dB	135 dB
Max range	17 km	27 km	38 km	28 km	38 km	52 km	27 km	37 km	50 km
Min range	8.5 km	10 km	12 km	13 km	15 km	15 km	17 km	20 km	22 km
Mean range	13 km	18 km	23 km	20 km	27 km	32 km	22 km	29 km	37 km

Table 3 – Collected summary of unweighted single strike SEL noise contours for noise modelling locations at Rampion 2 (-9 dB mitigation)

Unweighted SEL_{ss}	NW monopile			E monopile			S pin pile		
	147 dB	141 dB	135 dB	147 dB	141 dB	135 dB	147 dB	141 dB	135 dB
Max range	11 km	19 km	29 km	19 km	29 km	40 km	18 km	29 km	39 km
Min range	6.8 km	8.9 km	11 km	11 km	14 km	15 km	13 km	17 km	20 km
Mean range	8.7 km	13 km	18 km	15 km	21 km	28 km	16 km	23 km	31 km

Table 4 – Collected summary of unweighted single strike SEL noise contours for noise modelling locations at Rampion 2 (-15 dB mitigation)

Unweighted SEL_{ss}	NW monopile			E monopile			S pin pile		
	147 dB	141 dB	135 dB	147 dB	141 dB	135 dB	147 dB	141 dB	135 dB
Max range	6.2 km	11 km	19 km	11 km	19 km	29 km	10 km	18 km	29 km
Min range	4.6 km	6.8 km	8.9 km	7.7 km	11 km	14 km	9.1 km	13 km	17 km
Mean range	5.4 km	8.7 km	13 km	9.6 km	15 km	21 km	9.9 km	16 km	23 km

Table 5 – Collected summary of unweighted single strike SEL noise contours for noise modelling locations at Rampion 2 (-25 dB mitigation)

Unweighted SEL_{ss}	NW monopile			E monopile			S pin pile		
	147 dB	141 dB	135 dB	147 dB	141 dB	135 dB	147 dB	141 dB	135 dB
Max range	2.1 km	4.0 km	7.6 km	3.7 km	7.3 km	14 km	3.0 km	6.7 km	13 km
Min range	1.9 km	3.3 km	5.4 km	3.1 km	5.6 km	8.9 km	3.0 km	6.3 km	11 km
Mean range	2.0 km	3.7 km	6.4 km	3.4 km	6.6 km	11 km	3.0 km	6.5 km	12 km

Notes on underwater noise relating to this modelling

Contours are based on:

- 147 dB SEL_{ss} (Radford et al. 2016) increased ventilation in sea bass (lab).
- 141 dB SEL_{ss} (Kastelein et al. 2017) 50% initial response for larger sea bass (research pool).
- 135 dB SEL_{ss} (Hawkins et al. 2014) 50% response reaction in sprat (Lough Hyne, Ireland).

Hawkins et al. (2014) does not recommend this figure be used as criteria. Lough Hyne is much quieter than the seas as measured at Rampion 1, representative of Rampion 2.

Kastelein et al. (2017) only observes short-lived initial responses and conclude “If wild seabass are exposed to piledriving sounds at the levels used in the present study, there are unlikely to be any adverse effects on their ecology.”

Bruintjes et al. (2016) showed seabream increased oxygen uptake at 152 dB SEL_{ss} equivalent.

Psychological reactions such as avoidance and startle are fundamentally dependent on context: a sudden increase in noise level above a baseline is dependent on that baseline. This is different to physiological effects where exposure to a certain absolute pressure level, or exposure over time, can lead to physical injury. Hawkins et al. (2014) identified a reaction in 50% of a group of sprat at 40 dB above the ambient noise, equivalent to 135 dB SEL_{ss}. Radford et al. (2016) showed that a 30 dB increase in noise led to a lesser reaction – an increase in breathing rate – to the less sensitive species, sea bass. This was equivalent to 147 dB SEL_{ss} in ambient noise conditions similar to those found in the Rampion 2 survey area, where 143-150 dB SEL_{ss} would be 30 dB above measured background levels. This suggests a greater noise stimulus in the less sensitive species would be required to elicit the same reaction as was found with the sprat.

Bruintjes et al. (2016) showed a 25 dB increase in noise led to black seabream increasing their oxygen uptake, also a secondary stress response, at a level equivalent to 152 dB SEL_{ss} (although in a slightly higher ambient noise environment than in either of the previous studies). This would indicate that a greater increase in noise over the ambient level would be required to produce a stronger reaction such as that in Hawkins et al. (2014).

An increase of 40 dB over ambient produced a behavioural reaction in a high sensitivity species (sprat) and 30 dB led to secondary stress response (increased breathing rate) in seabass. As seabass is biologically similar to black seabream, and with an average ambient noise of 117 dB at the Rampion 2 survey area, it is therefore proposed that 30 dB above this ambient noise, or 147 dB SEL_{ss}, would represent a precautionary noise level for behavioural reaction in black seabream in these conditions.

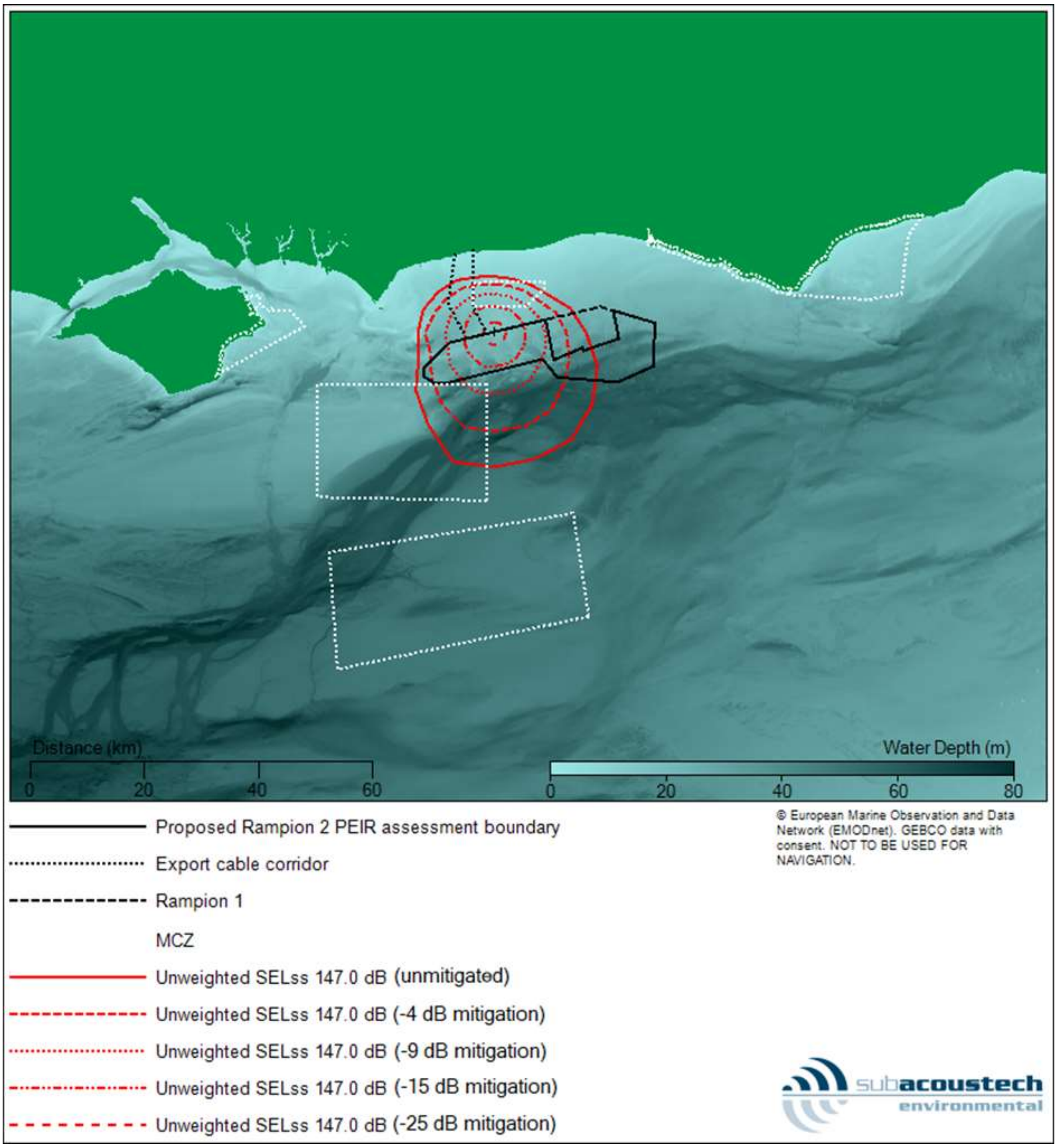


Figure 1 – Unweighted 147 dB SEL_{ss} noise modelling contours for piling at the NW location, monopile, max energy, considering various mitigation scenarios

Unweighted SEL_{ss} (147 dB)	**NW Monopile (worst-case)** 12 m diameter / 4400 kJ blow energy / 17.4 m depth		
	Max range	Min range	Mean range
Unmitigated	24 km	9.9 km	16 km
-4 dB mitigation	17 km	8.5 km	13 km
-9 dB mitigation	11 km	6.8 km	8.7 km
-15 dB mitigation	6.2 km	4.6 km	5.4 km
-25 dB mitigation	2.1 km	1.9 km	2.0 km

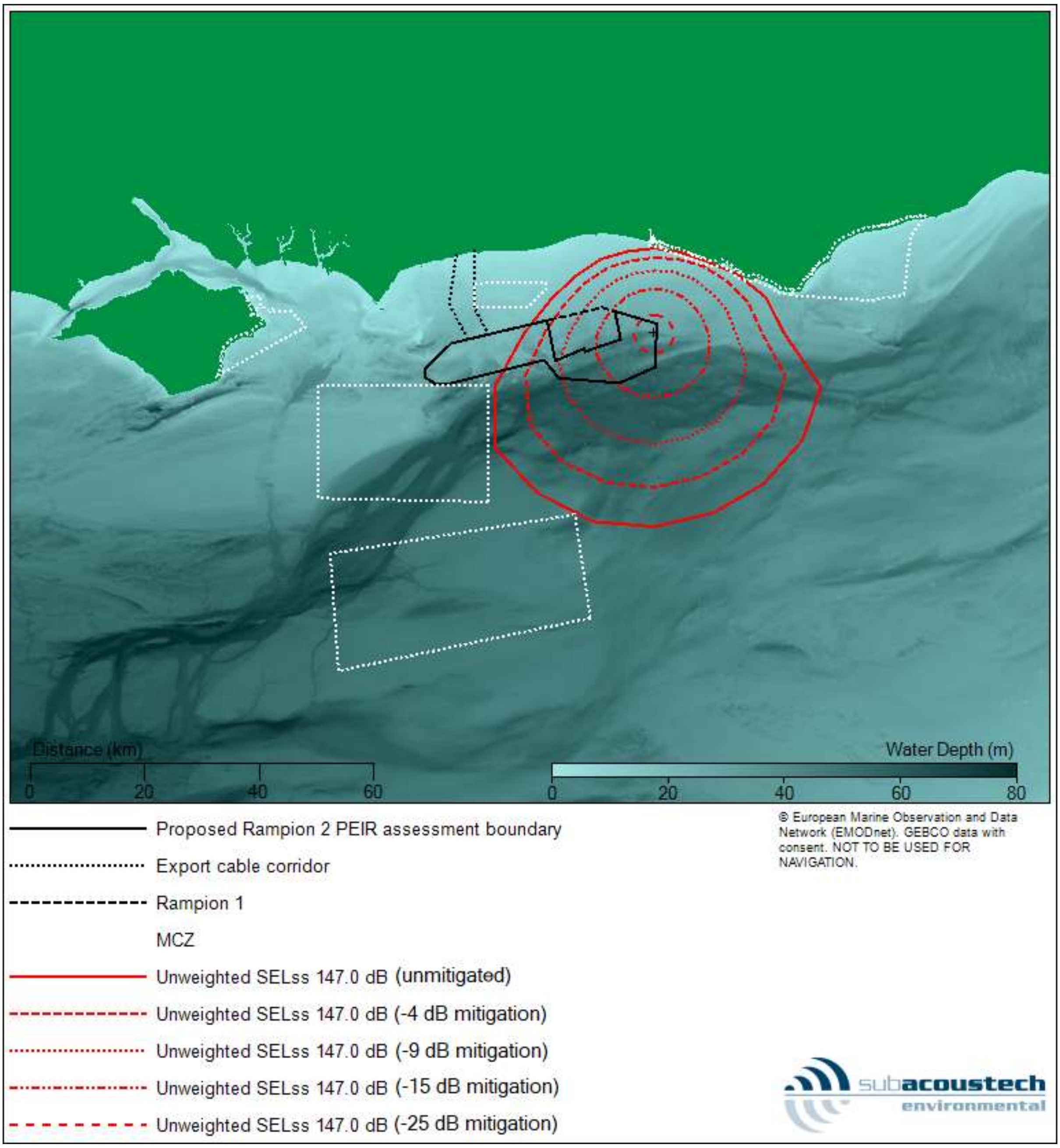


Figure 2 – Unweighted 147 dB SEL_{ss} noise modelling contours for piling at the E location, monopile, max energy, considering various mitigation scenarios

Unweighted SEL_{ss} (147 dB)	**E Monopile (worst-case)** 12 m diameter / 4400 kJ blow energy / 44.2 m depth		
	Max range	Min range	Mean range
Unmitigated	35 km	15 km	25 km
-4 dB mitigation	28 km	13 km	20 km
-9 dB mitigation	19 km	11 km	15 km
-15 dB mitigation	11 km	7.7 km	9.6 km
-25 dB mitigation	3.7 km	3.1 km	3.4 km

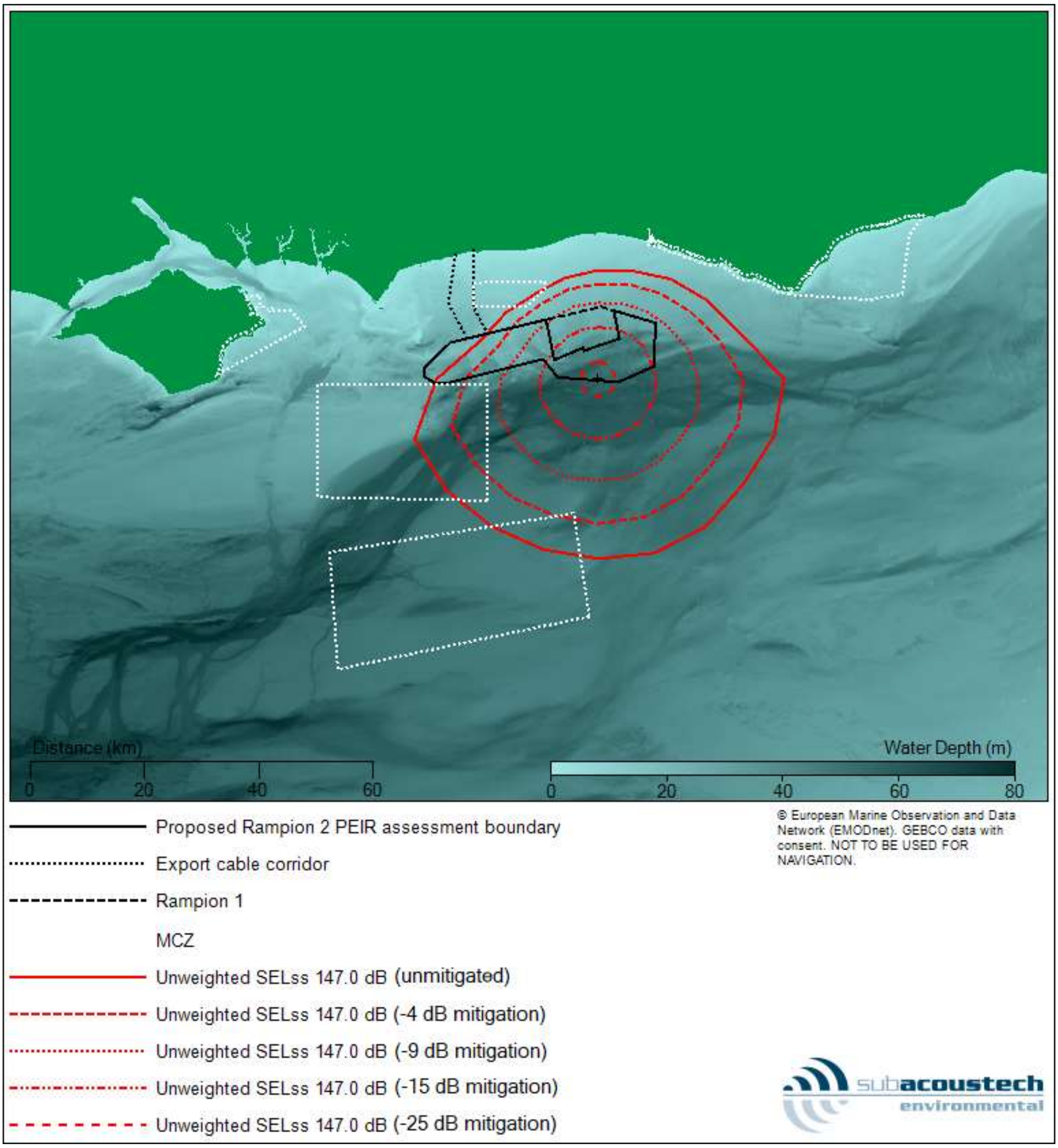


Figure 3 – Unweighted 147 dB SEL_{ss} noise modelling contours for piling at the S location, jacket pile, max energy, considering various mitigation scenarios

Unweighted SEL_{ss} (147 dB)	**S Jacket pile (worst-case)** 3 m diameter / 2500 kJ blow energy / 53.4 m depth		
	Max range	Min range	Mean range
Unmitigated	34 km	19 km	27 km
-4 dB mitigation	27 km	17 km	22 km
-9 dB mitigation	18 km	13 km	16 km
-15 dB mitigation	10 km	9.1 km	9.0 km
-25 dB mitigation	3.0 km	3.0 km	3.0 km

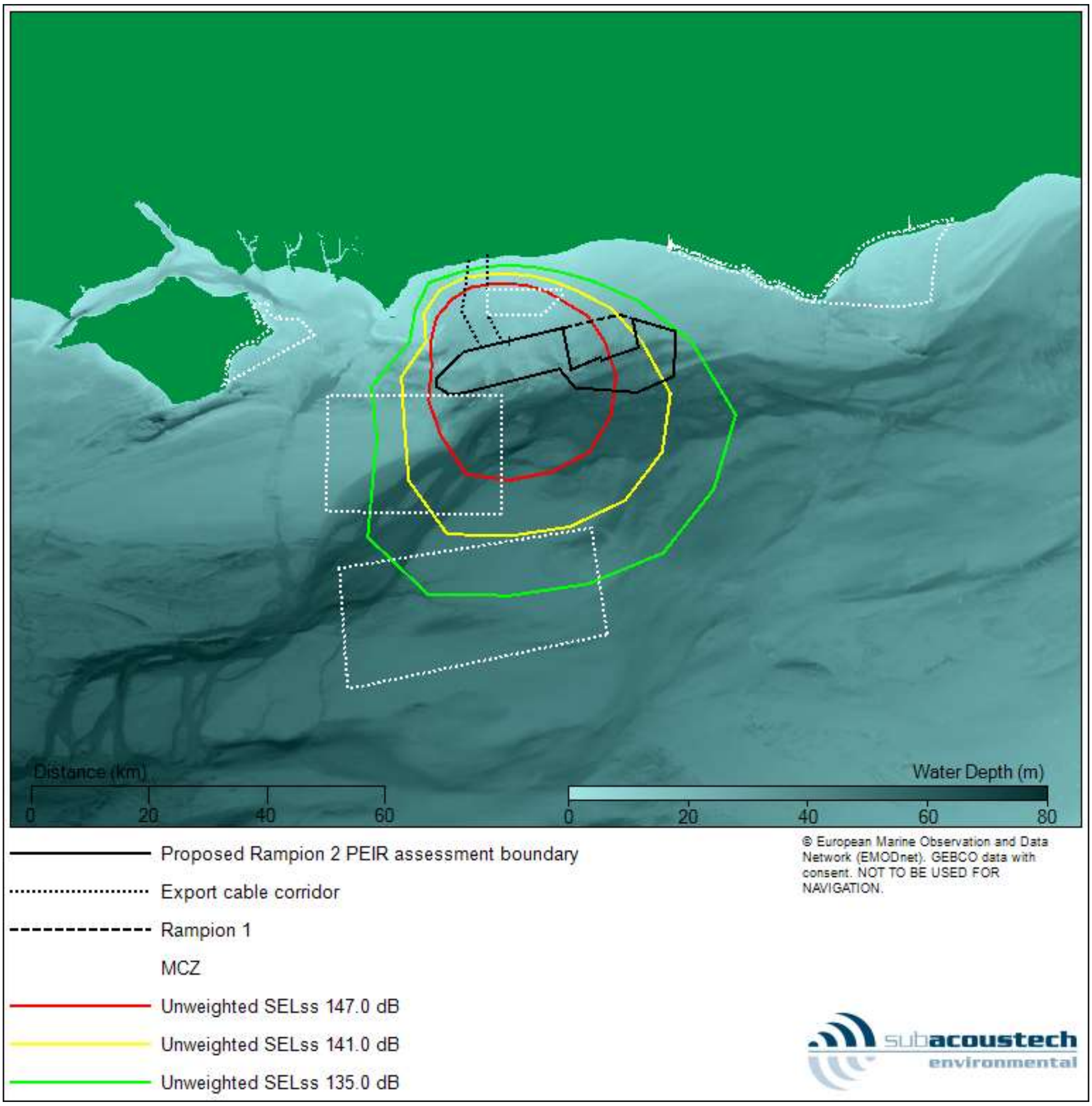


Figure 4 – SEL_{ss} noise modelling contours for piling at the NW location, monopile, max energy

Unweighted SEL_{ss}	**NW Monopile (worst-case)** 12 m diameter / 4400 kJ blow energy / 17.4 m depth		
	Max range	Min range	Mean range
147 dB	24 km	9.9 km	16 km
141 dB	34 km	11 km	21 km
135 dB	45 km	13 km	27 km

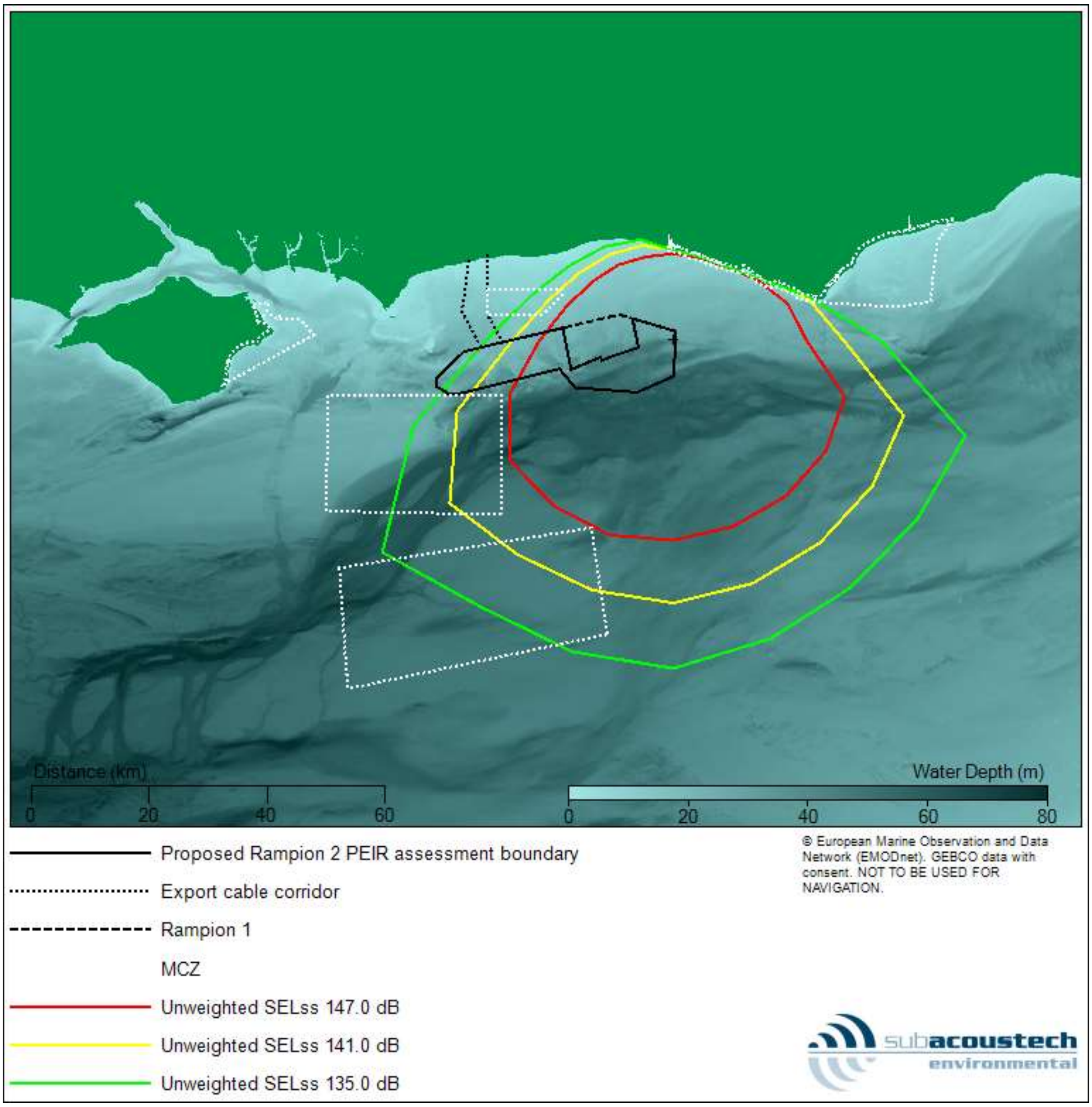


Figure 5 - SEL_{ss} noise modelling contours for piling at the E location, monopile, max energy

Unweighted SEL_{ss}	**E Monopile (worst-case)** 12 m diameter / 4400 kJ blow energy / 44.2 m depth		
	Max range	Min range	Mean range
147 dB	35 km	15 km	25 km
141 dB	47 km	15 km	30 km
135 dB	61 km	15 km	36 km

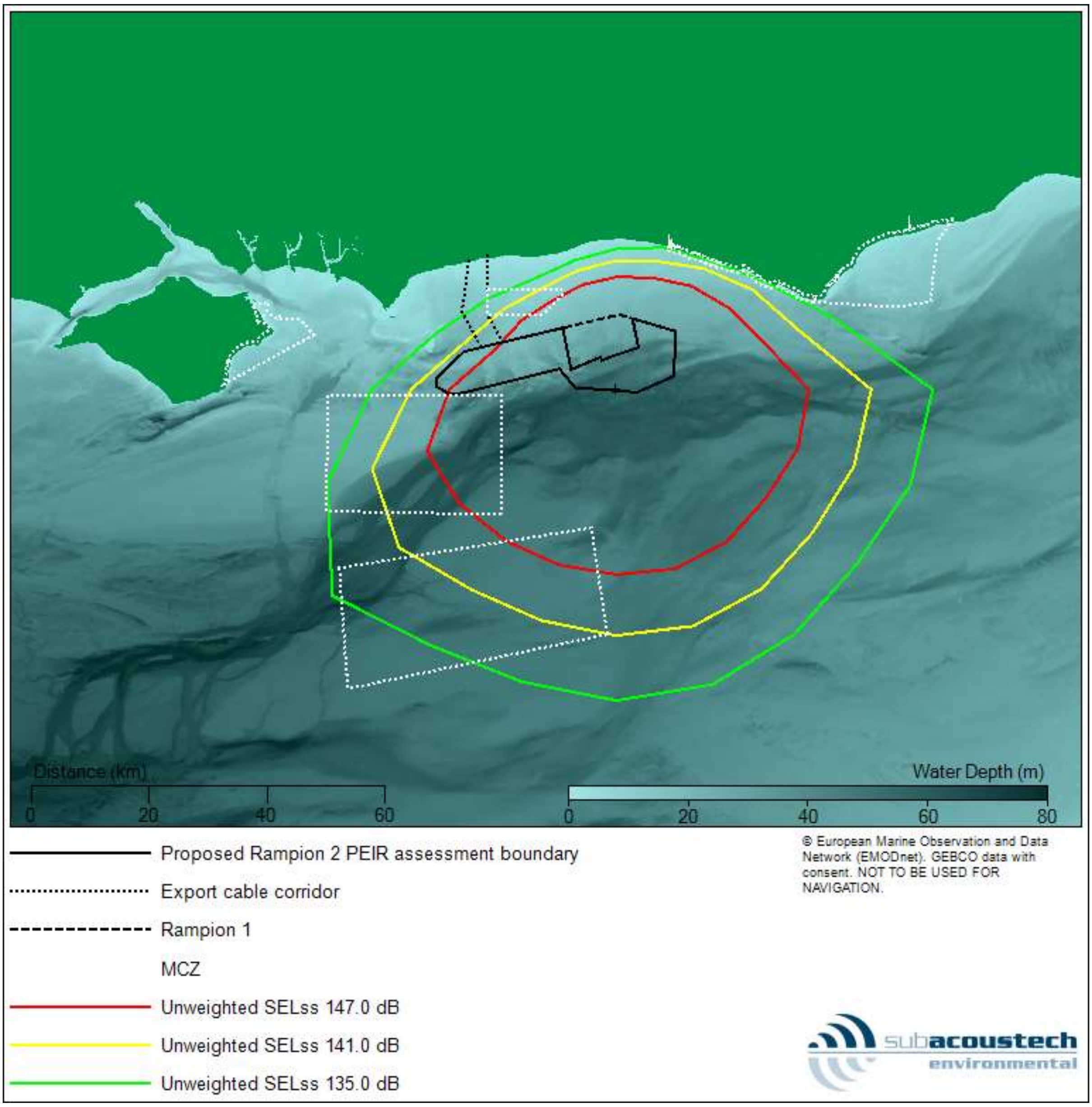


Figure 6 - SEL_{ss} noise modelling contours for piling at the S location, pin pile, max energy

Unweighted SEL_{ss}	**S Jacket pile (worst-case)** 3 m diameter / 2500 kJ blow energy / 53.4 m depth		
	Max range	Min range	Mean range
147 dB	34 km	19 km	27 km
141 dB	46 km	21 km	34 km
135 dB	60 km	23 km	41 km

References

Bruintjes, R., Simpson, S.D., Harding, H., Bunce, T., Benson, T., Rossington, K. and Jones, D. (2016) The impact of experimental impact pile driving on oxygen uptake in black seabream and plaice. In *Proceedings of Meetings on Acoustics 4ENAL*, 27(1), 010042

Hawkins, A.D., Roberts, L. and Cheesman, S. (2014). Responses of free-living coastal pelagic fish to impulsive sounds. *Journal of the Acoustic Society of America*, 135(5), pp. 3101–3116

Kastelein, R.A., Jennings, N., Kommeren, A., Helder-Hoek, L. and Schop, J. (2017). Acoustic dose-behavioral response relationship in sea bass (*Dicentrarchus labrax*) exposed to playbacks of pile driving sounds. *Marine environmental research*, 130, pp. 315-324.

