



MARINE ENERGY WALES

MARINE ENERGY TEST AREA (META)

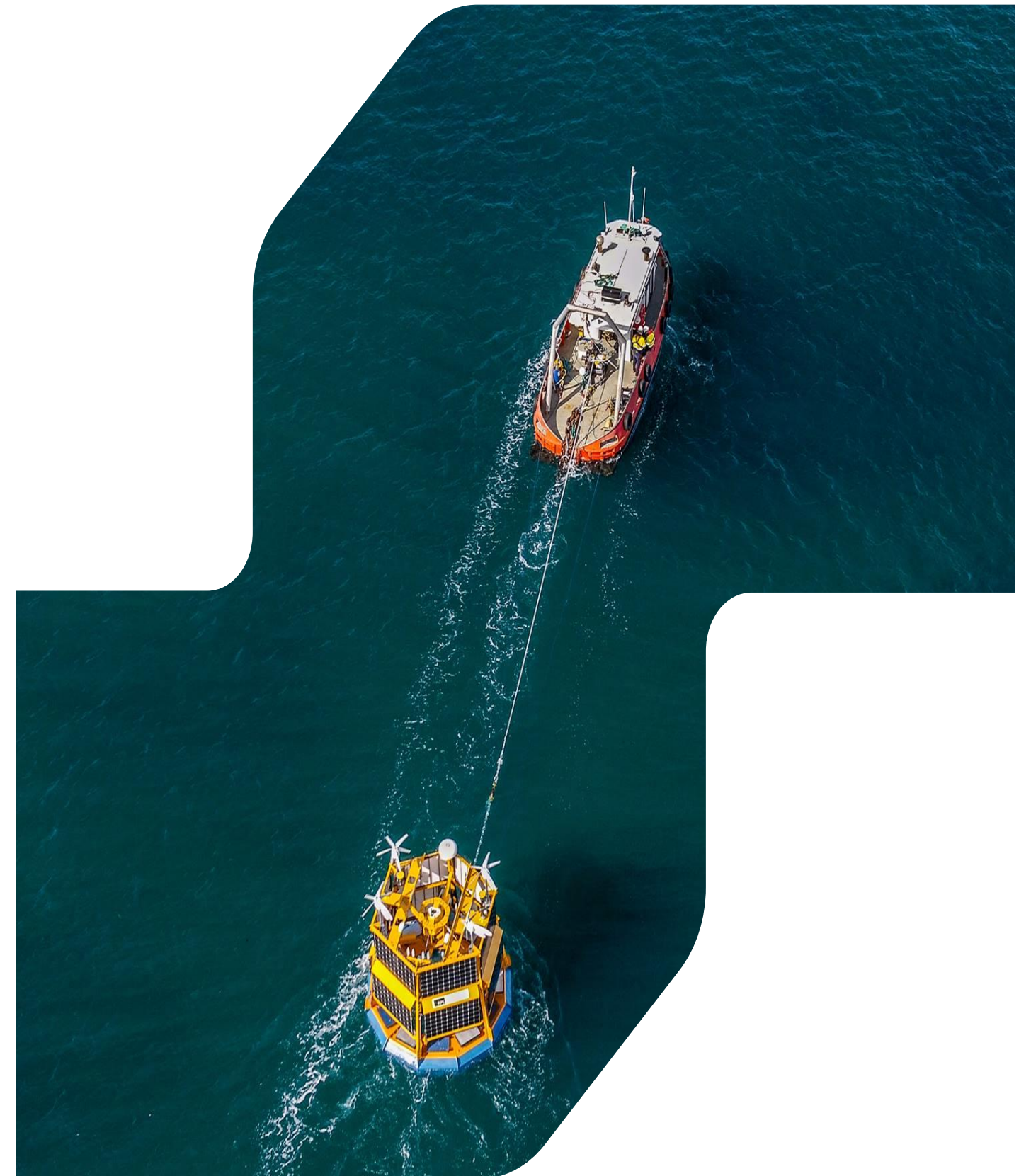
Environmental Impact Assessment

Habitat Regulations Assessment: Report to Inform Appropriate Assessment



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Marine Energy Wales

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Glossary

Term	Definition
Appropriate Assessment	An assessment to determine the implications of a plan or project on a European site in view of the site's Conservation Objectives. An Appropriate Assessment forms part of the Habitats Regulations Assessment and is required when a plan or project is likely to have a significant effect on a European site.
Annex I Habitat	Natural habitat types of community interest whose conservation requires the designation of Special Areas of Conservation.
Annex II Species	Animal and plant species of community interest whose conservation requires the designation of Special Areas of Conservation.
Biotope	The combination of physical environment (habitat) and its distinctive assemblage of conspicuous species.
Birds Directive	Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the Conservation of Wild Birds.
Conservation Objective	A statement of the nature conservation aspirations for the features of interest of a site.
Diadromous	Fish that spend portions of their life cycles partially in fresh water and partially in salt water.
Intertidal	An area of a seashore that is covered at high tide and uncovered at low tide.
European site	A Special Area of Conservation (SAC) or candidate SAC (cSAC), a Special Protection Area (SPA) or potential SPA (pSPA), a site listed as a site of community importance (SCI) or a Ramsar site.
Habitats Regulations Assessment (HRA)	A process which helps determine Likely Significant Effects and (where appropriate) assesses adverse effect on the integrity of European conservation sites and Ramsar sites. The process consists of up to four stages of assessment: screening, appropriate assessment, assessment of alternative solutions and assessment of imperative reasons of over-riding public interest (IROPI).
In-combination	The combined effect of the META project in combination with the effects from a number of different projects, on the same single feature.
Nursery habitat	Habitats where high numbers of juveniles of a species occur, having a greater level of productivity per unit area than other juvenile habitats.
Permanent Threshold Shift	Following a marine mammal's exposure to high noise levels, if a Threshold shift occurs and does not return to normal after several weeks then a Permanent Threshold Shift (PTS) has occurred. This results in a permanent auditory injury to the marine mammal.
Project design envelope	A description of the range of possible elements that make up the META project, as set out in detail in the project description. This envelope is used to define the META project for Environmental Impact Assessment (EIA) purposes when the exact engineering parameters are not yet known

Term	Definition
Recoverable injury	Relating to underwater noise impacts, recoverable injury includes hair cell damage, minor internal or external hematoma, etc. None of these injuries are likely to result in mortality.
Spawning	The release or deposition of eggs and sperm, usually into water, by aquatic animals.
Special Area of Conservation	Strictly protected sites designated under Article 3 of the Habitats Directive for habitats listed on Annex I and Animals listed on Annex II of the Directive.
Special Protected Area	Strictly protected sites designated under Article 4 of the Birds Directive for species listed on Annex I of the Directive and for regularly occurring migratory species.
Temporary Threshold Shift	Relating to underwater noise impacts, a temporary change in the hearing threshold of marine mammals following noise exposure. Hearing loss in this case is not permanent.

Acronyms

Acronym	Description
ASA	Acoustical Society of America
BTO	British Trust for Ornithology
CIA	Cumulative Impact Assessment
CCW	Countryside Council for Wales
CIC	Community Interest Company
CIS	Celtic and Irish Seas
cSAC	Candidate Special Area of Conservation
dWNMP	Draft Welsh National Marine Plan
DP	Dynamic Positioning
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
ESAS	European Seabirds at Sea
EU	European Union
FCS	Favourable Conservation Status
HF	High Frequency
HRA	Habitats Regulations Assessment
INNS	Invasive Non-Native Species
INNSMP	Invasive Non-Native Species Management Plan
IROPI	Imperative Reasons of Overriding Public Interest
JNCC	Joint Nature Conservation Committee
LSE	Likely Significant Effect

Acronym	Description
MCZ	Marine Conservation Zones
META	Marine Energy Test Areas
MEW	Marine Energy Wales
MHPA	Milford Haven Port Authority
MHWESG	Milford Haven Waterway Environmental Surveillance Group
MHWS	Mean High Water Springs
MLWS	Mean Low Water Springs
MMO	Marine Management Organisation
MPCP	Marine Pollution Contingency Plan
MU	Management Unit
NRW	Natural Resources Wales
NRW PS	Natural Resources Wales Permitting Services
NMFS	National Marine Fisheries Service
PCC	Pembrokeshire County Council
PCF	Pembrokeshire Coastal Forum
PDE	Project Design Envelope
PDZ	Pembrokeshire Demonstration Zone
PINS	Planning Inspectorate
pSAC	Possible Special Area of Conservation
pSPA	Potential Special Protection Area
PTS	Permanent Threshold Shift
rms	root-mean squared
RIAA	Report to Inform Appropriate Assessment
ROV	Remotely Operated Vehicle
RSPB	Royal Society for the Protection of Birds
SAC	Special Area of Conservation
SCI	Sites of Community Importance
SEL	Sound Exposure Level
SIC	Site d'Importance Communautaire
SMRU	Sea Mammal Research Unit
SPA	Special Protection Area
SSC	Suspended Sediment Concentration
TTS	Temporary Threshold Shift
WeBS	Wetland Bird Survey
WEC	Wave Energy Converter
WSDOT	Washington State Department of Transport
WWBIC	West Wales Biodiversity Information Centre

Acronym	Description
UK	United Kingdom
ZOI	Zone of Impact
ZSC	Zone Spéciale de Conservation
ZSL	Zoological Society of London

Units

Unit	Description
dB	Decibels
Ha	Hectare
Hz	Hertz
kHz	Kilohertz
km	Kilometre
m	Metre
m/s	Metres per second
mg/l	Milligrams per litre
m2	Metres squared
NM	Nautical miles
µPa	Micropascal
%	Percentage

1. INTRODUCTION

1.1 Overview and purpose of this report

- 1.1.1.1 This report has been prepared by RPS on behalf of Marine Energy Wales (MEW), a Pembrokeshire Coastal Forum (PCF) Community Interest Company (CIC) led project (the Applicant) to support licence/consent applications for the Marine Energy Test Area (META) project.
- 1.1.1.2 The Applicant intends to provide a suite of offshore marine energy test sites within, and in proximity to, the Milford Haven Waterway (hereafter referred to as 'the Waterway'), to facilitate the testing of marine energy components, sub-assembly, instrumentation and marine renewable devices, including trialling installation, retrieval and decommissioning methodologies and operation and management activities.
- 1.1.1.3 This will allow developers to test procedures and engineering solutions in a wide range of environmental conditions thereby de-risking marine energy projects prior to larger scale or array deployments.
- 1.1.1.4 This proposal, known as the META Project, will provide marine renewable energy device developers with pre-consented testing sites, which will reduce consenting time and financial burdens, and enable device developers to focus on the technical aspects of device development. The aim of the META project is therefore to provide a series of pre-consented, non-grid connected, marine energy test areas that will allow for the deployment and testing of devices, components and subassemblies, and ancillary activities and equipment, in support of marine energy testing.
- 1.1.1.5 The Conservation of Habitats and Species Regulations 2017 (hereafter the 'Habitats Regulations') stipulate that a Habitats Regulations Assessment (HRA) must be carried out on all plans and projects that have the potential to impact upon sites designated for supporting habitats or species of international importance, otherwise known as Natura 2000 or European designated sites. In the United Kingdom (UK), the requirements of the Habitats Regulations are also extended to consider the effects on Ramsar sites (listed under the Ramsar Convention on Wetlands of International Importance). The presence of Natura 2000/Ramsar sites, and the potential impacts that could occur as a result of the installation, operation and maintenance, or decommissioning of the META project, will therefore require assessment under the Habitats Regulations.
- 1.1.1.6 The European Commission's guidance on Planning for the Protection of European Sites: Appropriate Assessment (2001), identifies a staged process to the assessment of the effects of plans or projects on European sites. In England and Wales, cumulatively these stages are referred to as an HRA, in order to clearly distinguish the whole process from the second stage within it, which is referred to as the 'Appropriate Assessment'. There are potentially up to four stages of an HRA:
 - Screening;
 - Appropriate Assessment

- Mitigation and alternatives; and
- Imperative Reasons of Overriding Public Interest (IROPI).

- 1.1.1.7 This document presents information to inform an Appropriate Assessment under Section 63(1-2) of the Conservation of Habitats and Species Regulations 2017 for the META Project (as described in section 1.3) to be undertaken by the Competent Authority, and relates to the META phase 2 sites (Warrior Way (site 6), Dale Roads (site 7) and East Pickard Bay (site 8) only. Consideration of the above regulations in relation to the META Phase 1 sites (sites 1- 5) are considered in a separate set of licence/consent applications.
- 1.1.1.8 This report provides information on the qualifying interest features of European Sites where likely significant effect (LSE) could not be excluded at the HRA screening stage due to a specific potential receptor-impact pathway on these qualifying interest features. Further information on all qualifying interest features for each of the European Sites considered in this report are provided in the Regulation 37 advice documents. The Conservation Objectives for the qualifying interest features for which LSE could not be excluded for specific receptor-impact pathways have been extracted from the Regulation 37 advice documents for the relevant site and these are provided at Appendices 1 to 9. This RIAA provides the information required to allow the Competent Authority to undertake an Appropriate Assessment to determine whether there will be no adverse effect on site integrity of any European Site(s) in view of their Conservation Objectives as a result of the proposed project. It should be noted that this report is focused on the assessment of potential effects of the META project on site integrity and should be read in conjunction with the HRA Screening Report (see Appendix 1) and the META Environmental Statement and associated technical appendices.
- 1.1.1.9 A full project description is presented within the META Environmental Statement, chapter 2 Project Description and also within the HRA Screening Report (see Appendix 1), and is therefore, not repeated within this report. However the maximum design scenarios pertinent to the assessments presented within this report are provided under the relevant impact headings in sections 4 to 8.
- 1.1.1.10 This document is structured as follows:
 - Summary of the screening exercise (Stage 1 of the HRA process; provided in full in the HRA Screening Report (see Appendix 1)); and
 - Information to inform the Appropriate Assessment (Stage 2 of the HRA process), including:
 - Summary of potential impacts of the META project on relevant features and maximum design scenarios used for assessment and designed-in mitigation measures (see section 3.2 and section 3.3);
 - Description of the approach taken for in-combination assessment (see section 3.4);
 - Review of baseline information on the distribution and ecology of relevant features and European Sites requiring assessment (see section 4.3 for Annex I benthic habitats, section 5.3 for Annex II diadromous species; section 6.3 for Annex II marine mammals, section 7.3 for Annex II otters and section 8.3 on marine ornithology);

- Assessment of adverse effect on the integrity of European Sites alone by receptor (see section 4.4 for Annex I benthic habitats, section 5.4 for Annex II diadromous species; section 6.4 on Annex II marine mammals, section 7.4 for Annex II otters and section 8.4 on marine ornithology); and
- Assessment of adverse effect on the integrity of European Sites in-combination with other plans and projects by receptor (see section 4.5 for Annex I benthic habitats, section 5.5 for Annex II diadromous species; section 6.4.2.177 on Annex II marine mammals, section 7.5 for Annex II otters and section 8.5 on marine ornithology).

1.2 META project overview

1.2.1.1 Three META sites have been screened into the requirement to undertake an Environmental Impact Assessment (EIA), on the basis that the activities proposed at these sites are consistent with the characteristics of a Schedule 2 project under the Marine Works (EIA) Regulations 2017. That is, a project which is likely to have significant effects on the environment due to factors such as its size, nature or location. The META sites which will require an EIA and consideration within the HRA are outlined below and shown in Figure 1-1:

- Warrior Way (site 6);
- Dale Roads (site 7); and
- East Pickard Bay (site 8).

1.2.2 Warrior Way (site 6)

1.2.2.1 Warrior Way (site 6) is located within the Waterway offshore from the Pembrokeshire Science and Technology Park, south east of Pembroke Ferry, and at the mouth of the Cosheston Pill. The site supports the greatest tidal resource in the Milford Haven Estuary (1.2 m/s) and has a depth of between 16 -19 m. The Warrior Way site (site 6) encompasses an area of 93,000 m² (9.3 Ha) and lies entirely within the Pembrokeshire Marine/Sir Benfro Forol Special Area of Conservation (SAC). Figure 1-2 illustrates the location and extent of Warrior Way (site 6) in relation to the surrounding Milford Haven and Pembrokeshire environmental designated sites.

1.2.2.2 The Warrior Way site (site 6) will enable testing of:

- Scaled tidal devices,
- Micro tidal devices,
- Instruments, components and subassemblies;
- Remotely operated vehicle (ROV) or other monitoring equipment;
- Site preparation methodologies;
- Decommissioning methodologies; and
- Salvage methodologies.

1.2.3 Dale Roads (site 7)

1.2.3.1 Dale Roads (site 7) lies outside the Dale shelf anchorage within the Waterway to the west of Great Castle Head, and south of St Ishmael's. It supports depths of between 8 and 12 m and benefits from a significant wind and wave fetch from the south and southwest. The site encompasses an area of 195,565 m² (19.56 Ha) and lies entirely within the Pembrokeshire Marine/ Sir Benfro Forol SAC and the West Wales Marine SAC. Figure 1-3 illustrates the location and extent of Dale Roads (site 7) in relation to the surrounding Milford Haven and Pembrokeshire environmental designated sites.

1.2.3.2 Dale Roads (site 7) will enable testing of:

- Scaled wave energy converter (WEC) devices;
- Full-scale WEC devices; and
- Research and monitoring methodologies.

1.2.4 East Pickard Bay (site 8)

1.2.4.1 The north-west side of East Pickard Bay (site 8) overlaps with the southern boundary of the Waterway. It lies immediately south of Sheep Island and runs south-eastward parallel to the coast towards Freshwater West Bay.

The site is exposed to a good wave resource benefiting from a 200 km fetch from the prevailing wind direction and has a water depth of between 10 and 29 m. The East Pickard Bay site (site 8) encompasses an area of 1,230,000 m² (123 Ha) and lies entirely within the Pembrokeshire Marine/ Sir Benfro Forol SAC and the West Wales Marine SAC.

1.2.4.2 **Figure 1-4** illustrates the location and extent of East Pickard Bay (site 8) in relation to the surrounding Milford Haven and Pembrokeshire environmental designated sites.

1.2.4.3 The East Pickard Bay site (site 8) will enable testing of:

- Full-scale WEC device testing;
- Scaled wave energy WEC device testing; and
- Component testing for floating offshore wind technology.

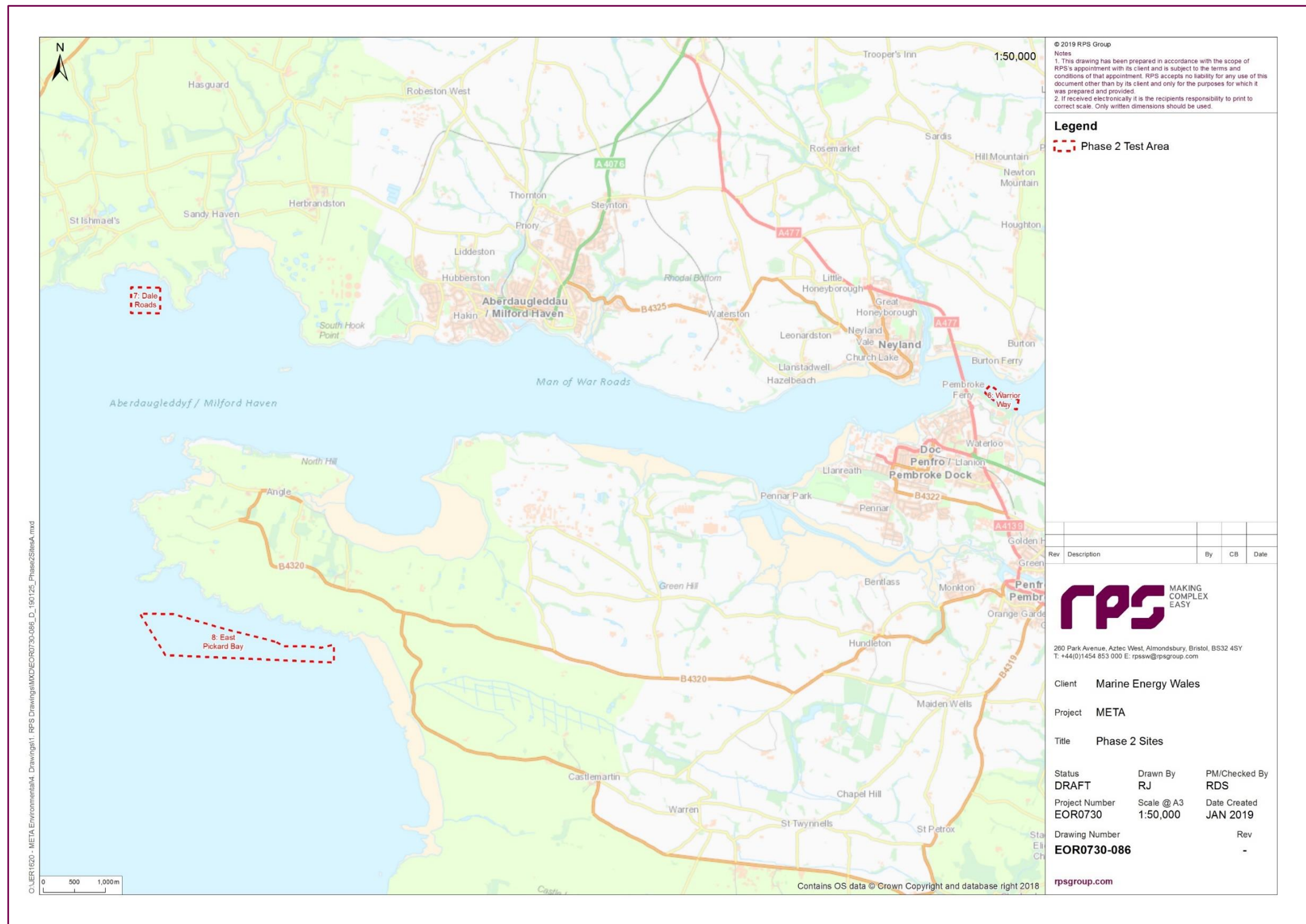


Figure 1-1: The META project site locations.

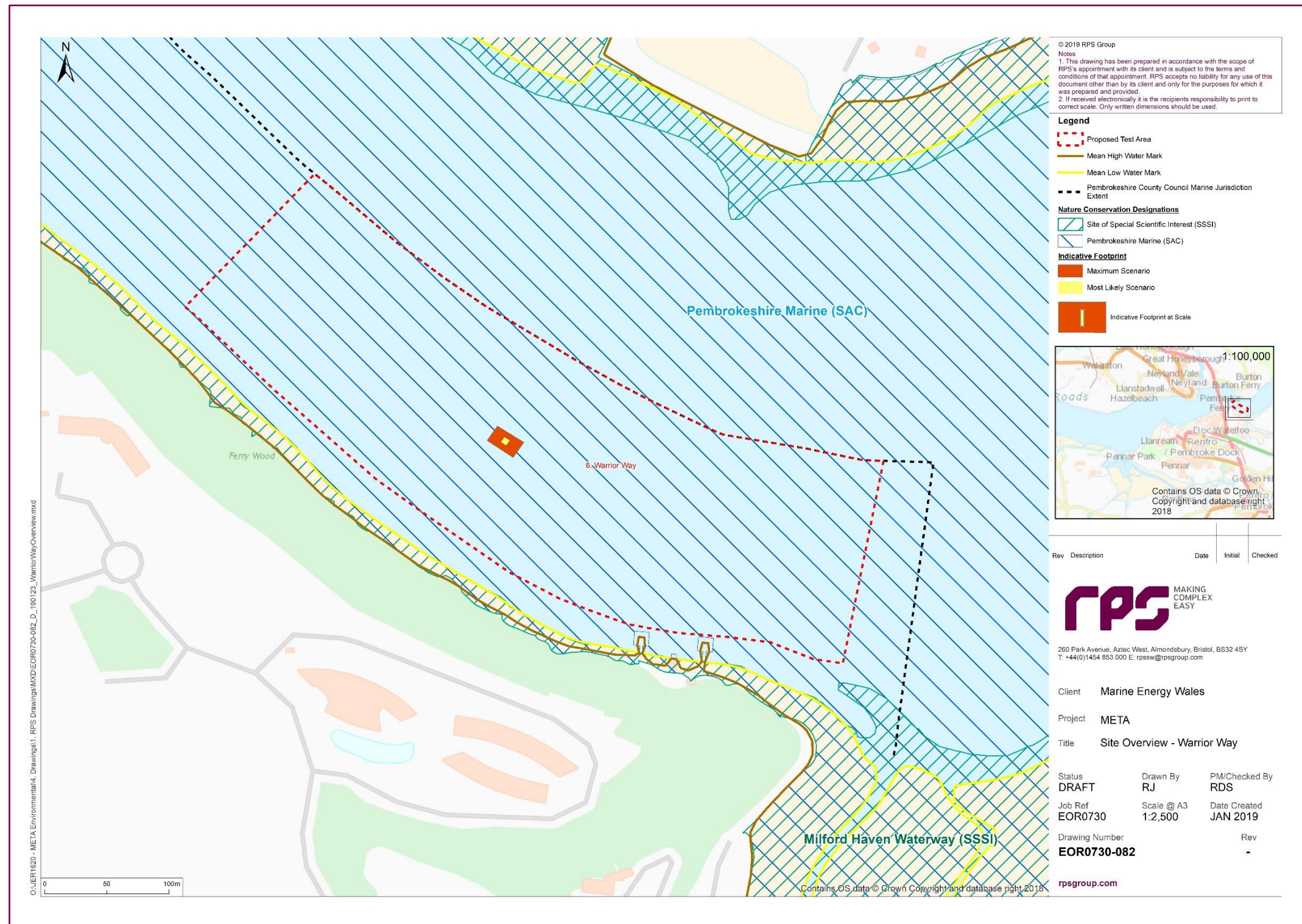


Figure 1-2: Location of Warrior Way (site 6).

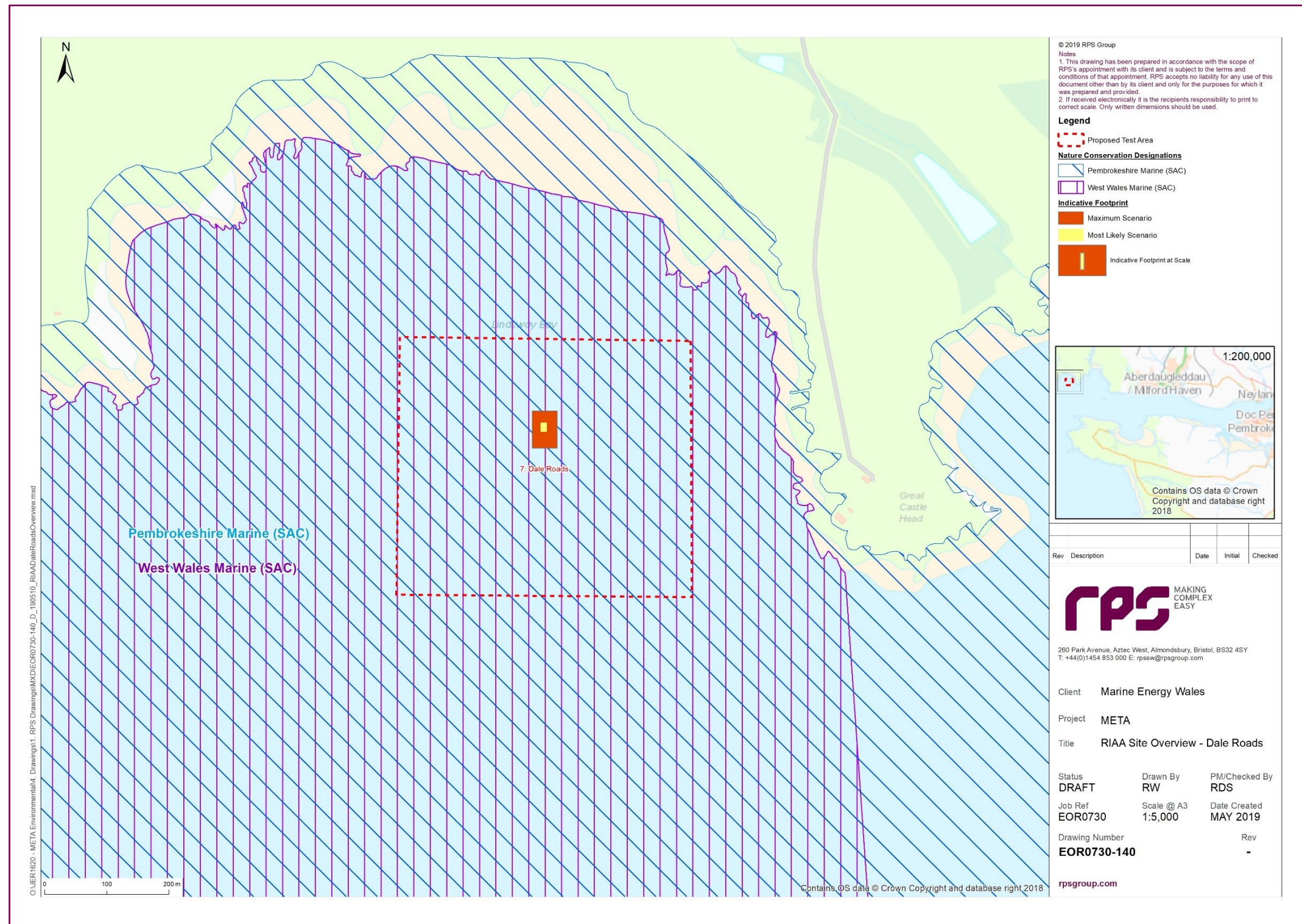


Figure 1-3: Location of Dale Roads (site 7).

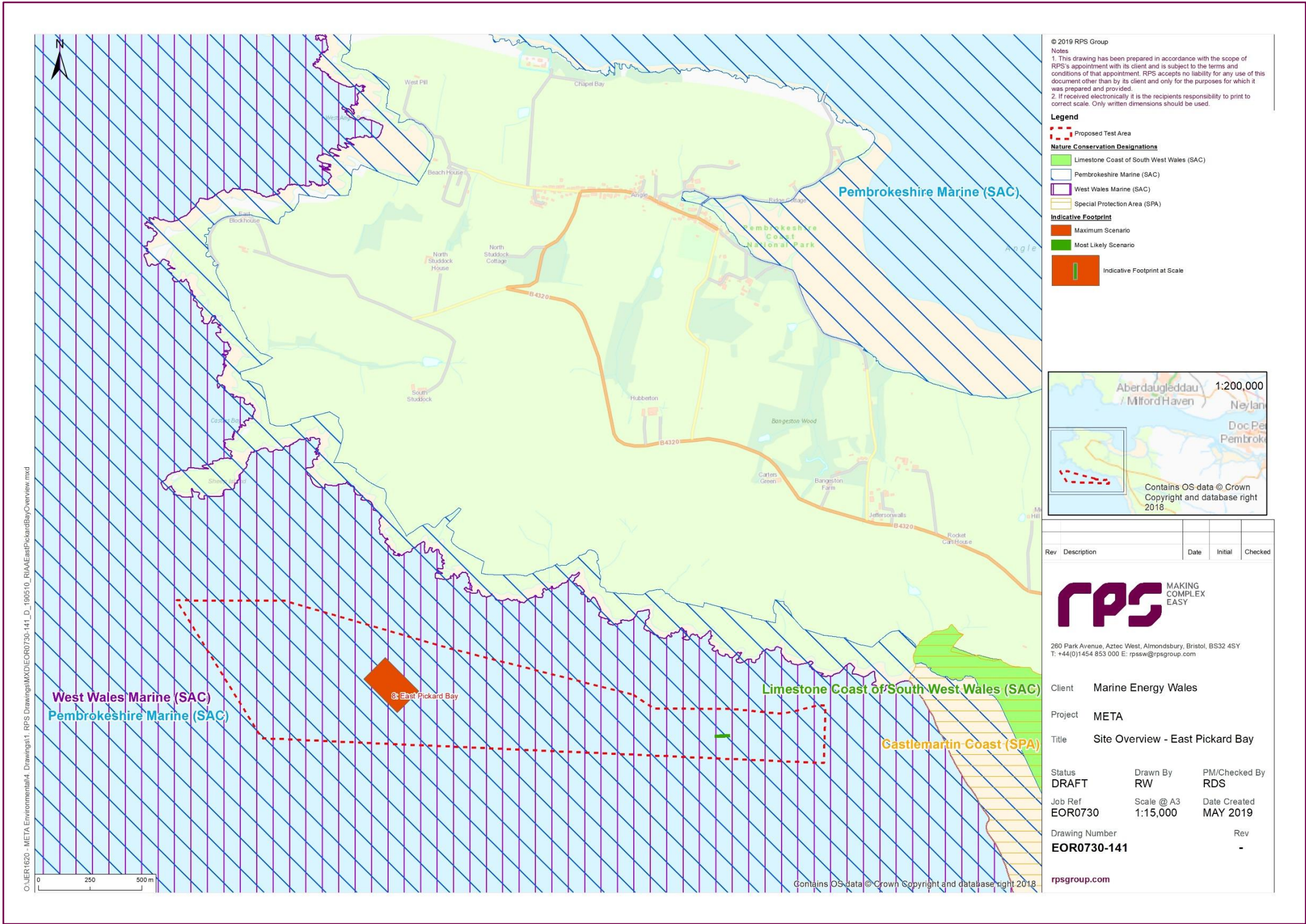


Figure 1-4: Location of East Pickard Bay (site 8)

1.3 The Habitat Regulations

1.3.1 Legislative context

1.3.1.1 The European Union (EU) Habitats Directive (92/43/EEC), on the conservation of natural habitats and of wild fauna and flora, protects habitats and species of European nature conservation importance. Together with Council Directive (2009/147/EC) on the conservation of wild birds (the 'Birds Directive'), the Habitats Directive establishes a network of internationally important sites, designated for their ecological status. This network of designated sites is comprised of the following:

- SACs which are designated under the Habitats Directive and promote the protection of flora, fauna and habitats; and
- Special Protection Areas (SPAs) which are designated under the Birds Directive in order to protect rare, vulnerable and migratory birds.

1.3.1.2 These Directives are transposed into UK law by The Conservation of Habitat and Species Regulations 2017 (the 'Habitats Regulations') which covers terrestrial areas of the UK and territorial waters out to 12 nautical miles (NM).

1.3.1.3 In addition to sites formally designated under European legislation, UK Government policy (ODPM Circular 06/2005) states that Wetlands of International Importance listed and proposed under the Ramsar Convention 1971 (Ramsar sites) are afforded the same protection. As a matter of policy, the UK Government also affords sites going through the formal designation process i.e. potential SPAs (pSPAs), candidate and possible SACs (cSACs and pSACs respectively), Sites of Community Importance (SCIs) and potential Ramsar sites, the same level of protection.

1.3.1.4 Under the Habitats Regulations, before granting approval (i.e. planning permissions, licenses and consents) for a development likely to have a significant effect on an SAC or SPA/Ramsar site, an Appropriate Assessment must be made by the Competent Authority, of the proposed plan or project's potential implications for the site in view of that site's Conservation Objectives.

1.3.1.5 There are several regulatory authorities involved in the consenting of the META project, therefore there is potentially more than one Competent Authority under these Regulations. The Competent Authority for the META project may be:

- NRW Permitting Services (NRW PS; Marine Licence);
- Milford Haven Port Authority (MHPA; Marine Works Licence); and
- Pembrokeshire County Council (PCC; Planning Permission within the Waterway).

1.3.1.6 Under Regulation 67 (Habitat Regulations, 2017), the Appropriate Authority (in this case Welsh Ministers), may issue guidance to Competent Authorities relating to circumstances where there is more than one Competent Authority, and relating to when a competent authority may or should adopt the reasoning or conclusions of another Competent Authority as to whether a plan or projects is likely to have a significant effect on a European Site, or whether it will adversely affect the integrity of a European Site. The competent authorities concerned must have regard to any such guidance, and they must have regard to the views of the other Competent Authority/Authorities involved.

1.3.2 The process

1.3.2.1 Regulation 63 of the Habitats Regulations (2017) requires that, wherever a plan or project that is not directly connected to, or necessary for, the management of a Natura 2000 site is likely to have a significant effect on the Conservation Objectives of the site (directly, indirectly, alone or in-combination with other plans or projects), an 'Appropriate Assessment' of the implications of the plan or project must be undertaken by the Competent Authority before consent or authorisation can be given for the plan or project.

1.3.2.2 Regulation 63 further makes clear that in light of the conclusions of such an Appropriate Assessment, the Competent Authority may agree to the plan or project only after it has determined that it will not adversely affect the integrity of the European site. If an Appropriate Assessment however, concludes that the development will adversely affect the integrity of the site (despite any proposed avoidance or mitigation measures or if uncertainty remains), Regulation 64 makes clear that consent/authorisation can only then be given if there are no alternative solutions and that the project must be carried out for IROPI. Where the site supports priority natural habitats or species, the IROPI must be in relation to reasons:

- relating to human health, public safety or beneficial consequences of primary importance to the environment; or
- other reason which the Competent Authority considers to be IROPI.

1.3.2.3 Agreement under these circumstances must be accompanied by the securing of necessary compensatory measures to ensure that the overall coherence of the network of European sites is protected.

1.3.2.4 Regulation 63 further makes it clear that the person applying for the authorisation of the plan or project must provide such information as the Competent Authority may reasonably require for the purposes of the assessment or to enable them to determine whether an Appropriate Assessment is required. This document provides such information.

1.3.2.5 This HRA Screening provides information on the methodology followed in carrying out the HRA Stage 2: RIAA for the META project in relation to Natura 2000 and Ramsar sites. In so far as there may be in combination effects on designated sites associated with the META Project these must be considered together with other relevant projects and plans.

1.3.2.6 The Planning Inspectorate (PINS) for England and Wales¹ Advice Note Ten ‘Habitat Regulations Assessment relevant to nationally significant infrastructure projects’ (version 8, November 2017), defines HRA as a multi-stage process which helps to determine LSE and (where appropriate) assesses adverse impact on the integrity of a European site, examines alternative solutions and provides justification of IROPI. Whilst it is recognised that the META Project does not constitute a nationally significant infrastructure project, the PINS Advice Note Ten is useful in guiding the META Project HRA process. European guidance describes a four-stage process to HRA, as summarised in Figure 1-5.

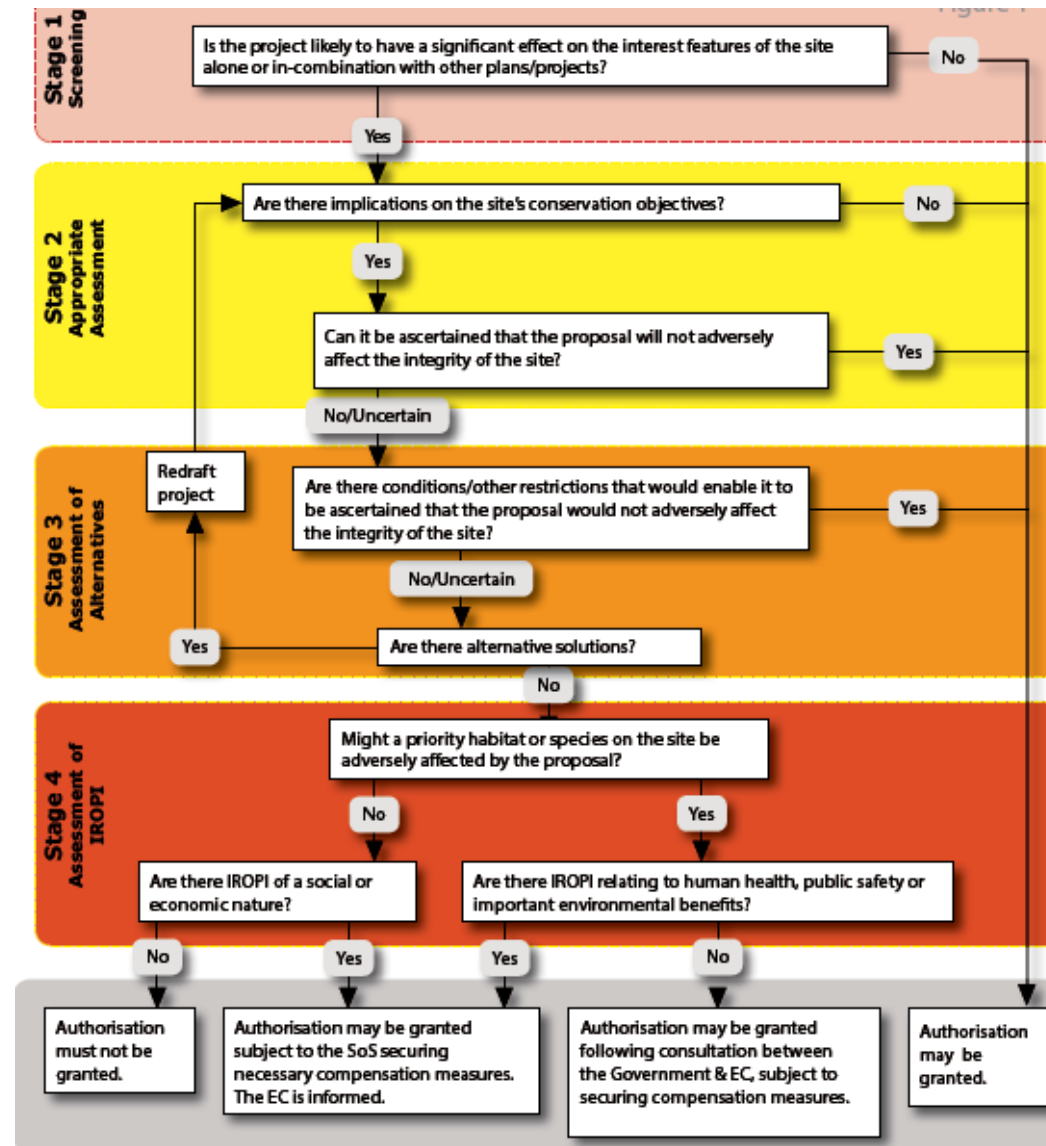


Figure 1-5: Summary of HRA process in accordance with European Guidance (PINS for England and Wales, 2017).

¹ At present, responsibility for making decisions and recommendations on a range of land use planning-related issues lies with the Planning Inspectorate for England and Wales. Welsh Government announced on 9 May 2019 that a new planning inspectorate for Wales is to be created which is expected to be fully operational by the end

1.3.2.7 All four stages of the process are referred to as the HRA to clearly distinguish the whole process from the one step within it referred to as the “Appropriate Assessment”.

1.3.2.8 The integrity of a site is defined as the coherence of the site’s ecological structure and function, across the whole of its area, which enables it to sustain the habitat, complex of habitats and/or populations of species for which the site has been designated (EC, 2001). An adverse effect on integrity is likely to be one which prevents the site from making the same contribution to favourable conservation status (FCS) of the habitats or species for which it is classified/designated, as it did at the time of designation.

1.3.2.9 In accordance to the PINS for England and Wales guidance note ten, there are four steps to the carrying out this HRA Screening and Report to Inform Appropriate Assessment (RIAA):

- Step 1 - Qualifying Interest features - Provide information on identified Natura 2000 and Ramsar sites and their Conservation Objectives;
- Step 2 - Likely Significant Effect - Identify the likely effects of a project upon a Natura 2000 site, either alone or in combination with other projects and plans and consider whether these effects may be significant. The assessment must show that there will be no significant effect, and if there is any uncertainty or where it cannot be determined that there is no LSE, an Appropriate Assessment is required;
- Step 3 - Appropriate Assessment: This is the detailed consideration of the potential effects identified during Screening to determine if there is a potential impact on the integrity of the Natura 2000 site. This step should use objective evidence to determine if it can be concluded that there is no potential for an adverse effect on site integrity based on the Conservation Objectives of the Natura 2000 site; and
- Step 4 - Avoidance and Mitigation - For identified adverse effects, provide suitable mitigation that will ensure that no adverse effect can be concluded.

1.3.2.10 The META HRA Screening Report (see Appendix 1) considered steps 1 and 2.

1.3.2.11 This report considers Step 3 and Step 4 of this process (i.e. Stage 2 of the HRA).

1.3.3 The Appropriate Assessment

1.3.3.1 A European Site is progressed to the Appropriate Assessment Stage (Stage 2 of the HRA) where it is not possible to exclude a LSE to one or more qualifying features of that site in view of the Conservation Objectives for that site. European Sites and features which will be subject to an Appropriate Assessment for the META project will therefore be those for which LSEs could not be ruled out during the screening exercise. These are summarised in section 2.

of the current Assembly term. In the interim, existing applications for infrastructure schemes and planning appeals, will continue to be looked at by the Planning Inspectorate for England and Wales.

- 1.3.3.2 Undertaking an Appropriate Assessment entails consideration of the impacts of a project, alone and in-combination with other plans and projects, on the integrity of a European Site, with regard to the site's structure and function and its Conservation Objectives.
- 1.3.3.3 The integrity of a site is defined as the coherence of the site's ecological structure and function, across the whole of its area, which enables it to sustain the habitat, complex of habitats and/or populations of species for which the site has been designated (EC, 2001). An adverse effect on integrity is likely to be one which prevents the site from making the same contribution to favourable conservation status (FCS) as it did at the time of designation.

2. SUMMARY OF THE SCREENING EXERCISE FOR THE META PROJECT

- 2.1.1.1 The screening exercise for the META project (Stage 1 of the HRA) is presented in full in the HRA Screening Report (see Appendix 1) and summarised in the sections below.
- 2.1.1.2 Following the initial identification of sites, the potential for LSEs was considered. Where there was no potential impact pathway, or the potential effects associated with an impact were considered to be insignificant, a site was screened out for further consideration in the HRA. Where the potential for LSE could not be excluded, sites were taken forward for further consideration throughout Stage 2 of the HRA process.

2.2 Sites considered during HRA screening

2.2.1 Sites designated for Annex I habitats (subtidal and coastal)

- 2.2.1.1 As discussed in the HRA Screening Report (see Appendix 1), the initial LSE screening assumed there was potential for a LSE on any European site which includes Annex I habitats where any part of the META project falls within the site boundary. In addition, it was assumed that there may be potential for indirect effects, due to, for example, sediment resuspension associated with device installation. The zone of influence (ZOI) for assessment of indirect effects was based on the extent of one tidal excursion which was defined as 10 km.
- 2.2.1.2 The subsequent assessment of LSE identified a potential for LSE, or that LSE could not be discounted, during the Stage 1 of the HRA for the European Sites with Annex I habitats as designated features listed shown in Table 2.1.

Table 2.1: European Sites designated for benthic Annex I habitat features for which a LSE has been identified or could not be discounted during HRA screening.

European Site	Relevant Annex I features	Distance to Warrior Way (site 6) in km	Distance to Dale Roads (site 7) in km	Distance to East Pickard Bay (site 8) in km
Pembrokeshire Marine/Sir Benfro Forol SAC ¹	Estuaries	0	0	0
	Large shallow inlets and bays			
	Reefs			
	Sandbanks which are slightly covered by sea water all the time			
	Mudflats and sandflats not covered by seawater at low tide			
	Coastal lagoons (*Priority feature)			
	Atlantic salt meadows (<i>Glauco-Puccinellietalia maritima</i>)			

European Site	Relevant Annex I features	Distance to Warrior Way (site 6) in km	Distance to Dale Roads (site 7) in km	Distance to East Pickard Bay (site 8) in km
	Submerged or partially submerged sea caves			
Limestone Coast of South West Wales SAC/Arfordir Calchfaen de Orllewin Cymru SAC ²	Submerged or partially submerged sea caves	10	7	2

¹ The migratory fish, marine mammals and otter which are also qualifying features of this site are covered in Table 2.2, Table 2.3 and Table 2.5, respectively. The Pembrokeshire Marine SAC is also designated for shore dock (*Rumex rupestris*) which was screened out at the initial site selection stage on the basis that there is no receptor-impact pathway.

² The Limestone Coast of South West Wales SAC is also designated for the following terrestrial features which were screened out at the initial site selection stage on the basis that there is no receptor-impact pathway:

- Vegetated sea cliffs of the Atlantic and Baltic coasts;
- Fixed dunes with herbaceous vegetation ("grey dunes");
- European dry heaths;
- Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia*) (* important orchid sites);
- Caves not open to the public;
- Greater horseshoe bat *Rhinolophus ferrumequinum*;
- Petalwort *Petalophyllum ralfsii*; and
- Early gentian *Gentianella anglica*.

- 2.2.1.3 As discussed later in section 2.4.2, refinements to the list of European Sites and associated designated features for which a LSE could not be discounted were refined following consultation on the HRA Screening Report with NRW Advisory Services. The updated summary of sites, features and potential impacts brought forward for further consideration to inform Appropriate Assessment following this consultation are detailed in Table 2.8.

2.2.2 Sites designated for Annex II diadromous migratory fish

- 2.2.2.1 As discussed in the HRA Screening Report (see Appendix 1), the initial LSE screening assumed there was potential for a LSE on any European site which includes Annex II diadromous fish species where any part of the META project falls within the site boundary. In addition, it was assumed that as these species are mobile and utilise both freshwater and marine/offshore environments throughout their life cycle, there may be potential for the META project to result in impacts on Annex II diadromous species at some distance from the sites for which they are qualifying interest features. Taking a precautionary approach, it was considered that European sites with Annex II diadromous fish notified interest features which are located within 50 km from the META project could potentially be affected by the META project.
- 2.2.2.2 The subsequent assessment of LSE identified a potential for LSE, or that LSE could not be discounted, during the Stage 1 of the HRA for the European Sites with Annex II diadromous migratory fish as designated features shown in Table 2.2.

Table 2.2: European Sites designated for Annex II diadromous fish species for which a LSE has been identified or could not be discounted during HRA screening.

European Site	Relevant Annex II features	Distance to Warrior Way (site 6) in km	Distance to Dale Roads (site 7) in km	Distance to East Pickard Bay (site 8) in km
Pembrokeshire Marine/Sir Benfro Forol SAC ¹	Twaite shad <i>Alosa fallax</i>	0	0	0
	Sea lamprey <i>Petromyzon marinus</i>			
	River lamprey <i>Lampetra fluviatilis</i>			
	Allis shad <i>Alosa alosa</i>			
Afonydd Cleddau/ Cleddau Rivers SAC ²	Sea lamprey <i>Petromyzon marinus</i>	11	16	17
	River lamprey <i>Lampetra fluviatilis</i>			

¹ The benthic habitats, marine mammal species and otter which are also qualifying features of this site are covered in Table 2.1, Table 2.3 and Table 2.5, respectively.

² Otters which are also a qualifying feature of this site are covered in Table 2.5. The Cleddau Rivers SAC is also designated for the following freshwater fish which were screened out at the initial site selection stage on the basis that there is no receptor-impact pathway:

- Brook lamprey *Lampetra planeri*; and
- Bullhead *Cottus gobio*.

2.2.2.3 As discussed later in section 2.4.3, refinements to the list of European Sites and associated designated features for which a LSE could not be discounted were refined following consultation on the HRA Screening Report with NRW Advisory Services. The updated summary of sites, features and potential impacts brought forward for further consideration to inform Appropriate Assessment following this consultation are detailed in Table 2.8.

2.2.3 Sites designated for Annex II marine mammals

2.2.3.1 As discussed in the HRA Screening Report (see Appendix 1), the initial LSE screening assumed there is potential for a LSE on any European site which includes Annex II marine mammal species where any part of the META project falls within the site boundary. In addition, it was assumed that as these are mobile species which potentially forage over wide areas, they could potentially be affected by activities that occur at some distance from the sites for which they are qualifying interest features. A precautionary approach was adopted which considered that European sites with Annex II marine mammal features which are located within 100 km of the META project could potentially be affected by the META project.

2.2.3.2 The subsequent assessment of LSE identified a potential for LSE, or that LSE could not be discounted, during the Stage 1 of the HRA for the European Sites and associated designated features shown in Table 2.3.

Table 2.3: European Sites designated for Annex II marine mammals for which a LSE has been identified or could not be discounted during HRA screening.

European Site	Relevant Annex II features	Distance to Warrior Way (site 6) in km	Distance to Dale Roads (site 7) in km	Distance to East Pickard Bay (site 8) in km
Pembrokeshire Marine/Sir Benfro Forol SAC ¹	Grey seal <i>Halichoerus grypus</i>	0	0	0
West Wales Marine/Gorllewin Cymru Forol cSAC	Harbour porpoise <i>Phocoena phocoena</i>	13	0	0
Bristol Channel Approaches cSAC/ Dynesfeydd Môr Hafren MPA	Harbour porpoise <i>Phocoena phocoena</i>	19	7	15
Cardigan Bay/ Bae Ceredigion SAC ²	Grey seal <i>Halichoerus grypus</i>	43	47	51
Lleyn Peninsula and the Sarnau/ Pen Llyn a'r Sarnau SAC ³	Grey seal <i>Halichoerus grypus</i>	91	98	102

¹ The benthic habitats, migratory fish and otter which are also qualifying features of this site are covered in Table 2.1, Table 2.2 and Table 2.5, respectively.

² Cardigan Bay SAC is also designated for the following features which were screened out at the initial site selection stage as they are either not within the respective ZOIs or there was no receptor-impact pathway:

- Sandbanks which are slightly covered by sea water all the time;
- Reefs;
- Submerged or partially submerged sea caves;
- Bottlenose dolphin *Tursiops truncatus*;
- Sea lamprey *Petromyzon marinus*; and
- River lamprey *Lampetra fluviatilis*.

³ Lleyn Peninsula and the Sarnau SAC is also designated for the following features which were screened out at the initial site selection stage as they are either not within the respective ZOIs or there was no receptor-impact pathway:

- Sandbanks which are slightly covered by sea water all the time;
- Estuaries;
- Coastal lagoons;
- Large shallow inlets and bays;
- Reefs;
- Mudflats and sandflats not covered by seawater at low tide
- Salicornia and other annuals colonizing mud and sand
- Atlantic salt meadows (*Glauco-Puccinellietalia maritima*)
- Submerged or partially submerged sea caves
- Bottlenose dolphin *Tursiops truncatus*;
- Otter *Lutra lutra*.

2.2.3.3 As discussed later in section 2.4.4, refinements to the list of European Sites and associated designated features for which a LSE could not be discounted were refined following consultation on the HRA Screening Report with NRW Advisory Services. The updated summary of sites, features and potential impacts brought forward for further consideration to inform Appropriate Assessment following this consultation are detailed in Table 2.8.

2.2.4 Sites designated for marine ornithological features

- 2.2.4.1 As discussed in the HRA Screening Report (see Appendix 1), it was assumed there is potential for a LSE on any European site which includes seabirds as a qualifying interest feature where any part of the META project falls within the site boundary. In addition, it was assumed that, as these are mobile species which potentially forage over wide areas, they could potentially be affected by activities that occur at some distance from the sites for which they are qualifying interest features. A precautionary approach was adopted which considered that European sites with seabirds as designated features which are located within 400 km of the META project could potentially be affected by the META project. Where a site lies outside the foraging range for the relevant species, these species (and where appropriate the site) were screened out.
- 2.2.4.2 European Sites and associated designated features for which a LSE has been identified or could not be discounted during the Stage 1 of the HRA are show in Table 2.4.

Table 2.4: European Sites designated for breeding marine bird species for which a LSE has been identified or could not be discounted during HRA screening.

European Site	Relevant qualifying breeding marine bird interest features	Distance to Warrior Way (site 6) in km	Distance to Dale Roads (site 7) in km	Distance to East Pickard Bay (site 8) in km
Skomer, Skokholm and the seas off Pembrokeshire/Sgomer, Sgogwm a Moroedd Penfro SPA ¹	Atlantic puffin <i>Fratercula arctica</i> European storm petrel <i>Hydrobates pelagicus</i> Lesser black-backed gull <i>Larus fuscus</i> Manx shearwater <i>Puffinus puffinus</i> Razorbill <i>Alca torda</i> Common guillemot <i>Uria aalge</i> Black-legged kittiwake <i>Rissa tridactyla</i>	7	5	8

¹ Skomer, Skokholm and the seas off Pembrokeshire SPA is also designated for the following features which were screened out at the initial site selection stage as there was no receptor-impact pathway:

- Red-billed chough *Pyrrhocorax pyrrhocorax*; and
- Short-eared owl *Asio flammeus*.

- 2.2.4.3 As discussed later in section 2.4.5 refinements to the list of European Sites and associated designated features for which a LSE could not be discounted were refined following consultation on the HRA Screening Report with NRW Advisory Services. The updated summary of sites, features and potential impacts brought forward for further consideration to inform Appropriate Assessment following this consultation are detailed in Table 2.8.

2.2.5 Sites designated for Annex II otters

- 2.2.5.1 As discussed in the HRA Screening Report (see Appendix 1), it was assumed there is potential for a LSE on any European site which includes Annex II otter as a qualifying feature where any part of the META project falls within the site boundary or within a 10 km buffer.
- 2.2.5.2 European Sites and associated designated features for which a LSE has been identified or could not be discounted during the Stage 1 of the HRA are show in Table 2.5Table 2.4.

Table 2.5: European Sites designated for otter for which a LSE has been identified or could not be discounted during HRA screening.

European Site	Relevant Annex II features	Distance to Warrior Way (site 6) in km	Distance to Dale Roads (site 7) in km	Distance to East Pickard Bay (site 8) in km
Pembrokeshire Marine/Sir Benfro Forol SAC ¹	Otter <i>Lutra lutra</i>	0.0	0.0	0.0
Cleddau Rivers/Afonydd Cleddau SAC ²	Otter <i>Lutra lutra</i>	11	16	17
Pembrokeshire Bat Sites and Bosherton Lakes/Safleoedd Ystlum Sir Benfro a Llynnoedd Bosherton SAC ³	Otter <i>Lutra lutra</i>	8	15	10

¹ The benthic habitats, migratory fish and marine mammals which are also qualifying features of this site are covered in Table 2.1, Table 2.2 and Table 2.3, respectively.

² Diadromous fish which are also a qualifying feature of this site are covered in Table 2.2.

³ Pembrokeshire Bat Sites and Bosherton Lakes SAC is also designated for the following features which were screened out at the initial site selection stage as there was no receptor-impact pathway:

- Hard oligo-mesotrophic waters with benthic vegetation of *Chara* spp.;
- Greater horseshoe bat *Rhinolophus ferrumequinum*; and
- Lesser horseshoe bat *Rhinolophus hipposideros*.

2.2.6 Sites designated for Annex II onshore/coastal ornithological features

- 2.2.6.1 As discussed in the HRA Screening Report (see Appendix 1), it was assumed there is potential for a LSE on any European site which includes Annex II onshore ornithological species as qualifying features where any part of t Benthic ecology he META project falls within the site boundary or within a 10 km buffer.

2.2.6.2 European Sites and associated designated features for which a LSE has been identified or could not be discounted during the Stage 1 of the HRA are show in Table 2.4. It should however be noted that META project no longer incorporates onshore or cabling works (see section 2.3 below), therefore this information is provided for information only (to reflect the HRA screening process) and no further assessment of onshore qualifying interest features has been undertaken.

Table 2.6: European Sites designated for Annex II onshore ornithological features for which a LSE has been identified or could not be discounted during HRA screening.

European Site	Relevant Annex II features	Distance to East Pickard Bay (site 8) in km
Castlemartin Coast SPA	Chough <i>Pyrrhocorax pyrrhocorax</i>	1

2.3 META project design envelope changes since HRA Screening

2.3.1.1 Since the consultation with NRW Advisory Services on 29 January 2019 on the HRA Screening Report (see Appendix 1), the META project design envelope (PDE) has been amended to remove all onshore elements and temporary communications cabling (including marine cable) at East Pickard Bay (site 8) from the PDE. The receptors that this has the greatest implications for are benthic ecology, otter, marine ornithology and onshore/coastal ornithological features.

2.3.2 Benthic ecology

2.3.2.1 On the basis of this change to the PDE, there will be no temporary habitat disturbance/loss of Annex I reef habitat at East Pickard Bay (site 8) as a result of the marine cable across any phase of the META project. Although this change does not result in any SACs being screened out, temporary habitat disturbance/loss no longer includes a pathway of effect associated with a marine cable. It should be noted that no impacts have been further screened out on this basis as habitat loss/disturbance may arise as a result of other aspects of the META project.

2.3.3 Otter

2.3.3.1 Impacts to otter features of the Pembrokeshire Bat Sites and Bosherton Lakes SAC had been screened in for LSE on the basis that the onshore works at East Pickard Bay (site 8) were likely to be within the foraging range of otters associated with this site. However, on the basis that the onshore works at East Pickard Bay (site 8) have been removed from the META project, this is no longer considered to be the case and no pathway for interaction exists. As such, the otter feature of the Pembrokeshire Bat Sites and Bosherton Lakes SAC has not been brought forward for consideration within this RIAA.

2.3.4 Marine ornithology

2.3.4.1 Impacts to lesser black backed gull, storm petrel and Manx shearwater features of the Skomer, Skokholm and the Seas off Pembrokeshire SPA had originally been screened in for LSE (see Appendix 1) but have subsequently not been brought forward for consideration within this RIAA, the justification for which is provided below (paragraph 2.3.4.2 to 2.3.5)

2.3.4.2 With respect to lesser black backed gull, this species had originally been screened in for LSE for accidental pollution (see Appendix 1). However, following receipt of updated baseline data since the HRA screening exercise was undertaken (i.e. British Trust for Ornithology (BTO) and Milford Haven Waterway Environmental Surveillance Group (MHWESG) data; see section 8.3) and as a result of the updates to the PDE, the lesser black backed gull feature of the site has not been brought forward for consideration within this RIAA. Although this species is susceptible to impact through interaction with pollutants as they will loaf on the surface, the baseline data indicates that the occurrence levels of this species in the vicinity of the META project sites is very low (~1 per 3 km² from the European Seabirds at Sea (ESAS) data) making interaction with the META project unlikely. This coupled with the tendency for the species to adopt a marine foraging strategy targeting fishing vessels or terrestrial strategy targeting urban/ human habitats (i.e. landfills) is further considered likely to reduce the potential for interaction due to the general lack of suitable foraging resource at the META project sites. Lesser black backed gull are also used to the presence of man, both onshore and offshore, and are in general highly tolerant of disturbance (McCluskie *et al.*, 2012). As such, there is considered to be no potential pathway of interaction between lesser black backed gull and the META project.

2.3.4.3 With respect to the storm petrel feature of the Skomer, Skokholm and the Seas off Pembrokeshire SPA, this species had originally been screened in for LSE for collision risk during operation and maintenance and for accidental pollution (see Appendix 1). However, this species has subsequently not been brought forward for consideration within this RIAA. This is due to the fact that the updated baseline data described above in paragraph 2.3.4.1, has demonstrated a lack of occurrence for this species within the marine ornithology data search study area. Furthermore, this species is primarily pelagic in nature. As such, there is considered to be no potential pathway of interaction between storm petrel and the META project.

2.3.5 With respect to the Manx shearwater feature of the Skomer, Skokholm and the Seas off Pembrokeshire SPA, this species had originally been screened in for LSE for accidental pollution across all phases of the META project (see Appendix 1). However, this species has not been brought forward for consideration within this RIAA. This change is due to the low levels of occurrence of this species within the marine ornithology data search study area, as demonstrated by the updated baseline data described above in paragraph 2.3.4.1, and the primarily pelagic nature of this species with occurrence largely associated with frontal systems and stratified waters. As such, there is considered to be no potential pathway of interaction between Manx shearwater and the META project. Onshore/coastal ornithological features

2.3.5.1 With respect to onshore/coastal ornithology, and as outlined in section 2.2.6 above, the conclusion of the HRA Screening was that LSE could not be discounted for the chough feature of the Castlemartin Coast SPA during the operation and maintenance phase of the META project. This was on the basis that chough are known to breed on the cliffs along the Angle peninsula so any maintenance activities of the marine and intertidal cable (up to MHWS) during the breeding season was considered to represent a potential disturbance to any nest sites present. On the basis that the marine and intertidal cable has been removed from the META project PDE, there is no longer considered to be a receptor-impact pathway for chough and, as such, the Castlemartin Coast SPA has subsequently been screened out of the requirement for further consideration within this RIAA.

2.4 Consultation

2.4.1.1 Consultation was undertaken with NRW Advisory Services on the HRA Screening Report (see Appendix 1) on 29 January 2019 (HRA Screening Report submitted to NRW Advisory Services) with comments received back on 28 February 2019.

2.4.1.2 Following this consultation, there has been refinement of some of the features for which an LSE was predicted in the HRA Screening Report (see Appendix 1). This has resulted in some sites and impacts being brought forward for further consideration within this RIAA where they had been initially proposed to be screened out in the HRA Screening Report (see Appendix 1). The HRA Screening Report (see Appendix 1) presents the sites, features and potential impacts for which LSEs could not be excluded at the screening stage. The following sections of this report, and Table 2.7, summarise the subsequent changes to the screening conclusions as a result of the consultation that has taken place in relation to the META HRA Screening Report (see Appendix 1) and therefore changes to the sites and/or impact pathways brought forward for further consideration within this RIAA.

Table 2.7: Summary of consultation with NRW on the HRA Screening (as presented in Appendix 1) and EIA Scoping Report.