Radford, A.N., Lebre, L., Lecaillon, G., Nedelec, S.L. and Simpson, S.D. (2016). Repeated exposure reduces the response to impulsive noise in European seabass. *Global Change Biology,* 22(10), pp. 3349–3360.

Rampion 2 Technical Note: Underwater noise mitigation for sensitive features

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Document revisions

No.	Details	Date
1	PM Review	21/01/22
2	PD Review	26/01/22
3	Final for issue	28/01/22

Contents

1. Introduction

1.1 Purpose of this Document

1.1.1 Following the submission of the Preliminary Environmental Information Report (PEIR) in 2021, Rampion Extension Development Limited (RED) carried out Expert Topic Group (ETG) meetings to address Section 42 (S42) consultation concerns raised by key stakeholders including Natural England, the Marine Management Organisation (MMO) and Centre for Environment, Fisheries and Aquaculture Science (Cefas), the Sussex Inshore Fisheries and Conservation Authority (Sussex IFCA), and the Sussex Wildlife Trust (SWT).

1.1.2 At the time of the ETG meeting on the 3 November 2021, RED was still in the process of assessing the full detail of S42 comments, however it was made clear during the November 2021 ETG meeting that further information was required in regard to proposed construction and mitigation approaches to reduce the potential for impact on the sensitive features identified within and adjacent to the offshore array area before the consultees would be able to make a decision on whether the S42 consultation comments had been resolved.

1.1.3 This document aims to provide the required further information, specifically in respect of proposed approaches to offshore piling noise reduction based on further engineering design work, noise modelling, continuing evaluation of ecological data and assessment of practical mitigation options. Following this work, the principal mitigation measures proposed comprise the following:

- Commitments to utilising at least one or a combination of offshore piling noise mitigation technologies to deliver noise attenuation with the aim to reduce predicted impacts to sensitive receptors at relevant Marine Conservation Zone (MCZ) sites to avoid the potential for significant residual effects.

1.1.4 This document sets out details on the approaches and methodologies proposed to be employed to provide mitigation of construction noise impacts offshore identified in the PEIR and to address issues raised in consultation (S42 and ETG meetings). The proposed approaches to delivering mitigation for potentially significant effects are supported by information and examples of the types of equipment that may be used. Details of available mitigation technology have been presented to provide confidence that the required levels of noise attenuation can be delivered (either through one of the examples given, or through other future potential mitigation technology) and can therefore be relied upon to avoid potentially significant effects that may arise in the absence of mitigation.

1.1.5 The intention is to present this information to inform a discussion on the proposed measures with Natural England, the MMO and their statutory advisors Cefas, and the Sussex IFCA. This will allow RED to progress the full Development Consent Order (DCO) Application Environmental Statement (ES) on the basis that with these measures in place, there would be no significant residual effects on the relevant sensitive features within the Rampion 2 offshore array area as a result of the construction of the Rampion 2.

1.1.6 Once a final form of the mitigation package is agreed, this will form the basis of an offshore piling mitigation plan, which will be submitted for approval prior to the offshore construction of relevant elements or stages of the Rampion 2 works. Delivery of the plan and measures will be secured within the draft deemed Marine Licence (dML) as a Site Integrity Plan (SIP) to provide certainty to all stakeholders of the mitigation commitments made by RED in progressing the development of Rampion 2, whilst maintaining the flexibility required by RED in selecting the most appropriate options at the time of construction works.

2. Project Background and Context

2.1 The Proposed Development

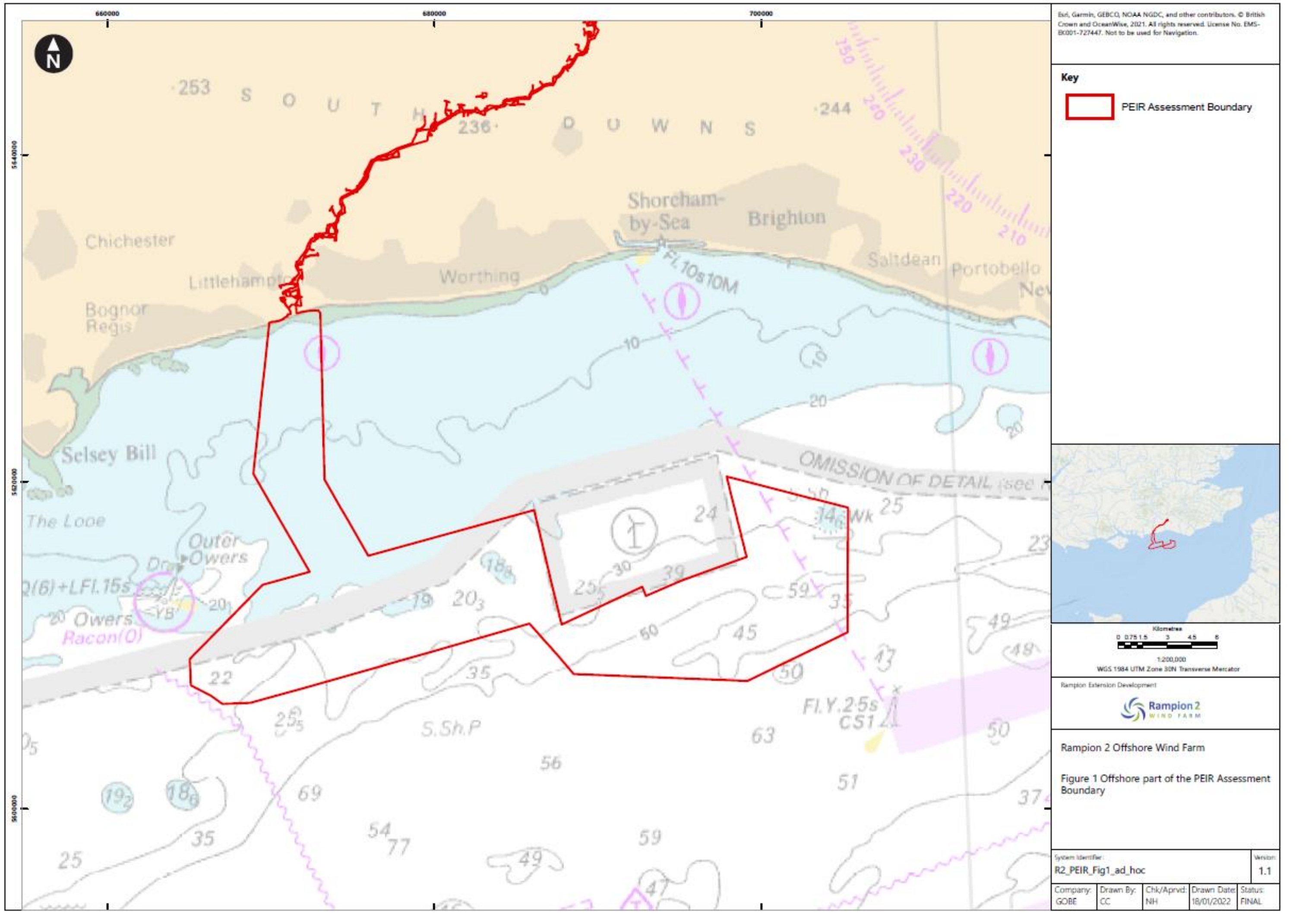
2.1.1 The current proposal for Rampion 2 will have an installed capacity of up to 1,200MW, with the offshore components comprising:

- offshore wind turbine generators (WTGs), associated foundations and inter array cables, with the wind farm generating an installed capacity of up to 1,200MW but not exceeding a maximum number of 90 WTGs;
- up to three offshore substations;
- up to four offshore export cables, each in its own trench within the overall cable corridor area; and
- up to two offshore interconnector cables between the offshore substations.

2.1.2 The offshore elements of the Proposed Development are situated within the offshore part of the PEIR Assessment Boundary. The offshore part of the PEIR Assessment Boundary is adjacent to the south, east and west of the existing Rampion 1 project site comprising seabed areas extending between 13km and 25km offshore, with the offshore export cable corridor area located on the western side of the area; see **Figure 1**. This note focuses on the potential noise impacts arising from Piling of turbine foundations during installation within array area of the PEIR assessment Boundary.

wood.

Figure 1 Rampion 2 Proposed development location. Figure extract from PEIR Volume 2, Chapter 4: The Proposed Development, RED, 2021



2.2 Overview of sensitive receptors in the vicinity of the offshore array area

2.2.1 The Rampion 2 PEIR (RED, 2021) outlines all receptor assessment, including all other relevant marine species and habitats., however for the purpose of this technical note, the focus is on black seabream (*Spondyliosoma cantharus*) specifically, with information presented and reference made where relevant to herring (*Clupea harengus*) and seahorse (*Hippocampus* sp.).

2.2.2 It should be noted that marine mammals were also a key receptor considered in the PEIR, being sensitive to underwater noise emissions, however following the assessment undertaken for PEIR, it was evident that the impact of the offshore piling for all impact and response criteria (including behavioural disturbance) under both the worst case scenario and the most likely scenario (MLS[1]) were not considered to have a significant effect on any marine mammal species (**PEIR Volume 2, Chapter 11: Marine mammals** **Table 11-29** and **Table 11-30**).

2.2.3 For all marine mammal groups, no impacts were found to result in an effect of more than minor adverse significance, which is not significant in EIA terms.

2.2.4 No objections to the marine mammal assessment conclusions were received during S42 consultation feedback and as such these species are not the focus of this mitigation plan note, however any noise mitigation measures will also afford additional mitigation for marine mammals. A construction Marine Mammal Mitigation Protocol (MMMP) will also be developed for agreement with relevant authorities and advisors, pre-construction and a commitment to produce a MMMP will be secured within the dML.

Black seabream

2.2.5 Black seabream are recognised as a significant interest to commercial and recreational fishers with spawning grounds within the region that are considered important within regional Marine Plan Policies. Kingmere MCZ was designated in part to protect areas of spawning importance in the region for this species, although areas outside of the designated site also provide suitable habitat and support active spawning of black seabream. Kingmere MCZ lies to the north (inshore) of the offshore part of the PEIR Assessment Boundary array area off the coast of Worthing, and adjacent to the offshore export cable corridor area PEIR Assessment Boundary (see **Figure 2**). More details on the Kingmere MCZ are presented in the dedicated section below.

[1] In line with recent industry experience, the maximum hammer energies permitted for offshore wind project piling are typically rarely used, with average hammer energies much lower than those stated in the MDS assumptions. The MDS assessment for each receptor establishes the maximum potential adverse impact and as a result impacts of greater adverse significance will not arise should any other development scenario (as described in Volume 2, Chapter 4) to that assessed within this Chapter be taken forward in the final scheme design In recognition of this, two scenarios are included in the below assessment: a worst-case scenario (worst case scenario) which is based on the maximum hammer energy; and a MLS which is based on a reduced hammer energy. Details regarding the MLS assumptions can be found in PEIR Chapter 11, Appendix 11.2, Volume 4.

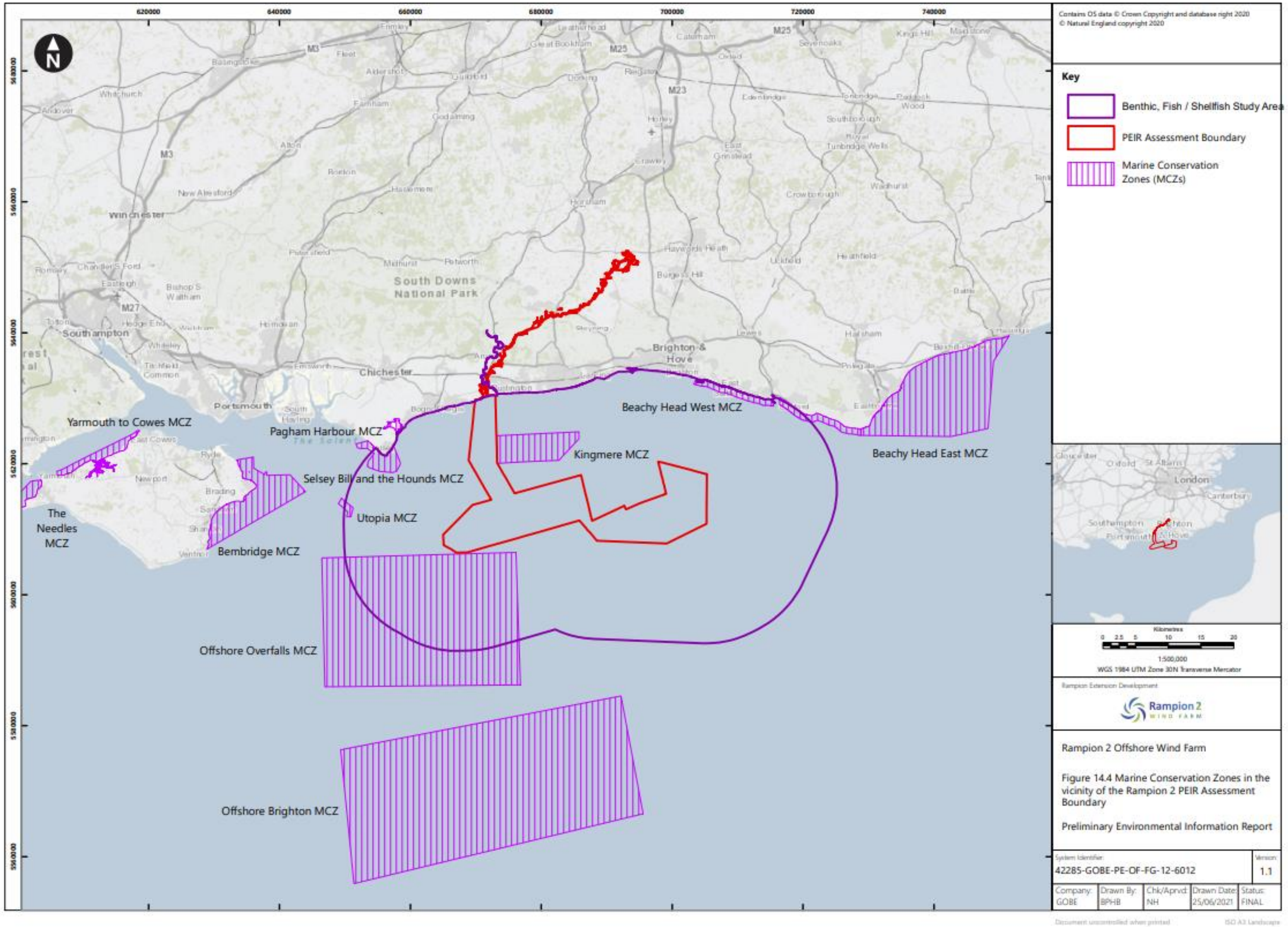
2.2.6 It is reported that the black seabream stock within the English Channel area overwinters in water depths of between 50 to 100m, prior to migrating inshore to breed between May and June in suitable habitats (Vause and Clark, 2011). The specified breeding season (and therefore sensitive period for black seabream in this area was considered (up to 2020) as being between April and June, however this has since been updated (in 2021) to reflect an extended breeding season between March and July (Natural England, 2021)

2.2.7 Black seabream are known to nest in areas around the south coast of the UK with extensive nesting grounds off the West Sussex coast to the Isle of Wight and Dorset (Collins and Mallinson, 2012; EMU Limited, 2009; Southern IFCA, 2014). Targeted studies identified black seabream nest areas off the coast of Littlehampton to Bogner Regis (EMU Limited, 2009), to Shoreham harbour in the east and to the north of Kingmere MCZ (EMU Limited, 2012a).

2.2.8 The broader nearshore area, both within the proposed offshore export cable corridor area and outwith the offshore part of the PEIR Assessment Boundary, is of noted importance for black seabream, with a significant body of evidence, albeit focused on the MCZ and control sites in the vicinity, compiled by the marine aggregate industry (via the (Marine Aggregates Levy Sustainability Fund (MALSF) and site-specific monitoring) contributing to the understanding of black seabream spawning within the area.

2.2.9 Black seabream sensitivity to noise is explored in more detail in **Section 5** in relation to appropriate thresholds for modelling.

Figure 2 Location of Rampion 2 in relation to identified MCZs. Figure extract from PEIR Volume 2, Chapter 14: Nature conservation, RED, 2021



Seahorse

2.2.10 Both short-snouted (*Hippocampus hippocampus*) and spiny/ long-snouted (*H. guttulatus*) seahorse species have been recorded in the English Channel. Seahorses can be found in a variety of habitats, including sand and soft sediment, seagrass meadows, rock and algae and artificial habitats (such as marinas) (Woodall *et al*., 2018).

2.2.11 Research suggests that seahorses are present in shallower waters during summer months for breeding and migrate to deeper water during winter months (usually around October to April) to avoid storms (The Seahorse Trust, 2013).

2.2.12 Globally, ecological data on seahorses is lacking due to their apparent patchy distribution and low density, as well as their cryptic nature (Foster and Vincent, 2004; Garrick-Maidment *et al*., 2010). A study by Garrick-Maidment *et al*. (2010) found an average home range for seahorse of approximately 167m^2. This range is considerably larger than previous studies with Foster and Vincent (2004) noting smaller home ranges during the breeding season (April-October) of 7.8m^2 for short-snouted seahorse and 12.1m^2 for spiny/long-snouted seahorse). A further study on the spiny/long-snouted seahorse in Portugal by Curtis and Vincent (2006) found a broadly similar mean home range of 19.9m^2 during breeding seasons.

2.2.13 Both spiny and short-snouted seahorses are known to frequent the south coast of England; however, they do not appear in any commercial landings data. Four short-snouted seahorses were recorded during surveys at Rampion offshore wind farm (RSK Environmental Limited, 2012) which confirms their presence in the wider area. With three short-snorted seahorses recorded during the post construction survey (OEL, 2020a). Several short-snorted seahorse observations have been recorded in the region of West and East Sussex and the Isle of Wight by Seasearch, Sussex IFCA, Marine Biological Society, the most recent of which was a single observation at Brighton Marina in July 2020 (National Biodiversity Network Atlas, 2021a).

2.2.14 Observations of spiny seahorse are limited in the region with a single spiny seahorse observation recorded near Brighton by Seasearch in 2019 (National Biodiversity Network Atlas, 2021b) as well as several unverified records submitted by the public from stranding and captures in the area (British Marine Life Study Society, 2020). Short-snouted seahorse are designated features at four MCZs in the area, The Bembridge MCZ, the Selsey Bill and the Hounds MCZ, Beachy Head East MCZ and Beachy Head West MCZ. These designated sites are located at approximately 20.4km, 10km, 13km and 21km distance from the Proposed Development respectively. Further detail on each of the MCZs is presented in the dedicated sections below. In addition to being features at these sites, both species of seahorse and their habitat are protected under The Wildlife and Countryside Act (1981).

Herring

2.2.15 As well as being a UK Biodiversity Action Plan (BAP) priority species, herring are important ecologically and form an important component of the diets of larger predators such as other fish, birds and marine mammals. Coull *et al*. (1998)

identified two spawning areas in the eastern English Channel; one in French waters (Baie de Seine) and one due south of the Sussex coast. Herring stock in the eastern Channel and southern North Sea is known as the Downs stock (Vause and Clark, 2011). This large herring spawning ground lies 34.2km offshore of the Rampion 2 fish and shellfish study area at its closest point, in the eastern English Channel, with no direct overlap with the Rampion 2 development area or the wider study area.

2.2.16 Consideration of herring spawning grounds of relevance to the PEIR Assessment Boundary is provided in **Section 8.7. PEIR Volume 2, Chapter 8: Fish and shellfish ecology**.

2.2.17 Although Coull *et al*. (1998) cites spawning as occurring from November to February, an extensive literature review by Orr (2013), suggests spawning occurs in December and January only. Herring are reported to spawn on well-oxygenated gravel and sandy gravel with little fine material (Ellis *et al*., 2012). The International Herring Larvae Survey ('IHLS') (1967-2020) identifies that herring are present in the fourth quarter of the year in ICES rectangle 30E9 but not at high densities.

2.2.18 Whilst there is no overlap with known herring spawning grounds, in a wider context, the study area for the PEIR Assessment Boundary, has a spatially limited interaction with a small portion of the herring larval abundance heat map (based on IHLS data between 2007-2020), which is of potential relevance to noise immissions during construction, though such effects will be limited to higher noise thresholds only (affecting larvae), rather than levels at which adult spawning fish might be expected to show disturbance reactions.

2.2.19 The preferred sediment habitat for herring spawning is gravel, with some tolerance of more sandy sediments, although these are primarily on the edge of any spawning grounds (Stratoudakis *et al*. 1998). Atlantic herring spawning beds are typically discrete, localised features. Actual spawning habitat, or habitat that could be used for spawning activity, likely comprises relatively small seabed features, with discrete spatial extents, although these may be spread across a wide area of suitable seabed spawning habitat at a regional scale (for example spawning grounds (MarineSpace *et al*., 2013a)). As noted in the PEIR (**PEIR Volume 2, Chapter 8: Fish and shellfish ecology**), whilst additional seabed areas that may comprise suitable spawning habitat for herring (i.e., gravels) are found within parts of the study area in closer proximity to the Proposed Development (as illustrated in **Figures 8-10, PEIR Volume 3**), there is no evidence of herring spawning at such locations.

2.2.20 Potential spawning grounds for herring and sandeel are considered in further detail in **Paragraphs 8.6.30 to 8.6.32** of the **PEIR Volume 2, Chapter 8: Fish and shellfish ecology**.

Selsey Bill and the Hounds MCZ

2.2.21 Selsey Bill and the Hounds MCZ lies 10km west of the offshore export cable corridor and 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 MCZ 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. The MCZ also protects one of the best examples of peat and clay exposures on the southeast coast. Within the southeast of the MCZ is the Mixon Hole, a dramatic 20m drop in the seafloor exposing clay cliffs capped with limestone.

2.2.22 The MCZ is designated for the following (**bold** text indicates relevance to this Technical Note):

- Bracklesham Bay geological feature;
- **Short-snouted seahorse;**
- Subtidal mixed sediments;
- Subtidal sand;
- High energy infralittoral rock;
- Low energy infralittoral rock;
- Moderate energy infralittoral rock;
- Moderate energy circalittoral rock; and
- Peat and clay exposures.

Beachy Head West MCZ

2.2.23 Beachy Head West MCZ lies 13km north-east of the PEIR Assessment Boundary array area. Beachy Head West MCZs are two spatially separate sites in the south-east of England. They run parallel to the East Sussex coastline extending from the Brighton to the Beachy Head Cliffs near Eastbourne and protects a total area of approximately 24km^2. These sites contain some of the best examples of chalk habitat in the south east region. Here the chalk reefs and gullies support specialised communities of animals and seaweeds. Additionally, the sites are known to support the rare short-snouted seahorse.

2.2.24 Beachy Head West MCZ is designated for the following (**bold** text indicates relevance to this Technical Note):

- Subtidal mixed sediments;
- Subtidal mud;
- Subtidal sand;
- Infralittoral muddy sand;
- Infralittoral sandy mud;
- Low energy infralittoral rock and thin sandy sediment;
- Blue mussel (Mytilus edulis) beds;
- Subtidal chalk;

- Littoral chalk communities;
- Native oyster (Ostrea edulis);
- **Short-snouted seahorse;**
- Moderate energy circalittoral rock;
- High energy circalittoral rock; and
- European native oyster and blue mussel beds.

Beachy Head East MCZ

2.2.25 Beachy Head East MCZ lies 21km north-east of the offshore part of the PEIR Assessment Boundary, consisting of sandstone/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. Marine chalk is a globally rare habitat, a large proportion of which is contained in the UK. The largest underwater chalk seascapes are predominantly found in Kent and Sussex, including within the Beachy Head East MCZ.

2.2.26 Short-snouted seahorses and Ross worm reefs are also found within this MCZ. The MCZ is also considered an important nursery area for herring, plaice and Dover sole. 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.

2.2.27 Beachy Head East MCZ is designated for the following (**bold** text indicates relevance to this Technical Note):

- **Short-snouted seahorse;**
- Littoral chalk communities;
- Subtidal coarse sediment;
- Subtidal sand; High energy circalittoral rock;
- Moderate energy circalittoral rock;
- Peat and clay exposures;
- Ross worm reefs (*Sabellaria spinulosa*); and
- Subtidal chalk.

Kingmere MCZ

2.2.28 Kingmere MCZ is located in the English Channel, between 5km and 10km off the West Sussex coast to the South of Littlehampton and Worthing. It covers an area of around 47km^2. Although the initial site selection for Rampion 2, including the offshore export cable corridor area, has ensured avoidance of any direct overlap with the Kingmere MCZ, the site lies adjacent to the eastern boundary of the offshore export cable corridor and therefore subject to potential indirect effects from construction activities.

2.2.29 Within the MCZ, the seabed features include rock habitats and outcrops of chalk reef systems. Much of the moderate energy infralittoral rock habitat is covered by a thin veneer of mixed sediments. This creates a complex mosaic of habitats, some of which are noted as being of particularly importance to black seabream during spawning (nesting) as noted above (**paragraph 2.2.5**).

2.2.30 Kingmere MCZ is designated for several marine features as set out in the following (**bold** text indicates relevance to this Technical Note):

- **Black seabream;**
- Moderate energy infralittoral rock and thin mixed sediment; and
- Subtidal chalk

2.2.31 There are two marine Sites of Nature Conservation Interest (mSNCI) within the boundaries of the Kingmere MCZ; Kingmere Rocks and Worthing Lumps. SNCI are non-statutory sites identified for their local conservation and geological values.

Bembridge MCZ

2.2.32 Bembridge MCZ is an inshore site, 20km west of the PEIR Assessment Boundary and lies adjacent to the east coast of the Isle of Wight from Nettlestone Point in the north to Ventnor in the south. The MCZ encompasses the intertidal and subtidal areas extending to the edge of the deep water channel approach into the Eastern Solent.

2.2.33 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.

2.2.34 The central area of the MCZ 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 (such as crabs, lobsters and barnacles) and molluscs (such as mussels, oysters and cockles).

2.2.35 The large areas of subtidal mixed sediments act as a supporting substrate to several important features such as maerl beds. The MCZ also protects the short-snouted seahorse as well as two species of stalked jellyfish.

2.2.36 Bembridge MCZ is designated for the following (**bold** text indicates relevance to this Technical Note):

- Sheltered muddy gravels;
- **Short-snouted seahorse;**
- Stalked jellyfish (*Calvadosia campanulata*);
- Stalked jellyfish (*Haliclystus spp.*);
- Subtidal coarse sediment;

- Subtidal sand;
- Maerl beds;
- Native oyster (*Ostrea edulis*);
- Peacock's tail (*Padina pavonica*);
- Sea-pens and burrowing megafauna;
- Seagrass beds;
- Subtidal mixed sediments; and
- Subtidal mud.

2.3 Spatial distribution of sensitive habitats and features within the offshore export cable corridor and array area - summary

2.3.1 Black seabream nests have been recorded within the Rampion 2 offshore export cable corridor area through targeted repeat aggregate industry surveys, as well as the Rampion 2 specific geophysical and benthic surveys undertaken in 2020 and 2021. Recognising that the wider area in the vicinity of the Kingmere MCZ is known to support black seabream spawning (nesting), there is a focus for the mitigation on the MCZ itself as it is within this site that specific protection is afforded the species during the spawning season. Notwithstanding, a reduction in noise propagation extents as a result of the mitigation measures proposed will ensure an attendant reduction in the risk of impact to all nesting areas for the species in the wider area.

2.3.2 Records of seahorses are limited across the south western region, however again there are specific locations where seahorse is a listed feature, as described in (**section 2.2**) above, where the species will be focused whilst breeding through the summer period. As outlined for black seabream, there are also wider areas within which seahorse will represent noise-sensitive receptors, specifically during the overwintering period for these species when it is understood they migrate to deeper waters further offshore. Low numbers of spiny and short-snouted seahorses have been observed in the immediate area of the Proposed Development. Four short-snouted seahorses were recorded during surveys at Rampion 1 offshore wind farm in the north-eastern and western regions of the project site, which lies adjacent to the north western boundary of the Proposed Development.

2.3.3 In relation to the four short-snouted seahorses recorded from Rampion 1 surveys, one was recorded in the Brown and May (2012a) beam trawl survey between 7 and 8 November 2011, the other three were recorded in the Brown and May (2012b) beam trawl survey between 20 and 23 February 2012. All four records therefore were outside of the breeding season for seahorse, therefore captured whilst overwintering in the larger ranging deeper water areas.

2.3.4 As outlined for black seabream, the focus of the mitigation design is on the MCZ sites where seahorse are a designated feature, with offshore piling noise attenuation measures mitigation applied to construction activities also minimising risks of noise impacts to seahorse when in its overwintering phase.

2.3.5 With regard to herring, the PEIR Assessment Boundary has a spatially limited interaction with a small portion of the IHLS larval heatmap area and no direct overlap with recorded spawning grounds. The mitigation measures and approach presented in this Technical Note will provide mitigation for the risk of disturbance to herring spawning activity through the reduction in noise propagation extents effected by the measures, however on the basis of the evident separation distance from the locations of piling, there is a low risk of any adverse effects arising even without mitigation as set out within the PEIR.

3. Consultation

3.1 Overview

3.1.1 RED has sought to engage with Natural England, Sussex IFCA, and the MMO (and their advisors Cefas) from the earliest stages of the process. This has included focused discussions relating to the known presence of black seabream nesting locations in particular, to seek agreement on the methodological approach for assessment as well as potential mitigation, should a significant impact risk be identified. Further concerns were raised however during S42 consultation in 2021 relating to impacts on other sensitive features in the offshore array area, in addition to black seabream nests, including seahorse and herring.

3.1.2 The key issues relevant to the offshore array foundation installation works (and the mitigation proposals put forward in this Technical Note) communicated by stakeholders following consultation on the PEIR (RED, 2021) and through the ETG meetings are summarised below:

3.2 The need for avoidance of impacts from construction noise on spawning/nesting black seabream, seahorse and spawning herring

3.2.1 Concerns were raised over the potential for noise impacts (mortality/permanent injury, temporary injury or disturbance) to sensitive features within the offshore export cable corridor, offshore array area, as well as neighbouring MCZs arising from the proposed construction works. Although impacts resulting in the potential for mortality or injurious effects have been addressed in the PEIR assessment, the ranges over which such levels of impact arise, even with unmitigated piling scenarios, is very localised to the location of piling is small and is not considered to represent an impact at a population scale on any receptor, however the extents of potential disturbance are much greater and also have the potential to extend to the adjacent MCZ sites. This applies to all noise sensitive species within the area but is of particular importance for black seabream nesting areas within the Kingmere MCZ and the local seahorse population (at relevant MCZ sites during the summer). In order to reduce the risk of significant effects arising, particularly from disturbance, there is a need to reduce the exposure of noise-sensitive species to high noise / sound pressure levels generated during the piling of foundations.

3.2.2 In their S42 response, it is the view of Natural England, the MMO, Sussex IFCA and SWT, disturbance from potential piling operations could result in male fish vacating the area, leaving unprotected black seabream nests, and loss of nest integrity. Further, the MMO believes that offshore piling restrictions during the black seabream spawning and nesting season and the Downs herring spawning season may be required, unless other forms of mitigation can be adopted to significantly reduce the extent of impact, e.g., bubble curtains or similar.

3.2.3 The issues highlighted by stakeholders during ETGs, and S42 responses in relation to noise effects on sensitive receptors was linked through to disagreement on some of the PEIR significance assessment findings for black seabream, as well as the appropriateness of the threshold parameters used in the assessment, namely Hawkins *et al*. (2014) and McCauley *et al*. (2000).This related to issues around the potential for impact magnitudes to be greater than those presented within the PEIR, in part due to a lack of supported avoidance mitigation (spatial and temporal) leading to impacts, Natural England suggests that the assessment as currently written understates the significance of the known spawning habitat within the study area.

3.2.4 Where mitigation measures in the form of bubble curtains or similar are proposed, acceptance of such mitigation would also require additional underwater noise modelling to provide evidence of the benefits delivered.

4. Overview of potential impacts

4.1 Overview

4.1.1 The section below summarises the main impacts associated with works within the offshore array area. As noted previously, the focus of this Technical Note is on construction activities relating to underwater noise from offshore piling activities for the purposes of informing the offshore noise mitigation strategy and it does not cover any other associated construction works or impacts.

4.1.2 It is also worth noting that for the purposes of the assessment of mitigation options, in common with the assessment of impacts and effects presented at PEIR, although black seabream and herring are mobile species, the noise modelling and assessment processes have included consideration of these species, along with the less mobile seahorses, as stationary receptors.

4.2 Potential impacts

4.2.1 Potential disturbance will occur during the construction of the offshore WTGs, from the use of percussive piling techniques for foundation installation (as a worst case). Within the context of the key concerns raised, this has the potential to affect sensitive features, notably including those associated with nearby MCZs, namely seahorses, and both spawning herring and spawning/nesting black seabream.

4.2.2 Full assessment criteria and impact radius for each impact category and sensitive species summarised above can be found in **Section 8.9** of the **PEIR, Volume 2, Chapter 8: Fish and Shellfish ecology**.

4.2.3 For ease of reference, the hearing sensitivity groups within which black seabream, herring and seahorse fall is presented below, extracted from the **Section 8.9** of the **PEIR, Volume 2, Chapter 8: Fish and Shellfish ecology** (after Popper *et al.*, (2014) categories based on their hearing system); **Table 1** below.

Table 1 Hearing categories of fish receptors (Popper *et al.,* 2014).

Category	Fish receptor
Group 1	Dover sole, lemon sole, dab, plaice, sandeel, mackerel, elasmobranch (thornback ray, undulate ray, tope and lesser spotted dogfish) and sea lamprey
Group 2	Atlantic salmon, sea trout and European eel
Group 3	**Black seabream**, cod and whiting
Group 4	**Herring**, sprat and shad species and **seahorses**.

Mortality

4.2.4 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.

4.2.5 Consequences of mortality of individuals could lead to greater impacts for black seabream and herring in particular such as unsuccessful breeding seasons, abandonment of nesting areas leaving them open to predation as well as reduction in numbers of sensitive species for seahorses. A full impact radius for mortality is provided in **Table 8-16 to Table 8-19** **PEIR Volume 2, Chapter 8: Fish and shellfish ecology**.

Injury

4.2.6 Recoverable injury is a survivable injury with full recovery occurring after exposure, although decreased fitness during this recovery period may result in increased susceptibility to predation or disease (Popper *et al*., 2014). The potential for mortality or mortal injury is likely to only occur in extreme proximity to pile installation, although the risk of this occurring will be reduced by use of soft start/ramp up techniques at the start of the piling.

4.2.7 This means that fish within close proximity to potential piling activity associated with the Proposed Development will move outside of the impact range before underwater noise levels reach an intensity likely to cause irreversible injury.

4.2.8 During breeding season, the flee response maybe compromised and therefore result in a high chance of decreased fitness or temporary injury. Full impact radius for injury is provided in **Table 8-16 to Table 8-19** **PEIR Volume 2, Chapter 8: Fish and shellfish ecology**.

Disturbance

4.2.9 Behavioural effects in response to construction related underwater noise include a variety of responses including startle response, strong avoidance behaviour, changes in swimming or schooling behaviour, or changes of position in the water column (for example Hawkins *et al*., 2014a). Depending on the strength of the response and the duration of the impact, there is the potential for some of these responses to lead to significant effects at an individual level (for example reduced fitness, increased susceptibility to predation) or at a population level (for example avoidance or delayed migration to key spawning grounds), although these may also result in short-term, intermittent changes in behaviour that have no wider effect, particularly once acclimatisation to the noise source is taken into account. See **Section 8.9.109 and Table 8-16 to Table 8-19** **PEIR Volume 2, Chapter 8: Fish and shellfish ecology**.

5. Underwater noise modelling

5.1 Overview

5.1.1 To further inform the assessment of impacts presented in the PEIR, and in order to inform appropriate mitigation solutions, RED commissioned Subacoustech Environmental Ltd to carry out additional INSPIRE Light modelling to assess the potential reduction in noise impact possible using a selection of mitigation options, and what level of noise reduction would be required in order to avoid any direct noise impact to MCZs designated for noise sensitive receptors such as black seabream, herring and seahorse.

5.1.2 To install the foundations for the turbines, monopiles or pin-piles will be driven into the seabed. For the purposes of assessing a worst case, the modelling assumption is that impact pile driving will be employed to install these foundation structures, consistent with options for most other offshore wind farms proposed or installed in and beyond the UK sector, including Rampion 1.

5.1.3 The use of impact pile driving generates substantial underwater noise, which can travel large distances underwater; the amount of noise produced (and subsequent distance of travel) relating to factors such as pile size, energy of the hammer used to drive the pile and the depth of water in which the pile is driven. This noise has the potential to negatively affect marine life, including marine mammals and fish species such as black seabream.

5.1.4 The sensitivity of fish to high intensity underwater noise is recognised and noise has the potential to cause effects from mortality to disturbance depending partly on the intensity and type of the noise, but many other factors, such as species anatomy and context (e.g., Popper and Hawkins, 2019). While guidelines exist that offer criteria to indicate quantitative noise level thresholds at which various effects can occur (Popper *et al*., 2014), the greatest confidence in absolute thresholds relates to those eliciting the most severe effects (mortality, physical injury, onset of effects on the hearing of individuals), leaving considerable uncertainty for any noise level threshold that could lead to a behavioural reaction or disturbance in a given fish. This is largely due to the lack of data across the wide range of fish species and contexts. This uncertainty remains despite considerable interest and research into noise effects on fish over the last 20 years.

5.1.5 For the Rampion 2, there is a particular concern over the potential for noise to affect populations of black seabream, as well as seahorse and herring during offshore piling. The following sections consider the available research for noise effects on an appropriate proxy for black seabream and proposes relevant thresholds for noise disturbance which RED considers are appropriate, following review.

5.2 Existing thresholds

5.2.1 Recent Environmental Impact Assessments (EIAs) focusing on the effects of underwater noise on fish have tended to utilise criteria published in guidelines proposed by Popper *et al*. (2014). To date, it remains the most authoritative and broadest publication to provide easily referenceable quantitative noise thresholds for species of fish. Popper *et al.* (2014) categorises species of fish broadly in terms of their hearing ability, which is linked to the physiology of the fish, principally around the presence or absence of a swim bladder. The presence of a swim bladder enhances the ability of a fish to detect sound, and the most sensitive species have this organ directly connected to its hearing system. The species least sensitive to underwater sound do not have a swim bladder. **PEIR Volume 2, Chapter 8: Fish and shellfish ecology** categorises species of fish in Group 1 (least sensitive) to Group 4 (most sensitive), with black seabream in Group 3: fish with swim bladders that are close, but not intimately connected to the auditory system of the fish, and herring and seahorse in Group 4 as noted above.

5.2.2 Popper *et al.* (2014) makes no attempt to establish quantitative thresholds for behavioural effects for underwater pile driving noise, instead recommending qualitative indicators for each fish species hearing category depending on their distance from the noise source; for example, fish in Group 3 are predicted to have a “moderate” behavioural effect at distances “far” from piling (generally considered greater than hundreds of metres).

5.2.3 Quantitative thresholds are however sought by stakeholders and regulators reviewing EIAs as they provide a hard boundary of effect/no effect, although it is generally recognised and important to stress that there is considerable doubt or uncertainty in such absolute designations. The greatest confidence in quantitative thresholds or criteria will be where there is a maximum overlap between the context that existed in the research identifying the threshold and the conditions in the field where, in this case, piling could occur. Unfortunately, significant overlap between these two cases is rare and some degree of extrapolation is usually required.

5.2.4 To attempt to identify a quantitative threshold for behavioural reaction or disturbance for more sensitive fish, reference to Hawkins *et al*. (2014) has been suggested by regulators. Hawkins *et al.* (2014) is based on a study of reactions by fish schools to the playback of pile driving sounds. The test location was Lough Hyne, County Cork, southwest Ireland. The authors were able to elicit a reaction in sprat (*Sprattus sprattus*) to the piling noise in 50% of presentations where the noise levels were measured at 135 dB re 1 $\mu Pa^2 s$ Sound Exposure Level “single strike” (SEL_{ss}), at the position of the fish. As sprat are clupeids, they are considered a reasonable proxy for herring and 135 dB SEL_{ss} has gained some traction as a precautionary threshold. Hawkins *et al.* urge caution to the use of the noise levels identified in the paper however, and state that they should not be used as assessment criteria as the acquired data is limited.

5.2.5 As noted earlier (**paragraph 5.2.3**), context is critical in behavioural studies. The study was undertaken in Lough Hyne, an enclosed inland water body with no significant anthropogenic noise sources nearby and thus it represents an exceptionally quiet location. As a concept, any sound played in quiet conditions could be perceived as loud; where the background noise is higher, an introduced sound at the same level would be likely to lead to a lower reaction or even be inaudible. The key distinction would be the difference between background noise and the received sound of interest, often referred to as a signal-to-noise ratio. Hawkins *et al*. indicate this difference is 40 dB or more at Lough Hyne.

5.2.6 Sprat are also in the most sensitive Group 4 hearing category, and thus their reactions to noise are likely to be greater than most fish: Popper *et al*. (2014) consistently predict a greater reaction at a further distance for the more sensitive fish species, albeit qualitatively. In principle, direct comparison with herring as a proxy is not unreasonable due to their both being in the clupeid family. However, the context should not be ignored, and when it comes to prediction of a reaction to piling, the background noise levels in the vicinity of Rampion 2 are much higher than in Lough Hyne. Underwater noise monitoring at both locations (Collett *et al.,* 2012 and Hawkins *et al.,* 2014) indicates that the ambient noise at Lough Hyne is of the order of 25 dB quieter than around the offshore part of the PEIR Assessment Boundary at the key sound frequencies between 10 Hz and 1000 Hz.

5.2.7 Prior to the publication of Popper *et al*. (2014), McCauley *et al.* (2000) was frequently referenced for behavioural reactions. McCauley *et al.* (2000) found a noise level of 168-173 dB SPL_{peak} re 1 µPa led to significant changes in schooling behaviour for species of Pacific rockfish, which has been typically referred to as possible strong to moderate avoidance. As the species of rockfish (within the family *Sebastes*) are somewhat different to those present at Rampion 2, were all tested in Australian waters and the sound stimulus was seismic airguns, it is felt that there are better and more up to date references available, although the impulsive noise sources in open water would not represent an entirely dissimilar scenario.

Black seabream

5.2.8 To attempt to provide a quantitative threshold for other key species in the Rampion 2 region, regulators have requested that the 135 dB SEL_{ss} threshold be applied to other species. As black seabream are important in the area, 135 dB SEL_{ss} was thought to represent a precautionary threshold, effectively using sprat as a proxy for seabream. As noted earlier, the sprat and herring are biologically similar and would make reasonable proxy species. For reference to black seabream however, the two species share only a class, and critically do not share key anatomical features, the most noteworthy being the lack of a meaningful connection between the swim bladder and inner ear. Clupeoids such as herring and sprat are recognised as having a complex connection between the swim bladder and otic bullae with the swim bladder have a characteristic anterior extension, giving enhanced hearing; black seabream (or *Sparidae* more broadly) do not possess a comparable anterior extension to the swim bladder. It is therefore suggested that the European seabass (*Dicentrarchus labrax*), which is of the same order as black seabream, perciform, is a better proxy anatomically, physiologically and geographically.

5.2.9 Research by Radford *et al.* (2016) using seabass was designed to examine the changes in ventilation rate (opercular beat rate (OBR)) caused by noise to captive fish, which would indicate a stress response. When pile driving noise was played at 147 dB SEL_{ss}, 30 dB above the ambient noise played prior to the stimulus (117 dB SPL_{RMS}), a clear increase in OBR was detected. Collett *et al.* (2012) measured an ambient noise level at sea at the Rampion 1 site of 113 to 120 dB SPL_{RMS} prior to wind turbine foundation installation, which was similar to the ambient noise in the Radford *et al*. (2016) experiment. 30 dB above the ambient noise at the Rampion site would therefore be 143 to 150 dB.

5.2.10 Additional research by Kastelein *et al.* (2017), also on sea bass, identified that initial responses in adult fish (sudden short-lived changes in swimming speed) occurred in response to impulsive pile driving at 141 dB SEL_{ss}, but concluded that no sustained responses (changes in school cohesion, swimming depth, and speed) occurred at levels up to 166 dB SEL_{ss}. Kastelein *et al.* (2017) concluded that the analysis showed that there is no evidence, even at the highest sound level, for any consistent sustained response to sound exposure by the study animals. In this context the conclusion drawn was that if seabass are exposed to pile driving sounds at the levels used in the present study, there are unlikely to be any adverse effects on their ecology, because the initial responses after the onset of the piling sound observed were short-lived.

5.2.11 The conclusions of Radford *et al* (2016) and Kastelein *et al*. (2017) therefore provide a robust basis on which to conclude that species such as European seabass and black seabream may exhibit short lived changes in behaviour in response to impulsive noise at levels between 141 dB SEL_{ss} and 147 dB SEL_{ss}, but are unlikely to exhibit sustained responses at levels up to 166 dB SEL_{ss}, Furthermore, the results indicate acclimation my occur over relatively short periods of time (8-12 week periods). These short-lived responses may be considered to result in a slight stress or behavioural response in adult fish. Therefore, it is suggested that a similar stress response for seabass, as a proxy for black seabream, could occur in this range.

5.2.12 It should be noted that the purpose of the paper by Radford *et al.* (2016) was to research changes in the response of European seabass to impulsive noise over time rather than identify an absolute noise level that would lead to a behavioural reaction (the paper concluded that the seabass no longer responded to pile driving noise at the end of a 12-week exposure). However, the use of seabass in the study, the relatively mild reaction of the subjects and particularly the similarity in ambient noise levels to those at Rampion 2 make the study particularly relevant in the context of considering possible responses of black seabream to impulsive noise over critical time periods such as breeding.

5.2.13 Consequently, it is the opinion of Rampion 2 that 147 dB SEL_{ss} is an appropriate, suitably conservative threshold figure for disturbance of sea bass, as a proxy for black seabream, to piling noise. Importantly it is an appropriate threshold that is based on published peer reviewed scientific literature, with a comparable baseline receiving environment, for an anatomically comparable species.

Black seabream ecology

5.2.14 When applying conservative thresholds for disturbance, as identified in the previous **paragraph 5.2.8** of this Technical Note, it is important to also consider the likely consequence. The receiving environment in which the Proposed Development will be constructed is considered important for the English Channel population of black seabream, specifically offering suitable spawning habitat from Eastbourne through to the Dorset coast, with particular hotspots from the western reaches of the Solent to areas east of the mouth of the Adur and Shoreham Harbour. As has been noted previously, (**paragraph 5.2.9**) the region has a baseline noise level of up to 120 dB SPL_{RMS}, notably higher than baseline conditions considered in other studies such as Hawkins *et al*. (2014), which have been previously suggested as appropriate proxies. Fish can therefore be expected to be acclimated to the presence of non-impulsive noise.

5.2.15 It is also important to note that the above referenced studies conclude that acclimation to impulsive noise occurs over an 8–12-week period in anatomically comparable species from the same class, and in the case of Kastelein *et al.* (2017) concludes that adult wild fish are unlikely to experience any adverse effects on their ecology, because the initial responses after the onset of the piling sound observed were short-lived.

5.2.16 This is important context when considering the potential implications of the impulsive noise associated with the Proposed Development on the spawning of black seabream. The results of the peer reviewed empirical studies do not allow a conclusion to be drawn that there will be an absence of effect but do allow a conclusion to be drawn that black seabream will not respond strongly to impulsive noise at levels between 147 dB SEL_{ss}, and 166 dB SEL_{ss}. They also provide some comfort that at the lower level (141 dB SEL_{ss}) acclimation is likely over periods of 8-12 weeks.

5.2.17 A further important context to consider is the breeding habits of black seabream. Male black seabream is well understood to form nests on the seabed, in which eggs are laid, particularly around the 10m depth contour in Sussex. The nests form what is frequently described as a moonscape, excavated in sediments overlying bedrock in a veneer, at a width of up to 2m diameter and sediment banked up around the nests up to a depth of around 300mm. Whilst the nests would not form a complete barrier to noise propagation, it is important context in that the features are constructed to offer protection from prevailing currents, and will offer protection to eggs, larvae, juveniles, and some protection to adult fish ‘on the nest’. This should not be considered to mean there will be no effect at all, but any effect will be spatially limited, with the natural spawning habits of black seabream being such that noise levels will attenuate further in proximity to the nest features

5.2.18 Finally, a further important context is black seabream feeding habits. Black seabream is an omnivorous species, feeding on a combination of seaweeds, small invertebrates, and notably crustaceans. The prey sources are all therefore of a low or non-existent sensitivity to increases in noise generally, or impulsive noise specifically, and there would therefore be no anticipated inter-related effect on black seabream from any changes in prey availability.

5.3 Threshold conclusion

5.3.1 Black seabream are an important fish species in the region of Rampion 2, off the south coast of England. Disturbance of this species is to be avoided during the spawning season, and in an effort to identify the extent to which disturbance could occur as a consequence of underwater noise from piling for foundations for the turbines, 135 dB SEL_{ss} has previously been suggested as a quantitative disturbance threshold. This threshold was derived from research on sprat, one of the species of fish known to be most sensitive to noise and, in common with clupeids, possessing a specialisation in their swim bladder that enhances their hearing that is not present with seabream. Sea bass and seabream are suggested as species with more comparable anatomy in relation to hearing.

5.3.2 The conditions leading to the 135 dB SEL_{ss} behavioural reaction threshold above were approximately 40 dB above the ambient noise at the time. Research by Radford *et al.* (2016) has shown an impulsive noise stimulus of 147 dB SEL_{ss} leads to a stress reaction in sea bass, which was 30 dB in excess of the ambient noise in the experiment. As the underwater ambient noise sampled during a survey at the Rampion 1 site was very similar to that used in Radford *et al* (2016), it is therefore suggested that 147 dB SEL_{ss} be used as an indicative and conservative threshold for disturbance. **Table 2** below provides a summary of these thresholds.

Table 2 Summary of Thresholds used for PEIR assessment and proposed mitigation approach

Summary of threshold
207 dB SPLpeak (Mortality and potential mortal injury in fish with a swim bladder, Popper *et al.,* 2014);
203 dB SELcum (Recoverable injury in fish with a swim bladder, Popper *et al.,* 2014)
186 dB SELcum (TTS in all species of fish, Popper *et al.,* 2014);
135 dB SELss (50% observed response in fish in quiet conditions, Hawkins *et al.,* 2014);
147 dB SELss (unweighted) for disturbance

6. Offshore piling mitigation

6.1 Overview

6.1.1 The design work to inform practical mitigation for the WTG foundation installation works has included investigation of the techniques that can be employed to reduce impact noise ranges, where this is required to address the potential for significant effects to arise. Whilst the noise modelling exercise has achieved avoidance of the majority of the sensitive features by way of avoidance of the MCZ areas near to and adjacent to the offshore array area, there remain instances where full avoidance has not been possible. This is due to the mobile nature of the species in question, such as seahorse migrations, in addition to uncertainties on the locations of all bream nesting activities, where this has not been identified with sufficient confidence from the available survey data to comprehensively represent in mapping.

6.1.2 The aim of the following sections is, therefore, to provide additional information on the techniques, approaches and equipment that are available to ensure direct effects are reduced for all receptors, both known and unknown.

6.2 General hammer noise mitigation

6.2.1 There are procedural measures that can be taken in order to manage noise emission impacts during offshore construction. This includes a 'soft-start' process where the hammering operations are commenced at a very low energy and low blow rate in order to enable sensitive species to move away from the affected area. The soft start procedure acts as a warning and has been accepted as a mitigation measure in UK waters to date.

6.2.2 Procedural measures such as "HiLo" can also be implemented to reduce noise emissions. This procedure uses a **hi**gh frequency **lo**w energy blow method and has been proven to have good noise control capabilities but may not be suitable for all ground conditions due to the lower energies utilised.

PULSE hammer by IHC (4 to 6 dB reduction in source level)

6.2.3 The biggest hammer IHC has currently offer is the S-4000. This hammer can be upgraded to a S-5500 based on the same design and general equipment.

6.2.4 The maximum size of the hammer anvil that can be forged is currently 7.5m in diameter. IHC have however developed a solution to increase the diameter of the anvil. Through the use of a secondary anvil adapter plate (forged separately) they are able to increase the maximum diameter to 8.5m.

6.2.5 Due to the increasing hammer size/length, IHC has worked to integrate their crane shock absorber (MAXINE) into the hammer shaft (or better building it around the hammer) and therefore reducing the overall length of the set-up.

6.2.6 IHC has developed an add-on noise mitigation which can be jointed with all existing hammers and will sit between the ram-weight and the anvil, called PULSE

(Pile Under Limited Stress), it consists of two pistons with a water cushion of 150 – 300mm.

6.2.7 For the S-4000 they have calculated a noise reduction capability of 4 to 6 dB.

MNRU hammer by Menck (9 to 11 dB reduction in source level)

6.2.8 The biggest hammer Menck has currently build is the MHU-4400. The MHU-4400 was built during 2020 and is currently available for use. A 5500 – 6000kJ hammer is currently being planned and may become available in the year 2022.