Receptor	Consultee and type/method of consultation	Date	Issue raised	How/where dealt with in this RIAA
Benthic ecology	NRW – Advisory Services. Response to META HRA Screening Report.	28 February 2019.	The potential for temporary habitat disturbance to Annex I 'Reef' feature during META installation and retrieval activities should also include disturbance arising from marine cable installation and removal at East Pickard Bay (site 8).	As discussed in section 2.3, the marine cable at East Pickard Bay (site 8) is no longer part of the META project and as such, any consideration of the impacts associated with a cable is no longer required.
Diadromous fish	NRW – Advisory Services. Response to META HRA Screening Report.	28 February 2019.	In the META EIA scoping report it was noted that the impacts to be scoped into the EIA for fish include: Temporary habitat disturbance Temporary increases in suspended sediments Sediment deposition. We consider that if these potential impact pathways are to be scoped into the EIA then they should also not be screened out of the HRA.	Consideration of temporary habitat disturbance during installation/decommissioning is made in paragraph 5.4.1.1 <i>et seq.</i> Consideration of increased SSC and sediment deposition is made in paragraph 5.4.1.19 <i>et seq.</i>
			Underwater noise should not be screened out of the assessment for any stage of the development, particularly given the hearing sensitivity of clupeids.	Underwater noise during installation/decommissioning is considered in paragraph 5.4.1.14 <i>et seq.</i> and during operation and maintenance in paragraph 5.4.2.16 <i>et seq.</i>
			Long term habitat loss should not be screened out.	Habitat loss during the operation of devices is considered in paragraph 5.4.2.1 <i>et seq.</i>
			Typical species of the estuary habitat feature of Pembrokeshire Marine SAC should also be considered. This includes Atlantic herring which are known to spawn within the Milford Haven Waterway. In particular, there is a known spawning ground at Burton Point within close proximity to the Warrior Way (site 6) test area. David Clarke of SEACAMS can provide more information on the location of these areas.	Impacts on diadromous fish are considered in section 0. Potential impacts to habitats supporting typical fish species, such as herring, as features of the Annex I 'estuary' and 'large shallow inlets and bay' features of the Pembrokeshire Marine SAC, are considered as relevant in section 4.
Marine mammals and otters	NRW – Advisory Services. Response to META HRA Screening Report.	28 February 2019.	We recommend that the relevant marine mammal management unit (MU) is used as the spatial scale for screening. If potential impact pathways are identified for a marine mammal Annex II feature, then all sites with that feature within the relevant MU for that species should be screened in for assessment.	The only species for which the MU is larger, and therefore incorporates more designated sites for the particular species, than the 100 km buffer used for the HRA screening is harbour porpoise. Additional clarification was sought from NRW advisory services on this point in May 2019 (see later in this table) and, on the basis of the advice provided by NRW advisory services, all sites within the relevant MU for harbour porpoise (i.e. the Celtic and Irish Seas (CIS) MU) have been brought forward to the Appropriate Assessment stage as requested.
			The META site is within the Celtic and Irish Seas MU for harbour porpoise. All of the SACs with harbour porpoise as a feature should therefore be considered in the assessment. We recommend that North Anglesey Marine SAC is considered in the same way as the other harbour porpoise SACs. The impact pathways, and conclusions of LSE would be the same for this site as with the other sites.	
			For the harbour porpoise features of the West Wales Marine SAC and Bristol Channel Approaches SAC we consider that it is not appropriate to rule out a potential LSE from underwater noise associated with tidal turbine operation and from pile drilling.	Effects associated with underwater noise during installation and operation on harbour porpoise have been brought forward to the Appropriate Assessment stage as requested by NRW. Consideration of effects associated with underwater noise during installation (i.e. from drilling and vessels) is made in paragraph 6.4.1.1 <i>et seq.</i> Consideration of effects associated with underwater noise from device operation is made in paragraph 6.4.2.1 <i>et seq.</i>
			For the Cardigan Bay SAC and Pen Llyn a'r Sarnau SAC, we agree with the conclusion of no LSE on the bottlenose dolphin features of both SACs.	Noted.
			For the grey seal feature of the Pembrokeshire Marine SAC, we consider that it is not appropriate to rule out a potential LSE from operational noise from tidal turbines operation and from pile drilling.	Effects associated with underwater noise during installation and operation on grey seal have been brought forward to the Appropriate Assessment stage as requested by NRW.
			For the grey seal feature of the Cardigan Bay SAC and Pen Llyn a'r Sarnau SAC, we disagree with the conclusions of no LSE from 'Disturbance from installation noise' and 'Disturbance from underwater noise resulting from device operation'.	Consideration of effects associated with underwater noise during installation (i.e. from drilling and vessels) is made in paragraph 6.4.1.1 <i>et seq.</i> Consideration of effects associated with underwater noise from device operation is made in paragraph 6.4.2.1 <i>et seq.</i>
	NRW – Permitting Services / Marine Management Organisation (MMO).	28 March 2019.	Changes to hydrodynamics resulting in potential impairment of foraging opportunities for marine mammals should be included.	Effects associated with changes to the hydrodynamic regime have been brought forward to the Appropriate Assessment stage as requested by NRW as presented in paragraph 6.4.2.129 <i>et seq.</i>
			Consideration must be given to all marine mammal SACs within the relevant management unit. While most sites have been included in the assessment, for completeness the assessment should also list	Additional clarification was sought from NRW advisory services on this point in May 2019 (see below) and, on the basis of the advice provided by NRW advisory services, all sites within the

Receptor	Consultee and type/method of consultation	Date	Issue raised	How/where dealt with in this RIAA
	Response to META EIA Scoping Report.		North Anglesey Marine SAC. Potential impacts should be considered on harbour porpoise from all 3 SACs within the management unit.	CIS MU for harbour porpoise have been brought forward to the Appropriate Assessment stage as requested and this has included North Anglesey Marine SAC.
			Clarification was sought from NRW Advisory Services on their advice regarding the use of marine mammal MUs as the spatial scale for screening sites. NRW confirmed that if potential impact pathways are identified for a marine mammal Annex II feature, then all sites with that feature within the relevant MU for that species should be screened in for assessment. If LSE cannot conclusively be ruled out for the species, then all the sites in the relevant MU for that species should be taken forward to appropriate assessment. NRW Advisory Services provided a map of the harbour porpoise CIS MU and the relevant SACs within it.	On the basis of NRW's advice, all 13 European sites designated for harbour porpoise within the CIS MU have been brought forward to the Appropriate Assessment stage as outlined in Table 2.8.
	NRW – Advisory Services. Email correspondence with Ceri Morris.	22 May 2019.	At the Appropriate Assessment stage, NRW Advisory Services recommend the following approach for harbour porpoise: assess the impacts on the site closest to the proposed plan or project location. Use those conclusions to assess the remaining sites. If the assessment concludes an adverse effect on integrity for the closest site, the next closest site should then be considered. It is possible that adverse effect on integrity could be ruled out at more distant sites due to the decreased chance of animals from further way being impacted. This will, however, be considered on a case by case basis.	The Applicant notes that this approach, whilst non-standard in term of the HRA Regulations as ruling out more distant sites on the basis of the decreased chance of animals being encountered and therefore impacted is typically undertaken at the LSE screening stage, represents NRW advisory service's recommended approach to the HRA for harbour porpoise for the META project. As such, this approach has been adopted by the Applicant in this RIAA for harbour porpoise only. For all other species, a full RIAA has been presented for all sites screened in for potential LSE in the HRA Screening Report, regardless of the conclusions of the assessment for adverse effect on integrity for the closest site to the META project.
			At the Appropriate Assessment stage, NRW Advisory Services recommend the following approach for bottlenose dolphin: carry out an Appropriate Assessment on both Welsh sites. The high level of connectivity between sites, and the strong evidence that there is a single population of bottlenose dolphins using both sites means that it is likely that an adverse effect on integrity on one site would also occur on the other.	The Applicant can confirm that the META project falls outside the Irish Sea MU for bottlenose dolphin and refers to NRW's formal response to the META HRA Screening Report, outlined above, which states that for the Cardigan Bay SAC and Pen Llyn a'r Sarnau SAC, they agree with the conclusion of no LSE. On this basis, the two Welsh sites designated for bottlenose dolphin were not brought forward to this RIAA.
			At the Appropriate Assessment stage, NRW Advisory Services recommend the following approach for grey seal: Pembrokeshire Marine SAC is the key site which supports most grey seal pupping within the Celtic and Irish Seas part of the OSPAR Region III area (interim management unit), yet other areas may be more important as non-breeding haul-outs. Grey seals are therefore a more complex feature to assess, and Appropriate Assessment should be conducted on a case by case basis but is likely to require an assessment against each of the Welsh SACs.	As outlined in Table 2.8, grey seal as a feature of the Pembrokeshire Marine SAC has been brought forward to the Appropriate Assessment stage on the basis that potential LSE was identified/cannot be discounted in the HRA Screening Report. The same is also true for all other Welsh SACs which list grey seal as a designated feature i.e. Cardigan Bay/ Bae Ceredigion SAC, Llyn Peninsula and the Sarnau/ Pen Llyn a'r Sarnau SAC and Lundy SAC. Full assessment of these sites is presented in section 6.4 of this RIAA.
	NRW – Advisory Services. Email correspondence with Ceri Morris.	31 May 2019	NRW Advisory Services provided a map of the bottlenose dolphin Irish Sea MU and the relevant SACs within it.	As above, the Applicant can confirm that the META project falls outside the Irish Sea MU for bottlenose dolphin and refers to NRW's formal response to the META HRA Screening Report, outlined above, which states that for the Cardigan Bay SAC and Pen Llyn a'r Sarnau SAC they agree with the conclusion of no LSE. On this basis, the two Welsh site designated for bottlenose dolphin were not brought forward to this RIAA.
Marine ornithology			NRW Advisory Services provided a map of the grey seal MU/OSPAR Region III and the relevant SACs within it.	The Applicant notes that the OSPAR Region III does not correspond with the published MU for grey seal (i.e. the Wales MU) but that the 100 km buffer used for screening grey seal sites in the HRA Screening Report encompasses all SACs within the Wales MU and therefore all relevant Welsh SACs for this species have been considered.
	NRW – Advisory Services. Response to META HRA Screening Report.	28 February 2019.	We consider that the correct ornithological sites and features have been screened into the assessment and agree with the methodology used.	Noted.
			Impacts of lighting on devices should also be considered.	Potential lighting impacts have been considered but scoped out due to the minimal lighting proposed within the PDE for the META project. Any lighting will be on marker buoys or devices only where surface piercing, as a navigation measure. Given the existing status of the Waterway, any additional lighting is considered unlikely to result in any additional effect.
	NRW – Permitting Services / Marine Management Organisation (MMO).	28 March 2019.	The list of species and designated sites to assess should be updated to include all sites for which the foraging range of their designated feature intersects the proposed site boundaries. This includes	Carmarthen Bay SPA and Northern Cardigan Bay SPA were considered in the HRA Screening Report (see section 3.4 in Appendix 1) and screened out on the basis of a lack of appropriate supporting habitat for the features of these sites and therefore the conclusion that

Receptor	Consultee and type/method of consultation	Date	Issue raised	How/where dealt with in this RIAA
	Response to META EIA Scoping Report.		Carmarthen Bay / Bae Caerfyrddin SPA (designated for wintering common scoter), Northern Cardigan Bay / Gogledd Bae Ceredigion SPA (designated for wintering red-throated diver) and Grassholm SPA.	there is no potential for LSE. Impacts to the gannet feature of the Grassholm SPA were also screened out for potential LSE, predominately on the basis of a lack of overlap between the META sites and the foraging areas of this species. Carmarthen Bay SPA is primarily designated for its population of wintering common scoter. Common scoter are considered to have the capability to move up to 200 km when foraging (BirdLife, 2011), however studies in Wales have recorded the majority of birds as restricted to 1-4 km offshore and the majority of birds more than 3 km offshore (Kaiser, 2004) and to shallow <20 m sandy substrate. This pelagic nature, the existing high levels of disturbance in the Waterway and the limited extents of suitable foraging habitat present in the META project area justify the conclusions of the HRA Screening Report and not bringing this site forward for consideration at the Appropriate Assessment stage, as connectivity between this SPA and the META development is highly unlikely. Northern Cardigan Bay SPA is primarily designated for its population of wintering red-throated diver. Red-throated diver are considered to have the capability to move large distances during winter but are generally highly site faithful (Dierschke, 2017). Although red-throated diver are susceptible to disturbance and show a strong stress response (Dierschke, 2017), the species is capable of utilising a range of marine habitats and prey species and tend to occur at relatively low densities. Consequently, reduced prey intake caused by increased density-dependent competition is unlikely. As a result of their site faithful nature and the existing high levels of disturbance in the Waterway, connectivity between this SPA and the META project is unlikely, thus justifying the conclusion of the HRA Screening Report and not bringing this site forward for consideration at the Appropriate Assessment stage.

2.4.2 Benthic ecology

2.4.2.1 As outlined in Table 2.7, NRW requested that potential for temporary habitat disturbance to Annex I 'Reef' feature during META installation and retrieval activities should also include disturbance arising from marine cable installation and removal at East Pickard Bay (site 8). However, as outlined in section 2.3, since the HRA Screening Report (Appendix 1) was submitted to NRW, there has been a change to the project design envelope (PDE) for the META project which removes all aspects of the marine cable at East Pickard Bay (site 8). Therefore, this comment from NRW is no longer relevant to the HRA and no assessment of potential disturbance arising from marine cable installation and removal at East Pickard Bay (site 8) has been undertaken in this RIAA.

2.4.3 Diadromous fish

2.4.3.1 Consultation with NRW identified that a number of additional impacts should be screened into the HRA. These included temporary habitat disturbance, habitat loss, temporary increases in suspended sediments and sediment deposition, and underwater noise across all phases (see Table 2.7). As such, these have been included within this RIAA.

2.4.4 Marine mammals

Sites brought through to the Appropriate Assessment stage

2.4.4.1 NRW recommended in their response to the HRA Screening Report, and subsequently clarified via email correspondence (see Table 2.7 and Appendix 2), that the relevant marine mammal management units (MU) must be used as the spatial scale for screening marine mammal sites rather than the 100 km buffer described in paragraph 2.2.3.1. The only species for which the MU incorporates more designated sites for the particular species than the 100 km buffer used for the HRA Screening Report (see Appendix 1), is harbour porpoise (i.e. Celtic and Irish Seas (CIS) MU). All other marine mammal species are unaffected. Therefore, on the basis of this advice, an additional 13 European sites for harbour porpoise have been brought forward to this RIAA as outlined in Table 2.8. This includes Irish and French sites within the CIS MU with zone spéciale de conservation (ZSC) being the equivalent of SACs in France and Site d'Importance Communautaire (SIC) being the equivalent of SCIs.

2.4.4.2 In addition, the Lundy SAC has been included for grey seal on the basis that this site is also within the 100 km buffer of the META project.

2.4.4.3 Since the HRA Screening was undertaken the Bristol Channel Approaches cSAC and the West Wales Marine cSAC have been formally designated and are now SACs.

Impacts brought through to the Appropriate Assessment stage

2.4.4.4 The response from NRW to the HRA Screening Report also advised that LSE could not be excluded for underwater noise associated with potential pile drilling during installation and from the operation of tidal turbines during the operation and maintenance phase for the harbour porpoise features of the West Wales Marine SAC and Bristol Channel Approaches SAC and grey seal features of the Pembrokeshire Marine SAC, Cardigan Bay SAC and Pen Llyn a'r Sarnau SAC.

2.4.4.5 NRW also advised that changes to the hydrodynamic regime resulting in potential impairment of foraging opportunities for marine mammals should be included. These have therefore been included within this RIAA.

Approach to the RIAA

2.4.4.6 As outlined in Table 2.7, during correspondence with NRW Advisory Services on the use of marine mammal MUs for screening sites for LSE (see paragraph 2.4.4.1), NRW also recommended an approach to be adopted for the RIAA for harbour porpoise. It is understood that this advice was based on NRW guidance which was unpublished at the time of drafting this RIAA. The approach recommended by NRW advisory services was to assess the impacts on the European site closest to the META project and use those conclusions to assess the remaining sites. In the event that the assessment concludes an adverse effect on integrity for the closest site, the next closest site should then be considered. Whilst it is possible that adverse effect on integrity could be ruled out at more distant sites due to the decreased chance of animals from further away being impacted, this must be considered on a case by case basis.

2.4.4.7 The Applicant notes that this approach, whilst non-standard in term of the HRA Regulations (ruling out more distant sites on the basis of the decreased chance of animals being encountered and therefore impacted is typically undertaken at the LSE screening stage), is NRW advisory service's recommended approach to HRA for harbour porpoise for the META project. As such, this approach has been adopted by the Applicant in this RIAA for harbour porpoise only (see section 6.4). The Applicant would note however, that they have adopted a more precautionary approach than suggested by NRW advisory services, as all Welsh SACs for harbour porpoise have in the first instance, been assessed for potential adverse effect on site integrity. On the basis of the conclusions of these assessments, all other more distant sites have been ruled out for potential adverse effect on integrity (see section 6.4).

2.4.4.8 It should be noted however, that for all other species, a full RIAA has been presented on all sites screened in for potential LSE in the HRA Screening Report, regardless of the conclusions of the assessment for adverse effect on integrity for the closest site to the META project, as per the methodology outlined in section 1.3.3.

2.4.5 Marine ornithology

- 2.4.5.1 As outlined in Table 2.7, NRW agreed with the ornithological sites and features screened into the assessment but highlighted that an assessment of lighting on devices should be considered. Potential lighting impacts have however, been scoped out, due to the minimal lighting proposed within the PDE for the META project. Any lighting will be on marker buoys or devices only where surface piercing as a navigation measure. Given the existing status of the Waterway with regular boat movements and associated navigational lighting, any additional lighting associated with the META project is considered unlikely to result in any additional effect.

2.5 Likely significant effects

- 2.5.1.1 An updated summary of sites, features and potential impacts brought forward to this RIAA following the consultation outlined in section 2.3 above for each receptor group and also following the PDE changes, are detailed in Table 2.8 and shown in Figure 2-1 for Annex I habitats, Figure 2-2 for Annex II diadromous fish, Figure 2-3 for Annex II marine mammals, Figure 2-4 for Annex II otters and Figure 2-5 for marine ornithological features.

Table 2.8: European Sites and features for which LSEs have been identified/cannot be discounted.

Receptor	Site	Feature(s)	META Project phase	Impact – receptor pathway
Benthic ecology	Pembrokeshire Marine/Sir Benfro Forol SAC	Estuaries Large shallow inlets and bays Reefs	Installation/decommissioning	Temporary habitat disturbance Increased SSCs and sediment deposition Resuspension of contaminated sediments Introduction of Invasive Non-Native Species (INNS) Accidental pollution
			Operation and maintenance	Temporary habitat Loss Temporary habitat disturbance Introduction of INNS Accidental pollution
		Sandbanks which are slightly covered by sea water all the time Mudflats and sandflats not covered by seawater at low tide Coastal lagoons (*Priority feature) Atlantic salt meadows (<i>Glauco-Puccinellietalia maritimae</i>) Submerged or partially submerged sea caves	Installation/decommissioning	Increased SSCs and sediment deposition Resuspension of contaminated sediments Introduction of INNS Accidental pollution
			Operation and maintenance	Introduction of INNS Accidental pollution
	Limestone Coast of South West Wales SAC/Arfordir Calchfaen de Orllewin Cymru SAC	Submerged or partially submerged sea caves	Installation/decommissioning	Increased SSCs and sediment deposition Resuspension of contaminated sediments Introduction of INNS Accidental pollution
			Operation and maintenance	Introduction of INNS Accidental pollution
Diadromous fish	Pembrokeshire Marine/Sir Benfro Forol SAC	Twaite shad <i>Alosa fallax</i> Sea lamprey <i>Petromyzon marinus</i> River lamprey <i>Lampetra fluviatilis</i> Allis shad <i>Alosa alosa</i>	Installation/decommissioning	Temporary changes to fish and shellfish habitat Increased SSC and sediment deposition Underwater noise Accidental pollution
			Operation and maintenance	Underwater noise Collision risk Barrier effects Temporary habitat loss Accidental pollution
	Cleddau Rivers/Afonydd Cleddau SAC	Sea lamprey <i>Petromyzon marinus</i> River lamprey <i>Lampetra fluviatilis</i>	Installation/decommissioning	Accidental pollution
			Operation and maintenance	Collision risk Accidental pollution
Marine mammals	Pembrokeshire Marine/Sir Benfro Forol SAC	Grey seal <i>Halichoerus grypus</i>	Installation/decommissioning	Underwater noise Increased SSCs Accidental pollution

Receptor	Site	Feature(s)	META Project phase	Impact – receptor pathway
	West Wales Marine/Gorllewin Cymru Forol SAC Bristol Channel Approaches/Dynesfeydd Môr Hafren SAC North Anglesey Marine / Gogledd Môn Forol SAC North Channel SAC Rockabill to Dalkey Islands SAC Basket Islands SAC Roaringwater Bay and Islands SAC Nord Bretagne DH sites proposition de classement du Site d'Importance Communautaire (pSIC) Côte de Granit rose-Sept-Iles zone spéciale de conservation (ZSC) Tregor Goëlo ZSC Baie de Morlaix ZSC Abers - Côtes des legends ZSC Chaussée de Sein ZSC Ouessant-Molène ZSC Mers Celtiques - Talus du golfe de Gascogne pSIC	Harbour porpoise <i>Phocoena phocoena</i>	Operation and maintenance	Underwater noise Vessel collision risk Collision risk with tidal turbine Entanglement risk Changes to hydrodynamic regime Accidental pollution
			Installation/decommissioning	Underwater noise Increased SSCs Accidental pollution
			Operation and maintenance	Underwater noise Vessel collision risk Collision risk with tidal turbine Entanglement risk Changes to hydrodynamic regime Accidental pollution
			Installation/decommissioning	Underwater noise Accidental pollution
			Operation and maintenance	Underwater noise Vessel collision risk Collision risk with tidal turbine Entanglement risk Changes to hydrodynamic regime Accidental pollution
			Installation/decommissioning	Underwater noise Accidental pollution
			Operation and maintenance	Underwater noise Vessel collision risk Collision risk with tidal turbine Entanglement risk Changes to hydrodynamic regime Accidental pollution
			Installation/decommissioning	Accidental pollution
			Operation and maintenance	Vessel noise Vessel collision risk Collision risk with tidal turbine Accidental pollution
			Installation/decommissioning	Accidental pollution
			Operation and maintenance	Collision (entrapment) risk with vessels/ structures
Marine ornithology	Skomer, Skokholm and the seas off Pembrokeshire/Sgomer, Sgogwm a Moroedd Penfro SPA	Atlantic puffin <i>Fratercula arctica</i> Razorbill <i>Alca torda</i>	Installation/decommissioning	Accidental pollution
			Operation and maintenance	Collision (entrapment) risk with vessels/ structures

Receptor	Site	Feature(s)	META Project phase	Impact – receptor pathway
		Common guillemot <i>Uria aalge</i> Black-legged kittiwake <i>Rissa tridactyla</i>		Accidental pollution

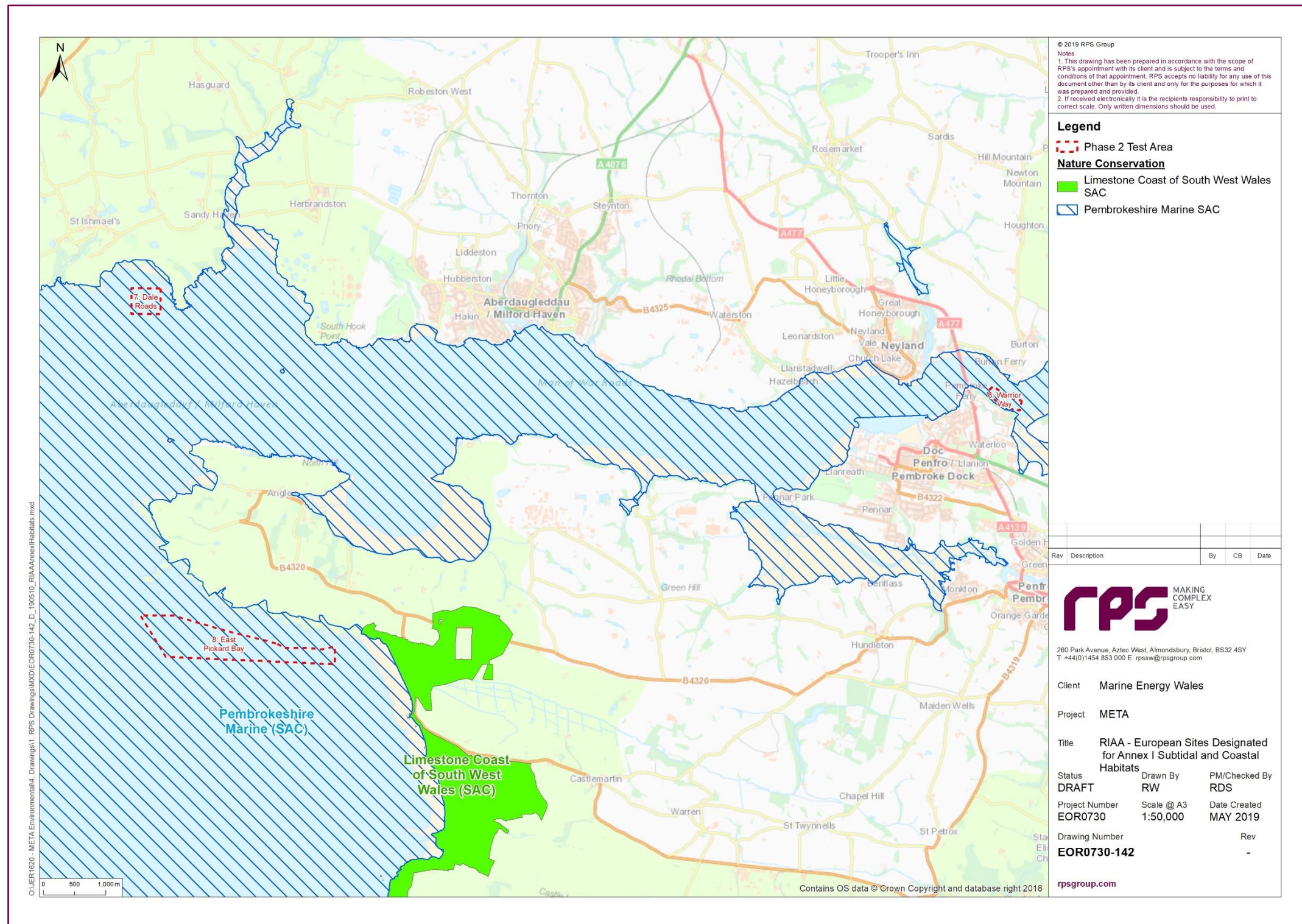


Figure 2-1: European sites designated for Annex I habitats (subtidal and coastal) brought forward to this RIAA.

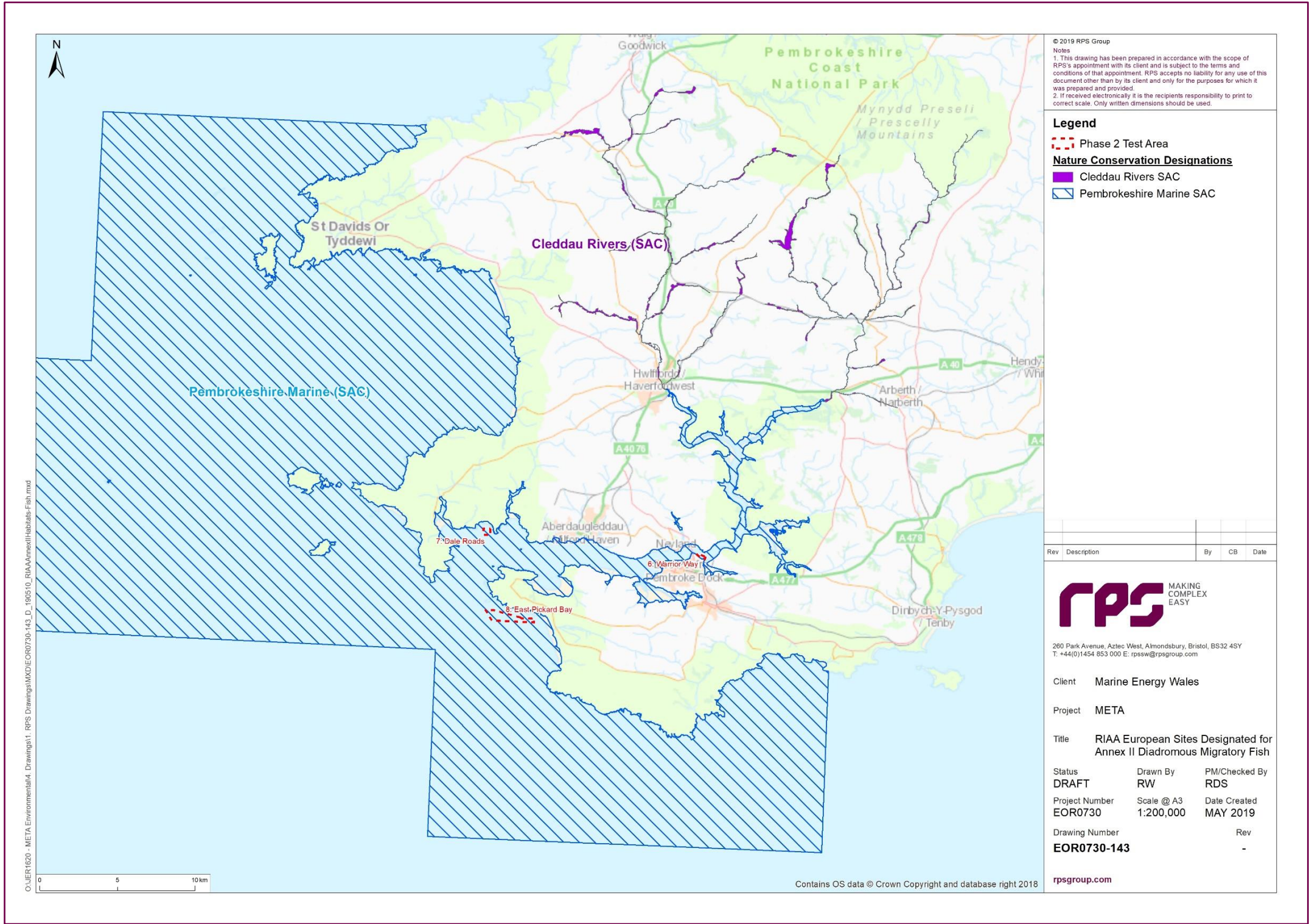


Figure 2-2: European sites designated for Annex II diadromous fish species brought forward to this RIAA.

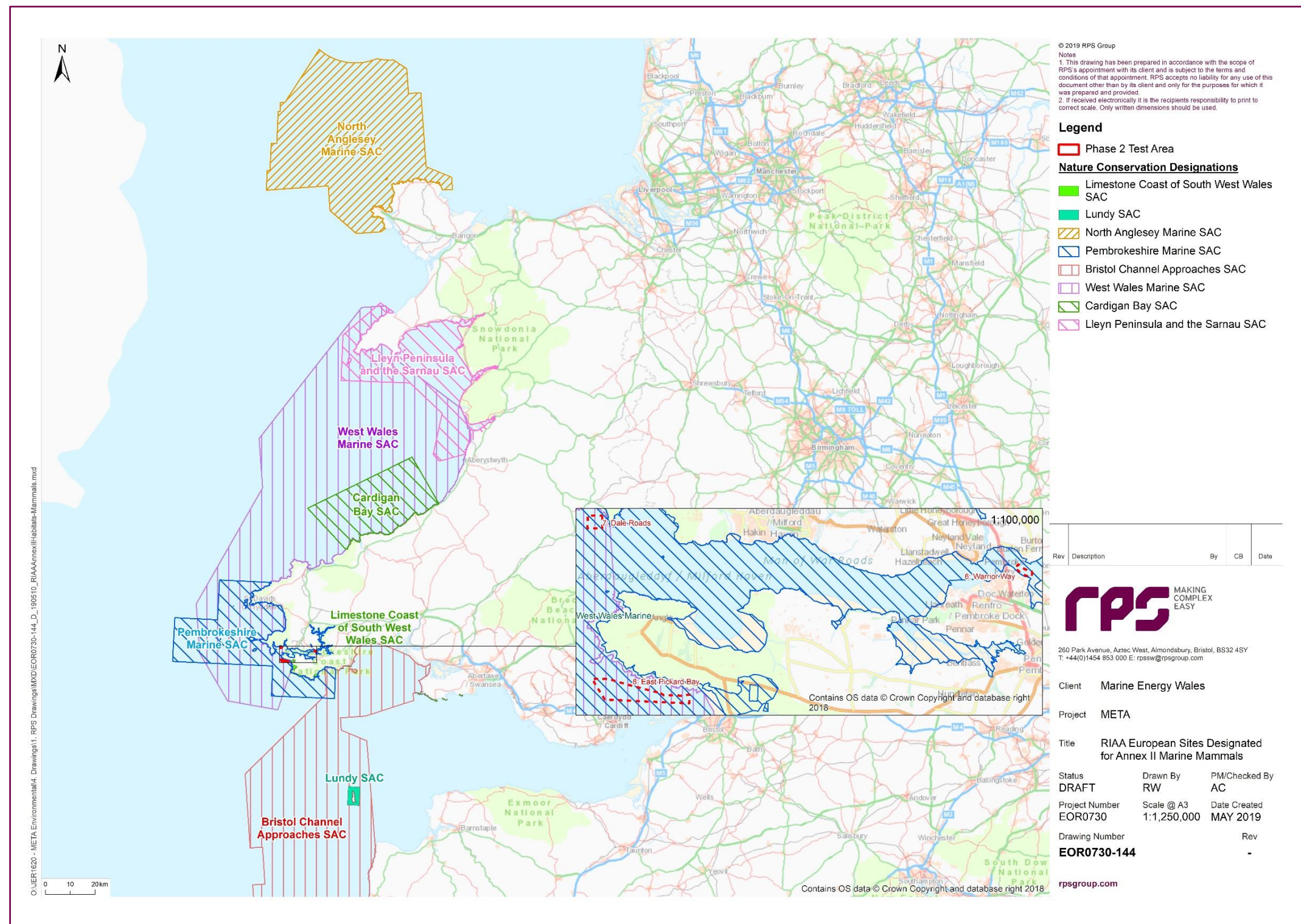


Figure 2-3: European sites designated for Annex II marine mammals brought forward to this RIAA.

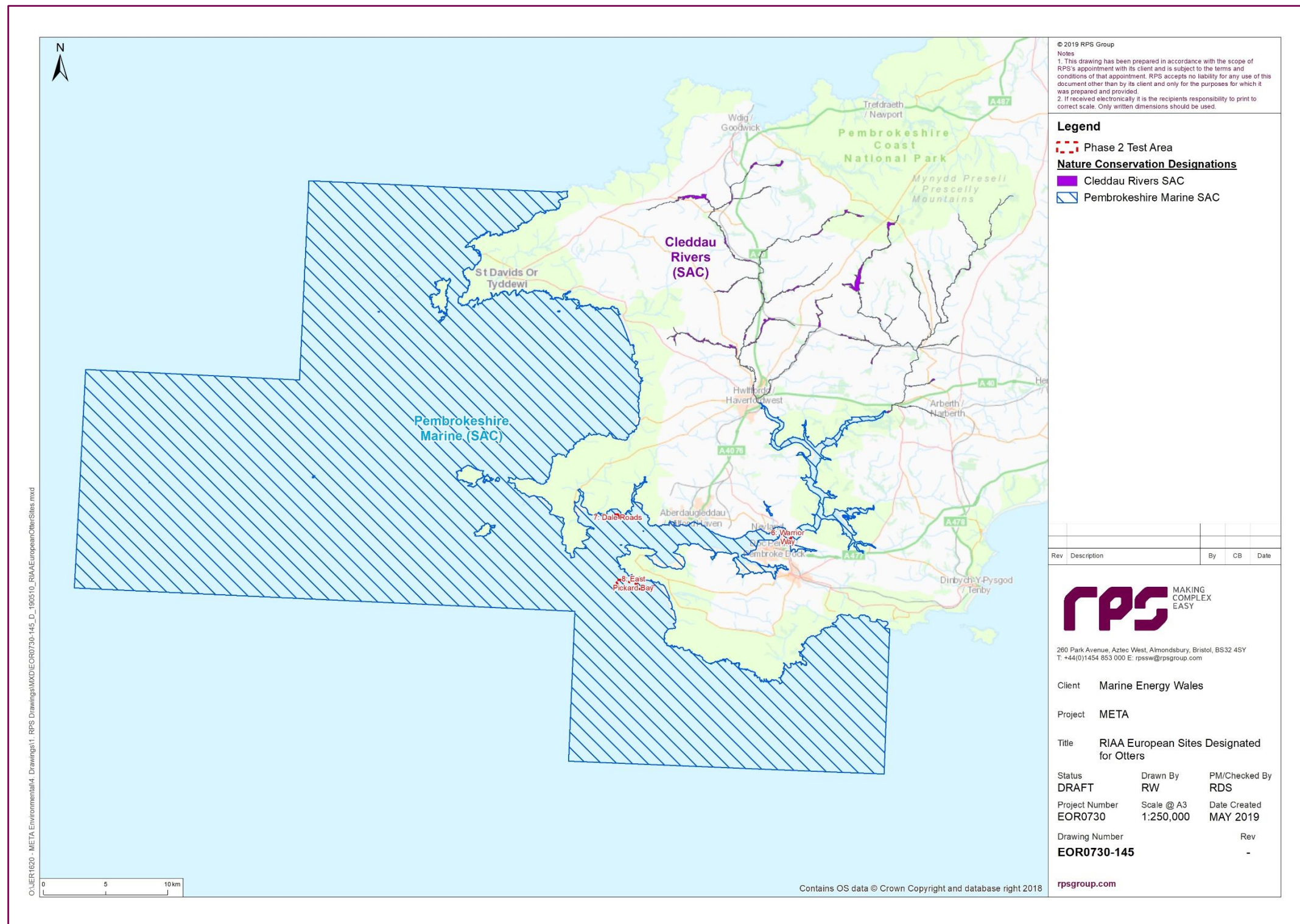


Figure 2-4: European sites designated for Annex II otters brought forward to this RIAA.

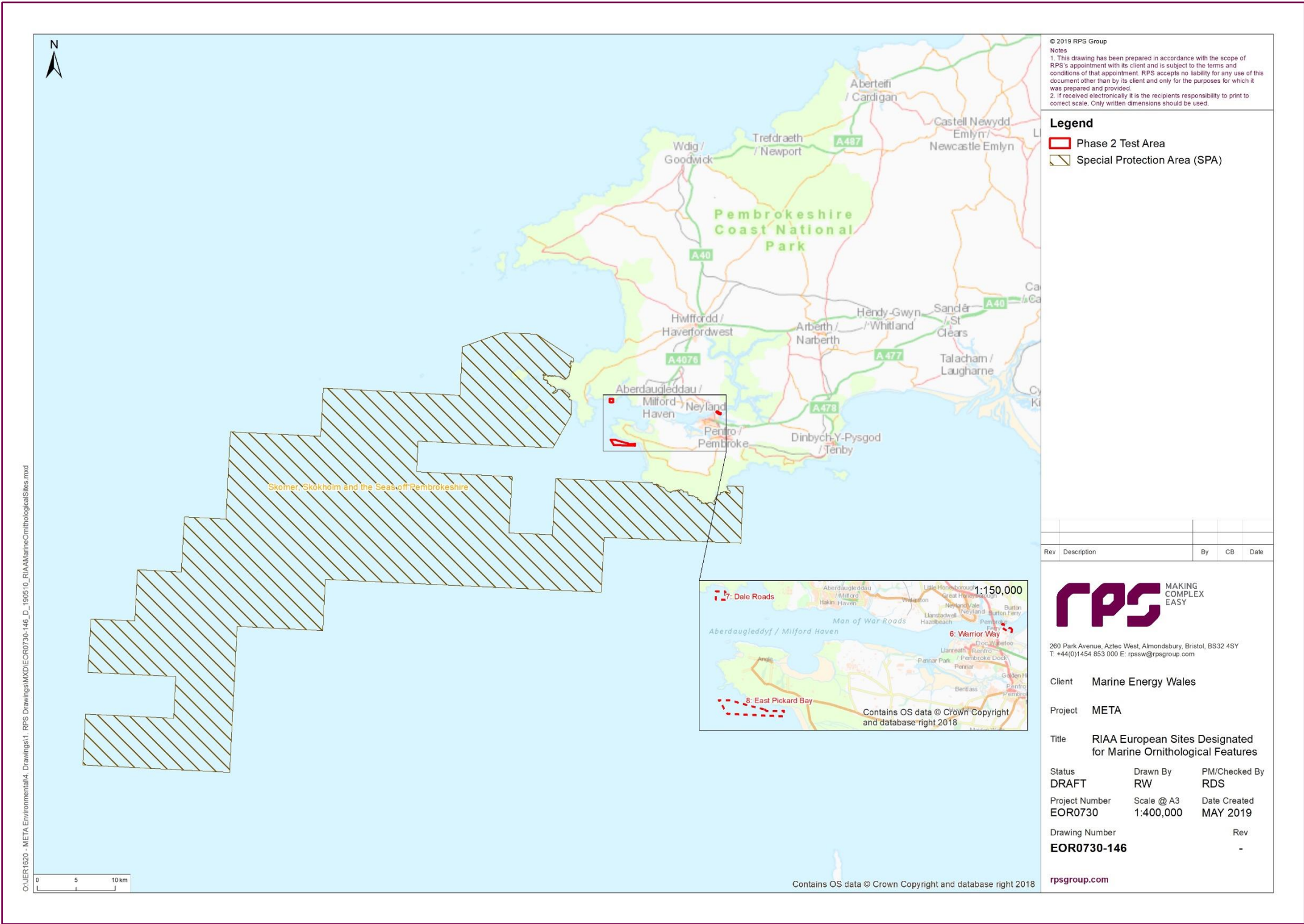


Figure 2-5: European sites designated for marine ornithological features brought forward to this RIAA.

3. INFORMATION TO INFORM THE APPROPRIATE ASSESSMENT

3.1.1.1 As described in section 1.3 above, a European Site is progressed to the Appropriate Assessment Stage (Stage 2 of the HRA) where it is not possible to exclude a LSE on one or more of its qualifying interest features in view of the Conservation Objectives. European Sites, features and potential impacts requiring an Appropriate Assessment for the META project are therefore those for which LSEs could not be ruled out during the screening exercise and following consultation (Table 2.8).

3.1.1.2 Information to help inform the Appropriate Assessment is provided in the following relevant receptors sections (i.e. section 4 for benthic Annex I habitats, section 5 for Annex II diadromous fish species, section 6 for Annex II marine mammal species, section 7 for Annex II otter, and section 8 for marine ornithology). This includes a description of the European Sites under consideration and their qualifying interest features, as well as an assessment of potential effects on site integrity in light of the Conservation Objectives of each site.

3.2 Maximum and most likely design scenarios

3.2.1.1 The maximum and most likely design scenarios for each of the potential impacts for each receptor group are tabulated separately in each of the receptor sections (i.e. section 4 for benthic Annex I habitats, section 5 for Annex II diadromous fish species, section 6 for Annex II marine mammal species, section 7 for Annex II otter, and section 8 for marine ornithology). The assessment scenarios are consistent with those used for assessment in relevant chapters of the META Environmental Statement, as follows:

- Volume 2, chapter 5: Coastal Processes;
- Volume 2, chapter 7: Benthic Subtidal and Intertidal Ecology;
- Volume 2, chapter 8: Fish and Shellfish Ecology;
- Volume 2, chapter 9: Marine Mammals, Basking Shark and Otter; and
- Volume 2, chapter 10: Marine Ornithology.

3.3 Project designed-in mitigation

3.3.1.1 As part of the project design process, a number of designed-in measures have been proposed to reduce the potential for impacts on European Site qualifying interest features. This approach has been employed in order to demonstrate commitment to measures by including them in the design of the META project and have therefore been considered in the assessments presented in this RIAA. A number of these measures are considered standard industry practice for marine developments. Relevant designed-in mitigation measures relating to benthic Annex I habitats, Annex II diadromous fish, Annex II marine mammals and otters and offshore ornithology are detailed, where relevant, in sections 4 to section 8.

3.4 Approach to in-combination assessment

3.4.1.1 The approach taken for assessment of in-combination impacts has been informed by the cumulative impacts assessment (CIA) carried out for relevant topics in the META Environmental Statement. The CIA methodology is described in detail in volume 1, chapter 4: Environmental Assessment Methodology of the Environmental Statement and summarised below.

3.4.1.2 The cumulative impacts of the project in conjunction with other proposed schemes have been considered within each topic chapter of the Environmental Statement. Other developments considered within the CIA include those that are:

- Under construction;
- Permitted, but not yet implemented; and
- Submitted, but not yet determined.

3.4.1.3 The types of project that have been considered with the CIA include:

- Other marine renewables projects;
- Other marine and coastal developments; and
- Temporal as well as spatial effects.

3.4.1.4 Developments that are built and operational at the time of submission are considered to be part of the existing baseline conditions.

3.4.1.5 Projects falling into the above categories were considered for inclusion within the CIAs presented for each topic chapter within the META Environmental Statement. In order to ensure consistency between assessments this approach has also been adopted for the RIAA.

4. ASSESSMENT OF ADVERSE EFFECTS ON SITE INTEGRITY: BENTHIC ANNEX I HABITAT FEATURES

4.1.1.1 The screening exercise (Stage 1 of the Habitats Regulations Assessment (HRA) process), and subsequent consultation with NRW (see section 2.3.5.1), identified potential for LSEs on the qualifying Annex I habitat features of the Pembrokeshire Marine/Sir Benfro Forol SAC and the Limestone Coast of South West Wales/Arfordir Calchfaen de Orllewin Cymru SAC as detailed in Table 2.8.

4.2 Conservation Objectives

4.2.1.1 The Conservation Objectives of the qualifying benthic Annex I interest features screened in for Stage 2 assessment (Table 2.8) are provided below. The Conservation Objectives have been informed by the Advice provided by Natural Resources Wales in fulfilment of Regulation 37 of the Conservation of Habitats and Species Regulations 2017 (NRW, 2018a) for the Pembrokeshire Marine SAC and the Core Management Plan (including Conservation Objectives) for the Limestone Coast of South West Wales SAC (CCW, 2008). The Conservation Objectives for these sites are provided in full in Appendix 3 and Appendix 4, respectively.

Pembrokeshire Marine SAC

4.2.1.2 The Conservation Objectives for Annex I habitat features of the Pembrokeshire Marine SAC are detailed in the Regulation 37 advice for the site (NRW, 2018a; see Appendix 3). In order to achieve FCS all of the following, subject to natural processes, need to be fulfilled and maintained in the long-term. If these objectives are not met restoration measures will be needed to achieve FCS:

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

Limestone Coast of South West Wales SAC

4.2.1.3 The Core Management Plan (including Conservation Objectives) for the Limestone Coast of South West Wales SAC (CCW, 2008) lists Conservation Objectives for each designated feature. The only feature for which LSE could not be excluded was submerged or partially submerged sea caves. The Conservation Objective for this feature includes a vision and a series of performance indicators. The vision for this feature is as follows:

- There should be minimal disturbance to the caves and they should remain closed to the public;

- The caves should remain suitable as bat roost/hibernation sites;
- The caves used by grey seal should remain free of human disturbance;
- The geological interest of the caves will be unconcealed;
- Natural processes such as small rock falls will be tolerated; and
- The effects of tidal activity in partially submerged caves should have a minimal effect on the internal environment of the cave (where the cave is a bat roost).

4.2.1.4 The performance indicators for the site include the following attributes:

- Extent and distribution - The caves will exist as determined by natural processes.
- Condition of caves - Other than ensuring that the caves remain free of human disturbance, both direct through physical damage and indirect through pollution and litter, there is little management of this feature that is either necessary or possible.

4.3 Baseline information

4.3.1.1 Baseline information on the Annex I habitat features of the European Sites identified for further assessment within the HRA process has been gathered through a comprehensive desktop study of existing studies and datasets, full details of which are presented within chapter 6: Benthic Subtidal and Intertidal Ecology of the Environmental Statement.

4.3.2 Pembrokeshire Marine SAC

4.3.2.1 Pembrokeshire Marine SAC extends from just north of Abereddy on the north Pembrokeshire coast to just east of Manorbier in the south, and includes the coast of the islands of Ramsey, Skomer, Grassholm, Skokholm, the Bishops and Clerks and The Smalls (see Figure 2-1).

4.3.2.2 The Pembrokeshire Marine SAC encompasses areas of sea, coast and estuary that support a wide range of different marine habitats and wildlife, some of which are unique in Wales. Pembrokeshire Marine SAC is a multiple interest site that has been selected for the presence of eight marine habitat types (NRW, 2018a). For the qualifying habitat features, the Pembrokeshire Marine SAC is considered to be one of the best areas in the UK for:

- Large shallow inlets and bays;
- Estuaries; and
- Reefs

4.3.2.3 The site supports a significant presence of:

- Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)
- Mud-flats and sand-flats not covered by seawater at low tide;
- Coastal lagoons;
- Submerged or partially submerged sea caves; and
- Sandbanks which are slightly covered by seawater all the time.

4.3.2.4 The features are distributed throughout the SAC with no single feature occupying the entire SAC, and with features overlapping in some locations (NRW, 2018a). The Pembrokeshire Marine SAC designation covers the entire Waterway and the Annex I habitats 'Estuary' and 'Large shallow inlets and bays' which are a primary reason for the selection of the site, are extensively distributed throughout the Waterway and encompass both the Warrior Way (site 6) and Dale Roads (site 7) sites (see

4.3.2.5 Figure 4-1).

4.3.2.6 As discussed in the following sections, the Annex I 'Estuary', 'Large shallow inlets and bays', 'Reefs' and 'Mudflats and sandflats not covered by seawater at low tide' features of the Pembrokeshire Marine SAC have a number of associated 'typical' species and habitats. Where typical species include species of fish, such as herring *Clupea harengus* for example, in order to consider whether effects have the potential to hinder the achievement of the Conservation Objective that "the presence, abundance, condition and diversity of typical species is such that habitat quality is not degraded", consideration has been given to potential impacts on important habitats supporting these species (e.g. herring spawning grounds).

Large shallow inlets and bays

4.3.2.7 The large shallow inlets and bays feature comprises the embayment of St Brides Bay, the marine inlet (or ria) of the Waterway and peripheral embayments including: Whitesands Bay; South Haven, Skomer; Gateholm – West Dale bays; Freshwater West. There are several habitats and species of conservation importance (Environment (Wales) Act Section 7 and OSPAR threatened and declining habitats and species) that occur within this habitat. These are:

- Estuarine rocky habitats;
- Fragile sponge and anthozoan communities on subtidal rocky habitats;
- Intertidal mudflats;
- Intertidal underboulder communities;
- Maerl;
- Mud habitats in deep water;
- *Musculus discors* beds;
- Mussel beds;
- *Ostrea edulis* beds;
- Seagrass beds;
- Seapens and burrowing megafauna;
- Sheltered muddy gravels;
- Subtidal mixed muddy sediments;
- Tide swept channels;
- Ocean quahog *Arctica islandica*;
- *Cruoria cruoriaeformis*;
- Pink sea fan *Eunicella verrucosa*;
- Kaleidoscope jellyfish *Haliclystus auricula*;

- Long-snouted seahorse *Hippocampus guttulatus*;
- *Lithothamnion corallioides*;
- *Lucernariopsis campanulata*;
- European flat oyster *Ostrea edulis*;
- *Padina pavonica*;
- *Palinurus elephas*;
- *Phymatolithon calcareum*;
- European eel *Anguilla anguilla*;
- Herring *Clupea harengus*;
- Common skate *Dipturus batis*;
- Plaice *Pleuronectes platessa*;
- Thornback ray *Raja clavata*;
- Spotted ray *Raja montagui*; and
- Common sole *Solea solea*.

4.3.2.8 As discussed in chapter 8: Fish and Shellfish Ecology of the Environmental Statement, the area encompassed by the Pembrokeshire Marine SAC provides suitable spawning habitat for the following typical fish species: plaice, sole and herring (Ellis *et al.*, 2012). The sheltered estuarine conditions also provide a safe environment for juvenile fish and other smaller species of fish, such as seahorses. The fish and shellfish study area can be considered as an important nursery area for the following typical fish species: plaice, sole, herring, spotted ray and thornback ray (Ellis *et al.*, 2012).

4.3.2.9 Herring, whose habitat preference for spawning is gravel, has been known to spawn at three gravel sites in the Waterway (Crothers, 1966; Clarke and King, 1985; Hobbs and Morgan, 1992) although positions vary from year to year according to gravel availability (see Figure 8.3 in chapter 8: Fish and Shellfish Ecology of the Environmental Statement). One historic spawning ground has been mapped to the north of Warrior Way (site 6) with the other two located mid-channel opposite Pennar Gut and further upriver past Burton. An interim report on the Milford Haven herring population by Dr David Clarke of SEACAMS (pers. comm.) suggests that spawning is greatly reduced compared to previous years (1980s), that herring growth rates are slower (this was reflected across the wider Celtic Sea Herring population possibly due to environmental pressures and not specific to the Milford Haven) and mean length and weight was considerably reduced potentially affecting fecundity of the species. The report by Clark *et al.* (2018) found that the historic spawning area adjacent to Warrior Way (site 6) was almost non-existent with no direct evidence of spawning activity. However, this study represents a 'snapshot' in time and more recent surveys (Dr David Clarke pers. comm, 2019) suggest that spawning is still occurring within these known sites as of March 2019.

Estuaries

4.3.2.10 The estuaries feature is associated with the wide range of environmental conditions, particularly seabed substrates, tidal streams and salinity gradients, there is a wide diversity of communities and species. The species-richness of sediment communities throughout the Waterway is high. The site includes smaller estuaries entering the Milford Haven, and wide intertidal mudflats with rich and productive invertebrate annelid and mollusc communities, occurring in 'pills' (creeks).

4.3.2.11 There are several habitats and species of conservation importance (Environment (Wales) Act Section 7 and OSPAR threatened and declining habitats and species) that occur within this habitat. These are:

- Estuarine rocky habitats;
- Fragile sponge and anthozoan communities on subtidal rocky habitats (only one point of confidence);
- Intertidal mudflats;
- Intertidal Underboulder Communities;
- Maerl;
- Mud habitats in deep water;
- *Musculus discors* beds;
- Mussel beds;
- *Ostrea edulis* beds;
- Seagrass beds;
- Sheltered muddy gravels;
- Subtidal mixed muddy sediments;
- Tide swept channels;
- *Phymatolithon calcareum*;
- *Anguilla anguilla*;
- *Clupea harengus*;
- *Dipturus batis*;
- *Pleuronectes platessa*;
- *Raja clavata*;
- *Raja montagui*; and
- *Solea solea*.

4.3.2.12 Habitats supporting typical fish species of this Annex I habitat feature are as described above in paragraphs 4.3.2.8 and 4.3.2.9.

Reefs

4.3.2.13 Reefs are distributed throughout the site (

4.3.2.14 Figure 4-1) and much of the intertidal zone is reef habitat, particularly along the open coast. Extensive areas of sublittoral rocky reefs stretch offshore from the west Pembrokeshire coast and around the islands and many small rocky islets. Reefs also extend through Milford Haven and into the variable salinity conditions of the Dagleddau estuary.

4.3.2.15 The shallower and south-west-facing rocky reefs are exposed to severe wave action, while many others are extremely wave-sheltered. Reef habitat diversity dependent on a range of variables, including aspect, slope, topography and water quality. More sheltered reefs, including those exposed to low salinities and high turbidity, typically support diverse and species-rich sponge and ascidian-dominated communities.

4.3.2.16 Subtidal reef habitat is typically characterised by algae and bivalves; for example, the biotope red seaweeds and kelps on tide-swept mobile infralittoral cobbles and pebbles (SS.SMp.KSwSS.LsacR.CbPb) has been recorded at reef habitat near the Cleddau bridge. The Skomer MCZ has the best studied reef habitat within the benthic subtidal and intertidal ecology study area. The steep subtidal walls off the north coast of Skomer are covered with soft corals including *Alcyonium digitatum* and *A. glomeratum*, pink sea-fans *Eunicella verrucosa* (a typical species of the Annex I 'large shallow inlets and bays' feature of the site), and turfs of seamats, hydroids, sponges and anemones. On the south side of Skomer Island, large silted boulders and rock plateaux display rich sponge communities and the nationally scarce scarlet and gold star coral *Balanophyllia regia*.

4.3.2.17 There are several habitats and species of conservation importance (Environment (Wales) Act Section 7 and OSPAR threatened and declining habitats and species) that occur within this habitat. These are:

- Estuarine rocky habitats;
- Fragile sponge and anthozoan communities on subtidal rocky habitats;
- Intertidal Underboulder Communities;
- *Musculus discors* beds (only one record);
- Mussel beds;
- *Ostrea edulis* beds;
- Subtidal mixed muddy sediments;
- Tide swept channels;
- *Anguilla anguilla*;
- *Clupea harengus*;
- *Cruoria cruoriaeformis*;
- *Dipturus batis*;
- *Eunicella verrucosa*;
- *Halicystus auricula*;
- *Hippocampus guttulatus*;
- *Lucernariopsis campanulata*;
- *Ostrea edulis*;
- *Padina pavonica*;
- *Palinurus elephas*;
- *Phymatolithon calcareum*;
- *Pleuronectes platessa*;
- *Raja clavata*; and
- *Solea solea*.



Atlantic salt meadows

4.3.2.18 Atlantic salt-meadow habitat occurs together with lower saltmarsh and adjacent transitional/freshwater marsh throughout the Waterway (NRW, 2018a). Tributary estuaries and lagoons within the Waterway are characterised by extensive pioneer saltmarsh and Atlantic salt-meadows and the habitat is distributed discontinuously on upper shores throughout and flanking both sides of the central and lower reaches of the Waterway. Saltmarsh habitat extends into the large shallow bays of Dale, Angle Bay and Sandy Haven (see

4.3.2.19 Figure 4-1).

Mudflats and sandflats not covered by seawater at low tide

4.3.2.20 Intertidal mudflats and sandflats are widespread in the site (

4.3.2.21 Figure 4-1), occurring between the low and high tide marks. They are distributed throughout embayments, inlets, estuaries and on the open coast within the site. Tributary estuaries and other wave-sheltered areas in the Milford Haven waterway are characterised by extensive upper, mid and low shore mudflats, supporting extensive pioneer salt-marsh and Atlantic salt-meadows. Moderately sheltered embayments in the lower Waterway have extensive shore flats with either sloping or constrained mid-upper shores similar to open coast embayments, or grading into adjacent tributary estuary mudflats.

4.3.2.22 Data hosted by EMODnet for the Phase 1 intertidal surveys undertaken by CCW between 1996 and 2006 (NRW, 2019) indicate that the intertidal communities associated with the mudflats in the Waterway are typically characterised by the EUNIS '*Hediste diversicolor* and *Streblospio shrubsolii* in littoral sandy mud' habitat (LMU.MU.HedStr). Further up the shore, the mudflats are often backed by mosaics of shingle and sand or rocky substrate typically characterised by the seaweeds such as *Fucus serratus* and *Ascophyllum nodosum*. The intertidal mudflats within the Pembroke River are predominantly characterised by the LMU.MU.HedStr habitat on the fringes and either sides of the channel, and *Zostera noltii* beds in upper to mid shore muddy sand.

4.3.2.23 There are several habitats and species of conservation importance (Environment (Wales) Act Section 7 and OSPAR threatened and declining habitats and species) that occur within this habitat. These are:

- Intertidal mudflats;
- Seagrass beds;
- Sheltered muddy gravels;
- Tide swept channels;
- *Halicystus auricula* (an old record);
- *Lucernariopsis campanulata*;
- *Anguilla anguilla*;
- *Clupea harengus*;
- *Dipturus batis*;

- *Pleuronectes platessa*;
- *Raja clavata*;
- *Raja montagui*; and
- *Solea solea*.

Coastal lagoons

4.3.2.24 Coastal lagoons are an Annex I priority habitat feature of the Pembrokeshire Marine SAC. Within the vicinity of Dale, in the Gann Estuary, there is a small coastal lagoon (Pickleridge Lagoon; see

4.3.2.25 Figure 4-1), with the only two other occurrences of this habitat occurring within the Carew River and inland at Westfield Pill (NRW, 2018a). Pickleridge Lagoon sediments consist of mud, gravel, shingle and poorly sorted sand mosaic. Pickleridge Lagoon has a typically estuarine/marine sandy substratum fauna at the south western end and sparse fauna at north east end. The lagoon cockle, *Cerastoderma glaucum* is present and there is fringing saltmarsh.

Submerged or partially submerged seacaves

4.3.2.26 Seacaves are widely distributed throughout the Pembrokeshire Marine SAC (

4.3.2.27 Figure 4-1) and are predominantly a feature of exposed coasts. Occurrences of this feature are concentrated around Skomer Island and around the mouth of the Waterway, including the coast to the north of the East Pickard Bay site (site 8). Some of the Welsh sea caves are used as pupping sites by grey seals *Halichoerus grypus* (see chapter 9: Marine Mammals, Basking Shark and Otter of the Environmental Statement). Very little is known about the benthic species colonising sea caves, but populations will include those tolerant of scour, of extreme wave surge and cryptic, apparent cave specialist species, including the rare snail *Palludinella littorina* (NRW, 2018a).

Sandbanks which are slightly covered by seawater all the time.

4.3.2.28 Offshore of the East Pickard Bay site (site 8) an area of coarse sediment corresponds with an area of identified Annex I habitat 'sandbanks which are slightly covered by seawater all the time' which is a feature of the Pembrokeshire Marine SAC (see

4.3.2.29 Figure 4-1). As outlined in the NRW Regulation 37 advice for the site (NRW, 2018a), the sandbank features of the Pembrokeshire Marine SAC are of sub-types gravelly and clean sands, and muddy sands. Within the benthic subtidal and intertidal ecology study area there are also sandbanks in the vicinity of Skokholm (The Knoll).

4.3.3 Limestone Coast of South West Wales SAC

- 4.3.3.1 The Limestone Coast of South West Wales SAC comprises a series of SSSI's stretching from Castlemartin at the western end of southern Pembrokeshire to the Bishopston Valley on the south-east coast of Gower (see Figure 2-1). The Carboniferous Limestone sea-cliffs include exposed and sheltered elevations, up to 50 m high in places, with numerous caves, arches, crevices and blow-holes.
- 4.3.3.2 The site has several terrestrial, coastal and species features, with one marine feature which is distributed throughout the SAC: Submerged or partially submerged sea caves.

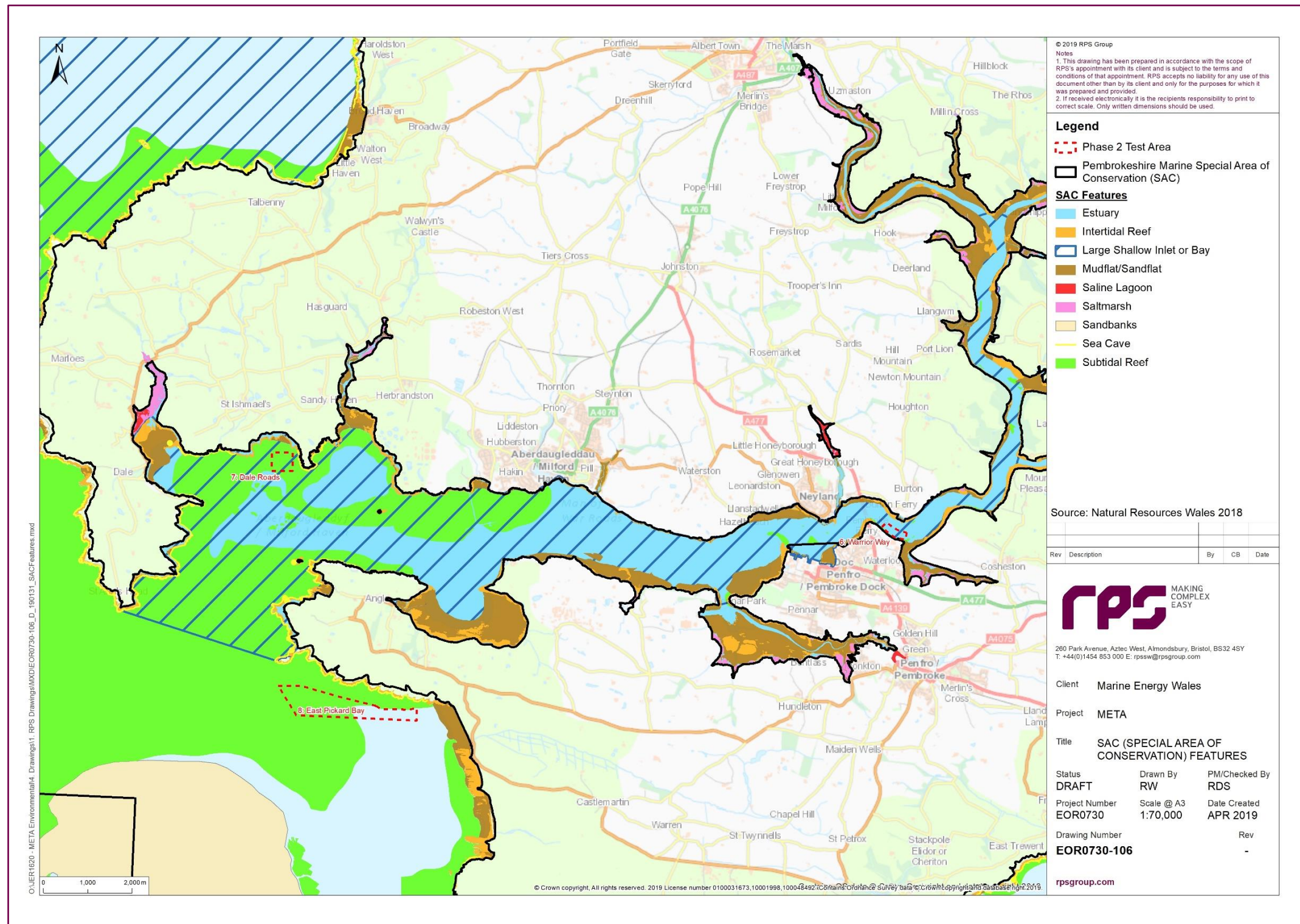


Figure 4-1: Annex I designated habitats of the Pembrokeshire Marine SAC.

4.4 Assessment of Adverse Effects on Integrity – the META project alone

4.4.1 Potential impacts – installation/decommissioning

Temporary habitat disturbance due to installation/decommissioning activities

- 4.4.1.1 Seabed clearance activities (e.g. boulder and debris clearance) within a 5 m buffer of the device/mooring footprints, prior to the installation of the devices and moorings, have the potential to result in the temporary disturbance of benthic habitats at each of the META test sites and subsequently the parts of the Pembrokeshire Marine SAC which overlap with this. There may also be temporary habitat disturbance as a result of mooring/anchor spreads for vessels employed in device/component installation.
- 4.4.1.2 The maximum and most likely design scenarios for temporary habitat disturbance, as presented in the chapter 6: Benthic Subtidal and Intertidal Ecology of the Environmental Statement, are summarised in Table 4.1 below.

Table 4.1: Maximum and most likely design scenarios considered for the assessment of potential impacts on Annex I habitats from temporary habitat disturbance during installation.

Maximum design scenario	Most likely design scenario
- Testing scenarios: - Warrior Way and Dale Roads: one testing activity/device deployment at any one time; - East Pickard Bay: two testing activities/device deployments at any one time; and - Up to 150 installation events occurring intermittently over the 15-year lifetime of the META project, 50% of which may touch the seabed, comprising: - Warrior Way: up to four device deployments in a 12-month period (i.e. up to 60 deployments over the project lifetime), 50% of which may touch the seabed; - Dale Roads: up to two device deployments in a 12-month period (i.e. up to 30 deployments over the project lifetime), 50% of which may touch the seabed; and - East Pickard Bay: up to two device deployments in a 12-month period at each berth therefore up to four device deployments over the project lifetime (i.e. up to 60 deployments over the project lifetime), 50% of which may touch the seabed. - Combined (Warrior Way + Dale Roads + East Pickard Bay) total subtidal temporary habitat disturbance at any one time of up to 124,679 m² comprising: - Up to 480 m² of temporary disturbance at Warrior Way per testing scenario broken down as follows:	- Testing scenarios: - Warrior Way, Dale Roads and East Pickard Bay: one testing activity/device deployment at any one time; and - Up to 60 installation events occurring intermittently over the 15-year lifetime of the META project, comprising: - Warrior Way: up to two device deployments in a 12-month period (i.e. up to 30 deployments over the project lifetime), 50% of which may touch the seabed; - Dale Roads: up to one device deployment in a 12-month period (i.e. up to 15 deployments over the project lifetime), 50% of which may touch the seabed; and - East Pickard Bay: up to one device deployment in a 12-month period (i.e. up to 15 deployments over the project lifetime), 50% of which may touch the seabed. - Combined (Warrior Way + Dale Roads + East Pickard Bay) total subtidal temporary habitat disturbance of up to 70,175 m² comprising: - Up to 75 m² of temporary disturbance at Warrior Way from a single mooring spread for deployment vessels at any one time;

Maximum design scenario	Most likely design scenario
- Up to 330 m² from a 5 m buffer around device footprint (200 m²) for seabed clearance activities; and - Up to 150 m² from a single mooring spread for deployment vessels.	- Up to 100 m² of temporary disturbance at Dale Roads from a single mooring spread for deployment vessels at any one time; and - Up to 70,000 m² of temporary disturbance at East Pickard Bay from mooring spread for deployment vessels per test activity.
- Up to 713 m² of temporary disturbance at Dale Roads per testing scenario broken down as follows: - Up to 513 m² from a 5 m buffer around device footprint (600 m²) for seabed clearance activities; and - Up to 200 m² from a single mooring spread for deployment vessels. - Up to 123,486 m² of temporary disturbance at East Pickard Bay per testing scenario broken down as follows: - Up to 3,485 m² from a 10 m buffer around device footprint (8,000 m²) for seabed clearance activities; and - Up to 120,000 m² from mooring spread for deployment vessels for up to two test activities at any one time.	

Embedded mitigation

- 4.4.1.3 As outlined in Table 7.13 of chapter 7: Benthic Subtidal and Intertidal Ecology of the Environmental Statement, measures adopted as part of the project to reduce impacts to benthic ecology include post-consent/pre-deployment Annex I reef surveys at Warrior Way (site 6) and Dale Roads (site 7). These surveys will identify and delineate any Annex I reef features present within these areas which will enable measures such as micrositing of moorings or device deployment location where necessary, to avoid direct impacts to reef habitat.

Benthic habitats associated with the Pembrokeshire Marine SAC

Estuaries

- 4.4.1.4 Both Warrior Way (site 6) and Dale Roads (site 7) overlap with the Annex I habitat 'estuaries' (there is no overlap with East Pickard Bay (site 8)) and, therefore, up to 1,193 m² of the total temporary habitat disturbance of 124,679 m² described in Table 4.1 is predicted to occur within this Annex I habitat per deployment, with up to 90 deployments at these two sites over the lifetime of the project. This represents 0.002% of the total area of Annex I estuary habitat within the Pembrokeshire Marine SAC per disturbance event.

- 4.4.1.5 All disturbance events will be restricted to the META test sites, will be of short-term duration, intermittent over the 15-year lifetime of the META project (although only a small proportion of the total area will be affected at any one time) and reversible. This is however considered to be highly precautionary as, the most likely design scenario only does not include any requirement for seabed clearance and therefore there would only be very limited disturbance (175 m²) across Warrior Way (site 6) and Dale Roads (site 7) under the most likely design scenario which represents 0.0003% of the total area of Annex I estuary habitat within the Pembrokeshire Marine SAC per disturbance event.
- 4.4.1.6 As discussed in paragraph 7.11.1.13 *et seq.* of chapter 7: Benthic Subtidal and Intertidal Ecology of the Environmental Statement, the sensitivity of the benthic communities/biotopes associated with this Annex I habitat is considered to be low as recovery of these biotopes following cessation of the disturbance is likely to occur within two years as opportunistic species will likely recruit rapidly back to disturbed areas and some damaged characterising species may recover or recolonise. Although there may be some repeat disturbance over the lifetime of the project, it is realistic to assume that sequential installations will affect different areas of seabed within the sites rather than the same footprint. It is therefore anticipated that this will allow sufficient time between any potential repeat disturbance events for the communities to fully recover.
- 4.4.1.7 With respect to habitats supporting typical fish species of this Annex I habitat (i.e. important spawning and nursery habitats), as discussed in paragraph 8.11.1.14 of chapter 8: Fish and Shellfish Ecology of the Environmental Statement, Warrior Way (site 6) and East Pickard Bay (site 8) lie within/adjacent to herring spawning grounds for example. However, extensive alternative spawning/nursery habitat is available throughout the Waterway and although nursery and spawning habitats may be more vulnerable to disturbance in the long-term, potential impacts on these areas are likely to be short-duration and of minimal extent due to limited overlap of the META sites with spawning or nursery areas. Furthermore, there will be no alteration to the substrate type within the META sites and therefore no change to the suitability of this habitat for spawning/nursery in the long-term.

Large shallow inlets

- 4.4.1.8 Both the Warrior Way (site 6) and Dale Roads (site 7) sites overlap with the Annex I habitat 'large shallow inlets' (there is no overlap with East Pickard Bay (site 8)) and, therefore, up to 1,193 m² of the total temporary habitat disturbance of 124,679 m² described in Table 4.1 is predicted to occur within this Annex I habitat per deployment with up to 90 deployments at these two sites over the lifetime of the project. This represents 0.0005% of the total area of Annex I large shallow inlet habitat within the Pembrokeshire Marine SAC per disturbance event.

- 4.4.1.9 All disturbance events will be restricted to the META test sites, will be of short-term duration, intermittent over the 15-year lifetime of the META project (although only a small proportion of the total area will be affected at any one time) and reversible. This is however considered to be highly precautionary. as the most likely design scenario does not include any requirement for seabed clearance and therefore there would only be very limited disturbance (175 m²) across Warrior Way (site 6) and Dale Roads (site 7) under the most likely design scenario which represents 0.00008% of the total area of Annex I estuary habitat within the Pembrokeshire Marine SAC per disturbance event.

- 4.4.1.10 Consideration of habitats supporting typical fish species of this Annex I habitat is as per paragraph 4.4.1.7.

Reefs

- 4.4.1.11 None of the META sites overlap with the known extent of Annex I rocky reef within the Pembrokeshire Marine SAC, as mapped on the Wales Marine Planning Portal. However, there is some overlap of Dale Roads (site 7) with the possible extent of Annex I rock reef as predicted on the Wales Marine Planning Portal. However, the measures adopted as part of the project, as outlined in paragraph 4.4.1.3, i.e. an Annex I reef survey at Warrior Way (site 6) and Dale Roads (site 7), will ensure that direct impact to Annex I reef features, if present, will be avoided by the implementation of mitigation measures to avoid them (e.g. micro-siting). Therefore, habitat disturbance to Annex I reef habitat at Warrior Way (site 6) and Dale Roads (site 7) is not predicted.

- 4.4.1.12 Consideration of habitats supporting typical fish species of this Annex I habitat is as per paragraph 4.4.1.7.

Conclusions

Pembrokeshire Marine SAC

- 4.4.1.13 Significant adverse effects on the qualifying Annex I habitats of the Pembrokeshire Marine SAC are not predicted to occur as a result of temporary habitat disturbance during installation activities. Potential effects from this activity on the relevant Conservation Objectives (as presented in paragraph 4.2.1.2) are discussed in turn below.

The overall distribution and extent of the habitat features within the site, and each of their main component parts is stable or increasing.

- 4.4.1.14 All disturbance during installation activities (i.e. seabed clearance and mooring spreads for deployment vessels) will be temporary, of short-term duration and will only affect a very small percentage of the total available extent of Annex I habitats within the SAC at any one time. Therefore, it is not considered that these activities will restrict the distribution or extent of identified Annex I habitat features from increasing or remaining stable.

The physical biological and chemical structure and functions necessary for the long-term maintenance and quality of the habitat are not degraded.

- 4.4.1.15 Given that the habitat disturbance will be temporary in nature, and the corresponding biological communities associated with the Annex I habitats are predicted to recover, it is not considered that installation activities will affect the physical biological and chemical structure and function of identified Annex I habitat features.

The presence, abundance, condition and diversity of typical species is such that habitat quality is not degraded.

- 4.4.1.16 Given that habitat disturbance associated with installation activities will be temporary and that the corresponding communities are predicted to recover following these activities, it is not considered that the typical benthic species associated with featured habitats will be affected in such a way that the habitat quality will be degraded. With regards to benthic habitats supporting typical fish species (i.e. spawning/nursery grounds), on the basis that extensive alternative spawning/nursery habitat is available throughout the Waterway, it is concluded that the overlap with known/potential spawning/nursery grounds is minimal and that the substrate type will remain unchanged in the long-term, therefore this Conservation Objective will also be maintained for typical fish species.

- 4.4.1.17 Therefore, no adverse effect on the integrity of the Pembrokeshire Marine SAC from this potential impact can be concluded.