6.2.9 Menck use a single anvil solution with no adapter plate and is currently able to achieve an anvil diameter of 7.5m.

6.2.10 Menck has developed a noise mitigation unit called Menck Noise Reduction Unit (MNRU). The unit is inserted between the ram weight and the anvil.

6.2.11 The unit consists of six individual round silencer blocks (800x800) acting like a spring. The blocks are guided inside and connected to the housing using plastic/nylon strakes. The unit is currently designed to be used on the 3500kJ and 4400kJ hammer.

6.2.12 Menck has modelled the estimated reduction of the MNRU which resulted in an SEL reduction of 9 dB and Peak reduction of 11 dB.

Hydro Sound Dampers, (HSD) and the AdBm (8 to 10 dB reduction in source level)

6.2.13 Another noise mitigation system is the use of a hydro sound damper (HSD).

6.2.14 An HSD net usually consists of three net layers, which are provided with sound-absorbing elements, as well as a safety net on the inside and outside. The nets themselves are similar to fishing nets with a mesh size of c. 2.5 x 2.5cm. Each of the inner nets are provided with air-filled PE foam elements or air-filled balloons. Each of these elements is tuned to a specific frequency.

6.2.15 The AdBM mechanism of action is in principle comparable to the HSD-system. So-called stationary resonators are placed in the water column. Here, no HSD-elements made of different foams are placed, but air-filled block-shapes are used (stationary Bubble Curtain with defined air volumes), which are open at the bottom.

6.2.16 HSDs, in contrast to free air bubbles of conventional bubble curtain solutions, reduce noise through physical properties.

6.2.17 The resonant effect of small air-filled balloons and PE-foam elements in water can be used to attenuate noise emissions.

6.2.18 HSD systems have the advantage of being light weight, facilitating fast deployment and recovery and being able to be specifically tuned to attenuate certain frequency ranges. Full integration of the HSD system into a monopile gripper frame is possible easing transport and installation activities.

Double large bubble curtains (15 dB reduction in source level).

6.2.19 The double bubble curtain (DBC) has been widely utilised in the offshore renewables industry and is the most common method for reducing underwater noise emissions for offshore wind piling activities.

6.2.20 Bubble curtain systems solution pump compressed air through a perforate hose / pipe laid in a circular configuration on the seabed. The compressed air is then released from the seabed and creates a rising bubble rings, or curtain, also known as a pneumatic barrier, which is used to attenuate the propagation of sound waves through the water column, thus reducing noise emissions.

6.2.21 A DBC has been proven to provide efficient noise reduction and is suitable for use in Germany where the emissions level limit is 160 dB SEL at 750m.

6.2.22 A DBC is deployed from a secondary vessel supporting the main installation vessel. The vessel is normally a platform supply vessel (PSV) with a number of air compressors on the back deck and a launch and recovery system for the perforated hose/pipe.

6.2.23 The DBC vessel is required to be on site for the full period that the main installation vessel is chartered to a project.

6.2.24 It should be noted that the DBC system has been shown to have limited effectiveness in high current locations.

7. Underwater noise modelling

7.1 Overview

7.1.1 The following sections give a summary of the INSPIRE Light underwater noise modelling outputs, with approximate maximum ranges utilised. All results ranges are calculated using 20 equally spaced transects and INSPIRE Light's 100m step resolution. All contour plots have been presented at the same scale for ease of comparison.

7.1.2 The parameters used for modelling are, unless noted, the same as those used in previous reporting for Rampion 2 in **PEIR Volume 2, Chapter 11: Marine mammals**, and **PEIR Volume 4, Appendix 11.3: Quantitative noise assessment**. These include up to 4.5 hours to install each pile using the worst-case parameters.

7.1.3 The INSPIRE Light modelling presents the potential reduction in sound levels possible when including a range of possible piling mitigations as described in **Section 6**, and the impact ranges arising for those mitigated noise levels. A summary of the options considered are given below. Modelling was carried out at the same North West (NW), East (E), West (W) and South (S) noise modelling locations as presented at PEIR, as well as additional South West (SW), North East (NE) and Middle array locations, closest to the MCZ areas, in order to explore the possibility of utilising a range of different noise reduction level requirements across the array area, rather than a single solution.

Primary mitigation options

- PULSE hammer by IHC (4 to 6 dB reduction in source level)
- MNRU hammer by Menck (9 to 11 dB reduction in source level)

Secondary mitigation options

- Hydro Sound Dampers, such as the AdBm (8 to 10 dB reduction in source level)
- Double big bubble curtains (15 dB reduction in source level)

7.1.4 In addition to modelling the mitigation reduction in source levels above, modelling runs were undertaken to assess the possibility of using more than one mitigation in tandem. Modelling was run for both the potential reduction to Cetacean Permanent Threshold Shift (PTS), fish response and Temporary Threshold Shift (TTS) impact ranges.

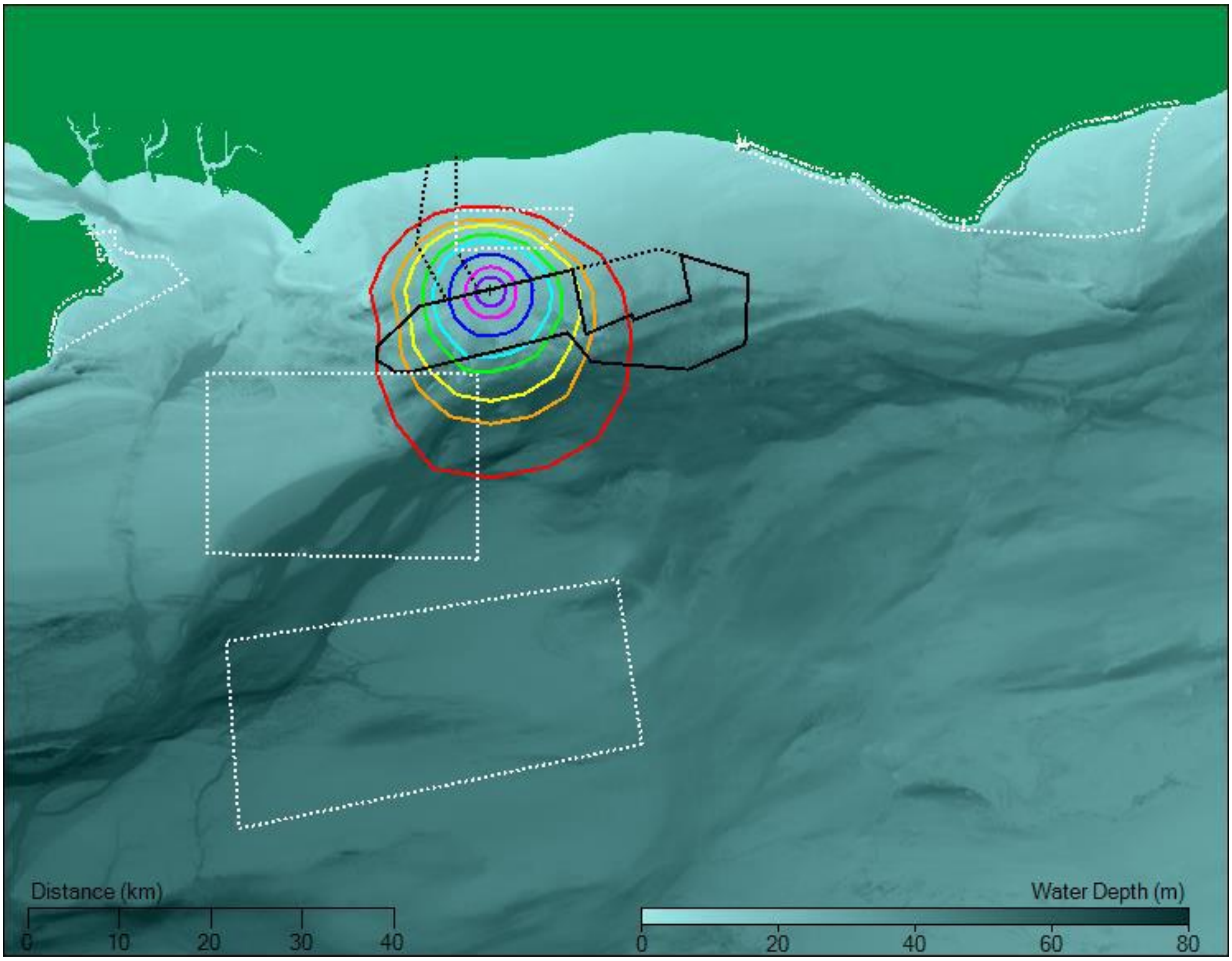
7.1.5 Outputs from the INSPIRE Light model runs for the same worst case locations as adopted in the PEIR, and are presented in the series of Figures shown below (**Figures 3 – 10**) when using various mitigation options. Most modelling includes for a minimum noise reduction (e.g., 4 dB in the case of the PULSE hammer).

7.1.6 When plotting the impact ranges for 207 dB SPL_{peak} (Mortality and potential mortal injury), and 203 dB SEL_{cum} (Recoverable injury), as explained in **Section 4**, impacts ranges were extremely small, forming no overlap with designated MCZs, and therefore have not been included in the figures below. **Figures 3-6** show the impact ranges with and without the various mitigation options at 186 dB SEL_{cum} (TTS). **Figures 7-10** show impact ranges with and without the various mitigation options for 147 dB (Disturbance).

7.1.7 For the ‘base case’ (i.e., with no mitigation) it is clear that noise impact ranges would extend into one or more of the designated MCZs.

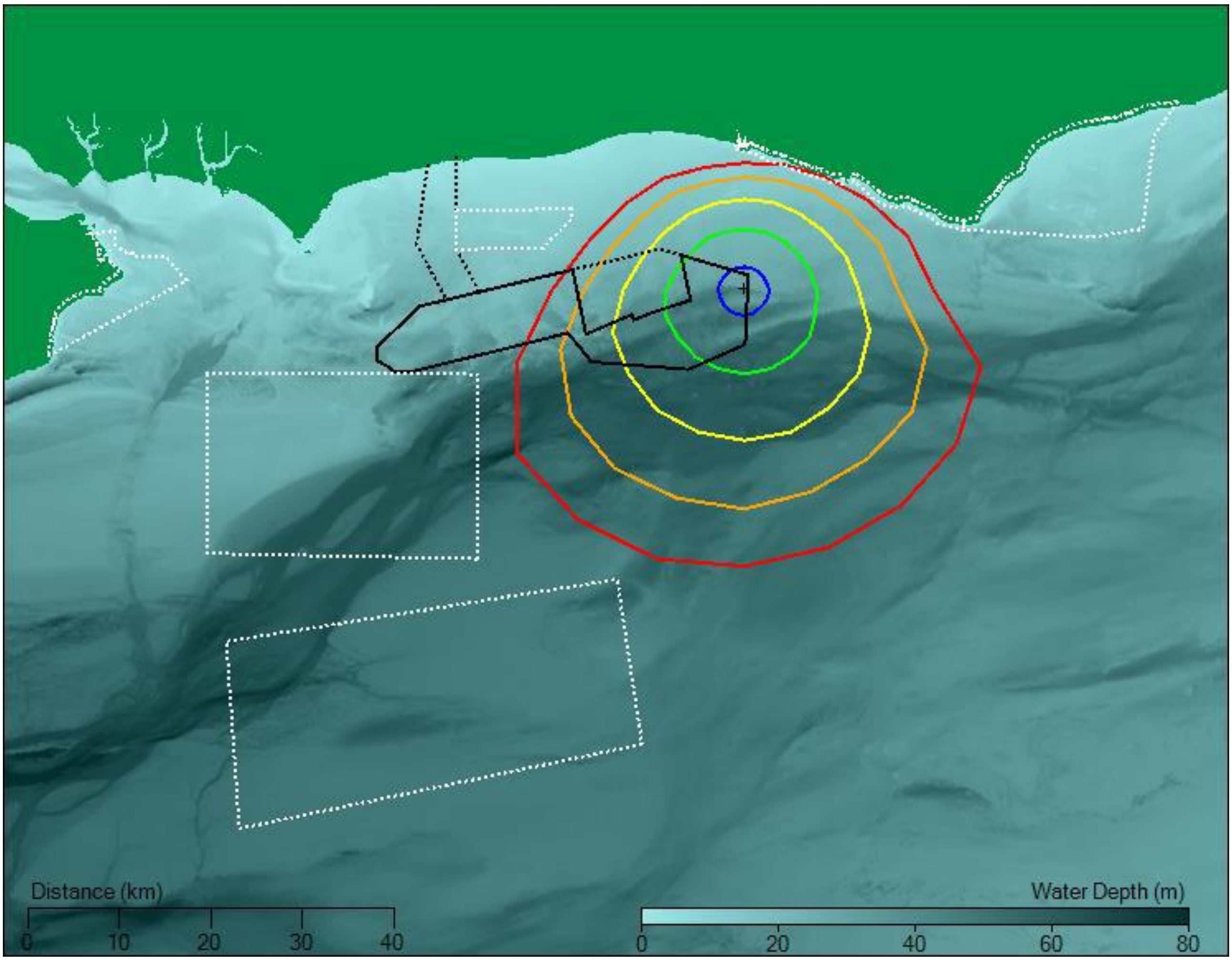
Noise modelling outputs for TTS (186 dB SEL_{cum})

Figure 3 Potential decreases in fish TTS impact ranges using the criteria from Popper *et al.* (2014) when using various mitigation options, at Northwest (NW) noise modelling location. White dotted lines represent designated MCZs.



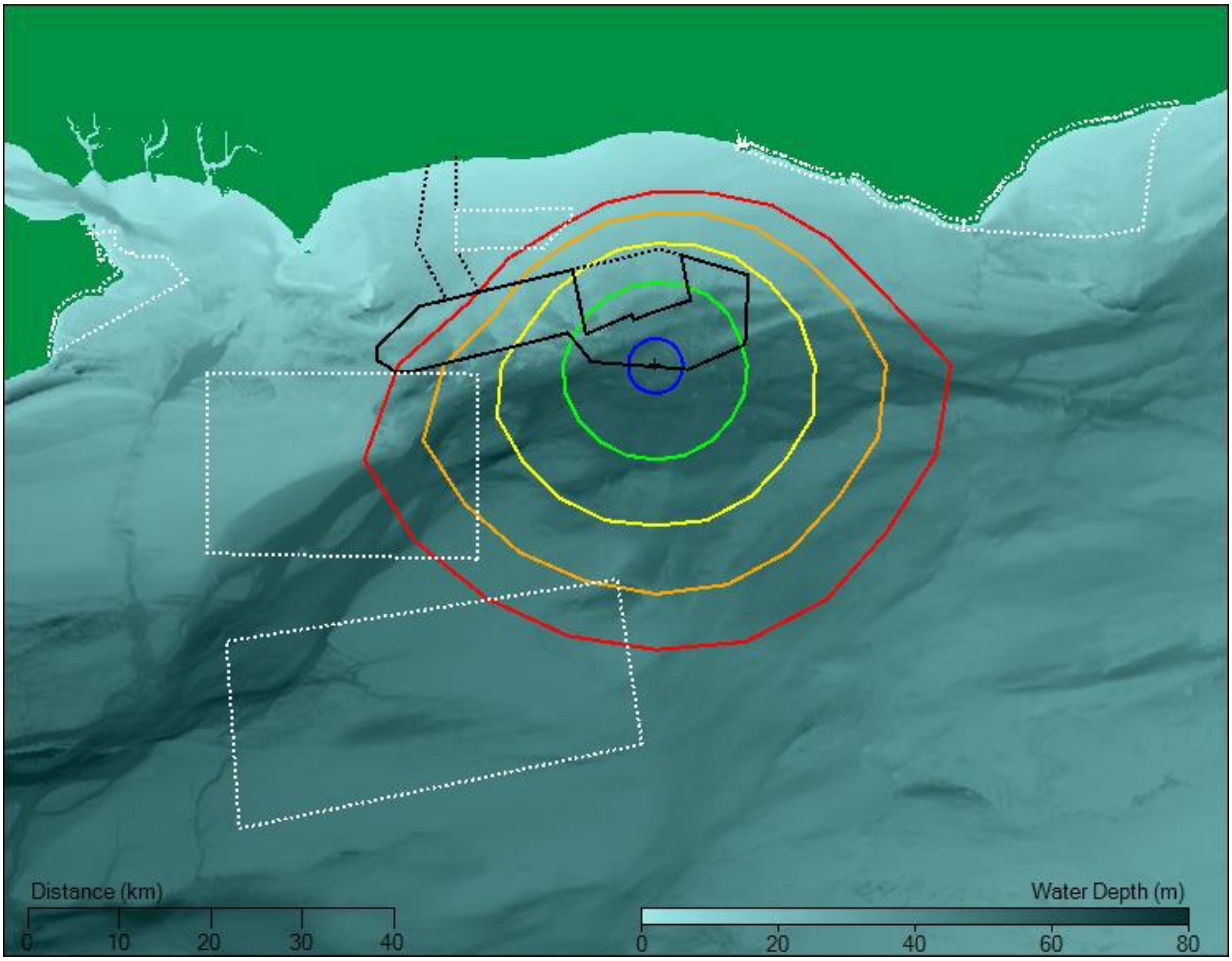
Location	Scenario	Max range	Contour
NW	Monopile (worst-case), 186 dB SELcum (1 pile) (TTS in all species of fish, Popper *et al*., 2014) (stationary receptor); **unmitigated.**	21km	Red
NW	Monopile (worst-case), 186 dB SELcum (1 pile) (TTS in all species of fish, Popper *et al*., 2014) (stationary receptor); **4 dB reduction (PULSE hammer, likely case).**	15km	Orange
NW	Monopile (worst-case), 186 dB SELcum (1 pile) (TTS in all species of fish, Popper *et al*., 2014) (stationary receptor); **6 dB reduction (PULSE hammer, best case).**	12km	Yellow
NW	Monopile (worst-case), 186 dB SELcum (1 pile) (TTS in all species of fish, Popper *et al*., 2014) (stationary receptor); **9 dB reduction (MNRU hammer, likely case).**	9.2km	Green
NW	Monopile (worst-case), 186 dB SELcum (1 pile) (TTS in all species of fish, Popper *et al*., 2014) (stationary receptor); **11 dB reduction (MNRU hammer, best case).**	7.6km	L. Blue
NW	Monopile (worst-case), 186 dB SELcum (1 pile) (TTS in all species of fish, Popper *et al*., 2014) (stationary receptor); **15 dB reduction (double big bubble curtain).**	4.9km	Blue
NW	Monopile (worst-case), 186 dB SELcum (1 pile) (TTS in all species of fish, Popper *et al*., 2014) (stationary receptor); **20 dB reduction (combined mitigation measures).**	3.0km	Magenta
NW	Monopile (worst-case), 186 dB SELcum (1 pile) (TTS in all species of fish, Popper *et al*., 2014) (stationary receptor); **25 dB reduction (combined mitigation measures).**	1.5km	Purple

Figure 4 Potential decreases in fish TTS impact ranges using the criteria from Popper *et al.* (2014) when using various mitigation options, at Eastern (E) noise modelling location. White dotted lines represent designated MCZs



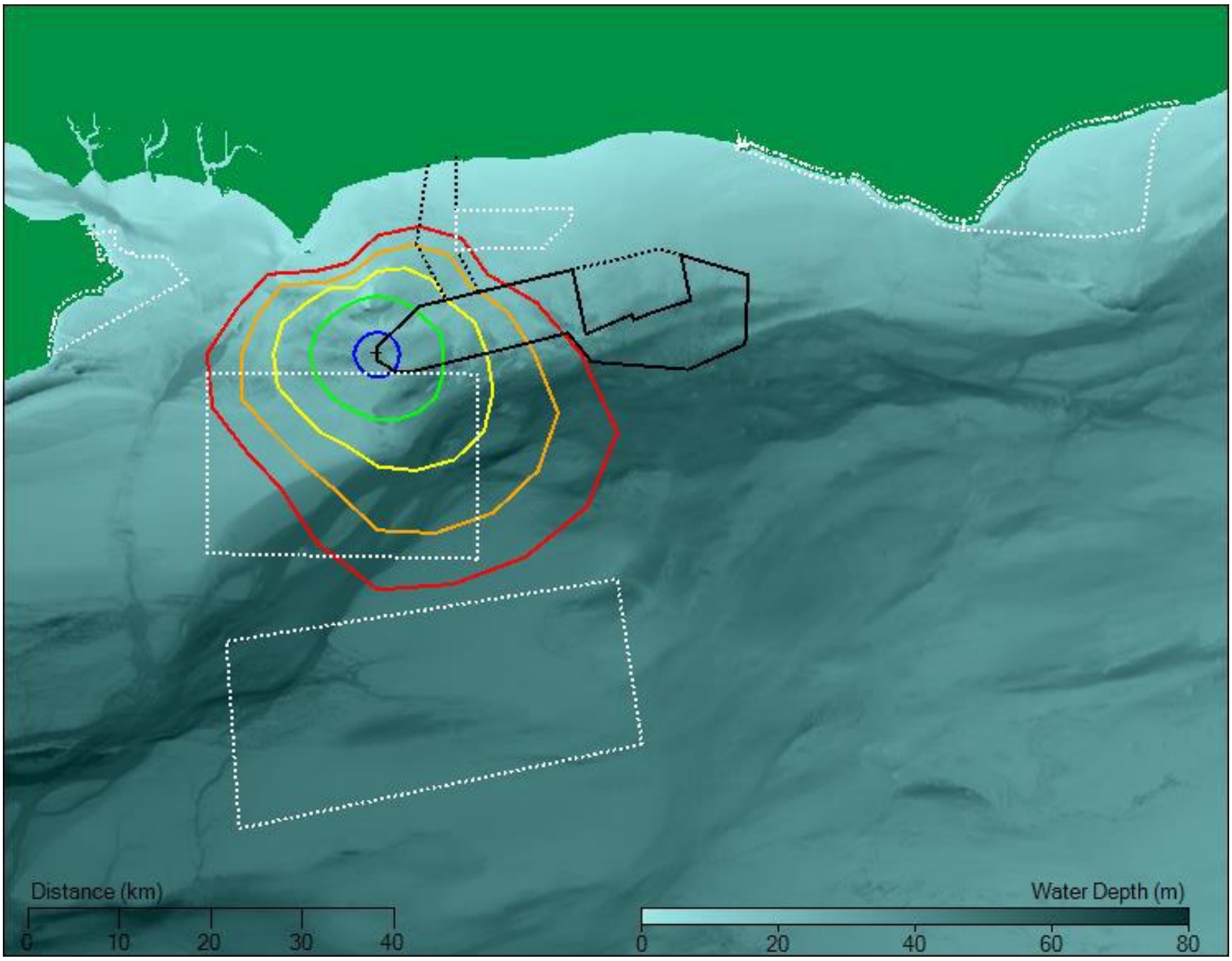
Location	Scenario	Max range	Contour
E	Monopile (worst-case), 186 dB SELcum (1 pile) (TTS in all species of fish, Popper *et al*., 2014) (stationary receptor); **unmitigated**.	31km	Red
E	Monopile (worst-case), 186 dB SELcum (1 pile) (TTS in all species of fish, Popper *et al*., 2014) (stationary receptor); **4 dB reduction (PULSE hammer, likely case)**.	24km	Orange
E	Monopile (worst-case), 186 dB SELcum (1 pile) (TTS in all species of fish, Popper *et al*., 2014) (stationary receptor); **9 dB reduction (MNRU hammer, likely case)**.	17km	Yellow
E	Monopile (worst-case), 186 dB SELcum (1 pile) (TTS in all species of fish, Popper *et al*., 2014) (stationary receptor); **15 dB reduction (double big bubble curtain)**.	9.1km	Green
E	Monopile (worst-case), 186 dB SELcum (1 pile) (TTS in all species of fish, Popper *et al*., 2014) (stationary receptor); **25 dB reduction (combined mitigation measures)**.	2.8km	Blue

Figure 5 Potential decreases in fish TTS impact ranges using the criteria from Popper et al. (2014) when using various mitigation options, at Southern (S) noise modelling location. White dotted lines represent designated MCZs



Location	Scenario	Max range	Contour
S	Monopile (worst-case), 186 dB SELcum (1 pile) (TTS in all species of fish, Popper *et al*., 2014) (stationary receptor); **unmitigated**.	34km	Red
S	Monopile (worst-case), 186 dB SELcum (1 pile) (TTS in all species of fish, Popper *et al*., 2014) (stationary receptor); **4 dB reduction (PULSE hammer, likely case)**.	27km	Orange
S	Monopile (worst-case), 186 dB SELcum (1 pile) (TTS in all species of fish, Popper *et al*., 2014) (stationary receptor); **9 dB reduction (MNRU hammer, likely case)**.	18km	Yellow
S	Monopile (worst-case), 186 dB SELcum (1 pile) (TTS in all species of fish, Popper *et al*., 2014) (stationary receptor); **15 dB reduction (double big bubble curtain)**.	10km	Green
S	Monopile (worst-case), 186 dB SELcum (1 pile) (TTS in all species of fish, Popper *et al*., 2014) (stationary receptor); **25 dB reduction (combined mitigation measures)**.	3.1km	Blue

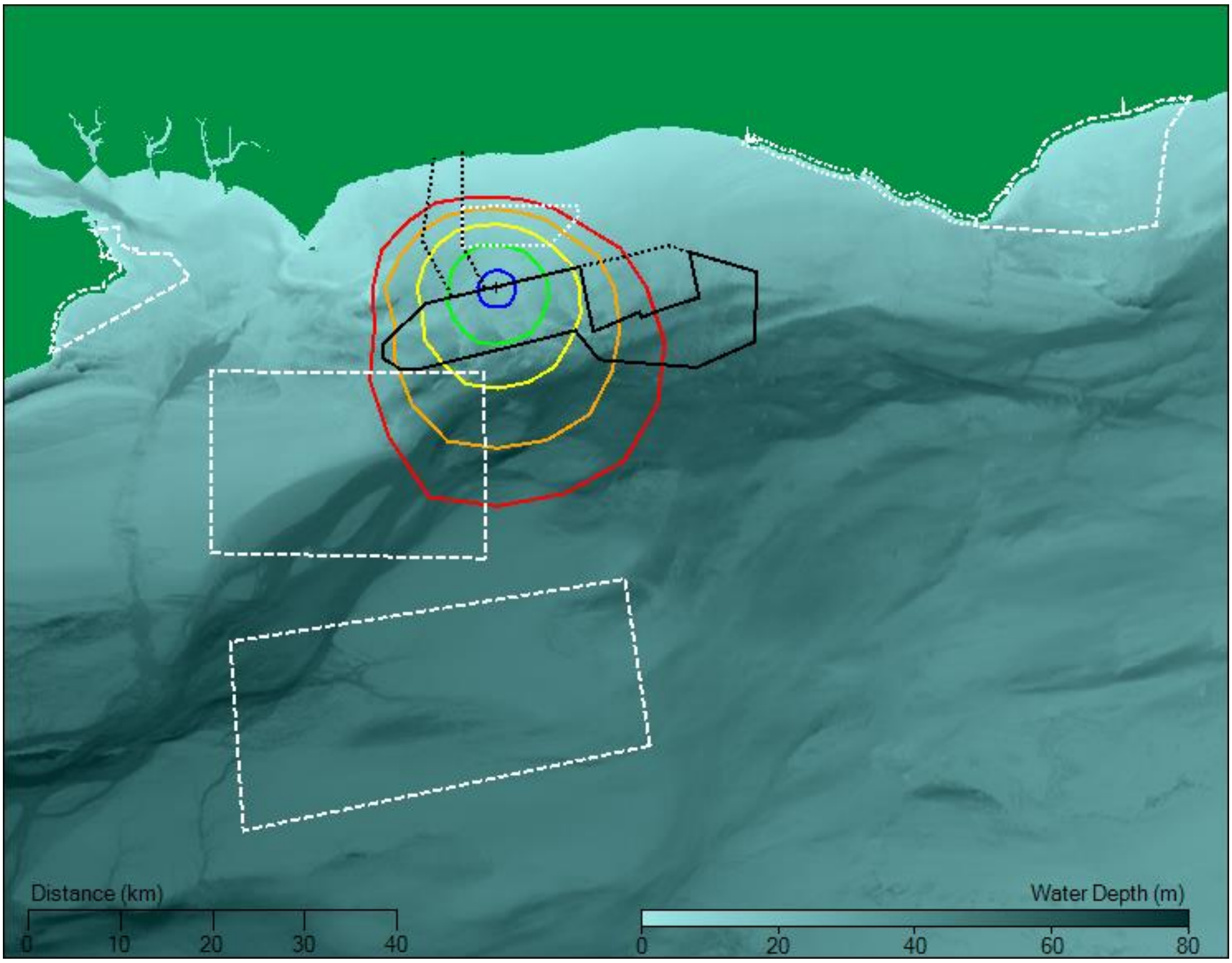
Figure 6 Potential decreases in fish TTS impact ranges using the criteria from Popper *et al.* (2014) when using various mitigation options, at Western (W) noise modelling location. White dotted lines represent designated MCZs