Temporary increases in SSCs and associated sediment deposition due to installation/decommissioning activities

- 4.4.1.18 Sediment disturbance may arise from a range of installation activities within the site such as gravity base installation and drilling to install pin piles (drilling at Dale Roads (site 7) and East Pickard Bay (site 8) sites only; see Table 4.2). In terms of increased SSC, the greatest level of disturbance would be created by the installation of gravity bases or seabed mounted devices (see chapter 5: Coastal Processes).
- 4.4.1.19 The maximum and most likely design scenarios for temporary increases in SSCs and sediment deposition, as presented in the chapter 6: Benthic Subtidal and Intertidal Ecology of the Environmental Statement, are summarised in Table 4.2 below.

Table 4.2: Maximum and most likely design scenarios considered for the assessment of potential impacts on Annex I habitats from temporary increases in SSC and sediment deposition.

Maximum design scenario	Most likely design scenario
- As per installation activities outlined in Table 4.1 for temporary habitat disturbance arising from gravity base installation. - Drilling for pin pile installation as follows:	- As per installation activities outlined in Table 4.1 for temporary habitat disturbance arising from gravity base installation. - No drilling for pin pile installation.

Maximum design scenario	Most likely design scenario
- Dale Roads: up to four pin piles per device. Each pin pile up to 100 mm diameter installed to a depth of 10 to 20 m; and - East Pickard Bay: up to four pin piles per device. Each pin pile up to 100 mm diameter installed to a depth of 10 to 20 m.	
4.4.1.20	As outlined in paragraph 7.11.1.27 <i>et seq.</i> of chapter 6: Benthic Subtidal and Intertidal Ecology of the Environmental Statement, for all installation activities, the coarsest fraction of the material disturbed would be anticipated to settle relatively quickly to the seabed in the immediate vicinity of the works, and would therefore be expected to be spatially restricted to within the boundaries of the META sites.
4.4.1.21	At Warrior Way (site 6), all but the finest material from the sediment plume would settle within a relatively short period after the works are complete i.e. less than one hour (see chapter 5: Coastal Processes of the Environmental Statement). The plume itself would give rise to an average increase in SSC of up to 40 mg/l and would settle within two hours. The finest material may be expected to travel up to 100 m from the site and at levels which are within the range of reported background levels for the Waterway (i.e. 15 mg/l; see chapter 5: Coastal Processes of the Environmental Statement).
4.4.1.22	At Dale Roads (site 7), the very finest material is predicted to travel in the order of 600 m from the site during an average tidal cycle (see chapter 5: Coastal Processes of the Environmental Statement) with increases in SSC of up to 50 mg/l which is within the order of those experienced during storm conditions. Given the silty nature of the bed and the circulatory current it is anticipated that the material would be deposited within the bay from which it originated.
4.4.1.23	At East Pickard Bay (site 8), as the sediment has a lower fines content than sites within the Waterway, increases in SSC above background of 70 mg/l may occur but would settle within a relatively short period after the works are complete (i.e. within one hour) and within a short distance of the works (i.e. the very finest material would travel in the order of 50 m from the site during an average tide).
4.4.1.24	Due to the meso-tidal range of Warrior Way (site 6) and Dale Roads (site 7) and the high energy environment at East Pickard Bay (site 8), it can be expected that any plumes of fine sediments will quickly dissipate and disperse according to the sites' hydrological regimes (see chapter 5: Coastal Processes of the Environmental Statement).
4.4.1.25	Furthermore, chronic sediment disturbance and resuspension occurs in the Waterway by propeller wash and bow-waves of tankers, tugs, ferries, cargo and fishing vessels and by small vessel mooring. Major anthropogenic causes of mud resuspension within the Waterway are periodic dredging events and less frequent large-scale engineering projects (Little <i>et al.</i> , 2016). Therefore, it must be assumed that the communities present at Warrior Way (site 6) and Dale Roads (site 7) are routinely exposed to elevated SSC and must therefore have a degree of tolerance to this pressure.

Benthic habitats associated with the Pembrokeshire Marine SAC

- 4.4.1.26 On the basis of the predicted extents of any plumes of fine suspended sediments, as described in paragraphs 4.4.1.21 to 4.4.1.24 (i.e. a maximum of 600 m from the release site), the Annex I 'Sandbanks which are slightly covered by sea water all the time', Annex I 'coastal lagoon', Annex I 'Submerged or partially submerged sea caves' and Annex I 'Atlantic salt meadows' habitat features of the Pembrokeshire Marine SAC are not predicted to be affected by increased SSCs at any of the META sites due to their distance from the potential release sites.

Estuaries and large shallow inlets

- 4.4.1.27 Both Warrior Way (site 6) and Dale Roads (site 7) overlap with Annex I estuary and Annex I large shallow inlets habitats of the Pembrokeshire Marine SAC. As outlined in paragraph 7.11.1.35 *et seq.* of chapter 7: Benthic Subtidal and Intertidal Ecology of the Environmental Statement, the component communities and biotopes of these habitat features have a low sensitivity to impacts of this nature (Tillin and Budd, 2016; Tillin and Ashley, 2016; De-Bastos and Marshall, 2016; Tillin and Rayment, 2016a; Tillin, 2016). This is on the basis that many of the characterising species of these sediments and habitats are infaunal and will therefore be largely unaffected by changes to the water clarity. The characterising polychaetes are deposit feeders and are therefore unlikely to be affected in changes in the light penetration in the water column and would recover rapidly following changes to food availability. The potential for recoverability is considered to be high following a return to baseline conditions.
- 4.4.1.28 With respect to sediment deposition, as the local hydrodynamic conditions are not predicted to be affected by the installation works, it is expected that fine particles will be removed by wave or tidal action moderating the impact of this pressure. Furthermore, most infaunal bivalves and polychaete species are capable of burrowing through sediment to feed and although there may be an energetic cost to species as a result of this, is not likely to be significant (Tillin and Budd, 2016; Tillin and Rayment, 2016a).

- 4.4.1.29 With respect to habitats supporting typical fish species of this Annex I habitat (i.e. important spawning and nursery habitats), as discussed in paragraph 8.11.1.40 *et seq.* of chapter 8: Fish and Shellfish Ecology of the Environmental Statement, Warrior Way (site 6) and East Pickard Bay (site 8) lie within/adjacent to herring spawning grounds for example. Spawning and nursery grounds may be at higher risk of impact as juvenile fish and eggs are likely to have a higher mortality associated with increases in suspended sediments because juvenile fish are more likely to be affected due to decreased mobility and therefore a lower likelihood of avoidance of areas of increased SCC, and eggs may be become smothered by SSC resulting in a decrease of gas diffusion to the egg, leading to cell death. However, any increases in SSC in with the META project area are likely to be minimal, equivalent to background levels during storm events and short lived. Similarly, this level of sediment is unlikely to result in a change to the baseline sediments of the area where fish lay their eggs. Warrior Way (site 6) is located within several known spawning areas, and adjacent to a herring spawning site, no drilled piling is to occur at this location and any sediment produced will be as a result of placing structures on the seabed or propeller backwash. Any plumes generated through the placement of structures or from vessel propeller backwash will be quickly dissipated with no change to the baseline substrate.

Reef

- 4.4.1.30 Annex I reef habitat is located in the proximity of all three META sites. As discussed in paragraph 7.11.1.44 *et seq.* of chapter 7: Benthic Subtidal and Intertidal Ecology of the Environmental Statement, the sensitivity of the component communities and biotopes to this impact is considered to be low.
- 4.4.1.31 The benthic communities associated with the rocky substrate in the vicinity of East Pickard Bay (site 8) will have a low resistance (high vulnerability) and medium recoverability to temporary increases in SSCs. Characterising species such as bryozoans (e.g. *F. foliacea*) are suspension feeders that may be adversely affected by increases in suspended sediment, due to clogging of their feeding apparatus although many encrusting sponges appear to be able to survive in highly sedimented conditions (Readman, 2016a). As this habitat tends to occur in areas of high energy, an increase in suspended sediment will result in an increase in scour. While some sponges and *Flustra* are probably resistant of scour, other fragile sponges, and bryozoans may be removed. Smothering is likely to cause limited mortality amongst some of characterising species, particularly the smaller sponges. However, due to the moderate to strong water movement at East Pickard Bay (site 8), the removal of the deposited sediment is likely to be rapid.

- 4.4.1.32 The communities associated with the subtidal reef habitats at the sites within the Waterway are more sheltered from wave action and exposed to moderately strong tidal streams. The communities of cushion sponges and hydroids are unlikely to be sensitive to the increased SSCs predicted as many cushion sponges can survive in highly turbid conditions and as the species occur in estuarine conditions, they are likely to be well adapted to turbid conditions (Readman, 2016b). Many of the sponges have also been recorded in turbid conditions and overall resistance is considered to be high (vulnerability low) and recoverability is high (Readman, 2016b). Smothering is likely to impact hydroids, ascidian and sponge species, however it is likely that enough of the population would survive to recover quite rapidly should the thin layer of sediment deposited be removed. Therefore, resistance/vulnerability is assessed as medium and recoverability is high (Readman, 2016b).
- 4.4.1.33 As discussed in paragraph 7.11.1.48 *et seq.* of chapter 7: Benthic Subtidal and Intertidal Ecology of the Environmental Statement, the predominant intertidal biotopes which are likely to be present in association with the intertidal reef habitat are the fucoid dominated biotopes within the Waterway (i.e. LR.HLR.FT.FserT and LR.LLR.F.Fspi.FS) and the IR.HIR.KFaR.Ala.Ldig and LR.HLR.MusB.Sem biotopes at East Pickard Bay (site 8). Increased SSC can reduce the photosynthetic capacity of algal species and, in turbid waters the feeding apparatus of suspension feeders (e.g. barnacles and limpets) may become clogged. However, once baseline conditions return to normal, photosynthesis and growth rates of fucoids and kelps will resume (Perry and d'Avack, 2015; d'Avack and Marshall, 2015; Stamp, 2015; Tillin and Hill, 2016).
- 4.4.1.34 With respect to smothering of intertidal reefs, fucoids are attached to the substratum by a holdfast and are thus not able to relocate in response to increased sedimentation and smothering of bedrock can impede attachment of Fucus embryos as well as decrease survival and growth of juveniles. However, the state of the tide will determine the extent of the impact as if smothering occurs at low tide when the algae are lying flat on the substratum, then most of the organism as well as the associated community will be covered by the deposition of fine material. If smothering occurs whilst the alga is submerged standing upright then the photosynthetic surfaces of adult plants will be left uncovered (Perry and d'Avack, 2015; d'Avack and Marshall, 2015). However, adverse effects within the Waterway are not anticipated on the basis that the tidal flows will likely wash away any deposited sediment. Overall the sensitivity of Annex I intertidal reefs is considered to be low.
- 4.4.1.35 Consideration of habitats supporting typical fish species of this Annex I habitat is as per paragraph 4.4.1.29.

Mudflats and sandflats not covered by seawater at low tide

- 4.4.1.36 As discussed in paragraph 7.11.1.45 *et seq.* of chapter 7: Benthic Subtidal and Intertidal Ecology of the Environmental Statement, the benthic communities associated with the mudflats and sandflats occurring in the vicinity of Warrior Way (site 6) and Dale Roads (site 7) are not likely to be sensitive to increased SSC on the basis that high levels of turbidity are typical of these muddy environments (Tillin and Rayment, 2016b). Similarly, most of the characterising polychaete species will be able to burrow through sediment to reposition (Tillin and Rayment, 2016b).
- 4.4.1.37 For the sandier communities, characterising species live within the sand and are unlikely to be directly affected by an increased concentration of suspended matter in the water. Mobile and/or burrowing species are generally considered to be able to reposition following periodic siltation events such that none of the characterising species are considered likely to be significantly affected by the levels of deposition anticipated as a result of the META installation activities. The overall sensitivity of the communities associated with these habitats is considered to be low.
- 4.4.1.38 Consideration of habitats supporting typical fish species of this Annex I habitat is as per paragraph 4.4.1.29.

Sandbanks which are slightly covered by sea water all the time

- 4.4.1.39 On the basis of the predicted extents of any plumes of fine suspended sediments, as described in paragraphs 4.4.1.21 to 4.4.1.24 (i.e. a maximum of 600 m from the release site), the Annex I 'Sandbanks which are slightly covered by sea water all the time' habitat feature of the Pembrokeshire Marine SAC is not predicted to be affected by increased SSCs at any of the META sites due to their distance from the potential release sites.

Coastal lagoon

- 4.4.1.40 On the basis of the predicted extents of any plumes of fine suspended sediments, as described in paragraphs 4.4.1.21 to 4.4.1.24 (i.e. a maximum of 600 m from the release site), the Annex I 'coastal lagoon' habitat feature of the Pembrokeshire Marine SAC is not predicted to be affected by increased SSCs at any of the META sites due to their distance from the potential release sites.

Submerged or partially submerged sea caves

- 4.4.1.41 On the basis of the predicted extents of any plumes of fine suspended sediments, as described in paragraphs 4.4.1.21 to 4.4.1.24 (i.e. a maximum of 600 m from the release site), the Annex I 'Submerged or partially submerged sea caves' habitat feature of the Pembrokeshire Marine SAC is not predicted to be affected by increased SSCs at any of the META sites due to their distance from the potential release sites.

Atlantic salt meadows

- 4.4.1.42 On the basis of the predicted extents of any plumes of fine suspended sediments, as described in paragraphs 4.4.1.21 to 4.4.1.24 (i.e. a maximum of 600 m from the release site), the Annex I 'Atlantic salt meadows' habitat feature of the Pembrokeshire Marine SAC is not predicted to be affected by increased SSCs at any of the META sites due to their distance from the potential release sites.

Benthic habitats associated with the Limestone Coast of South West Wales SAC

Submerged or partially submerged sea caves

- 4.4.1.43 On the basis of the predicted extents of any plumes of fine suspended sediments, as described in paragraphs 4.4.1.21 to 4.4.1.24 (i.e. a maximum of 600 m from the release site), the Annex I 'Submerged or partially submerged sea caves' habitat feature of the Limestone Coast of South West Wales SAC are not predicted to be affected by increased SSCs at any of the META sites due to their distance from the potential release sites.

Conclusions

Pembrokeshire Marine SAC

- 4.4.1.44 Significant adverse effects on the qualifying Annex I habitats of the Pembrokeshire Marine SAC are not predicted to occur as a result of temporary increases in SSC and sediment deposition during installation activities. Potential effects from this activity on the relevant Conservation Objectives (as presented in paragraph 4.2.1.2) are discussed in turn below.

The overall distribution and extent of the habitat features within the site, and each of their main component parts is stable or increasing.

- 4.4.1.45 Effects associated increased SSC and sediment deposition will be temporary and small scale and it is not considered that these activities will restrict the distribution or extent of identified Annex I habitat features from increasing or remaining stable.

The physical biological and chemical structure and functions necessary for the long-term maintenance and quality of the habitat are not degraded.

- 4.4.1.46 Given that impacts will be temporary and that the sensitivity of the corresponding biological communities associated with the Annex I habitats are predicted to recover following cessation of installation activities, it is not considered that installation activities will affect the structure and function of identified Annex I habitat features.

The presence, abundance, condition and diversity of typical species is such that habitat quality is not degraded.

- 4.4.1.47 Given that habitat disturbance associated with installation activities will be temporary and that the corresponding communities are predicted to recover following these activities, it is not considered that the typical species associated with featured habitats will be affected in such a way that the habitat quality will be degraded. With regards to benthic habitats supporting typical fish species (i.e. spawning/nursery grounds), on the basis that elevations in SSC will be akin to those experienced during storm events and that no drilling to install pin piles will occur at Warrior Way (site 6) and in proximity to known recent herring spawning ground, this Conservation Objective will also be maintained for typical fish species.

- 4.4.1.48 Therefore, no adverse effect on the integrity of the Pembrokeshire Marine SAC from this potential impact can be concluded.

Limestone Coast of South West Wales SAC

- 4.4.1.49 Significant adverse effects on the qualifying marine Annex I habitat of the Limestone Coast of South West Wales SAC are not predicted to occur as a result of temporary increases in SSC and sediment deposition during installation activities. Potential effects from this activity on the relevant Conservation Objectives (taken as the performance objectives as presented in paragraph 4.2.1.4) are discussed below.

The caves will exist as determined by natural processes.

- 4.4.1.50 As plumes of sediments and sediment deposition arising during installation/decommissioning activities are predicted to be highly localised to the disturbance areas and are not predicted to extend to the sea cave features of the SAC, it is not considered that these activities will affect the natural processes of the caves.

The caves will remain free of human disturbance both direct through physical damage, and indirect through pollution and litter.

- 4.4.1.51 As plumes of sediments and sediment deposition arising during installation/decommissioning activities are predicted to be highly localised to the areas of seabed being disturbed within East Pickard Bay (site 8) and are not predicted to extend to the sea cave features of the SAC, it is not considered that these activities will result in direct or indirect human disturbance to this Annex I habitat feature.

- 4.4.1.52 Therefore, no adverse effect on the integrity of the Limestone Coast of South West Wales SAC from this potential impact can be concluded.

Sediment disturbance leading to the potential for resuspension of contaminated sediments due to installation/decommissioning activities

4.4.1.53 All installation activities with the potential to disturb sediments, as outlined in paragraph 4.4.1.18 above, will be short-term and temporary, affecting only discrete areas of seabed at any one time. As outlined discussed in detail in chapter 7: Benthic Subtidal and Intertidal Ecology of the Environmental Statement, the sediments within the Waterway have been exposed to historic levels of contamination, associated with the industries in the Waterway, with levels of hydrocarbons and metals at Dale Roads (site 7) and East Pickard Bay (site 8) likely to be lower than those at Warrior Way (site 6). It is likely, based on the available desktop information, that levels of contaminants are, on the whole, below levels which would result in adverse effects to benthic receptors.

4.4.1.54 The maximum and most likely design scenarios for the potential for resuspension of contaminated sediments due to installation/decommissioning activities is as presented in Table 4.2 above for increases in SSCs and sediment deposition.

Benthic habitats associated with the Pembrokeshire Marine SAC

4.4.1.55 The Annex I habitats with the potential to be affected during installation activities are: Annex I 'estuaries' and Annex I 'large shallow inlets' at Warrior Way (site 6) and Dale Roads (site 7), Annex I subtidal 'reef' at all three META sites and Annex I 'mudflats and sandflats not covered by seawater at low tide' habitat features of the Pembrokeshire Marine SAC.

4.4.1.56 On the basis of the predicted extents of any plumes of fine suspended sediments, as described in paragraphs 4.4.1.21 to 4.4.1.24 (i.e. a maximum of 600 m from the release site), the Annex I 'Sandbanks which are slightly covered by sea water all the time', Annex I 'coastal lagoon', Annex I 'Submerged or partially submerged sea caves' and Annex I 'Atlantic salt meadows' habitat features of the Pembrokeshire Marine SAC are not predicted to be affected due to their distance from the potential release sites and are therefore not considered further.

Estuaries and large shallow inlets

4.4.1.57 As discussed in paragraph 7.11.1.63 *et seq.* of chapter 7: Benthic Subtidal and Intertidal Ecology of the Environmental Statement, the component communities of Annex I 'estuaries' and 'large shallow inlets' habitat features are deemed to have a medium sensitivity to resuspended contaminated sediments. Polychaetes are largely expected to be tolerant of heavy metal contamination and are generally the first organisms to recolonise sediments polluted by hydrocarbons (Tillin and Rayment, 2016a; Tillin and Budd, 2016). Whilst echinoderms are also regarded as being tolerant of heavy metals, the capacity for bivalves to accumulate heavy metals in their tissues is well (Tillin and Rayment, 2016a; Tillin and Budd, 2016). Similarly, with respect to exposure to oil, contact generally results in an increase in energy expenditure and a decrease in feeding rate, resulting in less energy available for growth and reproduction. Echinoderms are similarly intolerant of hydrocarbon contamination. However, given the historic levels of anthropogenic impact and input to the Waterway, the benthic communities are expected to be tolerant to the existing levels of contaminants within the sediments at the META sites.

Reef

4.4.1.58 As discussed in paragraph 7.11.1.67 of chapter 7: Benthic Subtidal and Intertidal Ecology of the Environmental Statement, evidence for effects on subtidal reef from resuspended contaminants is sparse although given the historic levels of anthropogenic impact and input to the Waterway, the benthic communities associated are expected to be tolerant to the periodic increases in contaminated sediments such that the overall sensitivity of subtidal reef is likely to be low.

4.4.1.59 As discussed in paragraph 7.11.1.70 of chapter 7: Benthic Subtidal and Intertidal Ecology of the Environmental Statement, macroalgal communities associated with intertidal reef are likely to be relatively tolerant of contamination (Stamp, 2015), as are barnacles and gastropods (Tillin and Hill, 2016) although grazing gastropods such as limpets are well documented as being highly intolerant of hydrocarbon contamination (Stamp, 2015). Any disturbance to limpets and barnacles on reef habitat is likely to result in rapid recolonisation, although this will depend on processes such as larval supply and recruitment between populations. The overall sensitivity of intertidal reef communities is likely to be medium.

Mudflats and sandflats not covered by seawater at low tide

4.4.1.60 As discussed in paragraph 7.11.1.68 *et seq.* of chapter 7: Benthic Subtidal and Intertidal Ecology of the Environmental Statement, the benthic communities associated with the mudflats and sandflats habitat in the vicinity of Warrior Way (site 6) and Dale Roads (site 7) are considered to have an overall medium sensitivity to this impact (Tillin and Marshall, 2016).

Sandbanks which are slightly covered by sea water all the time

4.4.1.61 On the basis of the predicted extents of any plumes of fine suspended sediments, as described in paragraphs 4.4.1.21 to 4.4.1.24 (i.e. a maximum of 600 m from the release site), the Annex I 'Sandbanks which are slightly covered by sea water all the time' habitat feature of the Pembrokeshire Marine SAC is not predicted to be affected by any resuspension of contaminated sediments at any of the META sites due to their distance from the potential release sites.

Coastal lagoon

4.4.1.62 On the basis of the predicted extents of any plumes of fine suspended sediments, as described in paragraphs 4.4.1.21 to 4.4.1.24 (i.e. a maximum of 600 m from the release site), the Annex I 'coastal lagoon' habitat feature of the Pembrokeshire Marine SAC is not predicted to be affected by the resuspension of contaminated sediments at any of the META sites due to their distance from the potential release sites.

Submerged or partially submerged sea caves

- 4.4.1.63 On the basis of the predicted extents of any plumes of fine suspended sediments, as described in paragraphs 4.4.1.21 to 4.4.1.24 (i.e. a maximum of 600 m from the release site), the Annex I 'Submerged or partially submerged sea caves' habitat feature of the Pembrokeshire Marine SAC is not predicted to be affected by the resuspension of contaminated sediments at any of the META sites due to their distance from the potential release sites.

Atlantic salt meadows

- 4.4.1.64 On the basis of the predicted extents of any plumes of fine suspended sediments, as described in paragraphs 4.4.1.21 to 4.4.1.24 (i.e. a maximum of 600 m from the release site), the Annex I 'Atlantic salt meadows' habitat feature of the Pembrokeshire Marine SAC is not predicted to be affected by the resuspension of contaminated sediments at any of the META sites due to their distance from the potential release sites.

Benthic habitats associated with the Limestone Coast of South West Wales SAC

Submerged or partially submerged sea caves

- 4.4.1.65 On the basis of the predicted extents of any plumes of fine suspended sediments, as described in paragraphs 4.4.1.21 to 4.4.1.24 (i.e. a maximum of 600 m from the release site), the Annex I 'Submerged or partially submerged sea caves' habitat feature of the Limestone Coast of South West Wales SAC are not predicted to be affected by the resuspension of contaminated sediments at East Pickard Bay (site 8) due to their distance from the potential release sites.

Conclusions

Pembrokeshire Marine SAC

- 4.4.1.66 Significant adverse effects on the qualifying Annex I habitats of the Pembrokeshire Marine SAC are not predicted to occur as a result of resuspension of contaminated sediments during installation/decommissioning activities. Potential effects from this activity on the relevant Conservation Objectives (as presented in paragraph 4.2.1.2) are discussed in turn below.

The overall distribution and extent of the habitat features within the site, and each of their main component parts is stable or increasing.

- 4.4.1.67 Effects associated with this impact will not restrict the distribution or extent of identified Annex I habitat features from increasing or remaining stable.

The physical biological and chemical structure and functions necessary for the long-term maintenance and quality of the habitat are not degraded.

- 4.4.1.68 Given that the extent of disturbance will be small at each site and that the benthic communities are expected to be tolerant to the existing levels of contaminants within the sediments at the META sites, it is not considered that installation activities will affect the physical biological and chemical structure and function of identified Annex I habitat features.

The presence, abundance, condition and diversity of typical species is such that habitat quality is not degraded.

- 4.4.1.69 Given that the benthic communities, and supporting habitats for typical fish species, associated with Annex I habitats are expected to be tolerant to the existing levels of contaminants within the sediments at the META sites, it is not considered that the typical species associated with featured habitats will not be affected in such a way that the habitat quality will be degraded.

- 4.4.1.70 Therefore, no adverse effect on the integrity of the Pembrokeshire Marine SAC from this potential impact can be concluded.

Limestone Coast of South West Wales SAC

- 4.4.1.71 Significant adverse effects on the qualifying marine Annex I habitat of the Limestone Coast of South West Wales SAC are not predicted to occur as a result of the resuspension of contaminated sediments during installation/decommissioning activities. Potential effects from this activity on the relevant Conservation Objectives (taken as the performance objectives as presented in paragraph 4.2.1.4) are discussed below.

The caves will exist as determined by natural processes.

- 4.4.1.72 As the resuspension of contaminated sediments arising during installation/decommissioning activities is predicted to be highly localised to the disturbance areas and are not predicted to extend to the sea cave features of the SAC, it is not considered that these activities will affect the natural processes of the caves.

The caves will remain free of human disturbance both direct through physical damage, and indirect through pollution and litter.

- 4.4.1.73 As the resuspension of contaminated sediments during installation/decommissioning activities is predicted to be highly localised to the areas of seabed being disturbed within East Pickard Bay (site 8) and are not predicted to extend to the sea cave features of the SAC, it is not considered that these activities will result in direct or indirect human disturbance to this Annex I habitat feature.

- 4.4.1.74 Therefore, no adverse effect on the integrity of the Limestone Coast of South West Wales SAC from this potential impact can be concluded.

Installation/decommissioning activities facilitating the introduction of marine INNS

4.4.1.75 As assessed in paragraph 7.11.1.80 *et seq.* of chapter 7: Benthic Subtidal and Intertidal Ecology of the Environmental Statement, there is a risk of the introduction and spread of marine INNS during installation/decommissioning activities as a result of increased vessel movements. The maximum and most likely design scenarios for the potential for resuspension of contaminated sediments due to installation/decommissioning activities is as presented in Table 4.3 below.

Table 4.3: Maximum and most likely design scenarios considered for the assessment of potential impacts on Annex I habitats from the introduction of marine INNS.

Maximum design scenario	Most likely design scenario
- A total of up to 80 vessel movements/round trips to port, involving up to 15 vessels, associated with test deployments per year comprising: - Up to 20 vessel movements/round trips to port, involving up to five vessels, associated with test deployments at Warrior Way and Dale Roads; and - Up to 40 vessel movements/round trips to port, involving up to five vessels, associated with test deployments at East Pickard Bay.	- A total of up to 60 vessel movements/round trips to port, involving up to nine vessels, associated with test deployments per year comprising: - Up to 20 vessel movements/round trips to port, involving up to three vessels, associated with test deployments per year for each META test site.

Embedded mitigation

4.4.1.76 As outlined in Table 7.13 of chapter 7: Benthic Subtidal and Intertidal Ecology of the Environmental Statement, measures adopted as part of the project include the production of an Invasive Non-Native Species Management Plan (INNSMP) as part of the Environmental Management Plan (EMP) which will detail how the risk of potential introduction and spread of marine INNS will be minimised through the implementation of biosecurity control measures (e.g. all vessels to adhere to relevant guidelines and international conventions to minimise the transfer of marine INNS, use of anti-fouling on vessel hulls, all equipment to be of terrestrial origin and cleaned and dried before re-deployment).

Benthic habitats

4.4.1.77 The maximum design scenario for installation activities at Warrior Way (site 6) and Dale Roads (site 7) are anticipated to require up to 20 vessel movements/round trips to port per site, involving up to five vessels at any one time, per year. At East Pickard Bay (site 8), up to 40 vessel movements/round trips to port may be required per year, involving up to five vessels at any one time. For all three META sites combined, this equates to a maximum design scenario of an additional 80 vessel movements/round trips to port per year. The most likely design scenario, as outlined in Table 7.8, would require up to 60 vessel movements/round trips to port per year, involving up to three vessels at any one time.

4.4.1.78 The uplift in vessel traffic associated with META installation activities on the existing baseline levels is considered to be very small, furthermore the vessels employed in installation activities are likely to be local to the Waterway or Wales, thereby limiting the potential for the introduction of new marine INNS to the area via this pathway. The implementation of an INNSMP will further reduce the likelihood of a marine INNS being introduced to the Waterway as a result of vessel movements.

4.4.1.79 Few invasive non-indigenous species are likely to be able to colonise mobile sediments such as those associated with sandy sediments, due to the high-levels of sediment disturbance. One of the key species of concern is the slipper limpet *C. fornicata* which may settle on stones/gravels in substrates and on hard surfaces such as bivalve shells. However, the slipper limpet is well established in the Waterway, particularly in the inner reaches, since it was first introduced in 1953 (Bohn *et al.*, 2015). Therefore, although the sensitivity of the component biotopes/communities to INNS is considered to be high, on the basis of their vulnerability to and very low resilience/recoverability to colonisation by slipper limpet, the additional risk posed by other INNS is considered to be low.

Conclusions

Pembrokeshire Marine SAC

4.4.1.80 Significant adverse effects on the qualifying Annex I habitats of the Pembrokeshire Marine SAC are not predicted to occur as a result of the risk posed by the introduction of marine INNS during installation/decommissioning activities. Potential effects from this activity on the relevant Conservation Objectives (as presented in paragraph 4.2.1.2) are discussed in turn below.

The overall distribution and extent of the habitat features within the site, and each of their main component parts is stable or increasing.

4.4.1.81 Effects associated with this impact will not restrict the distribution or extent of identified Annex I habitat features from increasing or remaining stable.

The physical biological and chemical structure and functions necessary for the long-term maintenance and quality of the habitat are not degraded.

4.4.1.82 Given the designed in measures in place and that all vessels will be local to the Waterway or Wales, the risk that marine INNS will be introduced as a result of META installation/decommissioning activities is considered to be low. Therefore, it is not considered that installation activities will affect the structure and function of identified Annex I habitat features.

The presence, abundance, condition and diversity of typical species is such that habitat quality is not degraded.

4.4.1.83 Given the designed in measures in place and that all vessels will be local to the Waterway or Wales, the risk that marine INNS will be introduced as a result of META installation/decommissioning activities is considered to be low. Therefore, it is not considered that the typical species associated with featured habitats will be affected in such a way that the habitat quality will be degraded.

4.4.1.84 Therefore, no adverse effect on the integrity of the Pembrokeshire Marine SAC from this potential impact can be concluded.

Limestone Coast of South West Wales SAC

4.4.1.85 Significant adverse effects on the qualifying marine Annex I habitat of the Limestone Coast of South West Wales SAC are not predicted to occur as a result of the risk posed by the introduction of marine INNS during installation/decommissioning activities. Potential effects from this activity on the relevant Conservation Objectives (as presented in paragraph 4.2.1.4) are discussed in turn below.

The caves will exist as determined by natural processes.

4.4.1.86 Any minimal potential risk posed by the introduction of marine INNS will not affect the natural processes of the caves. Therefore, this Conservation Objective will be maintained.

The caves will remain free of human disturbance both direct through physical damage, and indirect through pollution and litter.

4.4.1.87 Given the designed in measures in place and that all vessels will be local to the Waterway or Wales, the risk that marine INNS will be introduced as a result of META installation/decommissioning activities is considered to be low. Therefore, it is not considered that the caves will be affected by human disturbance.

4.4.1.88 Therefore, no adverse effect on the integrity of the Limestone Coast of South West Wales SAC from this potential impact can be concluded.

Accidental pollution events during installation/decommissioning activities

4.4.1.89 There is the potential for the accidental release of pollutants into the marine environment during installation/decommissioning works as a result of accidental spillage or leakage for example. Pollution may include diesel oil from vessels and synthetic chemicals.

4.4.1.90 In the unlikely event that pollutants were to enter the Waterway, they would be rapidly dispersed on the surface and in the water column and subject to twice daily tidal flushing, therefore any effects on water quality would be limited.

Embedded mitigation

4.4.1.91 As outlined in Table 7.13 of chapter 7: Benthic Subtidal and Intertidal Ecology of the Environmental Statement, measures adopted as part of the project include the production of an EMP which will include planning for accidental spills, address all potential contaminant releases and include key emergency contact detail. This will ensure that the potential for release of pollutants from installation and decommissioning activities is minimised. In this manner, accidental release of potential release of contaminants from vessels will be strictly controlled, thus providing protection for marine life across all phases of the project.

Benthic habitats

4.4.1.92 Effects of an accidental pollution event on the species of Annex I habitats within the Pembrokeshire Marine SAC or Limestone Coast of South West Wales SAC would be depend on the extent of the spill and the toxicity of the pollutants released. Low energy intertidal sediments are generally more susceptible to chemical pollution than high energy coastal environments. Furthermore, the low dispersion within these areas may result in them acting as sinks for pollutants and heavy metals, as a result of them becoming adsorbed onto fine sediments and organic particulates (Clark, 1997).

4.4.1.93 The intolerance of component species to impacts of this nature is typically high, and bivalves in particular may experience mortality following an accidental contamination event. Recovery of the sediment requires dilution, biodegradation or removal of the contaminant from the sediments. Therefore, chemicals may persist for some time and it is likely that severe contamination will lead to declines in species richness although recoverability will typically be high as discussed in paragraph 4.4.1.57 *et seq.* Furthermore, as outlined in paragraph 4.4.1.53, the sediments within the Waterway have been exposed to historic levels of contamination and therefore the component species and communities of the Annex I habitats are expected to have some tolerance to contamination.

4.4.1.94 While associated flora and fauna communities could be affected by an accidental pollution event, the volumes of pollutants would likely be small enough to not cause a significant effect on the Conservation Objectives of the SAC. In addition, the embedded mitigation described would ensure that the potential of an event occurring would be highly unlikely.

Conclusions

Pembrokeshire Marine SAC

4.4.1.95 Significant adverse effects on the qualifying Annex I habitats of the Pembrokeshire Marine SAC are not predicted to occur as a result of the risk posed by accidental pollution events occurring during installation/decommissioning activities. Potential effects from this activity on the relevant Conservation Objectives (as presented in paragraph 4.2.1.2) are discussed in turn below.

The overall distribution and extent of the habitat features within the site, and each of their main component parts is stable or increasing.

- 4.4.1.96 The likelihood of any significant pollution event from the project of occurring is low enough to ensure that the distribution and extent of habitat features will not be restricted from remaining stable or increasing in the future.

The physical biological and chemical structure and functions necessary for the long-term maintenance and quality of the habitat are not degraded.

- 4.4.1.97 Some localised effects on habitat function maybe observed following an accidental pollution event, however the implementation of the proposed mitigation ensures the likelihood of an event is extremely low and therefore the structure and function of identified habitat features will not be degraded.

The presence, abundance, condition and diversity of typical species is such that habitat quality is not degraded.

- 4.4.1.98 In the event of an accidental pollution event, there may be a short-term impact on species diversity, presence and abundance but impacts in the medium to long-term are not predicted. Furthermore, the likelihood of an accidental event is low given the embedded mitigation measures. This will ensure that the habitat quality will not be degraded by any effects of the project on typical species.

- 4.4.1.99 Therefore, no adverse effect on the integrity of the Pembrokeshire Marine SAC from this potential impact can be concluded.

Limestone Coast of South West Wales SAC

- 4.4.1.100 Significant adverse effects on the qualifying marine Annex I habitat of the Limestone Coast of South West Wales SAC are not predicted to occur as a result of the risk posed by accidental pollution events during installation/decommissioning activities. Potential effects from this activity on the relevant Conservation Objectives (as presented in paragraph 4.2.1.4) are discussed in turn below.

The caves will exist as determined by natural processes.

- 4.4.1.101 Any minimal potential risk posed by accidental spills will not affect the natural processes of the caves. Therefore, this Conservation Objective will be maintained.

The caves will remain free of human disturbance both direct through physical damage, and indirect through pollution and litter.

- 4.4.1.102 Given the designed in measures in place, the likelihood of any significant pollution event from the project occurring is low enough to ensure that the caves will remain free of any indirect human disturbance as a result of pollution.

- 4.4.1.103 Therefore, no adverse effect on the integrity of the Limestone Coast of South West Wales SAC from this potential impact can be concluded.

4.4.2 Potential impacts – operation and maintenance

Temporary habitat loss through presence of infrastructure on the seabed

- 4.4.2.1 Temporary habitat loss will occur directly under all foundation structures (i.e. gravity bases or pin piles) and within the footprints of the devices/components themselves on the seabed. The maximum and most likely design scenarios for temporary habitat loss during operation and maintenance, as presented in the chapter 6: Benthic Subtidal and Intertidal Ecology of the Environmental Statement, are summarised in Table 4.4 below.

Table 4.4: Maximum and most likely design scenarios considered for the assessment of potential impacts on Annex I habitats from temporary habitat disturbance during installation.

Maximum design scenario	Most likely design scenario
- Testing scenarios: - Warrior Way and Dale Roads: one testing activity/device deployment at any one time; - East Pickard Bay: two testing activities/device deployments at any one time; and 150 deployments occurring over the 15-year lifetime of the META project, 50% of which may touch the seabed (breakdown of deployments/installation events is as per that outlined above for temporary habitat disturbance during installation). - Combined (Warrior Way + Dale Roads + East Pickard Bay) total subtidal habitat loss of up to 11,050 m² at any one time comprising: - Up to 200 m² of habitat loss at Warrior Way per testing scenario broken down as follows: - Up to 200 m² from device or component footprint on the seabed (including mooring/pin pile footprint). - Up to 600 m² of long-term habitat loss at Dale Roads per testing scenario broken down as follows: - Up to 600 m² from device or component footprint on the seabed (including mooring/pin pile footprint) - Up to 10,250 m² of habitat loss at East Pickard Bay broken down as follows: - Up to 10,250 m² from up to two device or component footprints on the seabed (including mooring/pin pile footprint). - Deployment durations:	- Testing scenarios: - Warrior Way, Dale Roads and East Pickard Bay: one testing activity/device deployment at any one time; and 60 installation events occurring over the 15-year lifetime of the META project, 50% of which may touch the seabed (breakdown of deployments/installation events is as per that outlined above for temporary habitat disturbance during installation). - Combined (Warrior Way + Dale Roads + East Pickard Bay) total subtidal habitat loss of up to 2,000 m² at any one time comprising: - Up to 100 m² of habitat loss at Warrior Way per testing scenario from device or component footprint on the seabed; - Up to 200 m² of habitat loss at Dale Roads per testing scenario from device or component footprint on the seabed; and - Up to 1,700 m² of habitat loss at East Pickard Bay per testing scenario from device or component footprint on the seabed. - Deployment durations: - Moored/gravity base deployment duration at Warrior Way: up to 3 months; - Moored/gravity base deployment duration at Dale Roads: up to 6 months; and - Moored/gravity base deployment duration at East Pickard Bay: up to 6 months.

Maximum design scenario	Most likely design scenario
- Moored/gravity base deployment duration at Warrior Way: up to 6 months; - Moored/gravity base deployment duration at Dale Roads: up to 12 months; and - Moored/gravity base deployment duration at East Pickard Bay: up to 18 months.	

Embedded mitigation

- 4.4.2.2 As outlined in Table 7.13 of chapter 7: Benthic Subtidal and Intertidal Ecology of the Environmental Statement, measures adopted as part of the project to reduce impacts to benthic ecology include post-consent/pre-deployment Annex I reef surveys at Warrior Way (site 6) and Dale Roads (site 7). These surveys will identify and delineate if present, any Annex I reef features within these areas, which will enable measures such as micrositing of moorings or device deployment location etc. to be implemented to avoid direct impacts to reef habitat.

Benthic habitats associated with the Pembrokeshire Marine SAC

Estuaries

- 4.4.2.3 Both the Warrior Way (site 6) and Dale Roads (site 7) sites overlap with the Annex I habitat 'estuaries' and, therefore, up to 800 m² of the total temporary habitat loss of 11,050 m² described in Table 4.4 is predicted to occur within this Annex I habitat per deployment with up to 90 deployments at these two sites over the lifetime of the project. This represents 0.001% of the total area of Annex I estuary habitat within the Pembrokeshire Marine SAC per deployment. All habitat loss will be restricted to the META test sites, temporary and of short-term duration. The maximum design scenario of deployment duration is up to six months at Warrior Way (site 6) and up to 12 months at Dale Roads (site 7).
- 4.4.2.4 The maximum design scenario is however considered to be highly precautionary and temporary habitat loss of Annex I estuary habitat, associated with the most likely design scenario, equates to only 300 m² per deployment across the two sites (i.e. 0.0005% of the of the total area of Annex I estuary habitat within the Pembrokeshire Marine SAC). The durations of deployment are also lower are outlined in Table 4.4.

- 4.4.2.5 It is anticipated that the benthic infaunal and epifaunal species associated with the sediments would be lost along with the substratum within the footprints of the infrastructure. However, whereas impacts such as habitat loss are often considered as a permanent impact, in the case of the META project the impact is only short-term as infrastructure will be removed within the timescales outlined above. As discussed previously in paragraph 4.4.1.6, recovery of the communities biotopes following removal of the infrastructure from the seabed is predicted to occur within two years as opportunistic species will likely recruit rapidly back to disturbed areas and some damaged characterising species may recover or recolonise. Although there may be some repeat disturbance over the lifetime of the project, it is realistic to assume that sequential installations will affect different areas of seabed within the sites rather than the same footprint. It is therefore anticipated that this will allow sufficient time between any potential repeat disturbance events for the communities to fully recover. Overall sensitivity is considered to be low.

- 4.4.2.6 With respect to habitats supporting typical fish species of this Annex I habitat (i.e. important spawning and nursery habitats), as discussed in paragraph 8.11.2.27 of chapter 8: Fish and Shellfish Ecology of the Environmental Statement, Warrior Way (site 6) and East Pickard Bay (site 8) lie within/adjacent to herring spawning grounds for example. However, extensive alternative spawning/nursery habitat is available throughout the Waterway and although nursery and spawning habitats may be more vulnerable to disturbance in the long-term, potential impacts on these areas are likely to be short-duration and of minimal extent due to limited overlap of the META sites with spawning or nursery areas. Furthermore, there will be no alteration to the substrate type within the META sites and therefore no change to the suitability of this habitat for spawning/nursery of typical species of this Annex I habitat in the long-term.

Large shallow inlets

- 4.4.2.7 Both the Warrior Way (site 6) and Dale Roads (site 7) sites overlap with the Annex I habitat 'large shallow inlets' and, therefore, up to 800 m² of the total temporary loss may occur within this Annex I habitat per deployment with up to 90 deployments at these two sites over the lifetime of the project. This represents 0.0004% of the total area of Annex I large shallow inlet habitat within the Pembrokeshire Marine SAC per deployment across the two sites. All habitat loss will be temporary, restricted to the META test sites and of short-term duration. The maximum design scenario of deployment duration is up to six months at Warrior Way (site 6) and up to 12 months at Dale Roads (site 7). The most likely design scenario would result in considerably less temporary habitat loss of 300 m² which equates to 0.0001% of the total area of Annex I large shallow inlet habitat within the Pembrokeshire Marine SAC.
- 4.4.2.8 As discussed in paragraph 4.4.2.5, although the communities and species associated with the Annex I habitats would be temporarily lost, recovery is predicted following removal of the infrastructure and so sensitivity is considered to be low.
- 4.4.2.9 Consideration of habitats supporting typical fish species of this Annex I habitat is as per paragraph 4.4.2.6.

Reefs

- 4.4.2.10
- None of the META sites overlap with the known extent of Annex I rocky reef within the Pembrokeshire Marine SAC, as mapped on the Wales Marine Planning Portal and furthermore, as outlined in paragraph 4.4.2.2, measures will be adopted to avoid direct impacts to reef habitat (if present) including micrositing of infrastructure. Therefore, direct impacts to subtidal reef are not predicted at any of the META sites from the placement of foundation structures or from the footprints of the devices/components themselves, on the seabed.
- 4.4.2.11
- Consideration of habitats supporting typical fish species of this Annex I habitat is as per paragraph 4.4.1.7.

Conclusions

Pembrokeshire Marine SAC

- 4.4.2.12
- Significant adverse effects on the qualifying Annex I habitats of the Pembrokeshire Marine SAC are not predicted to occur as a result of temporary habitat loss during operation and maintenance. Potential effects from this activity on the relevant Conservation Objectives (as presented in paragraph 4.2.1.2) are discussed in turn below.

The overall distribution and extent of the habitat features within the site, and each of their main component parts is stable or increasing.

- 4.4.2.13
- All habitat loss will be temporary, of short-term duration, and is predicted to affect a very small percentage of the total available extent of Annex I habitats within the SAC at any one time. Therefore, it is not considered that these activities will restrict the distribution or extent of identified Annex I habitat features from increasing or remaining stable.

The physical biological and chemical structure and functions necessary for the long-term maintenance and quality of the habitat are not degraded.

- 4.4.2.14
- Given that the habitat loss will be temporary and the corresponding biological communities associated with the Annex I habitats are predicted to recover, it is not considered that installation activities will affect the physical biological and chemical structure and function of identified Annex I habitat features.

The presence, abundance, condition and diversity of typical species is such that habitat quality is not degraded.

- 4.4.2.15
- Given that habitat loss will be temporary and that the corresponding communities are predicted to recover following these activities, it is not considered that the typical species associated with featured habitats will not be affected in such a way that the habitat quality will be degraded. With regards to benthic habitats supporting typical fish species (i.e. spawning/nursery grounds), on the basis that extensive alternative spawning/nursery habitat is available throughout the Waterway, that the overlap with known/potential spawning/nursery grounds is minimal, and that the substrate type will remain unchanged in the long-term, this Conservation Objective will also be maintained for typical fish species.
- 4.4.2.16
- Therefore, no adverse effect on the integrity of the Pembrokeshire Marine SAC from this potential impact can be concluded.

Temporary habitat disturbance during operation and maintenance

- 4.4.2.17
- The use of mooring spreads to anchor devices/components at the META sites has the potential to result in temporary disturbance to benthic habitats and communities for the duration of the deployment of devices/components at the META sites as a result of the movement of the mooring lines/chains on the surface of the sediment and/or anchors penetrating the substratum surface for example. The maximum and most likely design scenarios for temporary habitat disturbance during operation and maintenance, as presented in the chapter 6: Benthic Subtidal and Intertidal Ecology of the Environmental Statement, are summarised in Table 4.5 below.

Table 4.5: Maximum and most likely design scenarios considered for the assessment of potential impacts on Annex I habitats from temporary habitat disturbance during installation.

Maximum design scenario	Most likely design scenario
- Testing scenarios: - Warrior Way and Dale Roads: one testing activity/device deployment at any one time; - East Pickard Bay: two testing activities/device deployments at any one time; and - Up to 150 installation events occurring intermittently over the 15-year lifetime of the META project (breakdown of deployments/installation events is as per that outlined above for temporary habitat disturbance during installation). - Combined (Warrior Way + Dale Roads + East Pickard Bay) total subtidal temporary habitat disturbance at any one time of up to 500,350 m² comprising: - Up to 150 m² of temporary disturbance at Warrior Way per testing scenario from a single mooring spread at any one time. - Up to 200 m² of temporary disturbance at Dale Roads per testing scenario broken from a single mooring spread at any one time.	- Testing scenarios: - Warrior Way, Dale Roads and East Pickard Bay: one testing activity/device deployment at any one time; and - Up to 60 installation events occurring intermittently over the 15 year lifetime of the META project (breakdown of deployments/installation events is as per that outlined above for temporary habitat disturbance during installation). - Combined (Warrior Way + Dale Roads + East Pickard Bay) total subtidal temporary habitat disturbance at any one time of up to 1,425 m² comprising: - Up to 75 m² of temporary disturbance at Warrior Way from a single mooring spread at any one time; - Up to 100 m² of temporary disturbance at Dale Roads from a single mooring spread at any one time; and - Up to 1,250 m² of temporary disturbance at East Pickard Bay from a single mooring spread at any one time.

Maximum design scenario	Most likely design scenario
Up to 500,000 m² of temporary disturbance at East Pickard Bay per testing scenario from mooring spread for up to two test activities at any one time.	

Embedded mitigation

- 4.4.2.18 As outlined in Table 7.13 of chapter 7: Benthic Subtidal and Intertidal Ecology of the Environmental Statement, measures adopted as part of the project to reduce impacts to benthic ecology include post-consent/pre-deployment Annex I reef surveys at Warrior Way (site 6), Dale Roads (site 7). These surveys will identify and delineate if present, any Annex I reef features within these areas which will enable measures to be implemented, if necessary, (e.g. micro-siting of moorings etc.) to avoid direct impacts to reef habitat.

Benthic habitats associated with the Pembrokeshire Marine SAC

Estuaries

- 4.4.2.19 Both the Warrior Way (site 6) and Dale Roads (site 7) sites overlap with the Annex I habitat 'estuaries' therefore, up to 350 m² of the total temporary habitat disturbance described in Table 4.4 is predicted to occur within this Annex I habitat per deployment with up to 90 deployments at these two sites over the lifetime of the project. This represents a very small proportion (0.0006%) of the total area of Annex I estuary habitat within the Pembrokeshire Marine SAC per deployment. All habitat disturbance will be restricted to the META test sites, will be temporary, intermittent and of short-term duration.
- 4.4.2.20 The maximum design scenario is however considered to be highly precautionary and temporary habitat disturbance of Annex I estuary habitat, associated with the most likely design scenario, equates to only 175 m² per deployment across the two sites (i.e. 0.0003% of the of the total area of Annex I estuary habitat within the Pembrokeshire Marine SAC).
- 4.4.2.21 The sensitivity of the component species and communities is as described previously in paragraph 4.4.1.6 and in full in paragraph 7.11.2.43 *et seq.* of chapter 7: Benthic Subtidal and Intertidal Ecology of the Environmental Statement and is considered to be low.
- 4.4.2.22 With respect to habitats supporting typical fish species of this Annex I habitat (i.e. important spawning and nursery habitats), Warrior Way (site 6) and East Pickard Bay (site 8) lie within/adjacent to herring spawning grounds for example. However, extensive alternative spawning/nursery habitat is available throughout the Waterway and although nursery and spawning habitats may be more vulnerable to disturbance in the long-term, potential impacts on these areas are likely to be short-duration and of minimal extent due to limited overlap of the META sites with spawning or nursery areas. Furthermore, there will be no alteration to the substrate type within the META sites and therefore no change to the suitability of this habitat for spawning/nursery of typical species of this Annex I habitat in the long-term.

Large shallow inlets

- 4.4.2.23 Both the Warrior Way (site 6) and Dale Roads (site 7) sites overlap with the Annex I habitat 'large shallow inlets' and, therefore, up to 350 m² of the total temporary loss may occur within this Annex I habitat per deployment with up to 90 deployments at these two sites over the lifetime of the project. This represents 0.0001% of the total area of Annex I large shallow inlet habitat within the Pembrokeshire Marine SAC per deployment across the two sites. All habitat disturbance will be temporary, restricted to the META test sites and of short-term duration. The most likely design scenario would result in considerably less temporary habitat loss of 175 m² which equates to 0.00008% of the total area of Annex I large shallow inlet habitat within the Pembrokeshire Marine SAC.
- 4.4.2.24 The sensitivity of the component species and communities is as described previously in paragraph 4.4.1.6 and in full in paragraph 7.11.2.43 *et seq.* of chapter 7: Benthic Subtidal and Intertidal Ecology of the Environmental Statement and is considered to be low.
- 4.4.2.25 Consideration of habitats supporting typical fish species of this Annex I habitat is as per paragraph 4.4.2.22.

Reefs

- 4.4.2.26 None of the META sites overlap with the known extent of Annex I rocky reef within the Pembrokeshire Marine SAC, as mapped on the Wales Marine Planning Portal and furthermore, as outlined in paragraph 4.4.2.18, measures will be adopted to avoid direct impacts to reef habitat (if present prior to deployment) including micro-siting of mooring spreads. Therefore, direct impacts to Annex I reef habitat are not predicted at any of the META sites from the presence of mooring spreads during the operation of devices/component.
- 4.4.2.27 Consideration of habitats supporting typical fish species of this Annex I habitat is as per paragraph 4.4.2.22.

Conclusions

Pembrokeshire Marine SAC

- 4.4.2.28 Significant adverse effects on the qualifying Annex I habitats of the Pembrokeshire Marine SAC are not predicted to occur as a result of temporary habitat loss during operation and maintenance. Potential effects from this activity on the relevant Conservation Objectives (as presented in paragraph 4.2.1.2) are discussed in turn below.

The overall distribution and extent of the habitat features within the site, and each of their main component parts is stable or increasing.

4.4.2.29 All habitat disturbance will be temporary, of short-term duration and is predicted to affect a very small percentage of the total available extent of Annex I habitats within the SAC at any one time. Therefore, it is not considered that these activities will restrict the distribution or extent of identified Annex I habitat features from increasing or remaining stable.

The physical biological and chemical structure and functions necessary for the long-term maintenance and quality of the habitat are not degraded.

4.4.2.30 Given that the habitat disturbance will be temporary and the corresponding biological communities associated with the Annex I habitats are predicted to recover, it is not considered that installation activities will affect the physical biological and chemical structure and function of identified Annex I habitat features.

The presence, abundance, condition and diversity of typical species is such that habitat quality is not degraded.

4.4.2.31 Given that habitat disturbance will be temporary and that the corresponding communities are predicted to recover following these activities, it is not considered that the typical species associated with featured habitats will not be affected in such a way that the habitat quality will be degraded.

4.4.2.32 Therefore, no adverse effect on the integrity of the Pembrokeshire Marine SAC from this potential impact can be concluded.

Operation and maintenance activities facilitating the introduction of marine INNS

4.4.2.33 As assessed in chapter 7: Benthic Subtidal and Intertidal Ecology of the Environmental Statement, there is a risk of the introduction and spread of marine INNS during i operational activities as a result of the physical presence of infrastructure for the duration of deployments and increased vessel movements associated with the operation and maintenance of the devices/components. The maximum and most likely design scenarios for the potential for resuspension of contaminated sediments due to installation/decommissioning activities is as presented in Table 4.6 below.

Table 4.6: Maximum and most likely design scenarios considered for the assessment of potential impacts on Annex I habitats from the introduction of marine INNS.

Maximum design scenario	Most likely design scenario
- Physical presence of single devices or components at the Warrior Way and Dale Roads sites and up to two devices or components at the East Pickard Bay site. - A total of up to 358 vessel movements/round trips to port, involving up to 15 vessels, associated with test deployments per year comprising: - Up to 104 vessel movements/round trips to port, involving up to five vessels, associated with test deployments per year at the Warrior Way site; - Up to 104 vessel movements/round trips to port, involving up to five vessels, associated with test deployments per year at the Dale Roads site; and - Up to 150 vessel movements/round trips to port, involving up to five vessels, associated with test deployments per year at the East Pickard Bay site.	- Physical presence of single devices or components at the Warrior Way, Dale Roads and East Pickard Bay sites. - A total of up to 208 vessel movements/round trips to port, involving up to 15 vessels, associated with test deployments per year comprising: - Up to 52 vessel movements/round trips to port, involving up to three vessels, associated with test deployments per year at the Warrior Way site; - Up to 52 vessel movements/round trips to port, involving up to three vessels, associated with test deployments per year at the Dale Roads site; and - Up to 104 vessel movements/round trips to port, involving up to three vessels, associated with test deployments per year at the East Pickard Bay site.

Embedded mitigation

4.4.2.34 As outlined in Table 7.13 of chapter 2: Benthic Subtidal and Intertidal Ecology of the Environmental Statement, measures adopted as part of the project include the production of an INNSMP as part of the EMP which will detail how the risk of potential introduction and spread of marine INNS will be minimised during operation and maintenance activities through the implementation of biosecurity control measures (e.g. all vessels to adhere to relevant guidelines and international conventions to minimise the transfer of marine INNS, use of anti-fouling on vessel hulls, all equipment to be of terrestrial origin and cleaned and dried before re-deployment).

Benthic habitats associated with the Pembrokeshire Marine SAC and Limestone Coast of South West Wales SAC

- 4.4.2.35 For the maximum design scenario, operational activities at the META sites are anticipated to require up to 358 vessel movements/round trips to port, involving up to 15 vessels, per year. For the most likely design scenario, up to 208 vessel movements/round trips to port, involving up to 15 vessels, are likely to be required per year. Therefore, for both the maximum design and most likely design scenarios, the uplift in vessel traffic associated with META operational activities on the existing baseline levels is considered to be very small. The vessels are also likely to be local to, and originating from, the Waterway or Wales. This will therefore, limit the potential for the introduction of new marine INNS to the area via this pathway. As detailed in paragraph 4.4.2.34, an Invasive Species Management Plan for the project will also be developed and agreed in consultation with the statutory consultees which will further reduce the likelihood of a marine INNS being introduced to the Waterway as a result of the META operational activities.
- 4.4.2.36 The sensitivity of the Annex I habitat features of the Pembrokeshire Marine SAC is as described previously in paragraph 4.4.1.79.

Conclusions

Pembrokeshire Marine SAC

- 4.4.2.37 Significant adverse effects on the qualifying Annex I habitats of the Pembrokeshire Marine SAC are not predicted to occur as a result of the risk posed by the introduction of marine INNS during operation and maintenance activities. Potential effects from this activity on the relevant Conservation Objectives (as presented in paragraph 4.2.1.2) are discussed in turn below.
- The overall distribution and extent of the habitat features within the site, and each of their main component parts is stable or increasing.*
- 4.4.2.38 Effects associated with this impact will not restrict the distribution or extent of identified Annex I habitat features from increasing or remaining stable.
- The physical biological and chemical structure and functions necessary for the long-term maintenance and quality of the habitat are not degraded.*
- 4.4.2.39 Given the designed in measures in place and that all vessels will be local to the Waterway or Wales, the risk that marine INNS will be introduced as a result of META installation/decommissioning activities is considered to be low. Therefore, it is not considered that installation activities will affect the structure and function of identified Annex I habitat features.
- The presence, abundance, condition and diversity of typical species is such that habitat quality is not degraded.*

- 4.4.2.40 Given the designed in measures in place and that all vessels will be local to the Waterway or Wales, the risk that marine INNS will be introduced as a result of META installation/decommissioning activities is considered to be low. Therefore, it is not considered that the typical species associated with featured habitats will be affected in such a way that the habitat quality will be degraded.

- 4.4.2.41 Therefore, no adverse effect on the integrity of the Pembrokeshire Marine SAC from this potential impact can be concluded.

Limestone Coast of South West Wales SAC

- 4.4.2.42 Significant adverse effects on the qualifying marine Annex I habitat of the Limestone Coast of South West Wales SAC are not predicted to occur as a result of the risk posed by the introduction of marine INNS during operation and maintenance activities. Potential effects from this activity on the relevant Conservation Objectives (as presented in paragraph 4.2.1.4) are discussed in turn below.

The caves will exist as determined by natural processes.

- 4.4.2.43 Any minimal potential risk posed by the introduction of marine INNS will not affect the natural processes of the caves. Therefore, this Conservation Objective will be maintained.

The caves will remain free of human disturbance both direct through physical damage, and indirect through pollution and litter.

- 4.4.2.44 Given the designed in measures in place and that all vessels will be local to the Waterway or Wales, the risk that marine INNS will be introduced as a result of META installation/decommissioning activities is considered to be low. Therefore, it is not considered that the caves will be affected by human disturbance.

- 4.4.2.45 Therefore, no adverse effect on the integrity of the Limestone Coast of South West Wales SAC from this potential impact can be concluded.

Accidental pollution events during operation and maintenance activities

- 4.4.2.46 There is the potential for the accidental release of pollutants into the marine environment during operation and maintenance activities, as a result of accidental spillage or leakage for example. Pollution may include diesel oil from vessels and synthetic chemicals.
- 4.4.2.47 In the unlikely event that pollutants were to enter the Waterway, they would be rapidly dispersed on the surface and in the water column and subject to twice daily tidal flushing, and so any effects on water quality would be limited.

Embedded mitigation

- 4.4.2.48 As outlined in Table 7.13 of chapter 7: Benthic Subtidal and Intertidal Ecology of the Environmental Statement, measures adopted as part of the project include the production of an EMP which will include planning for accidental spills, address all potential contaminant releases and include key emergency contact detail. This will ensure that the potential for release of pollutants during operation and maintenance activities is minimised. In this manner, accidental release of potential release of contaminants from vessels will be strictly controlled, thus providing protection for marine life across all phases of the project.

Benthic habitats associated with the Pembrokeshire Marine SAC and Limestone Coast of South West Wales SAC

- 4.4.2.49 Effects of an accidental pollution event on the species of Annex I habitats within the Pembrokeshire Marine SAC and Limestone Coast of South West Wales SAC is as described previously in paragraph 4.4.1.89 *et seq.* While associated flora and fauna communities could be affected by an accidental pollution event, the volumes of pollutants would likely be small enough to not cause a significant effect on the Conservation Objectives of the SAC. In addition, the embedded mitigation described would ensure that the potential of an event occurring would be highly unlikely.

Conclusions

Pembrokeshire Marine SAC

- 4.4.2.50 Significant adverse effects on the qualifying Annex I habitats of the Pembrokeshire Marine SAC are not predicted to occur as a result of the risk posed by accidental pollution events occurring during operation and maintenance activities. Potential effects from this activity on the relevant Conservation Objectives (as presented in paragraph 4.2.1.2) are discussed in turn below.

The overall distribution and extent of the habitat features within the site, and each of their main component parts is stable or increasing.

- 4.4.2.51 The likelihood of any significant pollution event from the project of occurring is low enough to ensure that the distribution and extent of habitat features will not be restricted from remaining stable or increase in the future.

The physical biological and chemical structure and functions necessary for the long-term maintenance and quality of the habitat are not degraded.

- 4.4.2.52 Some localised effects on habitat function maybe observed following an accidental pollution event however, the implementation of the proposed mitigation ensures the likelihood of an event is extremely low and therefore the physical biological and chemical structure and function of identified habitat features will not be degraded.

The presence, abundance, condition and diversity of typical species is such that habitat quality is not degraded.

- 4.4.2.53 The low likelihood of an accidental event will ensure that the habitat quality will not be degraded by the project.

- 4.4.2.54 Therefore, no adverse effect on the integrity of the Pembrokeshire Marine SAC from this potential impact can be concluded.

Limestone Coast of South West Wales SAC

- 4.4.2.55 Significant adverse effects on the qualifying marine Annex I habitat of the Limestone Coast of South West Wales SAC are not predicted to occur as a result of the risk posed by accidental pollution events during operation and maintenance activities. Potential effects from this activity on the relevant Conservation Objectives (as presented in paragraph 4.2.1.4) are discussed in turn below.

The caves will exist as determined by natural processes.

- 4.4.2.56 Any minimal potential risk posed by accidental spills will not affect the natural processes of the caves. Therefore, this Conservation Objective will be maintained.

The caves will remain free of human disturbance both direct through physical damage, and indirect through pollution and litter.

- 4.4.2.57 Given the designed in measures in place, the likelihood of any significant pollution event from the project occurring is low enough to ensure that the caves will remain free of any indirect human disturbance as a result of pollution.

- 4.4.2.58 Therefore, no adverse effect on the integrity of the Limestone Coast of South West Wales SAC from this potential impact can be concluded.

4.5 Assessment of Adverse Effects on Integrity – the META project in-combination with other plans or projects

- 4.5.1.1 The other developments (projects/plans) that could result in-combination effects associated with the proposal on Annex I benthic features of the designated sites identified have been summarised in Table 4.7.

4.5.1.2 A number of impacts considered for the META project alone, as set out in section 4, have not been considered in the in-combination assessment. This is because many of the potential impacts identified and assessed for the META project alone are relatively localised and temporary in nature and therefore have limited or no potential to interact with similar changes associated with other projects. On this basis, the potential impacts identified for assessment as part of the benthic subtidal and intertidal ecology CIA in chapter 7: Benthic Subtidal and Intertidal Ecology of the Environmental Statement, and which have been brought forward for consideration in the in-combination assessment of the RIAA are:

- Cumulative habitat loss/disturbance may affect benthic ecology; and
- Cumulative increases in SSC and sediment deposition may affect benthic ecology.

Table 4.7: List of other projects and plans with potential for in-combination effects on Annex I benthic features.

Phase	Developer - Reference	Distance from Warrior Way (site 6)	Distance from Dale Roads (site 7)	Distance from East Pickard Bay (site 8)	Dates of installation/ operation	Spatial / temporal overlap with the META project	Details	Further assessment required?	Justification for screening into in-combination assessment
Plans									
Installation/ Operation and Maintenance/ Decommissioning	Draft National Welsh Marine Plan (dWNMP) (Welsh Government, 2017)	0.00	0.0	0.0	Spatial overlap and temporal overlap	The WNMP is being prepared by the Welsh Government in accordance with the Marine and Coastal Access Act 2009 (MCAA). The purpose of marine planning under the MCAA is to help achieve sustainable development in the marine area. Welsh Ministers are the Marine Planning Authority under the MCAA, responsible for creating marine plans for both the inshore region (0-12 nautical miles) and offshore region (beyond 12 nautical miles) of Wales. Plans for both regions will be presented in a single document, the WNMP. The dWNMP applies to the Welsh marine area which consists of around 32,000 km2 of sea, as well as 2,120 km of coastline.	The WNMP will be implemented over a 20-year period, with 3 yearly reviews.	Yes – Benthic Subtidal and Intertidal habitats, Coastal and supralittoral habitats, Marine Mammals, Diadromous fish, Pelagic seabirds (breeding and wintering); and Wildfowl and waders (breeding and wintering)	As there is the potential for both temporal and spatial overlap of the META project with the dWNMP, it cannot be excluded from further consideration.
Dredging sites									
Installation / Operation and Maintenance	Neyland Yacht Haven Ltd. - DML1743	1.1	12.3	10.5	13/12/2017-12/12/2020	No spatial overlap with consented areas. Potential for temporal overlap.	Dredge and disposal from Neyland Marina - annual volume 5500 m³.	Yes	Sediment plumes generated during dredging activities may present potential cumulative impacts with the META project.
Installation/ Operation and Maintenance	Milford Haven Port Authority - DML1646	1.3	1.5	2.5	09/03/2017-08/03/2022	No spatial overlap with consented areas. Temporal overlap with all sites.	Maintenance dredging throughout the Milford Haven. Annual volume 362500 m³.	Yes	
Dredge disposal sites									
Installation/ Operation and Maintenance	Neyland dredge disposal site - LU190	0.5	12.4	10.5	N/A	No spatial overlap with any of the consented areas. Temporal overlap	Location: South of Neyland within the central channel of the Milford Haven, 0.22 nm diameter x 5 m depth. Status: Open	Yes	Sediment plumes generated from placement of material in identified disposal ground may present potential cumulative impacts with the META project.
Infrastructure									

Phase	Developer - Reference	Distance from Warrior Way (site 6)	Distance from Dale Roads (site 7)	Distance from East Pickard Bay (site 8)	Dates of installation/ operation	Spatial / temporal overlap with the META project	Details	Further assessment required?	Justification for screening into in-combination assessment
Installation/ Operation and Maintenance/ Decommissioning	Greenlink Interconnector Ltd. - Government reference: qA1296053	10.4	6	0	07/2018 - ongoing	Spatial overlap with East Pickard Bay (site 8). Temporal overlap will occur throughout the duration of the META project.	The Project is a 500MW subsea electricity interconnector linking the power markets in Ireland and Great Britain and is planned for commissioning in 2023. As an EU Project of Common Interest, it is one of Europe's most important energy infrastructure projects. The interconnector is planned to make Landfall at Fresh Water West beach to the south of the mouth of the Waterway.	Yes	There is the potential for cumulative impacts on benthic receptors due to increased suspended sediment and habitat loss/disturbance.
Installation/ Operation and Maintenance/ Decommissioning	Bombora Wave Energy	11.6	5.0	0	Q1 2020	Spatial overlap with East Pickard Bay (site 8) within META test area. Potential for temporal overlap.	Bombora offshore infrastructure and deployment of Bombora mWave device at East Pickard Bay. This is to include device deployment (mWave device), installation of temporary communications cable between mWave device and temporary onshore control station to be located above East Pickard Bay. Laying of marine cable to shore and through intertidal area at East Pickard Bay to involve up to three days cable laying below MHWS using cable lay vessel and up to four vessels, including guard boat. Cable to be laid on seabed and kept in place in sandy sediment using clamshell wrights. Where the marine cable traverses potential reef habitat, it will follow natural rock channel. In the intertidal area, the cable will be laid through a natural gully, or up the vertical gully side and attached to the semi-vertical rock face with rock bolts using hand held tools. JCB will pull the cable through the intertidal area from a location above MHWS.	Yes	There is the potential for spatial overlap in the META East Pickard Bay test area (site 8) and temporal overlap with all META project sites installation and operation and maintenance phases, therefore this project cannot be excluded from further consideration in the CIA.
Pembroke Dock Marine Projects									
Installation/ Operation and Maintenance	Marine Energy Wales - DEML1875	1.7	11.7	9.4	21/04/2019-21/04/2029	Yes No spatial overlap with any of the consented areas. Potential for temporal overlap.	Marine Energy Test Area - Phase 1 Band 2 application submitted. The Project aims to create pre-consented test areas within the Pembroke Dock area. The test areas will have licensable activities to suit testing of initial stage marine renewable devices. These include testing of non-operating components and subassemblies. No full-scale testing is to be support within the test areas	Yes	Vessel use and some testing activities could result in an increase in SSCs or reduction in benthic habitats. There is therefore the potential for cumulative impacts with the META Project.

Phase	Developer - Reference	Distance from Warrior Way (site 6)	Distance from Dale Roads (site 7)	Distance from East Pickard Bay (site 8)	Dates of installation/ operation	Spatial / temporal overlap with the META project	Details	Further assessment required?	Justification for screening into in-combination assessment
Installation/ Operation and Maintenance	Milford Haven Port Authority - SC1810: Pembroke Dock Infrastructure	2	11.3	8.8	Q3 2019 – Q3 2023	Yes No spatial overlap with consented sites. Potential for temporal overlap.	Pembroke Dock redevelopment	Yes	There will be temporal and spatial overlap of the project with the META Project and there is the potential for cumulative impacts due to increased SSCs and habitat loss/disturbance.
							Scoping Report submitted. The intention of the Project is to create a flexible and efficient port-related office, industrial, warehousing and distribution, and ancillary operations infrastructure. This will involve the redevelopment of its existing space to incorporate increased deep-water access, internal and external heavy fabrication areas, construction of MEECE and Education/Skills Facility and the construction of a heavy lift facility.		
Installation/ Operation and Maintenance/Decommissioning	Wave Hub Ltd. - SC1082	24.5	22.8	17.9	Jul-18	No spatial overlap with any consented areas. Potential for temporal overlap as the projects are linked.	Pembrokeshire Demonstration Zone	Yes	There is the potential for temporal overlap with this project therefore this project cannot be excluded from further consideration in the CIA.
							Scoping Report submitted. The Project entails the development of 90 km2 of seabed with water depths of approximately 50 metres and a wave resource of approximately 19 kW/m; to support the demonstration of wave arrays with a generating capacity of up to 30MW for each project. Consent for this Project could be achieved in 2022, infrastructure could be built by 2024 and the first technology could be installed in 2025.		
Research									
Installation	Greenlink Interconnector Ltd. - RML1827	10.4	6	0	07-2018 - no end date given	Spatial overlap with East Pickard Bay (site 8). Temporal overlap with East Pickard Bay (site 8).	Ground investigations	Yes	Research operations are likely to have vessels present, with equipment for undertaking ground truthing surveys therefore this projects cannot be excluded from further consideration in the CIA.
Installation	University College of Swansea - DEML1861	~4-5	~8-9	~6-7	Band 2 licence issued 12/12/2018 - three-year study	No spatial overlap with any of the consented areas. Temporal overlap.	Pembroke Power bubble barrier experiment. Location is assumed to be by the Pembroke Power station. Investigation into the effectiveness of bubble curtains in sediment management.	Yes	to META phase 2 sites and the potential for temporal overlap, these projects cannot be excluded from further consideration in the CIA.
Installation	University College of Swansea - DEML1845	12.7	5.4	0	30/08/2018-29/08/2019	Spatial overlap with East Pickard Bay (site 8). Temporal overlap with East Pickard Bay (site 8).	Deposition and subsequent removal of marker buoys with environmental monitoring and mid-water settlement plates.	Yes	Vessels and equipment will be required for the placement of marker buoys. It is highly likely to have temporal or spatial overlap with META phase 2 activities, therefore this projects cannot be excluded from further consideration in the CIA.

In-combination temporary habitat disturbance/loss

- 4.5.1.3 There is the potential for temporary habitat loss and/or disturbance as a result of installation and operational activities associated with the META project in-combination with activities associated with the following projects/activities: META Phase 1, Bombora Wave Energy offshore works, the Pembroke Dock redevelopment project, Pembrokeshire Demonstration Zone (PDZ), dredging and disposal activities in the Waterway, the Greenlink Interconnector project (and associated surveys), research undertaken by Swansea University, and the dWNMP.
- 4.5.1.4 The META Phase 1 project has recently submitted a Marine Licence application to NRW PS accompanied by an environmental appraisal (RPS, 2018a) which predicts that temporary habitat loss/disturbance may arise as a result of temporary vessel anchoring and the temporary placement of marine energy components/subassemblies on the seabed. The combined maximum total area affected by META Phase 1 activities is predicted to be up to 4,492 m². However, the META Phase 1 activities will be temporary in nature and spatially restricted to the habitats within Pembroke Dock and out with the boundary of the Pembrokeshire Marine SAC. Therefore, there will be no in-combination loss of features of the SAC as a result of this project and the META project.
- 4.5.1.5 The Bombora offshore works are predicted to result in subtidal habitat loss at East Pickard Bay (site 8) as a result of the surface laying of 1,400 m of cable seaward of MLWS and the use of rock bags to secure the cable to the seabed, and the presence of the Bombora mWave device within the East Pickard Bay site (site 8). The habitat loss associated with the marine cable lay may occur partially within Annex I reef habitat but is predicted to be small (up to 237 m² for the marine cable and rock bags), and there may be up to 1,700 m² of circalittoral coarse sediment habitat temporarily lost associated with the mWave device although this does not correspond with an Annex I habitat feature of the Pembrokeshire Marine SAC. The total temporary habitat loss associated with the Bombora mWave device equates to a total of 1,937 m² and will therefore only represent a marginal increase on the habitat loss associated with the META project alone. The Bombora works are also predicted to be a one-off, short-term event, with the maximum design scenario for the duration of this infrastructure on the seabed being up to 18 months (Bombora Wave Energy, *pers. comm.*).
- 4.5.1.6 The Pembroke Dock Infrastructure project has submitted a Scoping Report (RPS, 2018b) which outlines that the creation of a new slipway, the infilling of the Graving Dock and capital dredging works may result in habitat loss/disturbance of benthic habitats. Although an EIA for the project was not available at the time of writing this RIAA, it is understood that all works will be confined to the Pembroke Dock area and will be out with the boundary of the Pembrokeshire Marine SAC. Therefore, there will be no in-combination loss of features of the SAC as a result of this project and the META project.

- 4.5.1.7 The Greenlink Interconnector project has also submitted a Scoping Report for the UK marine route (Intertek, 2016) which outlines that temporary habitat loss may occur as a result of cable burial and maintenance activities. Although a detailed assessment was not available at the time of writing this RIAA, the Scoping Report concludes that it is likely that any impacts to species and habitats will be localised and short-term, and once installed, the substratum will be reinstated over the cable.
- 4.5.1.8 There is no information in the public domain relating to the estimated habitat disturbance/loss associated with the PDZ project and the two Swansea University research projects. However, it is likely that this will be small scale and localised to these project sites with no potential for spatial overlap with temporary habitat disturbance/loss associated with the META project, with the exception of the marker buoy deployment in East Pickard Bay (site 8) although this will be temporary and of limited spatial extent.
- 4.5.1.9 The HRA Appropriate Assessment for screened in policies within the dWMNP (Welsh Government, 2017) concludes no adverse effect on site integrity of any European site due to the plans included within the dWNMP.
- 4.5.1.10 Finally, dredging and associated disposal activities within the Waterway may result in habitat loss and disturbance in the vicinity of these activities. Although the extent of disturbance is difficult to quantify, maintenance dredging activities will remove sediments that have accumulated since the previous dredging event, so these habitats will be disturbed already. Similarly, placement of dredge sediments within disposal grounds will also experience habitat loss/disturbance from the most recent disposal event, but given that these areas will have previously been disturbed, the in-combination effect from these activities on benthic habitat loss are considered negligible.

Conclusions

Pembrokeshire Marine SAC

- 4.5.1.11 Significant adverse effects on the qualifying Annex I habitats of the Pembrokeshire Marine SAC are not predicted to occur as a result of in-combination temporary habitat disturbance/loss. Potential effects from this activity on the relevant Conservation Objectives (as presented in paragraph 4.2.1.2) are discussed in turn below.

The overall distribution and extent of the habitat features within the site, and each of their main component parts is stable or increasing.

- 4.5.1.12 All habitat disturbance/loss will be temporary, of short-term duration and will only affect a very small percentage of the total available extent of Annex I habitats within the SAC at any one time. Therefore, it is not considered that these activities will restrict the distribution or extent of identified Annex I habitat features from increasing or remaining stable.

The physical biological and chemical structure and functions necessary for the long-term maintenance and quality of the habitat are not degraded.

- 4.5.1.13 Given that in-combination habitat disturbance will be temporary and the corresponding biological communities associated with the Annex I habitats are predicted to recover, it is not considered that installation activities will affect the physical biological and chemical structure and function of identified Annex I habitat features.

The presence, abundance, condition and diversity of typical species is such that habitat quality is not degraded.

- 4.5.1.14 Given that in-combination habitat disturbance associated with installation activities will be temporary and that the corresponding communities are predicted to recover following these activities, it is not considered that the typical species associated with featured habitats will not be affected in such a way that the habitat quality will be degraded.

- 4.5.1.15 Therefore, no adverse effect on the integrity of the Pembrokeshire Marine SAC from this potential in-combination impact can be concluded.

In-combination temporary increases in SSCs and associated sediment deposition

- 4.5.1.16 There is the potential for in-combination increases in SSCs and sediment deposition to benthic receptors within the benthic subtidal and intertidal ecology study area as a result of installation/decommissioning activities associated with the META project together with the following projects/activities: construction activities associated with the Pembroke Dock redevelopment project, dredging and disposal activities in the Waterway, Bombora marine cable installation, the Greenlink Interconnector project and the dWNMP.

- 4.5.1.17 The Pembroke Dock Marine Scoping Report (RPS, 2018b) describes that there will be a requirement for some one-off capital dredging works within the footprint of the new slipway and also within the Graving Dock, removing up to approximately 16,000 m³ of material. Once cleared, this material will be disposed of at an authorised dredging disposal site. Although an EIA for the Pembroke Dock Infrastructure project was not available at the time of writing this RIAA, it is understood that all works will be confined to the Pembroke Dock area and dredging works will be temporary and short lived. On this basis it is considered unlikely that the dredging works from Pembroke Dock Infrastructure will temporally overlap with the installation/decommissioning activities from the META project.

- 4.5.1.18 The installation of the Bombora marine cable has the potential to result in very short-term (up to 3 days), temporary increases in SSC within the East Pickard Bay site (site 8), however any impact to benthic habitats will be highly localised within the immediate vicinity of the cable lay.

- 4.5.1.19 The Scoping Report for the Greenlink Interconnector project outlines that smothering of benthic species may occur as a result of ploughing and trenching operations to install the cable and through the placement of cable protection material on the seabed (Intertek, 2016). However, it is likely that any impacts will be of short duration and temporary in nature, and any impacts to benthic habitats from smothering will be highly localised to the immediate vicinity of the cable trench.

- 4.5.1.20 The HRA Appropriate Assessment for screened in policies within the dWNMP (Welsh Government, 2017) concludes no adverse effect on site integrity of any European site due to the plans included within the dWNMP.

- 4.5.1.21 On-going dredging and associated disposal activities within the Waterway also have the potential to result in periodic and short-term elevations in SSC and sediment deposition may result in habitat loss and disturbance in the vicinity of these activities. However, on the basis that the increases in SSC and deposition from the META project alone are predicted to be highly localised and of short duration, they are not considered to interact spatially with any of the cumulative projects/activities in any measurable way.

Conclusions

Pembrokeshire Marine SAC

- 4.5.1.22 Significant adverse in-combination effects on the qualifying Annex I habitats of the Pembrokeshire Marine SAC are not predicted to occur as a result of temporary increases in SSC and sediment deposition. Potential effects from this activity on the relevant Conservation Objectives (as presented in paragraph 4.2.1.2) are discussed in turn below.

The overall distribution and extent of the habitat features within the site, and each of their main component parts is stable or increasing.

- 4.5.1.23 Any in-combination effects associated increased SSC and sediment deposition will be temporary and small scale and it is not considered that these activities will restrict the distribution or extent of identified Annex I habitat features from increasing or remaining stable.

The physical biological and chemical structure and functions necessary for the long-term maintenance and quality of the habitat are not degraded.

- 4.5.1.24 Given that any in-combination effects will be temporary and that the sensitivity of the corresponding biological communities associated with the Annex I habitats are predicted to recover following cessation of installation activities, it is not considered that installation activities will affect the physical biological and chemical structure and function of identified Annex I habitat features.

The presence, abundance, condition and diversity of typical species is such that habitat quality is not degraded.

- 4.5.1.25 Given that the in-combination habitat disturbance associated with installation activities will be temporary and that the corresponding communities are predicted to recover following these activities, it is not considered that the typical species associated with featured habitats will not be affected in such a way that the habitat quality will be degraded.

- 4.5.1.26 Therefore, no adverse effect on the integrity of the Pembrokeshire Marine SAC from this potential impact can be concluded.

Limestone Coast of South West Wales SAC

- 4.5.1.27 Significant in-combination adverse effects on the qualifying marine Annex I habitat of the Limestone Coast of South West Wales SAC are not predicted to occur as a result of temporary increases in SSC and sediment deposition during installation activities. Potential effects from this activity on the relevant Conservation Objectives (taken as the performance objectives as presented in paragraph 4.2.1.4) are discussed below.

The caves will exist as determined by natural processes.

- 4.5.1.28 As plumes of sediments and sediment deposition arising during installation / decommissioning activities are predicted to be highly localised to the disturbance areas and are not predicted to extend to the sea cave features of the SAC, it is not considered that these activities will affect the natural processes of the caves.

The caves will remain free of human disturbance both direct through physical damage, and indirect through pollution and litter.

- 4.5.1.29 As plumes of sediments and sediment deposition arising during installation / decommissioning activities are predicted to be highly localised to the areas of seabed being disturbed and are not predicted to extend to the sea cave features of the SAC, it is not considered that these activities will result in direct or indirect human disturbance to this Annex I habitat feature.

- 4.5.1.30 Therefore, no adverse effect on the integrity of the Limestone Coast of South West Wales SAC from this potential impact can be concluded.

5. ASSESSMENT OF ADVERSE EFFECTS ON INTEGRITY: ANNEX II SPECIES – DIADROMOUS FISH

5.1.1.1 The screening exercise (Stage 1 of the Habitats Regulations Assessment (HRA) process), and subsequent consultation with NRW (see section 14), identified potential for LSEs on the qualifying Annex II diadromous fish features of Pembrokeshire Marine SAC and the Cleddau Rivers SAC, as detailed in Table 2.8.

5.2 Conservation Objectives

5.2.1.1 The Conservation Objectives of the qualifying benthic Annex II diadromous fish features screened in for Stage 2 assessment (Table 2.8) are provided below. The Conservation Objectives have been informed by the Advice provided by Natural Resources Wales in fulfilment of Regulation 37 of the Conservation of Habitats and Species Regulations 2017 (NRW, 2018a) for the Pembrokeshire Marine SAC and the Core Management Plan (including Conservation Objectives) for the Cleddau Rivers SAC (NRW, 2017). The Conservation Objectives for these sites are provided in full in Appendix 3 and Appendix 5, respectively.

Pembrokeshire Marine SAC

5.2.1.2 The Conservation Objectives for Annex II fish features of the Pembrokeshire Marine SAC are detailed in the Regulation 37 advice for the site (NRW, 2018a; see Appendix 3) and for allis shad, twaite shad, river lamprey and sea lamprey are as follows:

- The population is maintaining itself on a long-term basis as a viable component of its natural habitat. Important elements include: population size; structure, production; and condition of the species within the site;
- The species population within the site is such that the natural range of the population is not being reduced or likely to be reduced for the foreseeable future; and
- The presence, abundance, condition and diversity of habitats and species required to support this species is such that the distribution, abundance and population dynamics of the species within the site and population beyond the site is stable or increasing.

Cleddau Rivers SAC

5.2.1.3 The Core Management Plan (including Conservation Objectives) for the Cleddau Rivers SAC (NRW, 2017; see Appendix 5) lists Conservation Objectives for each designated species (i.e. sea lamprey and river lamprey). The Conservation Objective includes a vision and a series of performance indicators. The vision for these feature is as follows:

- The conservation objective for the watercourse is met;
- The population of the feature in the SAC must be stable or increasing over the long term;

- The natural range of the feature in the SAC is neither being reduced nor is likely to be reduced for the foreseeable future;
- Passage of the feature through the SAC is not to be hindered by artificial barriers such as weirs; and
- The characteristic channel morphology provides the diversity of water depths, current velocities and substrate types necessary to fulfil the habitat requirements of the features. The close proximity of different habitats facilitates movement of fish to new preferred habitats with age.

5.3 Baseline information

5.3.1.1 Baseline information on the Annex I habitat features of the European Sites identified for further assessment within the HRA process has been gathered through a comprehensive desktop study of existing studies and datasets. The key data sources are presented within chapter 8: Fish and Shellfish of the Environmental Statement.

5.3.2 Pembrokeshire Marine SAC

5.3.2.1 Twaite shad and allis shad are Annex II species present as qualifying interest features, but not primary reasons for the selection of the SAC. Shad migrate through estuaries in March-May on their way to spawning grounds and most adults die after spawning, but a proportion of UK fish are known to repeat spawn: these presumably migrate back to sea immediately after spawning in June-July. Juveniles generally migrate from estuaries between August and October, where they spend some time feeding. Further seaward migration is triggered by falling temperatures in winter, but it is possible that at least a proportion of the juvenile fish overwinter in the estuary. At all stages of their life cycle, shad are pelagic fish, and in estuaries the juveniles predominantly occur in the surface layers of the water column.

5.3.2.2 River lamprey and sea lamprey are also present as qualifying interest features, but not primary reasons for the selection of the SAC. Adult river lampreys migrate through the Pembrokeshire Marine SAC to reach the Afonydd Cleddau river on their spawning migration, entering freshwater between October and December. Juvenile river lampreys generally migrate downstream into estuaries and inshore waters in spring, though autumn migrations have also been recorded. Since river lampreys feed and grow in estuaries and inshore waters, it should be assumed that juveniles are present in the Pembrokeshire Marine SAC throughout the year.

5.3.2.3 Adult sea lampreys migrate through the site between March and June to reach the Afonydd Cleddau. Mature adults enter the estuaries from April onwards and migrate some distance upstream. Juvenile sea lampreys migrate downstream between December and June and spend some time feeding in the estuary and inshore waters before moving offshore in search of larger prey. However, as discussed below in section 5.3.3 for the Cleddau Rivers SAC, no sea lampreys have been recorded in the monitoring of the SAC since 2004 so there is no evidence that the site currently supports sea lamprey.

5.3.3 Cleddau Rivers SAC

5.3.3.1 The Afonydd Cleddau/ Cleddau Rivers SAC is designated for the Annex II species river lamprey which is a primary reason for the selection of the site. Sea lamprey are also present as a qualifying interest feature. The moderate to low-gradient catchment of the SAC together with the mixture of gravels and silts provides large areas of good river lamprey habitat. Electrofishing data indicates that river lamprey ammocoetes are widespread throughout the SAC, and adult river lampreys are evident during the spawning season (NRW, 2017).

5.3.3.2 Monitoring of the Cleddau Rivers SAC in 2004 found no evidence of sea lamprey ammocoetes in either optimal or sub-optimal habitat (CCW, 2008). There were also no records of adult migrating sea lamprey. In the second reporting cycle (2007-2012) no sea lamprey were recorded (NRW, 2017). There is therefore no evidence to indicate that the Cleddau Rivers SAC currently support sea lamprey.

5.4 Assessment of Adverse Effects on Integrity – the META project alone

5.4.1 Potential impacts – installation/decommissioning

Temporary changes to fish and shellfish habitat

5.4.1.1 Installation activities such as device or navigational buoy anchoring, and the presence of marine energy devices in the water column, have the potential to result in temporary changes to habitat for fish and shellfish. The nature of marine renewable devices means that from installation through to decommissioning, devices will occupy an area of sea, resulting in a reduction in water-column availability. Anchoring or attachment methods may also result in temporary disturbance to or loss of seabed habitat or compaction of sediment (i.e. during anchor placement or gravity base foundation placement). These changes have the potential to reduce the availability of marine habitat, including spawning, nursery of feeding habitats. These changes may result in a temporary reduction in fish and shellfish species abundance or diversity with affected areas, though demersal fish and shellfish species and demersal spawning species are likely to be affected to the greatest extent. Substratum loss will only directly affect species utilising the seabed and a temporary reduction in sections of water column will only directly affect pelagic species.

5.4.1.2 The maximum and most likely design scenarios for temporary changes to fish and shellfish habitat, as presented in the chapter 8: Fish and Shellfish of the Environmental Statement, are summarised in Table 5.1 below.

Table 5.1: Maximum and most likely design scenarios considered for the assessment of potential impacts on Annex II diadromous fish from temporary changes to fish and shellfish habitat.

Maximum design scenario	Most likely design scenario
- Up to 150 installation events occurring intermittently over the 15-year lifetime of the META project, 50 % of which may touch the seabed. - Warrior Way: up to four device deployments in a 12-month period (i.e. up to 60 deployments over the project lifetime), 50 % of which may touch the seabed; - Dale Roads: up to two device deployments in a 12-month period (i.e. up to 30 deployments over the project lifetime), 50% of which may touch the seabed; and - East Pickard Bay: up to two device deployments in a 12-month period at each berth therefore up to four device deployments in a 12-month period (i.e. up to 60 deployments over the project lifetime), 50% of which may touch the seabed. - Combined (Warrior Way + Dale Roads + East Pickard Bay) total subtidal temporary habitat disturbance at any one time of up to 124,679 m² comprising: - Up to 480 m² of temporary disturbance at Warrior Way per testing scenario broken down as follows: - Up to 330 m² from a 5 m buffer around device footprint (200 m²) for seabed clearance activities; and - Up to 150 m² from a single mooring spread for deployment vessels. - Up to 713 m² of temporary disturbance at Dale Roads per testing scenario broken down as follows: - Up to 513 m² from a 5 m buffer around device footprint (600 m²) for seabed clearance activities; and - Up to 200 m² from a single mooring spread for deployment vessels. - Up to 123,486 m² of temporary disturbance at East Pickard Bay per testing scenario broken down as follows: - Up to 3,485 m² from a 10 m buffer around device footprint (8,000 m²) for seabed clearance activities; and - Up to 120,000 m² from mooring spread for deployment vessels for up to two test activities at any one time. - A total of up to 160 test installation and removal vessel movements (which may involve anchoring) in a 12-month period broken down as follows: - up to 20 installation and 20 retrieval vessel movements in a 12-month period at Warrior Way (site 6) and Dale Roads (site 7). - up to 40 installation and 40 retrieval vessel movements in a 12-month period at East Pickard Bay (site 8).	- Up to 60 installation events occurring intermittently over the 15-year lifetime of the META project. - Warrior Way: up to two device deployments in a 12-month period (i.e. up to 30 deployments over the project lifetime), 50 % of which may touch the seabed; - Dale Roads: up to one device deployments in a 12-month period (i.e. up to 15 deployments over the project lifetime) 50 % of which may touch the seabed; and - East Pickard Bay: up to one device deployments in a 12-month period (i.e. up to 15 deployments over the project lifetime) 50 % of which may touch the seabed. - Combined (Warrior Way + Dale Roads + East Pickard Bay) total subtidal temporary habitat disturbance of up to 70,175 m² comprising: - Up to 75 m² of temporary disturbance at Warrior Way from a single mooring spread for deployment vessels at any one time; - Up to 100 m² of temporary disturbance at Dale Roads from a single mooring spread for deployment vessels at any one time; and - Up to 70,000 m² of temporary disturbance at East Pickard Bay from mooring spread for deployment vessels per test activity. - A total of up to 120 test installation and removal vessel movements (which may involve anchoring) in a 12-month period broken down as follows: - up to 20 installation and 20 retrieval vessel movements in a 12-month period at each site.

Allis shad, twaite shad, river lamprey and sea lamprey

- 5.4.1.3 The maximum total temporary habitat disturbance associated with anchoring or the presence of devices on the seabed at all three META project sites is 124,679 m². For each site this equates to 480 m² at Warrior Way (site 6), 713 m² at Dale Roads (site 7) and 123,486 m² at East Pickard Bay (site 8). The total area proposed for consent is 1,518,500 m², therefore, the maximum total area of temporary habitat change represents 8.2% of the total proposed META Project area (0.35% of Warrior Way (site 6), 0.26% of Dale Roads (site 7) and 10.03% of East Pickard Bay (site 8)).
- 5.4.1.4 The most likely scenario for the anchoring and presence of devices on the seabed at all three META project sites is 70,175 m². For each site this equates to 75 m² (Warrior Way (site 6)), 100 m² (Dale Roads (site 7)) and 70,000 m² (East Pickard Bay (site 8)). The maximum total area of temporary habitat loss or disturbance equates to 4.62% of the total proposed META project area.
- 5.4.1.5 Both the maximum and most likely scenarios represent a small proportion of available habitat within the proposed META project consented areas (8.2% and 4.62%, respectively). Devices and ancillary equipment such as navigational marker buoys will be placed in the marine environment for short durations; for the maximum scenario up to four device deployments in a 12-month period (Warrior Way (site 6)), two device deployments in a 12 month period (Dale Roads (site 7)), and up to two device deployments in a 12-month period at each berth therefore up to four device deployments in a 12-month period (East Pickard Bay (site 8)). Under the most likely scenario there may be up to two device deployments in a 12-month period at Warrior Way (site 6), up to one device deployment in a 12-month period at Dale Roads (site 7), and up to one device deployment in a 12-month period at East Pickard Bay (site 8). Testing activities and therefore potential temporary changes to fish and shellfish habitat are considered therefore to be short/medium term duration, and intermittent
- 5.4.1.6 As outlined in paragraph 8.11.1.12 *et. seq.* of chapter 8: Fish and Shellfish of the Environmental Statement, migratory fish species may be vulnerable to habitat disturbance or loss of habitat in the very short term when devices/ancillary equipment are deployed, however recovery is likely to be rapid as extensive alternative habitat is available throughout the Waterway and the area of potential overlap of the META project with migratory fish species pathways is very small.
- 5.4.1.7 Warrior Way (site 6) represents the narrowest section of where migratory fish may pass through at approximately 330 m width (MLWS to MLWS). The maximum design scenario for device dimensions at Warrior Way (site 6) is 20 m x 10 m; at its maximum length the device will occupy 7.57% of the site area within a high energy environment. Migratory fish are likely to avoid high energy environments to conserve energy during the migration and will likely move towards the lee of the meander, away from the site area (Potter, 1988). In addition, migratory fish are likely to react and exhibit avoidance behaviours to the device during installation and use the remaining width of the river to pass by the disturbance. Any disturbance to migratory fish will also be intermittent during the installation phase and temporary in nature. The overall sensitivity of migratory fish is considered to be low.

Conclusions

Pembrokeshire Marine SAC

- 5.4.1.8 Significant adverse effects on the qualifying Annex II diadromous fish features of the Pembrokeshire Marine SAC (i.e. allis shad, twaite shad, sea lamprey and river lamprey) are not predicted to occur as a result of temporary changes to fish and shellfish habitat. Potential effects from this activity on the relevant Conservation Objectives (as presented in paragraph 5.2.1.2) are discussed in turn below.
- The population is maintaining itself on a long-term basis as a viable component of its natural habitat.*
- 5.4.1.9 All habitat disturbance associated with the META project will be temporary, of short-term duration and will only affect a very small percentage of the total extent of habitats available in the wider area to migratory fish features of the SAC. Therefore, it is not considered that these activities will affect the ability of migratory fish species populations to be maintained in the long term.
- The species population within the site is such that the natural range of the population is not being reduced or likely to be reduced for the foreseeable future.*
- 5.4.1.10 Some restriction to the natural range may occur as a result of habitat disturbance within a localised area within each META site. However, all disturbance/loss will be temporary and therefore reversible following decommissioning of the devices/components.
- The presence, abundance, condition and diversity of habitats and species required to support this species is such that the distribution, abundance and populations dynamics of the species within the site and population beyond the site is stable or increasing.*
- 5.4.1.11 Some change to the condition of habitats required to support migratory fish may occur as a result of habitat disturbance within a localised area within each META site. However, all disturbance/loss will be temporary and therefore reversible following decommissioning of the devices/components.
- 5.4.1.12 Therefore, no adverse effect on the integrity of the Pembrokeshire Marine SAC from this potential impact can be concluded.

Cleddau Rivers SAC

- 5.4.1.13 Significant adverse effects on the qualifying Annex II diadromous fish features of the Cleddau Rivers SAC (i.e. sea lamprey and river lamprey) are not predicted to occur as a result of temporary changes to fish and shellfish habitat. Potential effects from this activity on the relevant Conservation Objectives (as presented in paragraph 5.2.1.3) are discussed in turn below.
- The population of the feature in the SAC must be stable or increasing over the long term.*

5.4.1.14 The habitat disturbance predicted as a result of the META project will be temporary, small scale and localised. This impact is not predicted to result in the direct mortality of migratory fish species or to affect the survival rates of individuals or the populations as a whole on the basis that extensive comparable habitat is present in the wider area. Therefore, it is not considered that these activities will affect the ability of the populations of migratory fish to remain stable or increase over the long term.

The natural range of the feature in the SAC is neither being reduced nor is likely to be reduced for the foreseeable future.

5.4.1.15 Some minor restriction to the natural range may occur as a result of habitat disturbance within a localised area within each META site. However, all disturbance/loss will be temporary, restricted in scale, and reversible following decommissioning of the devices/components.

Passage of the feature through the SAC is not to be hindered by artificial barriers such as weirs.

5.4.1.16 As all habitat disturbance predicted to arise as a result of the META project falls out with the boundary of the SAC, there will be no barrier to the passage of sea lamprey or river lamprey through the Cleddau Rivers SAC as a result of the project. Similarly, the project is not predicted to result in any barrier to the passage of designated fish features during their migrations to or from the SAC. Therefore, this Conservation Objective will be maintained.

The characteristic channel morphology provides the diversity of water depths, current velocities and substrate types necessary to fulfil the habitat requirements of the features. The close proximity of different habitats facilitates movement of fish to new preferred habitats with age.

5.4.1.17 As all habitat disturbance predicted to arise as a result of the META project falls out with the boundary of the SAC, it is not considered that these activities will affect the channel morphology or range of habitat present within the site.

5.4.1.18 Therefore, no adverse effect on the integrity of the Cleddau Rivers SAC from this potential impact can be concluded.

Increased SSC and sediment deposition

5.4.1.19 Anchoring/attachment of marine energy devices and navigational marker buoys may lead to temporary disturbance of sediment within the test deployment areas. The main activities that will contribute to increases in suspended sediments include the placement of seabed-mounted marine energy devices, drilled pin piling, and the placement of gravity anchors or drag anchors for marine energy devices or navigational marker buoys. Vessel movements may also lead to very short-term increases in suspended sediment due to vessel manoeuvring/anchoring or dynamic positioning.

5.4.1.20 The maximum and most likely design scenarios for temporary changes to fish and shellfish habitat, as presented in the chapter 8: Fish and Shellfish of the Environmental Statement, are summarised in Table 5.2 below.

Table 5.2: Maximum and most likely design scenarios considered for the assessment of potential impacts on Annex II diadromous fish from increased SSC and sediment deposition during installation/decommissioning.

Maximum design scenario	Most likely design scenario
- As per Temporary changes in fish and shellfish habitat outlined in Table 5.1. - Drilling for pin pile installation as follows: - Dale Roads: up to four pin piles per device. Each pin pile up to 100 mm diameter installed to a depth of 10 to 20 m; and - East Pickard Bay: up to four pin piles per device. Each pin pile up to 100 mm diameter installed to a depth of 10 to 20 m.	- As per Temporary changes in fish and shellfish habitat outlined in Table 5.1. - No drilling for pin pile installation.

Allis shad, twaite shad, river lamprey and sea lamprey

5.4.1.21 Activities which may result in increased SSC and sediment deposition for migratory fish are as described previously in paragraphs 4.4.1.18 to 4.4.1.25. All activities proposed at all three test areas are of a temporary and intermittent nature with devices and ancillary equipment such as navigational marker buoys and marine energy devices placed in the marine environment for short durations. The maximum design scenario assumes up to four device deployments in a 12-month period at Warrior Way (site 6), up to two device deployments in a 12-month period at Dale Roads (site 7), and up to two device deployments in a 12-month period at each berth therefore up to four device deployments in a 12-month period at East Pickard Bay (site 8). Under the most likely scenario there would be up to two device deployments in a 12-month period at Warrior Way (site 6), up to one device deployment in a 12-month period at Dale Roads (site 7) and up to one device deployment in a 12-month period at East Pickard Bay (site 8).

5.4.1.22 At Warrior Way (site 6), the mixed coarse gravely marine sands would give rise to plumes of approximately 40 mg/l which would be expected to settle in a relatively short period of time (one hour) following cessation of works. At Dale Roads (site 7), the coarse sands with muddy sediment would give rise to plumes of approximately 50 mg/l would be expected to settle within two hours of cessation of works. At East Pickard Bay (site 8), the coarse sands would give rise to sediment plumes of up to 70 mg/l which again would be expected to settle following cessation of works after one hour.

5.4.1.23 As outlined in paragraph 8.11.1.39 of chapter 8: Fish and Shellfish of the Environmental Statement, migratory fish species may be vulnerable to temporary increases in suspended sediment in the very short term when devices/ancillary equipment are deployed, however recovery is likely to be high as all META sites are located in either high energy (East Pickard Bay (site 8)) or meso-tidal energy environments, therefore dispersing any suspended sediments rapidly. Migratory fish species known to occur in the META project area are also expected to show some tolerance to naturally occurring relatively high levels of SSC in the fish and shellfish study area due to its location within an estuarine environment. Installation activities resulting in temporary increases in SSC are short-lived and likely to result in only short-term changes in migratory fish behaviour (avoidance) and are therefore not considered likely to create a barrier to migratory movement.

Conclusions

Pembrokeshire Marine SAC

5.4.1.24 Significant adverse effects on the qualifying Annex II diadromous fish features of the Pembrokeshire Marine SAC (i.e. allis shad, twaite shad, sea lamprey and river lamprey) are not predicted to occur as a result of increased SSC and sediment deposition. Potential effects from this activity on the relevant Conservation Objectives (as presented in paragraph 5.2.1.2) are discussed in turn below.

The population is maintaining itself on a long-term basis as a viable component of its natural habitat.

5.4.1.25 Given the short term nature of the works which may result in temporary increases in SSC/sediment deposition and the small spatial extent of any impacts, this is not predicted to result in any effect on the viability of the populations of allis shad, twaite shad, sea lamprey and river lamprey within the SAC or to affect the ability of migratory fish species populations to be maintained in the long term.

The species population within the site is such that the natural range of the population is not being reduced or likely to be reduced for the foreseeable future.

5.4.1.26 Although some migratory fish may avoid areas of increased SSCs during installation activities, such effects would only be temporary, barrier effects to migration are not predicted and normal behaviour would be resumed following return to baseline SSC levels. Therefore, this Conservation Objective will be maintained.

The presence, abundance, condition and diversity of habitats and species required to support this species is such that the distribution, abundance and populations dynamics of the species within the site and population beyond the site is stable or increasing.

5.4.1.27 Significant effects on the habitats available for migratory fish features of the SAC are not predicted and neither are the works predicted to have any impact on the viability of the populations of migratory fish, on account of the temporary and short-term nature of the works and resulting effects. Therefore, it is not considered that these activities will affect the distribution, abundance and populations dynamics of the species within the site and population beyond the site, or prevent it from increasing.

5.4.1.28 Therefore, no adverse effect on the integrity of the Pembrokeshire Marine SAC from this potential impact can be concluded.

Cleddau Rivers SAC

5.4.1.29 Significant adverse effects on the qualifying Annex II diadromous fish features of the Cleddau Rivers SAC (i.e. sea lamprey and river lamprey) are not predicted to occur as a result of increased SSC and sediment deposition. Potential effects from this activity on the relevant Conservation Objectives (as presented in paragraph 5.2.1.3) are discussed in turn below.

The population of the feature in the SAC must be stable or increasing over the long term.

5.4.1.30 Given the short-term nature of the works which may result in temporary increases in SSC/sediment deposition and the small spatial extent of any impacts, this is not predicted to result in any effect the ability of the populations of sea lamprey and river lamprey within the SAC to remain stable or increase over the long term.

The natural range of the feature in the SAC is neither being reduced nor is likely to be reduced for the foreseeable future.

5.4.1.31 The elevations in SSC associated with installation/decommissioning activities are not predicted to result in any barrier to the migration of sea lamprey and river lamprey within or to/from the SAC. Furthermore, any avoidance behaviour of areas experiencing elevated SSC levels will be temporary. Therefore, it is not considered that these activities will affect the natural range of these species within the SAC.

Passage of the feature through the SAC is not to be hindered by artificial barriers such as weirs.

5.4.1.32 The elevations in SSC associated with installation/decommissioning activities are not predicted to result in any barrier to the migration of sea lamprey and river lamprey through or to/from the SAC. Therefore, this Conservation Objective will be maintained.

The characteristic channel morphology provides the diversity of water depths, current velocities and substrate types necessary to fulfil the habitat requirements of the features. The close proximity of different habitats facilitates movement of fish to new preferred habitats with age.

No permanent/long-term habitat change is predicted to arise as a result in sediment deposition arising from installation/decommissioning works which disturb the seabed and therefore it is not considered that this impact will affect the channel morphology or range of habitat present within the site. Therefore, this Conservation Objective will be maintained.

5.4.1.33 Therefore, no adverse effect on the integrity of the Cleddau Rivers SAC from this potential impact can be concluded.

Underwater noise

5.4.1.34 There is potential for vessels, drilling to install pin piles (at Dale Roads (site 7) and East Pickard Bay (site 8) sites only) and other equipment to produce noise during installation of the energy devices.

5.4.1.35 The maximum and most likely design scenarios for underwater noise, as presented in the chapter 8: Fish and Shellfish and chapter 6: Underwater Noise of the Environmental Statement, are summarised in Table 5.3 below.

Table 5.3: Maximum and most likely design scenarios considered for the assessment of potential impacts on Annex II diadromous fish from underwater noise.

Maximum design scenario	Most likely design scenario
Vessel movements - A total of up to 160 test installation and removal vessel movements (which may involve anchoring) in a 12-month period broken down as follows: - Up to 20 installation and 20 retrieval vessel movements in a 12-month period at Warrior Way (site 6) and Dale Roads (site 7). - Up to 40 installation and 40 retrieval vessel movements in a 12-month period at East Pickard Bay (site 8). Drilling for pin piles - Drilling for pin pile installation as follows: - Dale Roads: up to four pin piles per device. Each pin pile up to 100 mm diameter installed to a depth of 10 to 20 m; and - East Pickard Bay: up to four pin piles per device. Each pin pile up to 100 mm diameter installed to a depth of 10 to 20 m.	Vessel movements - A total of up to 120 test installation and removal vessel movements (which may involve anchoring) in a 12-month period broken down as follows: - Up to 20 installation and 20 retrieval vessel movements in a 12-month period at each site. Drilling for pin piles - No drilling for pin pile installation.

Allis shad, twaite shad, river lamprey and sea lamprey

5.4.1.36 As outlined in chapter 6: Underwater Noise of the Environmental Statement, peer reviewed guidelines have been published by the Acoustical Society of America (ASA) and provide directions and recommendations for setting criteria (including injury and behavioural criteria) for fish. For the purposes of this assessment, these Sound Exposure Guidelines for Fishes and Sea Turtles (Popper *et al.*, 2014) were considered to be most relevant for impacts of underwater noise on migratory fish species. The guidelines relevant to the META project are considered to be those for injury due to continuous noise (which are applicable for vessels, drilled piling activities and operational noise from devices).

5.4.1.37 The Popper *et al.* (2014) guidelines broadly group fish into the following categories according to the presence or absence of a swim bladder and on the potential for that swim bladder to improve the hearing sensitivity and range of hearing (Popper *et al.*, 2014):

- Group 1: Fishes lacking swim bladders (e.g. elasmobranchs and flatfish). These species are only sensitive to particle motion, not sound pressure;
- Group 2: Fishes with a swim bladder but the swim bladder does not play a role in hearing (e.g. salmonids). These species are only sensitive to particle motion;
- Group 3: Fishes with swim bladders that are close, but not connected, to the ear (e.g. gadoids and eels). These fishes are sensitive to both particle motion and sound pressure and show a more extended frequency range than groups 1 and 2, extending to about 500 Hz; and
- Group 4: Fishes that have special structures mechanically linking the swim bladder to the ear (e.g. clupeids such as herring, sprat and shads). These fishes are sensitive primarily to sound pressure, although they also detect particle motion. These species have a wider frequency range, extending to several kHz and generally show higher sensitivity to sound pressure than fishes in Groups 1, 2 and 3.

5.4.1.38 Allis shad and twaite shad are therefore considered to be Group 4 species. Sea lamprey have been reported to respond to low frequencies (20-100 Hz) (Lenhardt and Sismour, 1995), though it has been suggested that sound may not be relevant to these species at all (Popper, 2005). Therefore, although uncertain, the sensitivity of lamprey to underwater noise is likely to be less than that for shad.

5.4.1.39 As described in chapter 6: Underwater Noise of the Environmental Statement, the potential for injury to migratory fish as a result of noise generated during installation/decommissioning is considered to be very low. The calculated ranges of injury to fish with swim bladders (i.e. Group 4 species such as shad) in line with ASA guidelines, based on exceedance of 170 dB re 1 µPa (rms) over 48 hours continuous exposure, is up to a maximum of 6 m which is from an installation vessel using dynamic positioning. Although this is a very small distance, it should be noted that this is highly precautionary and unrealistic as it assumes that migratory fish would stay at a stationary location or within a fixed radius of a vessel (or any other noise source) for a period of 48 hours. It should also be noted that there is no potential for injury to fish as a result of drilling to install pin piles.

5.4.1.40 The qualitative risk of disturbance to migratory fish, according to the ASA guidelines, is high in the near field (i.e. within 10s of metres), moderate in the intermediate field (i.e. within 100s of metres) and low in the far field (i.e. within 1,000s of metres). The criteria presented in the Washington State Department of Transport (WSDOT) Biological Assessment Preparation for Transport Projects Advanced Training Manual (WSDOT, 2011) provides quantitative criteria for disturbance to fish and suggests an un-weighted sound pressure level of 150 dB re 1 μ Pa (rms) as the criterion for onset of behavioural effects, based on work by Hastings (2002). Using the WSDOT criteria, the radius of the zone of potential disturbance to migratory fish is estimated to range from 6 m during drilling to 37 m during the use of dynamic positioning by an installation vessel. Therefore, disturbance to migratory fish is predicted only in the immediate vicinity of installation/decommissioning activities.

Conclusions

Pembrokeshire Marine SAC

5.4.1.41 Significant adverse effects on the qualifying Annex II diadromous fish features of the Pembrokeshire Marine SAC (i.e. allis shad, twaite shad, sea lamprey and river lamprey) are not predicted to occur as a result of underwater noise during installation/decommissioning. Potential effects from this activity on the relevant Conservation Objectives (as presented in paragraph 5.2.1.2) are discussed in turn below.

The population is maintaining itself on a long-term basis as a viable component of its natural habitat.

5.4.1.42 The META project will not affect the ability of migratory fish species populations to be maintained in the long term given the short duration, temporary effects quantified during installation/decommissioning activities and the fact that injury to migratory fish from underwater noise is highly unlikely.

The species population within the site is such that the natural range of the population is not being reduced or likely to be reduced for the foreseeable future.

5.4.1.43 Some temporary restriction to the natural range of migratory fish may occur as a result of underwater noise emissions within a highly localised area (i.e. within up to 37 m of the works), during installation/decommissioning activities. However, any such disturbance will be temporary and short term with background conditions returning following completion of installation activities. Given that the Waterway currently experiences high levels of vessel traffic, the proposed META activities are not predicted to result in any novel disturbance to migratory fish in the area.

The presence, abundance, condition and diversity of habitats and species required to support this species is such that the distribution, abundance and populations dynamics of the species within the site and population beyond the site is stable or increasing.

5.4.1.44 The objective to maintain the habitats upon which migratory species rely will not be affected by underwater noise emissions from the META project and therefore this objective will not be restricted from being achieved.

5.4.1.45 Therefore, no adverse effect on the integrity of the Pembrokeshire Marine SAC from this potential impact can be concluded.

Cleddau Rivers SAC

5.4.1.46 Significant adverse effects on the qualifying Annex II diadromous fish features of the Cleddau Rivers SAC (i.e. sea lamprey and river lamprey) are not predicted to occur as a result of underwater noise during installation/decommissioning. Potential effects from this activity on the relevant Conservation Objectives (as presented in paragraph 5.2.1.3) are discussed in turn below.

The population of the feature in the SAC must be stable or increasing over the long term.

5.4.1.47 The project will not affect or restrict the objective for sea and river lamprey populations to remain stable or to increase over the long term as all proposed activities will be temporary in nature, of short duration, and are unlikely to result in injury or any significant disturbance effects.

The natural range of the feature in the SAC is neither being reduced nor is likely to be reduced for the foreseeable future.

5.4.1.48 Some temporary restriction to the natural range of migratory fish may occur as a result of underwater noise emissions within a highly localised area (i.e. within up to 37 m of the works), during installation/decommissioning activities. However, any such disturbance will be temporary and short term, with background conditions returning following completion of installation activities. Given that the Waterway currently experiences high levels of vessel traffic, the proposed META activities are not predicted to result in any novel disturbance to migratory fish in the area.

Passage of the feature through the SAC is not to be hindered by artificial barriers such as weirs.

5.4.1.49 The META project is not located within the SAC therefore migratory fish species will not be hindered by artificial barriers.

The characteristic channel morphology provides the diversity of water depths, current velocities and substrate types necessary to fulfil the habitat requirements of the features. The close proximity of different habitats facilitates movement of fish to new preferred habitats with age.

5.4.1.50 The META project will not affect channel morphology within this SAC and therefore the project will not affect this objective from being achieved.

5.4.1.51 Therefore, no adverse effect on the integrity of the Cleddau Rivers SAC from this potential impact can be concluded.

Accidental pollution

- 5.4.1.52 During the installation/decommissioning of META devices and ancillary infrastructure, accidental spillages or release of chemicals, such as fuel, oil and lubricants, into the environment could potentially contaminate the marine environment and Annex II diadromous fish.
- 5.4.1.53 The magnitude of such an impact on migratory fish would be entirely dependent upon the quantities and nature of the spillage, the dilution and dispersal properties of the waters and the bio-availability of the contaminant to species. The more toxic components of fuel spills are volatile and relatively short-lived. Heavier hydrocarbons, while less toxic, may persist for longer in the marine environment. Pollutants within a low energy environment, such as closed harbours, are able to accumulate to potentially toxic levels. All META sites, due to the nature of the marine renewable device, are located within high energy environments. Should any pollutants be accidentally released, dilution and the local hydrodynamic regime will aid in dispersal to levels below that of biological toxicity.

Embedded mitigation

- 5.4.1.54 As outlined in Table 8.17 of chapter 8: Fish and Shellfish of the Environmental Statement, measures adopted as part of the project include the production of a Marine Pollution Contingency Plan (MPCP). The MPCP will cover the installation, operation and maintenance, and decommissioning phases of the META project and will include planning for accidental spills, address all potential contaminant releases and include key emergency contact details and process to follow in the event of accidental spill. This will ensure that the potential for release of pollutants from operation and maintenance activities is minimised. In this manner, accidental release of potential release of contaminants from devices/components as well as from maintenance vessels will be strictly controlled, thus providing protection for marine life across all phases of the project.

Allis shad, twaite shad, river lamprey and sea lamprey

- 5.4.1.55 The sensitivity of fish species will vary depending on a range of factors including the pollutant, species and life stage involved with fish eggs and larvae likely to be particularly sensitive (Westernhagen, 1988). As only adult and juvenile fish species are likely to be in the vicinity of the installation works, they are considered less likely to be affected by marine pollution due to their increased mobility. There is also evidence that fish have the ability to detect (and therefore avoid) oil-contaminated waters through olfactory (smell) or gustatory (taste) systems (Claireaux *et al.* 2017).
- 5.4.1.56 In the unlikely event that pollutants were to enter the Waterway, they would be rapidly dispersed on the surface and in the water column and subject to twice daily tidal flushing, and so any effects on water quality would be limited.

- 5.4.1.57 Annex II diadromous fish species may be vulnerable to pollutants in the very short term when the accidental event occurs, however recovery is likely to be high as all META sites are located in either high energy or meso-tidal energy environments, therefore dispersing any pollutants rapidly, demonstrated by the Sea Empress oil spill in 1996 (Edwards and White, 1999). Migratory fish species are also expected to show some tolerance and avoidance behaviour to pollutants as evidenced in the Sea Empress spill, no mortalities of these species were recorded following the 72,000 tonnes of light crude oil spilt at the entrance of the Milford Haven (Edwards and White, 1999), although it is important to point out that this spill occurred in February outside of migrating season. Any accidental pollution event associated with the META project is likely to be considerably smaller in magnitude. Installation activities are short-lived and likely to result in only short-term changes in migratory fish behaviour (avoidance) and are therefore not considered likely to result in fish mortality.

Conclusions

Pembrokeshire Marine SAC

- 5.4.1.58 Significant adverse effects on the qualifying Annex II diadromous fish features of the Pembrokeshire Marine SAC (i.e. allis shad, twaite shad, sea lamprey and river lamprey) are not predicted to occur as a result of accidental pollution during installation/decommissioning activities. Potential effects from this activity on the relevant Conservation Objectives (as presented in paragraph 5.2.1.2) are discussed in turn below.

The population is maintaining itself on a long-term basis as a viable component of its natural habitat.

- 5.4.1.59 Given the low volumes of potential pollutants that will be used during the META project, the low likelihood of a spill occurring, and the highly mobile nature of migratory fish populations associated with the SAC, they are not considered likely to be affected over the long term.

The species population within the site is such that the natural range of the population is not being reduced or likely to be reduced for the foreseeable future.

- 5.4.1.60 The migratory fish populations will not reduce for the foreseeable future as a consequence of an accidental pollution event. Therefore, this Conservation Objective will be maintained.

The presence, abundance, condition and diversity of habitats and species required to support this species is such that the distribution, abundance and populations dynamics of the species within the site and population beyond the site is stable or increasing.

- 5.4.1.61 The low likelihood of an accidental event will ensure that the habitat quality will not be degraded by the project. Therefore, this Conservation Objective will be maintained.

- 5.4.1.62 Therefore, no adverse effect on the integrity of the Pembrokeshire Marine SAC from this potential impact can be concluded.

Cleddau Rivers SAC

- 5.4.1.63 Significant adverse effects on the qualifying Annex II diadromous fish features of the Cleddau Rivers SAC (i.e. sea lamprey and river lamprey) are not predicted to occur as a result of accidental pollution during installation/decommissioning activities. Potential effects from this activity on the relevant Conservation Objectives (as presented in paragraph 5.2.1.3) are discussed in turn below.

The population of the feature in the SAC must be stable or increasing over the long term.

- 5.4.1.64 Migratory fish species populations would not be restricted by any potential accidental spill event given the low volumes of pollutants that will be used, the proposed mitigation measures that will be in place and highly mobile nature of the fish species. Therefore, this Conservation Objective will be maintained.

The natural range of the feature in the SAC is neither being reduced nor is likely to be reduced for the foreseeable future.

- 5.4.1.65 The migratory fish populations will not reduce for the foreseeable future as a consequence of an accidental pollution event. Therefore, this Conservation Objective will be maintained.

Passage of the feature through the SAC is not to be hindered by artificial barriers such as weirs.

- 5.4.1.66 Any potential accidental pollution event would not cause migratory to fish to be restricted by artificial barriers within the SAC. Therefore, this Conservation Objective will be maintained.

The characteristic channel morphology provides the diversity of water depths, current velocities and substrate types necessary to fulfil the habitat requirements of the features. The close proximity of different habitats facilitates movement of fish to new preferred habitats with age.

- 5.4.1.67 Any potential accidental pollution event would not cause changes to the channel morphology of the SAC on which migratory fish species rely. Therefore, this Conservation Objective will be maintained.

- 5.4.1.68 Therefore, no adverse effect on the integrity of the Cleddau Rivers SAC from this potential impact can be concluded.

5.4.2 Potential impacts – operation and maintenance

Temporary habitat loss

- 5.4.2.1 The presence of marine renewable devices and ancillary infrastructure for the META project with the Waterway may result in a medium term (up to 12 -18 months) habitat loss from the area. The most likely temporary habitat loss is up to 3-6 months.
- 5.4.2.2 The maximum and most likely design scenarios for temporary habitat loss, as presented in the chapter 8: Fish and Shellfish of the Environmental Statement, are summarised in Table 5.4 below.

- 5.4.2.3 The combined maximum scenario for all sites for marine renewable devices and ancillary infrastructure for habitat loss is up to 11,050 m² and for the most likely scenario is 2,000 m². It can be expected that gravity base/moorings are to be in-situ for up to 6 months at Warrior Way (site 6), 12 months for Dale Roads (site 7) and 18 months at East Pickard Bay (site 8).

Table 5.4: Maximum and most likely design scenarios considered for the assessment of potential impacts on Annex II diadromous fish from temporary loss of fish and shellfish habitat.

Maximum design scenario	Most likely design scenario
- Combined (Warrior Way + Dale Roads + East Pickard Bay) total subtidal habitat loss of up to 11,050 m² at any one time comprising: - Up to 200 m² of habitat loss at Warrior Way per testing scenario broken down as follows: - Up to 200 m² from device or component footprint on the seabed (including mooring/pin pile footprint). - Up to 600 m² of long-term habitat loss at Dale Roads per testing scenario broken down as follows: - Up to 600 m² from device or component footprint on the seabed (including mooring/pin pile footprint) - Up to 10,250 m² of habitat loss at East Pickard Bay broken down as follows: - Up to 10,250 m² from up to two device or component footprints on the seabed (including mooring/pin pile footprint). - Deployment durations: - Moored/gravity base deployment duration at Warrior Way: up to 6 months; - Moored/gravity base deployment duration at Dale Roads: up to 12 months; and - Moored/gravity base deployment duration at East Pickard Bay: up to 18 months.	- Combined (Warrior Way + Dale Roads + East Pickard Bay) total subtidal habitat loss of up to 2,000 m² at any one time comprising: - Up to 100 m² of habitat loss at Warrior Way per testing scenario from device or component footprint on the seabed; - Up to 200 m² of habitat loss at Dale Roads per testing scenario from device or component footprint on the seabed; - Up to 1,700 m² of habitat loss at East Pickard Bay per testing scenario from device or component footprint on the seabed. - Deployment durations: - Moored/gravity base deployment duration at Warrior Way: up to 3 months; - Moored/gravity base deployment duration at Dale Roads: up to 6 months; and - Moored/gravity base deployment duration at East Pickard Bay: up to 6 months.

Allis shad, twaite shad, river lamprey and sea lamprey

- 5.4.2.4 Migratory fish may be vulnerable to habitat disturbance or loss of habitat in the medium term when devices/ancillary equipment are deployed, however recovery is likely to be rapid as extensive alternative habitat is available throughout the Waterway and the area of potential overlap of the META project with migratory fish species pathways is very small. Any disturbance to migratory fish will also be intermittent during the installation phase and temporary in nature.

Conclusions

Pembrokeshire Marine SAC

- 5.4.2.5 Significant adverse effects on the qualifying Annex II diadromous fish features of the Pembrokeshire Marine SAC (i.e. allis shad, twaite shad, sea lamprey and river lamprey) are not predicted to occur as a result of temporary loss of fish and shellfish habitat. Potential effects from this activity on the relevant Conservation Objectives (as presented in paragraph 5.2.1.2) are discussed in turn below.

The population is maintaining itself on a long-term basis as a viable component of its natural habitat.

- 5.4.2.6 All habitat loss associated with the META project will be temporary, of short-term duration and will only affect a very small percentage of the total extent of habitats available in the wider area to migratory fish features of the SAC. It will also be reversible following the decommissioning of devices/components. Therefore, it is not considered that these activities will affect the ability of migratory fish species populations to be maintained in the long term.

The species population within the site is such that the natural range of the population is not being reduced or likely to be reduced for the foreseeable future.

- 5.4.2.7 Some restriction to the natural range may occur as a result of habitat loss within a localised area within each META site. However, all disturbance/loss will be temporary and of a small scale, and reversible following decommissioning of the devices/components.

The presence, abundance, condition and diversity of habitats and species required to support this species is such that the distribution, abundance and populations dynamics of the species within the site and population beyond the site is stable or increasing.

- 5.4.2.8 Some change to the condition of habitats required to support migratory fish may occur as a result of habitat loss within a localised area within each META site. However, all disturbance/loss will be temporary and therefore reversible following decommissioning of the devices/components.

- 5.4.2.9 Therefore, no adverse effect on the integrity of the Pembrokeshire Marine SAC from this potential impact can be concluded.

Cleddau Rivers SAC

- 5.4.2.10 Significant adverse effects on the qualifying Annex II diadromous fish features of the Cleddau Rivers SAC (i.e. sea lamprey and river lamprey) are not predicted to occur as a result of temporary loss of fish and shellfish habitat. Potential effects from this activity on the relevant Conservation Objectives (as presented in paragraph 5.2.1.3) are discussed in turn below.

The population of the feature in the SAC must be stable or increasing over the long term.

- 5.4.2.11 The habitat loss predicted as a result of the META project will be temporary, small scale and localised. This impact is not predicted to result in the direct mortality of migratory fish species or to affect the survival rates of individuals or the populations as a whole on the basis that extensive comparable habitat is present in the wider area. Therefore, it is not considered that these activities will affect the ability of the populations of migratory fish to remain stable or increase over the long term.

The natural range of the feature in the SAC is neither being reduced nor is likely to be reduced for the foreseeable future.

- 5.4.2.12 Some restriction to the natural range may occur as a result of habitat loss within a localised area within each META site. However, all loss will be temporary and therefore reversible following decommissioning of the devices/components.

Passage of the feature through the SAC is not to be hindered by artificial barriers such as weirs.

- 5.4.2.13 As all temporary habitat loss predicted to arise as a result of the META project falls out with the boundary of the SAC, there will be no barrier to the passage of sea lamprey or river lamprey through the Cleddau Rivers SAC as a result of the project. Similarly, the project is not predicted to result in any barrier to the passage of designated fish features during their migrations to or from the SAC. Therefore, this Conservation Objective will be maintained.

The characteristic channel morphology provides the diversity of water depths, current velocities and substrate types necessary to fulfil the habitat requirements of the features. The close proximity of different habitats facilitates movement of fish to new preferred habitats with age.

- 5.4.2.14 As all temporary habitat loss predicted to arise as a result of the META project falls out with the boundary of the SAC, it is not considered that these activities will affect the channel morphology or range of habitat present within the site.

- 5.4.2.15 Therefore, no adverse effect on the integrity of the Cleddau Rivers SAC from this potential impact can be concluded.

Underwater noise

- 5.4.2.16 The operation of wave and tidal devices at the META sites, over the lifetime of the project, has the potential to introduce underwater noise into the marine environment.

- 5.4.2.17 The maximum and most likely design scenarios for underwater noise arising from device operation are summarised in Table 5.5 below.

Table 5.5: Maximum and most likely design scenarios considered for the assessment of potential impacts on Annex II diadromous fish from underwater noise during device operation.

Maximum design scenario	Most likely design scenario
Warrior Way - Scaled tidal devices; and - Micro tidal devices.	Warrior Way - Scaled tidal devices; and - Micro tidal devices.
Dale Roads - Scaled wave energy converter (WEC) devices; and - Full-scale WEC devices.	Dale Roads - Scaled wave energy converter (WEC) devices; and - Full-scale WEC devices.
East Pickard Bay - Scaled WEC devices; and - Full-scale WEC devices.	East Pickard Bay - Scaled WEC devices; and - Full-scale WEC devices.

Allis shad, twaite shad, river lamprey and sea lamprey

5.4.2.18 Chapter 6: Underwater Noise of the Environmental Statement presents a review of underwater noise emissions from wave and tidal energy devices. Using the outcomes of this review, a range of source noise levels has been modelled (162 to 180 dB re 1 µPa at 1 m) based on noise measurements of an OpenHydro tidal turbine at the EMEC facility in Orkney (Parvin and Brooker, 2008) and the Pelamis P2 measured at Billia Croo (Lepper and Robinson, 2016). It is considered that the source noise levels modelled are representative of the potential noise output from renewable energy convertors that might be used, although it is likely that the dB level will be higher and therefore the predicted effects on fish, as outlined in Table 5.6, are considered to represent a highly conservative assessment.

Table 5.6: Calculated effects of continuous operational device noise on fish receptors.

Activity	ASA Radius of potential recoverable injury zone (assuming continuous exposure within that radius over 24-hour period)	
	Fish: swim bladder involved in hearing	All fish
OpenHydro tidal turbine	4 m	78 m
Pelamis P2 WEC	0 m	6 m

5.4.2.19 On the basis of the above, it is not expected that any fish will experience injury as a result of exposure to noise from the operation of marine energy devices. The disturbance zone for migratory fish is likely to be less than 80 m around each device, although this is based on the upper range of noise levels expected.

Conclusions

Pembrokeshire Marine SAC

5.4.2.20 Significant adverse effects on the qualifying Annex II diadromous fish features of the Pembrokeshire Marine SAC (i.e. allis shad, twaite shad, sea lamprey and river lamprey) are not predicted to occur as a result of underwater noise during operation. Potential effects from this activity on the relevant Conservation Objectives (as presented in paragraph 5.2.1.2) are discussed in turn below.

The population is maintaining itself on a long-term basis as a viable component of its natural habitat.

5.4.2.21 The META project will not affect the ability of migratory fish species populations to be maintained in the long term given the fact that injury to migratory fish from underwater noise is highly unlikely and disturbance will be highly localised to the immediate vicinity of the devices.

The species population within the site is such that the natural range of the population is not being reduced or likely to be reduced for the foreseeable future.

5.4.2.22 Some temporary restriction to the natural range of migratory fish may occur as a result of underwater noise emissions during operation of scaled tidal turbines within a highly localised area (i.e. within up to 80 m of the devices). However, any such disturbance will be temporary and short term with background conditions returning following removal of the devices. Furthermore, in reality the disturbance zone is likely to be less than 80 m as this is the predicted zone of disturbance based on a source noise for a full-scale tidal device and only scaled tidal devices (with lower source levels) will be deployed. Given that the Waterway currently experiences high levels of vessel traffic, the proposed META activities are not predicted to result in any novel disturbance from underwater noise to migratory fish in the area.

The presence, abundance, condition and diversity of habitats and species required to support this species is such that the distribution, abundance and populations dynamics of the species within the site and population beyond the site is stable or increasing.

5.4.2.23 The objective to maintain the habitats upon which migratory species rely will not be affected by underwater noise emissions during operation from the META project and therefore this objective will not be restricted from being achieved.

5.4.2.24 Therefore, no adverse effect on the integrity of the Pembrokeshire Marine SAC from this potential impact can be concluded.

Cleddau Rivers SAC

5.4.2.25 Significant adverse effects on the qualifying Annex II diadromous fish features of the Cleddau Rivers SAC (i.e. sea lamprey and river lamprey) are not predicted to occur as a result of underwater noise during operation. Potential effects from this activity on the relevant Conservation Objectives (as presented in paragraph 5.2.1.3) are discussed in turn below.

The population of the feature in the SAC must be stable or increasing over the long term.

5.4.2.26 The project will not affect or restrict the objective for sea and river lamprey populations to remain stable or to increase over the long term as none of the proposed activities are likely to result in injury or any significant disturbance effects.

The natural range of the feature in the SAC is neither being reduced nor is likely to be reduced for the foreseeable future.

5.4.2.27 Some temporary restriction to the natural range of migratory fish may occur as a result of underwater noise emissions within a highly localised area (i.e. within up to 80 m of the devices), during operation. However, any such disturbance will be temporary and short term with background conditions returning following removal of the devices. Furthermore, in reality the disturbance zone is likely to be less than 80 m as this is the predicted zone of disturbance based on a source noise for a full-scale tidal device and only scaled tidal devices (with lower source levels) will be deployed. Given that the Waterway currently experiences high levels of vessel traffic and anthropogenic input, the proposed META activities are not predicted to result in any novel disturbance from underwater noise to migratory fish in the area.

Passage of the feature through the SAC is not to be hindered by artificial barriers such as weirs.

5.4.2.28 The META project is not located within the SAC therefore migratory fish species will not be hindered by artificial barriers within the SAC.

The characteristic channel morphology provides the diversity of water depths, current velocities and substrate types necessary to fulfil the habitat requirements of the features. The close proximity of different habitats facilitates movement of fish to new preferred habitats with age.

5.4.2.29 The META project will not affect channel morphology within this SAC and therefore the project will not affect this objective from being achieved.

5.4.2.30 Therefore, no adverse effect on the integrity of the Cleddau Rivers SAC from this potential impact can be concluded.

Turbine collision risk at Warrior Way (site 6)

5.4.2.31 The introduction of scaled or micro-scale tidal turbines poses a potential risk to fish receptors at Warrior Way (site 6). Device components, specifically the terminal end of the rotating blade, poses the greatest risk of potential injury in the event of a collision (Turnpenny *et al.*, 2000).

5.4.2.32 The maximum and most likely design scenarios for collision temporary changes to fish and shellfish habitat, as presented in the chapter 8: Fish and Shellfish of the Environmental Statement, are summarised in Table 5.7 below.

Table 5.7: Maximum and most likely design scenarios considered for the assessment of potential impacts on Annex II diadromous fish from turbine collision risk during operation.

Maximum design scenario	Most likely design scenario
Warrior Way - Tidal device testing will only be supported at Warrior Way (site 6). - Tidal components may occupy all or part of the water-column. - Up to 20 m width and 10 m length. - Rotor diameter up to 5 m, with a tip speed of up to 5 m/s and a swept area of 19.63 m².	Warrior Way - Tidal device testing will only be supported at Warrior Way (site 6). - Tidal components may occupy all or part of the water-column. - Up to 5 m width and 5 m length. - Rotor diameter up to 5 m, with a tip speed of up to 2 m/s and a swept area of 19.63 m².

Allis shad, twaite shad, river lamprey and sea lamprey

5.4.2.33 As discussed in paragraph 8.11.2.46 *et seq.* of chapter 8: Fish and Shellfish of the Environmental Statement, the maximum number of tidal turbines to be installed at Warrior Way (site 6) at any time is one. Tidal turbines will be scaled/micro-scale devices. The maximum rotor diameter (for both the maximum and most likely design scenarios) will be up to 5 m, with tip speeds of 5 m/s or less. This equates to a swept area of 19.63 m².

5.4.2.34 For context, the width of the Waterway at Warrior Way (site 6) equates to approximately 330 m. The rotor diameter therefore equates to 1.51% of the tidal stream cross-sectional area at this location. The maximum duration of scaled tidal device testing at Warrior Way (site 6) is 3-6 months, and the most likely is 1-3 months.

5.4.2.35 Migratory fish species may be vulnerable to collision with scaled, operational tidal turbines at Warrior Way (site 6). Should an individual come into close proximity to turbine blades or nacelle, it is likely that avoidance behaviour of the perceived risk will minimise potential collision (Zhang *et al.*, 2016; Wilson *et al.*, 2007). Zhang *et al.* (2016) found that the presence of a tidal turbine with a tip speed of 10 m/s (twice the maximum speed at Warrior Way (site 6)) resulted in 100% survival of all fish species (no injury of deaths) used in the study. In addition, collision risk has been found to be low for small -sized fish, but as the turbines increase in size, greater than 5 m, the risk of collision increases for bigger fish (Hammar, 2015; Wilson *et al.*, 2007).

- 5.4.2.36 Should a collision occur, recovery is likely (Amaral, 2015). In addition, migratory species are likely to conserve energy in the lee side of a river, away from high energy environments (Hinch and Rand, 2000). As the marine renewable device is designed to generate energy from high energy environments, it is likely the device will be positioned in an unfavourable environment for migratory species (Hinch and Rand, 2000).

Conclusions

Pembrokeshire Marine SAC

- 5.4.2.37 Significant adverse effects on the qualifying Annex II diadromous fish features of the Pembrokeshire Marine SAC (i.e. allis shad, twaite shad, sea lamprey and river lamprey) are not predicted to occur as a result of tidal turbine collision risk at Warrior Way (site 6) during operation. Potential effects from this activity on the relevant Conservation Objectives (as presented in paragraph 5.2.1.2) are discussed in turn below.

The population is maintaining itself on a long-term basis as a viable component of its natural habitat.

- 5.4.2.38 On the basis that mortality of migratory fish as a result of a collision with a tidal turbine at Warrior Way (site 6) is considered to be unlikely, the META project is not deemed likely to affect the ability of migratory fish species populations to be maintained in the long term.

The species population within the site is such that the natural range of the population is not being reduced or likely to be reduced for the foreseeable future.

- 5.4.2.39 Collision risk at Warrior Way (site 6) will not reduce the natural range of the populations of migratory fish and, therefore, the project will not affect this objective from being achieved.

The presence, abundance, condition and diversity of habitats and species required to support this species is such that the distribution, abundance and populations dynamics of the species within the site and population beyond the site is stable or increasing.

- 5.4.2.40 The objective to maintain the habitats upon which migratory species rely will not be affected by collision risk during operation from the META project and therefore this objective will not be restricted from being achieved.

- 5.4.2.41 Therefore, no adverse effect on the integrity of the Pembrokeshire Marine SAC from this potential impact can be concluded.

Cleddau Rivers SAC

- 5.4.2.42 Significant adverse effects on the qualifying Annex II diadromous fish features of the Cleddau Rivers SAC (i.e. sea lamprey and river lamprey) are not predicted to occur as a result of tidal turbine collision risk during operation. Potential effects from this activity on the relevant Conservation Objectives (as presented in paragraph 5.2.1.3) are discussed in turn below.

The population of the feature in the SAC must be stable or increasing over the long term.

- 5.4.2.43 The project will not affect or restrict the objective for sea and river lamprey populations to remain stable or to increase over the long term as the presence of tidal turbines at Warrior Way (site 6) are considered highly unlikely to result in mortality of migratory fish.

The natural range of the feature in the SAC is neither being reduced nor is likely to be reduced for the foreseeable future.

- 5.4.2.44 Collision risk at Warrior Way (site 6) will not reduce the natural range of the populations of migratory fish and, therefore, the project will not affect this objective from being achieved.

Passage of the feature through the SAC is not to be hindered by artificial barriers such as weirs.

- 5.4.2.45 The META project is not located within the SAC therefore migratory fish species will not be hindered by artificial barriers.

The characteristic channel morphology provides the diversity of water depths, current velocities and substrate types necessary to fulfil the habitat requirements of the features. The close proximity of different habitats facilitates movement of fish to new preferred habitats with age.

- 5.4.2.46 The META project will not affect channel morphology within this SAC and therefore the project will not affect this objective from being achieved.

- 5.4.2.47 Therefore, no adverse effect on the integrity of the Cleddau Rivers SAC from this potential impact can be concluded.

Barrier effects due to presence of tidal devices at Warrior Way (site 6)

- 5.4.2.48 The presence of a single tidal turbine within the Warrior Way site (site 6) at any time, has the potential to cause a barrier to movement of migratory fish, including displacement from known migratory routes. This could affect migratory species ability to reach breeding/feeding grounds, and therefore may affect breeding success and population viability.

- 5.4.2.49 The maximum and most likely design scenarios for barrier effects from tidal devices, as presented in the chapter 8: Fish and Shellfish of the Environmental Statement, are summarised previously for collision risk in Table 5.5 above.

Allis shad, twaite shad, river lamprey and sea lamprey

- 5.4.2.50 The maximum number of tidal turbines to be installed at Warrior Way (site 6) at any time is one and tidal turbines will be scaled/micro-scale devices. The maximum rotor diameter (maximum scenario) will be up to 5 m, with tip speeds of 5 m/s or less. This equates to a swept area for both the maximum and most likely design scenarios of up to 19.63 m².
- 5.4.2.51 For context, the width of the Waterway at Warrior Way (site 6) equates to approximately 330 m. The rotor diameter therefore equates to 1.51% of the tidal stream cross-sectional area at this location. The maximum duration of scaled tidal device testing at Warrior Way (site 6) is 3-6 months, and the most likely is 1-3 months.
- 5.4.2.52 Wilson *et al.* (2007) demonstrated that visual appearance and activity of a marine device is important in fish avoidance behaviour. The study found that fish will predominately use vision as their main stimulus and it has been observed that fish do not perform well when ambient light falls below critical levels night time (Ryer and Olla, 2000). For instance, herring avoided stationary objects using visual stimuli during the day but collided with the same obstacle during the night (Blaxter and Batty, 1985). It has also been found that herring exhibit strong avoidance behaviours of vibrating obstacles in the dark (Blaxter and Batty, 1985).
- 5.4.2.53 As lamprey species are known to migrate along the seabed, the main species of concern are shad, however animals are likely to display some avoidance behaviour in close proximity to an operating turbine. In addition, there is sufficient space for migratory species to pass the turbine and species are likely to migrate along areas of low energy i.e. in the lee of a meander, to conserve energy (Hinch and Rand, 2000). The marine renewable device will most likely be placed in an area of high energy. Any vibration coming from the turbine will most likely be far less than vessels commuting through the area and is unlikely to pose a barrier to migratory species.