Location	Scenario	Max range	Contour
W	Monopile (worst-case), 186 dB SELcum (1 pile) (TTS in all species of fish, Popper *et al*., 2014) (stationary receptor); **unmitigated**.	28km	Red
W	Monopile (worst-case), 186 dB SELcum (1 pile) (TTS in all species of fish, Popper *et al*., 2014) (stationary receptor); **4 dB reduction (PULSE hammer, likely case)**.	22km	Orange
W	Monopile (worst-case), 186 dB SELcum (1 pile) (TTS in all species of fish, Popper *et al*., 2014) (stationary receptor); **9 dB reduction (MNRU hammer, likely case)**.	14km	Yellow
W	Monopile (worst-case), 186 dB SELcum (1 pile) (TTS in all species of fish, Popper *et al*., 2014) (stationary receptor); **15 dB reduction (double big bubble curtain)**.	7.4km	Green
W	Monopile (worst-case), 186 dB SELcum (1 pile) (TTS in all species of fish, Popper *et al*., 2014) (stationary receptor); **25 dB reduction (combined mitigation measures)**.	2.6km	Blue

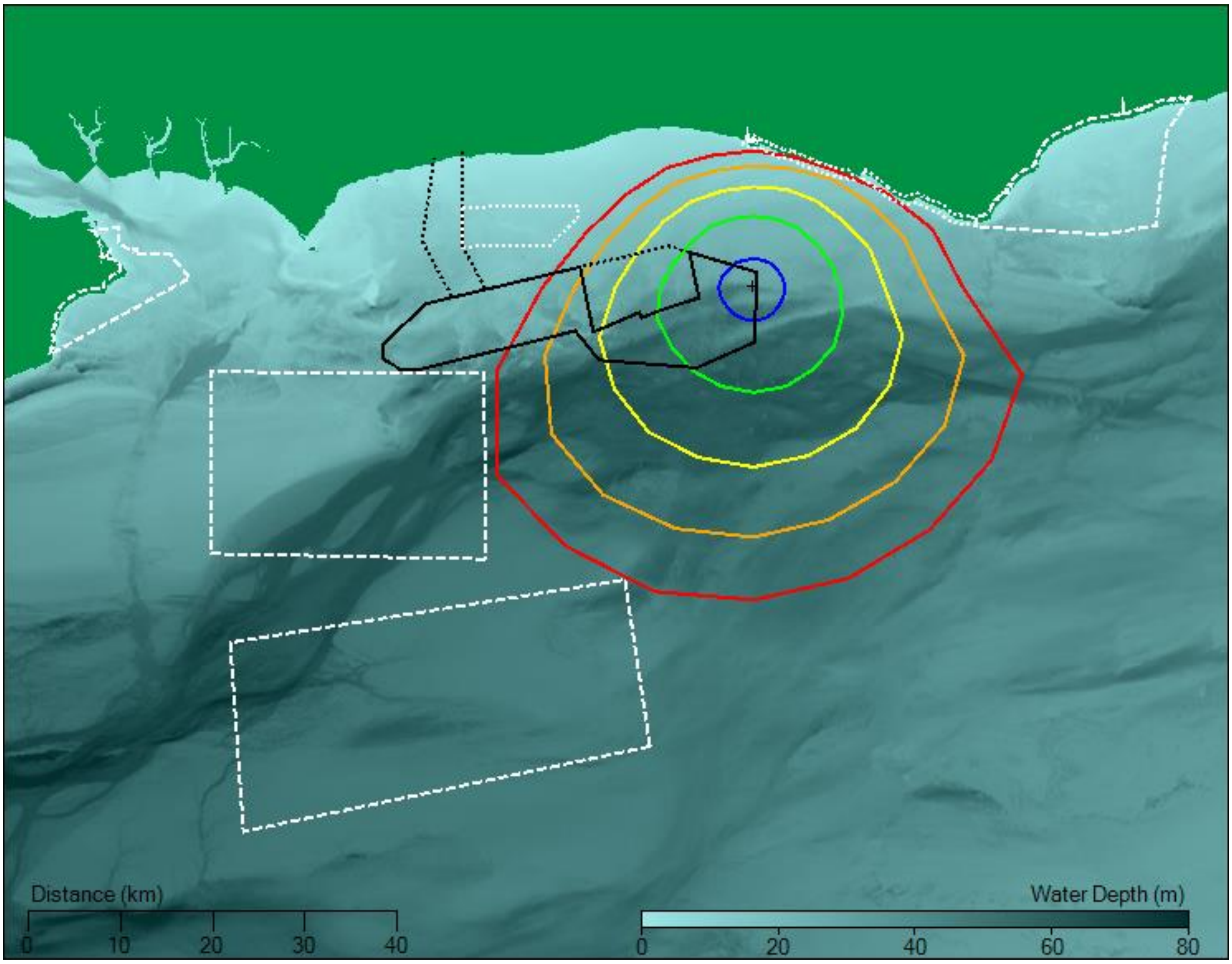
Noise modelling outputs for Disturbance (147 dB SEL_{ss})

Figure 7 Potential decreases in fish disturbance impact ranges using the criteria 147dB, when using various mitigation options, at the North West (NW) noise modelling location. White dotted lines represent designated MCZs



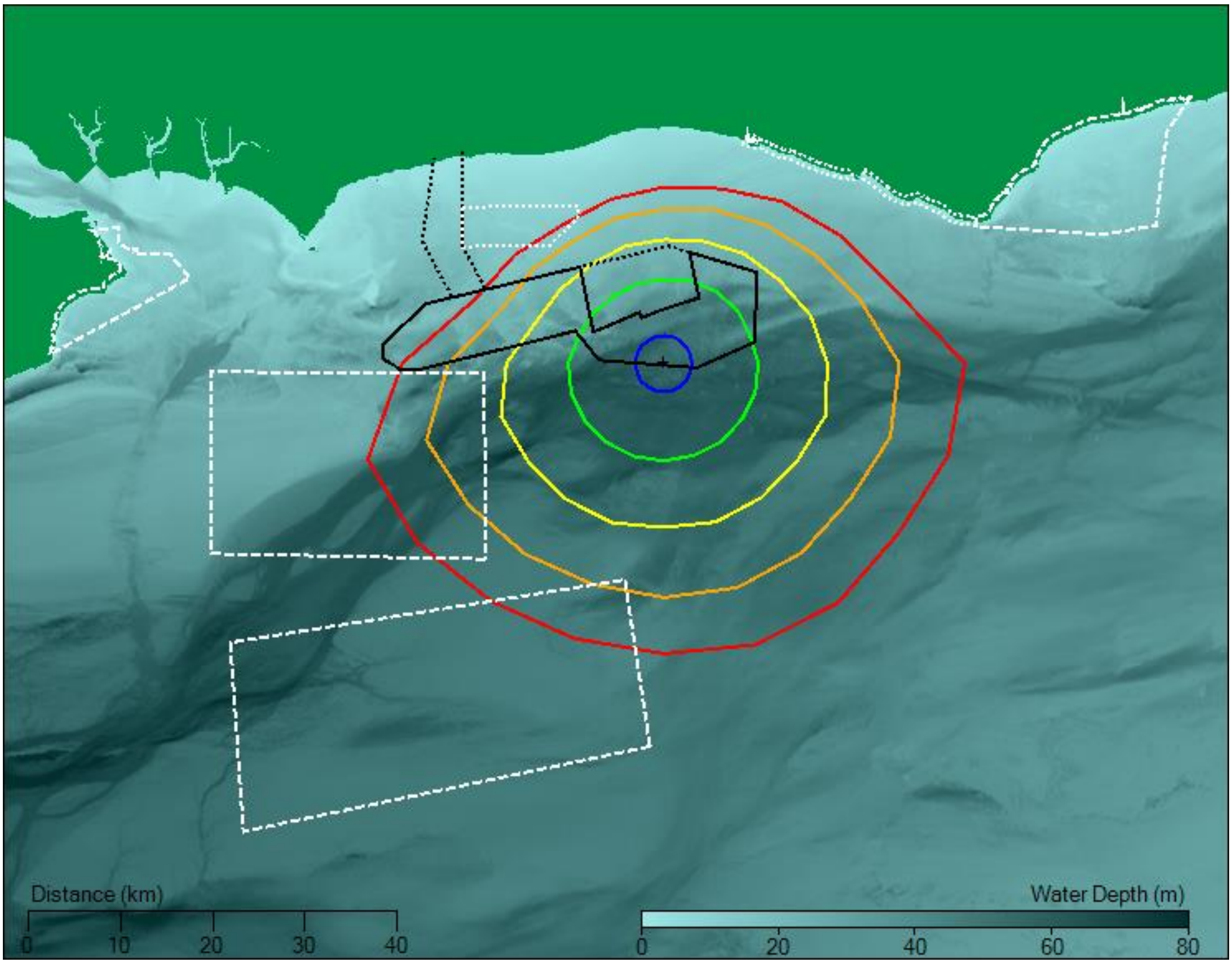
Location	Scenario	Max range	Contour
NW	Monopile (worst-case), 147 dB SELss (1 pile) Disturbance; **unmitigated**.	24km	Red
NW	Monopile (worst-case), 147 dB SELss (1 pile) Disturbance; **4 dB reduction (PULSE hammer, likely case)**.	17km	Orange
NW	Monopile (worst-case), 147 dB SELss (1 pile) Disturbance; **9 dB reduction (MNRU hammer, likely case)**.	11km	Yellow
NW	Monopile (worst-case), 147 dB SELss (1 pile) Disturbance; **15 dB reduction (double big bubble curtain)**.	6.3km	Green
NW	Monopile (worst-case), 147 dB SELss (1 pile) Disturbance; **25 dB reduction (combined measures)**.	2.2km	Blue

Figure 8 Potential decreases in fish disturbance impact ranges using the criteria 147 dB, when using various mitigation options, at the Eastern (E) noise modelling location. White dotted lines represent designated MCZs



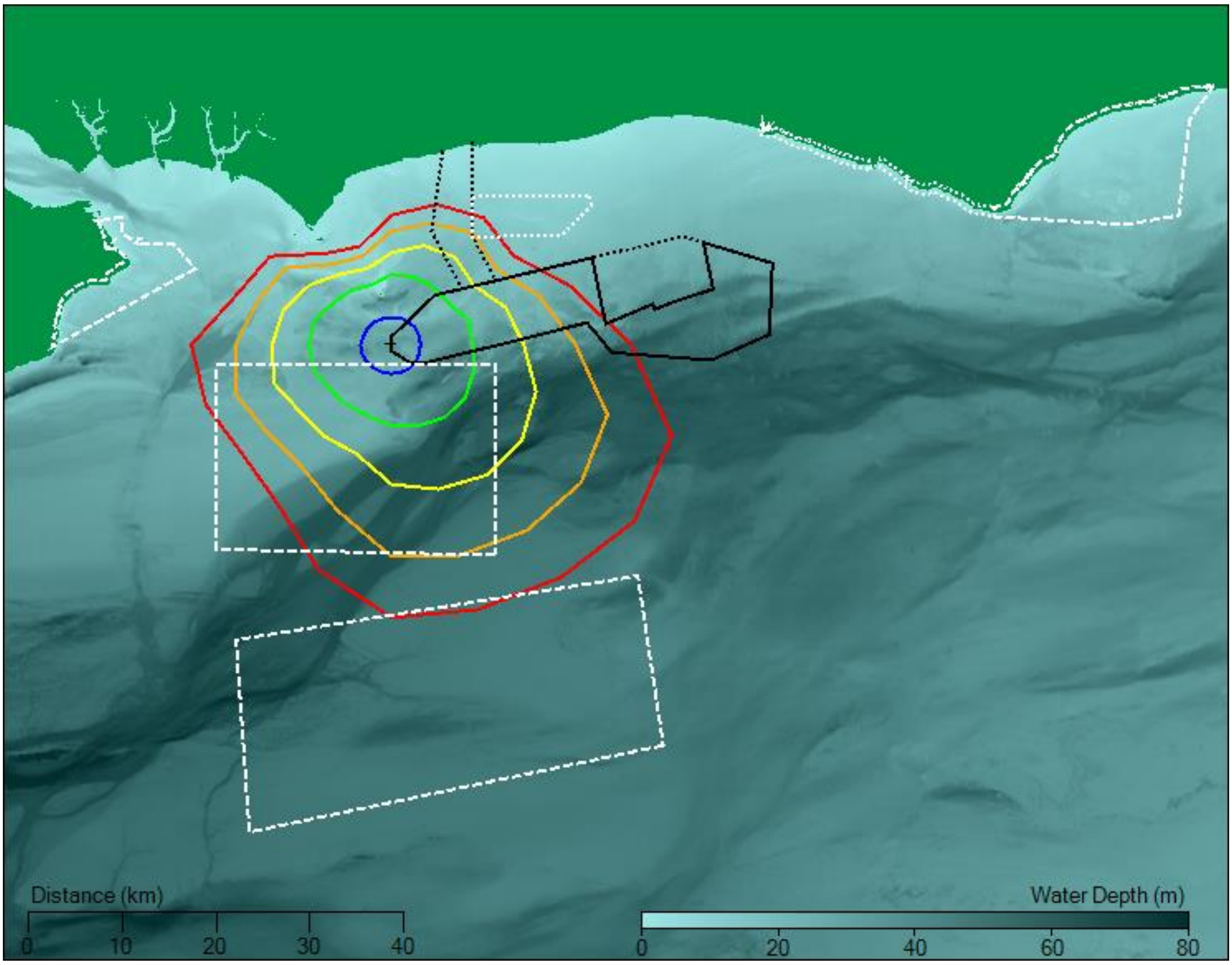
Location	Scenario	Max range	Contour
E	Monopile (worst-case), 147 dB SELss (1 pile) Disturbance; **unmitigated**.	35km	Red
E	Monopile (worst-case), 147 dB SELss (1 pile) Disturbance; **4 dB reduction (PULSE hammer, likely case)**.	27km	Orange
E	Monopile (worst-case), 147 dB SELss (1 pile) Disturbance; **9 dB reduction (MNRU hammer, likely case)**.	19km	Yellow
E	Monopile (worst-case), 147 dB SELss (1 pile) Disturbance; **15 dB reduction (double big bubble curtain)**.	11km	Green
E	Monopile (worst-case), 147 dB SELss (1 pile) Disturbance; **25 dB reduction (combined mitigation measures)**.	3.8km	Blue

Figure 9 Potential decreases in fish disturbance impact ranges using the criteria 147 dB, when using various mitigation options, at the Southern (S) noise modelling location. White dotted lines represent designated MCZs



Location	Scenario	Max range	Contour
S	Monopile (worst-case), 147 dB SELss (1 pile) Disturbance; **unmitigated**.	34km	Red
S	Monopile (worst-case), 147 dB SELss (1 pile) Disturbance; **4 dB reduction (PULSE hammer, likely case)**.	27km	Orange
S	Monopile (worst-case), 147 dB SELss (1 pile) Disturbance; **9 dB reduction (MNRU hammer, likely case)**.	19km	Yellow
S	Monopile (worst-case), 147 dB SELss (1 pile) Disturbance; **15 dB reduction (double big bubble curtain)**.	11km	Green
S	Monopile (worst-case), 147 dB SELss (1 pile) Disturbance; **25 dB reduction (combined mitigation measures)**.	3.2km	Blue

Figure 10 Potential decreases in fish disturbance impact ranges using the criteria 147 dB, when using various mitigation options, at the West (W) noise modelling location. White dotted lines represent designated MCZs.



Location	Scenario	Max range	Contour
W	Monopile (worst-case), 147 dB SELss (1 pile) Disturbance; **unmitigated**.	31km	Red
W	Monopile (worst-case), 147 dB SELss (1 pile) Disturbance; **4 dB reduction (PULSE hammer, likely case)**.	24km	Orange
W	Monopile (worst-case), 147 dB SELss (1 pile) Disturbance; **9 dB reduction (MNRU hammer, likely case)**.	17km	Yellow
W	Monopile (worst-case), 147 dB SELss (1 pile) Disturbance; **15 dB reduction (double big bubble curtain)**.	9.7km	Green
W	Monopile (worst-case), 147 dB SELss (1 pile) Disturbance; **25 dB reduction (combined mitigation measures)**.	3.4km	Blue

Overview of model outputs

7.1.8 With the implementation of mitigation, it is evident that sufficient reduction in noise propagation extents is achievable for both cumulative TTS exposure (186 dB SEL_{cum}) and the disturbance threshold (147 dB SEL_{ss}). With this mitigation in place, overlap with the Kingmere MCZs can be avoided, therefore ensuring no significant effects through disturbance will arise on black seabream through the sensitive breeding/spawning period at the designated site. It is also apparent that overlap with the coastal MCZs at which seahorse are a designated feature can also be avoided at this threshold level, which will mitigate the likelihood of effects arising on seahorse in the summer period. It should be noted that as an appropriate level of protection against behavioural effects can be delivered through mitigation, it can also be surmised that no mortality or injurious effects would arise at the designated sites, as the noise exposure levels causing such potential impacts will be far smaller in extent and therefore there is no potential for these to overlap with designated areas from any piling within the Rampion 2 offshore array area.

7.1.9 Results of the INSPIRE Light modelling show that noise impact ranges can be reduced by varying degrees using any one (or a combination) of the specialised mitigation equipment options provided. The level of mitigation required to avoid overlap at defined thresholds with the MCZ sites changes according to the separation distance of the location of the piling event to the sensitive receptor.

7.1.10 In establishing the required reduction in noise propagation extents for the relevant threshold levels to avoid overlap with the MCZ sites, there are several mitigation options or combinations that may affect the required noise propagation extents at the 147 dB.

7.1.11 Modelling and assessment has been undertaken to derive a contour map of the noise reduction levels required in order to avoid overlap with each MCZ, according to where piling is undertaken spatially within the Rampion 2 offshore array area. Multiple INSPIRE Light model runs were undertaken at 147 dB across the entire array area to estimate regions within the offshore part of the PEIR Assessment Boundary such that a target noise level of 147 dB SEL_{ss} is avoided in the Kingmere MCZ or Beachy Head West MCZ (i.e., the closest MCZs with designated noise-sensitive features).

7.1.12 **Figure 11** shows an example of a composite plot derived from a series of single point modelling runs to calculate 147 dB SEL_{ss} threshold extents, which is followed by a map (**Figure 12**) that presents derived boundaries for differing levels of noise reduction required to deliver mitigation for the MCZs across the Rampion 2 offshore array area based on these modelling runs.

Figure 11 Example runs of the 147 dB model, at multiple locations across the Rampion 2 array area, for the purposes of mitigation partitioning of the offshore array area. White dotted lines represent designated MCZs.

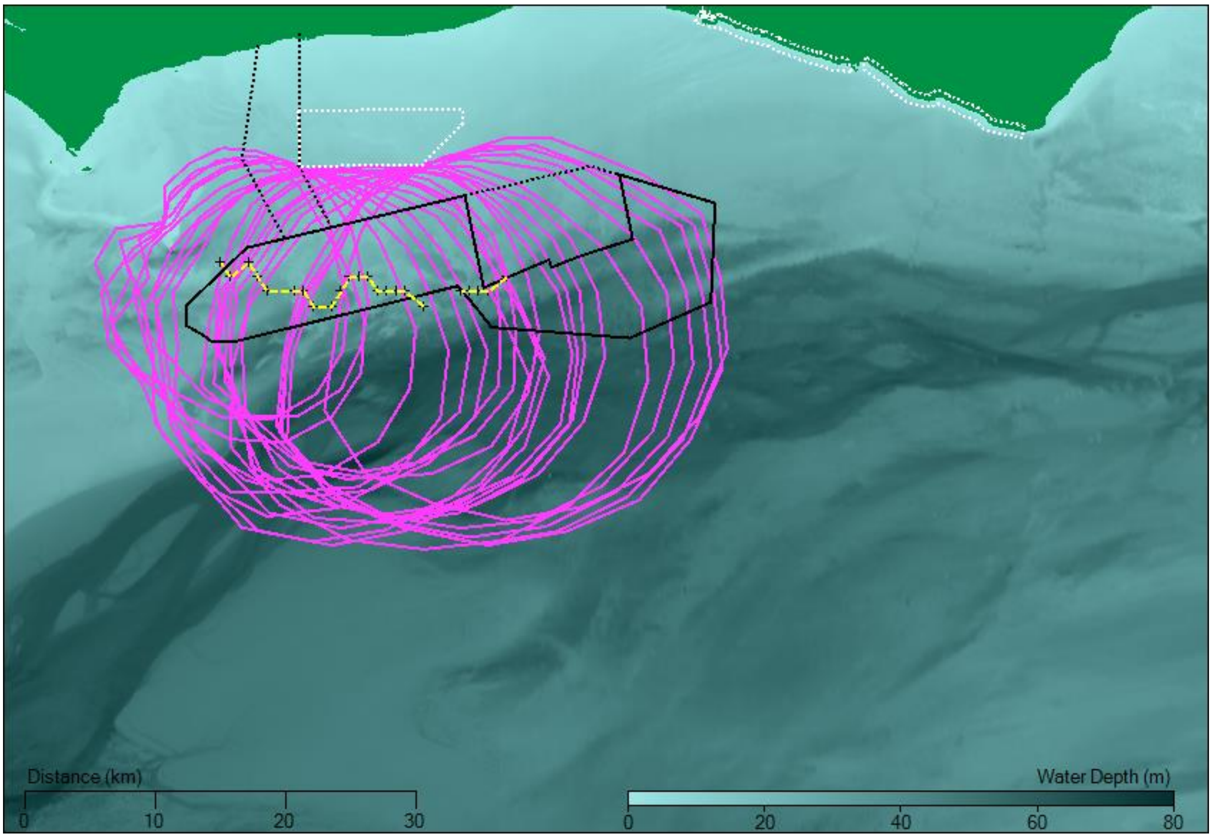
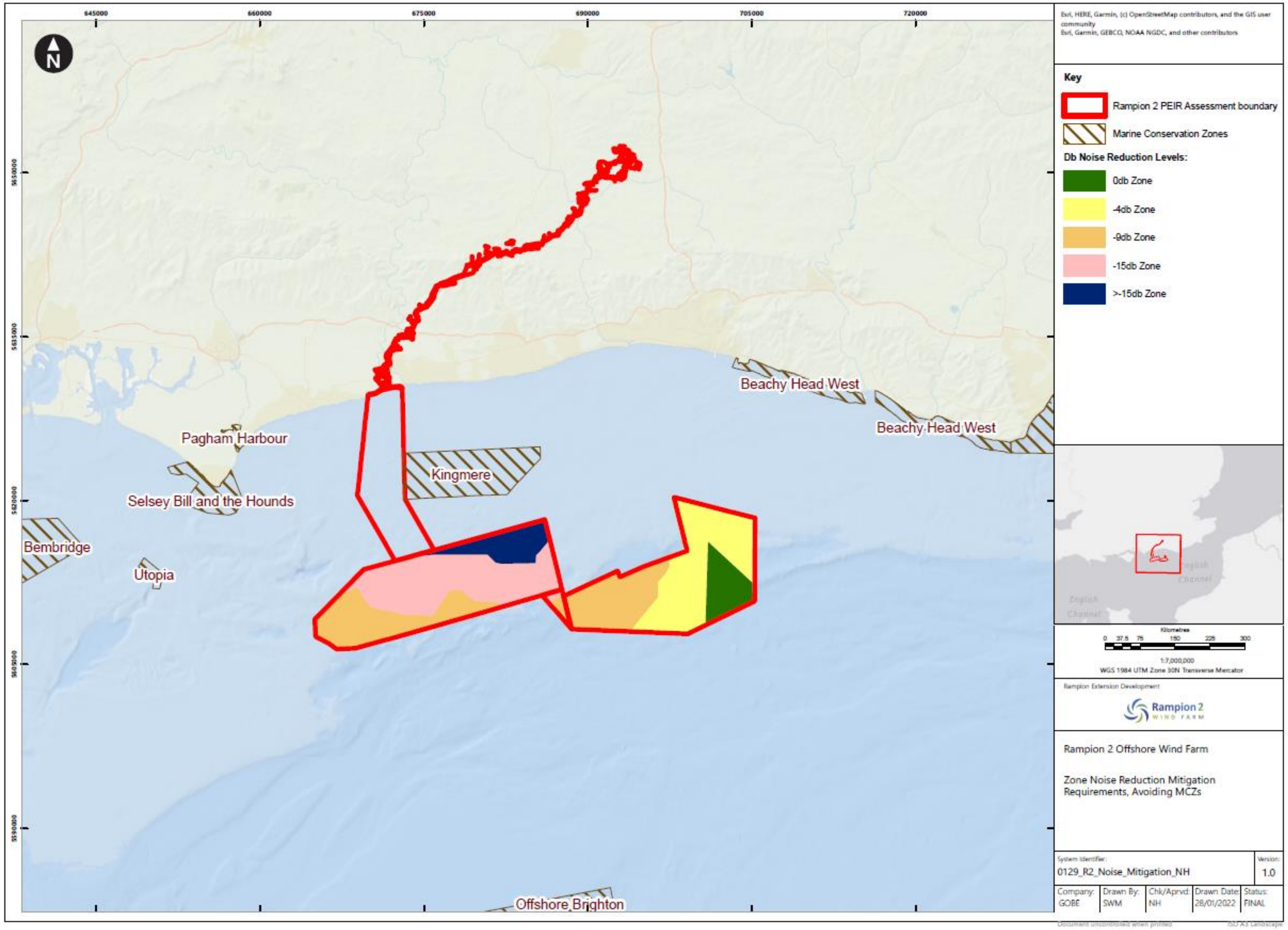


Figure 12 Contour boundaries, utilising 147 dB SELss (unweighted) model outputs with zero overlap target to the boundary of Kingmere and Beachy Head West MCZ, for worst case monopiles with various mitigations.



7.1.13 Each of the contour boundaries depicted in **Figure 12** represents the limits within which a certain attenuation will be required in order to avoid overlap with the sensitive features of relevant MCZs at the disturbance level (147 dB SEL_{ss}). For example, an attenuation greater than 15 dB will be necessary for foundation piling to the north of the boundary of the blue area to limit the predicted noise levels in the Kingmere MCZ to less than 147 dB SEL_{ss}.

7.1.14 Based on the estimated INSPIRE Light modelling, no attenuation will be necessary within the green segment in the south east. The 147 dB SEL_{ss} used in this study target is based on the proposed behavioural reaction criterion for black seabream, as set out in **Section 5**.

8. Mitigation approach

8.1.1 There are a range of complex interdependencies common to all offshore wind farms in the early (pre-consent) project development stages. These include the selection of specific infrastructure, equipment, and collection and analysis of more detailed site engineering data, which means that design work continues up until the immediate pre-construction period. This therefore means a degree of flexibility must be retained for appropriate selection of the precise equipment to be deployed to achieve the required spatial mitigation zoning reductions in noise levels, demonstrated in **Figure 12** above.

8.1.2 Key outstanding areas of uncertainty that will be addressed post consent/ pre-construction include:

- The precise extent and location of geotechnical and environmental constraints. This will be informed by Geotechnical surveys following DCO award prior to WTG installation; and
- The detailed WTG installation methodology. This will be further informed by pre-construction surveys which must be undertaken no earlier than 12 months prior to offshore WTG installation.