Conclusions

Pembrokeshire Marine SAC

- 5.4.2.54 Significant adverse effects on the qualifying Annex II diadromous fish features of the Pembrokeshire Marine SAC (i.e. allis shad, twaite shad, sea lamprey and river lamprey) are not predicted to occur as a result of barrier effects from tidal devices during operation. Potential effects from this activity on the relevant Conservation Objectives (as presented in paragraph 5.2.1.2) are discussed in turn below.
- The population is maintaining itself on a long-term basis as a viable component of its natural habitat.*
- 5.4.2.55 Barrier effects to the movement of migratory fish are not anticipated on the basis of the small proportion of the cross-sectional area of the Waterway which will be affected at Warrior Way (site 6) and therefore this objective will not be restricted from being achieved.

The species population within the site is such that the natural range of the population is not being reduced or likely to be reduced for the foreseeable future.

- 5.4.2.56 As barrier effects to the movement of migratory fish are not predicted, it is not considered that the presence of tidal devices at Warrior Way (site 6) will reduce the natural range of the populations of migratory fish in the future. Therefore, the project will not affect this objective from being achieved.

The presence, abundance, condition and diversity of habitats and species required to support this species is such that the distribution, abundance and populations dynamics of the species within the site and population beyond the site is stable or increasing.

- 5.4.2.57 Although there will be some exclusion of migratory fish from the immediate vicinity of tidal devices at Warrior Way (site 6), the habitat in this vicinity is not considered likely to be of particular importance to migratory fish and similar habitat is available in the wider area. Therefore, this objective will not be restricted from being achieved.

- 5.4.2.58 Therefore, no adverse effect on the integrity of the Pembrokeshire Marine SAC from this potential impact can be concluded.

Cleddau Rivers SAC

- 5.4.2.59 Significant adverse effects on the qualifying Annex II diadromous fish features of the Cleddau Rivers SAC (i.e. sea lamprey and river lamprey) are not predicted to occur as a result of barrier effects from tidal devices during operation. Lamprey species are known to migrate along the seabed, and are therefore considered unlikely to interact with any operating scaled or micro-scale tidal turbine. Potential effects from this activity on the relevant Conservation Objectives (as presented in paragraph 5.2.1.3) are discussed in turn below.

The population of the feature in the SAC must be stable or increasing over the long term.

- 5.4.2.60 The project will not affect or restrict the objective for sea and river lamprey populations to remain stable or to increase over the long term as the presence of tidal turbines at Warrior Way (site 6) are unlikely to result in barrier effects to their movement to/from this site.

The natural range of the feature in the SAC is neither being reduced nor is likely to be reduced for the foreseeable future.

- 5.4.2.61 The presence of tidal devices at Warrior Way (site 6) will not reduce the natural range of the populations of migratory fish and, therefore, the project will not affect this objective from being achieved.

Passage of the feature through the SAC is not to be hindered by artificial barriers such as weirs.

- 5.4.2.62 The META project is not located within the SAC so therefore migratory fish species will not be hindered by artificial barriers.

The characteristic channel morphology provides the diversity of water depths, current velocities and substrate types necessary to fulfil the habitat requirements of the features. The close proximity of different habitats facilitates movement of fish to new preferred habitats with age.

5.4.2.63 The META project will not affect channel morphology within this SAC and therefore the project will not affect this objective from being achieved.

5.4.2.64 Therefore, no adverse effect on the integrity of the Cleddau Rivers SAC from this potential impact can be concluded.

Accidental pollution

5.4.2.65 There is the potential for the accidental release of pollutants into the marine environment during operation and maintenance activities, as a result of accidental spillage or leakage for example. Pollution may include diesel oil from vessels and synthetic chemicals.

Embedded mitigation

5.4.2.66 As outlined in Table 8.17 of chapter 8: Fish and Shellfish of the Environmental Statement, measures adopted as part of the project include the production of a MSCP which will include planning for accidental spills, address all potential contaminant releases and include key emergency contact detail. This will ensure that the potential for release of pollutants from operation and maintenance activities is minimised. In this manner, accidental release of potential release of contaminants from maintenance vessels and from the devices/components deployed at the META sites will be strictly controlled, thus providing protection for marine life across all phases of the project.

Allis shad, twaite shad, river lamprey and sea lamprey

5.4.2.67 Effects of an accidental pollution event on Annex II diadromous species is as described previously in paragraph 5.4.1.55 *et seq.* Annex II diadromous fish species may be vulnerable to pollutants in the very short term when the accidental event occurs, however recovery is likely to be high as all META sites are located in either high energy or meso-tidal energy environments, therefore dispersing any pollutants rapidly, demonstrated by the sea empress oil spill in 1996 (Edwards and White, 1999). Migratory fish species are also expected to show some tolerance and avoidance behaviour to pollutants. Any accidental pollution event associated with the META project is likely to considerably smaller in magnitude and are therefore not considered likely to result in fish mortality.

Conclusions

Pembrokeshire Marine SAC

5.4.2.68 Significant adverse effects on the qualifying Annex II diadromous fish features of the Pembrokeshire Marine SAC (i.e. allis shad, twaite shad, sea lamprey and river lamprey) are not predicted to occur as a result of accidental pollution during operation and maintenance activities. Potential effects from this activity on the relevant Conservation Objectives (as presented in paragraph 5.2.1.2) are discussed in turn below.

The population is maintaining itself on a long-term basis as a viable component of its natural habitat.

5.4.2.69 Given the low volumes of potential pollutants that will be used during the META project, the low likelihood of a spill occurring, and the highly mobile nature of migratory fish populations associated with the SAC, they are not considered likely to be affected over the long term.

The species population within the site is such that the natural range of the population is not being reduced or likely to be reduced for the foreseeable future.

5.4.2.70 The migratory fish populations will not reduce for the foreseeable future as a consequence of an accidental pollution event. Therefore, this Conservation Objective will be maintained.

The presence, abundance, condition and diversity of habitats and species required to support this species is such that the distribution, abundance and populations dynamics of the species within the site and population beyond the site is stable or increasing.

5.4.2.71 The low likelihood of an accidental event will ensure that the habitat quality will not be degraded by the project. Therefore, this Conservation Objective will be maintained.

5.4.2.72 Therefore, no adverse effect on the integrity of the Pembrokeshire Marine SAC from this potential impact can be concluded.

Cleddau Rivers SAC

5.4.2.73 Significant adverse effects on the qualifying Annex II diadromous fish features of the Cleddau Rivers SAC (i.e. sea lamprey and river lamprey) are not predicted to occur as a result of accidental pollution during operation and maintenance activities. Potential effects from this activity on the relevant Conservation Objectives (as presented in paragraph 5.2.1.3) are discussed in turn below.

The population of the feature in the SAC must be stable or increasing over the long term.

5.4.2.74 Migratory fish species populations would not be restricted by any potential accidental spill event given the low volumes of pollutants that will be used, the proposed mitigation measures that will be in place and highly mobile nature of the fish species. Therefore, this Conservation Objective will be maintained.

The natural range of the feature in the SAC is neither being reduced nor is likely to be reduced for the foreseeable future.

- 5.4.2.75 The migratory fish populations will not reduce for the foreseeable future as a consequence of an accidental pollution event. Therefore, this Conservation Objective will be maintained.

Passage of the feature through the SAC is not to be hindered by artificial barriers such as weirs.

- 5.4.2.76 Any potential accidental pollution event would not cause migratory fish to be restricted by artificial barriers within the SAC. Therefore, this Conservation Objective will be maintained.

The characteristic channel morphology provides the diversity of water depths, current velocities and substrate types necessary to fulfil the habitat requirements of the features. The close proximity of different habitats facilitates movement of fish to new preferred habitats with age.

- 5.4.2.77 Any potential accidental pollution event would not cause changes to the channel morphology of the SAC on which migratory fish species rely. Therefore, this Conservation Objective will be maintained.

- 5.4.2.78 Therefore, no adverse effect on the integrity of the Cleddau Rivers SAC from this potential impact can be concluded.

5.5 Assessment of Adverse Effects on Integrity – the META project in-combination with other plans or projects

- 5.5.1.1 The other developments (projects/plans) that could result in in-combination effects associated with the proposal on Annex II diadromous fish features of the designated sites identified have been summarised in Table 5.8.

- 5.5.1.2 A number of impacts considered for the META project alone, as set out in section 5.4, have not been considered in the in-combination assessment. This is because many of the potential impacts identified and assessed for the META project alone are relatively localised and temporary in nature and therefore have limited or no potential to interact with similar changes associated with other projects. Impacts ‘tidal turbine collision risk’, and ‘physical barrier to movement of known migratory routes due to presence of tidal device’ have not been assessed, as only operations associated with META project testing at Warrior Way (site 6) have the potential to result in either impact. On this basis, the potential impacts identified for assessment as part of the fish and shellfish CIA in chapter 8: Fish and Shellfish Ecology of the Environmental Statement, and which have been brought forward for consideration in the in-combination assessment of the RIAA are:

- Temporary changes in fish and shellfish habitat; and
- Temporary increases in suspended sediments.

Table 5.8: List of other projects and plans with potential for in-combination effects on Annex II diadromous fish.

Phase	Developer - Reference	Distance from Warrior Way (site 6) (km)	Distance from Dale Roads (site 7) (km)	Distance from East Pickard Bay (site 8) (km)	Spatial/temporal overlap with the META project	Details	Date of installation/operation	Further assessment required?	Justification for screening into in-combination assessment
Plans									
Installation/ Operation and Maintenance/ Decommissioning	dWNMP (Welsh Government, 2017)	0.00	0.0	0.0	Spatial overlap and temporal overlap	The WNMP is being prepared by the Welsh Government in accordance with the Marine and Coastal Access Act 2009 (MCAA). The purpose of marine planning under the MCAA is to help achieve sustainable development in the marine area. Welsh Ministers are the Marine Planning Authority under the MCAA, responsible for creating marine plans for both the inshore region (0-12 nautical miles) and offshore region (beyond 12 nautical miles) of Wales. Plans for both regions will be presented in a single document, the WNMP. The dWNMP applies to the Welsh marine area which consists of around 32,000 km2 of sea, as well as 2,120 km of coastline.	The WNMP will be implemented over a 20-year period, with 3 yearly reviews.	Yes – Benthic Subtidal and Intertidal habitats, Coastal and supralittoral habitats, Marine Mammals, Diadromous fish, Pelagic seabirds (breeding and wintering); and Wildfowl and waders (breeding and wintering)	As there is the potential for both temporal and spatial overlap of the META project with the dWNMP, it cannot be excluded from further consideration.
Dredging sites									
Installation/ Operation and Maintenance	Neyland Yacht Haven Ltd. - DML1743	1.1	12.3	10.5	No spatial overlap with consented areas.	Dredge and disposal from Neyland Marina - annual volume 5500 m³.	13/12/2017-12/12/2020	Yes	Sediment plumes generated from dredging activities may present potential cumulative effects with the META project.
					Potential for temporal overlap.				
Installation/ Operation and Maintenance	Milford Haven Port Authority - DML1646	1.3	1.5	2.5	No spatial overlap with consented areas Temporal overlap with all sites.	Maintenance dredging throughout the Milford Haven. Annual volume 362500 m³.	09/03/2017-08/03/2022	Yes	
Dredge disposal sites									
Installation/ Operation and Maintenance	Neyland dredge disposal site - LU190	0.5	12.4	10.5	No spatial overlap with any of the consented areas.	Location: South of Neyland within the central channel of the Milford Haven, 0.22 nm diameter x 5 m depth.	Not applicable	Yes	Sediment plumes generated from placement of material in identified disposal ground and dredging activities may present potential cumulative effects with the META project.
					Temporal overlap	Status: Open			
Research									
Installation	Greenlink Interconnector Ltd. - RML1827	10.4	6	0	Spatial overlap with East Pickard Bay (site 8).	Ground investigations	07-2018 - no end date given	Yes	Research operations are likely to have vessels present, with equipment for undertaking ground truthing surveys. Increased prop wash may result in further suspended sediments.
					Temporal overlap with East Pickard Bay (site 8).				
Installation	Swansea University - DEML1845	12.7	5.4	0	Spatial overlap with East Pickard Bay (site 8).	Deposition and subsequent removal of marker buoys with environmental monitoring and mid-water settlement plates.	30/08/2018-29/08/2019	Yes	

Phase	Developer - Reference	Distance from Warrior Way (site 6) (km)	Distance from Dale Roads (site 7) (km)	Distance from East Pickard Bay (site 8) (km)	Spatial/temporal overlap with the META project	Details	Date of installation/operation	Further assessment required?	Justification for screening into in-combination assessment
					Temporal overlap with East Pickard Bay (site 8).				buoys. It is highly likely to have overlap with impacts.
Infrastructure									
Installation/ Operation and Maintenance	Mixed use developments - Local Planning Authority Reference: 14/0158/PA	7.3	5.3	5.6	No spatial overlap with any consented areas. Temporal overlap remains unknown due to insufficient information on start and end dates.	Undetermined planning application. Demolition of several existing buildings and the mixed-use redevelopment of Milford Waterfront comprising up to 26,266 m2 of commercial, hotel, leisure, retail and fishery related floorspace. Up to 190 residential properties, up to 70 additional marina berths, replacement boat yards, landscaping, public realm enhancements, access and ancillary works. A decision on this application is yet to be made by the local planning authority.	EIA screening decision was returned on the 30/04/2018 - no further information has been provided	Yes	Given the distance from the project and likely impact pathways, there is potential for cumulative impacts to affect fish and shellfish due to increased suspended sediment and/or changes in habitat availability.
Installation/ Operation and Maintenance/ Decommissioning	Greenlink Interconnector Ltd. - Government reference: qA1296053	10.4	6	0	Spatial overlap with East Pickard Bay (site 8). Temporal overlap will occur throughout the duration of the META project	The Project is a 500MW subsea electricity interconnector linking the power markets in Ireland and Great Britain and is planned for commissioning in 2023. As an EU Project of Common Interest, it is one of Europe's most important energy infrastructure projects. The interconnector is planned to make Landfall at Fresh Water West beach to the south of the mouth of the Waterway.	07/2018 - ongoing	Yes	There is the potential for cumulative effects on fish and shellfish due to increased suspended sediment and/or changes in habitat availability.
Installation/ Operation and Maintenance/Decommissioning	Bombora Wave Energy	11.6	5.0	0	Spatial overlap with East Pickard Bay (site 8) in intertidal area. Potential for temporal overlap	Bombora on- and off-shore infrastructure and deployment of Bombora mWave device at East Pickard Bay. This is to include device deployment (mWave device), installation of temporary communications cable between mWave device and temporary onshore control station to be located above East Pickard Bay, and installation and operation of temporary control station onshore. Laying of marine cable to shore and through intertidal area at East Pickard Bay to involve up to 3 days cable laying below MHWS using cable lay vessel and up to four vessels, including guard boat. Cable to be laid on seabed and kept in place in sandy sediment using clamshell wrights. Where the marine cable traverses potential reef habitat, it will follow natural rock channel. In the intertidal area, the cable will be laid through a natural gully, or up the vertical gully side and attached to the semi-vertical rock face with rock bolts using hand held tools. JCB will pull the cable through the intertidal area from a location above MHWS.	Q1 2020 - 2022	Yes	Bombora works are likely to cumulatively impact with the META project as spatial overlap is present

Phase	Developer - Reference	Distance from Warrior Way (site 6) (km)	Distance from Dale Roads (site 7) (km)	Distance from East Pickard Bay (site 8) (km)	Spatial/temporal overlap with the META project	Details	Date of installation/operation	Further assessment required?	Justification for screening into in-combination assessment
Aquaculture projects									
Installation/ Operation and Maintenance	Tethys Oysters	8.9	2.6	5.1	Temporal overlap	The oyster farm is located on the eastern side of Angle Bay, whereby oysters are grown in baskets on metal supports. The farm will be serviced from the shore by foot.	Oct 2017 – Oct 2020 (possible renewal of licence)	Yes	Installation of an oyster farm may result in fish aggregation and as a source recruitment site.
Installation/ Operation and Maintenance	Pembrokeshire Scallops	15.3	3.9	1.8	Temporal overlap	The scallop farm is located within Castlebeach Bay, whereby a system of weighted ropes will be deployed for growing scallops and mix species of native algae. The farm will be serviced by vessels and divers.	Jan 2019 – Q4 2020 (possible renewal of licence)	Yes	As above.
Pembroke Dock Marine Projects									
Installation/ Operation and Maintenance	Milford Haven Port Authority - SC1810	2	11.3	8.8	No spatial overlap with consented sites. Potential for temporal overlap.	Pembroke Dock redevelopment Scoping Report submitted. The intention of the Project is to create a flexible and efficient port-related office, industrial, warehousing and distribution, and ancillary operations infrastructure. This will involve the redevelopment of its existing space to incorporate increased deep-water access, internal and external heavy fabrication areas, construction of MEECE and Education/Skills Facility and the construction of a heavy lift facility.	Oct-18	Yes	Port activity as a result of Pembroke Dock Port operations could cause an increase in underwater noise emissions, increased potential for suspended sediments, and impacts on shipping and navigation. There is therefore the potential for cumulative effects with activities associated the META Project.
Installation/ Operation and Maintenance/Decommissioning	Marine Energy Wales - DEML1875	1.7	11.7	9.4	No spatial overlap with any of the consented areas. Potential for temporal overlap	Marine Energy Test Area - Phase 1 Band 2 application submitted. The Project aims to create pre-consented test areas within the Pembroke Dock area. The test areas will have licensable activities to suit testing of initial stage marine renewable devices. These include testing of non-operating components and subassemblies. No full-scale testing is to be support within the test areas	21/04/2019-21/04/2029	Yes	Vessel use, and some testing activities could result in an increase in suspended sediment or reduction in habitat available to fish and shellfish VERs.

In-combination temporary changes to fish habitat

- 5.5.1.3 There is the potential for temporary changes to fish habitat as a result of installation and operational activities associated with the META project in-combination with activities associated with the following projects/activities: META Phase 1, Bombora Wave Energy offshore works, the Pembroke Dock redevelopment project, the mixed use development of the Milford Haven Waterfront, dredging and disposal activities in the Waterway, the Greenlink Interconnector project (and associated surveys), research undertaken by Swansea University and the dWNMP.
- 5.5.1.4 Dredging activities and dredge disposal may result in temporary changes in fish habitat in a restricted area around these locations within the Waterway. Research activities are very short duration (days) and of minimal impact on fish and shellfish habitat (temporary deployment of scientific equipment) and are therefore considered unlikely to result in a detectable change on fish and shellfish habitat. Mixed use development of the Milford Haven waterfront, development of the Pembroke Dock infrastructure project, and activities associated with Phase 1 of the META project may result in temporary changes in fish and shellfish habitat in close proximity to Warrior Way (site 6) but are unlikely to affect fish or shellfish habitat at Dale Roads (site 7) or East Pickard Bay (site 8). Cabling works associated with the Greenlink interconnector and proposed Bombora mWave deployment, and the mWave deployment itself, may lead to temporary loss of habitat at East Pickard Bay (site 8). The HRA Appropriate Assessment for screened in policies within the dWMNP (Welsh Government, 2017) concludes no adverse effect on site integrity of any European site due to the plans included within the dWNMP.
- 5.5.1.5 Though a number of projects are predicted to overlap either with the installation, operation and maintenance, or decommissioning phases of the META project as outlined above, potential changes to fish habitat are predicted to be of local spatial extent, temporary in nature, short-medium term duration and are likely to be intermittent and reversible.

Conclusions

Pembrokeshire Marine SAC

- 5.5.1.6 Significant adverse effects on the qualifying Annex II diadromous fish features of the Pembrokeshire Marine SAC (i.e. allis shad, twaite shad, sea lamprey and river lamprey) are not predicted to occur as a result of in-combination temporary changes to fish habitat. Potential effects from this activity on the relevant Conservation Objectives (as presented in paragraph 5.2.1.2) are discussed in turn below.
- The population is maintaining itself on a long-term basis as a viable component of its natural habitat.*
- 5.5.1.7 All in-combination habitat disturbance associated with the META project will be temporary, of short-term duration, and will only affect a very small percentage of the total extent of habitats available in the wider area to migratory fish features of the SAC. Therefore, it is not considered that these activities will affect the ability of migratory fish species populations to be maintained in the long term.

The species population within the site is such that the natural range of the population is not being reduced or likely to be reduced for the foreseeable future.

- 5.5.1.8 Some restriction to the natural range may occur as a result of in-combination habitat disturbance. However, all disturbance/loss will be temporary and therefore reversible following decommissioning of the devices/components.
- The presence, abundance, condition and diversity of habitats and species required to support this species is such that the distribution, abundance and populations dynamics of the species within the site and population beyond the site is stable or increasing.*
- 5.5.1.9 Some change to the condition of habitats required to support migratory fish may occur as a result of habitat disturbance within a localised area for each of the in-combination projects. As such, the presence, abundance, condition and diversity of habitats required to support qualifying diadromous fish features is unlikely to be affected and this Conservation Objective will be maintained.
- 5.5.1.10 *Therefore, no adverse effect on the integrity of the Pembrokeshire Marine SAC from this potential impact can be concluded.*

Cleddau Rivers SAC

- 5.5.1.11 Significant adverse effects on the qualifying Annex II diadromous fish features of the Cleddau Rivers SAC (i.e. sea lamprey and river lamprey) are not predicted to occur as a result of in-combination temporary changes to fish habitat. Potential effects from this activity on the relevant Conservation Objectives (as presented in paragraph 5.2.1.3) are discussed in turn below.
- The population of the feature in the SAC must be stable or increasing over the long term.*
- 5.5.1.12 Potential in-combination habitat change will be temporary, small scale and localised. This impact is not predicted to result in the direct mortality of migratory fish species or to affect the survival rates of individuals or the populations as a whole, on the basis that extensive comparable habitat is present in the wider area. Therefore, it is not considered that these activities will affect the ability of the populations of migratory fish to remain stable or increase over the long term.
- The natural range of the feature in the SAC is neither being reduced nor is likely to be reduced for the foreseeable future.*
- 5.5.1.13 Some restriction to the natural range may occur as a result of habitat disturbance within a localised area for each in-combination project. However, all disturbance/loss will be temporary and therefore reversible following decommissioning of the devices/components.
- Passage of the feature through the SAC is not to be hindered by artificial barriers such as weirs.*

- 5.5.1.14 As all habitat change as a result of the in-combination projects falls out with the boundary of the SAC, there will be no barrier to the passage of sea lamprey or river lamprey through the Cleddau Rivers SAC as a result of the project. Similarly, the in-combination projects are not predicted to result in any barrier to the passage of designated fish features during their migrations to or from the SAC. Therefore, this Conservation Objective will be maintained.

The characteristic channel morphology provides the diversity of water depths, current velocities and substrate types necessary to fulfil the habitat requirements of the features. The close proximity of different habitats facilitates movement of fish to new preferred habitats with age.

- 5.5.1.15 As all habitat disturbance predicted to arise as a result of the META project and in-combination projects falls out with the boundary of the SAC, it is not considered that these activities will affect the channel morphology or range of habitat present within the site.

- 5.5.1.16 Therefore, no adverse effect on the integrity of the Cleddau Rivers SAC from this potential impact can be concluded.

In-combination temporary increases in SSC

- 5.5.1.17 There is the potential for temporary increases in SSCs as a result of installation and operational activities associated with the META project in-combination with activities associated with the following projects/activities: META Phase 1, Bombora Wave Energy offshore works, the Pembroke Dock redevelopment project, the mixed use development of the Milford Haven Waterfront, dredging and disposal activities in the Waterway, the Greenlink Interconnector project (and associated surveys), and research undertaken by Swansea University.

- 5.5.1.18 Dredging activities and dredge disposal may result in temporary increases in suspended sediment within the Waterway. Research activities are very short duration (days) and are considered to have negligible potential to result in increase in suspended sediment. Mixed use development of the Milford Haven waterfront, development of the Pembroke Dock Infrastructure project, and activities associated with Phase 1 of the META project may result in temporary increases in suspended sediment in close proximity to Warrior Way (site 6) but are unlikely to result in increased suspended sediment at Dale Roads (site 7) or East Pickard Bay (site 8). Cabling works associated with the Greenlink interconnector and the proposed Bombora mWave deployment may lead to temporary increases of suspended sediment at East Pickard Bay (site 8), but these are expected to be short-duration (days) and temporary in nature. The HRA Appropriate Assessment for screened in policies within the dWMNP (Welsh Government, 2017) concludes no adverse effect on site integrity of any European site due to the plans included within the dWNMP.

Conclusions

Pembrokeshire Marine SAC

- 5.5.1.19 Significant adverse effects on the qualifying Annex II diadromous fish features of the Pembrokeshire Marine SAC (i.e. allis shad, twaite shad, sea lamprey and river lamprey) are not predicted to occur as a result of in-combination effects associated with increased SSC and sediment deposition. Potential effects from this activity on the relevant Conservation Objectives (as presented in paragraph 5.2.1.2) are discussed in turn below.

The population is maintaining itself on a long-term basis as a viable component of its natural habitat.

- 5.5.1.20 Any increases in SSC/sediment deposition associated with each in-combination project are anticipated to be short term and intermittent in nature which will result in a small spatial extent of any impact. As such, this is not predicted to result in any effect on the viability of the populations of allis shad, twaite shad, sea lamprey and river lamprey within the SAC or to affect the ability of migratory fish species populations to be maintained in the long term.

The species population within the site is such that the natural range of the population is not being reduced or likely to be reduced for the foreseeable future.

- 5.5.1.21 Although some migratory fish may avoid areas of increased SSCs associated with each in-combination project, such effects would only be temporary, barrier effects to migration are not predicted and normal behaviour would be resumed following return to baseline SSC levels. Therefore, this Conservation Objective will be maintained.

The presence, abundance, condition and diversity of habitats and species required to support this species is such that the distribution, abundance and populations dynamics of the species within the site and population beyond the site is stable or increasing.

- 5.5.1.22 Significant effects on the habitats available for migratory fish features of the SAC are not predicted and neither are the in-combination effects predicted to have any impact on the viability of the populations of migratory fish, on account of the temporary and short-term nature of the works and resulting effects. Therefore, it is not considered that in-combination projects will affect the distribution, abundance and populations dynamics of the species within the site and population beyond the site or prevent it from increasing.

- 5.5.1.23 Therefore, no adverse effect on the integrity of the Pembrokeshire Marine SAC from this potential impact can be concluded.

Cleddau Rivers SAC

- 5.5.1.24 Significant adverse effects on the qualifying Annex II diadromous fish features of the Cleddau Rivers SAC (i.e. sea lamprey and river lamprey) are not predicted to occur as a result of in-combination increased SSC and sediment deposition. Potential effects from this activity on the relevant Conservation Objectives (as presented in paragraph 5.2.1.3) are discussed in turn below.

The population of the feature in the SAC must be stable or increasing over the long term.

- 5.5.1.25 Given the short-term nature of the works associated with each project which may result in temporary increases in SSC/sediment deposition and the small spatial extent of any impacts, this is not predicted to result in any effect the ability of the populations of sea lamprey and river lamprey within the SAC to remain stable or increase over the long term.

The natural range of the feature in the SAC is neither being reduced nor is likely to be reduced for the foreseeable future.

- 5.5.1.26 The elevations in SSC associated with each project are not predicted to result in any barrier to the migration of sea lamprey and river lamprey within or to/from the SAC. Furthermore, any avoidance behaviour of areas experiencing elevated SSC levels will be temporary. Therefore, it is not considered that these activities will affect the natural range of these species within the SAC.

Passage of the feature through the SAC is not to be hindered by artificial barriers such as weirs.

- 5.5.1.27 The elevations in SSC associated with the in-combination projects are not predicted to result in any barrier to the migration of sea lamprey and river lamprey through or to/from the SAC. Therefore, this Conservation Objective will be maintained.

The characteristic channel morphology provides the diversity of water depths, current velocities and substrate types necessary to fulfil the habitat requirements of the features. The close proximity of different habitats facilitates movement of fish to new preferred habitats with age.

- 5.5.1.28 Any temporary increases in SSC will not affect the channel morphology or range of habitats present within the site. Therefore, this Conservation Objective will be maintained.

- 5.5.1.29 Therefore, no adverse effect on the integrity of the Cleddau Rivers SAC from this potential impact can be concluded.

6. ASSESSMENT OF ADVERSE EFFECTS ON INTEGRITY: ANNEX II SPECIES – MARINE MAMMALS

- 6.1.1.1 The screening exercise (Stage 1 of the Habitats Regulations Assessment (HRA) process), together with consultation feedback from NRW (see section 2.3.5.1), identified potential for LSEs on the qualifying Annex II harbour porpoise features of all European sites within the CIS MU, as detailed in Table 2.8 and potential for LSE on the Annex II grey seal features of the Pembrokeshire Marine SAC Cardigan Bay SAC, Llyn Peninsula and the Sarnau SAC and Lundy SAC, as detailed in Table 2.8.
- 6.1.1.2 As detailed in paragraph 2.4.4.6, the approach recommended by NRW advisory services for harbour porpoise was, in the first instance, to assess the impacts on the European site closest to the META project (i.e. West Wales Marine SAC) and use those conclusions to assess the remaining sites. In the event that the assessment concluded an adverse effect on integrity for the closest site, the next closest site should then be considered, and so on. A more precautionary approach than that suggested by NRW advisory services has been adopted for this RIAA, as all Welsh SACs for harbour porpoise have, in the first instance, been assessed for potential adverse effect on integrity (i.e. West Wales Marine SAC, Bristol Channel Approaches SAC and North Anglesey Marine SAC) before consideration of the more distant sites within the MU has been made.

6.2 Conservation Objectives

- 6.2.1.1 The Conservation Objectives of the qualifying Annex II marine mammal species screened in for Stage 2 assessment (Table 2.8) are provided below.

Pembrokeshire Marine SAC

- 6.2.1.2 The Conservation Objectives for the grey seal feature of the Pembrokeshire Marine SAC are detailed in the Regulation 37 advice for the site (NRW, 2018a; see Appendix 3). In order to achieve FCS, all the following, subject to natural processes, need to be fulfilled and maintained in the long-term. If these objectives are not met restoration measures will be needed to achieve FCS:

- The population is maintaining itself on a long-term basis as a viable component of its natural habitat;
- The species population within the site is such that the natural range of the population is not being reduced or likely to be reduced for the foreseeable future; and
- The presence, abundance, condition and diversity of habitats and species required to support this species is such that the distribution, abundance and populations dynamics of the species within the site and population beyond the site is stable or increasing.

West Wales Marine SAC

- 6.2.1.3 The Conservation Objectives and Advice on Activities for the West Wales Marine SAC document (Joint Nature Conservation Committee (JNCC) and NRW, 2019; see Appendix 6) lists the following draft Conservation Objectives for harbour porpoise. To avoid deterioration of the habitats of the harbour porpoise or significant disturbance to the harbour porpoise, thus ensuring that the integrity of the site is maintained and the site makes an appropriate contribution to maintaining FCS for the UK harbour porpoise.

- 6.2.1.4 To ensure for harbour porpoise that, subject to natural change, the following attributes are maintained or restored in the long term:

- The species is a viable component of the site;
- There is no significant disturbance of the species; and
- The supporting habitats and processes relevant to harbour porpoises and their prey are maintained.

Bristol Channel Approaches SAC

- 6.2.1.5 The Conservation Objectives and Advice on Activities for the Bristol channel Approaches SAC document (JNCC *et al.*, 2019; see Appendix 7) lists the following Conservation Objectives for harbour porpoise. To ensure that the integrity of the site is maintained and that it makes the best possible contribution to maintaining FCS for harbour porpoise in UK waters

- 6.2.1.6 In the context of natural change, this will be achieved by ensuring that:

- Harbour porpoise is a viable component of the site;
- There is no significant disturbance of the species; and
- The condition of supporting habitats and processes, and the availability of prey is maintained.

Cardigan Bay SAC

- 6.2.1.7 The Conservation Objectives for the grey seal feature of the Cardigan Bay SAC are detailed in the Regulation 37 advice for the site (NRW, 2018b; see Appendix 8). To achieve FCS all the following, subject to natural processes, need to be fulfilled and maintained in the long-term. If these objectives are not met restoration measures will be needed to achieve FCS:

- The population is maintaining itself on a long-term basis as a viable component of its natural habitat;
- The species population within the site is such that the natural range of the population is not being reduced or likely to be reduced for the foreseeable future; and
- The presence, abundance, condition and diversity of habitats and species required to support this species is such that the distribution, abundance and populations dynamics of the species within the site and population beyond the site is stable or increasing.

Lundy SAC

6.2.1.8 The Conservation Objectives for the grey seal feature of the Lundy SAC (Natural England, 2018; see Appendix 9) are to ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the FCS of its qualifying features, by maintaining or restoring;

- The extent and distribution of qualifying natural habitats and habitats of qualifying species;
- The structure and function of the habitats of qualifying species;
- The supporting processes on which qualifying natural habitats and the habitats of qualifying species rely;
- The populations of qualifying species; and
- The distribution of qualifying species within the site.

Lleyn Peninsula and the Sarnau SAC

6.2.1.9 The Conservation Objectives for the grey seal feature of the Lleyn Peninsula and the Sarnau SAC are detailed in the Regulation 33 advice for the site (NRW, 2018c; see Appendix 10). In order to achieve FCS all the following, subject to natural processes, need to be fulfilled and maintained in the long-term. If these objectives are not met restoration measures will be needed to achieve FCS:

- The population is maintaining itself on a long-term basis as a viable component of its natural habitat;
- The species population within the site is such that the natural range of the population is not being reduced or likely to be reduced for the foreseeable future; and
- The presence, abundance, condition and diversity of habitats and species required to support this species is such that the distribution, abundance and populations dynamics of the species within the site and population beyond the site is stable or increasing.

North Anglesey Marine SAC

6.2.1.10 The Conservation Objectives and Advice on Activities for the North Anglesey Marine SAC document (JNCC *et al.*, 2019; see Appendix 11) lists the following draft Conservation Objectives for harbour porpoise. To avoid deterioration of the habitats of the harbour porpoise or significant disturbance to the harbour porpoise, thus ensuring that the integrity of the site is maintained, and the site makes an appropriate contribution to maintaining FCS for the UK harbour porpoise.

6.2.1.11 To ensure for harbour porpoise that, subject to natural change, the following attributes are maintained or restored in the long term:

- The species is a viable component of the site;
- There is no significant disturbance of the species; and
- The supporting habitats and processes relevant to harbour porpoises and their prey are maintained.

6.3 Baseline information

6.3.1.1 Baseline information on the Annex II marine mammal features of the European Sites identified for further assessment within the HRA process has been gathered through a comprehensive desktop study of existing studies and datasets. The key data sources are presented within chapter 9: Marine Mammals, Basking Shark and Otter of the Environmental Statement.

6.3.2 Harbour porpoise

6.3.2.1 Harbour porpoise are the most common and widespread cetacean in Welsh waters (Baines and Evans, 2012) with hot spots identified off the Pembrokeshire coast; the Lleyn Peninsula (to a lesser extent); in southern Cardigan Bay; and in the Bristol Channel off the south coast of Wales (around the Gower Peninsula and in Newport Bay) (Baines and Evans, 2012).

6.3.2.2 Along the Pembrokeshire coast, harbour porpoise is the most commonly encountered cetacean (Reid *et al.*, 2003, Baines and Evans, 2012) and the species is present throughout the year (Pierpoint, 2001, Evans *et al.*, 2003). The whole of the West Wales Marine SAC has been identified as an important summer area for harbour porpoise, and a smaller section to the south of the site, around Cardigan Bay, has also been identified as winter habitat for this species. Survey data has identified the West Wales Marine SAC as an area with persistently higher density of porpoises in relation to other areas (IAMMWG, 2015a). Survey data from 2006 – 2011, supporting the designation of the West Wales Marine SAC, identifies the regional marine mammal study area as hosting a discrete and persistent area of relatively high harbour porpoise density in comparison to the wider marine area, with concentrations of animals identified off Strumble Head, Pembrokeshire Islands, and in the vicinity of Cemaes Head and the Teifi Estuary at Cardigan (Heinänen and Skov, 2015; Pierpoint, 2001). Surveys carried out between March and November (2015) on Skomer Island show that harbour porpoise were sighted almost daily for much of this time, which is fairly typical of this species (noted to be ‘abundant’ in Skomer waters) (Bueche and Stubbings, 2015).

6.3.2.3 Data obtained from incidental sightings (1979 - 2018) and small vessel surveys from Neyland (just north-west of Warrior Way (site 6)) to the Celtic Deep, provided by the West Wales Biodiversity Information Centre (WWBIC, 2019) show that harbour porpoise have been sighted at the mouth of the Waterway and within the local marine mammal study area. This data shows that harbour porpoise have been sighted as far east as South Hook Pier, east of Dale Roads (site 7) (see Figure 6-1).

6.3.2.4 The META project falls within the Celtic and Irish Seas (CIS) Management Unit for harbour porpoise (IAMMWG, 2015b). The total harbour porpoise abundance for the CIS MU was estimated as 104,695 animals (95% Confidence Interval 25,611 to 87,092) (IAMMWG, 2015b).

6.3.3 Grey seal

- 6.3.3.1 Grey seals are widely distributed in Welsh waters with breeding colonies in northwest Pembrokeshire, particularly on Ramsey Island, extending southwards to Skomer Island and northwards to southern Ceredigion (Baines and Evans, 2009). Small concentrations occur around the Llyn Peninsula and the coast of Anglesey. These breeding colonies act as haul-out sites in the non-breeding season. Approximately 5,000 grey seals use habitats on the Welsh coast, which is the most important breeding colony for grey seal in the southern UK and the most significant breeding colony of grey seal in the Celtic and Irish sea overlaps with the local marine mammal, basking shark and otter study area. Approximately 5% of UK grey seal pups are born on the coasts of south west Wales and south West England each year (Duck, 1995; Baines *et al.*, 1995; SCOS, 2017). Grey seals are a feature of the Skomer Marine Conservation Zone (MCZ) and seal pupping sites are found at both Skomer Island and Marloes peninsula sites (Lock *et al.*, 2017). The Marloes peninsula contributes, on average, 41% of the total pup production in the Skomer MCZ.
- 6.3.3.2 In 2015, 465 pups were born in North Pembrokeshire and 379 pups born on Skomer and adjacent mainland sites in 2015 (SCOS, 2017). In 2017, 383 pups were born within the Skomer MCZ (the highest number of seal births within the whole of the MCZ since records began) with 225 pups born on Skomer Island (the second highest total ever recorded) and 158 born on Marloes Peninsula (Büche and Stubbings, 2018). Pupping occurs between July and November, and in 2017 the highest number of pups were born in September (n = 146) and October (n = 57). Büche and Stubbings (2018) identified Castle Bay, North Haven and Matthew's Wick (all on east Skomer Island) as the most important haul-out sites within the MCZ, with average daily numbers of seals recorded as 44, 33 and 24 seals respectively. The Garland Stone does not appear to play a major role as a haul-out site during the autumn, however seals use it all year round. Weather conditions are most likely the most significant determining factor on number of seals hauled-out per site day to day (Büche and Stubbings, 2018).
- 6.3.3.3 The Grey Seal Breeding Census Skomer Island 2017 (Büche and Stubbings, 2018) identified two seals hauled-out on North Haven beach, with tags which identified them as having originated 105 km. Two seals which originated from the Skomer MCZ were identified in Cornwall, 147 km and 131 km away.
- 6.3.3.4 Sightings data provided by the WWBIC (WWBIC, 2019) show that grey seal have been sighted in low numbers within both the local and regional marine mammal study areas.
- 6.3.3.5 While grey seals are known to travel up to 2,100 km on foraging trips, most foraging trips occur within 145 km from haul-out sites (SCOS, 2015). Seals are highly mobile and feed mainly at the benthos in shelf seas (Thompson, 2012; Chen *et al.*, 2017). Telemetry studies of animals tagged on Welsh haul-out sites indicate that grey seals may make foraging trips to very localised areas, with animals from a particular locality tending to remain in that region (Strong *et al.*, 2006).

- 6.3.3.6 The local and regional marine mammal study area coincides with the Wales MU which extends from south of the Isle of Man to the Bristol Channel. The total grey seal summer population size estimate for this MU is 1,650.

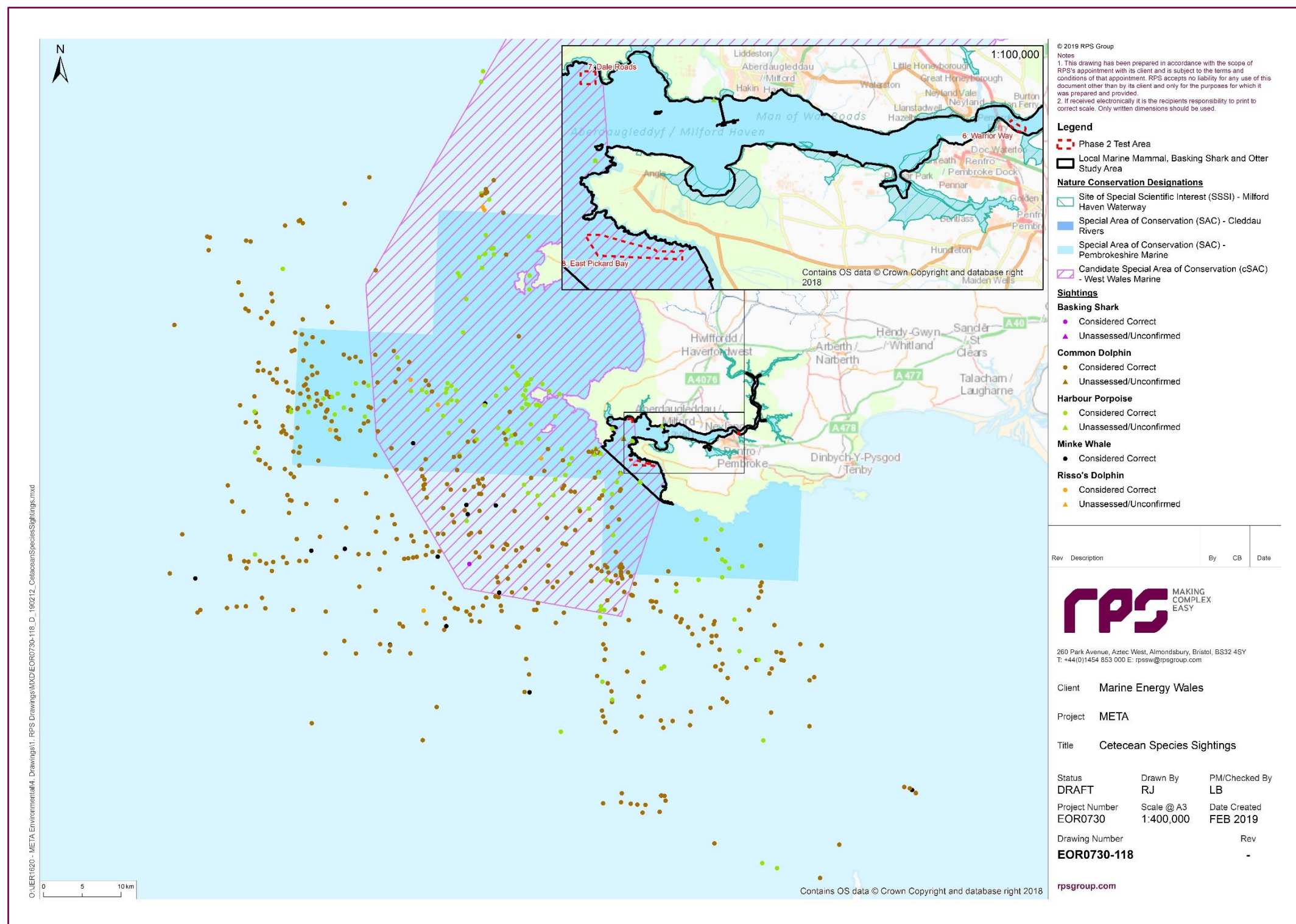


Figure 6-1: Cetacean sightings from small-vessel surveys (2005-2015) and incidental sightings (1979 – 2018) (WWBIC, 2019).

6.4 Assessment of Adverse Effects on Integrity – the META project alone

6.4.1 Potential impacts – installation/decommissioning

Increased underwater noise due to installation/decommissioning activities

- 6.4.1.1 There is potential for installation vessels and other equipment to produce noise during installation of the devices/components and associated moorings at all META sites. There is also the potential for drilling to install pin piles at Dale Roads (site 7) and East Pickard Bay (site 8).
- 6.4.1.2 The maximum and most likely design scenarios for increased underwater noise during installation, as presented in the chapter 9: Marine Mammals, Basking Shark and Otter of the Environmental Statement, are summarised in Table 6.1 below.

Table 6.1: Maximum and most likely design scenarios considered for the assessment of potential impacts on Annex II marine mammals from underwater noise during installation.

Maximum design scenario	Most likely design scenario
Warrior Way - Up to 5 vessels utilised at any one time for deployment and retrieval operations - Up to 20 deployment and 20 retrieval vessel movements in a 12-month period, restricted to daylight hours. - Vessel size - up to 35 m in length and 6.8 m draught - No use of DP vessels - Source sound pressure level at 1 m = 172 dB re 1 µPa (rms) / 221 SEL (24h) dB re 1 µPa²s	Warrior Way - Up to three vessels utilised at any one time for device deployment and retrieval operations. - Up to 20 deployment and 20 retrieval vessel movements in a 12-month period, restricted to daylight hours. - Vessel size up to 30 m in length and 6.8 m draught - No use of DP vessels - Source sound pressure level at 1 m = 172 dB re 1 µPa (rms) / 221 SEL (24h) dB re 1 µPa²s
Dale Roads - Up to five vessels utilised at any one time for deployment and retrieval operations. - Up to 20 deployment and 20 retrieval vessel movements in a 12-month period, restricted to daylight hours. - Potential use of DP vessels - Vessel size - up to 164 m in length and 6.8 m draught - Vessel - source sound pressure level at 1 m = 183 dB re 1 µPa (rms) / 232 SEL (24h) dB re 1 µPa²s - Use of drilled pin piling - up to 4 four drilled pin piles per device (each pin pile up to 100 mm diameter installed to a depth of 10 – 20 m) - Pin piles - source sound pressure level at 1 m = 163 dB re 1 µPa (rms) / 212 SEL (24h) dB re 1 µPa²s	Dale Roads - Up to three vessels utilised at any one time for device deployment and retrieval operations. - Up to 20 deployment and 20 retrieval vessel movements in a 12-month period, restricted to daylight hours. - Potential use of DP vessels - Vessel size - up to 164 m in length and 6.8 m draught - Source sound pressure level at 1 m = 183 dB re 1 µPa (rms) / 232 SEL (24h) dB re 1 µPa²s
East Pickard Bay	East Pickard Bay <i>Device installation and decommissioning</i> - Up to three vessels utilised at any one time for device deployment and retrieval operations. - Up to 20 deployment and 20 retrieval vessel movements in a 12-month period.

Maximum design scenario

Device installation and decommissioning

- Up to five vessels utilised at any one time for device deployment and retrieval operations.
- Up to 40 deployment and 40 retrieval vessel movements in a 12-month period, restricted to daylight hours.
- Vessel size - up to 200 m in length and 8 m draught
- Potential use of DP vessels
- Use of drilled pin piling - up to 4 four drilled pin piles per device (each pin pile up to 100 mm diameter installed to a depth of 10 – 20 m)

Pin piles - source sound pressure level at 1 m = 163 dB re 1 µPa (rms) / 212 SEL (24h) dB re 1 µPa²s

Most likely design scenario

- Vessel size - up to 164 m in length and 6.8 m draught
- Potential use of DP vessels

- 6.4.1.3 Installation activities at Warrior Way (site 6) may require up to five vessels to be involved in the deployment and retrieval of devices. Up to 20 test deployment vessel operations and 20 test retrieval vessel operations in a 12-month period will be required (in total up to 40 per year). The maximum design scenario for the size of vessels used at Warrior Way (site 6) is up to 35 m and most likely is 30 m in length with a 6.8 m draught. The anticipated source sound pressure level at 1 m is estimated to be 172 dB re 1 µPa (rms) / 221 sound exposure level (SEL; 24h) dB re 1 µPa²s (see Table 6.1).
- 6.4.1.4 Installation activities at Dale Roads (site 7) may require up to five vessels to be involved at any one time for deployment and retrieval operations. Up to 20 test deployment vessel operations and 20 test retrieval vessel operations in a 12-month period will be required (in total up to 40 per year), restricted to daylight hours. The maximum size of vessels at Dale Roads (site 7) is 164 m length and 6.8 m draught. The anticipated source sound pressure level at 1 m is estimated to be 183 dB re 1 µPa (rms) / 232 SEL (24h) dB re 1 µPa²s if operating on dynamic positioning (see Table 6.1).
- 6.4.1.5 Installation activities at East Pickard Bay (site 8) required up to five vessels to be involved at any one time for deployment and retrieval operations. Up to 40 test deployment vessel operations and 40 test retrieval vessel operations in a 12-month period will be required (in total up to 80 per year), restricted to daylight hours. The maximum size of vessels at East Pickard Bay (site 8) is 200 m length and 8 m draught. The anticipated source sound pressure level at 1 m is estimated to be 183 dB re 1 µPa (rms) / 232 SEL (24h) dB re 1 µPa²s if operating on dynamic positioning (see Table 6.1).
- 6.4.1.6 An assessment of the distance to the potential onset of injury to harbour porpoise and grey seal from each vessel category has been undertaken in chapter 6: Underwater Noise of the Environmental Statement based on the SEL cumulative exposure criterion. The assessment adopts a conservative approach to behavioural response thresholds and uses the National Marine Fisheries Service (NMFS, 2005) Level B harassment threshold of 120 dB re 1 µPa (root-mean squared (rms)) for continuous (non-impulsive) sound (vessel noise) for all marine mammal auditory frequency groups (see Table 6.2 and chapter 6 – Underwater Noise of the Environmental Statement). Level B harassment is defined as:

“having the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioural patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering but which does not have the potential to injure a marine mammal or marine mammal stock in the wild” (NMFS, 2005).

- 6.4.1.7 The relevant criteria for permanent threshold shift (PTS) and temporary threshold shift (TTS) in harbour porpoise and grey seal are summarised in Table 6.2. This includes the thresholds for non-impulsive sound based on the relevant guidelines (NMFS 2018, NMFS 2005). In Table 6.2, the Sound Exposure Levels (SEL) are expressed as dB re 1 $\mu\text{Pa}^2\text{s}$ and RMS sound pressure levels are in dB re 1 μPa (rms). Harbour porpoise are high frequency (HF) cetaceans (with an estimated functional hearing range between 275 Hz and 160 kHz) and grey seal are considered as phocid pinnipeds (PW) (with an estimated functional hearing range between 50 Hz and 86 kHz).

Table 6.2: Summary of acoustic thresholds for marine mammals for non-impulsive sound.

Hearing group	Parameter	PTS	TTS	Disturbance
High-frequency (HF) cetaceans (i.e. harbour porpoise)	SEL, HF weighted dB re 1 $\mu\text{Pa}^2\text{s}$	173	153	-
	RMS _{T90} dB re 1 μPa (rms)	-	-	120
Phocid pinnipeds (PW) (i.e. grey seal)	SEL, PW weighted dB re 1 $\mu\text{Pa}^2\text{s}$	201	181	-
	RMS _{T90} dB re 1 μPa (rms)	-	-	120
	RMS _{T90} dB re 1 μPa (rms)	-	-	120

- 6.4.1.8 An assessment of the distance to the potential onset of injury from each vessel category and for drilling to install pin piles is presented in Table 6.3 based on the SEL cumulative exposure criterion. The potential radii for injury are based on exposure levels over a 24-hour period. Table 6.3 also presents the potential radius of disturbance for marine mammals based on the conservative 120 dB re 1 μPa (rms) criterion.
- 6.4.1.9 It is important to bear in mind when viewing these potential disturbance radii that the 120 dB re 1 μPa (rms) criterion is very precautionary and that ambient noise levels could well exceed this value, particularly during periods with high tidal flow.

Table 6.3: Calculated effects of continuous vessel / installation noise.

Activity / vessel	Radius of potential injury zone (assuming continuous exposure within that radius over 24 hour period)		Radius of potential disturbance
	HF	PW	
Anchor handling vessel	46 m	7 m	2 km
Installation / construction vessel (using DP)	3 m	8 m	12 km

Activity / vessel	Radius of potential injury zone (assuming continuous exposure within that radius over 24 hour period)		Radius of potential disturbance
	HF	PW	
Support vessel / tug	46 m	7 m	2 km
Pile drilling	45 m	3 m	0.5 km

Harbour porpoise

- 6.4.1.10 For harbour porpoise, a high frequency cetacean, a conservative assessment estimates that animals may be exposed to underwater noise that has the potential to result in the onset of injury up to 45 m from the sound source during pile drilling and up to 46 m from some vessel activity anchor handling/support vessel activities. It is important to remember, however, that the potential radii for injury are based on exposure levels over a 24-hour period. Thus, a harbour porpoise would need to stay within 45 m of pile drilling operations for a period of 24 hours, for example, to experience any injury. This is considered to be an unrealistically conservative scenario and therefore it is not considered likely that any harbour porpoise will be injured as a result of installation activities.
- 6.4.1.11 With respect to disturbance, the maximum predicted range of disturbance at Warrior Way (site 6) would be up to approximately 2 km and for Dale Roads (site 7) and East Pickard Bay (site 8) where DP vessels may be used, disturbance to harbour porpoise could be up to 12 km.
- 6.4.1.12 Low numbers of both harbour porpoise are likely to occur in the vicinity of the META sites and considering the potential zone of the impact from injury is very small, few animals are expected to be affected by noise levels sufficient to cause injury. Although disturbance may affect a larger area, the duration of these noise generating activities would be short term and intermittent.
- 6.4.1.13 The Waterway hosts a high number of vessels year-round, and it is highly likely that harbour porpoise occurring in the Waterway are habituated to this level of activity (Nowacek *et al.*, 2007). Marine mammals can both be attracted to, and avoid, vessels. Harbour porpoise are particularly sensitive to high frequency noise and are more likely to avoid vessels (Heinänen and Skov, 2015). Harbour porpoise are deemed to be of low vulnerability and high recoverability to the levels of noise which will be generated during installation activities.

Grey seal

- 6.4.1.14 For grey seal, a conservative assessment estimates that underwater noise levels sufficient to result in injury will only occur in the immediate vicinity (i.e. within 3 m) of pile drilling activities and vessel activities (i.e. up to 8 m during the use of DP vessels). Furthermore, a grey seal would need to stay within 3 m of pile drilling operations or 8 m of a vessel for a period of 24 hours to experience any injury. As discussed above for harbour porpoise, this is considered to be an unrealistically conservative scenario and therefore it is considered unlikely that any grey seal will be injured as a result of noise arising from installation activities.
- 6.4.1.15 With respect to disturbance, the maximum predicted range of disturbance at Warrior Way (site 6) would be up to approximately 2 km and for Dale Roads (site 7) and East Pickard Bay (site 8), where DP vessels may be used, disturbance to grey seal could be up to 12 km. In addition, it is reasonable to assume that individuals foraging within the vicinity of the META sites are habituated to the existing high levels of vessel traffic within the Waterway. In addition, given that seals are not thought to communicate underwater, the impact will not mask communication and any disturbance impact which does occur will individually be of short duration.
- 6.4.1.16 Whilst pinnipeds do not critically rely on hearing to survive, they are highly vocally active under water and can use sounds passively to forage (Chen *et al.*, 2017). Their repertoires extend across a wide range of frequencies, usually from 0.1 kHz to 3 kHz, but upsweeps can go up to 4.7 kHz (Chen *et al.*, 2017). Their hearing ranges from very low frequencies (~ 100 Hz) to high frequencies (~ 30 kHz) and it is therefore likely that shipping noise is within the hearing range of grey seals (Chen *et al.*, 2017). Grey seals are however likely to exhibit avoidance behaviour in response to vessel noise (Anderwald *et al.*, 2013). Grey seals are deemed to be of low vulnerability and high recoverability to the levels of noise which will be generated during META installation activities.

Conclusions

Grey seal: Pembrokeshire Marine SAC, Cardigan Bay SAC and the Llyn Peninsular and the Sarnau SAC

- 6.4.1.17 Significant adverse effects on the qualifying grey seal features of the Pembrokeshire Marine SAC, Cardigan Bay SAC and the Llyn Peninsular and the Sarnau SAC are not predicted to occur as a result of underwater noise generated during installation activities. Potential effects from this activity on the Conservation Objectives of these sites are discussed in turn below.

The population is maintaining itself on a long-term basis as a viable component of its natural habitat

- 6.4.1.18 It is not considered likely that any grey seal will be injured as a result of underwater noise generated during installation activities. Although low levels of short-term disturbance to individuals, potentially resulting in avoidance behaviour, of grey seal may occur during installation works, these should be considered in the context of the existing high levels of vessel traffic and anthropogenic activities occurring within the Waterway and the likely habituation of animals foraging in these waters. This is not predicted to restrict the objective of the population being able to maintain itself as a viable component of its natural habitat over the long-term.

The species population within the site is such that the natural range of the population is not being reduced or likely to be reduced for the foreseeable future

- 6.4.1.19 Low levels of short term and intermittent disturbance to individuals, potentially resulting in avoidance behaviour, of grey seal may occur during installation works, although these should be considered in the context of the existing high levels of vessel traffic and anthropogenic activities occurring within the Waterway and the likely habituation of animals foraging in these waters. Upon cessation of underwater noise generation from vessel movements and pile drilling, any grey seals affected will return to the affected area relatively quickly. Therefore, disturbance to the species is not considered significant and will not reduce the range of this species in the medium to long-term. Therefore, this Conservation Objective will be maintained.

The presence, abundance, condition and diversity of habitats and species required to support this species is such that the distribution, abundance and populations dynamics of the species within the site and population beyond the site is stable or increasing

- 6.4.1.20 Some short-term disturbance is predicted to potential prey fish species, although effects are not considered to be significant, therefore ensuring that the project will not affect prey species populations from being maintained in the long term.
- 6.4.1.21 Therefore, no adverse effect on the integrity of the Pembrokeshire Marine SAC, Cardigan Bay SAC and the Llyn Peninsular and the Sarnau SAC from this potential impact can be concluded.

Grey seal: Lundy SAC

- 6.4.1.22 Significant adverse effects on the qualifying grey seal feature of the Lundy SAC are not predicted to occur as a result of underwater noise generated during installation activities. Potential effects from this activity on the relevant Conservation Objectives (as presented in paragraph 6.2.1.8) are discussed in turn below.

The extent and distribution of qualifying natural habitats and habitats of qualifying species are maintained

- 6.4.1.23 Underwater noise will not impact foraging or breeding habitats of the grey seal feature of this SAC and therefore this Conservation Objective will be maintained.

The structure and function of the habitats of qualifying species are maintained

- 6.4.1.24 Underwater noise will not impact foraging or breeding habitats of the grey seal feature of this SAC and therefore this Conservation Objective will be maintained.

The supporting processes on which qualifying natural habitats and the habitats of qualifying species rely

- 6.4.1.25 Underwater noise will not impact foraging or breeding habitats of the grey seal feature of this SAC and therefore this Conservation Objective will be maintained.

The populations of qualifying species are maintained

- 6.4.1.26 Although the Waterway and the META sites are within the foraging range of grey seal features of the Lundy SAC, numbers of individuals from this site occurring in the area are likely to be low. It is not considered likely that any grey seal will be injured as a result of underwater noise generated during installation activities. Although low levels of short-term disturbance to individuals, potentially resulting in temporary avoidance behaviour of grey seal may occur during installation works, these should be considered in the context of the existing high levels of vessel traffic and anthropogenic activities occurring within the Waterway and the likely habituation of animals foraging in these waters. This is not predicted to restrict the objective of the population being able to maintain itself as a viable component of its natural habitat over the long-term.

The distribution of qualifying species within the site is maintained

- 6.4.1.27 Low levels of short term and intermittent disturbance to individuals, potentially resulting in temporary avoidance behaviour of grey seal may occur during installation works may occur, although this should be considered in the context of the existing high levels of vessel traffic and anthropogenic activities occurring within the Waterway and the likely habituation of animals foraging in these waters. Upon cessation of underwater noise generation from vessel movements and pile drilling, any grey seals affected will return to the affected area relatively quickly. Therefore, disturbance to the species is not considered significant and will not affect the distribution of this species in the long-term. Therefore, this Conservation Objective will be maintained.

- 6.4.1.28 Therefore, no adverse effect on the integrity of the Lundy SAC from this potential impact can be concluded.

Harbour porpoise: West Wales Marine SAC; Bristol Channel Approaches SAC and North Anglesey Marine SAC

- 6.4.1.29 Significant adverse effects on the qualifying harbour porpoise features of the West Wales Marine SAC, Bristol Channel Approaches SAC and the North Anglesey Marine SAC are not predicted to occur as a result of underwater noise generated during installation activities. Potential effects from this activity on the Conservation Objectives of these sites are discussed in turn below.

The species is a viable component of the site

- 6.4.1.30 On the basis of the levels of underwater noise which will be generated during installation activities, it is not considered likely that any harbour porpoise will be injured as a result of underwater noise generated during installation activities. Although low levels of short-term disturbance to individuals, potentially resulting in temporary avoidance behaviour, may occur during installation works, numbers of harbour porpoise occurring in the area of effect is likely to be low. Furthermore, the levels of noise generated should be considered in the context of the existing high levels of vessel traffic and anthropogenic activities occurring within the Waterway and the likely habituation of animals foraging in these waters. Underwater noise is therefore not predicted to restrict the objective of the population being able to maintain itself as a viable component of its natural habitat over the long-term.

There is no significant disturbance of the species

- 6.4.1.31 There may be some low-level disturbance to harbour porpoise within the zone of impact, resulting in potential avoidance behaviour. However, upon cessation of the installation activities, any harbour porpoise affected would be expected to return to affected areas relatively quickly. Given the short time during which installation activities will take place, significant or prolonged disturbance to harbour porpoise is not predicted and underwater noise generated during installation will not prevent this objective from being achieved.

The supporting habitats and processes relevant to harbour porpoises and their prey are maintained

- 6.4.1.32 Habitats and processes will not be affected by underwater noise. With respect to prey species, although some short-term disturbance is predicted to potential prey fish species, effects are not considered to be significant or long-term ensuring that the project will not affect prey species populations being maintained in the long term.

- 6.4.1.33 Therefore, no adverse effect on the integrity of the West Wales Marine SAC, Bristol Channel Approaches SAC and North Anglesey Marine SAC from this potential impact can be concluded.

Harbour porpoise: All other European sites within the harbour porpoise CIS MU

- 6.4.1.34 On the basis that no adverse effect on the integrity of the West Wales Marine SAC, Bristol Channel Approaches SAC and North Anglesey Marine SAC from this potential impact have been concluded (see paragraph 6.4.1.33), and that numbers of harbour porpoise occurring in the area of effect is likely to be low, it has been concluded that there is no potential for adverse effect on site integrity for all other European sites for harbour porpoise within the CIS MU.

Increased suspended sediment concentrations due to installation/decommissioning activities

- 6.4.1.35 Increases in SSC arising from installation/decommissioning activities may affect marine mammals through visual impairment thereby altering their ability to navigate in their environment, detect prey and avoid obstacles.
- 6.4.1.36 The maximum and most likely design scenarios for increased SSCs during installation/decommissioning, as presented in the chapter 9: Marine Mammals, Basking Shark and Otter of the Environmental Statement, are summarised in Table 6.4 below.

Table 6.4: Maximum and most likely design scenarios considered for the assessment of potential impacts on Annex II marine mammals from increased SSCs during installation/decommissioning.

Maximum design scenario	Most likely design scenario
Warrior Way - Up to 5 vessels utilised at any one time for deployment and retrieval operations - Up to 20 deployment and 20 retrieval vessel movements in a 12-month period, restricted to daylight hours. - Up to four device deployments in a 12-month period. - Total maximum number of vessel movements over a 12-month period equals 40. - Up to 330 m² from a 5 m buffer around device footprint (200 m²) for seabed clearance activities.	Warrior Way - Up to three vessels utilised at any one time for device deployment and retrieval operations. - Up to 20 deployment and 20 retrieval vessel movements in a 12-month period, restricted to daylight hours. - Up to two device deployments in a 12-month period. - Total maximum number of vessel movements over a 12-month period equals 40. - No seabed clearance required.
Dale Roads - Up to 5 vessels utilised at any one time for deployment and retrieval operations - Up to 20 deployment and 20 retrieval vessel movements in a 12-month period, restricted to daylight hours. - Up to two devices deployed in a 12-month period. - Total maximum number of vessel movements over a 12-month period equals 40. - Up to 510 m² from a 5 m buffer around device footprint for seabed clearance activities	Dale Roads - Up to three vessels utilised at any one time for device deployment and retrieval operations. - Up to 20 deployment and 20 retrieval vessel movements in a 12-month period, restricted to daylight hours. - Up to one device deployed in a 12-month period. - Total maximum number of vessel movements over a 12-month period equals 40. - No seabed clearance required
East Pickard Bay - Up to five vessels utilised at any one time for device deployment and retrieval operations. - Up to 40 deployment and 40 retrieval vessel movements in a 12-month period, restricted to daylight hours - Up to two deployments per berth in a 12-month period therefore up to four moored or gravity base device deployments in a 12-month period, 50 % of which may touch the seabed.	East Pickard Bay - Up to three vessels utilised at any one time for device deployment and retrieval operations. - Up to 20 deployment and 20 retrieval vessel movements in a 12-month period. - Up to one device deployment within the test site in a 12-month period. - Total maximum number of vessel movements over a 12-month period equals 40. Up to 70,000 m² of temporary disturbance at East Pickard Bay from mooring spread for deployment vessels per test activity.

Maximum design scenario	Most likely design scenario
- Total maximum number of vessel movements over a 12-month period equals 80. - Up to 3,486 m² from a 10 m buffer around device footprint for seabed clearance activities; and Up to 120,000 m² from mooring spread for deployment vessels for up to two test activities at any one time.	
6.4.1.37	The main activities that will contribute to increases in suspended sediments include the placement of seabed-mounted marine energy devices, drilled pin piling and the placement of gravity anchors or drag anchors for marine energy devices or navigational marker buoys. Vessel movements may also lead to very short-term increases in suspended sediment due to vessel manoeuvring/anchoring or dynamic positioning.
6.4.1.38	All activities proposed at all three test areas are of a temporary and intermittent nature with devices and ancillary equipment such as navigational marker buoys and marine energy devices placed in the marine environment for a maximum of 1-3 months (Warrior Way – site 6), 3-12 months (Dale Roads – site 7), and 12-18 months (East Pickard Bay – site 8) and under the most likely scenario for of 3-6 months (Warrior Way – site 6), 6-12 months (Dale Roads – site 7), and 6-12 months (East Pickard Bay – site 8). Warrior Way (site 6) and Dale Roads (site 7) will support only single device testing at any one time, and East Pickard Bay (site 8) will support up to two concurrent device tests. Drilled pin piling may only occur at Dale Roads (site 7) and East Pickard Bay (site 8) and will be of small diameter (100 mm) therefore minimising sediment disturbance.
6.4.1.39	Seabed disturbance and associated temporary increases in suspended sediments due to placement of devices or anchoring is therefore considered to be occasional and of very short-duration for individual deployments. Due to the meso-tidal range of Warrior Way (site) and Dale Roads (site 7) and the high energy environment at East Pickard Bay (site 8), it can be expected that any suspended sediments will quickly dissipate and disperse according to the sites' hydrological regimes (chapter 5: Coastal Processes).
6.4.1.40	The potential impact of temporary increases in suspended sediment is therefore predicted to be of local spatial extent, long-term duration, but intermittent (short-duration over period of device installation) and reversible for all META sites.
6.4.1.41	Marine mammals regularly occur in turbid environments and therefore are adapted to finding prey in such conditions. Marine mammals forage through the diel cycle and can therefore successfully forage in low light conditions, including at night. Most marine mammals rely on vision to some extent: the large forward pointing eyes of seals gives them binocular vision and suggests that this is an important sense for detecting prey.

- 6.4.1.42 The use of echolocation by odontocetes enables these species to locate prey that is out of sight. Prey capture may be more difficult for non-echolocating species, such as seals, in turbid environments. Most marine mammals, however, have an acute sense of touch. Seals possess sensitive muzzles with vibrissae or sensory whiskers that these species use to detect prey items either through direct contact or due to receiving vibrations in the water column (Denhardt *et al.*, 2001).
- 6.4.1.43 Harbour porpoise and grey seal are both deemed to be of low vulnerability and high recoverability, with overall low sensitivity to the levels of increased SSC likely to be generated.

Conclusions

Grey seal: Pembrokeshire Marine SAC

- 6.4.1.44 Significant adverse effects on the qualifying grey seal features of the Pembrokeshire Marine SAC are not predicted to occur as a result of increased SSCs during installation activities. Potential effects from this activity on the Conservation Objectives of this site are discussed in turn below.
- The population is maintaining itself on a long-term basis as a viable component of its natural habitat*
- 6.4.1.45 The small increases in SSCs associated with installation activities are predicted to be short term and highly localised such that significant effects on the foraging ability or success of grey seal in the vicinity of META sites are not predicted. Therefore, increased SSCs will not restrict the ability of the grey seal populations of the Pembrokeshire Marine SAC to be maintained in the long-term.
- The species population within the site is such that the natural range of the population is not being reduced or likely to be reduced for the foreseeable future*
- 6.4.1.46 Increased SSCs are not predicted to affect the range of grey seals i.e. this impact will not result in the exclusion of grey seals from the META sites during installation events. Therefore, this Conservation Objective will be maintained for the Pembrokeshire Marine SAC.
- The presence, abundance, condition and diversity of habitats and species required to support this species is such that the distribution, abundance and populations dynamics of the species within the site and population beyond the site is stable or increasing*
- 6.4.1.47 Given the temporary, intermittent and reversible nature of any increases in SSC during installation, fish prey species are highly unlikely to be significantly affected and the majority of grey seal foraging areas within the Waterway will be unaffected. Therefore, increased SSC will not prevent this objective from being achieved.
- 6.4.1.48 Therefore, no adverse effect on the integrity of the Pembrokeshire Marine SAC from this potential impact can be concluded.

Harbour porpoise: West Wales Marine SAC, Bristol Channel Approaches SAC and North Anglesey Marine SAC

- 6.4.1.49 Significant adverse effects on the qualifying harbour porpoise features of the West Wales Marine SAC, Bristol Channel Approaches SAC and the North Anglesey Marine SAC are not predicted to occur as a result of increased SSCs during installation activities. Potential effects from this activity on the Conservation Objectives of these sites are discussed in turn below.
- The species is a viable component of the site*
- 6.4.1.50 The small increases in SSCs associated with installation activities are predicted to be short term and highly localised such that significant effects on the foraging ability or success of harbour porpoise in the vicinity of META sites are not predicted. Therefore, increased SSCs will not restrict the ability of the harbour porpoise populations of the West Wales Marine SAC, Bristol Channel Approaches SAC and the North Anglesey Marine SAC to be maintained in the long-term.
- There is no significant disturbance of the species*
- 6.4.1.51 The levels of SSCs predicted to be generated during installation activities, when considered in the context of the background levels of turbidity in the area, are not predicted to result in any significant disturbance to harbour porpoise or prevent this objective from being achieved.
- The supporting habitats and processes relevant to harbour porpoises and their prey are maintained*
- 6.4.1.52 Given the temporary, intermittent and reversible nature of any increases in SSC during installation, fish prey species are highly unlikely to be significantly affected and the majority of harbour porpoise foraging areas within the Waterway will be unaffected. Therefore, increased SSC will not prevent this objective from being achieved.
- 6.4.1.53 Therefore, no adverse effect on the integrity of the West Wales Marine SAC, Bristol Channel Approaches SAC or North Anglesey Marine SAC from this potential impact can be concluded.

Harbour porpoise: All other European sites within the harbour porpoise CIS MU

- 6.4.1.54 On the basis that no adverse effect on the integrity of the West Wales Marine SAC, Bristol Channel Approaches SAC and North Anglesey Marine SAC from this potential impact have been concluded (see paragraph 6.4.1.53), and that numbers of harbour porpoise occurring in the area of effect is likely to be low, it has been concluded that there is no potential for adverse effect on site integrity for all other European sites for harbour porpoise within the CIS MU.

Accidental pollution events due to installation/decommissioning activities

- 6.4.1.55 The maximum and most likely design scenarios for impacts associated with accidental pollution events during installation/decommissioning activities, as presented in the chapter 9: Marine Mammals, Basking Shark and Otter of the Environmental Statement, are summarised in Table 6.5 below.

Table 6.5: Maximum and most likely design scenarios considered for the assessment of potential impacts on Annex II marine mammals from accidental pollution events installation/decommissioning.

Maximum design scenario	Most likely design scenario
- A total of up to 160 test installation and removal vessel movements (which may involve anchoring) in a 12-month period broken down as follows: - Up to 20 installation and 20 retrieval vessel movements in a 12-month period at Warrior Way (site 6) and Dale Roads (site 7). - Up to 40 installation and 40 retrieval vessel movements in a 12-month period at East Pickard Bay (site 8).	- A total of up to 120 test installation and removal vessel movements (which may involve anchoring) in a 12-month period broken down as follows: - up to 20 installation and 20 retrieval vessel movements in a 12-month period at each site.

Embedded mitigation

- 6.4.1.56 As outlined in Table 9.13 of chapter 9: Marine Mammals, Basking Shark and Otter of the Environmental Statement, measures adopted as part of the project include the production of an EMP which will include planning for accidental spills, address all potential contaminant releases and include key emergency contact detail. This will ensure that the potential for release of pollutants from installation and decommissioning activities is minimised. In this manner, accidental release of potential contaminants from vessels will be strictly controlled, thus providing protection for marine life across all phases of the project.

Grey seal and harbour porpoise

- 6.4.1.57 Grey seal and harbour porpoise are highly mobile species and capable of detecting surface slicks in open water. However, the more extensive the slick, the more likely it is that an animal will surface within it (Geraci and St. Aubin, 1990). The most likely impact will be where a pollutant washes up and accumulates on seal haul out sites. Seals may therefore be displaced from preferred haul out sites (e.g. Skomer MCZ), which would be of concern particularly during grey seal pupping season, since juveniles do not initially have a waterproof coat and movement from a haul-out site could negatively impact on pup survival rates.
- 6.4.1.58 Known haul-out site for grey seals exist at Ramsey Island, extending southwards to Skomer Island and northwards to southern Ceredigion; the nearest grey seal haul-out sites to the META project occur within the Skomer MCZ, on the Marloes Peninsula and Skomer Island.

- 6.4.1.59 Whist grey seal and harbour porpoise could be adversely affected by an accidental pollution event, the volumes of pollutants would likely be small enough to not cause a significant effect on the Conservation Objectives of the SAC. In addition, the embedded mitigation described would ensure that the likelihood of an event occurring would be highly unlikely.

Conclusions

Grey seal: Pembrokeshire Marine SAC, Cardigan Bay SAC and Llyn Peninsula and the Sarnau SAC

- 6.4.1.60 Significant adverse effects on the qualifying grey seal features of the Pembrokeshire Marine SAC, Cardigan Bay SAC and Llyn Peninsula and the Sarnau SAC are not predicted to occur as a result of an accidental pollution event during installation/decommissioning. Potential effects from this activity on the Conservation Objectives of these sites are discussed in turn below.

The population is maintaining itself on a long-term basis as a viable component of its natural habitat

- 6.4.1.61 The likelihood of any significant pollution event from the META project occurring is low enough to ensure that the ability of the grey seal populations of these sites to be maintained in the long-term will not be affected.

- 6.4.1.62 *The species population within the site is such that the natural range of the population is not being reduced or likely to be reduced for the foreseeable future*

- 6.4.1.63 Grey seal are highly mobile species and are likely to be able to detect and avoid areas where pollution has occurred, therefore, there may be some localised alteration to the natural range of this species. However, this would be temporary and reversible, and furthermore, the mitigation measures embedded in the project will ensure that the likelihood of such an event occurring is very low. Therefore, an accidental pollution event will not prevent this objective from being achieved.

The presence, abundance, condition and diversity of habitats and species required to support this species is such that the distribution, abundance and populations dynamics of the species within the site and population beyond the site is stable or increasing

- 6.4.1.64 Given the mitigation measures to be implemented for the META project, the likelihood of a spill occurring and resulting in significant adverse effects on grey seal prey species (or habitats of prey species) is extremely low and therefore this Conservation Objective will be maintained.

- 6.4.1.65 Therefore, no adverse effect on the integrity of the Pembrokeshire Marine SAC, Cardigan Bay SAC or Llyn Peninsula and the Sarnau SAC from this potential impact can be concluded.

Grey seal: Lundy SAC

- 6.4.1.66 Significant adverse effects on the qualifying grey seal feature of the Lundy SAC are not predicted to occur as a result of an accidental pollution event during installation activities. Potential effects from this activity on the relevant Conservation Objectives (as presented in paragraph 6.2.1.8) are discussed in turn below.

The extent and distribution of qualifying natural habitats and habitats of qualifying species are maintained

- 6.4.1.67 An accidental pollution event will not impact the extent or distribution of grey seal foraging or breeding habitats and therefore this Conservation Objective will be maintained.

The structure and function of the habitats of qualifying species are maintained

- 6.4.1.68 The likelihood of any significant pollution event from the META project occurring is low enough to ensure that the ability of the grey seal foraging and breeding habitats to be maintained in the long-term will not be affected.

The supporting processes on which qualifying natural habitats and the habitats of qualifying species rely are maintained

- 6.4.1.69 An accidental pollution event will not impact the supporting processes of grey seal habitats and therefore this Conservation Objective will be maintained.

The populations of qualifying species are maintained

- 6.4.1.70 The likelihood of any significant pollution event from the META project occurring is low enough to ensure that the population of grey seal will be maintained.

The distribution of qualifying species within the site is maintained

- 6.4.1.71 The likelihood of any significant pollution event from the META project occurring is low enough to ensure that the distribution of the grey seal population of the sites will be maintained in the long-term.

- 6.4.1.72 Therefore, no adverse effect on the integrity of the Lundy SAC from this potential impact can be concluded.

Harbour porpoise: West Wales Marine SAC, Bristol Channel Approaches SAC and North Anglesey Marine SAC

- 6.4.1.73 Significant adverse effects on the qualifying harbour porpoise features of the West Wales Marine SAC, Bristol Channel Approaches SAC and the North Anglesey Marine SAC are not predicted to occur as a result of an accidental pollution event. Potential effects from this activity on the Conservation Objectives of these sites are discussed in turn below.

The species is a viable component of the site

- 6.4.1.74 Numbers of harbour porpoise likely to occur in the vicinity of the META sites is considered to be low and the likelihood of any significant pollution event from the META project occurring is low enough to ensure that harbour porpoise will remain viable components of the West Wales Marine SAC, Bristol Channel Approaches SAC and the North Anglesey Marine SAC.

There is no significant disturbance of the species

- 6.4.1.75 The likelihood of an accidental pollution event occurring, with the mitigation measures in place, is low, but in the event that it does occur, it will not cause disturbance to harbour porpoise or prevent this objective from being achieved.

The supporting habitats and processes relevant to harbour porpoises and their prey are maintained

- 6.4.1.76 Given the mitigation measures to be implemented for the META project, the likelihood of a spill occurring and resulting in significant adverse effects on harbour porpoise prey species (or habitats of prey species) is extremely low and therefore this Conservation Objective will be maintained.

- 6.4.1.77 Therefore, no adverse effect on the integrity of the West Wales Marine SAC, Bristol Channel Approaches SAC or North Anglesey Marine SAC from this potential impact can be concluded.

Harbour porpoise: All other European sites within the harbour porpoise CIS MU

- 6.4.1.78 On the basis that no adverse effect on the integrity of the West Wales Marine SAC, Bristol Channel Approaches SAC and North Anglesey Marine SAC from this potential impact have been concluded (see paragraph 6.4.1.77), and that numbers of harbour porpoise occurring in the area of effect is likely to be low, it has been concluded that there is no potential for adverse effect on site integrity for all other European sites for harbour porpoise within the CIS MU.

6.4.2 Potential impacts – operation and maintenance

Increased underwater noise due to tidal turbine operation

- 6.4.2.1 Underwater noise may be generated during the operation and maintenance phase as a result of the operation of tidal devices at Warrior Way (site 6). The maximum and most likely design scenarios for this impact, as presented in chapter 9: Marine Mammals, Basking Shark and Otter of the Environmental Statement, are summarised in Table 6.6 below.

Table 6.6: Maximum and most likely design scenarios considered for the assessment of potential impacts on Annex II marine mammals from underwater noise associated with tidal turbine operation.

Maximum design scenario	Most likely design scenario
- Tidal device testing will only be supported at Warrior Way (site 6). - Tidal components may occupy all or part of the water-column. - Up to 20 m width and 10 m length. - Rotor diameter up to 5 m. with a tip speed of up to 5 m/s and a swept area of 19.63 m². Maximum duration of device testing: up to 6 months.	- Tidal device testing will only be supported at Warrior Way (site 6). - Tidal components may occupy all or part of the water-column. - Up to 5 m width and 5 m length. - Rotor diameter up to 5 m, with a tip speed of up to 2 m/s and a swept area of 19.63 m². Maximum duration of device testing: up to 3 months.

- 6.4.2.2 Tidal device testing will only occur at Warrior Way (site 6) and the underwater noise assessment, for the operation of these devices, as presented in chapter 9: Marine Mammals, Basking Shark and Otter of the Environmental Statement and chapter 6: Underwater Noise of the Environmental Statement, is based on the same criteria for marine mammals as outlined previously in paragraph 6.4.1.6 *et seq.* and Table 6.2 for non-impulsive sound. The noise modelling undertaken to inform this assessment has been based on noise measurements of an OpenHydro tidal turbine at the EMEC facility in Orkney (Parvin and Brooker 2008) It is considered that the source noise levels modelled (162 dB re 1 µPa at 1 m) is representative of the potential noise output from tidal devices that might be used at Warrior Way (site 6) although it is likely that the dB level will be higher and therefore the predicted effects on marine mammals, as outlined in Table 6.7, are considered to represent a highly conservative assessment.
- 6.4.2.3 An assessment of the distance to onset of injury from each operational device is presented in Table 6.7 based on the SEL cumulative exposure criterion, along with an assessment of potential disturbance zones. As noted previously, the potential radii for injury are based on exposure levels over a 24-hour period. In reality, an animal is highly unlikely to spend 24 hours within a short range of an operating device and the radii can therefore be considered as a maximum scenario, highly precautionary zone.

Table 6.7: Calculated effects of continuous operational device noise.

Activity / vessel	Radius of potential injury zone (assuming continuous exposure within that radius over 24-hour period)		Radius of potential disturbance
	HF	PW	
OpenHydro tidal turbine	2 m	0m	0.5 km

Harbour porpoise

- 6.4.2.4 For harbour porpoise, a high frequency cetacean, a conservative assessment estimates that animals may be exposed to underwater noise that has the potential to result in the onset of injury within 2 m of the sound source. It is important to remember, however, that the potential radii for injury are based on exposure levels over a 24-hour period. Thus, a harbour porpoise would need to stay within 2 m of a tidal device for a period of 24 hours to experience any injury. This is considered to be an unrealistically conservative scenario and therefore it is not considered likely that any harbour porpoise will be injured as a result of tidal device operation.
- 6.4.2.5 With respect to disturbance, the maximum radius of potential disturbance for harbour porpoise is 0.5 km (based on the OpenHydro tidal turbine source level).

Grey seal

- 6.4.2.6 For grey seal, a conservative assessment estimates that animals may be exposed to underwater noise that has the potential to result in the onset of injury within 0 m of the sound source. Although a grey seal would need to remain within 0 m of a tidal device for 24 hours to experience any injury and, as discussed above for harbour porpoise, this is considered to be an unrealistically conservative scenario and therefore it is not thought likely that any grey seal will be injured as a result of tidal device operation.
- 6.4.2.7 With respect to disturbance, the maximum radius of potential disturbance for grey seal is 0.5 km (based on the OpenHydro tidal turbine source level) which falls more than 18 km out with known grey seal haul out sites. Whilst some avoidance behaviour may occur up to 0.5 km from a full-scale operational tidal turbine, limited numbers of animals are expected to be foraging within potential disturbance ranges of Warrior Way (site 6). Furthermore, potential disturbance distances are likely to be significantly smaller given the micro-scale and/or scaled nature of tidal devices proposed to be tested at Warrior Way (site 6).

Conclusions

Grey seal: Pembrokeshire Marine SAC, Cardigan Bay SAC and Lleyn Peninsular and the Sarnau SAC

- 6.4.2.8 Significant adverse effects on the qualifying grey seal features of the Pembrokeshire Marine SAC, Cardigan Bay SAC and Lleyn Peninsular and the Sarnau SAC are not predicted to occur as a result of underwater noise generated by tidal device operation at Warrior Way (site 6). Potential effects from this activity on the relevant Conservation Objectives of these sites are discussed in turn below.

The population is maintaining itself on a long-term basis as a viable component of its natural habitat

6.4.2.9 Whilst grey seals may forage in the vicinity of Warrior way (site 6), the numbers of animals likely to occur in this area is low when compared to numbers in the regional marine mammal study area. It is not considered likely that grey seal will be injured as a result of underwater noise generated during tidal device operation. Although low levels of short-term disturbance to individuals, potentially resulting in avoidance behaviour, of grey seal may occur, the potential disturbance range is small and should be considered in the context of the existing high levels of vessel traffic and anthropogenic activities occurring within the Waterway and the likely habituation of animals foraging in these waters to underwater noise. Furthermore, the nearest grey seal haul-out site is 18 km away and will therefore not be affected by disturbance. Underwater noise from tidal device operation is not predicted to restrict the objective of the population being able to maintain itself as a viable component of its natural habitat over the long-term.

The species population within the site is such that the natural range of the population is not being reduced or likely to be reduced for the foreseeable future

6.4.2.10 Low levels of short term and intermittent disturbance to individuals, potentially resulting in avoidance behaviour, of grey seal may occur during installation works, although the nearest grey seal haul-out sites will not be affected. This disturbance should also be considered in the context of the existing high levels of vessel traffic and anthropogenic activities occurring within the Waterway and the likely habituation of animals foraging in these waters to underwater noise. Upon cessation of tidal device testing, any grey seals affected will return to the affected area relatively quickly. Therefore, disturbance to the species is not considered significant and is not predicted to reduce the range of this species in the long-term. Therefore, this Conservation Objective will be maintained.

The presence, abundance, condition and diversity of habitats and species required to support this species is such that the distribution, abundance and populations dynamics of the species within the site and population beyond the site is stable or increasing

6.4.2.11 Some short-term disturbance is predicted to potential prey fish species, although effects are not considered to be significant, therefore ensuring that the tidal device operation will not affect prey species populations from being maintained in the long term.

6.4.2.12 Therefore, no adverse effect on the integrity of the Pembrokeshire Marine SAC, Cardigan Bay SAC or Llyn Peninsula and the Sarnau SAC from this potential impact can be concluded.

Grey seal: Lundy SAC

6.4.2.13 Significant adverse effects on the qualifying grey seal feature of the Lundy SAC are not predicted to occur as a result of underwater noise generated by tidal device operation. Potential effects from this activity on the relevant Conservation Objectives (as presented in paragraph 6.2.1.8) are discussed in turn below.

The extent and distribution of qualifying natural habitats and habitats of qualifying species are maintained

6.4.2.14 Underwater noise will not impact foraging or breeding habitats of the grey seal feature of this SAC and therefore this Conservation Objective will be maintained.

The structure and function of the habitats of qualifying species are maintained

6.4.2.15 Underwater noise will not impact the structure and function of foraging or breeding habitats of the grey seal feature of this SAC and therefore this Conservation Objective will be maintained.

The supporting processes on which qualifying natural habitats and the habitats of qualifying species rely

6.4.2.16 Underwater noise will not impact the supporting process of foraging or breeding habitats of the grey seal feature of this SAC and therefore this Conservation Objective will be maintained.

The populations of qualifying species are maintained

6.4.2.17 Although the Waterway is within the foraging range of grey seal features of the Lundy SAC, numbers of individuals from this site occurring in the vicinity of Warrior Way (site 6) are likely to be low. It is not considered likely that any grey seal will be injured as a result of underwater noise generated during tidal device operation. Although low levels of short-term disturbance to individuals, potentially resulting in avoidance behaviour of grey seal may occur during installation works, these should be considered in the context of the existing high levels of vessel traffic and anthropogenic activities occurring within the Waterway and the likely habituation of animals foraging in these waters. Furthermore, impacts to haul-out sites on Lundy SAC will not be affected. Therefore, underwater noise is not predicted to restrict the objective of the population being able to maintain itself as a viable component of its natural habitat over the long-term.

The distribution of qualifying species within the site is maintained

6.4.2.18 Low levels of short term and intermittent disturbance to individuals, potentially resulting in avoidance behaviour of grey seal may occur during installation works, although these should be considered in the context of the existing high levels of vessel traffic and anthropogenic activities occurring within the Waterway and the likely habituation of animals foraging in these waters to underwater noise. Upon cessation of underwater noise generation from tidal device operation, any grey seals affected are predicted to return to the affected area relatively quickly. Therefore, disturbance to the species is not considered significant and will not affect the distribution of this species in the long-term. Therefore, this Conservation Objective will be maintained.

6.4.2.19 Therefore, no adverse effect on the integrity of the Lundy SAC from this potential impact can be concluded.

Harbour porpoise: West Wales Marine SAC, Bristol Channel Approaches SAC and North Anglesey Marine SAC

- 6.4.2.20 Significant adverse effects on the qualifying harbour porpoise feature of the West Wales Marine SAC, Bristol Channel Approaches SAC or North Anglesey Marine SAC are not predicted to occur as a result of underwater noise generated during installation activities. Potential effects from this activity on the relevant Conservation Objectives (as presented in paragraph 6.2.1.3) of these sites are discussed in turn below.

The species is a viable component of the site

- 6.4.2.21 On the basis of the levels of underwater noise which will be generated during tidal device operation, it is not considered likely that any harbour porpoise will be injured as a result of underwater noise. Although low levels of short-term disturbance to individuals, potentially resulting in avoidance behaviour, may occur during tidal device operation, numbers of harbour porpoise occurring in the vicinity of Warrior Way (site 6) is likely to be very low. Furthermore, the levels of noise generated should be considered in the context of the existing high levels of vessel traffic and anthropogenic activities occurring within the Waterway and the likely habituation of animals foraging in these waters. Underwater noise during tidal device operation is therefore not predicted to restrict the objective of the population being able to maintain itself as a viable component of its natural habitat over the long-term.

There is no significant disturbance of the species

- 6.4.2.22 There may be some low-level disturbance to harbour porpoise within the zone of impact, resulting in potential avoidance behaviour. However, it is considered highly unlikely that harbour porpoise will be foraging in the vicinity of Warrior Way (site 6) and any individuals would be expected to return to any areas affected relatively quickly upon removal of the tidal devices from the site. Significant or prolonged disturbance to harbour porpoise features of these sites are not predicted and underwater noise generated during tidal device operation will not prevent this objective from being achieved.

The supporting habitats and processes relevant to harbour porpoises and their prey are maintained

- 6.4.2.23 Habitats and processes will not be affected by underwater noise. With respect to prey species, although some short-term and localised disturbance is predicted to potential prey fish species, effects are not considered to significant ensuring that the project will not affect prey species populations being maintained in the long term.

- 6.4.2.24 Therefore, no adverse effect on the integrity of the West Wales Marine SAC, Bristol Channel Approaches SAC or North Anglesey Marine SAC from this potential impact can be concluded.

Harbour porpoise: All other European sites within the harbour porpoise CIS MU

- 6.4.2.25 On the basis that no adverse effect on the integrity of the West Wales Marine SAC, Bristol Channel Approaches SAC and North Anglesey Marine SAC from this potential impact have been concluded (see paragraph 6.4.2.24), and that numbers of harbour porpoise occurring in the area of effect is likely to be low, it has been concluded that there is no potential for adverse effect on site integrity for all other European sites for harbour porpoise within the CIS MU.

Increased underwater noise due to operation and maintenance vessel activity

- 6.4.2.26 Underwater noise may be generated during the operation and maintenance phase as a result of vessels employed in operation and maintenance activities at all three META sites. The maximum and most likely design scenarios for impacts associated with increased vessel movements, as presented in chapter 9: Marine Mammals, Basking Shark and Otter of the Environmental Statement, are summarised in Table 6.8 below.

Table 6.8: Maximum and most likely design scenarios considered for the assessment of potential impacts on Annex II marine mammals from underwater noise associated with operation and maintenance vessel activity.

Maximum design scenario	Most likely design scenario
Warrior Way - Up to four device deployments in a 12-month period. - Up to one device deployed at any one time. - Up to 104 vessel visits within a 12-month period associated with up to four device deployments. - Vessel size - up to 35 m in length and 6.8 m draught. - No use of DP vessels. - Source sound pressure level at 1 m = 183 dB re 1 µPa (rms) / 232 SEL (24h) dB re 1 µPa²s.	Warrior Way - Up to two device deployments in a 12-month period. - Up to one device deployed at any one time. - Up to 54 vessel visits within a 12-month period associated with up to two device deployments. - Vessel size up to 30 m in length and 6.8 m draught. - No use of DP vessels. - Source sound pressure level at 1 m = 172 dB re 1 µPa (rms) / 221 SEL (24h) dB re 1 µPa²s.
Dale Roads - Up to two devices deployed in a 12-month period. - Up to one device deployed at any one time. - Up to 104 vessel visits associated with up to two device tests in a 12-month period. - Vessel size - up to 164 m in length and 6.8 m draught. - Source sound pressure level at 1 m = 183 dB re 1 µPa (rms) / 232 SEL (24h) dB re 1 µPa²s.	Dale Roads - Up to one device deployed in a 12-month period. - Up to one device deployed at any one time. - Up to 52 vessel visits associated with up to one device tests in a 12-month period. - Vessel size - up to 164 m in length and 6.8 m draught. - Source sound pressure level at 1 m = 183 dB re 1 µPa (rms) / 232 SEL (24h) dB re 1 µPa²s.
East Pickard Bay - Up to four device deployments in a 12-month period. - Up to two devices deployed at any one time. - Up to 150 O&M visits associated with up to four device deployments. - Vessel size - up to 200 m in length and 8 m draught.	East Pickard Bay - Up to one device deployed in a 12-month period. - Up to 104 O&M visits in a 12-month period. - Vessel size - up to 164 m in length and 6.8 m draught.

Maximum design scenario	Most likely design scenario
Source sound pressure level at 1 m = 183 dB re 1 μPa (rms) / 232 SEL (24h) dB re 1 μPa²s.	Source sound pressure level at 1 m = 183 dB re 1 μPa (rms) / 232 SEL (24h) dB re 1 μPa²s.

6.4.2.27 Whilst vessel movements during the operational and maintenance phase increases by almost double that of the installation phase, these numbers remain small in comparison to the existing levels of traffic in the Waterway. The assessment of effects on grey seal and harbour porpoise is as presented previously for underwater noise from installation/decommissioning vessels in paragraph 6.4.1.1 *et seq.*

Harbour porpoise

6.4.2.28 A conservative assessment estimates that animals may be exposed to underwater noise that has the potential to result in the onset of injury within 46 m of some vessel activity anchor handling/support vessel activities. It is important to remember, however, that the potential radii for injury are based on exposure levels over a 24-hour period. Thus, a harbour porpoise would need to stay within 46 m of a vessel for a period of 24 hours to experience any injury. This is considered to be an unrealistically conservative scenario and therefore it is not considered likely that any harbour porpoise will be injured as a result of underwater noise from operation and maintenance vessels.

6.4.2.29 With respect to disturbance, the maximum predicted range of disturbance at Warrior Way (site 6) would be up to approximately 2 km and for Dale Roads (site 7) and East Pickard Bay (site 8) where DP vessels may be used, disturbance to harbour porpoise could be up to 12 km. Low numbers of both harbour porpoise are likely to occur in the vicinity of the META sites and the duration of these noise generating activities would be short term and intermittent.

6.4.2.30 The Waterway hosts a high number of vessels year-round and it is highly likely that harbour porpoise occurring in the Waterway are habituated to this level of activity (Nowacek *et al.*, 2007). Marine mammals can both be attracted to, and avoid, vessels. Harbour porpoise are particularly sensitive to high frequency noise and are more likely to avoid vessels (Heinänen and Skov, 2015). Harbour porpoise are deemed to be of low vulnerability and high recoverability to the levels to noise which will be generated during installation activities.

Grey seal

6.4.2.31 For grey seal, a conservative assessment estimates that underwater noise levels sufficient to result in injury will only occur in the immediate vicinity of vessel activities (i.e. up to 8 m during the use of DP vessels). However, the assessment assumes that a grey seal would need to stay within 8 m of a vessel for a period of 24 hours to experience any injury. Therefore, it is not likely that any grey seal will be injured as a result of underwater noise from operation and maintenance vessels.

6.4.2.32 With respect to disturbance, the maximum predicted range of disturbance at Warrior Way (site 6) would be up to approximately 2 km and for Dale Roads (site 7) and East Pickard Bay (site 8), where DP vessels may be used, disturbance to grey seal could be up to 12 km. In addition, it is reasonable to assume that individuals foraging within the vicinity of the META sites are habituated to the existing high levels of vessel traffic within the Waterway. In addition, given that seals are not thought to communicate underwater, the impact will not mask communication and any disturbance impact which does occur will individually be of short duration.

6.4.2.33 Whilst pinnipeds do not critically rely on hearing to survive, they are highly vocally active under water and can use sounds passively to forage (Chen *et al.*, 2017). Their repertoires extend across a wide range of frequencies, usually from 0.1 kHz to 3 kHz, but upsweeps can go up to 4.7 kHz (Chen *et al.*, 2017). Their hearing ranges from very low frequencies (~ 100 Hz) to high frequencies (~ 30 kHz) and it is therefore likely that shipping noise is within the hearing range of grey seals (Chen *et al.*, 2017). Grey seals are however likely to exhibit avoidance behaviour in response to vessel noise (Anderwald *et al.*, 2013). Grey seal are deemed to be of low vulnerability and high recoverability to the levels of noise which will be generated by operation and maintenance vessels.

Conclusions

Grey seal: Pembrokeshire Marine SAC, Cardigan Bay SAC and Lleyn Peninsular and the Sarnau SAC

6.4.2.34 Significant adverse effects on the qualifying grey seal features of the Pembrokeshire Marine SAC, Cardigan Bay SAC and Lleyn Peninsular and the Sarnau SAC are not predicted to occur as a result of underwater noise generated by operation and maintenance vessels. Potential effects from this activity on the relevant Conservation Objectives of these sites are discussed in turn below.

The population is maintaining itself on a long-term basis as a viable component of its natural habitat

6.4.2.35 It is not considered likely that any grey seal will be injured as a result of underwater noise generated by operation and maintenance vessels. Although low levels of short-term disturbance to individuals, potentially resulting in avoidance behaviour, of grey seal may occur, these should be considered in the context of the existing high levels of vessel traffic and anthropogenic activities occurring within the Waterway and the likely habituation of animals foraging in these waters. This is not predicted to restrict the objective of the population being able to maintain itself as a viable component of its natural habitat over the long-term.

The species population within the site is such that the natural range of the population is not being reduced or likely to be reduced for the foreseeable future

- 6.4.2.36 Low levels of short term and intermittent disturbance to individuals, potentially resulting in avoidance behaviour of grey seal may occur due to underwater noise generated by operation and maintenance vessels. These should, however, be considered in the context of the existing high levels of vessel traffic and anthropogenic activities occurring within the Waterway and the likely habituation of animals foraging in these waters. Upon cessation of underwater noise generation from vessel movements, any grey seals affected are predicted to return to the affected area relatively quickly. Therefore, disturbance to the species is not considered significant and will not reduce the range of this species in the long-term. Therefore, this Conservation Objective will be maintained.

The presence, abundance, condition and diversity of habitats and species required to support this species is such that the distribution, abundance and populations dynamics of the species within the site and population beyond the site is stable or increasing

- 6.4.2.37 Some short-term disturbance is predicted to potential prey fish species, although effects are not considered to be significant, therefore ensuring that the project will not affect prey species populations from being maintained in the long term.

- 6.4.2.38 Therefore, no adverse effect on the integrity of the Pembrokeshire Marine SAC, Cardigan Bay SAC or Llyn Peninsula and the Sarnau SAC from this potential impact can be concluded.

Grey seal: Lundy SAC

- 6.4.2.39 Significant adverse effects on the qualifying grey seal feature of the Lundy SAC are not predicted to occur as a result of underwater noise generated by operation and maintenance vessels. Potential effects from this activity on the relevant Conservation Objectives (as presented in paragraph 6.2.1.8) are discussed in turn below.

The extent and distribution of qualifying natural habitats and habitats of qualifying species are maintained

- 6.4.2.40 Underwater noise will not impact the extent of distribution of foraging or breeding habitats of the grey seal feature of this SAC and therefore this Conservation Objective will be maintained.

The structure and function of the habitats of qualifying species are maintained

- 6.4.2.41 Underwater noise will not impact the structure or function of foraging or breeding habitats of the grey seal feature of this SAC and therefore this Conservation Objective will be maintained.

The supporting processes on which qualifying natural habitats and the habitats of qualifying species rely

- 6.4.2.42 Underwater noise will not impact the supporting processes of foraging or breeding habitats of the grey seal feature of this SAC and therefore this Conservation Objective will be maintained.

The populations of qualifying species are maintained

- 6.4.2.43 Although the Waterway and the META sites are within the foraging range of grey seal features of the Lundy SAC, numbers of individuals from this site occurring in the area are likely to be low. It is not considered likely that any grey seal will be injured as a result of underwater noise generated by operation and maintenance vessels. Although low levels of short-term disturbance to individuals, potentially resulting in avoidance behaviour of grey seal may occur during installation works, these should be considered in the context of the existing high levels of vessel traffic and anthropogenic activities occurring within the Waterway and the likely habituation of animals foraging in these waters. This is not predicted to restrict the objective of the population being able to maintain itself as a viable component of its natural habitat over the long-term.

The distribution of qualifying species within the site is maintained

- 6.4.2.44 Low levels of short term and intermittent disturbance to individuals, potentially resulting in temporary avoidance behaviour of grey seal may occur during installation works, although these should be considered in the context of the existing high levels of vessel traffic and anthropogenic activities occurring within the Waterway, and the likely habituation of animals foraging in these waters. Upon cessation of underwater noise generation from vessel movements, any grey seals affected are predicted to return to the affected area relatively quickly. Therefore, disturbance to the species is not considered significant and will not affect the distribution of this species in the long-term. Therefore, this Conservation Objective will be maintained.

- 6.4.2.45 Therefore, no adverse effect on the integrity of the Lundy SAC from this potential impact can be concluded.

Harbour porpoise: West Wales Marine SAC, Bristol Channel Approaches SAC and North Anglesey Marine SAC

- 6.4.2.46 Significant adverse effects on the qualifying harbour porpoise feature of the West Wales Marine SAC, Bristol Channel Approaches SAC and North Anglesey Marine SAC are not predicted to occur as a result of underwater noise generated by operation and maintenance activities. Potential effects from this activity on the relevant Conservation Objectives of these sites are discussed in turn below.

The species is a viable component of the site

6.4.2.47 On the basis of the levels of underwater noise which will be generated by operation and maintenance vessels, it is not considered likely that any harbour porpoise will be injured as a result of underwater noise generated by these vessels. Although low levels of short-term disturbance to individuals, potentially resulting in avoidance behaviour may occur, numbers of harbour porpoise occurring in the area of effect, is likely to be low. Furthermore, the levels of noise generated should be considered in the context of the existing high levels of vessel traffic and anthropogenic activities occurring within the Waterway and the likely habituation of animals foraging in these waters. Underwater noise is therefore not predicted to restrict the objective of the population being able to maintain itself as a viable component of its natural habitat over the long-term.

There is no significant disturbance of the species

6.4.2.48 There may be some low-level disturbance to harbour porpoise within the zone of impact, resulting in potential avoidance behaviour. However, any individuals would be expected to return to any affected areas relatively quickly once vessel noise ceases. Given the intermittent nature of vessel movements and the context of the baseline levels of vessel activity in the Waterway, significant or prolonged disturbance to harbour porpoise is not predicted and underwater noise generated by operation and maintenance vessels will not prevent this objective from being achieved.

The supporting habitats and processes relevant to harbour porpoises and their prey are maintained

6.4.2.49 Habitats and processes will not be affected by underwater noise. With respect to prey species, although some short-term disturbance is predicted to potential prey fish species, effects are not considered to be significant ensuring that the project will not affect prey species populations being maintained in the long term.

6.4.2.50 Therefore, no adverse effect on the integrity of the West Wales Marine SAC, Bristol Channel Approaches SAC or North Anglesey Marine SAC from this potential impact can be concluded.

Harbour porpoise: All other European sites within the harbour porpoise CIS MU

6.4.2.51 On the basis that no adverse effect on the integrity of the West Wales Marine SAC, Bristol Channel Approaches SAC and North Anglesey Marine SAC from this potential impact have been concluded (see paragraph 6.4.2.50), and that numbers of harbour porpoise occurring in the area of effect is likely to be low, it has been concluded that there is no potential for adverse effect on site integrity for all other European sites for harbour porpoise within the CIS MU.

Increased collision risk with vessels

6.4.2.52 The maximum and most likely design scenarios for impacts associated with increased collision risk with vessels during operation and maintenance activities is as presented in chapter 9: Marine Mammals, Basking Shark and Otter of the Environmental Statement, are summarised previously in Table 6.8.

6.4.2.53 Vessels travelling at 7 m/s or faster are those most likely to cause death or serious injury to marine mammals, basking sharks and otters (Wilson *et al.*, 2007). Vessels involved in operation and maintenance activities are likely to be travelling considerably slower than this, in accordance with the high levels of traffic expected within the META project area, and therefore collision risk is expected to be lower than that posed by commercial shipping activity.

6.4.2.54 Larger vessels, such as the maximum size expected at Dale Roads (site 7) and East Pickard Bay (site 8) as outlined in Table 6.6, are less likely to be involved in vessel collisions, based on their predictable movements and larger volume of noise produced, making them more detectable to marine mammals than the smaller, most likely size of vessels at Warrior Way (site 6). However, the slow speed of all vessels used in installation operations at the META project means that vessel strike is unlikely

6.4.2.55 The impact to marine mammals is predicted to be of local spatial extent, long-term duration, but intermittent (short-term duration of individual vessel movements) and reversible.

Harbour porpoise

6.4.2.56 Considering the likely low abundance of harbour porpoise in the vicinity of the META sites, regardless of size of vessel, few animals are expected to enter the zones of impact and thus, few, if any, will be affected by potential increased collision risk associated with increased vessel movement associated with the META project. A likely response to vessels is to move away. Small, fast moving odontocetes are less likely to be struck by large commercial vessels producing loud noise and moving in predictable directions. Odontocetes are more likely to be struck by small, fast moving vessels, due to unpredictability of direction of movement, and engine noise which is masked by ambient noise. Individuals are likely to exhibit some habituation to high baseline levels of traffic, therefore the potential increase in vessel collision risk associated with increased vessel movements associated with the installation phase of the META Project, regardless of ambient noise in the Waterway, are considered unlikely to significantly increase potential for vessel strike. Although animals which are found near to East Pickard Bay (site 8) may be less habituated to vessel traffic due to the lower levels of existing vessel movement, the likely ambient noise in this area will be lower and therefore individual vessels will be more acoustically discernible.

Grey seal

6.4.2.57 Vessel strike in seals is likely related to a combination of increased vessel speed and size (Moore *et al.*, 2013). Whilst grey seals are likely to be observed in the local marine mammal study area, and this population is deemed important in the scale of the MU, the number of animals are relatively low when compared to the regional marine mammal study area. In addition, it is highly likely that grey seals will have habituated to presence of vessels in the META project area and will therefore likely exhibit vessel avoidance

6.4.2.58 Harbour porpoise and grey seal are both deemed to be of medium vulnerability and low recoverability to vessel collision.

Conclusions

Grey seal: Pembrokeshire Marine SAC, Cardigan Bay SAC and Llyn Peninsular and the Sarnau SAC

- 6.4.2.59 Significant adverse effects on the qualifying grey seal features of the Pembrokeshire Marine SAC, Cardigan Bay SAC and Llyn Peninsular and the Sarnau SAC are not predicted to occur as a result of increased collision risk with operation and maintenance vessels. Potential effects from this activity on the relevant Conservation Objectives of these sites are discussed in turn below.

The population is maintaining itself on a long-term basis as a viable component of its natural habitat

- 6.4.2.60 The potential for collision risk with vessels is considered to be low on the basis that vessels will be operating and manoeuvring at low speeds. The META sites are within the Pembrokeshire Marine SAC and therefore any grey seal individuals from this SAC occurring within the vicinity of the META sites are considered likely to be habituated to vessel activity in the Waterway. Although the Waterway and the META sites are within the foraging range of grey seal features of the Cardigan Bay SAC and Llyn Peninsular and the Sarnau SAC, numbers of individuals from this site occurring in the area are likely to be low. As such, collisions resulting in grey seal fatalities and therefore effects on the population size or structure of these SACs are considered unlikely. This impact will not restrict the objective of the population being able to maintain itself as a viable component of its natural habitat over the long-term.

The species population within the site is such that the natural range of the population is not being reduced or likely to be reduced for the foreseeable future

- 6.4.2.61 As vessel activity will be intermittent and localised to the Waterway and META sites, any avoidance behaviour exhibited by grey seals will only be temporary and will not constrain the range of this species within the site or affect the access of grey seals to areas of prey. Therefore, this Conservation Objective will be maintained.

The presence, abundance, condition and diversity of habitats and species required to support this species is such that the distribution, abundance and populations dynamics of the species within the site and population beyond the site is stable or increasing

- 6.4.2.62 Prey species are unlikely to be significantly affected by collision risk with vessels and as such, this Conservation Objective will be maintained.

- 6.4.2.63 Therefore, no adverse effect on the integrity of the Pembrokeshire Marine SAC, Cardigan Bay SAC or Llyn Peninsula and the Sarnau SAC from this potential impact can be concluded.

Grey seal: Lundy SAC

- 6.4.2.64 Significant adverse effects on the qualifying grey seal feature of the Lundy SAC are not predicted to occur as a result of increased collision risk with operation and maintenance vessels. Potential effects from this activity on the relevant Conservation Objectives (as presented in paragraph 6.2.1.8) are discussed in turn below.

The extent and distribution of qualifying natural habitats and habitats of qualifying species are maintained

- 6.4.2.65 Collision risk will not impact the extent and distribution of foraging or breeding habitats of the grey seal feature of this SAC and therefore this Conservation Objective will be maintained.

The structure and function of the habitats of qualifying species are maintained

- 6.4.2.66 Collision risk will not impact the structure or function of foraging or breeding habitats of the grey seal feature of this SAC and therefore this Conservation Objective will be maintained.

The supporting processes on which qualifying natural habitats and the habitats of qualifying species rely

- 6.4.2.67 Collision risk will not impact the supporting processes of foraging or breeding habitats of the grey seal feature of this SAC and therefore this Conservation Objective will be maintained.

The populations of qualifying species are maintained

- 6.4.2.68 Although the Waterway and the META sites are within the foraging range of grey seal features of the Lundy SAC, numbers of individuals from this site occurring in the area are likely to be low. Furthermore, individuals routinely foraging in this area can be expected to be habituated to the existing high levels of vessel traffic and the uplift resulting from operation and maintenance activities is considered to be low. As such, collisions resulting in grey seal fatalities, and therefore effects on the size or structure of the grey seal population of the site are considered unlikely. This impact will, therefore, not restrict the objective of the population being maintained.

The distribution of qualifying species within the site is maintained

- 6.4.2.69 As vessel activity will be intermittent and localised to the Waterway and META sites, any avoidance behaviour exhibited by grey seals during foraging activities will only be temporary and will not significantly affect the distribution of grey seals within the site. Therefore, this Conservation Objective will be maintained.

- 6.4.2.70 Therefore, no adverse effect on the integrity of the Lundy SAC from this potential impact can be concluded.

Harbour porpoise: West Wales Marine SAC, Bristol Channel Approaches SAC and North Anglesey Marine SAC

6.4.2.71 Significant adverse effects on the qualifying harbour porpoise features of the West Wales Marine SAC, Bristol Channel Approaches SAC and North Anglesey Marine SAC are not predicted to occur as a result of increased collision risk with operation and maintenance vessels. Potential effects from this activity on the relevant Conservation Objectives of these sites are discussed in turn below.

The species is a viable component of the site

6.4.2.72 On the basis that numbers of harbour porpoise in the vicinity of the META sites and the wider Waterway are low, the uplift in vessel numbers compared to the existing baseline of high vessel traffic in the area is small, and vessels will be operating at low speeds, the risk of collision with vessels resulting in fatality, injury or significant disturbance is low and this is not predicted to affect the ability of harbour porpoise to survive and live successfully within the site.

There is no significant disturbance of the species

6.4.2.73 Vessel activity associated with operation and maintenance activities will be intermittent and localised to the Waterway and META sites. Collision risk is anticipated to be of low likelihood, and any avoidance behaviour exhibited by grey seals during foraging activities will only be temporary and will not constrain the range of this species or affect the access of grey seals to areas of prey. Therefore, this Conservation Objective will be maintained

The supporting habitats and processes relevant to harbour porpoises and their prey are maintained

6.4.2.74 Prey species are unlikely to be significantly affected by collision risk with vessels and as such, this Conservation Objective will be maintained.

6.4.2.75 Therefore, no adverse effect on the integrity of the West Wales Marine SAC, Bristol Channel Approaches SAC or North Anglesey Marine SAC from this potential impact can be concluded.

Harbour porpoise: All other European sites within the harbour porpoise CIS MU

6.4.2.76 On the basis that no adverse effect on the integrity of the West Wales Marine SAC, Bristol Channel Approaches SAC and North Anglesey Marine SAC from this potential impact have been concluded (see paragraph 6.4.2.75), and that numbers of harbour porpoise occurring in the area of effect is likely to be low, it has been concluded that there is no potential for adverse effect on site integrity for all other European sites for harbour porpoise within the CIS MU.

Collision risk with tidal turbines at Warrior Way (site 6)

6.4.2.77 The deployment of scaled or micro-scale marine tidal turbines at Warrior Way (site 6) poses a potential risk to marine mammals. Device components, specifically the terminal end of the rotating blade, pose the greatest risk of potential injury in the event of a collision (Turnpenny *et al.*, 2000).

6.4.2.78 The maximum and most likely design scenarios for impacts associated with collision risk with tidal turbines, as presented in chapter 9: Marine Mammals, Basking Shark and Otter of the Environmental Statement, are summarised in Table 6.9 below.

Table 6.9: Maximum and most likely design scenarios considered for the assessment of potential impacts on Annex II marine mammals from collision risk with tidal turbines.

Maximum design scenario	Most likely design scenario
- Tidal testing will only be supported at Warrior Way. - Tidal components may occupy all or part of the water-column. - Rotor diameter up to 5 m with a tip speed of up to 5 m/s and a swept area of 19.63 m². - One device at any one time. - Up to four device deployments in a 12-month period.	- Tidal testing will only be supported at Warrior Way. - Tidal components may occupy all or part of the water-column. - Rotor diameter up to 5 m with a tip speed of up to 2 m/s and a swept area of 19.63 m². - One device at any one time. - Up to two device deployments in a 12-month period.

6.4.2.79 In the context of the cross-section of sea area in the Waterway at the mid-point of Warrior Way (site 6) (11,570 m²), the swept area outlined in Table 6.9 equates to only 0.17% of the tidal stream cross-sectional area at this location. The maximum duration of scaled tidal device testing at Warrior Way (site 6) is up to six months, with the most likely being up to three months.

6.4.2.80 The potential impact on grey seal and harbour porpoise is predicted to be of local spatial extent, long-term duration, but intermittent (short-term duration of individual scaled device deployments) and reversible.

Harbour porpoise and grey seal

6.4.2.81 Responses to the tidal devices are likely to occur on two spatial scales; at long range the marine mammals have the option to avoid the area of device placement (i.e. swim around) and at closer range they can evade the particular structures (i.e. dodge or swerve) (Wilson *et al.*, 2007). Research conducted by the Sea Mammal Research Unit (SMRU) on the SeaGen commercial tidal device, showed that tagged harbour seals exhibited avoidance behaviour up to 250 m from the tidal device, and the tidal device did not act as a barrier to expected transiting behaviour. Telemetry information however showed that whilst the turbine was operating, some individual seals were reducing the frequency of transit by between 10 and 50% (Sparling *et al.*, 2017). Data also showed that for the duration of environmental monitoring, no seals were reported to have collided with the turbine.

6.4.2.82 It is highly likely that animals within the Waterway are habituated to high levels of traffic and are adept at avoiding obstacles in the water column. In daytime and high visibility, underwater structures will be visible at ranges of tens of metres, giving sufficient warning and associated avoidance behaviour. Collision risk is also expected to be higher in waters of high turbidity; chapter 5: Coastal Processes of the Environmental Statement reports that suspended sediments at Warrior Way (site 6) are not typically high and it is unlikely that the turbines themselves will resuspend any sediments.

6.4.2.83 Although it is highly unlikely that harbour porpoise would be found within the Warrior Way (site 6) site area, sightings suggest that they do occasionally enter the Waterway. However, given that numbers of animals are relatively low, few harbour porpoise are expected to enter the zones of impact and thus, few, if any, will be negatively impacted. Whilst grey seals also have the potential to occur in the vicinity of Warrior Way (site 6), numbers are also likely to be low. Harbour porpoise and grey seal are deemed to be of medium vulnerability and low recoverability.

Conclusions

Grey seal: Pembrokeshire Marine SAC, Cardigan Bay SAC and Llyn Peninsular and the Sarnau SAC

6.4.2.84 Significant adverse effects on the qualifying grey seal features of the Grey seal: Pembrokeshire Marine SAC, Cardigan Bay SAC and Llyn Peninsular and the Sarnau SAC are not predicted to occur as a result of collision risk with tidal turbines. Potential effects from this activity on the relevant Conservation Objectives of these sites are discussed in turn below.

The population is maintaining itself on a long-term basis as a viable component of its natural habitat

6.4.2.85 The META sites are within the Pembrokeshire Marine SAC and although the Waterway and the META sites are also within the foraging range of grey seal features of the Cardigan Bay SAC and Llyn Peninsular and the Sarnau SAC, numbers of grey seals occurring in the vicinity of Warrior Way (site 6) area are likely to be low. As discussed in paragraph 6.4.1.58, the nearest grey seal haul-out sites to the META project occur within the Skomer MCZ, on the Marloes Peninsula and Skomer Island. On the basis that numbers of grey seal numbers foraging/transiting in the vicinity of Warrior Way (site 6) is likely to be low and that it is likely that any individuals approaching the turbines would exhibit avoidance behaviour, collisions resulting in grey seal fatalities and therefore effects on the population size or structure are considered unlikely. This impact will not restrict the objective of the population being able to maintain itself as a viable component of its natural habitat over the long-term.

The species population within the site is such that the natural range of the population is not being reduced or likely to be reduced for the foreseeable future

6.4.2.86 The area potentially swept by the tidal turbines represents only a very small proportion of the width of the Waterway at Warrior Way (site 6). Therefore, in the event that grey seals approach a turbine and exhibit avoidance behaviour, there would be sufficient unaffected space within the channel such that the devices would not cause a barrier to movement and therefore would not affect the natural range of this species.

The presence, abundance, condition and diversity of habitats and species required to support this species is such that the distribution, abundance and populations dynamics of the species within the site and population beyond the site is stable or increasing

6.4.2.87 As discussed in paragraph 5.4.2.35, prey species are also considered likely to exhibit avoidance behaviour and, as such the presence, abundance, condition and diversity of prey species is unlikely to be significantly affected. As such, this Conservation Objective will be maintained.

6.4.2.88 Therefore, no adverse effect on the integrity of the Pembrokeshire Marine SAC, Cardigan Bay SAC or Llyn Peninsular and the Sarnau SAC from this potential impact can be concluded.

Grey seal: Lundy SAC

6.4.2.89 Significant adverse effects on the qualifying grey seal feature of the Lundy SAC are not predicted to occur as a result of increased collision risk with tidal devices. Potential effects from this activity on the relevant Conservation Objectives (as presented in paragraph 6.2.1.8) are discussed in turn below.

The extent and distribution of qualifying natural habitats and habitats of qualifying species are maintained

6.4.2.90 Collision risk will not impact the extent and distribution of foraging or breeding habitats of the grey seal feature of this SAC and therefore this Conservation Objective will be maintained.

The structure and function of the habitats of qualifying species are maintains

6.4.2.91 Collision risk will not impact the structure and function foraging or breeding habitats of the grey seal feature of this SAC and therefore this Conservation Objective will be maintained.

The supporting processes on which qualifying natural habitats and the habitats of qualifying species rely

6.4.2.92 Collision risk will not impact supporting processes of foraging or breeding habitats of the grey seal feature of this SAC and therefore this Conservation Objective will be maintained.

The populations of qualifying species are maintained

6.4.2.93 Although the Waterway and the META sites are within the foraging range of grey seal features of the Lundy SAC, numbers of individuals from this site occurring in the vicinity of Warrior Way (site 6) are likely to be very low. Furthermore, individuals foraging in this area can be expected to exhibit avoidance behaviour. As such, collisions resulting in grey seal fatalities and, therefore, effects on the size or structure of the grey seal population of the site are considered unlikely. This impact will, therefore, not restrict the objective of the population being maintained.

The distribution of qualifying species within the site is maintained

6.4.2.94 As the area potentially swept by the tidal turbines represents only a very small proportion of the width of the Waterway at Warrior Way (site 6), in the event that grey seals approach a turbine and exhibit avoidance behaviour, there would be sufficient unaffected space within the channel such that the devices would not cause a barrier to movement and therefore would not affect the distribution of this species.

6.4.2.95 Therefore, no adverse effect on the integrity of the Lundy SAC from this potential impact can be concluded.

Harbour porpoise: West Wales Marine SAC, Bristol Channel Approaches SAC and North Anglesey Marine SAC

6.4.2.96 Significant adverse effects on the qualifying harbour porpoise feature of the West Wales Marine SAC, Bristol Channel Approaches SAC and North Anglesey Marine SAC are not predicted to occur as a result of increased collision risk with tidal devices. Potential effects from this activity on the relevant Conservation Objectives of these sites are discussed in turn below.

The species is a viable component of the site

6.4.2.97 On the basis that harbour porpoise are considered unlikely to be present in the vicinity of Warrior Way (site 6), the risk of collision with scaled or micro-scale marine tidal turbines resulting in fatality, injury or significant disturbance is low and this not predicted to affect the ability of harbour porpoise to survive and live successfully within the site.

There is no significant disturbance of the species

6.4.2.98 As discussed in paragraph 6.4.2.97 above, the risk of harbour porpoise collision with tidal turbines is low and will not prevent this objective from being achieved.

The supporting habitats and processes relevant to harbour porpoises and their prey are maintained

6.4.2.99 Collision risk with tidal devices will not affect supporting habitats or processes of the site and, as such, this Conservation Objective will be maintained.

6.4.2.100 Therefore, no adverse effect on the integrity of the West Wales Marine SAC, Bristol Channel Approaches SAC or North Anglesey Marine SAC from this potential impact can be concluded.

Harbour porpoise: All other European sites within the harbour porpoise CIS MU

6.4.2.101 On the basis that no adverse effect on the integrity of the West Wales Marine SAC, Bristol Channel Approaches SAC and North Anglesey Marine SAC from this potential impact have been concluded (see paragraph 6.4.2.100), and that numbers of harbour porpoise occurring in the area of effect is likely to be low, it has been concluded that there is no potential for adverse effect on site integrity for all other European sites for harbour porpoise within the CIS MU.

Entanglement risk

6.4.2.102 The maximum and most likely design scenarios for impacts associated with entanglement risk, as presented in chapter 9: Marine Mammals, Basking Shark and Otter of the Environmental Statement, are summarised in Table 6.10 below.

Table 6.10: Maximum and most likely design scenarios considered for the assessment of potential impacts on Annex II marine mammals from entanglement risk.

Maximum design scenario	Most likely design scenario
Warrior Way - Mooring/attachment method - Up to 4 drag anchors with associated slack lines, catenary mooring system. - One device deployment at any one time - Up to four device deployments in a 12-month period	Warrior Way - Mooring/attachment method - deployed from vessel or attached to test support buoys - One device deployment at any one time - Up to two device deployments in a 12-month period
Dale Roads - Up to 10 drag anchors with associated slack lines, catenary mooring system. - One device deployment at any one time. - Up to two device deployments in a 12-month period.	Dale Roads - Mooring/attachment method - dynamic tether mooring system or up to 4-standard drag embedment anchors. - One device deployment at any one time. - Up to one device deployment in a 12-month period.
East Pickard Bay - Mooring/attachment method - Up to 10 drag anchors with associated slack lines, catenary mooring system. - Up to two device deployments at any one time. - Up to four device deployments in a 12-month period.	East Pickard Bay - Mooring/attachment method - dynamic tether mooring system or up to 4-standard drag embedment anchors. - One device deployment at any one time. - Up to one device deployment in a 12-month period.

6.4.2.103 At Warrior Way (site 6) mooring of testing devices will require up to four drag anchors with associated slack lines, with one device deployed at any one time. At Dale Roads (site 7) mooring of testing devices will require up to ten drag anchors with associated slack lines, with one device deployed at any one time. At East Pickard Bay (site 8) mooring of testing devices will require up to ten standard drag embedment anchors with associated slack lines, with up to two devices deployed at any one time, and up to four device deployments in a 12-month period.

- 6.4.2.104 The most likely scenario at Dale Roads (site 7) and East Pickard Bay (site 8) is up to four standard drag embedment anchors with associated slack lines, and at Warrior Way (site 6) the most likely scenario is that no slack lines will be required as the device will be deployed from vessels or a test support buoy.
- 6.4.2.105 A number of factors including the visibility, dimensions, how important the location is for feeding or breeding and the extent of close-range evasion all interact to determine the likelihood of entanglement. At Warrior Way (site 6) the presence of operating scaled tidal turbines and associated noise may contribute to marine mammals avoiding the testing site, and therefore avoiding entanglement with drag anchors and mooring lines. However, sightings of harbour porpoise and grey seal within the Waterway are low.
- 6.4.2.106 The impact is predicted to be of local spatial extent, medium-term duration, intermittent and reversible.

Harbour porpoise and grey seal

- 6.4.2.107 The potential outcomes of entanglement in slack lines for a marine mammal can include low level injury such as abrasions, to long-term severe injury and even mortality. Worldwide, fatal entanglement in fishing gear is a source of anthropogenically induced mortality in cetaceans, pinnipeds and elasmobranchs (Cassoff *et al.*, 2011), however much less is known of the potential risks for incidental mortality associated with marine renewable energy developments.
- 6.4.2.108 Rope entanglement has been reported to be the cause of many incidental mortalities of pinnipeds worldwide (Harnois *et al.*, 2015). Allen *et al.* (2012) report rope as one of several types of marine debris found on grey seals at a haul-out site in Cornwall, suggesting that this problem could occur elsewhere in UK waters.
- 6.4.2.109 Harbour porpoise and grey seal are deemed to be of low vulnerability and low recoverability to entanglement.

Conclusions

Grey seal: Pembrokeshire Marine SAC, Cardigan Bay SAC and Llyn Peninsular and the Sarnau SAC

- 6.4.2.110 Significant adverse effects on the qualifying grey seal feature of the Pembrokeshire Marine SAC, Cardigan Bay SAC and Llyn Peninsular and the Sarnau SAC are not predicted to occur as a result of entanglement risk. Potential effects from this activity on the relevant Conservation Objectives of these sites are discussed in turn below.

The population is maintaining itself on a long-term basis as a viable component of its natural habitat

- 6.4.2.111 The META sites are within the Pembrokeshire Marine SAC, but as discussed in paragraph 6.4.1.58, the nearest grey seal haul-out sites to the META project occur within the Skomer MCZ, on the Marloes Peninsula and Skomer Island. Therefore, numbers of grey seal foraging within the META sites is considered to be low and the corresponding risk of entanglement is also considered to be low. Although the Waterway and the META sites are within the foraging range of grey seal features of the Cardigan Bay SAC and Llyn Peninsular and the Sarnau SAC, numbers of individuals from these sites occurring in the area are also likely to be low. Any interaction with mooring lines, should they occur, are considered unlikely to result in grey seal fatalities and, therefore, effects on the population size or structure are considered unlikely. This impact will not restrict the objective of the population being able to maintain itself as a viable component of its natural habitat over the long-term.

The species population within the site is such that the natural range of the population is not being reduced or likely to be reduced for the foreseeable future

The risk of entanglement will not reduce the natural range of grey seal and, as such, this Conservation Objective will be maintained.

The presence, abundance, condition and diversity of habitats and species required to support this species is such that the distribution, abundance and populations dynamics of the species within the site and population beyond the site is stable or increasing

- 6.4.2.112 The presence, abundance, condition and diversity of prey species will not be affected and, as such, this Conservation Objective will be maintained.
- 6.4.2.113 Therefore, no adverse effect on the integrity of the Pembrokeshire Marine SAC, Cardigan Bay SAC or Llyn Peninsular and the Sarnau SAC from this potential impact can be concluded.

Grey seal: Lundy SAC

- 6.4.2.114 Significant adverse effects on the qualifying grey seal feature of the Lundy SAC are not predicted to occur as a result of entanglement. Potential effects from this activity on the relevant Conservation Objectives (as presented in paragraph 6.2.1.8) are discussed in turn below.

The extent and distribution of qualifying natural habitats and habitats of qualifying species are maintained

- 6.4.2.115 Entanglement will not impact the extent and distribution foraging or breeding habitats of the grey seal feature of this SAC and therefore this Conservation Objective will be maintained.

The structure and function of the habitats of qualifying species are maintained

- 6.4.2.116 Entanglement will not impact the structure and function foraging or breeding habitats of the grey seal feature of this SAC and therefore this Conservation Objective will be maintained.

The supporting processes on which qualifying natural habitats and the habitats of qualifying species rely

6.4.2.117 Entanglement will not impact the supporting processes foraging or breeding habitats of the grey seal feature of this SAC and therefore this Conservation Objective will be maintained.

The populations of qualifying species are maintained

6.4.2.118 Although the Waterway and the META sites are within the foraging range of grey seal features of the Lundy SAC, numbers of individuals from this site occurring in the vicinity of the META sites is likely to be very low. Any interaction with mooring lines, should they occur, are considered unlikely to result in grey seal fatalities and, therefore, effects on the population size or structure are considered unlikely. This impact will, therefore, not restrict the objective of the population of grey seal being maintained.

The distribution of qualifying species within the site is maintained

6.4.2.119 The risk of entanglement will not affect the natural range or distribution of grey seal and, as such, this Conservation Objective will be maintained.

6.4.2.120 Therefore, no adverse effect on the integrity of the Lundy SAC from this potential impact can be concluded.

Harbour porpoise: West Wales Marine SAC, Bristol Channel Approaches SAC and North Anglesey Marine SAC

6.4.2.121 Significant adverse effects on the qualifying harbour porpoise feature of the West Wales Marine SAC, Bristol Channel Approaches SAC and North Anglesey Marine SAC are not predicted to occur as a result of entanglement risk. Potential effects from this activity on the relevant Conservation Objectives of these sites are discussed in turn below.

The species is a viable component of the site

6.4.2.122 On the basis that numbers of harbour porpoise likely to be in vicinity of the META sites is low, together with the fact that the deployment durations of the moorings will be short term and temporary, the risk posed by the mooring lines for entanglement is similarly low and an interaction resulting in fatality, injury or significant disturbance is unlikely. Therefore, entanglement risk is not predicted to affect the ability of harbour porpoise of the SACs to survive and live successfully within the site.

There is no significant disturbance of the species

6.4.2.123 The presence of slack mooring lines will not result in the significant disturbance of harbour porpoise and will therefore not prevent this objective from being achieved.

The supporting habitats and processes relevant to harbour porpoises and their prey are maintained

6.4.2.124 Entanglement risk with slack mooring line will not affect supporting habitats or processes of the site and, as such, this Conservation Objective will be maintained.

6.4.2.125 Therefore, no adverse effect on the integrity of the West Wales Marine SAC, Bristol Channel Approaches SAC or North Anglesey Marine SAC from this potential impact can be concluded.

Harbour porpoise: All other European sites within the harbour porpoise CIS MU

6.4.2.126 On the basis that no adverse effect on the integrity of the West Wales Marine SAC, Bristol Channel Approaches SAC and North Anglesey Marine SAC from this potential impact have been concluded (see paragraph 6.4.2.125), and that numbers of harbour porpoise occurring in the area of effect is likely to be low, it has been concluded that there is no potential for adverse effect on site integrity for all other European sites for harbour porpoise within the CIS MU.

Changes in hydrodynamic regime

6.4.2.127 Tidal current devices which employ impeller or turbine technology extract kinetic energy from the tidal flow. They therefore have the potential to change the hydrodynamic regime where they are deployed and operational. Warrior Way (site 6) is the only META site where this type of device will be deployed. This site will enable the testing of scaled and micro tidal power devices on a short-term basis.

6.4.2.128 The maximum and most likely design scenarios for impacts associated with changes in the hydrodynamic regime, as presented in chapter 9: Marine Mammals, Basking Shark and Otter of the Environmental Statement, are summarised in Table 6.11 below.

Table 6.11: Maximum and most likely design scenarios considered for the assessment of potential impacts on Annex II marine mammals from changes in hydrodynamic regime.

Maximum design scenario	Most likely design scenario
- Tidal testing will only be supported at Warrior Way. - Tidal components may occupy all or part of the water-column. - Rotor diameter up to 5 m with a tip speed of up to 5 m/s and a swept area of 19.63 m². - One device at any one time. - Up to four device deployments in a 12-month period.	- Tidal testing will only be supported at Warrior Way. - Tidal components may occupy all or part of the water-column. - Rotor diameter up to 5 m, with a tip speed of up to 2 m/s and a swept area of 19.63 m². - One device at any one time. - Up to two device deployments in a 12-month period.

6.4.2.129 In chapter 5: Coastal Processes of the Environmental Statement, an analysis was undertaken using the maximum design proposed for Warrior Way (site 6) (see Table 6.11); the maximum duration of scaled tidal device testing at Warrior Way (site 6) is six months, and the most likely is three months. The maximum swept area of scaled tidal devices is 19.63 m².

6.4.2.130 An assessment of a 5 m diameter turbine determined that the swept area of the blade constituted 0.17% of the cross-sectional area of the channel, at the mean water level. Applying a normalised power, the drag co-efficient for a turbine working within optimal parameters would be 0.4, i.e. extraction of 40% of the energy passing through the swept area. Applying this parameter to the proposed device showed a reduction in the energy across the channel of < 0.15%. The localised reduction in current speed in the immediate swept area was 2% which is in the order of 0.035 m/s at peak current speeds. Therefore, there would not be any change in the flow regime, with indiscernible changes in current speed outside the immediate area.

Harbour porpoise

6.4.2.131 Although it is highly unlikely that harbour porpoise would be found within the Warrior Way (site 6) site area, sightings data suggest that they do occasionally enter the Waterway, a precautionary approach would be to assume that individuals have the potential to enter the test area. However, given that numbers of animals are relatively low in the area when compared to the regional study area, few harbour porpoise are expected to enter the zone of impact.

6.4.2.132 In addition, based on the information provided in paragraph 6.4.2.77 *et seq.* for impacts associated with collision risk with tidal turbines at Warrior Way (site 6), it is considered highly likely that animals would exhibit avoidance of the tidal turbines, and therefore any changes to hydrodynamic regime within the test area would have little or no effect on harbour porpoise.

6.4.2.133 Marine mammals regularly occur in turbid environments, exploiting energetic tidal-stream habitats (Benjamins *et al.*, 2016). Harbour porpoise in particular, tend to forage in high energy habitat; in Pembrokeshire preferred foraging for harbour porpoise is high-energy habitat in South Ramsey Sound where a tide race overfalls, and upwelling zones form, during the ebb phase of the tide. Tidal currents and the steep walls of a trench are believed to concentrate prey which is funnelled towards the waiting porpoises. Harbour porpoise are therefore adapted to finding prey in such conditions.

6.4.2.134 Changes to hydrodynamic regime in important high-energy feeding habitat for harbour porpoise could lead to a reduction in foraging opportunities, however Warrior Way (site 6) has not been recorded as an important foraging area for harbour porpoise and therefore any change to hydrodynamic regime is not likely to reduce foraging availability, particularly when high-energy tidal-stream habitat is located nearby at Ramsey Sound (Pierpoint, 2008).

Grey seal

6.4.2.135 Grey seals have been sighted within the Waterway and as far east as Neyland, as such it is assumed that individuals have the potential to enter the vicinity of Warrior Way (site 6) and thus the potential to forage within the test area. Based on the information provided in paragraph 6.4.2.77 *et seq.* for impacts associated with collision risk with tidal turbines at Warrior Way (site 6), it is highly likely that seals would exhibit avoidance of the tidal turbines. In particular, research conducted by the SMRU on the SeaGen commercial tidal device, showed that tagged harbour seals exhibited avoidance behaviour up to 250 m from the tidal device. As such a receptor-impact pathway is unlikely, and few animals are expected to be negatively affected by impairment of foraging opportunities as a result of changes in hydrodynamic regime at Warrior Way (site 6).

6.4.2.136 Grey seal foraging strategies have also been linked to areas categorised by complex hydrodynamic processes, driven by irregular topography and strong tidal currents; physical processes and variety in substrates lead to high biodiversity (Vincent *et al.*, 2016). Changes to hydrodynamic regime in important high-energy feeding habitat for grey seal could lead to a reduction in foraging opportunity, however Warrior Way (site 6) has not been recorded as an important foraging area for grey seal and therefore any change to hydrodynamic regime is not likely to reduce foraging availability particularly when high-energy tidal-stream habitat is located nearby at Ramsey Sound (Pierpoint, 2008).

Conclusions

Grey seal: Pembrokeshire Marine SAC, Cardigan Bay SAC and the Llyn Peninsular and the Sarnau SAC

6.4.2.137 Significant adverse effects on the qualifying grey seal features of the Pembrokeshire Marine SAC, Cardigan Bay SAC and the Llyn Peninsular and the Sarnau SAC are not predicted to occur as a result of increased SSCs during installation activities. Potential effects from this activity on the Conservation Objectives of these site are discussed in turn below.

The population is maintaining itself on a long-term basis as a viable component of its natural habitat

6.4.2.138 Any changes to the hydrodynamic regime at Warrior Way (site 6) are predicted to be short term and highly localised such that significant effects on the foraging ability or success of grey seal in the vicinity of META sites are not predicted. Therefore, any small change to the hydrodynamic regime will not restrict the ability of the grey seal populations of the Pembrokeshire Marine SAC, Cardigan Bay SAC or the Llyn Peninsular and the Sarnau SAC to be maintained in the long-term.

The species population within the site is such that the natural range of the population is not being reduced or likely to be reduced for the foreseeable future

- 6.4.2.139 Any minor changes to current speed within Warrior Way (site 6) are not predicted to affect the range of grey seal i.e. this impact will not result in the exclusion of grey seals from the META site during installation events. Therefore, this Conservation Objective will be maintained for all sites.

The presence, abundance, condition and diversity of habitats and species required to support this species is such that the distribution, abundance and populations dynamics of the species within the site and population beyond the site is stable or increasing

- 6.4.2.140 Given the small scale, localised, temporary and reversible nature of any changes to the current regime at Warrior Way (site 6), fish prey species are highly unlikely to be significantly affected, and the majority of grey seal foraging areas within the Waterway will be unaffected. Therefore, any small changes to the hydrodynamic regime will not prevent this objective from being achieved.

- 6.4.2.141 Therefore, no adverse effect on the integrity of the Pembrokeshire Marine SAC, Cardigan Bay SAC or the Llyn Peninsular and the Sarnau SAC from this potential impact can be concluded.

Grey seal: Lundy SAC

- 6.4.2.142 Significant adverse effects on the qualifying grey seal feature of the Lundy SAC are not predicted to occur as a result of changes to the hydrodynamic regime. Potential effects from this activity on the relevant Conservation Objectives (as presented in paragraph 6.2.1.8) are discussed in turn below.

The extent and distribution of qualifying natural habitats and habitats of qualifying species are maintained

- 6.4.2.143 Changes to the hydrodynamic regime will not impact the extent and distribution of foraging or breeding habitats of the grey seal feature of this SAC and therefore this Conservation Objective will be maintained.

The structure and function of the habitats of qualifying species are maintained

- 6.4.2.144 Changes to the hydrodynamic regime will not impact the structure and function of foraging or breeding habitats of the grey seal feature of this SAC and therefore this Conservation Objective will be maintained.

The supporting processes on which qualifying natural habitats and the habitats of qualifying species rely

- 6.4.2.145 Changes to the hydrodynamic regime are predicted to be very small and localised to the Warrior Way (site 6) test area and therefore this Conservation Objective will be maintained.

The populations of qualifying species are maintained

- 6.4.2.146 Although the Waterway and the META sites are within the foraging range of grey seal features of the Lundy SAC, numbers of individuals from this site occurring in the vicinity of Warrior Way (site 6) are likely to be very low. Furthermore, individuals foraging in this area can be expected to exhibit avoidance behaviour and with extensive alternative foraging habitat available in the wider area, this impact will, therefore, not restrict the objective of the population being maintained.

The distribution of qualifying species within the site is maintained

- 6.4.2.147 As the area potentially swept by the tidal turbines represents only a very small proportion of the width of the Waterway at Warrior Way (site 6), in the event that grey seals approach a turbine and exhibit avoidance behaviour, there would be sufficient unaffected space within the channel such that the devices would not cause a barrier to movement and therefore would not affect the distribution of this species.