8.1.3 This follows through to the final design selection, including aspects such as WTG type and layout, foundation design and contract placement for precise foundation installation methodologies and equipment. As a result, much of this detail is necessarily determined later in the process, at the pre-construction stage. Whilst there is therefore a requirement for the retention of flexibility in terms of precise details of final design and construction methodologies, the parameters for mitigation and related design principles can be set out pre-consent where these are to be relied upon for the purposes of assessment.

8.1.4 This current Technical Note therefore provides as much detail as possible in terms of examples of the technology currently available to deliver the mitigation measures needed to achieve sufficient reduction in noise levels so that no significant adverse effects would be predicted.

8.1.5 It should be noted that for the purposes of agreeing the mitigation plan, the focus is not on specific equipment, but on the objective that the required level of offshore piling noise reduction is achieved; the use of example equipment that could be deployed has been detailed to provide confidence that such mitigation is practical and can be delivered at the construction stage.

8.1.6 Once the mitigation measures are agreed, these will be applied within the EIA process, which will be reported in the Environmental Statement (ES), with the measures secured as set out earlier in this Technical Note (**Paragraph 1.1.6**). Within the ES, commitments will be made to utilise one or a combination of the technologies, as appropriate, set out in **Section 6** or comparable alternatives. Additionally, should improved technology become available nearer the time of construction, then utilising such equipment will also be considered.

9. Summary and conclusions

9.1.1 Mitigation options including installation equipment choice and secondary noise mitigation options, will ensure a noise reduction is achievable to reduce impact ranges to that outside of the designated MCZ area. With no direct noise impact overlap with MCZ areas, the residual significance of effect will be reduced. For black seabream, this means no disturbance to nesting features within the Kingmere MCZ, whilst for seahorse no overlap of noise impact ranges will remain with the Selsey Bill or Beachy Head MCZs. As it is concluded that as the greatest impact of disturbance to sensitive receptors is likely to occur during the breeding seasons, the targeted zoned mitigation approach is proposed to be applied during March-July for black seabream and the Kingmere MCZ, as well as relevant measures through the summer months for seahorse breeding at the Beachy Head (East and West) MCZs.

9.1.2 It is proposed that mitigations are secured initially through a SIP approach, similar to the process that noise mitigations are agreed and secured for impacts to marine mammals through Habitats Regulation Assessment (HRA). Once a final form of the mitigation package is agreed, this will form the basis of an offshore piling mitigation plan, which will be submitted for approval prior to the offshore construction of relevant elements or stages of the Rampion 2 works. Delivery of the plan and measures will be secured within the draft dML to provide certainty to all stakeholders of the mitigation commitments made by RED in progressing the development of Rampion 2.

9.1.3 On the basis of the mitigations that are available and, subject to agreement of the options, the SIP will be employed during percussive piling during sensitive (temporal) periods, it is proposed that requirements for seasonal restriction are not considered necessary. This is based on the use of appropriate noise mitigation being predicted to result in no significant effect on sensitive receptors, particularly at designated MCZ sites, as supported by the modelled underwater noise propagation extents at either TTS or disturbance thresholds.

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Rampion 2
WIND FARM

GoBe

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WIND FARM

Rampion 2 Technical Note: Cable Corridor area mitigation for sensitive features

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Document revisions

No.	Details	Date
1	PM Review	18/01/22
2	PD Review	18/01/22
3	Final for issue	19/01/22

Contents

1. Introduction

1.1 Purpose of this Document

1.1.1 Following the submission of the Preliminary Environmental Information Report (PEIR) in 2021, Rampion Extension Development Limited (RED) carried out Expert Topic Group (ETG) meetings to address Section 42 (S42) consultation concerns raised by key stakeholders including Natural England, the Marine Management Organisation (MMO) and Centre for Environment, Fisheries and Aquaculture Science (Cefas), the Sussex Inshore Fisheries and Conservation Authority (Sussex IFCA), and the Sussex Wildlife Trust (SWT).

1.1.2 At the time of the ETG meeting on the 3 November 2021, RED was still in the process of assessing the full detail of S42 comments, however it was made clear during the November 2021 ETG meeting that further information was required in regard to proposed construction and mitigation approaches to avoid or reduce the potential for impact on the sensitive features identified in the offshore export cable corridor area before the consultees would be able to make a decision on whether the S42 consultation comments had been resolved.

1.1.3 This document aims to provide the required further information, specifically in respect of proposed approaches to offshore export cable installation[1] based on further engineering design work, continuing evaluation of ecological data and assessment of practical mitigation options. Following this work, the principal mitigation measures proposed comprise the following:

- commitments to ensure offshore cable routeing and micro-siting within the offshore export cable corridor area delivers avoidance of known sensitive features as far as practicable;
- offshore cable routeing design to maximise the potential to achieve cable burial, thus providing for seabed habitat recovery in sediment areas and reducing the need for secondary protection and consequently minimising any potential for longer-term residual effects;
- the adoption of specialist offshore cable laying and installation techniques to minimise the direct and indirect (secondary) seabed disturbance footprint to reduce impacts, which will provide mitigation of impacts to all seabed habitats, but particularly chalk and reef areas as well as potential (unknown) black seabream nesting locations, where avoidance is not possible; and
- adherence to a seasonal restriction to ensure cable installation activities within the export cable area are undertaken outside the black seabream breeding period (March-July) to avoid any effects from installation works on black bream nesting.

1.1.4 This document sets out details on the approaches and methodologies proposed to be employed to provide mitigation of impacts identified in the PEIR and the

[1] Note: issues relating to offshore noise and vibration are addressed in a separate Technical Note (in publication)

subsequent feedback from consultation (S42 and ETG), supported by information and examples of the types of equipment that may be used. The importance of the latter aspect is to demonstrate that such methods and techniques are deliverable for the proposed works within the offshore export cable corridor area and can therefore be relied upon to deliver the mitigation of potentially significant impacts that may arise in the absence of such.

1.1.5 The intention is to present this information to inform a discussion on the proposed measures with Natural England, the MMO and their statutory advisors Cefas, and the Sussex IFCA. This will allow us to progress the full DCO Application Environmental Statement (ES) on the basis that with these measures in place, there would be no significant residual effects on the relevant sensitive features within the Rampion 2 offshore export cable corridor area as a result of the installation of the Rampion 2 export cables.

1.1.6 Once a final form of the mitigation package is agreed, this will form the basis of an offshore export cable installation mitigation plan, which will be submitted for approval prior to the offshore construction of relevant elements or stages of the Rampion 2 works. Delivery of the plan and measures will be secured within the draft deemed Marine Licence (dML) to provide certainty to all stakeholders of the mitigation commitments made by RED in progressing the development of the Proposed Development.

2. Project Background and Context

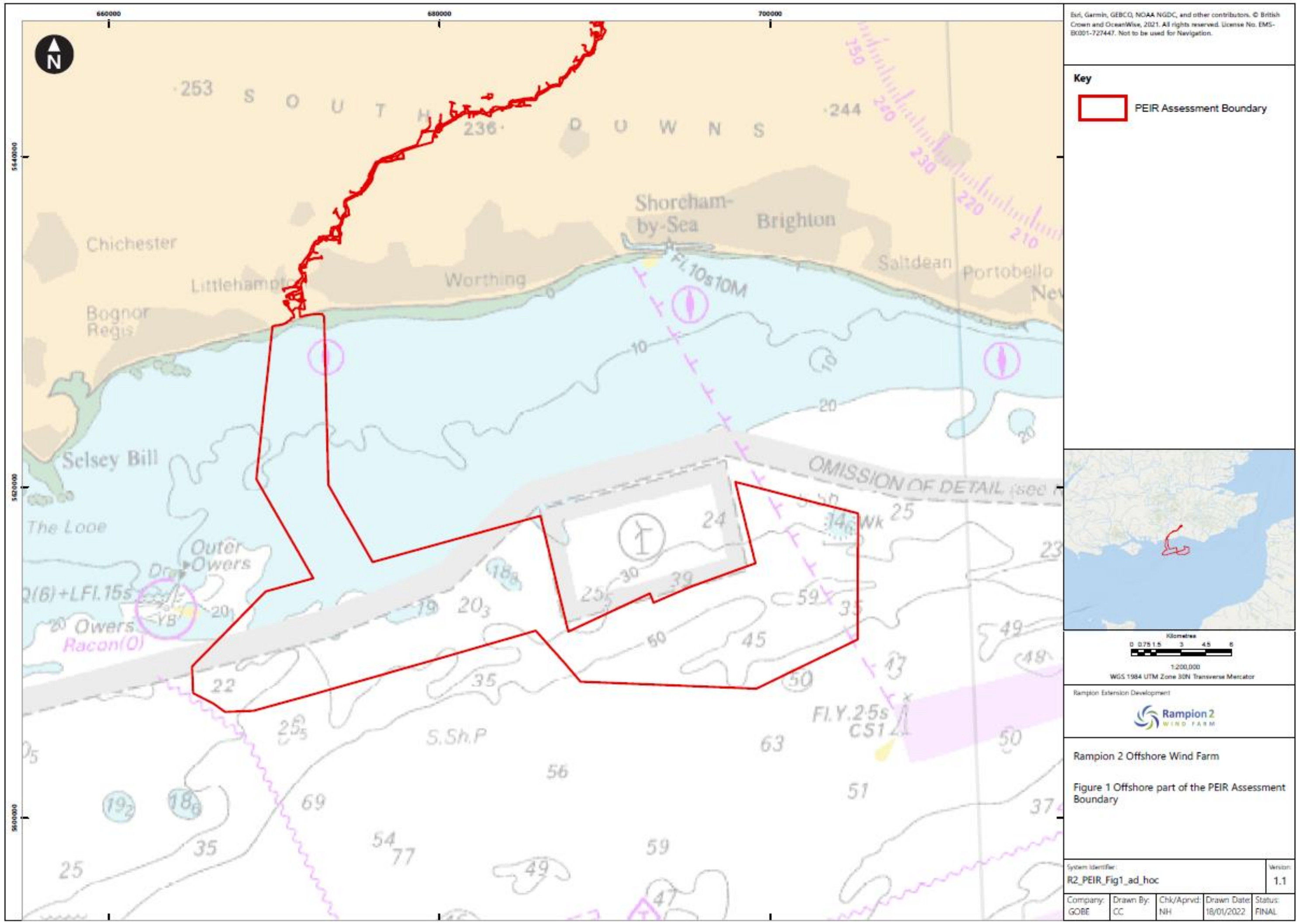
2.1 The Proposed Development

2.1.1 The current proposal for Rampion 2 will have an installed capacity of up to 1,200MW, with the offshore components comprising:

- offshore wind turbine generators (WTGs), associated foundations and inter array cables, with the wind farm generating an installed capacity of up to 1,200MW but not exceeding a maximum number of 90 WTGs;
- up to three offshore substations;
- up to four offshore export cables, each in its own trench within the overall cable corridor area; and
- up to two offshore interconnector cables between the offshore substations.

2.1.2 The offshore elements of the Proposed Development are situated within the offshore part of the PEIR Assessment Boundary. The offshore part of the PEIR Assessment Boundary is adjacent to the south, east and west of the existing Rampion 1 project site comprising seabed areas extending between 13km and 25km offshore, with the offshore export cable corridor area located on the western side of the area; see **Figure 1**.

Figure 1 Rampion 2 Proposed development location. Figure extract from PEIR Volume 2, Chapter 4 The Proposed Development, RED, 2021



2.2 Overview of sensitive receptors in the vicinity of the offshore export cable corridor area

Black Seabream

2.2.1 Black seabream are recognised as a significant interest to commercial and recreational fishers with spawning grounds within the region that are considered important within regional Marine Plan Policies. Kingmere Marine Conservation Zone (MCZ) was designated in part to protect areas of spawning importance in the region for this species, although areas outside of the designated site also provide suitable and active spawning of black seabream. Kingmere MCZ lies to the north (inshore) of the offshore part of the PEIR Assessment Boundary array area off the coast of Worthing, and adjacent to the offshore export cable corridor area PEIR Assessment Boundary (see **Figure 2**). More details on the Kingmere MCZ are presented in the dedicated section below.

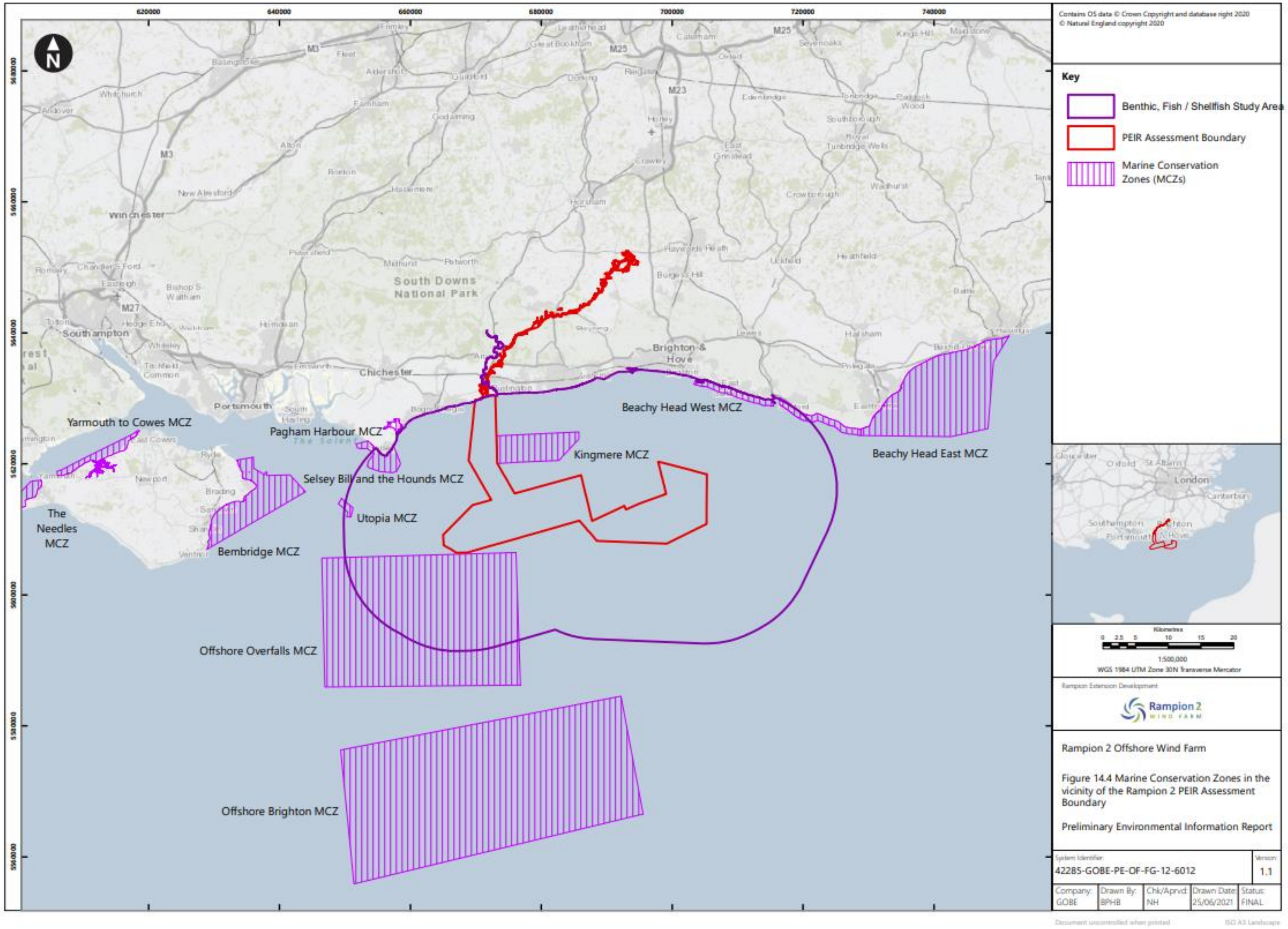
2.2.2 It is reported that the Black seabream stock within the English Channel area overwinters in water depths of between 50 to 100m, prior to migrating inshore to breed between May and June in suitable habitats (Vause and Clark, 2011). The specified breeding season (and therefore sensitive period for black seabream in this area was considered (up to 2020) as being between April and June, however this has since been updated (in 2021) to reflect an extended breeding season between March and July (Natural England, 2021)

2.2.3 Black seabream are known to nest in areas around the south coast of the UK with extensive nesting grounds off the West Sussex coast to the Isle of Wight and Dorset (Collins and Mallinson, 2012; EMU Limited, 2009; Southern IFCA, 2014). Targeted studies identified black seabream nest areas off the coast of Littlehampton to Bogner Regis (EMU Limited, 2009), to Shoreham harbour in the east and to the north of Kingmere MCZ (EMU Limited, 2012a).

2.2.4 Historical analysis of black seabream monitoring data identified black seabream nesting areas tend to correspond to shallow waters (<10m) environments with thin layers of coarse sediments (10 to 30cm deep) overlying bedrock within the general vicinity of rocky outcrops (GoBe, 2015). British Geological Survey (BGS) data identified areas of chalk beds within the infralittoral zone of the offshore export cable corridor area and within the north-eastern tip of the array area (see **PEIR Volume 2, Chapter 8: Fish and shellfish ecology, Figure 8-13**).

2.2.5 The broader nearshore area, both within the proposed offshore export cable corridor area and outwith the offshore part of the PEIR Assessment Boundary, is of noted importance for black seabream, with a significant body of evidence, albeit focused on the MCZ and control sites in the vicinity, compiled by the marine aggregate industry (via the (Marine Aggregates levy Sustainability Fund (MALSF) and site-specific monitoring) contributing to the understanding of black seabream spawning within the area.

Figure 2 Location of Rampion 2 in relation to the Kingmere MCZ. Figure extract from PEIR Volume 2, Chapter 14: Nature conservation, RED, 2021



NERC (UK BAP) Reef habitat features

2.2.6 Outcrops of bedrock forming reef features, some of which comprise chalk substrata, are known to occur through the inshore portion of the benthic subtidal ecology study area. These features were positively identified in the existing Rampion 1 offshore wind farm characterisation study (EMU Limited, 2011) and have been identified through the predictive habitat mapping process undertaken for Rampion 2 based on geophysical survey data as being characterised by two principal biotopes '*Sabellaria spinulosa* with kelp and red seaweeds on sand-influenced infralittoral rock (A3.215)' and 'Piddocks with a sparse associated fauna in sublittoral very soft chalk or clay (A4.231)' (see **PEIR Volume 2, Chapter 9: Benthic, subtidal and intertidal ecology, Figure 9-4**).

2.2.7 The specific biotopes characterising the outcropping rock and chalk areas within the offshore export cable corridor area subject to further verification following a benthic survey undertaken in 202/21, however both bedrock and chalk reef habitats are listed as UK Biodiversity Action Plan (UK BAP) and comprise habitats identified as requiring conservation action under the UK BAP, being listed under Section 41 of the Natural Environment and Rural Communities (NERC) Act 2006.

Kingmere MCZ

2.2.8 Kingmere MCZ is located in the English Channel, between 5 and 10km off the West Sussex coast to the South of Littlehampton and Worthing. It covers an area of around 47km^2. Although the initial site selection for Rampion 2, including the offshore export cable corridor area, has ensured avoidance of any direct overlap with the Kingmere MCZ, the site is in proximity to the proposed development area and therefore subject to potential indirect effects from construction activities.

2.2.9 Within the MCZ, the seabed features include rock habitats and outcrops of chalk reef systems. Much of the moderate energy infralittoral rock habitat is covered by a thin veneer of mixed sediments. This creates a complex mosaic of habitats, some of which are noted as being of particularly importance to black seabream during spawning (nesting) as noted above. Kingmere MCZ is designated for several marine features including:

- Black seabream, (*Spondyliosoma cantharus);*
- Moderate energy infralittoral rock and thin mixed sediment; and
- Subtidal chalk.

2.2.10 There are two marine Sites of Nature Conservation Interest (mSNCI) within the boundaries of the Kingmere MCZ; Kingmere Rocks and Worthing Lumps. SNCI are non-statutory sites identified for their local conservation and geological values. Further details are provided in the site factsheet[2]:

[2] Natural England (2013). Kingsmere MCZ Factsheet (MCZ035). (Online) Available at: http://publications.naturalengland.org.uk/publication/5715535983542272?category=1721481 (Accessed January 2022).

Spatial distribution of habitats and features within the offshore export cable corridor area - summary

2.2.11 Sediment habitats make up the majority of the seabed biotopes recorded in the offshore export cable corridor area (**Figure 3**). They consist mainly of Infralittoral mobile clean sand with sparse fauna, Infralittoral mixed sediments, *Flustra foliacea* and *Hydrallmania falcata* on tide-swept circalittoral mixed sediment.

2.2.12 Reef habitats are present in varying density across the width of the offshore export cable corridor area primarily in the mid-central band of the area (**Figure 3**). Reef habitats recorded include *Laminaria hyperborea* forest and foliose red seaweeds on moderately exposed upper infralittoral rock; Piddocks with a sparse associated fauna in sublittoral very soft chalk or clay; and *Pomatoceros triqueter* with barnacles and bryozoan crusts on unstable circalittoral cobbles and pebbles.

2.2.13 Black seabream nests evident from the Rampion 2 and the targeted repeat aggregate industry surveys are often recorded in association with chalk reef features identified in the offshore export cable corridor area (Error! Reference source not found.).

Figure 3 Level 5 Predictive benthic habitat map of the Rampion 2 offshore area, using ground truth survey data collected 2020

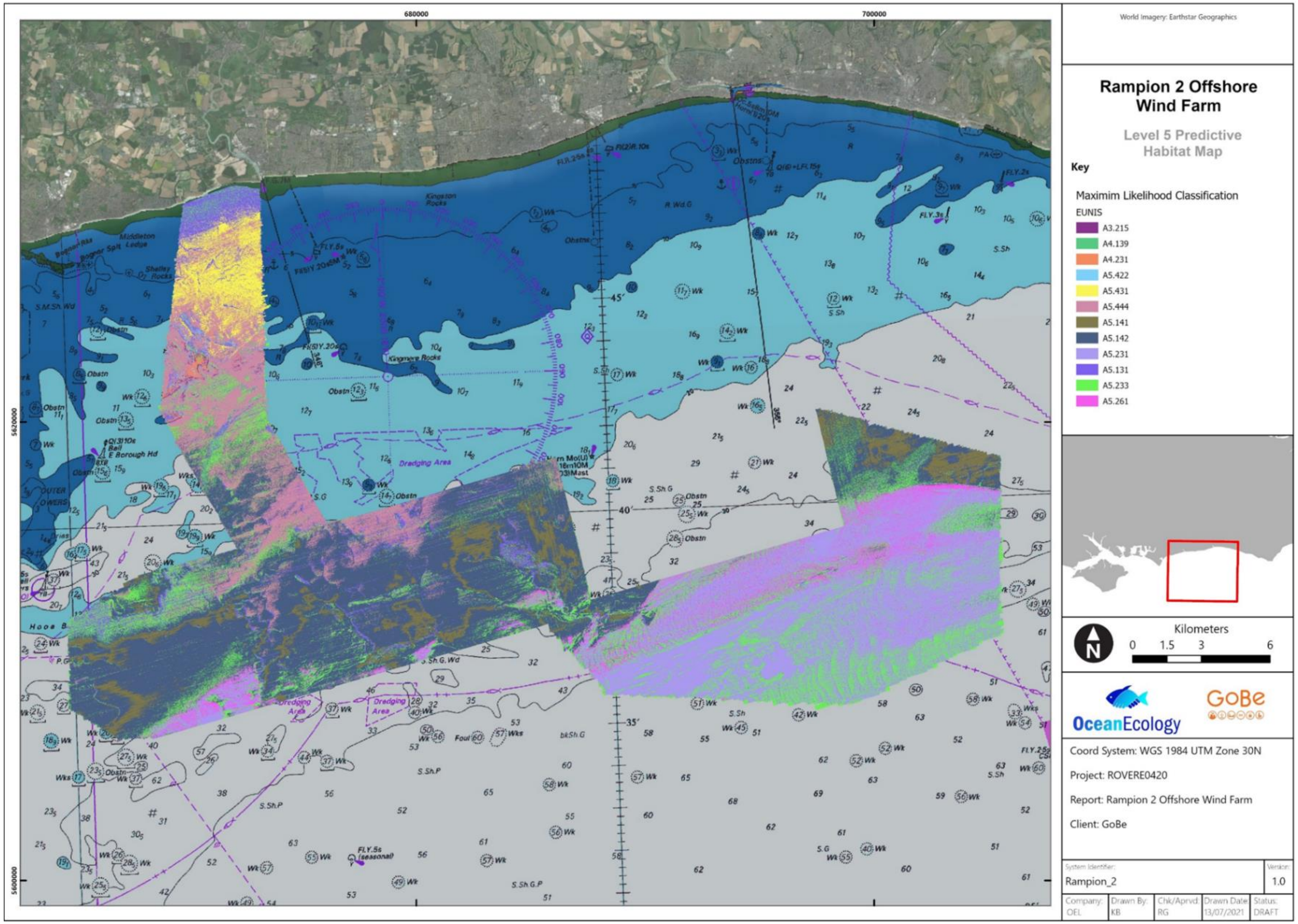
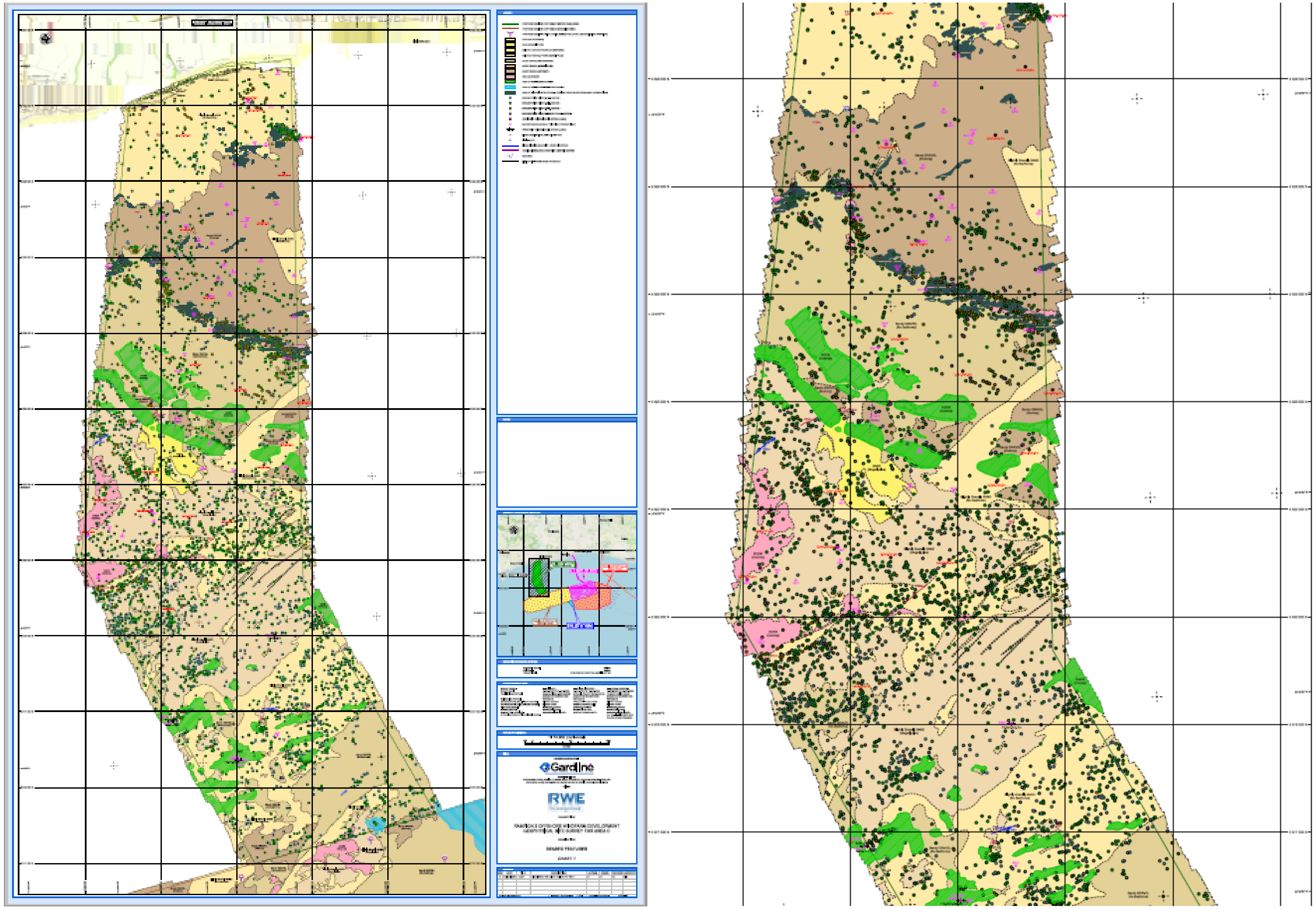


Figure 4. 4a. Black seabream nest distribution within the offshore export cable corridor area. Extract from PEIR Volume 2, Chapter 9: Benthic, subtidal and intertidal ecology, Appendix 9.4: Geophysical survey; Seabed Features Chart 7. Page 189. Figure 4b. closer detail of sensitive features chalk, reef and areas of sediment



3. Consultation

3.1.1 RED has sought to engage with Natural England, Sussex IFCA, and the MMO (and their advisors Cefas) from the earliest stages of the process. This has included focused discussions relating to the known presence of black seabream nesting locations in the area to seek agreement on the methodological approach for assessment as well as potential mitigation, should a significant impact risk be identified. Further concerns were raised however during S42 consultation in 2021 relating to impacts on other sensitive features in the offshore export cable corridor area, in addition to Black seabream nests, including NERC (UK BAP) reef habitats (specifically chalk reef and *Sabellaria spinulosa* reef).