- 6.4.2.148 Therefore, no adverse effect on the integrity of the Lundy SAC from this potential impact can be concluded.

Harbour porpoise: West Wales Marine SAC, Bristol Channel Approaches SAC and North Anglesey Marine SAC

- 6.4.2.149 Significant adverse effects on the qualifying harbour porpoise features of the West Wales Marine SAC, Bristol Channel Approaches SAC and the North Anglesey Marine SAC are not predicted to occur as a result of changes to the hydrodynamic regime at Warrior Way (site 6). Potential effects from this activity on the Conservation Objectives of these sites are discussed in turn below.

The species is a viable component of the site

- 6.4.2.150 The small changes to the current speeds are predicted to be short term and highly localised such that significant effects on the foraging ability or success of harbour porpoise in the vicinity of Warrior Way (site 6) are not predicted. Therefore, changes to the hydrodynamic regime will not restrict the ability of the harbour porpoise populations of the West Wales Marine SAC, Bristol Channel Approaches SAC and the North Anglesey Marine SAC to be maintained in the long-term.

There is no significant disturbance of the species

- 6.4.2.151 Given that changes in current speed will be indiscernible outside the immediate area of the tidal testing devices at Warrior Way (site 6), they are not predicted to result in any significant disturbance to harbour porpoise or prevent this objective from being achieved.

The supporting habitats and processes relevant to harbour porpoises and their prey are maintained

- 6.4.2.152 Given the temporary, intermittent and reversible nature of any changes to current speeds during device operation, fish prey species are highly unlikely to be significantly affected and the majority of harbour porpoise foraging areas within the Waterway will be unaffected. Therefore, changes to the hydrodynamic regime will not prevent this objective from being achieved.

- 6.4.2.153 Therefore, no adverse effect on the integrity of the West Wales Marine SAC, Bristol Channel Approaches SAC or North Anglesey Marine SAC from this potential impact can be concluded.

Harbour porpoise: All other European sites within the harbour porpoise CIS MU

- 6.4.2.154 On the basis that no adverse effect on the integrity of the West Wales Marine SAC, Bristol Channel Approaches SAC and North Anglesey Marine SAC from this potential impact have been concluded (see paragraph 6.4.2.153), and that numbers of harbour porpoise occurring in the area of effect is likely to be low, it has been concluded that there is no potential for adverse effect on site integrity for all other European sites for harbour porpoise within the CIS MU.

Accidental pollution

- 6.4.2.155 There is the potential for the accidental release of pollutants into the marine environment during operation and maintenance activities, as a result of accidental spillage or leakage for example. Pollution may include diesel oil from vessels and synthetic chemicals.
- 6.4.2.156 In the unlikely event that pollutants were to enter the Waterway, they would be rapidly dispersed on the surface and in the water column and subject to twice daily tidal flushing, and so any effects on water quality would be limited.

Embedded mitigation

- 6.4.2.157 As outlined in Table 9.13 of chapter 9: Marine Mammals, Basking Shark and Otters of the Environmental Statement, measures adopted as part of the project include the production of an EMP which will include planning for accidental spills, address all potential contaminant releases and include key emergency contact detail. This will ensure that the potential for release of pollutants during operation and maintenance activities is minimised. In this manner, accidental release of potential release of contaminants from vessels will be strictly controlled, thus providing protection for marine life across all phases of the project.

Grey seal and harbour porpoise

- 6.4.2.158 Effects of an accidental pollution event on the marine mammal features of SACs is as described previously in paragraph 6.4.1.57 *et seq.* While marine mammals could be affected by an accidental pollution event, the volumes of pollutants would likely be small, and the embedded mitigation described would ensure that the potential of an event occurring would be highly unlikely.

Conclusions

Grey seal: Pembrokeshire Marine SAC, Cardigan Bay SAC and the Llyn Peninsular and the Sarnau SAC

- 6.4.2.159 Significant adverse effects on the qualifying grey seal features of the Pembrokeshire Marine SAC, Cardigan Bay SAC and the Llyn Peninsular and the Sarnau SAC are not predicted to occur as a result of an accidental pollution event during operation and maintenance. Potential effects from this activity on the Conservation Objectives of these sites are discussed in turn below.

The population is maintaining itself on a long-term basis as a viable component of its natural habitat

- 6.4.2.160 The likelihood of any significant pollution event from the META project occurring is low enough to ensure that the ability of the grey seal populations of these sites to be maintained in the long-term will not be affected.

- 6.4.2.161 *The species population within the site is such that the natural range of the population is not being reduced or likely to be reduced for the foreseeable future*

- 6.4.2.162 Grey seal are highly mobile species and are likely to be able to detect and avoid areas where pollution has occurred, therefore, there may be some localised alteration to the natural range of this species. However, this would be temporary and reversible and, furthermore, the mitigation measures embedded in the project will ensure that the likelihood of such an event occurring is very low. Therefore, an accidental pollution event will not prevent this objective from being achieved.

The presence, abundance, condition and diversity of habitats and species required to support this species is such that the distribution, abundance and populations dynamics of the species within the site and population beyond the site is stable or increasing

- 6.4.2.163 Given the mitigation measures to be implemented for the META project, the likelihood of a spill occurring and resulting in significant adverse effects on grey seal prey species (or habitats of prey species) is extremely low and therefore this Conservation Objective will be maintained.

- 6.4.2.164 Therefore, no adverse effect on the integrity of the Pembrokeshire Marine SAC, Cardigan Bay SAC or Llyn Peninsula and the Sarnau SAC from this potential impact can be concluded.

Grey seal: Lundy SAC

- 6.4.2.165 Significant adverse effects on the qualifying grey seal feature of the Lundy SAC are not predicted to occur as a result of an accidental pollution event during operation and maintenance. Potential effects from this activity on the relevant Conservation Objectives (as presented in paragraph 6.2.1.8) are discussed in turn below.

The extent and distribution of qualifying natural habitats and habitats of qualifying species are maintained

- 6.4.2.166 An accidental pollution event will not impact the extent or distribution of grey seal foraging or breeding habitats and therefore this Conservation Objective will be maintained.

The structure and function of the habitats of qualifying species are maintained

- 6.4.2.167 The likelihood of any significant pollution event from the META project occurring is low enough to ensure that the structure and function of grey seal foraging and breeding habitats will be maintained in the long-term.

The supporting processes on which qualifying natural habitats and the habitats of qualifying species rely are maintained

- 6.4.2.168 An accidental pollution event will not impact the supporting processes of grey seal habitats and therefore this Conservation Objective will be maintained.

The populations of qualifying species are maintained

- 6.4.2.169 The likelihood of any significant pollution event from the META project occurring is low enough to ensure that the distribution of the grey seal population of the site will be maintained in the long-term.

The distribution of qualifying species within the site is maintained

- 6.4.2.170 The likelihood of any significant pollution event from the META project occurring is low enough to ensure that the distribution of the grey seal population of the sites will be maintained in the long-term.

- 6.4.2.171 Therefore, no adverse effect on the integrity of the Lundy SAC from this potential impact can be concluded.

Harbour porpoise: West Wales Marine SAC, Bristol Channel Approaches SAC and North Anglesey Marine SAC

- 6.4.2.172 Significant adverse effects on the qualifying harbour porpoise features of the West Wales Marine SAC, Bristol Channel Approaches SAC and the North Anglesey Marine SAC are not predicted to occur as a result of an accidental pollution event during operation and maintenance. Potential effects from this activity on the Conservation Objectives of these sites are discussed in turn below.

The species is a viable component of the site

- 6.4.2.173 Numbers of harbour porpoise likely to occur in the vicinity of the META sites is considered to be low and the likelihood of any significant pollution event from the META project occurring is low enough to ensure that harbour porpoise will remain viable components of the West Wales Marine SAC, Bristol Channel Approaches SAC and the North Anglesey Marine SAC.

There is no significant disturbance of the species

- 6.4.2.174 The likelihood of an accidental pollution event occurring, with the mitigation measures in place, is low but in the event that it does occur, it will not cause disturbance to harbour porpoise or prevent this objective from being achieved.

The supporting habitats and processes relevant to harbour porpoises and their prey are maintained

- 6.4.2.175 Given the mitigation measures to be implemented for the META project, the likelihood of a spill occurring and resulting in significant adverse effects on harbour porpoise prey species (or habitats of prey species) is extremely low and therefore this Conservation Objective will be maintained.

- 6.4.2.176 Therefore, no adverse effect on the integrity of the West Wales Marine SAC, Bristol Channel Approaches SAC or North Anglesey Marine SAC from this potential impact can be concluded.

Harbour porpoise: All other European sites within the harbour porpoise CIS MU

- 6.4.2.177 On the basis that no adverse effect on the integrity of the West Wales Marine SAC, Bristol Channel Approaches SAC and North Anglesey Marine SAC from this potential impact have been concluded (see paragraph 6.4.2.176), and that numbers of harbour porpoise occurring in the area of effect is likely to be low, it has been concluded that there is no potential for adverse effect on site integrity for all other European sites for harbour porpoise within the CIS MU.

6.5 Assessment of Adverse Effects on Integrity – the META project in-combination with other plans or projects

- 6.5.1.1 The other developments (projects/plans) that could result in-combination effects associated with the proposal on Annex II marine mammal features of the designated sites identified have been summarised in Table 6.12.

- 6.5.1.2 A number of impacts considered for the META project alone, as set out in section 6.4, have not been considered in the in-combination assessment. This is because many of the potential impacts identified and assessed for the META project alone are relatively localised and temporary in nature and therefore have limited or no potential to interact with similar changes associated with other projects. On this basis, the potential impacts identified for assessment as part of the marine mammal CIA in chapter 9: Marine Mammals, Basking Shark and Otter of the Environmental Statement, and which have been brought forward for consideration in the in-combination assessment of the RIAA are:

- Increased underwater noise emissions;
- Vessel collision; and
- Increase in SSC.

Table 6.12: List of other projects and plans with potential for in-combination effects on Annex II marine mammal features.

Phase	Developer - Reference	Distance from Warrior Way (site 6) (km)	Distance from Dale Roads (site 7) (km)	Distance from East Pickard Bay (site 8) (km)	Spatial/temporal overlap with the META project	Details	Date of installation/operation	Further Assessment required?	Justification for screening into in-combination assessment
Plans									
Installation/ Operation and Maintenance/ Decommissioning	dWNMP (Welsh Government, 2017)	0.00	0.0	0.0	Spatial overlap and temporal overlap	The WNMP is being prepared by the Welsh Government in accordance with the Marine and Coastal Access Act 2009 (MCAA). The purpose of marine planning under the MCAA is to help achieve sustainable development in the marine area. Welsh Ministers are the Marine Planning Authority under the MCAA, responsible for creating marine plans for both the inshore region (0-12 nautical miles) and offshore region (beyond 12 nautical miles) of Wales. Plans for both regions will be presented in a single document, the WNMP. The dWNMP applies to the Welsh marine area which consists of around 32,000 km2 of sea, as well as 2,120 km of coastline.	The WNMP will be implemented over a 20-year period, with 3 yearly reviews.	Yes – Benthic Subtidal and Intertidal habitats, Coastal and supralittoral habitats, Marine Mammals, Diadromous fish, Pelagic seabirds (breeding and wintering); and Wildfowl and waders (breeding and wintering)	As there is the potential for both temporal and spatial overlap of the META project with the dWNMP, it cannot be excluded from further consideration.
Dredging sites									
Installation/ Operation and Maintenance	Neyland Yacht Haven Ltd. - DML1743	1.1	12.3	10.5	No spatial overlap with consented areas. Potential for temporal overlap.	Dredge and disposal from Neyland Marina - annual volume 5500 m³.	13/12/2017-12/12/2020	Yes	Given the distances to META phase 2 sites and the potential for temporal overlap, these projects can not be excluded from further consideration in the CIA. Vessel operation and therefore potential for collision risk and increased underwater noise, may present potential cumulative impacts with the META project.
Installation/ Operation and Maintenance	Milford Haven Port Authority - DML1646	1.3	1.5	2.5	No spatial overlap with consented areas Temporal overlap with all sites.	Maintenance dredging throughout the Milford Haven. Annual volume 362500 m³.	09/03/2017-08/03/2022	Yes	
Dredge disposal sites									
Installation/ Operation and Maintenance	Neyland dredge disposal site - LU190	0.5	12.4	10.5	No spatial overlap with any of the consented areas. Temporal overlap	Location: South of Neyland within the central channel of the Milford Haven, 0.22 nm diameter x 5 m depth. Status: Open	Not applicable	Yes	Given the distances to META phase 2 sites and the potential for temporal overlap, this projects cannot be excluded from further consideration in the CIA. Vessel operation and therefore potential for collision risk and increased underwater noise, may present potential cumulative impacts with the META project.
Research									
Installation	Greenlink Interconnector Ltd. - RML1827	10.4	6	0	Spatial overlap with East Pickard Bay (site 8).	Ground investigations	07-2018 - no end date given	Yes	Research operations are likely to have vessels present, with equipment for undertaking ground truthing surveys. Vessels may present potential cumulative impacts for collision risk and both

Phase	Developer - Reference	Distance from Warrior Way (site 6) (km)	Distance from Dale Roads (site 7) (km)	Distance from East Pickard Bay (site 8) (km)	Spatial/temporal overlap with the META project	Details	Date of installation/operation	Further Assessment required?	Justification for screening into in-combination assessment
Installation	University College of Swansea - DEML1845	12.7	5.4	0	Temporal overlap with East Pickard Bay (site 8).				vessels and ground investigation equipment may present potential cumulative impacts for increased underwater noise
					Spatial overlap with East Pickard Bay (site 8).	Deposition and subsequent removal of marker buoys with environmental monitoring and mid-water settlement plates.	30/08/2018-29/08/2019	Yes	Vessels and equipment will be required for the placement of marker buoys. It is highly likely to have overlap with impacts. Vessel operation and therefore potential for collision risk and increased underwater noise, may present potential cumulative impacts with the META project
					Temporal overlap with East Pickard Bay (site 8).				
Infrastructure									
Installation/ Operation and Maintenance	Mixed use developments - Local Planning Authority Reference: 14/0158/PA	7.3	5.3	5.6	No spatial overlap with any consented areas.	Demolition of several existing buildings and the mixed-use redevelopment of Milford Waterfront comprising up to 26,266 m2 of commercial, hotel, leisure, retail and fishery related floorspace. Up to 190 residential properties, up to 70 additional marina berths, replacement boat yards, landscaping, public realm enhancements, access and ancillary works. A decision on this application is yet to be made by the local planning authority.	EIA screening decision was returned on the 30/04/2018 - no further information has been provided	Yes	Given the distance from the project and likely impact pathways, there is potential for cumulative impacts to affect marine mammals, basking shark and otter due to increased vessels and therefore increased underwater noise
					Temporal overlap remains unknown due to insufficient information on start and end dates.				
Installation/ Operation and Maintenance/ Decommissioning	Greenlink Interconnector Ltd. - Government reference: qA1296053	10.4	6	0	Spatial overlap with East Pickard Bay (site 8).	The Project is a 500MW subsea electricity interconnector linking the power markets in Ireland and Great Britain and is planned for commissioning in 2023. As an EU Project of Common Interest, it is one of Europe's most important energy infrastructure projects. The interconnector is planned to make Landfall at Fresh Water West beach to the south of the mouth of the Waterway.	07/2018 - ongoing	Yes	Given potential for temporal and spatial overlap with META phase 2 sites this project cannot be excluded from further consideration in the CIA. There is the potential for cumulative effects on marine mammals, basking shark and otter due to increased suspended sediment and/or changes in habitat availability.
					Temporal overlap will occur throughout the duration of the META project				
Installation/ Operation and Maintenance/ Decommissioning	Bombora Wave Energy	11.6	5	0	Spatial overlap with East Pickard Bay (site 8) within META test area.	Bombora on- and off-shore infrastructure and deployment of Bombora mWave device at East Pickard Bay. This is to include device deployment (mWave device), installation of temporary communications cable between mWave device and temporary onshore control station to be located above East Pickard Bay, and installation and operation of temporary control station onshore. Laying of marine cable to shore and through	Q1 2020	Yes	There is the potential for spatial overlap in the META East Pickard Bay test area (site 8) and temporal overlap with all META project sites installation and operation and maintenance phases, therefore this project cannot be excluded from further consideration in the CIA.
					Potential for temporal overlap				

Phase	Developer - Reference	Distance from Warrior Way (site 6) (km)	Distance from Dale Roads (site 7) (km)	Distance from East Pickard Bay (site 8) (km)	Spatial/temporal overlap with the META project	Details	Date of installation/operation	Further Assessment required?	Justification for screening into in-combination assessment
						intertidal area at East Pickard Bay to involve up to 3 days cable laying below MHWS using cable lay vessel and up to four vessels, including guard boat. Cable to be laid on seabed and kept in place in sandy sediment using clamshell wrights. Where the marine cable traverses potential reefy habitat, it will follow natural rock channel. In the intertidal area, the cable will be laid through a natural gully, or up the vertical gully side and attached to the semi-vertical rock face with rock bolts using hand held tools. JCB will pull the cable through the intertidal area from a location above MHWS.			
Ministry of Defence Sites									
Installation/ Operation and Maintenance/ Decommissioning	Ministry of Defence	8.1	5.5	0.0	Temporal overlap	The Castlemartin Range is located immediately south of the entrance to the Waterway and extends for up to 12 NM from the coast between Little Furznip (at the southern extent of Freshwater West) and St Govan's Head (Milford Haven Port Authority 2019). The southern boundary of the East Pickard Bay (Site 8) site is located adjacent to the northern boundary of the Castlemartin Military Practice Area D113A. The range at Castlemartin supports the training of military personnel (Army) in the firing of a range of munitions at land based targets. The seaward danger area provides a safety zone for overfire and shrapnel which may result from the striking of targets (RPS, 2010). The Castlemartin Range is used every day of the week and on some weekends (RPS, 2010).	N/A	Yes	There is a high level of uncertainty as to timing of MOD activities at the MOD site, however on-going activity is likely therefore there is the potential for cumulative impacts with the META project. Vessel operation and therefore potential for collision risk and increased underwater noise, may present potential cumulative impacts with the META project
Aquaculture projects									
Installation/ Operation and Maintenance	Tethys Oysters	8.9	2.6	5.1	Temporal overlap	The oyster farm is located on the eastern side of Angle Bay, whereby oysters are grown in baskets on metal supports. The farm will be serviced from the shore by foot.	Oct 2017 – Oct 2020 (possible renewal of licence)	Yes	There is potential for temporal overlap with the META project and as such will be included for assessment.
Installation/ Operation and Maintenance	Pembrokeshire Scallops	15.3	3.9	1.8	Temporal overlap	The scallop farm is located within Castlebeach Bay, whereby a system of weighted ropes will be deployed for growing scallops and mix species of	Jan 2019 – Q4 2020 (possible renewal of licence)	Yes	There is potential for temporal overlap with Dale Roads (site 7) and as such will be taken forward for assessment.

Phase	Developer - Reference	Distance from Warrior Way (site 6) (km)	Distance from Dale Roads (site 7) (km)	Distance from East Pickard Bay (site 8) (km)	Spatial/temporal overlap with the META project	Details	Date of installation/operation	Further Assessment required?	Justification for screening into in-combination assessment
						native algae. The farm will be serviced by vessels and divers.			
Pembroke Dock Marine Projects									
						Pembroke Dock redevelopment			
						Scoping Report submitted.			
Installation/ Operation and Maintenance	Milford Haven Port Authority - SC1810	2	11.3	8.8	No spatial overlap with consented sites. Potential for temporal overlap.	The intention of the Project is to create a flexible and efficient port-related office, industrial, warehousing and distribution, and ancillary operations infrastructure. This will involve the redevelopment of its existing space to incorporate increased deep-water access, internal and external heavy fabrication areas, construction of MEECE and Education/Skills Facility and the construction of a heavy lift facility.	Q3 2019 – Q3 2023	Yes	Port activity as a result of Pembroke Dock Port operations could cause an increase in vessels and underwater noise emissions, increased potential for suspended sediments, and impacts on shipping and navigation. There is therefore the potential for cumulative impact with activities associated the META Project.
						Marine Energy Test Area - Phase 1			
						Band 2 application submitted.			
Installation/ Operation and Maintenance/Decommissioning	Marine Energy Wales - DEML1875	1.7	11.7	9.4	No spatial overlap with any of the consented areas. Potential for temporal overlap	The Project aims to create pre-consented test areas within the Pembroke Dock area. The test areas will have licensable activities to suit testing of initial stage marine renewable devices. These include testing of non-operating components and subassemblies. No full-scale testing is to be support within the test areas	21/04/2019-21/04/2029	Yes	Vessel use, and some testing activities could result in an increase in vessels and underwater noise. There is therefore the potential for cumulative impact with activities associated the META Project.
						Pembrokeshire Demonstration zone			
						Scoping Report submitted			
Installation/ Operation and Maintenance/Decommissioning	Wave Hub Ltd. - SC1082	24.5	22.8	17.9	No spatial overlap with any consented areas. Potential for temporal overlap as the projects are linked.	The Project entails the development of 90 km2 of seabed with water depths of approximately 50 metres and a wave resource of approximately 19 kW/m; to support the demonstration of wave arrays with a generating capacity of up to 30MW for each project. Consent for this Project could be achieved in 2022, infrastructure could be built by 2024 and the first technology could be installed in 2025.	Jul-18	Yes	There is the potential for temporal overlap with this project therefore this project cannot be excluded from further consideration in the CIA.

In-combination increases in underwater noise

- 6.5.1.3 There is the potential for increases in underwater noise associated with the META project in-combination with activities associated with the following projects/activities: META Phase 1, Bombora Wave Energy offshore works, the Pembroke Dock redevelopment project, the mixed use development of the Milford Haven Waterfront, dredging and disposal activities in the Waterway, the Greenlink Interconnector project (and associated surveys), research undertaken by Swansea University and the dWNMP.
- 6.5.1.4 There is the potential for marine mammals to be affected by underwater noise emissions associated with the META project in-combination with the following projects/activities: dredging, Greenlink Interconnector, Bombora Wave Energy and Pembroke Dock Infrastructure. Research activities are not considered likely to result in potential for cumulative noise impacts. META phase 1 is not considered likely to result in increased underwater noise and pile replacement at Neyland Marina is scheduled to have completed by the time the META project is installed therefore there is no potential for cumulative impact. In relation to East Pickard Bay (site 8), MOD activities are on-going and considered to constitute part of the baseline and Pembrokeshire Demonstration Zone is considered to be of sufficient distance from the META project not to have the potential for cumulative impact.
- 6.5.1.5 Installation of the Greenlink Interconnector and Bombora Wave Energy temporary communications cable may result in very short-duration increases in underwater noise in proximity to East Pickard Bay (site 8) and Pembroke Dock Infrastructure may result in short-term increases in underwater noise in proximity to Warrior Way (site 6).
- 6.5.1.6 The impact ranges from installation vessels for other projects are likely to be of a similar scale as predicted for the META project and therefore the scope for cumulative impact is minimal since each project will have minimal potential to cause injury or disturbance and uplift in noise emissions is therefore expected to be low.
- 6.5.1.7 The HRA Appropriate Assessment for screened in policies within the dWMNP (Welsh Government, 2017) concludes no adverse effect on site integrity of any European site due to the plans included within the dWNMP.
- 6.5.1.8 The potential cumulative impact of a small number of projects resulting in small potential injury or disturbance zones due to increased underwater noise might make a slightly larger proportion of suitable habitat unavailable for marine mammals. However, the local/regional density estimates for harbour porpoise and grey seals are very low. The geographic ranges of these species are large and as a result it is unlikely that cumulative impacts of temporary increased disturbance due to increased underwater noise will result in detectable changes in spatial or temporal disturbance to marine mammal species.

- 6.5.1.9 Though a number of projects are predicted to overlap either with the installation, operation and maintenance, or decommissioning phases of the META project as outlined above, the impact to marine mammals is predicted to be of local spatial extent, long-term duration over the lifetime of the project, but intermittent (short-duration) and reversible.

Conclusions

Grey seal: Pembrokeshire Marine SAC, Cardigan Bay SAC and the Lleyn Peninsular and the Sarnau SAC

- 6.5.1.10 Significant adverse effects on the qualifying grey seal features of the Pembrokeshire Marine SAC, Cardigan Bay SAC and the Lleyn Peninsular and the Sarnau SAC are not predicted to occur as a result of in-combination effects associated with underwater noise. Potential effects from this activity on the Conservation Objectives of these sites are discussed in turn below.

The population is maintaining itself on a long-term basis as a viable component of its natural habitat

- 6.5.1.11 It is not considered likely that any grey seal will be injured as a result of increased underwater noise. Although low levels of short-term disturbance to individuals, potentially resulting in avoidance behaviour of grey seal may occur, these should be considered in the context of the existing high levels of vessel traffic and anthropogenic activities occurring within the Waterway, and the likely habituation of animals foraging in these waters. This is not predicted to restrict the objective of the population being able to maintain itself as a viable component of its natural habitat over the long-term.

The species population within the site is such that the natural range of the population is not being reduced or likely to be reduced for the foreseeable future

- 6.5.1.12 Low levels of short term and intermittent disturbance to individuals, potentially resulting in avoidance behaviour of grey seal may occur, although these should be considered in the context of the existing high levels of vessel traffic and anthropogenic activities occurring within the Waterway and the likely habituation of animals foraging in these waters. Upon cessation of underwater noise generation from vessel movements and pile drilling etc., any grey seals affected are considered likely to return to the affected area relatively quickly. Therefore, disturbance to the species is not considered significant and will not reduce the range of this species in the long-term. Therefore, this Conservation Objective will be maintained.

The presence, abundance, condition and diversity of habitats and species required to support this species is such that the distribution, abundance and populations dynamics of the species within the site and population beyond the site is stable or increasing

6.5.1.13 Some short-term disturbance is predicted to potential prey fish species as a result of in-combination increases in underwater noise, although effects are not considered to be significant, therefore ensuring that the META project in-combination with other plans or projects will not affect prey species populations from being maintained in the long term.

6.5.1.14 Therefore, no adverse effect on the integrity of the Pembrokeshire Marine SAC, Cardigan Bay SAC and the Llyn Peninsular and the Sarnau SAC from this potential impact can be concluded.

Grey seal: Lundy SAC

6.5.1.15 Significant adverse effects on the qualifying grey seal feature of the Lundy SAC are not predicted to occur as a result of in-combination effects associated with underwater noise. Potential effects from this activity on the relevant Conservation Objectives (as presented in paragraph 6.2.1.8) are discussed in turn below.

The extent and distribution of qualifying natural habitats and habitats of qualifying species are maintained

6.5.1.16 Underwater noise will not impact extent and distribution of foraging or breeding habitats of the grey seal feature of this SAC and therefore this Conservation Objective will be maintained.

The structure and function of the habitats of qualifying species are maintained

6.5.1.17 Underwater noise will not impact structure and function of foraging or breeding habitats of the grey seal feature of this SAC and therefore this Conservation Objective will be maintained.

The supporting processes on which qualifying natural habitats and the habitats of qualifying species rely

6.5.1.18 Underwater noise will not impact supporting processes of foraging or breeding habitats of the grey seal feature of this SAC and therefore this Conservation Objective will be maintained.

The populations of qualifying species are maintained

6.5.1.19 Although the Waterway and the META sites are within the foraging range of grey seal features of the Lundy SAC, numbers of individuals from this site occurring in the area are likely to be low. It is not considered likely that any grey seal will be injured as a result of underwater noise generated from activities at in-combination projects. Although low levels of short-term disturbance to individuals, potentially resulting in avoidance behaviour, of grey seal may occur, these should be considered in the context of the existing high levels of vessel traffic and anthropogenic activities occurring within the Waterway and the likely habituation of animals foraging in these waters. This is not predicted to restrict the objective of the population being able to maintain itself as a viable component of its natural habitat over the long-term.

The distribution of qualifying species within the site is maintained

6.5.1.20 Low levels of short term and intermittent disturbance to individuals, potentially resulting in avoidance behaviour of grey seal may occur, although these should be considered in the context of the existing high levels of vessel traffic and anthropogenic activities occurring within the Waterway and the likely habituation of animals foraging in these waters. Upon cessation of underwater noise generation, any grey seals affected will return to the affected area relatively quickly. Therefore, disturbance to the species is not considered significant and will not affect the distribution of this species in the long-term. Therefore, this Conservation Objective will be maintained.

6.5.1.21 Therefore, no adverse effect on the integrity of the Lundy SAC from this potential impact can be concluded.

Harbour porpoise: West Wales Marine SAC; Bristol Channel Approaches SAC and North Anglesey Marine SAC

6.5.1.22 Significant adverse effects on the qualifying harbour porpoise features of the West Wales Marine SAC, Bristol Channel Approaches SAC and the North Anglesey Marine SAC are not predicted to occur as a result of in-combination effects associated with underwater noise. Potential effects from this activity on the Conservation Objectives of these sites are discussed in turn below.

The species is a viable component of the site

6.5.1.23 On the basis of the levels of underwater noise which will be generated, it is not considered likely that any harbour porpoise will be injured as a result of underwater noise. Although low levels of short-term disturbance to individuals, potentially resulting in avoidance behaviour, may occur as a result of in-combination activity, numbers of harbour porpoise occurring in the area of effect is likely to be low. Furthermore, the levels of noise generated should be considered in the context of the existing high levels of vessel traffic and anthropogenic activities occurring within the Waterway and the likely habituation of animals foraging in these waters. Underwater noise is therefore not predicted to restrict the objective of the population being able to maintain itself as a viable component of its natural habitat over the long-term.

There is no significant disturbance of the species

6.5.1.24 There may be some low-level disturbance to harbour porpoise within the zone of impact, resulting in potential avoidance behaviour. However, upon cessation of the noise-generating activities, harbour porpoise affected would be expected to return to any areas affected relatively quickly. Given the short time during which installation activities will take place, significant or prolonged disturbance to harbour porpoise is not predicted and underwater noise generated during installation will not prevent this objective from being achieved.

The supporting habitats and processes relevant to harbour porpoises and their prey are maintained

6.5.1.25 Habitats and processes will not be affected by underwater noise. With respect to prey species, although some short-term disturbance is predicted to potential prey fish species effects are not considered to significant ensuring that the project will not affect prey species populations being maintained in the long term.

6.5.1.26 Therefore, no adverse effect on the integrity of the West Wales Marine SAC; Bristol Channel Approaches SAC and North Anglesey Marine SAC from this potential impact can be concluded.

Harbour porpoise: All other European sites within the harbour porpoise CIS MU

6.5.1.27 On the basis that no adverse effect on the integrity of the West Wales Marine SAC, Bristol Channel Approaches SAC and North Anglesey Marine SAC from this potential in-combination impact have been concluded (see paragraph 6.5.1.26), and that numbers of harbour porpoise occurring in the area of effect is likely to be low, it has been concluded that there is no potential for adverse effect on site integrity for all other European sites for harbour porpoise within the CIS MU.

In-combination increased vessel collision risk

6.5.1.28 Installation and maintenance vessels for all projects assessed in Table 6.12 will be slow moving, and the number of vessels involved will be low, particularly in comparison with the existing levels of traffic within the Waterway.

6.5.1.29 Animals are likely to show some degree of habituation to already high levels of existing traffic therefore a small cumulative increase in vessels is considered unlikely to result in an increased number of collisions. In addition, local/regional density estimates for all marine mammal and basking shark species are low and therefore the impact on marine mammals and basking shark is predicted to be of local spatial extent, long-term duration but intermittent (short-duration of vessel movements) and reversible.

Conclusions

Grey seal: Pembrokeshire Marine SAC, Cardigan Bay SAC and Llyn Peninsular and the Sarnau SAC

6.5.1.30 Significant adverse effects on the qualifying grey seal features of the Pembrokeshire Marine SAC, Cardigan Bay SAC and Llyn Peninsular and the Sarnau SAC are not predicted to occur as a result of in-combination effects associated with increased collision risk with vessels. Potential effects from this activity on the relevant Conservation Objectives of these sites are discussed in turn below.

The population is maintaining itself on a long-term basis as a viable component of its natural habitat

6.5.1.31 The potential for collision risk with vessels is considered to be low on the basis that vessels associated with each of the in-combination projects will be operating and manoeuvring at low speeds and that any grey seal individuals occurring within the Waterway are considered likely to be habituated to the existing high levels of vessel activity. All in-combination projects are within the Pembrokeshire Marine SAC and within the foraging range of grey seal features of the Cardigan Bay SAC and Llyn Peninsular and the Sarnau SAC, however, numbers of individuals from these sites occurring in the area are likely to be low. As such, collisions resulting in grey seal fatalities and therefore effects on the population size or structure of these SACs are considered unlikely. This impact will not restrict the objective of the population being able to maintain itself as a viable component of its natural habitat over the long-term.

The species population within the site is such that the natural range of the population is not being reduced or likely to be reduced for the foreseeable future

6.5.1.32 As vessel activity associated with each of the in-combination projects will be intermittent and localised to the Waterway the individual project sites, any avoidance behaviour exhibited by grey seals will only be temporary and will not constrain the range of this species within the site or affect the access of grey seals to areas of prey. Therefore, this Conservation Objective will be maintained.

The presence, abundance, condition and diversity of habitats and species required to support this species is such that the distribution, abundance and populations dynamics of the species within the site and population beyond the site is stable or increasing

6.5.1.33 Prey species are unlikely to be significantly affected by collision risk with vessels associated with in-combination projects and as such, this Conservation Objective will be maintained.

6.5.1.34 Therefore, no adverse effect on the integrity of the Pembrokeshire Marine SAC, Cardigan Bay SAC or Llyn Peninsula and the Sarnau SAC from this potential impact can be concluded.

Grey seal: Lundy SAC

6.5.1.35 Significant adverse effects on the qualifying grey seal feature of the Lundy SAC are not predicted to occur as a result of in-combination effects associated with increased collision risk with vessels. Potential effects from this activity on the relevant Conservation Objectives (as presented in paragraph 6.2.1.8) are discussed in turn below.

The extent and distribution of qualifying natural habitats and habitats of qualifying species are maintained

6.5.1.36 Collision risk will not impact the extent and distribution of foraging or breeding habitats of the grey seal feature of this SAC and therefore this Conservation Objective will be maintained.

The structure and function of the habitats of qualifying species are maintains

6.5.1.37 Collision risk will not impact the structure and function of foraging or breeding habitats of the grey seal feature of this SAC and therefore this Conservation Objective will be maintained.

The supporting processes on which qualifying natural habitats and the habitats of qualifying species rely

- 6.5.1.38 Collision risk will not impact the supporting processes of foraging or breeding habitats of the grey seal feature of this SAC and therefore this Conservation Objective will be maintained.

The populations of qualifying species are maintained

- 6.5.1.39 Although the in-combination projects are within the foraging range of grey seal features of the Lundy SAC, numbers of individuals from this site occurring in the Waterway are likely to be low. Furthermore, individuals routinely foraging in the Waterway and vicinity of the in-combination projects can be expected to be habituated to the existing high levels of vessel traffic and the uplift resulting from operation and maintenance activities is considered to be low. As such, collisions resulting in grey seal fatalities, and therefore effects on the size or structure of the grey seal population of the site, are considered unlikely. This impact will therefore not restrict the objective of the population being maintained.

The distribution of qualifying species within the site is maintained

- 6.5.1.40 As vessel activity will be intermittent and localised to the Waterway and META sites, any avoidance behaviour exhibited by grey seals during foraging activities will only be temporary and will not significantly affect the distribution of grey seals within the site. Therefore, this Conservation Objective will be maintained.
- 6.5.1.41 Therefore, no adverse effect on the integrity of the Lundy SAC from this potential impact can be concluded.

Harbour porpoise: West Wales Marine SAC, Bristol Channel Approaches SAC and North Anglesey Marine SAC

- 6.5.1.42 Significant adverse effects on the qualifying harbour porpoise features of the West Wales Marine SAC, Bristol Channel Approaches SAC and North Anglesey Marine SAC are not predicted to occur as a result of in-combination effects associated with increased collision risk with vessels. Potential effects from this activity on the relevant Conservation Objectives of these sites are discussed in turn below.

The species is a viable component of the site

- 6.5.1.43 On the basis that numbers of harbour porpoise in the vicinity of the META sites and the wider Waterway are low, the in-combination uplift in vessel numbers is small on the existing baseline of high vessel traffic in the area, and vessels will be operating at low speeds, the risk of collision with vessels resulting in fatality, injury or significant disturbance is low and this not predicted to affect the ability of harbour porpoise to survive and live successfully within the site.

There is no significant disturbance of the species

- 6.5.1.44 Vessel activity will be intermittent and localised to the Waterway and META sites. Any significant collision risk is not anticipated, and any avoidance behaviour exhibited by grey seals during foraging activities will only be temporary and will not constrain the range of this species or affect the access of grey seals to areas of prey. Therefore, this Conservation Objective will be maintained

The supporting habitats and processes relevant to harbour porpoises and their prey are maintained

- 6.5.1.45 Prey species are unlikely to be significantly affected by collision risk with vessels and as such, this Conservation Objective will be maintained.
- 6.5.1.46 Therefore, no adverse effect on the integrity of the West Wales Marine SAC, Bristol Channel Approaches SAC or North Anglesey Marine SAC from this potential impact can be concluded.

Harbour porpoise: All other European sites within the harbour porpoise CIS MU

- 6.5.1.47 On the basis that no adverse effect on the integrity of the West Wales Marine SAC, Bristol Channel Approaches SAC and North Anglesey Marine SAC from this potential in-combination impact have been concluded (see paragraph 6.5.1.46), and that numbers of harbour porpoise occurring in the area of effect is likely to be low, it has been concluded that there is no potential for adverse effect on site integrity for all other European sites for harbour porpoise within the CIS MU.

In-combination increases in SSC

- 6.5.1.48 Dredging activities and dredge disposal may result in temporary increases in suspended sediment within the Waterway. Activities are very short duration (days) and are considered to have negligible potential to result in increase in suspended sediment. Mixed use development of the Milford Haven Waterfront, development of the Pembroke Dock Infrastructure project, and activities associated with Phase 1 of the META project may result in temporary increases in suspended sediment in close proximity to Warrior way (site 6) but are unlikely to result in increased suspended sediment at Dale Roads (site 7) or East Pickard bay (site 8). Cabling works associated with the Greenlink interconnector and the proposed Bombora Wave Energy project may lead to temporary increases of suspended sediment at East Pickard bay (site 8), but these will be of short-duration (days).
- 6.5.1.49 Though a number of projects which could lead to increases in SSC are predicted to overlap with the installation, operation and maintenance, or decommissioning phases of the META project, potential increases in suspended sediment are not predicted to be extensive or long-term due to the high energy environment and meso-tidal environments present within the Waterway and associated waters. It is considered that increases in suspended sediment could occur in the medium-term. The in-combination impact is therefore predicted to be of local spatial extent, short-term duration, to be intermittent and reversible.

Conclusions

Grey seal: Pembrokeshire Marine SAC

- 6.5.1.50 Significant adverse effects on the qualifying grey seal features of the Pembrokeshire Marine SAC are not predicted to occur as a result of in-combination effects associated with increased SSCs. Potential effects from this activity on the Conservation Objectives of this site are discussed in turn below.

The population is maintaining itself on a long-term basis as a viable component of its natural habitat

- 6.5.1.51 The small increases in SSCs associated with in-combination projects are predicted to be short term and highly localised such that significant effects on the foraging ability or success of grey seal in the Waterway are not predicted. Therefore, increased SSCs will not restrict the ability of the grey seal populations of the Pembrokeshire Marine SAC to be maintained in the long-term.

The species population within the site is such that the natural range of the population is not being reduced or likely to be reduced for the foreseeable future

- 6.5.1.52 Increased SSCs are not predicted to affect the range of grey seal i.e. this impact will not result in the exclusion of grey seals from the Waterway. Therefore, this Conservation Objective will be maintained for the Pembrokeshire Marine SAC.

The presence, abundance, condition and diversity of habitats and species required to support this species is such that the distribution, abundance and populations dynamics of the species within the site and population beyond the site is stable or increasing

- 6.5.1.53 Given the temporary, intermittent and reversible nature of any increases in SSC, fish prey species are highly unlikely to be significantly affected and the majority of grey seal foraging areas within the Waterway will be unaffected. Therefore, increased SSC will not prevent this objective from being achieved.

- 6.5.1.54 Therefore, no adverse effect on the integrity of the Pembrokeshire Marine SAC from this potential impact can be concluded.

Harbour porpoise: West Wales Marine SAC, Bristol Channel Approaches SAC and North Anglesey Marine SAC

- 6.5.1.55 Significant adverse effects on the qualifying harbour porpoise features of the West Wales Marine SAC, Bristol Channel Approaches SAC and the North Anglesey Marine SAC are not predicted to occur as a result of in-combination effects associated with increased SSCs during installation activities. Potential effects from this activity on the Conservation Objectives of these sites are discussed in turn below.

The species is a viable component of the site

- 6.5.1.56 The small increases in SSCs associated with in-combination projects are predicted to be short term and highly localised such that significant effects on the foraging ability or success of harbour porpoise in the Waterway are not predicted. Therefore, increased SSCs will not restrict the ability of the harbour porpoise populations of the West Wales Marine SAC, Bristol Channel Approaches SAC and the North Anglesey Marine SAC to be maintained in the long-term.

There is no significant disturbance of the species

- 6.5.1.57 The levels of SSCs predicted to be generated, when considered in the context of the background levels of turbidity in the area, are not predicted to result in any significant disturbance to harbour porpoise or prevent this objective from being achieved.

The supporting habitats and processes relevant to harbour porpoises and their prey are maintained

- 6.5.1.58 Given the temporary, intermittent and reversible nature of any increases in SSC, fish prey species are highly unlikely to be significantly affected and the majority of harbour porpoise foraging areas within the Waterway will be unaffected. Therefore, increased SSC will not prevent this objective from being achieved.

- 6.5.1.59 Therefore, no adverse effect on the integrity of the West Wales Marine SAC, Bristol Channel Approaches SAC or North Anglesey Marine SAC from this potential impact can be concluded.

Harbour porpoise: All other European sites within the harbour porpoise CIS MU

- 6.5.1.60 On the basis that no adverse effect on the integrity of the West Wales Marine SAC, Bristol Channel Approaches SAC and North Anglesey Marine SAC from this potential in-combination impact have been concluded (see paragraph 6.5.1.59), and that numbers of harbour porpoise occurring in the area of effect is likely to be low, it has been concluded that there is no potential for adverse effect on site integrity for all other European sites for harbour porpoise within the CIS MU.

7. ASSESSMENT OF ADVERSE EFFECTS ON INTEGRITY: ANNEX II SPECIES – OTTERS

7.1.1.1 The screening exercise (Stage 1 of the HRA process), together with consultation feedback from NRW, identified potential for LSEs on the qualifying otter features of the Pembrokeshire Marine/Sir Benfro Forol SAC and the Cleddau Rivers/ Afonydd Cleddau SAC, as detailed in Table 2.8.

7.2 Conservation Objectives

7.2.1.1 The Conservation Objectives of the sites screened in for Stage 2 assessment (Table 2.8) are provided below.

Pembrokeshire Marine SAC

7.2.1.2 The Conservation Objectives for the otter feature of the Pembrokeshire Marine SAC are detailed in the Regulation 37 advice for the site (NRW, 2018a; see Appendix 3). In order to achieve FCS all of the following, subject to natural processes, need to be fulfilled and maintained in the long-term. If these objectives are not met restoration measures will be needed to achieve FCS:

- The population is maintaining itself on a long-term basis as a viable component of its natural habitat;
- The species population within the site is such that the natural range of the population is not being reduced or likely to be reduced for the foreseeable future; and
- The presence, abundance, condition and diversity of habitats and species required to support this species is such that the distribution, abundance and populations dynamics of the species within the site and population beyond the site is stable or increasing.

Cleddau Rivers SAC

7.2.1.3 The Core Management Plan (including Conservation Objectives) for the Cleddau Rivers SAC (NRW, 2017; see Appendix 5) lists Conservation Objectives for each designated species (i.e. sea lamprey and river lamprey). The Conservation Objective includes a vision and a series of performance indicators. The vision for these features is as follows:

- The population of otters in the SAC is stable or increasing over the long term and reflects the natural carrying capacity of the habitat within the SAC;
- The SAC will have sufficient habitat, including riparian trees and vegetation and wetlands, to support the otter population in the long term;
- The natural range of otters in the SAC is neither being reduced nor is likely to be reduced for the foreseeable future;
- The otter must be able to breed and recruit successfully in the SAC. The size of breeding territories may vary depending on prey abundance;
- Otter food sources must be sufficient for maintenance of the population;

- The safe movement and dispersal of individuals around the SAC is facilitated by the provision, where necessary, of suitable riparian habitat, and underpasses, ledges, fencing etc at road bridges and other artificial barriers; and
- No otter breeding site should be subject to a level of disturbance that could have an adverse effect on breeding success. Where necessary, potentially harmful levels of disturbance must be managed.

7.3 Baseline information

7.3.1.1 Baseline information on the Annex II otter features of the European Sites identified for further assessment within the HRA process has been gathered through a comprehensive desktop study of existing studies and datasets. The key data sources are presented within chapter 9: Marine Mammals, Basking Shark and Otter of the Environmental Statement.

7.3.1.2 The otter is one of only a few European carnivores that has evolved the ability to actively forage both in water and on land (Oliveira *et al.*, 2008) and is highly capable of hunting in both freshwater (Carss *et al.*, 1990; Copp and Roche, 2003) and marine environments (Kruuk and Moorhouse, 1991; Heggberget, 1993; Parry *et al.*, 2010)). The European otter is largely solitary and adult otters tend not to associate with other adults except for reproduction. Sexual maturity is attained at around 18 months in males and 24 months in females. They are non-seasonally polyoestrous, and gestation period is approximately 63-65 days, the litter size varies from one to five, and the life expectancy is around 17 years. Fish is the major prey of otters, sometimes exceeding more than 80% of their diet, which also consists of aquatic insects, reptiles, amphibians, birds, small mammals, and crustaceans (Roos *et al.*, 2015).

7.3.1.3 Otter are found across the UK and following a rapid decline in the 1950s (Mason and McDonald, 2004) has shown recovery in the last two decades across most of its western European distribution (Van Looy *et al.*, 2014).

7.3.1.4 Coastal otter populations are not well defined in Wales and the prevalence of otter marine activity within this species' European range is currently also poorly defined. However, the coastline of South Wales provides a wealth of opportunities for otters, with large sections of remote or inaccessible coastline that provide potential foraging, resting and breeding sites (Parry *et al.*, 2010).

7.3.1.5 It is known that otters are widely distributed in Pembrokeshire (Jones and Jones, 2004) and records indicate that otters utilise coastal areas for foraging and breeding at some locations (Liles, 2003). Accordingly, Pembrokeshire may represent one of the most important areas for otters in Wales; the Milford Haven Waterway SSSI supports nationally important numbers of otter (NRW – Marine character Areas MCA 21 Milford Haven). In 2004 the population estimate for otter in Wales was given as 762 (JNCC, 2007).

7.3.1.6 Sightings data provided by the WWBIC (WWBIC, 2019) show that otter have been sighted throughout the local marine mammal, basking shark and otter study area, up into the Cleddau rivers, with sightings predominantly occurring within a few metres of the MLWS (WWBIC, 2019) (see Figure 7-1).

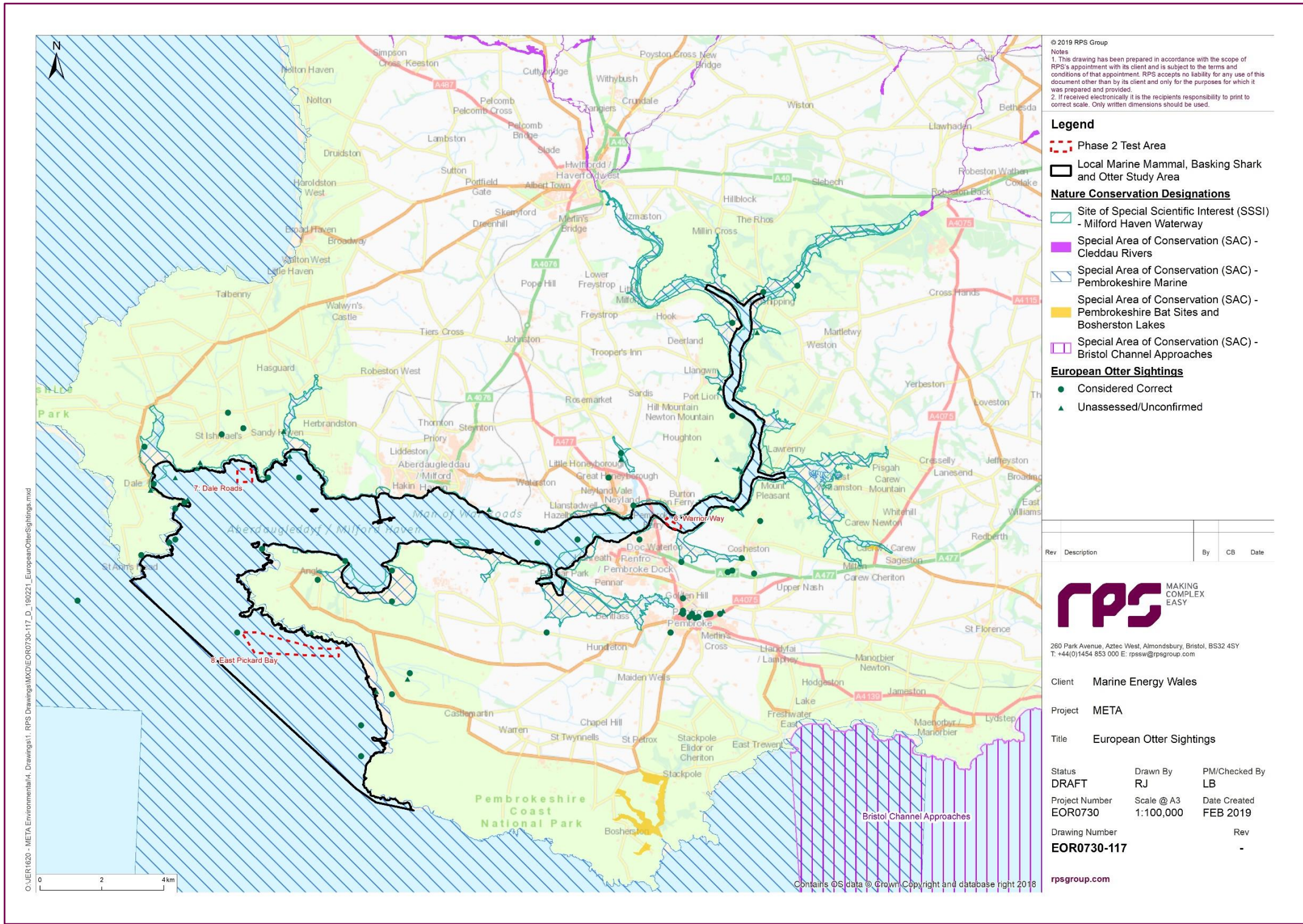


Figure 7-1: European otter sightings from small-vessel surveys (2005-2015) and incidental sightings (1979 – 2018) (WWBIC, 2019).

7.4 Assessment of Adverse Effects on Integrity – the META project alone

7.4.1 Potential impacts – installation/decommissioning

Accidental pollution

- 7.4.1.1 As discussed previously in paragraph 6.4.1.55, there is the potential for the accidental release of pollutants into the marine environment during operation and maintenance activities, as a result of accidental spillage or leakage for example. Pollution may include diesel oil from vessels and synthetic chemicals. The maximum and most likely design scenarios for impacts associated with accidental pollution events during installation/decommissioning activities, as presented in the chapter 9: Marine Mammals, Basking Shark and Otter of the Environmental Statement, are as summarised previously for marine mammals in Table 6.5.

Embedded mitigation

- 7.4.1.2 As outlined in Table 9.13 of chapter 9: Marine Mammals, Basking Shark and Otter of the Environmental Statement, measures adopted as part of the project include the production of an EMP which will include planning for accidental spills, address all potential contaminant releases and include key emergency contact detail. This will ensure that the potential for release of pollutants from installation and decommissioning activities is minimised. In this manner, accidental release of potential release of contaminants from vessels will be strictly controlled, thus providing protection for marine life across all phases of the project.

Otter

- 7.4.1.3 Otter are highly mobile species and are likely to be able to detect pollutants and as a result are expected to avoid areas where there has been an accidental release of pollutants. In the unlikely event that pollutants were to enter the Waterway, they would be rapidly dispersed on the surface and in the water column and subject to twice daily tidal flushing, and so any effects on water quality would be limited.

Conclusions

Pembrokeshire Marine SAC

- 7.4.1.4 Significant adverse effects on the qualifying otter feature of the Pembrokeshire Marine SAC are not predicted to occur as a result of an accidental pollution event during installation/decommissioning activities. Potential effects from this activity on the Conservation Objectives of these sites (as presented in paragraph 7.2.1.2) are discussed in turn below.

The population is maintaining itself on a long-term basis as a viable component of its natural habitat

- 7.4.1.5 The likelihood of any significant pollution event from the META project occurring is low enough to ensure that the ability of the otter population of this site to be maintained in the long-term will not be affected.

- 7.4.1.6 *The species population within the site is such that the natural range of the population is not being reduced or likely to be reduced for the foreseeable future*

- 7.4.1.7 Otter are highly mobile species and are likely to be able to detect and avoid areas where pollution has occurred, therefore, there may be some localised alteration to the natural range of this species. However, this would be temporary and reversible and, furthermore, the mitigation measures embedded in the project will ensure that the likelihood of such an event occurring is very low. Therefore, an accidental pollution event will not prevent this objective from being achieved.

The presence, abundance, condition and diversity of habitats and species required to support this species is such that the distribution, abundance and populations dynamics of the species within the site and population beyond the site is stable or increasing

- 7.4.1.8 Given the mitigation measures to be implemented for the META project, the likelihood of a spill occurring and resulting in significant adverse effects on otter prey species (or habitats of prey species) is extremely low and therefore this Conservation Objective will be maintained.

- 7.4.1.9 Therefore, no adverse effect on the integrity of the Pembrokeshire Marine SAC from this potential impact can be concluded.

Cleddau Rivers SAC

- 7.4.1.10 Significant adverse effects on the qualifying otter feature of the Cleddau Rivers SAC are not predicted to occur as a result of an accidental pollution event during installation/decommissioning. Potential effects from this activity on the relevant Conservation Objectives (as presented in paragraph 7.2.1.3) are discussed in turn below.

The population of otters in the SAC is stable or increasing over the long term and reflects the natural carrying capacity of the habitat within the SAC.

- 7.4.1.11 The likelihood of any significant pollution event from the META project occurring is low enough to ensure that the ability of the otter population of this site to be maintained will not be affected.

The SAC will have sufficient habitat, including riparian trees and vegetation and wetlands, to support the otter population in the long term.

- 7.4.1.12 An accidental pollution event will not impact these habitat features and therefore this Conservation Objective will be maintained.

The natural range of otters in the SAC is neither being reduced nor is likely to be reduced for the foreseeable future.

- 7.4.1.13 Otter are highly mobile species and are likely to be able to detect and avoid areas where pollution has occurred, therefore, there may be some localised alteration to the natural range of this species. However, this would be temporary and reversible and, furthermore, the mitigation measures embedded in the project will ensure that the likelihood of such an event occurring is very low. Therefore, an accidental pollution event will not prevent this objective from being achieved.

The otter must be able to breed and recruit successfully in the SAC.

- 7.4.1.14 The likelihood of any significant pollution event from the META project occurring is low enough to ensure that impacts to the breeding/recruitment success of this species are highly unlikely.

Otter food sources must be sufficient for maintenance of the population.

- 7.4.1.15 Given the mitigation measures to be implemented for the META project, the likelihood of a spill occurring and resulting in significant adverse effects on otter prey species (or habitats of prey species) is extremely low and therefore this Conservation Objective will be maintained.

The safe movement and dispersal of individuals around the SAC is facilitated by the provision, where necessary, of suitable riparian habitat, and underpasses, ledges, fencing etc at road bridges and other artificial barriers.

- 7.4.1.16 Any accidental pollution would not have any impact on any measures in place to facilitate the movement of otters around the SAC. Therefore, this Conservation Objective will be maintained.

No otter breeding site should be subject to a level of disturbance that could have an adverse effect on breeding success. Where necessary, potentially harmful levels of disturbance must be managed.

- 7.4.1.17 Given the mitigation measures to be implemented for the META project, the likelihood of a spill occurring is very low. Furthermore, otter is a mobile species and would be able to avoid any areas where there has been a release of pollutants. Any effects on otter would not be expected to have any implications for breeding success.

- 7.4.1.18 Therefore, no adverse effect on the integrity of the Cleddau Rivers SAC from this potential impact can be concluded.

7.4.2 Potential impacts – operation and maintenance

Increased underwater noise due to operation and maintenance vessel activity

- 7.4.2.1 Underwater noise may be generated during the operation and maintenance phase as a result of vessels employed in operation and maintenance activities at all three META sites. The maximum and most likely design scenarios for impacts associated with increased vessel movements, as presented in chapter 9: Marine Mammals, Basking Shark and Otter of the Environmental Statement, are as summarised previously in Table 6.8.

- 7.4.2.2 Whilst vessel movements during the operational and maintenance phase increases by almost double that of the installation phase, these numbers remain small in comparison to the existing levels of traffic in the Waterway.

Otter

- 7.4.2.3 Otters produce a range of vocalisations in different social contexts, however vocalisations have never been observed beneath the water's surface (Ghoul and Reichmuth, 2012), thus communication masking is unlikely to occur. Studies on sea otters show an audible range of 0.125 kHz and 32 kHz, which are relatively comparable to terrestrial mustelids (Ghoul and Reichmuth, 2012). Peak underwater hearing sensitivity lies in the range 7 kHz to 16 kHz while overall sensitivity levels are somewhat reduced compared with pinniped species. The pinniped behavioural response thresholds outlined in chapter 6: Underwater Noise and Table 6.2 were used as a proxy for otter behavioural response thresholds, though this is assumed to be an over-precautionary assessment of the likely impact of underwater noise on otters. As outlined in Table 6.3, the assessment predicts that underwater noise levels sufficient to result in injury will only occur in the immediate vicinity of vessel activities (i.e. up to 8 m during the use of DP vessels). Furthermore, an otter would need to stay within 8 m of a vessel for a period of 24 hours to experience any injury which is considered to be an unrealistically conservative scenario and therefore it is considered unlikely that otter will be injured as a result of noise arising from installation activities. With respect to disturbance, the maximum predicted range of disturbance at Warrior Way (site 6) would be up to approximately 2 km and for Dale Roads (site 7) and East Pickard Bay (site 8), where DP vessels may be used, disturbance to otter could be up to 12 km although, as discussed above, this assessment is based on thresholds for pinnipeds and so is considered to be over-precautionary.

- 7.4.2.4 Otters within range of increased vessel noise are likely to leave the water (Ghoul and Reichmuth, 2012). However, since the hearing acuity of otters is significantly less than for many marine mammal species, it is unlikely that disturbance ranges for otter will extend as far underwater as predicted for other marine mammals.

Conclusions

Pembrokeshire Marine SAC

- 7.4.2.5 Significant adverse effects on the qualifying otter feature of the Pembrokeshire Marine SAC are not predicted to occur as a result of increased underwater noise due to operation and maintenance vessel activity. Potential effects from this activity on the Conservation Objectives of these sites (as presented in paragraph 7.2.1.2) are discussed in turn below.

The population is maintaining itself on a long-term basis as a viable component of its natural habitat

7.4.2.6 It is considered highly unlikely that any otter will be injured as a result of underwater noise generated by operation and maintenance vessels, particularly since otters are likely to leave the water. Although low levels of short-term disturbance may occur, if it occurs at all this is likely to be highly localised to the immediate vicinity of the vessels, which it can be assumed the otters will avoid. This should also be considered in the context of the existing high levels of vessel traffic and anthropogenic activities occurring within the Waterway and the likely habituation of animals foraging in these waters. Noise generated by operation and maintenance vessels is not predicted to restrict the objective of the population being able to maintain itself as a viable component of its natural habitat over the long-term.

The species population within the site is such that the natural range of the population is not being reduced or likely to be reduced for the foreseeable future

7.4.2.7 Although underwater noise may result in some avoidance behaviour of otter, this should be considered in the context of the existing high levels of vessel traffic and anthropogenic activities occurring within the Waterway and the likely habituation of animals foraging in these waters. Therefore, any disturbance to otter is not considered significant and will not reduce the range of this species in the long-term. Therefore, this Conservation Objective will be maintained.

The presence, abundance, condition and diversity of habitats and species required to support this species is such that the distribution, abundance and populations dynamics of the species within the site and population beyond the site is stable or increasing

7.4.2.8 Some short-term disturbance is predicted to potential prey fish species, although effects are not considered to be significant, therefore ensuring that the project will not affect prey species populations from being maintained in the long term.

7.4.2.9 Therefore, no adverse effect on the integrity of the Pembrokeshire Marine SAC from this potential impact can be concluded.

Cleddau Rivers SAC

7.4.2.10 Significant adverse effects on the qualifying otter feature of the Cleddau Rivers SAC are not predicted to occur as a result of increased underwater noise due to operation and maintenance vessel activity. Potential effects from this activity on the relevant Conservation Objectives (as presented in paragraph 7.2.1.3) are discussed in turn below.

The population of otters in the SAC is stable or increasing over the long term and reflects the natural carrying capacity of the habitat within the SAC.

7.4.2.11 Otters are likely to leave the water in the vicinity of underwater noise. Therefore, it is considered highly unlikely that any otter will be injured as a result of underwater noise and any low levels of disturbance, should it occur, is likely to be highly localised to the immediate vicinity of the vessels, which it can be assumed the otters will avoid. This should also be considered in the context of the existing high levels of vessel traffic and anthropogenic activities occurring within the Waterway and the likely habituation of animals foraging in these waters. Noise generated by operation and maintenance vessels is not predicted to result in any effects on the population level of otters within the SAC.

The SAC will have sufficient habitat, including riparian trees and vegetation and wetlands, to support the otter population in the long term.

7.4.2.12 Underwater noise will have no impact these habitat features and therefore this Conservation Objective will be maintained.

The natural range of otters in the SAC is neither being reduced nor is likely to be reduced for the foreseeable future.

7.4.2.13 Underwater noise generated by vessels will be intermittent and should be considered in the context of existing high levels of vessel traffic in the Waterway. Therefore, although otter may leave the water, any effects are anticipated to be temporary and will not restrict the range of otters as normal foraging can be expected to resume after the vessel activity has ceased.

The otter must be able to breed and recruit successfully in the SAC.

7.4.2.14 Any avoidance behaviour exhibited by otters to underwater noise is not predicted to affect their ability to breed and recruit successfully.

Otter food sources must be sufficient for maintenance of the population.

7.4.2.15 Some short-term disturbance is predicted to potential prey fish species, although effects are not considered to be significant, therefore ensuring that the project will not affect the maintenance of otter food sources.

The safe movement and dispersal of individuals around the SAC is facilitated by the provision, where necessary, of suitable riparian habitat, and underpasses, ledges, fencing etc at road bridges and other artificial barriers.

7.4.2.16 Underwater noise will not impact on any measures which may be in place to facilitate the movement of otters around the SAC. Therefore, this Conservation Objective will be maintained.

No otter breeding site should be subject to a level of disturbance that could have an adverse effect on breeding success. Where necessary, potentially harmful levels of disturbance must be managed.

7.4.2.17 Although otter may leave the water, and therefore there may be reduced foraging opportunities when exposed to underwater noise, any effects are anticipated to be temporary and reversible and should be considered in the context of the existing high levels of vessel traffic in the Waterway. Any resulting disturbance is not predicted to have an adverse effect on breeding success.

7.4.2.18 Therefore, no adverse effect on the integrity of the Cleddau Rivers SAC from this potential impact can be concluded.

Increased collision risk with vessels

7.4.2.19 The maximum and most likely design scenarios for impacts associated with increased collision risk with vessels during operation and maintenance activities is as presented in chapter 9: Marine Mammals, Basking Shark and Otter of the Environmental Statement, are as summarised previously in in Table 6.6.

7.4.2.20 Vessels travelling at 7 m/s or faster are those most likely to cause death or serious injury to otters (Wilson *et al.*, 2007). Vessels involved in operation and maintenance activities are likely to be travelling considerably slower than this, in accordance with the high levels of traffic expected within the META project area, and therefore collision risk is expected to be lower than that posed by commercial shipping activity.

7.4.2.21 Larger vessels, such as the maximum size expected at Dale Roads (site 7) and East Pickard Bay (site 8) as outlined in Table 6.8, are less likely to be involved in vessel collisions, based on their predictable movements and larger volume of noise produced, making them more detectable to marine mammals than the smaller, most likely size of vessels at Warrior Way (site 6). However, the slow speed of all vessels used in installation operations at the META project means that vessel strike is unlikely

Otter

7.4.2.22 Otters primarily utilise a narrow strip of water along the shore for foraging, and rarely venture more than 2 km from the shoreline (Kruuk, 2006). An observational survey of 500 dives off the coast of Shetland revealed that coastal otters dive for food within 80 m of the shore 62% of the time, within 50 m 84% of the time, and within 20 m 98% of the time (Kruuk and Moorhouse, 1991). Otters prefer to dive in shallow waters of 0 – 3 m and rocky intertidal areas where benthic prey are more abundant; it has been theorised this is also a method of conserving body heat, reducing thermoregulatory costs and reducing travel time (Kruuk and Moorhouse, 1991; Nolet *et al.*, 1993).

7.4.2.23 Although it is highly unlikely that there is a receptor-impact pathway, and that otters will come in to contact with vessels involved in the installation phase, individuals have been sighted diving 2 km from shore, thus a precautionary approach to this assessment will be taken, particularly as audibility in otters and thus ability to detect vessels is less sensitive than pinnipeds or cetaceans.

Conclusions

Pembrokeshire Marine SAC

7.4.2.24 Significant adverse effects on the qualifying otter feature of the Pembrokeshire Marine SAC are not predicted to occur as a result of collision risk with vessels. Potential effects from this activity on the Conservation Objectives of these sites (as presented in paragraph 7.2.1.2) are discussed in turn below.

The population is maintaining itself on a long-term basis as a viable component of its natural habitat

7.4.2.25 The potential for collision risk with vessels is considered to be low on the basis that vessels will be operating and manoeuvring at low speeds and that otters have been shown to forage largely within 20 m of the shore. Any otters with foraging grounds in the vicinity of the META sites are considered likely to be habituated to vessel activity in the Waterway. As such, collisions resulting in otter fatalities and therefore effects on the population size or structure of this SAC is considered unlikely. This impact will not restrict the objective of the population being able to maintain itself as a viable component of its natural habitat over the long-term.

The species population within the site is such that the natural range of the population is not being reduced or likely to be reduced for the foreseeable future

7.4.2.26 As vessel activity will be intermittent and localised to the Waterway and META sites, any avoidance behaviour exhibited by otters will be temporary and will not constrain the range of this species within the site or affect the access of otters to areas of prey. Therefore, this Conservation Objective will be maintained.

The presence, abundance, condition and diversity of habitats and species required to support this species is such that the distribution, abundance and populations dynamics of the species within the site and population beyond the site is stable or increasing

7.4.2.27 Otter prey species are unlikely to be significantly affected by collision risk with vessels and as such, this Conservation Objective will be maintained.

7.4.2.28 Therefore, no adverse effect on the integrity of the Pembrokeshire Marine SAC from this potential impact can be concluded.

Cleddau Rivers SAC

7.4.2.29 Significant adverse effects on the qualifying otter feature of the Cleddau Rivers SAC are not predicted to occur as a result of collision risk with vessels. Potential effects from this activity on the relevant Conservation Objectives (as presented in paragraph 7.2.1.3) are discussed in turn below.

The population of otters in the SAC is stable or increasing over the long term and reflects the natural carrying capacity of the habitat within the SAC.

- 7.4.2.30 The potential for collision risk with vessels is considered to be low on the basis that vessels will be operating and manoeuvring at low speeds and that otters have been shown to forage largely within 20 m of the shore. Any otters with foraging grounds in the vicinity of the META sites are considered likely to be habituated to vessel activity in the Waterway. As such, collisions resulting in otter fatalities and therefore effects on the population size of this SAC is considered unlikely.

The SAC will have sufficient habitat, including riparian trees and vegetation and wetlands, to support the otter population in the long term.

- 7.4.2.31 Collision risk with vessels will have no impact these habitat features and therefore this Conservation Objective will be maintained.

The natural range of otters in the SAC is neither being reduced nor is likely to be reduced for the foreseeable future.

- 7.4.2.32 The anticipated vessel movements associated with the META activities are considered unlikely to coincide with areas used most likely to be used by otters for foraging (i.e. within 20 m of the shore). Therefore, this impact is not considered to reduce the natural range of otters within the SAC.

The otter must be able to breed and recruit successfully in the SAC.

- 7.4.2.33 The anticipated vessel movements associated with the META activities are considered unlikely to coincide with areas most likely to be used by otters for foraging (i.e. within 20 m of the shore) and therefore collisions resulting in fatality or injury are unlikely. Therefore, this impact is not affect the ability of otter to breed and recruit successfully within the SAC.

Otter food sources must be sufficient for maintenance of the population.

- 7.4.2.34 Prey species are unlikely to be significantly affected by collision risk with vessels and as such, this Conservation Objective will be maintained.

The safe movement and dispersal of individuals around the SAC is facilitated by the provision, where necessary, of suitable riparian habitat, and underpasses, ledges, fencing etc at road bridges and other artificial barriers.

- 7.4.2.35 Vessel collision risk will not impact on any measures which may be in place to facilitate the movement of otters around the SAC. Therefore, this Conservation Objective will be maintained.

No otter breeding site should be subject to a level of disturbance that could have an adverse effect on breeding success. Where necessary, potentially harmful levels of disturbance must be managed.

- 7.4.2.36 The anticipated vessel movements associated with the META activities are considered unlikely to coincide with areas most likely to be used by otters for foraging (i.e. within 20 m of the shore) and therefore any significant disturbance leading to adverse effects of breeding success are not predicted.

- 7.4.2.37 Therefore, no adverse effect on the integrity of the Cleddau Rivers SAC from this potential impact can be concluded.

Collision risk with tidal turbines at Warrior Way (site 6)

- 7.4.2.38 The deployment of scaled or micro-scale marine tidal turbines at Warrior Way (site 6) poses a potential risk to otters. Device components, specifically the terminal end of the rotating blade, pose the greatest risk of potential injury in the event of a collision (Turnpenny *et al.*, 2000). The maximum and most likely design scenarios for impacts associated with collision risk with tidal turbines, as presented in chapter 9: Marine Mammals, Basking Shark and Otter of the Environmental Statement, are summarised previously in in Table 6.9.

- 7.4.2.39 In the context of the cross-section of sea area in the Waterway at the mid-point of Warrior Way (site 6) (11,570 m²), the swept area equates to only 0.17% of the tidal stream cross-sectional area at this location. The maximum duration of scaled tidal device testing at Warrior Way (site 6) is up to six months, with the most likely being up to three months.

Otter

- 7.4.2.40 Otters are found throughout the Waterway and as such it is assumed that individuals have the potential to enter the vicinity of Warrior Way (site 6), however it is likely that otters would exhibit avoidance. In addition, Hung and Law (2016) observed that otters usually forage less than 50 m from shore and less than 8 m water depth, bringing prey one at a time back to the surface, with dives lasting less than 96 seconds. This is corroborated by Heggbergettet (1993) who describes a 0 – 10 m foraging depth zone for otters, and by Kruuk and Moorhouse, 1991 (as stated in paragraph 7.4.2.22) who observed that otters forage within 80 m of the shore 62% of the time, within 50 m 84% of the time, and within 20 m 98% of the time. Otters are thought to prefer to dive in shallow waters of 0 – 3 m and rocky intertidal areas where benthic prey are more abundant (Kruuk and Moorhouse, 1991; Kruuk, 2006).

- 7.4.2.41 Given that the expected rotor diameter of the tidal turbine is 5 m, and the maximum scenario of device diameters is 20 m x 10 m, the water depth required to deploy the device would far exceed 3 m, and would most likely be deployed at a distance from the shoreline that otters would not expect to be found foraging at. However, given that the Waterway supports important numbers of otters, there remains a small potential for otters to be affected by collision with operational scaled tidal turbines at Warrior Way (site 6).

Conclusions

Pembrokeshire Marine SAC

- 7.4.2.42 Significant adverse effects on the qualifying otter feature of the Pembrokeshire Marine SAC are not predicted to occur as a result of collision risk with tidal turbines. Potential effects from this activity on the relevant Conservation Objectives of these sites are discussed in turn below.

The population is maintaining itself on a long-term basis as a viable component of its natural habitat

- 7.4.2.43 As the tidal devices at Warrior Way (site 6) are unlikely to be deployed within the foraging range of otters and it is likely that any individuals that do approach the turbines would exhibit avoidance behaviour, collisions resulting in otter fatalities and therefore effects on the population size or structure are considered unlikely. This impact will not restrict the objective of the population being able to maintain itself as a viable component of its natural habitat over the long-term.

The species population within the site is such that the natural range of the population is not being reduced or likely to be reduced for the foreseeable future

- 7.4.2.44 The area potentially swept by the tidal turbines represents only a very small proportion of the width of the Waterway at Warrior Way (site 6). Therefore, in the event that otters approach a turbine and exhibit avoidance behaviour, there would be sufficient unaffected space within the channel such that the devices would not cause a barrier to movement and therefore would not affect the natural range of this species.

The presence, abundance, condition and diversity of habitats and species required to support this species is such that the distribution, abundance and populations dynamics of the species within the site and population beyond the site is stable or increasing

- 7.4.2.45 Although as discussed in paragraph 5.4.2.35, prey species are also considered likely to exhibit avoidance behaviour, the presence, abundance, condition and diversity of prey species is unlikely to be significantly affected. As such, this Conservation Objective will be maintained.

- 7.4.2.46 Therefore, no adverse effect on the integrity of the Pembrokeshire Marine SAC from this potential impact can be concluded.

Cleddau Rivers SAC

- 7.4.2.47 Significant adverse effects on the qualifying otter feature of the Cleddau Rivers SAC are not predicted to occur as a result of collision risk with tidal turbines. Potential effects from this activity on the relevant Conservation Objectives (as presented in paragraph 7.2.1.3) are discussed in turn below.

The population of otters in the SAC is stable or increasing over the long term and reflects the natural carrying capacity of the habitat within the SAC.

- 7.4.2.48 As the tidal devices at Warrior Way (site 6) are unlikely to be deployed within the foraging range of otters and it is likely that any individuals that do approach the turbines would exhibit avoidance behaviour, collisions resulting in otter fatalities and therefore effects on the population size or structure are considered unlikely. This impact will therefore not restrict the objective of the population being able to remain stable to increase over the long-term.

The SAC will have sufficient habitat, including riparian trees and vegetation and wetlands, to support the otter population in the long term.

- 7.4.2.49 Collision risk with tidal turbines will have no impact these habitat features and therefore this Conservation Objective will be maintained.

The natural range of otters in the SAC is neither being reduced nor is likely to be reduced for the foreseeable future.

- 7.4.2.50 The area potentially swept by the tidal turbines represents only a very small proportion of the width of the Waterway at Warrior Way (site 6). Therefore, in the event that otters approach a turbine and exhibit avoidance behaviour, there would be sufficient unaffected space within the channel such that the devices would not cause a barrier to movement and therefore would not affect the natural range of this species.

The otter must be able to breed and recruit successfully in the SAC.

- 7.4.2.51 As fatalities/injury to otters as a result of collision with tidal turbines is not anticipated, this impact is not predicted affect the ability of otter to breed and recruit successfully within the SAC.

Otter food sources must be sufficient for maintenance of the population.

- 7.4.2.52 Prey species are unlikely to be significantly affected by collision risk with tidal turbines and as such, this Conservation Objective will be maintained.

The safe movement and dispersal of individuals around the SAC is facilitated by the provision, where necessary, of suitable riparian habitat, and underpasses, ledges, fencing etc at road bridges and other artificial barriers.

- 7.4.2.53 Tidal turbine collision risk will not impact on any measures which may be in place to facilitate the movement of otters around the SAC. Therefore, this Conservation Objective will be maintained.

No otter breeding site should be subject to a level of disturbance that could have an adverse effect on breeding success. Where necessary, potentially harmful levels of disturbance must be managed.

- 7.4.2.54 Although otters may avoid the tidal turbines, there would be sufficient unaffected space within the channel such that the devices would not cause a barrier to movement or any effects on breeding success. Therefore, this Conservation Objective will be maintained.

7.4.2.55 Therefore, no adverse effect on the integrity of the Cleddau Rivers SAC from this potential impact can be concluded.

Accidental pollution

7.4.2.56 As discussed previously in paragraph 6.4.2.155, there is the potential for the accidental release of pollutants into the marine environment during operation and maintenance activities, as a result of accidental spillage or leakage for example. Pollution may include diesel oil from vessels and synthetic chemicals.

Embedded mitigation

7.4.2.57 As outlined in Table 9.13 of chapter 9: Marine Mammals, Basking Shark and Otter of the Environmental Statement, measures adopted as part of the project include the production of an EMP which will include planning for accidental spills, address all potential contaminant releases and include key emergency contact detail. This will ensure that the potential for release of pollutants from installation and decommissioning activities is minimised. In this manner, accidental release of potential release of contaminants from vessels will be strictly controlled, thus providing protection for marine life across all phases of the project.

Otter

7.4.2.58 Otter are highly mobile species and are likely to be able to detect pollutants and as a result are expected to avoid areas where there has been an accidental release of pollutants. In the unlikely event that pollutants were to enter the Waterway, they would be rapidly dispersed on the surface and in the water column and subject to twice daily tidal flushing, and so any effects on water quality would be limited.

Conclusions

Pembrokeshire Marine SAC

7.4.2.59 Significant adverse effects on the qualifying otter feature of the Pembrokeshire Marine SAC are not predicted to occur as a result of an accidental pollution event during operation and maintenance. Potential effects from this activity on the Conservation Objectives of these sites (as presented in paragraph 7.2.1.2) are discussed in turn below.

The population is maintaining itself on a long-term basis as a viable component of its natural habitat

7.4.2.60 The likelihood of any significant pollution event from the META project occurring is low enough to ensure that the ability of the otter population of this site to be maintained in the long-term will not be affected.

7.4.2.61 *The species population within the site is such that the natural range of the population is not being reduced or likely to be reduced for the foreseeable future*

7.4.2.62 Otter are highly mobile species and are likely to be able to detect and avoid areas where pollution has occurred, therefore, there may be some localised alteration to the natural range of this species. However, this would be temporary and reversible and, furthermore, the mitigation measures embedded in the project will ensure that the likelihood of such an event occurring is very low. Therefore, an accidental pollution event will not prevent this objective from being achieved.

The presence, abundance, condition and diversity of habitats and species required to support this species is such that the distribution, abundance and populations dynamics of the species within the site and population beyond the site is stable or increasing

7.4.2.63 Given the mitigation measures to be implemented for the META project, the likelihood of a spill occurring and resulting in significant adverse effects on otter prey species (or habitats of prey species) is extremely low and therefore this Conservation Objective will be maintained.

7.4.2.64 Therefore, no adverse effect on the integrity of the Pembrokeshire Marine SAC from this potential impact can be concluded.

Cleddau Rivers SAC

7.4.2.65 Significant adverse effects on the qualifying otter feature of the Cleddau Rivers SAC are not predicted to occur as a result of an accidental pollution event during operation and maintenance. Potential effects from this activity on the relevant Conservation Objectives (as presented in paragraph 7.2.1.3) are discussed in turn below.

The population of otters in the SAC is stable or increasing over the long term and reflects the natural carrying capacity of the habitat within the SAC.

7.4.2.66 The likelihood of any significant pollution event from the META project occurring is low enough to ensure that the ability of the otter population of this site to be maintained will not be affected.

The SAC will have sufficient habitat, including riparian trees and vegetation and wetlands, to support the otter population in the long term.

7.4.2.67 An accidental pollution event will not impact these habitat features and therefore this Conservation Objective will be maintained.

The natural range of otters in the SAC is neither being reduced nor is likely to be reduced for the foreseeable future.

7.4.2.68 Otter are highly mobile species and are likely to be able to detect and avoid areas where pollution has occurred, therefore, there may be some localised alteration to the natural range of this species. However, this would be temporary and reversible and, furthermore, the mitigation measures embedded in the project will ensure that the likelihood of such an event occurring is very low. Therefore, an accidental pollution event will not prevent this objective from being achieved.

The otter must be able to breed and recruit successfully in the SAC.

- 7.4.2.69 The likelihood of any significant pollution event from the META project occurring is low enough to ensure that impacts to the breeding/recruitment success of this species are highly unlikely.

Otter food sources must be sufficient for maintenance of the population.

- 7.4.2.70 Given the mitigation measures to be implemented for the META project, the likelihood of a spill occurring and resulting in significant adverse effects on otter prey species (or habitats of prey species) is extremely low and therefore this Conservation Objective will be maintained.

The safe movement and dispersal of individuals around the SAC is facilitated by the provision, where necessary, of suitable riparian habitat, and underpasses, ledges, fencing etc at road bridges and other artificial barriers.

- 7.4.2.71 Any accidental pollution would not have any impact on any measures in place to facilitate the movement of otters around the SAC. Therefore, this Conservation Objective will be maintained.

No otter breeding site should be subject to a level of disturbance that could have an adverse effect on breeding success. Where necessary, potentially harmful levels of disturbance must be managed.

- 7.4.2.72 Given the mitigation measures to be implemented for the META project, the likelihood of a spill occurring is very low. Furthermore, otter is a mobile species and would be able to avoid any areas where there has been a release of pollutants. Any effects on otter would not be expected to have any implications for breeding success.

- 7.4.2.73 Therefore, no adverse effect on the integrity of the Cleddau Rivers SAC from this potential impact can be concluded.

7.5 Assessment of Adverse Effects on Integrity – the META project In-combination with other plans or projects

- 7.5.1.1 The other developments (projects/plans) that could result in-combination effects associated with the proposal on Annex II otter features of the designated sites identified have been summarised and are presented previously in Table 6.12 for Annex II marine mammals.

- 7.5.1.2 A number of impacts considered for the META project alone, as set out in section 7.4, have not been considered in the in-combination assessment. This is because many of the potential impacts identified and assessed for the META project alone are relatively localised and temporary in nature and therefore have limited or no potential to interact with similar changes associated with other projects. On this basis, the potential impacts identified for assessment as part of the marine mammal CIA in chapter 9: Marine Mammals, Basking Shark and Otter of the Environmental Statement, and which have been brought forward for consideration in the in-combination assessment of the RIAA for otter are:

- Increased underwater noise emissions;
- Vessel collision.

In-combination increases in underwater noise

- 7.5.1.3 As discussed in paragraph 6.5.1.3 *et seq.* there is the potential for increases as a result of installation and operational activities associated with the META project in-combination with activities associated with the following projects/activities: META Phase 1, Bombora Wave Energy offshore works, the Pembroke Dock redevelopment project, the mixed use development of the Milford Haven Waterfront, dredging and disposal activities in the Waterway, the Greenlink Interconnector project (and associated surveys), research undertaken by Swansea University and the dWNMP.

- 7.5.1.4 Impacts associated with these other projects are described in paragraph 6.5.1.5 *et seq.* and are not repeated here. The impact ranges from installation vessels for other projects are likely to be of a similar scale as predicted for the META project and therefore the scope for cumulative impact is minimal since each project will have minimal potential to cause injury or disturbance and uplift in noise emissions is therefore expected to be low.

- 7.5.1.5 The potential in-combination impact of a small number of projects resulting in small disturbance zones due to increased underwater noise might make a slightly larger proportion of suitable habitat unavailable for otters. However, most of this disturbance is unlikely to occur within the preferred foraging ranges of otters.

Conclusions

Pembrokeshire Marine SAC

- 7.5.1.6 Significant adverse effects on the qualifying otter feature of the Pembrokeshire Marine SAC are not predicted to occur as a result of in-combination increases in underwater noise due to vessel activity. Potential effects from this activity on the Conservation Objectives of these sites (as presented in paragraph 7.2.1.2) are discussed in turn below.

The population is maintaining itself on a long-term basis as a viable component of its natural habitat

- 7.5.1.7 It is considered highly unlikely that any otter will be injured as a result of underwater noise generated by vessels, particularly since otters are likely to leave the water. Although low levels of short-term disturbance may occur, if it occurs at all this is likely to be highly localised to the immediate vicinity of the vessels which it can be assumed the otters will avoid. This should also be considered in the context of the existing high levels of vessel traffic and anthropogenic activities occurring within the Waterway and the likely habituation of animals foraging in these waters. Noise generated by vessels is not predicted to restrict the objective of the population being able to maintain itself as a viable component of its natural habitat over the long-term.

The species population within the site is such that the natural range of the population is not being reduced or likely to be reduced for the foreseeable future

- 7.5.1.8 Although underwater noise may result in some avoidance behaviour of otter, this should be considered in the context of the existing high levels of vessel traffic and anthropogenic activities occurring within the Waterway and the likely habituation of animals foraging in these waters. Therefore, any disturbance to otter is not considered significant and will not reduce the range of this species in the long-term. Therefore, this Conservation Objective will be maintained.

The presence, abundance, condition and diversity of habitats and species required to support this species is such that the distribution, abundance and populations dynamics of the species within the site and population beyond the site is stable or increasing

- 7.5.1.9 Some short-term disturbance is predicted to potential prey fish species, although effects are not considered to be significant, therefore ensuring that the project will not affect prey species populations from being maintained in the long term.
- 7.5.1.10 Therefore, no adverse effect on the integrity of the Pembrokeshire Marine SAC from this potential impact can be concluded.

Cleddau Rivers SAC

- 7.5.1.11 Significant adverse effects on the qualifying otter feature of the Cleddau Rivers SAC are not predicted to occur as a result of in-combination increased underwater noise due to vessel activity. Potential effects from this activity on the relevant Conservation Objectives (as presented in paragraph 7.2.1.3) are discussed in turn below.

The population of otters in the SAC is stable or increasing over the long term and reflects the natural carrying capacity of the habitat within the SAC.

- 7.5.1.12 Otters are likely to leave the water in the vicinity of underwater noise. Therefore, it is considered highly unlikely that any otter will be injured as a result of underwater noise and any low levels of disturbance, should it occur, is likely to be highly localised to the immediate vicinity of the vessels which it can be assumed the otters will avoid. This should also be considered in the context of the existing high levels of vessel traffic and anthropogenic activities occurring within the Waterway and the likely habituation of animals foraging in these waters. Noise generated by operation and maintenance vessels is not predicted to result in any effects on the population level of otters within the SAC.

The SAC will have sufficient habitat, including riparian trees and vegetation and wetlands, to support the otter population in the long term.

- 7.5.1.13 Underwater noise will have no impact these habitat features and therefore this Conservation Objective will be maintained.

The natural range of otters in the SAC is neither being reduced nor is likely to be reduced for the foreseeable future.

- 7.5.1.14 Underwater noise generated by vessels will be intermittent and should be considered in the context of existing high levels of vessel traffic in the Waterway. Therefore, although otter may leave the water and foraging opportunities, any effects are anticipated to be temporary and will not restrict the range of otters as normal foraging can be expected to resume after the vessel activity has ceased.

The otter must be able to breed and recruit successfully in the SAC.

- 7.5.1.15 Any avoidance behaviour exhibited by otters to underwater noise is not predicted to affect their ability to breed and recruit successfully.

Otter food sources must be sufficient for maintenance of the population.

- 7.5.1.16 Some short-term disturbance is predicted to potential prey fish species, although effects are not considered to be significant, therefore ensuring that the project will not affect the maintenance of otter food sources.

The safe movement and dispersal of individuals around the SAC is facilitated by the provision, where necessary, of suitable riparian habitat, and underpasses, ledges, fencing etc at road bridges and other artificial barriers.

- 7.5.1.17 Underwater noise will not impact on any measures which may be in place to facilitate the movement of otters around the SAC. Therefore, this Conservation Objective will be maintained.

No otter breeding site should be subject to a level of disturbance that could have an adverse effect on breeding success. Where necessary, potentially harmful levels of disturbance must be managed.

- 7.5.1.18 Although otter may leave the water and foraging opportunities when exposed to underwater noise, any effects are anticipated to be temporary and reversible and should be considered in the context of the existing high levels of vessel traffic in the Waterway. Any resulting disturbance is not predicted to have an adverse effect on breeding success.

- 7.5.1.19 Therefore, no adverse effect on the integrity of the Cleddau Rivers SAC from this potential impact can be concluded.

In-combination increased vessel collision risk

- 7.5.1.20 The vessels involved with all projects assessed in Table 6.12 will be slow moving, and the number of vessels involved will be low, particularly in comparison the existing levels of traffic within the Waterway. Animals are likely to show some degree of habituation to already high levels of existing traffic therefore a small cumulative increase in vessels is considered unlikely to result in an increased number of collisions.

Conclusions

Pembrokeshire Marine SAC

- 7.5.1.21 Significant adverse effects on the qualifying otter feature of the Pembrokeshire Marine SAC are not predicted to occur as a result of in-combination collision risk with vessels. Potential effects from this activity on the Conservation Objectives of these sites (as presented in paragraph 7.2.1.2) are discussed in turn below.

The population is maintaining itself on a long-term basis as a viable component of its natural habitat

- 7.5.1.22 The potential for collision risk with vessels is considered to be low on the basis that vessels will be operating and manoeuvring at low speeds and that otters have been shown to forage largely within 20 m of the shore. Any otters with foraging grounds in the Waterway are considered likely to be habituated to vessel activity in the Waterway. As such, collisions resulting in otter fatalities and therefore effects on the population size or structure of this SAC is considered unlikely. This impact will not restrict the objective of the population being able to maintain itself as a viable component of its natural habitat over the long-term.

The species population within the site is such that the natural range of the population is not being reduced or likely to be reduced for the foreseeable future

- 7.5.1.23 As vessel activity will be intermittent and localised to the Waterway and META sites, any avoidance behaviour exhibited otters will only be temporary and will not constrain the range of this species within the site or affect the access of otters to areas of prey. Therefore, this Conservation Objective will be maintained.

The presence, abundance, condition and diversity of habitats and species required to support this species is such that the distribution, abundance and populations dynamics of the species within the site and population beyond the site is stable or increasing

- 7.5.1.24 Otter prey species are unlikely to be significantly affected by collision risk with vessels and as such, this Conservation Objective will be maintained.

- 7.5.1.25 Therefore, no adverse effect on the integrity of the Pembrokeshire Marine SAC from this potential impact can be concluded.

Cleddau Rivers SAC

- 7.5.1.26 Significant adverse effects on the qualifying otter feature of the Cleddau Rivers SAC are not predicted to occur as a result of in-combination collision risk with vessels. Potential effects from this activity on the relevant Conservation Objectives (as presented in paragraph 7.2.1.3) are discussed in turn below.

The population of otters in the SAC is stable or increasing over the long term and reflects the natural carrying capacity of the habitat within the SAC.

- 7.5.1.27 The potential for collision risk with vessels is considered to be low on the basis that vessels will be operating and manoeuvring at low speeds and that otters have been shown to forage largely within 20 m of the shore. Any otters with foraging grounds in the Waterway are considered likely to be habituated to vessel activity in the Waterway. As such, collisions resulting in otter fatalities and therefore effects on the population size of this SAC is considered unlikely.

The SAC will have sufficient habitat, including riparian trees and vegetation and wetlands, to support the otter population in the long term.

- 7.5.1.28 Collision risk with vessels will have no impact these habitat features and therefore this Conservation Objective will be maintained.

The natural range of otters in the SAC is neither being reduced nor is likely to be reduced for the foreseeable future.

- 7.5.1.29 The anticipated vessel movements are considered unlikely to coincide with areas used most likely to be used by otters for foraging (i.e. within 20 m of the shore). Therefore, this impact is not considered to reduce the natural range of otters within the SAC.

The otter must be able to breed and recruit successfully in the SAC.

- 7.5.1.30 The anticipated vessel movements associated are considered unlikely to coincide with areas used most likely to be used by otters for foraging (i.e. within 20 m of the shore) and therefore collisions resulting in fatality or injury are unlikely. Therefore, this impact is not affect the ability of otter to breed and recruit successfully within the SAC.

Otter food sources must be sufficient for maintenance of the population.

- 7.5.1.31 Prey species are unlikely to be significantly affected by collision risk with vessels and as such, this Conservation Objective will be maintained.

The safe movement and dispersal of individuals around the SAC is facilitated by the provision, where necessary, of suitable riparian habitat, and underpasses, ledges, fencing etc at road bridges and other artificial barriers.

- 7.5.1.32 Vessel collision risk will not impact on any measures which may be in place to facilitate the movement of otters around the SAC. Therefore, this Conservation Objective will be maintained.

No otter breeding site should be subject to a level of disturbance that could have an adverse effect on breeding success. Where necessary, potentially harmful levels of disturbance must be managed.

- 7.5.1.33 The anticipated vessel movements are considered unlikely to coincide with areas used most likely to be used by otters for foraging (i.e. within 20 m of the shore) and therefore any significant disturbance leading to adverse effects of breeding success are not predicted.
- 7.5.1.34 Therefore, no adverse effect on the integrity of the Cleddau Rivers SAC from this potential impact can be concluded.

8. ASSESSMENT OF ADVERSE EFFECTS ON INTEGRITY: ANNEX II SPECIES – MARINE ORNITHOLOGY

8.1.1.1 The screening exercise (Stage 1 of the Habitats Regulations Assessment (HRA) process), together with the subsequent consultation with NRW (see section 2.3.5.1), identified potential for LSEs on the qualifying Annex II coastal ornithology features of the Skomer, Skokholm and the Seas off Pembrokeshire SPA as detailed in Table 2.8.

8.2 Conservation Objectives

8.2.1.1 The Conservation Objectives of the qualifying bird features screened in for Stage 2 assessment (Table 2.8) are provided below.

Skomer, Skokholm and the Seas off Pembrokeshire SPA

8.2.1.2 The Conservation Objectives for Annex II marine ornithological features of the Skomer, Skokholm and the Seas off Pembrokeshire SPA are detailed in the draft Conservation Objectives document for the site (NRW, 2015; see Appendix 12). The protected features covered by the draft conservation advice are the qualifying marine species of the SPA: breeding populations of storm petrel, lesser black-backed gull, Manx shearwater, and Atlantic puffin as well as the breeding seabird assemblage (which includes razorbill, common guillemot and black-legged kittiwake). The overarching Conservation Objective for the protected features of this site is to ensure that their condition is maintained or enhanced. For each of these features there are four Conservation Objectives:

- The size of the population should be stable or increasing, allowing for natural variability, and sustainable in the long term;
- The distribution of the population should be being maintained, or where appropriate increasing;
- There should be sufficient habitat, of sufficient quality, to support the population in the long term; and
- Factors affecting the population or its habitat should be under appropriate control.

8.2.1.3 The feature specific targets for each of these objectives is also given in the draft Conservation Objectives document for the site (NRW and JNCC, 2015) and are presented in full in Appendix 12.

8.3 Baseline information

8.3.1.1 Baseline information on the marine ornithological features of the European Sites identified for further assessment within the HRA process has been gathered through a comprehensive desktop study of existing studies and datasets. These comprised:

- European Seabirds at Sea (ESAS) Evidence Base (NRW, 2017);
- WWBIC sea and coastal bird data search 2009-2018;

- BTO Wetland Bird Survey - Low tide counts 2013/2014 and core counts 2012-2016; and
- MHWESG Wetland bird monitoring reports 2016-2018.

8.3.1.2 The data sources summarised in Table 8.1 were also used to provide relevant information on relevant species; full detail is presented within chapter 10: Marine Ornithology of the Environmental Statement.

Table 8.1: Desktop data sources used within marine ornithology assessment.

Title	Description	Dataset Owner	Relevant Season	What it shows
European Seabirds at Sea (ESAS)	ESAS data was amalgamated from a long-running programme of survey and research work on seabirds in the marine environment in the north-east Atlantic since 1979, and in the southwest Atlantic between 1998 and 2002 (cetacean data collected during this period is also available from JNCC). This data set recorded a wide range of seabirds, divers and seaducks.	JNCC/NRW	All – can be split into spring passage, breeding, post breeding autumn passage and wintering. Data from all seasons must be used in marine planning.	Location and seasonality of important aggregations of seabirds offshore, including spring passage, breeding, autumn passage and wintering.
The Wetland Bird Survey (WeBS)	An annual scheme of counts at 2,000 coastal and wetland sites between September and March. At least 1,100 of these sites are monitored regularly (monthly) during this period and some sites are monitored year-round.	British Trust for Ornithology (BTO), RSPB and JNCC in association with the Wildfowl and Wetlands Trust.	Spring passage, autumn passage, winter	Abundance and distribution of waterbird populations, coastal and wetland locations of importance for waterbirds.

Skomer, Skokholm and the Seas off Pembrokeshire SPA

- 8.3.1.3 Skomer, Skokholm and the Seas off Pembrokeshire SPA is located off the south-west tip of Pembrokeshire in Welsh territorial and UK offshore waters. It includes the islands of Skomer and Skokholm. The marine area of the SPA is physically and hydrographically diverse, with high levels of primary productivity. The associated growth and concentration of zooplankton and fish offers rich feeding resources for seabirds and mammals.
- 8.3.1.4 The SPA qualifies under Article 4.1 of the Birds Directive, by regularly supporting the Annex I species: European storm petrel, red-billed chough and short-eared owl; and qualifies under Article 4.2 by supporting internationally important breeding populations of the regularly occurring migratory species: Manx shearwater, Atlantic puffin, and lesser black-backed gull. Furthermore, the Skomer, Skokholm and the Seas off Pembrokeshire SPA protects an assemblage of breeding seabirds (394,260 birds), the listed components of which are Manx shearwater, European storm petrel, Atlantic puffin, black-legged kittiwake, razorbill, common guillemot, and lesser black-backed gull.
- 8.3.1.5 The islands of Skomer and Skokholm support the largest concentration of breeding seabirds in England and Wales. They hold the largest breeding colony of Manx shearwater in the world (considered to be 316,000 pairs), one of the largest colonies of lesser black-backed gull in Britain (currently over 10,000 apparently occupied sites), as well as being important Welsh breeding sites for other seabird populations, such as razorbill, black-legged kittiwake, Atlantic puffin and common guillemot, supporting a breeding seabird assemblage of over 394,000 birds.

Atlantic puffin

- 8.3.1.6 The Atlantic puffin is exclusively marine, found on rocky coasts and offshore islands nesting on grassy maritime slopes, sea cliffs and rocky slopes. During the winter it is wide-ranging and is found in offshore and pelagic habitats. The UK supports approximately 9.6% of the global population of Atlantic puffin with approximately 508,700 pairs/occupied burrows (Mitchell *et al.*, 2004).
- 8.3.1.7 The species is a pursuit-diver, catching most of its prey within 30 m of the water surface but they are capable of diving to 60 m (Piatt and Nettleship, 1985; Burger and Simpson, 1986). They prey on 'forage' species, including juvenile pelagic fishes, such as herring, juvenile and adult capelin *Mallotus villosus*, and sandeel *Ammodytes* spp. (Barrett *et al.*, 1987). When feeding chicks, birds generally forage within 10 km of their colony, but may range as far as 50 to 100 km or more (Thaxter *et al.*, 2012). Atlantic puffin spend a lot of time on the water surface, initiating dives from it when foraging and at the start of the breeding season when they raft in close proximity to the colony before returning to burrows.

- 8.3.1.8 The META project is located approximately 6 km to the west of the Skomer, Skokholm and the seas off Pembrokeshire SPA. The population of puffin at the SPA use the islands as a breeding site. Adult puffins arrive back at the breeding colony in March and April and leave again in mid-August. Some remain in the North Sea over winter, others move further south to the Bay of Biscay. The Atlantic puffin is sexually mature at the age of 4 to 5 years. The birds are colonial nesters, excavating burrows on grassy clifftops or reusing existing holes, and on occasion may nest in crevices and among rocks and scree.
- 8.3.1.9 Shoji *et al.* (2015) showed that puffin from Skomer spent most of their foraging dive time making shallow, V-shaped dives during daylight hours. Pratte *et al.* (2017) revealed that puffins in Labrador headed offshore to forage and were likely to be associated with a pelagic food web. Tracking studies on Atlantic puffins are currently being undertaken by the Royal Society for the Protection of Birds (RSPB) in Scotland and the Zoological Society of London (ZSL) in Ireland and recent work by ZSL in Ireland is consistent with this evidence of pelagic zone foraging with individual birds traveling up to 40 km from the colony and diving to 8-12 m deep (<https://www.zsl.org/blogs/conservation/using-gps-tracking-to-serve-puffins> accessed 11/03/2019).
- 8.3.1.10 As discussed in chapter 10: Marine Ornithology of the Environmental Statement, based on ESAS data, puffin have been recorded within the marine ornithology data search study area at densities of 14 puffin per 3 km². The ESAS data predict very small densities of puffin at the closest point to the META project of 0.5 animals per 3 km². Given the foraging preference of this species for offshore/pelagic habitats, puffin is considered unlikely to use the areas in the vicinity of the META sites for foraging although occasional presence around East Pickard Bay (site 8) and Dale Roads (site 7) is possible.

Razorbill

- 8.3.1.11 Razorbills are relatively common throughout the coastal waters of Wales. They breed on small ledges or in cracks of rocky cliffs, in associated scree, and on boulder-fields. Colonies are usually in association with other seabirds. Birds only come to shore to breed and they winter in the northern Atlantic. Out with the breeding season, they occur widely in coastal waters off western Britain and Ireland, and in the North Sea (McCluskie *et al.*, 2012).
- 8.3.1.12 Britain and Ireland are home to internationally important populations of breeding razorbill, with 20% of the global population (93,600 pairs; Mitchell *et al.* 2004). Razorbills are listed as a feature of the Skomer, Skokholm and the seas off Pembrokeshire SPA due to the breeding colonies present.

- 8.3.1.13 Razorbills have high flight costs because of their relatively high wing loading (Pennycuik, 1987; Elliott *et al.*, 2013). As a result, energy expenditure is expected to increase substantially with foraging distance. Razorbill often fly in small groups low over the sea surface and are not very agile in flight and take-off is difficult (King *et al.*, 2009). Estimated flight heights from multiple sources report heights between 0 and 13 m above sea level with the vast majority of flights <5 m in height (Thaxter *et al.*, 2015). Flights to foraging areas tend to be relatively short with multiple stops / search phase behaviour and when food patches are identified/reached multiple dive events occur with time between dives spent at the surface (McCluskie *et al.*, 2012; Shoji *et al.*, 2016).
- 8.3.1.14 Razorbills feed mainly on shoaling fish; mostly sandeel for birds at breeding colonies in British Isles, supplemented by herring, sprat, and rockling. Fish are caught by pursuit diving from the surface, typically to depths of five to 30 m, but possibly deeper than 100 m on occasions (Bird Life International, 2011). Studies of birds fitted with data loggers at the Isle of May, which is approximately 8 km from the mainland, recorded almost half of all razorbill foraging trips within 10 km of the coast (Thaxter *et al.*, 2010). The remainder of trips were to areas 30-40 km offshore. Maximum foraging ranges of up to 110 km have been recorded with a mean maximum range of 66 km (Soanes *et al.*, 2016).
- 8.3.1.15 Foraging trips recorded from birds in the Baltic sea consisted of a number of flights interrupted by a small number of dives probably performed to explore the site for prey availability (Benvenuti *et al.*, 2001). Loggers deployed on razorbills have identified they tend to make a large number of short, relatively shallow dives and spend little time in the bottom phase of the dive (Benvenuti *et al.*, 2001; Thaxter *et al.*, 2010; Linnebjerg *et al.*, 2013). These differences in foraging behaviour are considered likely to partly reflect the fact razorbills carry and feed their chicks multiple prey items from the water column and forage both at or near the seabed and in the water column.
- 8.3.1.16 Recent tracking work on Skomer (Shoji *et al.*, 2016) shows that razorbills also vary their foraging patterns dependent on the stage of the breeding cycle and shift to a more focused pattern during chick rearing, targeting a region of interest known to support prey items. Tracking work data used to inform Wakefield *et al.* (2017) confirmed that razorbill space use declines with distance from colony, as would be expected for a central place forager (mean foraging distance of 13.2 km (Inter Quartile range 5.1–26.2, n=299). This work also confirmed that on average razorbill travel further than common guillemot to forage with predicted space use more dispersed through the Celtic Sea to the north and west of the colonies in Pembrokeshire.
- 8.3.1.17 The ESAS data identified razorbill using the marine ornithology data search study area with peak densities of 1.8 per 3 km².

Guillemot

- 8.3.1.18 Common guillemots spend most of their time at sea, only coming to land to breed on rocky cliff shores or islands. Britain and Ireland are home to internationally important populations of common guillemot, with 13% of the global population (708,200 pairs; Mitchell *et al.*, 2004). Common guillemot is listed as a feature of the Skomer, Skokholm and the seas off Pembrokeshire SPA due to the breeding colonies present.
- 8.3.1.19 Birds return to their British breeding colonies in March or April each year, with many of the adults having wintered offshore, usually within a few hundred kilometres of the colony. British breeding colonies are mainly on steep cliff faces, with most foraging during the breeding season occurring within 10 to 20 km of the colony, although foraging distances of over 100 km have been recorded (BirdLife International, 2011). Flights to foraging areas tend to be relatively short and when reached, significant time between dives is spent at the surface (McCluskie *et al.*, 2012). Estimated flight heights from multiple sources report heights between 0 and 10 m above sea level with the vast majority of flights < 5 m in height (Thaxter *et al.*, 2015).
- 8.3.1.20 The main prey items of the adult common guillemot are shoaling pelagic fish, mostly sandeel, herring and sprats, as well as small gadoids, and they are capable of switching prey in response to availability. Prey are caught by pursuit diving, with birds diving from the surface, typically to depths of less than 50 m, but up to 200 m (BirdLife International, 2011). Guillemot catch prey from the bottom of the water column and carry single prey items back to the colony to provision chicks (Thaxter *et al.*, 2010). This combination of pursuit diving and single prey loading imposes energetic constraints on individuals and influences habitat use and behaviour, with a preference for higher quality prey items. The bottom phase of dives by guillemots are relatively long, indicating considerable time spent searching for and pursuing prey. Loggers deployed on birds from the breeding season have shown guillemot make relatively long, deep, foraging dives in the pelagic and demersal zones (Thaxter *et al.*, 2010; Linnebjerg *et al.*, 2013). When feeding, they spend a high proportion of time under water and have a fast rate of ascent.
- 8.3.1.21 Tracking and habitat suitability modelling work by Wakefield *et al.* (2017) showed that in areas with relatively simple coastlines (i.e. not island archipelagos) guillemot tend to forage further from land. This is evident in the predicted space use for the south west Wales colonies, with the highest intensity space use predicted to the South and West of Skomer and Pembrokeshire (Maps available at <https://www.mba.ac.uk/projects/dassh-uk-archive-marine-species-and-habitats-data>).
- 8.3.1.22 Tracking work data used to inform the Wakefield *et al.* (2017) study also confirmed that common guillemot space use declines with distance from colony, as would be expected for a central place forager (mean foraging distance of 10.5 km (Inter Quartile range 3.2–19.1), n=192).

- 8.3.1.23 Guillemots are considered to be relatively plastic in their prey choice and capable of prey switching although this may not be the case at all colonies. Recent work (Riordan *et al.*, 2017) on chick diet of Skomer colonies has shown that diet has remained broadly similar (mainly Clupeids) since 1973, although in recent years an increase in relatively low-quality prey (Gadids) is evident, suggesting a shift in prey availability in the region. The ability to prey shift may mean they are less at risk from the negative effects of displacement in areas of suitable foraging habitat, provided equivalent feeding opportunities are available close to the breeding colony.
- 8.3.1.24 The ESAS data set identified guillemots using the marine ornithology data search study area with peak densities of 1 per 3 km². This observed low density is consistent with common guillemots' habitat preferences and predicted intensity of space use from Wakefield *et al.* (2017).

Black-legged kittiwake

- 8.3.1.25 Black legged kittiwakes (hereafter kittiwake) are coastal breeding birds ranging in the North Pacific, North Atlantic, and Arctic oceans. They are the only gull species that are exclusively cliff-nesting. The UK population is an estimated 370,000 pairs (Mitchell *et al.*, 2004) and this is approximately 14% of the biogeographic population. Kittiwakes have undergone a recent 25% decline in population estimate and as such are considered of conservation concern and are red listed in Wales.
- 8.3.1.26 Kittiwake are migratory and disperse after breeding from coastal areas to the open ocean (del Hoyo *et al.*, 1996). During the winter the species is highly pelagic, usually remaining on the wing out of sight of land (del Hoyo *et al.*, 1996).
- 8.3.1.27 Kittiwake nest on high, steep, coastal cliffs with narrow ledges in areas with easy access to freshwater (del Hoyo *et al.*, 1996). They return to breeding grounds from January, where they breed from mid-May to mid-June (del Hoyo *et al.*, 1996, Snow and Perrins, 1998). The species begins to disperse from the breeding colonies between July and August (Olsen and Larsson, 2003).
- 8.3.1.28 Kittiwake are strong capable fliers with relatively broad wings and a low wing loading. They do much foraging in flight, dipping down to take items at surface or plunging into water to take prey below surface; they also feed by seizing items at the surface while swimming. Estimated flight heights using a variety of methods summarised by Thaxter *et al.* (2015) indicate Kittiwake have a median flight height of ~16 m (80 m max) from visual survey and maximum heights of up to 250 m recorded using radar.
- 8.3.1.29 Kittiwake are pelagic surface feeders feeding in the upper couple of metres of the water column. In the breeding season they feed mainly on small (15-20 cm) pelagic shoaling fish, such as sandeel, sprat and clupeids (del Hoyo *et al.*, 1996) but have been shown to have up to 40 different prey items in their diet (Soanes *et al.*, 2016). At sea during the winter, they will also take planktonic invertebrates and exploit sewage outfalls and fishing vessels (del Hoyo *et al.*, 1996).

- 8.3.1.30 Tracking and habitat suitability modelling work by Wakefield *et al.* (2017) showed that kittiwakes are more pelagic, with activity patchily distributed offshore with core hotspots including a large area of the central Irish Sea. This is evident in the predicted space use for the south west Wales colonies, with the highest intensity space use predicted to the north and west (maps available at <https://www.mba.ac.uk/projects/dassh-uk-archive-marine-species-and-habitats-data>).
- 8.3.1.31 Maximum foraging ranges of up to 201 km have been recorded with a mean maximum range of 104 km (Soanes *et al.*, 2016). Recent tracking work data used to inform the Wakefield *et al.* (2017) study confirmed that in general Kittiwake space use declines with distance from colony, as would be expected for a central place forager (mean foraging distance of 11.9 km (Inter Quartile range 4.2–30.9), n=583).
- 8.3.1.32 Kittiwake were identified within the marine ornithology data search study area in the ESAS data set at peak densities of 1 per 3 km².

8.4 Assessment of Adverse Effects on Integrity – the META project alone

8.4.1 Potential impacts – installation/decommissioning

Accidental pollution

- 8.4.1.1 There is the potential for the accidental release of pollutants into the marine environment during installation/decommissioning activities, as a result of accidental spillage or leakage for example, to affect marine bird features of the Skomer, Skokholm and the seas off Pembrokeshire SPA foraging in the area. Pollution may include diesel oil from vessels and synthetic chemicals.

Embedded mitigation

- 8.4.1.2 As outlined in Table 10.14 of chapter 10: Marine Ornithology of the Environmental Statement, measures adopted as part of the project include the production of an EMP which will include planning for accidental spills, address all potential contaminant releases and include key emergency contact detail. This will ensure that the potential for release of pollutants from installation and decommissioning activities is minimised. In this manner, accidental release of potential release of contaminants from vessels will be strictly controlled, thus providing protection for marine life across all phases of the project.

Atlantic puffin

- 8.4.1.3 As puffin spend a lot of time on the water surface, initiating dives from it, they are vulnerable to contamination by oil-based pollutants. However, any impact is considered extremely unlikely due to the small and localised scale of the META project, the lack of puffin records at the META sites and the very small densities of puffin recorded at the closest point to the META project (i.e. 0.5 animals per three km²). Furthermore, with the embedded mitigation measures in place as outlined in paragraph 8.4.1.2 (i.e. an EMP in place to cover installation/decommissioning) the risk of an accidental spill occurring is considered to be very low. In the highly unlikely event that pollutants were to enter the Waterway, they would however be rapidly dispersed on the surface and in the water column and subject to twice daily tidal flushing, and so any effects on water quality, and subsequently bird species, would be limited.

Razorbill

- 8.4.1.4 As razorbill spend a lot of time on the water surface, initiating dives from it, they are vulnerable to contamination by oil-based pollutants. However, any impact is considered extremely unlikely due to the small and localised scale of the META project, the lack of records of razorbill at the META sites, and the very small densities of razorbill recorded at the closest point to the META project (i.e. 0.2 animals per three km²). Furthermore, with the embedded mitigation measures in place as outlined in paragraph 8.4.1.2 (i.e. an EMP in place to cover installation/decommissioning) the risk of an accidental spill occurring is considered to be very low. In the highly unlikely event that pollutants were to enter the Waterway, they would however be rapidly dispersed on the surface and in the water column and subject to twice daily tidal flushing, and so any effects on water quality, and subsequently bird species, would be limited.

Common guillemot

- 8.4.1.5 When feeding, common guillemot spend a high proportion of time under water and make multiple dives. This means they spend a relatively high proportion of time on the water surface and as such will be at risk of contamination by oil-based pollutants (McCluskie *et al.*, 2012). However, any impact is considered extremely unlikely due to the small scale of the META project, the very low densities of guillemot recorded at the closest point to the META project (maximum 0.5 animals per 3 km²) and the embedded mitigation measures in place as outlined in paragraph 8.4.1.2.

Kittiwake

- 8.4.1.6 As discussed in paragraph 8.3.1.28, kittiwake spend the majority of their time on the wing and are more opportunistic in feeding and are therefore at a much reduced risk of impacts from accidental pollution as they spend less time on the surface. However, the risk of impacts to kittiwake will be reduced further as a result of the embedded mitigation measures in place as outlined in paragraph 8.4.1.2 (i.e. an EMP in place to cover installation/decommissioning) which will substantially reduce the risk of a spill event occurring.

Conclusions

Skomer, Skokholm and the Seas of Pembrokeshire SPA

- 8.4.1.7 Significant adverse effects on the qualifying Annex II marine ornithological features of the habitats of the Skomer, Skokholm and the Seas of Pembrokeshire SPA are not predicted to occur as a result of the risk of accidental pollution during installation/decommissioning activities at the META sites. Potential effects from this activity on the relevant Conservation Objectives (as presented in paragraph 8.2.1.2) are discussed in turn below.

The size of the population should be stable or increasing, allowing for natural variability, and sustainable in the long term.

- 8.4.1.8 Given the mitigation measures to be implemented during installation/decommissioning activities which will both substantially reduce the likelihood of an accidental pollution event occurring and reduce the magnitude of any impact should an uncontrolled release occur, it is not considered that accidental pollution would result in direct mortality of Atlantic puffin, razorbill, common guillemot or kittiwake features of the SPA. The size of the population will be unchanged and, therefore, this Conservation Objective will be maintained for all species.

The distribution of the population should be being maintained, or where appropriate increasing.

- 8.4.1.9 Although an accidental pollution event may result in localised areas of foraging habitat being unavailable and therefore minor changes to the distribution of the foraging activities of Atlantic puffin, razorbill, common guillemot or kittiwake, the mitigation measures proposed will minimise the extent of such an impact and any effects would be temporary and reversible. Furthermore, the mitigation measures to be implemented will substantially reduce the likelihood of an uncontrolled release occurring. The distribution of the population of each species will be maintained in the long term.

There should be sufficient habitat, of sufficient quality, to support the population in the long term.

- 8.4.1.10 Although an accidental pollution event may result in localised areas of foraging habitat being unavailable, the mitigation measures proposed will minimise the extent of such an impact in the unlikely event that it occurs. Any effects would be temporary and in the long term, foraging and breeding habitats will be maintained.

Factors affecting the population or its habitat should be under appropriate control.

- 8.4.1.11 There is no mechanism by which an accidental pollution event could impact the control of factors affecting the population or habitat of Atlantic puffin, razorbill, common guillemot or kittiwake features of the SPA.

- 8.4.1.12 Therefore, no adverse effect on the integrity of the Skomer, Skokholm and the Seas of Pembrokeshire SPA from this potential impact can be concluded.

8.4.2 Potential impacts – operation and maintenance

Collision with development/vessels

8.4.2.1 The operation of wave and tidal devices at the META sites, including the movement of vessels engaged in operation and maintenance activities has have the potential to result in an increased risk of collision for marine ornithological features of the Skomer, Skokholm and the seas off Pembrokeshire SPA. The maximum and most likely design scenarios for collision risk with structures and vessels, as presented in the chapter 10: Marine Ornithology of the Environmental Statement, are summarised in Table 8.2 below.

Table 8.2: Maximum and most likely design scenarios considered for the assessment of potential impacts on Annex II marine ornithology features from collision risk during operation.

Maximum design scenario	Most likely design scenario
Warrior Way - Scaled or micro tidal devices, instruments, components and subassemblies, monitoring equipment, site preparation. - Up to one device deployment occurring at any one time occupying all or part of the water column and demarked by up to four navigational marker buoys. - Rotor diameter up to 5 m. 20 m x 10 m. - Swept area of 19.63 m². - Speed of moving parts up to 5 m/s. - Up to four deployments in a 12-month period. - Minimum 2m between water surface and tip of turbine blades	Warrior Way - Scaled or micro tidal devices, instruments, components and subassemblies, monitoring equipment, site preparation. - Up to one device deployment occurring at any one time (which may consist of multiple components or activities for testing) occupying all or part of the water column and demarked by up to four navigational marker buoys. 5 m x 5 m. - Swept area of 19.63 m². - Speed of moving parts up to 2 m/s. - Up to two deployments in a 12-month period.
Dale Roads - Scaled or full-scale wave energy converter (WEC) devices, research and monitoring methodologies. - Up to one device deployment occurring at any one time which may occupy a significant proportion of the water column and may include surface-piercing devices, demarked by up to four navigational marker buoys. 30 m (L) x 20 m (W). - Up to 2 m above sea surface. - Up to two devices deployed in a 12-month period.	Dale Roads - Scaled or full-scale WEC devices, research and monitoring methodologies. - Up to one device deployment occurring at any one time which may occupy a significant proportion of the water column and may include surface-piercing devices, demarked by up to four navigational marker buoys. 15 m (L) x 10 m (W). - At sea surface. - Up to one device deployed in a 12-month period.
East Pickard Bay - Scaled or full-scale WEC device testing and component testing for floating offshore wind technology. - Up to two device deployments at any one time which may occupy a significant proportion of the water column and may include surface-piercing, at surface and sub-surface components, demarked by up to four navigational marker buoys. 147 m (L) x 230 m (W).	East Pickard Bay - Scaled or full-scale WEC device testing and component testing for floating offshore wind technology. - Up to one device deployment occurring at any one time (which may occupy a significant proportion of the water column and may include surface-piercing, at surface and sub-surface components, demarked by up to four navigational marker buoys. 80 m (L) x 17 m (W). - At sea surface.

Maximum design scenario	Most likely design scenario
A maximum scenario height of up to 15 m above sea surface will only apply in devices up to a maximum dimension scenario of 60 m length x 60 m width. Where maximum dimensions of a device are over 60 m length x 60 m width, a maximum height of 5 m above sea surface will be applied	Up to one device deployment within the test site in a 12-month period.

Atlantic puffin

8.4.2.2 Puffin are pursuit divers, catching most of their prey within 30 m of the surface and 10 km of the colony. Puffin have been shown to have a strong association with fast horizontal current speeds indicating that they are particularly likely to interact with in-stream tidal installations during the breeding season (Waggitt *et al.*, 2016) and are also therefore susceptible to below surface collision. However, the likelihood of collision with marine energy device testing is considered unlikely due to the META project's small and localised scale, and the very small densities of puffin recorded at the closest point to the META project (0.5 animals per 3 km²). Furthermore, Warrior Way (site 6) is the only META site that will support tidal turbines with a maximum rotor swept area of 12.63 m² at any one time (Table 8.2). Given this site is also located upstream in the Waterway, approximately 20 km from the SPA colony, and given that radio tracking at the Isle of May recorded 64% of puffin flights occur within 2 km of the colony and only 29% more than 10 km (Wanless *et al.*, 1990), the risk of collision between Atlantic puffin and a tidal turbine is considered low.

8.4.2.3 Recent counts of this species on Skomer are increasing with over 21,000 individuals recorded, a significant increase on the 11,497 recorded in 2012. This increasing population trend will likely increase the capacity of the species to adapt to environmental change.

Razorbill

8.4.2.4 With little flight manoeuvrability and low flight height (Garthe and Hüppop, 2004), razorbills will be at higher risk of above surface collisions. Their dives are relatively short and shallow, so they will be less at risk of below surface collisions. They are considered moderately susceptible to disturbance to boat traffic.

8.4.2.5 The likelihood of collision with the marine energy device testing or increasing movement of vessels associated with operation and maintenance of the META project is considered unlikely due to its the Project's small scale and localised nature, and the very small densities of razorbill recorded at the closest point to the META project (2.8 animals per 3 km²).

- 8.4.2.6 Razorbill are a long lived, low breeding productivity species currently facing a variety of pressures due to climate change and overfishing. The trend in abundance of razorbills at Welsh colonies has generally been upward since 1986, with a new peak reached in 2015. However, productivity has shown a sharply declining trend in recent years and the reasons for this are unknown. This will likely compromise their capacity to adapt to change.

Common guillemot

- 8.4.2.7 The main prey items of the adult common guillemot are shoaling pelagic fish, mostly sandeel, herring and sprats, as well as small gadoids, and they are capable of switching prey in response to availability. Prey are caught by pursuit diving, with birds generally diving from the surface, typically to depths of less than 50 m, but up to 200 m on occasions (BirdLife International, 2011).
- 8.4.2.8 Guillemots fly low and have a low flight manoeuvrability (King *et al.*, 2009), and so are at risk of collision with above surface structures. When feeding, they spend a high proportion of time under water and have a fast rate of ascent, meaning they have a high risk of below surface collision. Since they are very capable of prey switching, they may be less at risk from the negative effects of displacement, provided equivalent feeding opportunities are available close to the breeding colony. They are moderately affected by disturbance from boat traffic (Garthe and Hüppop, 2004).
- 8.4.2.9 The likelihood of collision with the marine energy device testing or increasing movement of vessels associated with the installation, operation or decommissioning phases of the META project is considered unlikely due to the Project's small scale and localised nature and the very small densities of guillemot recorded at the closest point to the META project (maximum 0.5 animals per three km²).

Kittiwake

- 8.4.2.10 Kittiwake are pelagic surface feeders feeding in the upper couple of metres of the water column. Due to their low-level flights, kittiwakes are likely to be at moderate risk of surface device collisions. Sub surface collisions and entrapment are less likely as they are visual surface feeders. They are also tolerant of human disturbance, so unlikely to be affected by installation and maintenance activities, and the presence of vessels and helicopters (McCluskie *et al.*, 2012).
- 8.4.2.11 The likelihood of collision with the marine energy device testing or increasing movement of vessels associated with the installation, operation or decommissioning phases of the META project is considered unlikely due to the META project's small scale and localised nature, and the very small densities of kittiwake recorded at the closest point to the META project (0.08 animals per 3 km²).

- 8.4.2.12 Kittiwake are a long lived, low breeding productivity species found across the Northern Atlantic. They are currently facing a variety of pressures largely due to climate change pollution, bycatch and overfishing which may compromise their resilience to environmental change. The population trend is also decreasing in Wales with regular low productivity also recorded in recent years (<http://jncc.defra.gov.uk/page-3201#species>). The species is also identified as vulnerable by IUCN (BirdLife International, 2019).

Conclusions

Skomer, Skokholm and the Seas of Pembrokeshire SPA

- 8.4.2.13 Significant adverse effects on the qualifying Annex II marine ornithological features of the habitats of the Skomer, Skokholm and the Seas of Pembrokeshire SPA are not predicted to occur as a result of the risk of collision with marine energy device testing devices or vessels engaged in operation and maintenance activities. Potential effects from this activity on the relevant Conservation Objectives (as presented in paragraph 8.2.1.2) are discussed in turn below.

The size of the population should be stable or increasing, allowing for natural variability, and sustainable in the long term.

- 8.4.2.14 On the basis that the scale of each device/component deployed will be small and highly localised, the risk of devices/components or vessel movements resulting in a collision risk for Atlantic puffin, razorbill, common guillemot or kittiwake features of the SPA is considered to be low. Furthermore, the predicted densities of these species in the vicinity of the META sites is low and therefore direct mortality is not predicted. As such, operation and maintenance activities are not considered to result in any change to the size of the population or to affect its stability or prevent it from increasing.

The distribution of the population should be being maintained, or where appropriate increasing.

- 8.4.2.15 Given the highly localised nature of the proposed activities at the META sites and the widespread availability of similar habitat in the wider Waterway, collision risk impacts are not considered to affect the distribution of populations of Atlantic puffin, razorbill, common guillemot or kittiwake or prevent them from increasing.

There should be sufficient habitat, of sufficient quality, to support the population in the long term.

- 8.4.2.16 No breeding or foraging habitats that are relied on by Atlantic puffin, razorbill, common guillemot or kittiwake will be lost through collision risk impacts as a result of the operation and maintenance of the project. Whilst collision risk may result in localised areas of the sea surface being unavailable during deployments for foraging by these species, this will only be temporary, and in the long term, foraging and breeding habitats will be maintained.

Factors affecting the population or its habitat should be under appropriate control.

- 8.4.2.17 All proposed META activities within the META sites lie out with the SPA and therefore collision risk impacts are not considered to affect the control of factors affecting each population or its habitat.
- 8.4.2.18 Therefore, no adverse effect on the integrity of the Skomer, Skokholm and the Seas of Pembrokeshire SPA from this potential impact can be concluded.

Accidental pollution

- 8.4.2.19 As discussed in paragraph 8.4.1.1 *et seq.* for the installation/decommissioning phase, there is the potential for the accidental release of pollutants into the marine environment during operation and maintenance activities, as a result of accidental spillage or leakage for example, to affect marine bird features of the Skomer, Skokholm and the seas off Pembrokeshire SPA foraging in the area. Pollution may include diesel oil from vessels and synthetic chemicals.

Embedded mitigation

- 8.4.2.20 As outlined in Table 10.14 of chapter 10: Marine Ornithology of the Environmental Statement, measures adopted as part of the project include the production of an EMP which will include planning for accidental spills, address all potential contaminant releases and include key emergency contact detail. This will ensure that the potential for release of pollutants from installation and decommissioning activities is minimised. In this manner, accidental release of potential release of contaminants from vessels will be strictly controlled, thus providing protection for marine life across all phases of the project.

Atlantic puffin, razorbill, common guillemot and kittiwake

- 8.4.2.21 The sensitivity of the features of the SPA are as described previously in paragraphs 8.4.1.3 to 8.4.1.6. With the embedded mitigation measures in place as outlined in paragraph 8.4.2.20 (i.e. an EMP in place to cover installation/decommissioning), the risk of an accidental spill occurring is considered to be very low. In the highly unlikely event that pollutants were to enter the Waterway, they would however be rapidly dispersed on the surface and in the water column and subject to twice daily tidal flushing, and so any effects on water quality, and subsequently bird species, would be limited.

Conclusions

Skomer, Skokholm and the Seas of Pembrokeshire SPA

- 8.4.2.22 Significant adverse effects on the qualifying Annex II marine ornithological features of the habitats of the Skomer, Skokholm and the Seas of Pembrokeshire SPA are not predicted to occur as a result of the risk of accidental pollution during operation and maintenance activities at the META sites. Potential effects from this activity on the relevant Conservation Objectives (as presented in paragraph 8.2.1.2) are discussed in turn below.

The size of the population should be stable or increasing, allowing for natural variability, and sustainable in the long term.

- 8.4.2.23 Given the mitigation measures to be implemented during operation and maintenance activities which will both substantially reduce the likelihood of an accidental pollution event occurring and reduce the magnitude of any impact should an uncontrolled release occur, it is not considered that accidental pollution would result in direct mortality of Atlantic puffin, razorbill, common guillemot or kittiwake features of the SPA. The size of the population will be unchanged and, therefore, this Conservation Objective will be maintained for all species.

The distribution of the population should be being maintained, or where appropriate increasing.

- 8.4.2.24 Although an accidental pollution event may result in localised areas of foraging habitat being unavailable and therefore minor changes to the distribution of the foraging activities of Atlantic puffin, razorbill, common guillemot or kittiwake, the mitigation measures proposed will minimise the extent of such an impact and any effects would be temporary and reversible. Furthermore, the mitigation measures to be implemented will substantially reduce the likelihood of an uncontrolled release occurring. The distribution of the population of each species will be maintained in the long term.

There should be sufficient habitat, of sufficient quality, to support the population in the long term.

- 8.4.2.25 Although an accidental pollution event may result in localised areas of foraging habitat being unavailable, the mitigation measures proposed will minimise the extent of such an impact in the unlikely event that it occurs. Any effects would be temporary and in the long term, foraging and breeding habitats will be maintained.

Factors affecting the population or its habitat should be under appropriate control.

- 8.4.2.26 There is no mechanism by which an accidental pollution event could impact the control of factors affecting the population or habitat of Atlantic puffin, razorbill, common guillemot or kittiwake features of the SPA.
- 8.4.2.27 Therefore, no adverse effect on the integrity of the Skomer, Skokholm and the Seas of Pembrokeshire SPA from this potential impact can be concluded.

8.5 Assessment of Adverse Effects on Integrity – In-combination

- 8.5.1.1 All of the potential impacts to marine ornithology identified and assessed for the META project alone in section 8.4 are relatively localised and temporary in nature and therefore have limited or no potential to interact with similar changes associated with other projects. None of the impacts considered in section 8.4 were identified for assessment as part of the marine ornithology CIA in chapter 10: Marine Ornithology of the Environmental Statement. On this basis, none of the impacts considered for the META project alone have been brought forward for consideration in the in-combination assessment of the RIAA.

9. SUMMARY

9.1 Effects of site integrity

9.1.1.1 A summary of the conclusions of adverse effect on the integrity of the sites considered within in this RIAA is presented below and in Table 9.1.

9.1.2 Pembrokeshire Marine SAC

9.1.2.1 Based on the information presented above in sections 4 to 7, no adverse effect on the integrity of the Pembrokeshire Marine SAC, with specific regard to the qualifying Annex I benthic habitats, Annex II diadromous fish, marine mammals and other populations for which LSE could not be excluded, is predicted as a result of the META project, either alone or in-combination with other plans and projects.

9.1.3 Limestone Coast of South West Wales SAC

9.1.3.1 Based on the information presented above in section 4, no adverse effect on the integrity of the Limestone Coast of South West Wales SAC, with specific regard to the qualifying Annex I benthic habitats for which LSE could not be excluded, is predicted as a result of the META project, either alone or in-combination with other plans and projects.

9.1.4 Cleddau Rivers SAC

9.1.4.1 Based on the information presented above in sections 5 and 7, no adverse effect on the integrity of the Cleddau Rivers SAC, with specific regard to the qualifying Annex II diadromous fish and other populations for which LSE could not be excluded, is predicted as a result of the META project, either alone or in-combination with other plans and projects.

9.1.5 West Wales Marine SAC

9.1.5.1 Based on the information presented above in section 6, no adverse effect on the integrity of the West Wales Marine SAC, with specific regard to the qualifying Annex II marine mammal populations for which LSE could not be excluded (harbour porpoise), is predicted as a result of the META project, either alone or in-combination with other plans and projects.

9.1.6 Bristol Channel Approaches SAC

9.1.6.1 Based on the information presented above in section 6, no adverse effect on the integrity of the Bristol Channel Approaches SAC, with specific regard to the qualifying Annex II marine mammal populations for which LSE could not be excluded (harbour porpoise), is predicted as a result of the META project, either alone or in-combination with other plans and projects.

9.1.7 North Anglesey Marine SAC

9.1.7.1 Based on the information presented above in section 6, no adverse effect on the integrity of the North Anglesey Marine SAC, with specific regard to the qualifying Annex II marine mammal populations (harbour porpoise), is predicted as a result of the META project, either alone or in-combination with other plans and projects.

9.1.8 Cardigan Bay SAC

9.1.8.1 Based on the information presented above in section 6, no adverse effect on the integrity of the Cardigan Bay SAC, with specific regard to the qualifying Annex II marine mammal populations for which LSE could not be excluded (grey seal), is predicted as a result of the META project, either alone or in-combination with other plans and projects.

9.1.9 Lleyn Peninsula and the Sarnau SAC

9.1.9.1 Based on the information presented above in section 6, no adverse effect on the integrity of the Lleyn Peninsula and the Sarnau SAC, with specific regard to the qualifying Annex II marine mammal populations for which LSE could not be excluded (grey seal), is predicted as a result of the META project, either alone or in-combination with other plans and projects.

9.1.10 Lundy SAC

9.1.10.1 Based on the information presented above in section 6, no adverse effect on the integrity of the Lundy SAC, with specific regard to the qualifying Annex II marine mammal populations for which LSE could not be excluded (grey seal), is predicted as a result of the META project, either alone or in-combination with other plans and projects.

9.1.11 Skomer, Skokholm and the seas off Pembrokeshire SPA

9.1.11.1 Based on the information presented above in section 8, no adverse effect on the integrity of the Skomer, Skokholm and the seas off Pembrokeshire SPA, with specific regard to the qualifying marine ornithological features for which LSE could not be excluded, is predicted as a result of the META project, either alone or in-combination with other plans and projects.

Table 9.1: Summary of conclusions.

Site	Feature	Project phase	Effect	Conclusion - project alone	Conclusion - project in-combination with other plans and projects	
Annex I benthic habitats						
Pembrokeshire Marine SAC	Estuaries Large shallow inlets and bays Reefs	Installation/decommissioning	Temporary habitat disturbance Increased SSCs and sediment deposition Resuspension of contaminated sediments Introduction of INNS Accidental pollution	No adverse effect on site integrity predicted	No adverse effect on site integrity predicted	
		Operation and maintenance	Temporary habitat Loss Temporary habitat disturbance Introduction of INNS Accidental pollution	No adverse effect on site integrity predicted	No adverse effect on site integrity predicted	
	Sandbanks which are slightly covered by sea water all the time Mudflats and sandflats not covered by seawater at low tide Coastal lagoons (*Priority feature) Atlantic salt meadows (<i>Glauco-Puccinellietalia maritima</i> e) Submerged or partially submerged sea caves	Installation/decommissioning	Increased SSCs and sediment deposition Resuspension of contaminated sediments Introduction of INNS Accidental pollution	No adverse effect on site integrity predicted	No adverse effect on site integrity predicted	
			Operation and maintenance	Introduction of INNS Accidental pollution	No adverse effect on site integrity predicted	No adverse effect on site integrity predicted
Annex II diadromous fish						
Pembrokeshire Marine/Sir Benfro Forol SAC	Twaite shad <i>Alosa fallax</i> Sea lamprey <i>Petromyzon marinus</i> River lamprey <i>Lampetra fluviatilis</i> Allis shad <i>Alosa alosa</i>	Installation/decommissioning	Temporary changes to fish and shellfish habitat Increased SSC and sediment deposition Underwater noise Accidental pollution	No adverse effect on site integrity predicted	No adverse effect on site integrity predicted	
		Operation and maintenance	Underwater noise Collision risk Barrier effects Temporary habitat loss Accidental pollution	No adverse effect on site integrity predicted	No adverse effect on site integrity predicted	
Cleddau Rivers/Afonydd Cleddau SAC	Sea lamprey <i>Petromyzon marinus</i> River lamprey <i>Lampetra fluviatilis</i>	Installation/decommissioning	Accidental pollution	No adverse effect on site integrity predicted	No adverse effect on site integrity predicted	
		Operation and maintenance	Collision risk Accidental pollution	No adverse effect on site integrity predicted	No adverse effect on site integrity predicted	
Annex II marine mammals						
Pembrokeshire Marine/Sir Benfro Forol SAC	Grey seal <i>Halichoerus grypus</i>	Installation/decommissioning	Underwater noise Increased SSCs Accidental pollution	No adverse effect on site integrity predicted	No adverse effect on site integrity predicted	

Site	Feature	Project phase	Effect	Conclusion - project alone	Conclusion - project in-combination with other plans and projects
West Wales Marine/Gorllewin Cymru Forol SAC	Harbour porpoise <i>Phocoena phocoena</i>	Operation and maintenance	Underwater noise	No adverse effect on site integrity predicted	No adverse effect on site integrity predicted
			Vessel collision risk		
		Installation/decommissioning	Collision risk with tidal turbine		
			Entanglement risk		
Bristol Channel Approaches/Dynesfeydd Môr Hafren SAC	Harbour porpoise <i>Phocoena phocoena</i>	Operation and maintenance	Changes to hydrodynamic regime	No adverse effect on site integrity predicted	No adverse effect on site integrity predicted
			Accidental pollution		
		Installation/decommissioning	Underwater noise		
			Increased SSCs		
North Anglesey Marine / Gogledd Môn Forol SAC	Harbour porpoise <i>Phocoena phocoena</i>	Operation and maintenance	Accidental pollution	No adverse effect on site integrity predicted	No adverse effect on site integrity predicted
			Underwater noise		
		Installation/decommissioning	Vessel collision risk		
			Collision risk with tidal turbine		
North Channel SAC Rockabill to Dalkey Islands SAC Blasket Islands SAC Roaringwater Bay and Islands SAC	Harbour porpoise <i>Phocoena phocoena</i>	Operation and maintenance	Entanglement risk	No adverse effect on site integrity predicted	No adverse effect on site integrity predicted
			Changes to hydrodynamic regime		
		Installation/decommissioning	Accidental pollution		
			Underwater noise		

Site	Feature	Project phase	Effect	Conclusion - project alone	Conclusion - project in-combination with other plans and projects
Nord Bretagne DH sites proposition de classement du Site d'Importance Communautaire (pSIC) Côte de Granit rose-Sept-Iles zone spéciale de conservation (ZSC) Tregor Goëlo ZSC Baie de Morlaix ZSC Abers - Côtes des legends ZSC Chaussée de Sein ZSC Ouessant-Molène ZSC Mers Celtiques - Talus du golfe de Gascogne pSIC			Vessel collision risk Collision risk with tidal turbine Entanglement risk Changes to hydrodynamic regime Accidental pollution		
		Installation/decommissioning	Underwater noise Accidental pollution	No adverse effect on site integrity predicted	No adverse effect on site integrity predicted
		Operation and maintenance	Underwater noise Vessel collision risk Collision risk with tidal turbine Entanglement risk Changes to hydrodynamic regime Accidental pollution	No adverse effect on site integrity predicted	No adverse effect on site integrity predicted
Cardigan Bay/ Bae Ceredigion SAC	Grey seal <i>Halichoerus grypus</i>				
		Installation/decommissioning	Underwater noise Accidental pollution	No adverse effect on site integrity predicted	No adverse effect on site integrity predicted
		Operation and maintenance	Underwater noise Vessel collision risk Collision risk with tidal turbine Entanglement risk Changes to hydrodynamic regime Accidental pollution	No adverse effect on site integrity predicted	No adverse effect on site integrity predicted
Lleyn Peninsula and the Sarnau/ Pen Llyn a`r Sarnau SAC	Grey seal <i>Halichoerus grypus</i>				
		Installation/decommissioning	Underwater noise Accidental pollution	No adverse effect on site integrity predicted	No adverse effect on site integrity predicted
		Operation and maintenance	Underwater noise Vessel collision risk Collision risk with tidal turbine Entanglement risk Changes to hydrodynamic regime Accidental pollution	No adverse effect on site integrity predicted	No adverse effect on site integrity predicted
Lundy SAC	Grey seal <i>Halichoerus grypus</i>	Installation/decommissioning	Underwater noise Accidental pollution	No adverse effect on site integrity predicted	No adverse effect on site integrity predicted
		Operation and maintenance	Underwater noise Vessel collision risk Collision risk with tidal turbine Entanglement risk Changes to hydrodynamic regime Accidental pollution	No adverse effect on site integrity predicted	No adverse effect on site integrity predicted
Annex II otters					
Pembrokeshire Marine/Sir Benfro Forol SAC	Otter <i>Lutra lutra</i>	Installation/decommissioning	Accidental pollution	No adverse effect on site integrity predicted	No adverse effect on site integrity predicted

Site	Feature	Project phase	Effect	Conclusion - project alone	Conclusion - project in-combination with other plans and projects
Cleddau Rivers/Afonydd Cleddau SAC	Otter <i>Lutra lutra</i>	Operation and maintenance	Vessel noise	No adverse effect on site integrity predicted	No adverse effect on site integrity predicted
			Vessel collision risk		
		Installation/decommissioning	Collision risk with tidal turbine	No adverse effect on site integrity predicted	No adverse effect on site integrity predicted
			Accidental pollution		
Cleddau Rivers/Afonydd Cleddau SAC	Otter <i>Lutra lutra</i>	Operation and maintenance	Vessel noise	No adverse effect on site integrity predicted	No adverse effect on site integrity predicted
			Vessel collision risk		
		Installation/decommissioning	Collision risk with tidal turbine	No adverse effect on site integrity predicted	No adverse effect on site integrity predicted
			Accidental pollution		
Annex II marine ornithology					
Skomer, Skokholm and the seas off Pembrokeshire/Sgomer, Sgogwm a Moroedd Penfro SPA	Atlantic puffin <i>Fratercula arctica</i>	Installation/decommissioning	Accidental pollution	No adverse effect on site integrity predicted	No adverse effect on site integrity predicted
	Razorbill <i>Alca torda</i>				
	Common guillemot <i>Uria aalge</i>	Operation and maintenance	Collision (entrapment) risk with vessels/ structures	No adverse effect on site integrity predicted	No adverse effect on site integrity predicted
	Black-legged kittiwake <i>Rissa tridactyla</i>		Accidental pollution		

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