3.1.2 The key issues relevant to offshore export cable works (and the mitigation proposals put forward in this document) communicated by stakeholders following consultation on the PEIR (2021) and through the ETG meetings are summarised below:

The need for avoidance of direct impacts on bream nesting habitats, sensitive chalk reefs and chalk habitats, rock reef habitats and biogenic reef habitats.

3.1.3 Concerns were raised over the potential for direct impacts to sensitive features within the offshore export cable corridor area arising from the proposed construction works. This applies to all habitats within the area but is of particular importance for black seabream nesting areas and both geogenic (rock or chalk) reefs and biogenic reef (*S. spinulosa*). In order to reduce the risk of significant effects arising, there is a need to avoid direct impacts to features within the offshore export cable corridor area where practicable; spatially and temporally.

3.1.4 In the view of Natural England, the MMO, Sussex IFCA and SWT, the issue around the ability to avoid such features is compounded for black seabream nesting areas by uncertainty over where nesting occurs outside the focused aggregate industry survey boxes or the locations identified from the Rampion 2 surveys. This concern arises as the Rampion 2 surveys undertaken to inform this wider spatial distribution were completed in July/August; the surveys are therefore viewed as having overlap with only the later part of the spawning season (March to July), as well as comprising surveys over the course of a single year only.

3.1.5 Therefore, whilst the Rampion 2 surveys provide coverage of the entire Proposed Development boundary area, concerns remain that the survey may not have captured all relevant nesting areas as the nest features can be ephemeral, being re-covered by sediment under the natural sediment transport regime once the male fish have ceased maintaining excavated areas. Longer term temporal trends in nesting are also not captured by a single year of survey effort in the wider area.

3.1.6 Stakeholders also highlighted that direct impacts have the potential to include long-term or permanent habitat loss (of chalk, chalk and rock reef, and black seabream nesting habitats) as a result of the installation of secondary protection where cable burial is not possible, or permanent habitat loss for geogenic reef features subject to direct impacts from cable trenching.

3.1.7 The issues highlighted by stakeholders in relation to direct effects on sensitive receptors was linked through to disagreement on some of the PEIR significance assessment findings for black seabream. This related to issues around the potential for impact magnitudes to be greater than those presented within the PEIR, in part due to a lack of supported avoidance mitigation (spatial and temporal) leading to direct impacts, long term or permanent habitat loss and the importance of the areas subject to impacts from the proposed offshore export cable corridor works.

The need to reduce indirect impacts on bream nesting habitats, sensitive chalk reefs and chalk habitats, rock reef habitats and biogenic reef habitats

3.1.8 Concerns were raised over the potential for indirect impacts (suspended sediment concentrations (SSC) and subsequent sediment deposition) to sensitive features within the offshore export cable corridor area arising from the proposed construction works. Again, this applies to all habitats within the offshore export cable corridor area, however of principal concern was the potential for impacts relating to sediment deposition on black seabream nesting areas during the breeding season arising from seabed disturbance during cable installation activities. The deposition of significant amounts of sediment on nests during the breeding season could disturb spawning and nesting, and/or potentially place an energetic burden on male fish to maintain the nests, leading to the potential smothering of eggs. In addition, longer term changes to the nature of seabed habitats as a result of sediment deposition in areas where black seabream nesting currently occurs has the potential to impact the suitability of such areas for future spawning.

3.1.9 Secondary effects arising from SSC plumes and subsequent sediment deposition was also raised as a concern for the Kingmere MCZ, particularly again on relation to black seabream nesting areas and spawning success during the breeding season and also over the longer term if sediment deposition changed the nature of seabed habitats previously suitable for nesting.

The issues highlighted by stakeholders in relation to indirect effects on sensitive receptors was also linked through to disagreement on some of the PEIR significance assessment findings for black seabream. Again, this related to issues around the potential for impact magnitudes to be greater than those presented within the PEIR. Much of this related to a lack of clarity around SSC and deposition during the breeding season, which could lead to disturbance as well as the energetic burden on the fish noted above, and the longer term consequence of sediment deposition that could lead to a change in the suitability of seabed areas for black seabream nesting part due to a lack of supported avoidance mitigation (spatial and temporal) leading to direct impacts, long term or permanent habitat loss and the importance of the areas subject to impacts from the proposed offshore export cable corridor works.

4. Developing mitigation measures

4.1.1 In developing mitigation measures for the proposed works within the offshore export cable corridor area, the following sensitivities and constraints have been carefully considered in order to refine the routeing proposals to minimise the potential for significant adverse effects on sensitive receptors:

- Black seabream nesting sites (known and unknown); and
- NERC (UK BAP) reef habitat designations.

4.1.2 To ensure that mitigation proposals are deliverable, a range of environmental factors that fundamentally affect engineering practicalities have also been taken into consideration in developing the proposed routeing design, as well as in the identification of installation methodologies and equipment, as follows:

- Presence of chalk and quasi-lithified rock and very hard soils at seabed;
- Complex geological and geotechnical conditions, including paleochannels; and
- Limited available water depth in the shore approach, which presents engineering and logistical difficulty.

4.2 Overview of potential impacts

4.2.1 The section below summarises the main impacts associated with works within the offshore export cable corridor area. As noted previously, the focus of this paper is on construction activities relating to the cable installation, including direct disturbance, SSC and smothering, it does not include impacts from noise/piling, which will be addressed in a separate technical note.

Direct impacts

4.2.2 Direct disturbance will occur during the installation of the offshore export cable corridor area, from the use of seabed trenching equipment. Following construction, direct impacts may occur over the period of the project lifetime where secondary protection has been required over the installed cables.

4.2.3 Within the context of the key concerns raised, this has the potential to affect sediment habitats, reef habitats and black seabream nesting sites.

4.2.4 For sediment seabed areas, the disturbance arising from the offshore cable installation works will be temporary, being limited to the anticipated four months of offshore export cable installation activity. Once the construction works have ceased, it is expected that natural processes will re-work mobile sediments characteristic of the area and return the seabed to pre-construction conditions where cables have been successfully buried below the seabed surface. It is therefore predicted that habitats will naturally revert to baseline condition over the course of weeks rather than months, once the works have completed, with no long-term change to the nature of the seabed habitats anticipated. With reference specifically to sediment habitats suitable for black seabream nesting, the return to baseline condition following completion of the offshore cable installation in areas where cables have been buried will therefore maintain habitat suitability for black seabream nesting where this occurred pre-construction.

4.2.5 For geogenic rock and reef habitats, where avoidance is not possible, direct impacts from offshore cable installation will lead to a loss in habitat. Where geogenic reef have been crossed by the cables, this loss will be permanent.

4.2.6 For biogenic reef, impacts arising from direct disturbance impact would again be predicted to be temporary. Whilst, as noted in the literature and from a range of previous studies, *Sabellaria* reef habitats are sensitive to disturbance and abrasion, the recovery of reef habitat is also noted (MarLIN) as being rapid following short term or intermediate levels of disturbance as found by Vorberg (2000) and recovery is accelerated if some of the reef is left intact following disturbance as this promotes larval settlement. The offshore cable works will be short term and temporary and even if reef was impacted, the area involved will be limited in extent and any surrounding reef areas would be left intact; the works are, therefore, clearly within the condition criteria for promoting rapid recovery. Even so, and more importantly, the baseline surveys of the export cable corridor area showed that, with the exception of a small area of potential biogenic reef (or possible bream nest site) at the western border of the inshore part of the offshore export cable corridor area (see **Figure 5**), no prominent *Sabellaria* reef features exist within the proposed offshore export cable corridor area. Even if this location does comprise *Sabellaria* reef feature, the routeing of the cables will ensure avoidance of any direct impact and therefore no impacts to any such established forms of *Sabellaria* biogenic reef will arise during the construction of the Proposed Development.

4.2.7 Even if this location does comprise *Sabellaria* reef feature, the routeing of the cables will minimise any direct impact and therefore impacts to any such established forms of *Sabellaria* biogenic reef arising during the construction of the Proposed Development will be limited.

Indirect impacts

4.2.8 Indirect disturbance will occur during the installation of the offshore export cable corridor area, in the form of temporary raised SSC and subsequent sediment deposition of/smothering from the mobilised sediment material disturbed by the use of seabed trenching equipment. Within the context of the key concerns raised, this has the potential to affect sediment habitats, reef habitats and black seabream nesting sites.

4.2.9 Within the area of active trenching, very high plume concentrations are expected. SSC could be tens to hundreds of thousands of mg/l, though this will be very localised, occurring only within approximately 5m of the location of the active works and over a period of seconds to a few minutes. Levels of SSC in the order of thousands to tens of thousands of mg/l would extend further, but will again be spatially limited, in this instance to within 100 to 200m downstream from active trenching (depending on the initial height of ejection and the local current speed) and arising as a relatively narrow plume (up to tens of metres wide), being comprised mainly of resuspended sands and gravels. SSC will be increased for fine sediment fractions which have not settled to the seabed by low tens of mg/l in a narrow plume (tens to a few hundreds of metres wide), up to one tidal excursion in length (up to 11 to 16km on spring tides and 5 to 8km on neap tides) aligned to the tidal stream downstream from the source. Sufficiently fine sediment may persist in suspension for hours to days or longer but will become diluted to very low concentrations (less than 5mg/l, indistinguishable from natural background levels and variability) within timescales of around one day.

4.2.10 Sediment that is disturbed and put into suspension will resettle gradually to the seabed over a timescale largely proportional to the individual grain size and the height above the seabed to which it was initially suspended. In the time it takes for sediment grains to settle back to the seabed, they will be advected (transported) by the ambient currents which, being mainly tidal, may vary in speed and direction over that time. The pattern and local thickness of sediment deposition will, therefore, depend on the combination of initial suspension height, the tidal current transport path and speed, the total amount of sediment in suspension, and the distribution of grain sizes within the sediment. Although the pattern of deposition may be variable, the volume of sediment disturbed is finite, and so there is a limited range of sediment deposit area and thickness combinations that can realistically occur.

4.2.11 For the subsequent deposition of mobilised sediments, the maximum expected average local thickness of deposition in the case of predominantly gravelly sediments is 30 to 60cm, over an area up to 5 to 10m downstream of the trenching as the work proceeds along the length of the trench. The maximum expected average local thickness of deposition in the case of predominantly sandy sediments is 3 to 6cm, over an area up to 100 to 200m downstream of the active trenching location as installation proceeds along the length of the trench.

4.2.12 Fine sediment material is expected to become widely dispersed and is not predicted to resettle on the seabed with measurable thickness locally.

4.2.13 Both the sediment and reef biotopes identified in the offshore export cable corridor area are either not sensitive or have low sensitivity to raised SSC and sediment deposition based on Marine Evidence based Sensitivity Assessment (MarESA) assessments.

4.2.14 Where offshore export cable installation is undertaken in proximity to bream nesting areas, there is the potential for sediment deposition impacts to arise. However, the physical processes assessment findings summarised above indicate that no significant deposition of gravels will occur beyond the immediate vicinity of the trenching works (i.e., within 5-10m down tide of the trencher). Beyond this area, and extending some 100-200m, deposition depths of sand fraction sediments will be in the range of 3-6cm). This level of deposition could have potential energetic impacts to black seabream if this occurs during the breeding season or lead to smothering of eggs on the nest. However, the low levels of deposition and the limited areas over which these might occur, are not considered likely to persist for a long period of time, with natural processes redistributing deposited sediments over a few tidal cycles and return to baseline conditions would be expected within weeks.

4.2.15 Sediment that is disturbed, displaced and redeposited to the seabed within short distances (e.g. up to 100-200m) from an activity is very likely to be similar in grain size and mineral composition to the existing natural seabed. The redeposited sediment will immediately re-join and become indistinguishable from the natural local sedimentary environment at that point and will be subject to the same natural rates and directions of sediment transport as the surrounding seabed. Sediment that remains in suspension for longer periods of time will also be subject to continuous diffusion and dispersion, which will progressively reduce the local suspended sediment concentration, and so the thickness of sediment that might be redeposited in any particular location.

4.2.16 Active deposition of sediment thicknesses greater than one centimetre is only likely to occur during and up to a few minutes after the end of the associated activity causing sediment disturbance. Following deposition, sediment that is disturbed and put into suspension will resettle gradually to the seabed over a timescale largely proportional to the individual grain size and the height above the seabed to which it was initially suspended. In the time it takes for sediment grains to settle back to the seabed, they will be advected (transported) by the ambient currents which, being mainly tidal, may vary in speed and direction over that time.

4.2.17 The pattern and local thickness of sediment deposition will, therefore, depend on the combination of initial suspension height, the tidal current transport path and speed, the total amount of sediment in suspension, and the distribution of grain sizes within the sediment. Although the pattern of deposition may be variable, the volume of sediment disturbed is finite, and so there is a limited range of sediment deposit area and thickness combinations that can realistically occur.

4.2.18 The existing nature of the seabed associated with black seabream nest habitat (mixed gravels and sands overlying hard substrate), prior to the deposition is indicative of sediment transport patterns that will naturally winnow and remove any excess of finer sediment over time. Where a measurable thickness of sand or finer material is deposited, the timescale for natural dispersion of the material will depend on the thickness and extent of the deposit around the nest site, and the naturally occurring rate and direction of net sediment transport.

4.2.19 There is therefore no potential for indirect impacts to continue to affect the nature of the seabed long term or cause any issue outside of a period when black seabream might be actively spawning during the cable installation works.

4.3 Mitigation approach

4.3.1 There are a range of complex interdependencies common to all offshore wind farms in the early (pre-consent) project development stages. These include the selection of specific infrastructure, equipment, and collection and analysis of more detailed site engineering data, which means that design work continues up until the immediate pre-construction period.

4.3.2 Key outstanding areas of uncertainty that will be addressed post consent/pre-construction include:

- The precise extent and location of Geotechnical and environmental constraints. This will be informed by Geotechnical surveys following DCO award prior to cable installation; and

- The detailed installation methodology, cable crossings and requirement for any cable protection. This will be further informed by pre-construction surveys which must be undertaken no earlier than 12 months prior to offshore cable installation.

4.3.3 This follows through to the final design selection, including aspects such as WTG layout, actual cable route selection within the offshore export cable corridor area and contract placement for precise installation methodologies and equipment. As a result, much of this detail is necessarily determined later in the process, at the pre-construction stage. Whilst there is therefore a requirement for the retention of flexibility in terms of precise details of final design and construction methodologies, the parameters for mitigation and related design principles can be set out pre-consent where these are to be relied upon for the purposes of assessment.

4.3.4 The following therefore provides as much detail as possible in terms of cable routeing (refined cable corridors within the wider offshore export cable corridor area), and examples of the technology currently available to deliver the mitigation measures needed to achieve sufficient reduction in impact magnitude to ensure significant adverse effects will not arise.

4.3.5 Once the mitigation measures are agreed, these will be applied within the EIA process, which will be reported in the ES, with the measures secured as set out earlier in this technical note (**paragraph 1.1.6**). Within the ES, commitments will be made to utilise the technologies set out below or comparable alternatives. Additionally, should improved technology become available nearer the time of construction, then utilising such equipment will also be considered. It should be noted that for the purposes of agreeing the mitigation plan, the focus is not on specific equipment, but on the objective that the required level of impact reduction is achieved; the use of example equipment that could be deployed has been detailed in the sections below to provide confidence that such mitigation is practical and can be delivered at the construction stage.

4.3.6 As noted in the introduction section, the proposed mitigation measures developed in response to the ecological sensitivities within the export cable corridor area and consultation comments comprise the following:

- Refined cable routeing:
  - This aims to deliver avoidance of known sensitive features within the offshore export cable corridor area as far as practicable, as well as maximising the potential to achieve cable burial, thus providing for seabed habitat recovery in sediment areas and reducing the need for secondary protection, consequently minimising any potential for longer-term residual effects;
- Use of specialist cable laying and installation techniques:
  - This aims to minimise the direct and indirect (secondary) seabed disturbance footprint to reduce impacts, which will provide mitigation of impacts to all seabed habitats, but particularly chalk and reef areas as well as potential (unknown) black seabream nesting locations, where avoidance is not possible; and
- Seasonal restriction for cable installation works:

- This will ensure offshore export cable corridor installation activities are undertaken outside the black seabream breeding period (March-July) to avoid any effects from installation works on active black bream nesting.

4.3.7 The way in which each of these mitigation measures has been developed is presented in the sections below. In order to provide confidence in the practicality of the mitigation commitments proposed, RED have carried out a routeing exercise to ascertain the feasibility of avoiding sensitive features such as Black seabream and NERC (UK BAP) reef features as well as the opportunity for implementing additional buffers to ensure that the features are not significantly impacted, either directly or indirectly.

4.4 Refined offshore cable routeing

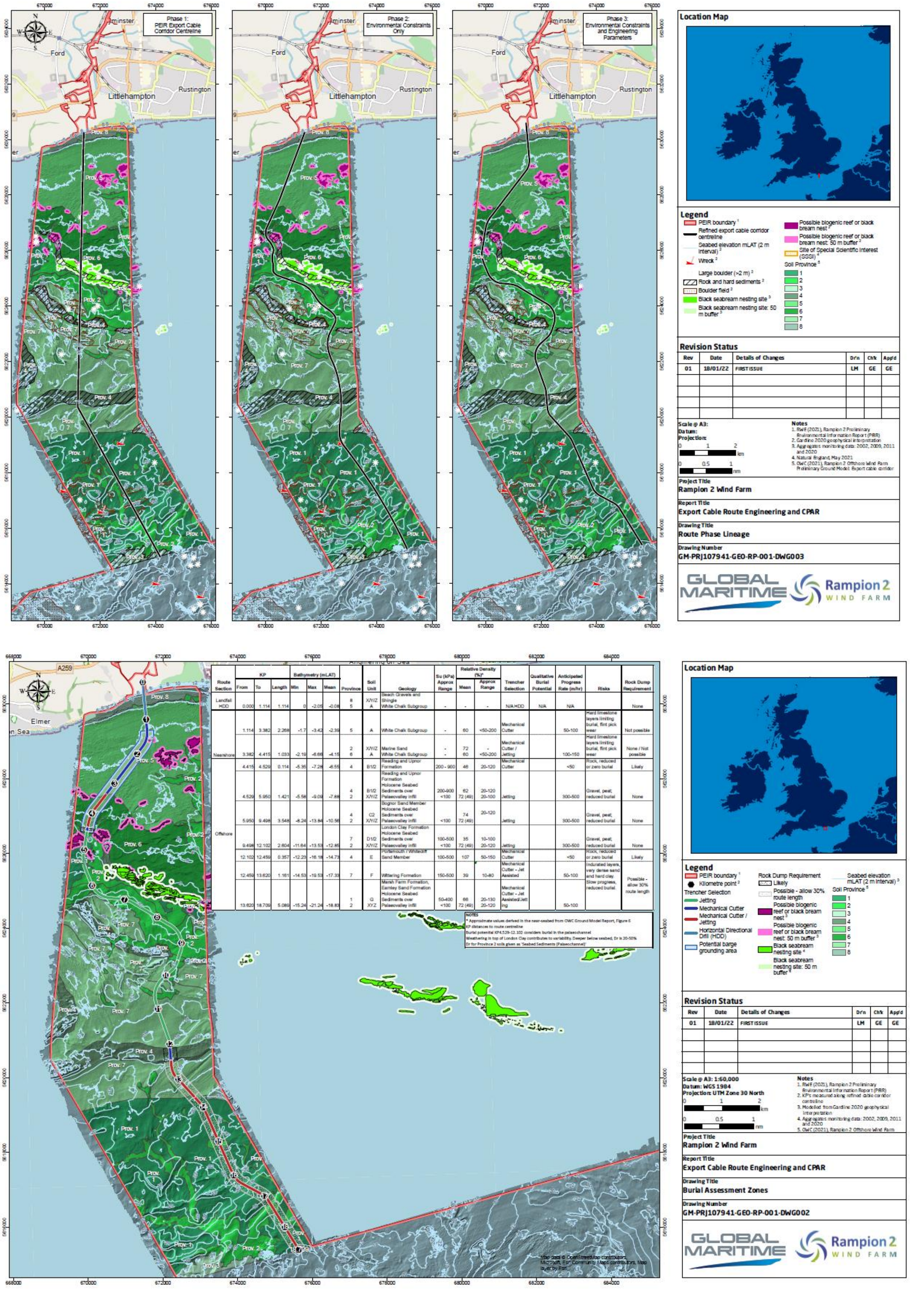
4.4.1 The objective of the macro-route engineering exercise was to mitigate as far as possible the impact on environmental constraints, whilst also maintaining the requirement to progress the shortest installable routes, within seabed conditions which maximise the potential for burial. The resulting routes were then used to produce refined export cable corridors within the wider offshore export cable corridor area, which place emphasis on constraint avoidance/mitigation and feasible constructability.

4.4.2 Indicative cable route and refined offshore export cable corridor design were therefore split into three distinct phases:

- As a baseline, define the PEIR offshore export cable corridor centreline. This acts as the shortest route between wind farm and landfall whilst maintaining maximum separation from the corridor perimeter, excluding all physical and technical constraints, and engineering design parameters (Error! Reference source not found., Phase 1);
- Design a refined offshore export cable corridor centreline based on environmental constraints only (Error! Reference source not found., Phase 2), but not considering technical constraints or engineering design parameters; and
- Produce a further refined offshore export cable corridor centreline, which takes into account environmental constraints, but also introduces technical constraints and design parameters (Error! Reference source not found., Phase 3). The resulting centreline is then used to generate refined offshore export cable corridors which are both environmentally considerate and feasible from an engineering and installation perspective.

4.4.3 The lineage described by the three route design phases above is represented in Error! Reference source not found. below.

Figure 4 Route Phase Lineage (extract from Global Maritime routeing study)



Route Section	KP From	KP To	KP Length	Bathymetry (mLAT) Min	Bathymetry (mLAT) Max	Bathymetry (mLAT) Mean	Province	Soil Unit	Geology	Su (kPa) Approx Range	Relative Density (%)* Mean	Relative Density (%)* Approx Range	Trencher Selection	Qualitative Burial Potential	Anticipated Progress Rate (m/hr)	Risks	Rock Dump Requirement
Landfall HDD	0.000	1.114	1.114	0	-2.05	-0.08	8 5	X/Y/Z A	Beach Gravels and Shingle White Chalk Subgroup	-	-	-	N/A HDD	N/A	N/A		None
Nearshore	1.114	3.382	2.268	-1.7	-3.42	-2.39	5	A	White Chalk Subgroup	-	60	<50-200	Mechanical Cutter		50-100	Hard limestone layers limiting burial, flint pick wear	Not possible
	3.382	4.415	1.033	-2.19	-6.66	-4.15	2 6	X/Y/Z A	Marine Sand White Chalk Subgroup	- -	72 60	- <50-200	Mechanical Cutter / Jetting		100-150	Hard limestone layers limiting burial, flint pick wear	None / Not possible
Offshore	4.415	4.529	0.114	-5.35	-7.28	-6.55	4	B1/2	Reading and Upnor Formation	200 - 900	46	20-120	Mechanical Cutter		<50	Rock, reduced or zero burial	Likely
	4.529	5.950	1.421	-5.58	-9.09	-7.88	4 2	B1/2 X/Y/Z	Reading and Upnor Formation Holocene Seabed Sediments over Palaeovalley infill	200-900 <100	62 72 (49)	20-120 20-100	Jetting		300-500	Gravel, peat; reduced burial	None
	5.950	9.498	3.548	-8.24	-13.84	-10.56	4 2	C2 X/Y/Z	Bognor Sand Member Holocene Seabed Sediments over Palaeovalley infill	<100	74 72 (49)	20-120	Jetting		300-500	Gravel, peat; reduced burial	None
	9.498	12.102	2.604	-11.64	-13.53	-12.85	7 2	D1/2 X/Y/Z	London Clay Formation Holocene Seabed Sediments over Palaeovalley infill	100-500 <100	35 72 (49)	10-100 20-120	Jetting		300-500	Gravel, peat; reduced burial	None
	12.102	12.459	0.357	-12.23	-16.18	-14.73	4	E	Portsmouth / Whitecliff Sand Member	100-500	107	50-150	Mechanical Cutter		<50	Rock, reduced or zero burial	Likely
	12.459	13.620	1.161	-14.53	-19.53	-17.33	7	F	Wittering Formation	150-500	39	10-80	Mechanical Cutter - Jet Assisted		50-100	Indurated layers, very dense sand and hard clay. Slow progress, reduced burial.	Possible - allow 30% route length
	13.620	18.709	5.089	-15.24	-21.24	-18.83	1 2	G XYZ	Marsh Farm Formation, Earnley Sand Formation Holocene Seabed Sediments over Palaeovalley infill	50-400 <100	66 72 (49)	20-130 20-120	Mechanical Cutter - Jet Assisted/Jetting		50-100		

4.4.4 The initial refined offshore export cable corridor centre line (Error! Reference source not found., Phase 1) crosses directly through several sensitive features including mapped (known) black seabream nesting areas and NERC (UK BAP) reefs. The routeing study therefore applied constraint rules in order to avoid these features where this was possible (Error! Reference source not found., Phase 2), before applying technical engineering constraints to further refine the best environmental routeing solution to ensure the feasibility of offshore cable installation (Error! Reference source not found., Phase 3). The way in which the constraint rules for the development of the Phase 2 route were developed and applied is described below.

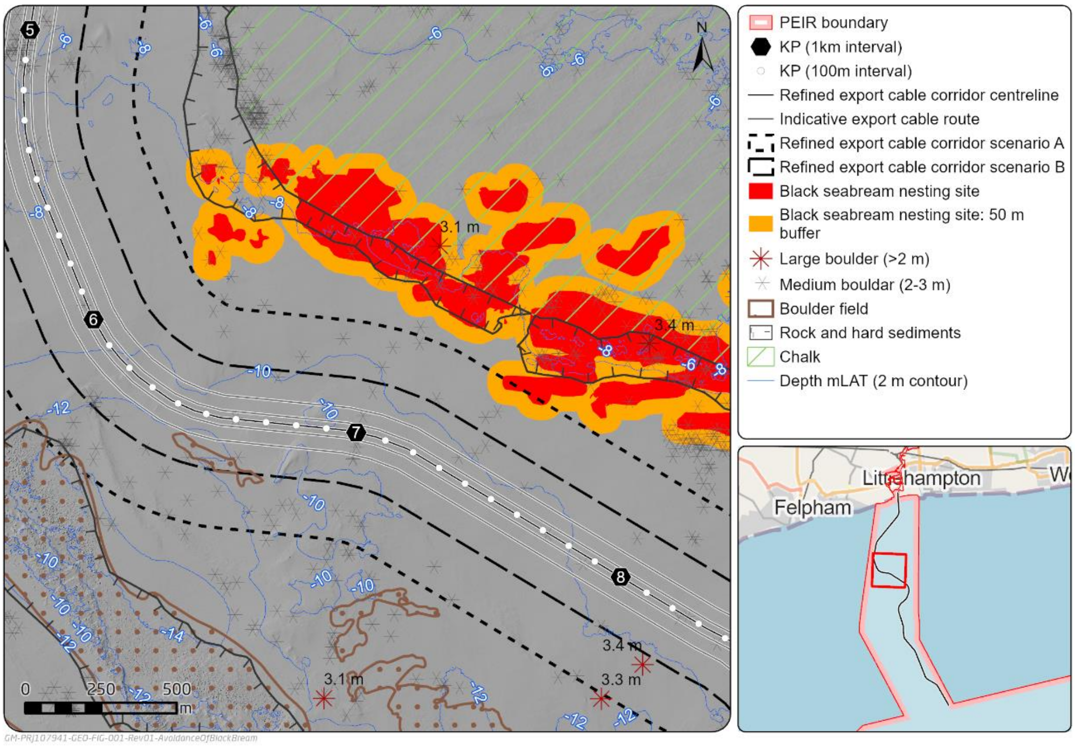
Black seabream nesting sites

4.4.5 Black seabream nesting sites are known to exist within the PEIR offshore export cable corridor area, as shown in Error! Reference source not found.. Principal densities and aggregations of these nesting sites were mapped utilising both historic desk studies and the most recent survey data, drawn from the aggregates industry surveys and from the geophysical survey of the Rampion 2 PEIR boundary carried out in 2020. These nest sites were considered as a hard constraint and therefore routeing design sought to avoid direct overlap with these areas as far as practicable.

4.4.6 In order to ensure sufficient separation distance from sensitive features was afforded in the routeing, a target distance for laying cables within the refined offshore export cable corridor (within the wider offshore export cable corridor area) for the outermost cable was set at 250m inside the refined offshore export cable corridor. For the purposes of the routeing, an additional 50m buffer was also added outside of the refined offshore export cable corridor (effected by adding this to the boundaries of each sensitive feature), therefore meaning actual cable installation activity would generally be 300m away from the edge of any black bream nesting area.

4.4.7 An example graphic for the routeing design, avoiding a black seabream nesting area is presented in **Figure 5** below.

Figure 5 Example output from routeing study showing bream nest area and separation distance (extract from Global Maritime routeing study)



4.4.8 The buffering distance was set on the basis of the potential indirect effects of the cable installation, drawing on the findings of the physical processes assessment work. As noted above, this is predicted to comprise a maximum average local thickness of deposition in the case of predominantly gravelly sediments of 30 to 60cm, over an area up to 5 to 10m downstream of the trenching as the work proceeds along the length of the trench. For sands, the depositional area is greater, however this is predicted to be limited in terms of both deposition and extent, comprising a depositional depth range of 3-6cm over an area up to 100 to 200m downstream of the active trenching location as installation proceeds along the length of the trench. Fine sediment material is expected to become widely dispersed and although elevated SSC will result for a short period, elevated SSC levels will reduce gradually over time through dispersion, to less than measurable levels (<10mg/l) within two to three days. Furthermore, fines are not predicted to resettle on the seabed with measurable thickness locally.

4.4.9 The exact nature of the disturbance will vary along the offshore export cable route, depending on the sediment conditions, and the final length of installed cable, burial depth and burial method, however the buffer distance from the trenching works provides protection at the bream nesting sites from any significant localised and temporary re-suspension and settling of sediments as a result of cable installation activities.

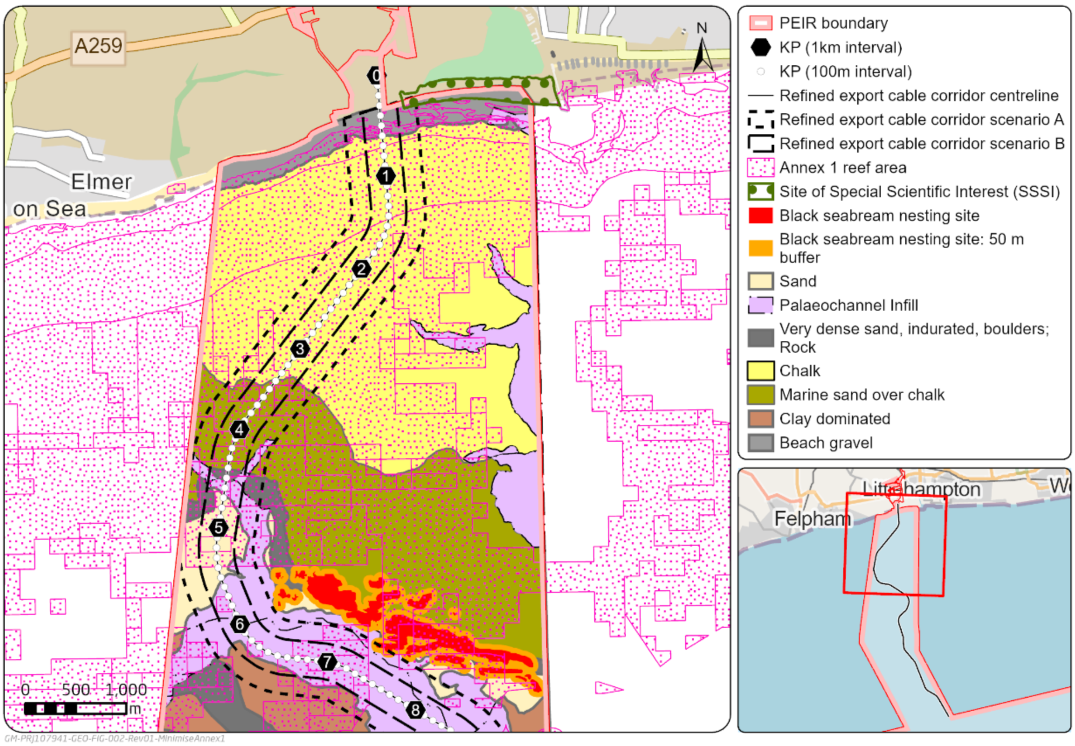
4.4.10 Following the routeing exercise, RED Engineers identified a pinch point over a short route length, where the nearest cable installation operation would be at a reduced spacing of approximately 175m from the edge of a black seabream nesting area. Whilst this is less that the 300m generally provided for, the total distance (125m + 50m buffer) would still provide in excess of 150m separation distance and full avoidance of the nesting site feature.

NERC (UK BAP) reef habitats

4.4.11 NERC (UK BAP) reef habitats within the route corridor take the form of rock reefs at seabed, formed by outcropping chalk and harder/indurated lithologies within the Palaeogene deposits. The same buffering distances were applied to these features for the Phase 2 and Phase 3 routeing design exercise with the objective of avoiding impacts to these features.

With reference to the extents of such features across the wider offshore export cable corridor area, whilst it was possible to avoid interaction with the majority, it was not possible to provide complete avoidance (Error! Reference source not found.) of all reef features. At points along the refined offshore export cable corridor where NERC (UK BAP) Reef habitats cannot be wholly avoided, RED will seek to utilise the most appropriate equipment to minimise the width of disturbance through the feature. In addition, and where relevant, the route will also take the shortest path through underlying chalk substrate, for example to the west of the PEIR offshore export cable corridor area (see **Figure 6** below) to minimise the impact footprint and also to route into paleochannels infilled with soils where possible. An example of routeing around black seabream nesting areas, targeting paleochannels and minimising the distance over which interaction with chalk substrata arises is presented in **Figure 6** below.

Figure 6 Cable routeing through paleochannel, avoidance of bream nest area and minimised chalk interaction (extract from Global Maritime routeing study)



4.4.12 The targeting of paleochannels and areas where cable burial is most likely to be successful has also been included within the routeing design work in order to minimise the potential for secondary cable protection to be required. Further information on this aspect is provided in the section below on cable laying and installation techniques. In addition, where reefs are required to be crossed by the offshore cable works, appropriate equipment options will be selected to ensure the width of any crossing is minimised (also see **Section 4.5** below).

4.4.13 RED engineers have also identified a single pinch point at the most western border of the offshore export cable corridor to the edge of the known black seabream nests features where currently high level micro-siting indicates a potential for the refined offshore export cable corridor to be in closer proximity to an area of potential "biogenic reef" (although this may be a black bream nest feature) identified from the RWE 2020 Geophysical survey data (Error! Reference source not found.). The proximity would be approximately (and no less than) 150m at the edge of the reef feature however, and although this is less than the 300m separation distance generally provided for in the routeing, this still ensures that the area would not be subject to significant deposition effects, which are largely limited to an area within 50m of the works as set out in the physical processes assessment.

4.5 Use of specialist cable laying and installation techniques

4.5.1 The design work to inform practical mitigation for the cable installation works has also included investigation on the techniques that can be employed to reduce impact footprints where this is required to address the potential for significant effects to arise. Whilst the offshore cable routeing exercise has achieved avoidance of the majority of the sensitive features within the wider offshore export cable corridor area, there remain instances where full avoidance has not been possible as described above, in addition to uncertainties on the locations of all bream nesting activities, where this has not been identified with sufficient confidence from the available survey data to comprehensively represent in mapping.

4.5.2 The aim of the following sections is, therefore, to provide additional information on the techniques, approaches and equipment that are available to ensure both direct (footprint) and indirect (SSC and deposition) effects are reduced for all receptors, both known and unknown. The mitigation is aimed at reducing impact risks to non-significant levels for NERC (UK BAP) reef features and potential (unknown) black seabream nesting locations, where avoidance is not possible.

Cable protection

4.5.3 It is widely recognised in the offshore industry that burial is the most cost-effective means of achieving cable protection. In addition, minimising the use of cable protection at the seabed surface also serves to limit areas over which a longer-term change impact) to seabed habitats will arise, as the presence of such material can limit the potential for such areas to return to baseline condition through the action of natural sediment transport processes following cessation of construction activities. Routeing design has therefore been undertaken to maximise burial potential along the route. It is important to note that in the Rampion 2 offshore export cable corridor area, in common with the wider area off the Sussex coast, the geological conditions are not entirely conducive to burial. Even so, many of the geological formations along the route are considered trenchable with mechanical cutting, although other formations are strongly cemented and are likely to pose an issue.

4.5.4 Wherever possible, the routeing design has taken advantage of soil infilled paleochannels to maximise burial potential with conventional jetting methods, with trenchable geological formations targeted next; this minimises cable routeing through the harder more strongly cemented formations in the area. When examining feasibility, conservative target trench depths of 1.0m in Palaeogene and Cretaceous deposits have been selected.

Potential unburied cable due to ground conditions

4.5.5 Certain sections of the route cross lithologies at seabed which are likely to be difficult to trench, resulting in reduced or absence of burial. These problematic lithologies are likely to be limited to the cemented sands of the Bognor Rocks. Over these route lengths, rock placement may be required to secure cable on-bottom stability and to protect the cable from primary threats such as ship anchors and fishing trawls.

Alternative cable protection

4.5.6 There are no anticipated infrastructure within the export corridor that require to be crossed, leading to the need for engineered crossing arrangements and alternative protection.

4.5.7 There are some route sections where reduced or absence of burial may be anticipated, although this is reduced as far as possible. In total, 2.35km of route length (per cable) may require a level of alternative protection, such as rock dumping. Overall, the engineering study has identified that a mechanical cutting trencher is necessary for up to 54% of the route length, of which 13% is considered likely to require further protection with rock placement. The remaining 46% is considered possible to achieve with jet trenching. This can be further clarified when route specific geotechnical data is obtained at the pre-construction stage and the burial potential confirmed.

4.6 Cable installation methodology

4.6.1 With regards to trenching and burial, it is clear from the geophysical survey data for the offshore export cable corridor area that a mechanical trencher is required to achieve burial in chalk areas without sufficient soft sediment cover. There are a number of considerations as to which particular trenchers may be suitable, which are not resolvable at this time due to other dependencies, including the ability for a cable lay barge to directly access the horizontal directional drill (HDD) exit pit. Key considerations include:

- The need or requirement for support vessel to house pumps and power systems;

- The ability to operate in lay-back from a cable lay barge, and the distance over which this is possible;
- The degree of disturbance to the seabed, both in terms of the dimensions of the trench excavated, and the disturbance caused by machine tracks;
- The manoeuvrability of the trencher and ability to traverse seabed irregularities; and
- The ability of the nearshore trencher to continue on to successfully complete the offshore scope, thus reducing both repeat impact to the environment and mobilisation costs.

4.6.2 What is clear is that there are a number of potentially suitable trenching solutions in the market, which would reduce the temporal and spatial impact to both the NERC (UK BAP) reef features, as well as minimise suspended sediment impact to the black seabream nest areas, examples of which are presented below.

Aratellus Leviathan – Onshore, Nearshore and Offshore Mechanical and Jet Trencher

4.6.3 The Aratellus Leviathan – Onshore, Nearshore and Offshore Mechanical and Jet Trencher (**Figure 7**) utilises a combination of a mechanical cutting chain and jetting to deliver burial in a post-lay mode. It is unique in its capability to automatically self-level through a suspension system, and to independently steer it's front and rear tracks, giving enhanced manoeuvrability. It is largely independently operated but would require a separate support vessel for shallow water and beaching operations.

4.6.4 This trencher could continue from the nearshore section to trench the remainder of the route in both jetting and cutting modes. The total footprint of the trencher is small in comparison to other cable laying equipment such as cable ploughs, being approximately 4m, with the direct trench cutting area of 1m, and a trenching speed of approximately 75-100m an hour.

Figure 7 Aratellus Leviathan Mechanical Trencher

Van Oord Deep Dig-It – Nearshore, Offshore Mechanical and Jet Trencher

4.6.5 A similar proposition to the Aratellus Leviathan with deeper burial capability and more power, but less manoeuvrable. The Van Oord Deep Dig-It – Nearshore, Offshore Mechanical and Jet Trencher (shown in **Figure 8**) is remotely operated and therefore does require support vessels in the nearshore environment.

Figure 8 Van Oord Deep Dig-It (image courtesy of Van Oord)

4.6.6 Other trenchers exist on the market for nearshore conditions, in hard seabed soils and soft rocks, such as Enshore's T1 and SWT1 combined jetting and cutting trenchers.

4.7 Seasonal restriction for installation works within offshore export cable corridor area

4.7.1 As described previously, during the breeding season, black seabream are reported to return to the same area every year. As a result of this focused area of nesting activity, Kingmere MCZ was created to protect this important breeding and spawning site and enforced seasonal restrictions on certain activities during the black seabream nesting period. Although the restricted period is specifically relevant to the protected site, the same spawning period obviously also applies to bream nesting outside of the MCZ boundaries. Additionally, whilst Rampion 2 is outside of the MCZ, the proximity of the Proposed Development to the MCZ requires consideration in terms of indirect impacts arising, in this instance from the cable installation works.

4.7.2 The mitigation measures presented in the preceding sections will ensure that direct impacts to known black seabream nesting areas can be avoided and that installation methodologies can be employed to ensure indirect impacts do not pose a risk of significant effect to spawning habitats for the species. The adoption of the installation methodologies also results in mitigation, by impact footprint reduction, for areas where bream may nest but which are not represented in the available data sets. Notwithstanding, it is recognised that even with these mitigation measures in place, there is the potential for a risk of impact through disturbance to nesting black seabream or, for unknown seabream nesting areas at least, an uncertain level of risk of direct or indirect effects arising from the seabed disturbance during offshore cable laying, together with subsequent raised SSC and deposition.

4.7.3 In order to provide a higher level of protection to avoid potential for significant effects to arise, RED will also commit to a seasonal restriction on the offshore export cable installation works. As black seabream vacate nests outside of the breeding season, the impact of disturbance to nesting individuals from the offshore export cable installation is only relevant during the breeding season, therefore RED are committed to ensuring that all cable installation activities within the export cable corridor area are undertaken outside of the identified breeding season of March to July (Natural England, 2021).

5. Overview of mitigation commitments

- Cable routeing and micro-siting within the offshore export cable corridor area will provide for avoidance of known sensitive features as far as practicable.
- As part of the routeing design, a working separation distance will be maintained wherever possible from sensitive features, notably bream nesting areas to limit the potential for impacts to arise (direct or indirect). The current target for this is 300m, being comprised of a 250m working distance and an additional 50m buffer around sensitive features (principally bream nesting areas).
- As part of the routeing design, a working separation distance will be targeted wherever possible from sensitive bream nest features, to limit the potential for impacts to arise (direct or indirect). The current target for this is 300m, being comprised of a 250m working distance and an additional 50m buffer around bream nest features.
- The offshore export cable routeing design has included the targeting of seabed areas to maximise the potential for cables to be buried, thus providing for seabed habitat recovery in sediment areas and reducing the need for secondary protection and consequently minimising any potential for longer-term residual effects.
- Adoption of specialist offshore export cable laying and installation techniques will minimise the direct and indirect (secondary) seabed disturbance footprint to reduce impacts, which will provide mitigation of impacts to all seabed habitats, but particularly chalk and reef areas as well as potential (unknown) black seabream nesting locations, where avoidance is not possible. RED will seek to utilise the most appropriate technology available at the time of construction to reduce the direct footprint impact from cutting machinery.
- A seasonal restriction will be put in place to ensure cable installation activities within the export cable area are undertaken outside the black seabream breeding period (March-July) to avoid any effects from installation works on black seabream nesting within or outside of the Kingmere MCZ.

6. Summary and Conclusions

6.1.1 An offshore export routeing design process has been undertaken, commencing with a baseline centre offshore export corridor route, moving to environmental mitigation and finally into an engineered route.

6.1.2 The engineered route provides for the avoidance of the majority of sensitive features within the offshore export cable corridor area, whilst complying with engineering constraints to secure an installable route. The routeing selections also minimise secondary impacts (SSC and sediment deposition) on the majority of known black seabream nesting habitat and NERC (UK BAP) reef features by implementing appropriate installation works separation distances and additional buffers around features for the routeing design work, although the route of individual cables within the offshore export corridor has not yet been considered in detail. The buffering distances afford substantial additional mitigation against indirect effects for relevant habitats, since both the sediment and reef biotopes identified in the cable corridor area are either not sensitive or have low sensitivity to raised SSC and sediment deposition based on MarESA assessments.

6.1.3 The offshore export routeing mitigation has sought to maximise the potential for burial of cables, either through direct burial where there is sufficient sediment depth (for example within paleochannels) or via trenching to bury cables in areas of underlying chalk, ensuring that no long-term change to the nature of the surface habitat character will arise from the requirement for secondary protection that would be needed for surface lay in such areas. This approach, maximising the length of the offshore export cables that is effectively buried minimises the potential for long-term impacts (change) to seabed habitats along the cable routes through the post-construction operational phase of Rampion 2. Notably this also includes a reduction in the potential for longer term impacts on areas of black seabream nesting not currently known (or possible to map).

6.1.4 Nevertheless, over significant parts of the offshore export cable route, it is not possible to avoid all areas where rock or hard soils outcrop at seabed. For this reason, a mechanical cutting trencher is necessary for up to 54% of the route length, of which 13% is considered likely to require further protection with rock placement. The remaining 46% is considered possible to achieve with jet trenching. The mitigation set out in this document includes the use of specialist cable laying and installation techniques to ensure that where this is the case, a reduction in impact magnitude arising from the cable installation works can be delivered. Adoption of these approaches will minimise both the direct and indirect (secondary) seabed disturbance footprint to reduce impacts. This will provide benefits for all seabed habitats where the techniques are applied, but particularly chalk and reef areas as well as potential (unknown) black seabream nesting locations, where avoidance is not possible to provide with the current baseline data (and in recognition of the uncertainties in coverage raised by stakeholders).

6.1.5 Importantly, the capability of avoidance of all mapped black seabream nests, as identified in the PEIR, with additional buffering from cable installation means that there is no anticipated residual significant effect to known black seabream from direct disturbance or sediment dispersion.

6.1.6 The application of a seasonal restriction to ensure cable installation activities within the export cable area are undertaken outside the black seabream breeding period (March-July) will avoid any effects from installation works on black seabream nesting activities during the breeding season. For areas subject to even low order indirect impacts from SSC and sediment deposition, notably including the Kingmere MCZ, and areas where the offshore export cables have been buried below the seabed surface, the short period for seabed recovery (weeks) ensures there is no potential for significant impacts on favourable habitat to persist for any protracted period following completion of the works.

7. References

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Rampion 2 PEIR, RED, 2021

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Rampion 2 WIND FARM

GoBe

wood.

From: [redacted]
Sent: 23 June 2022 16:01
To: [redacted]
Subject: RE: Rampion 2 Underwater noise monitoring survey method statement

[redacted]

Thank you very much for the feedback received in relation to the Rampion 2 Underwater Noise Survey Method Statement. We can confirm that CEFAS were also sent the method statement via the MMO, but we are yet to receive feedback from them.
Please see below our comments in response to your email from 16 June 2022

Natural England - email 16 June 2022	RED response
Whilst we understand that the Applicant seeks to progress discussions with the aim of achieving agreement on an appropriate way to define a threshold for disturbance, and whilst it would be helpful to understand more about the background noise, we would highlight the risk that this work does not guarantee a way forward in terms of removing a seasonal working restriction. Any attempt to determine a threshold would still need to be referenced with suitable literature, particularly where noise levels within the MCZ are predicted to be above the ambient level. Additionally, sufficient evidence would need to be provided to have confidence in the level of noise attenuation being achieved from any mitigation measures proposed.	*RED recognises that collection of these data does not guarantee agreement with stakeholders on noise thresholds, however it will provide valuable information and potentially an alternative approach to seek, in discussion with you, an acceptable metric for assessing the risk of significant disturbance effects arising from the proposed construction activities on sensitive receptors. It is understood that following data collection, further consultation with NE, CEFAS, MMO etc will be required to discuss the findings and how they may be utilised to underpin an ecologically meaningful benchmark against which to develop (and come to agreement on) appropriate noise mitigation to address the current issues around seasonal restrictions and the practicality of constructing the Project.*
The data gained from this survey would be a helpful indication of ambient noise levels but has limitations in that it will be conducted over the end segment of one breeding season. More confidence could be gained from a dataset over an entire season (March – July), over multiple years. This limitation will need to be recognised. Noise levels are likely to be highly variable, so it is important that data collection is as comprehensive as possible.	*Noted. Following completion of the survey, the data will be assessed and options for repeating the survey next year discussed.*
We understand that two locations will be monitored, one in close proximity to Kingmere MCZ, and one in close proximity to Beachy Head West MCZ. We note the limitation of only having two sampling points, with only one relating to black seabream within Kingmere MCZ. Have these locations been selected based on them being the closest points in the MCZ to any proposed piling activity?	*The locations were chosen to gain a representative point for the closest MCZs with sensitive features of concern relating to underwater noise, namely black sea bream in Kingmere and seahorse at the Beachy Head West MCZ. The aim of the survey is to ascertain ambient noise levels at these sites to inform baseline understanding. The objective of obtaining such data is to move away from utilising a blanket noise threshold and ensure an evidence-based approach to assessment of noise effect on receptors can be taken forward, with specific data for the relevant sites provided, which can be used in an ecologically relevant manner.* *The monitoring locations have been selected to provide relevant data for the MCZ sites, whilst avoiding direct disturbance within the MCZs, and at the same time ensuring data collection is undertaken at positions relevant to the proposed piling locations within the offshore wind turbine array area.*

	It is considered that the siting of two stations will provide adequate and appropriate ambient noise level data to characterise baseline conditions over two full tidal cycles within the summer breeding season.
In relation to the period of time that the hydrophone will be deployed we note that this will include continuous monitoring for a period of two weeks in June, with a second follow up survey proposed in July for a 14-day period. Is there a reason why the hydrophone could not be left in situ, from mid-June until the end of July, to gather more data?	*The hydrophone battery life will not allow for a greater length of time in water without requiring to be removed, changed and recalibrated. Due to current project timescales and the need to ensure collection of the proposed data, the field work strategy does not allow for continuous deployment and therefore the monitoring equipment requires collection and re-deployment for the second 14 day period. The data collection has, however, been targeted at ensuring data capture over two sets of full tidal cycles within the relevant breeding season and the retrieval of the data from the initial period also provides the opportunity to rapidly analyse the initial 14 day dataset to inform discussions as early as possible. Future seasons (2023) can be sampled in more detail if necessary.*
We note that a survey location at Beachy Head West MCZ has been included. Short snouted seahorse (*Hippocampus hippocampus*) are a feature of Beachy Head West MCZ. Detailed discussions to date have focused on Black seabream, with limited discussion/information provided from the Applicant with regards to how the ES will considered the assessment of seahorses and any potential mitigation. Without an understanding of how the Applicant intends on using this data in relation to seahorses we cannot provide further comment on how useful this may be.	*RED has provided information on our assessment and proposed mitigation approach to seahorse in the same discussions as for black sea bream. It is our view that data relating to the ambient noise levels at Beachy Head West MCZ, will similarly provide relevant baseline noise data to inform the assessment of seahorse as noise-sensitive receptors at the Beach Head West MCZ, based on contemporary empirical data.*
We understand that the entire proposed 'Static Monitoring Equipment Set-up' will stand at 9m tall, with the hydrophone approximately 2m above the sea floor. We advise you seek advice from Cefas in relation to the appropriateness of this set up for collecting the data required.	*Noted. We are currently awaiting feedback from Cefas, however the equipment proposed is industry standard/best available and follows current best practice guidelines and is therefore considered appropriate for the current field work.*
We understand that the weight (1.5 * 1.5 m (2.25m^2)) will be deployed outside of the MCZ's. This should not be placed on any known Black seabream nesting areas or any known areas of Section 41 habitats protected under the NERC Act. We wish to clarify that in the recovery phase all deployed equipment including the weight will be removed from the seabed?	*We can confirm that deployment of the equipment will be outside the boundaries of the MCZs and will avoid any sensitive features, as informed by the data collection undertaken previously. All equipment will be removed from the seabed following completion of the fieldwork.*

<table>
<tr><td></td><td></td></tr>
<tr><td>Is there any way that you could also measure associated/background levels of particle motion as part of the survey effort?</td><td>The equipment available does not allow for these measurements unfortunately.</td></tr>
<tr><td>Natural England are aware that there is currently a telemetry array in the area. We advise a buffer of 100m should be kept from the receivers. If the hydrophone picks up pings from any tagged fish, can the data be made available to FishIntel/University of Plymouth? Also please note UoPKingmere CS has an f-pod attached to detect cetaceans. We understand that the locations of this array are approximately as stated below, but you may wish to contact the University of Plymouth to fully understand any potential interactions.

<table>
<tr><td>Location (dd)</td><td>Station ID</td></tr>
<tr><td>X: 506801.526417796, Y: 93118.2461088692, Z: NaN</td><td>UoPKingmere SW</td></tr>
<tr><td>X: 506853.369661285, Y: 93286.6113130309, Z: NaN</td><td>UoPKingmere NW</td></tr>
<tr><td>X: 507063.287921451, Y: 93030.8251821931, Z: NaN</td><td>UoPKingmere CS</td></tr>
<tr><td>X: 507091.012716847, Y: 93131.9546468094, Z: NaN</td><td>UoPKingmere CC</td></tr>
<tr><td>X: 507113.128721737, Y: 93255.2175559865, Z: NaN</td><td>UoPKingmere CN</td></tr>
<tr><td>X: 507312.205891376, Y: 93177.4268352861, Z: NaN</td><td>UoPKingmere NE</td></tr>
<tr><td>X: 507283.295443445, Y: 93013.8655616497, Z: NaN</td><td>UoPKingmere SE</td></tr>
</table></td><td>We can confirm the telemetry array will be avoided with 100m buffer, and will consider the possibility of interactions when assessing the data and will advise NE of any interactions should they be apparent within the data.</td></tr>
<tr><td>We understand that it is possible that further hydrophone work may be carried out next year. Should this be Rampion’s intention, then you may wish to discuss this with local academic institutions, such as the University of Portsmouth and the University of Brighton, who may have some interest in this work. We understand that the timeframes for data collection this year have not allowed a more detailed discussion to be undertaken. Should work be planned for next year then Natural England would welcome a more detailed discussion on this with the Applicant and the MMO/Cefas.</td><td>Noted</td></tr>
</table>

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Kind regards

[redacted]

[redacted]
Offshore Consents Manager
RWE Renewables UK