

MDM Ltd

Tuskar Cable Route Site Investigation Surveys

Habitats Regulations Assessment Report

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COMMERCIAL IN CONFIDENCE



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1. Introduction

1.1 Overview

Proposed plans or projects that have the potential to affect designated nature conservation sites (detailed below) are required to be considered through the Habitats Regulations Assessment (HRA) process under The Conservation of Habitats and Species Regulations 2017 (as amended¹) (the Habitats Regulations).

This Report to Inform Appropriate Assessment (RIAA) considers the work activities (hereafter referred to as ‘works’ or ‘work activities’) required for a marine survey and site investigation works to investigate the feasibility of constructing a new subsea telecoms cable system, Tuskar, through the stages of the HRA process. The report provides the information required by Natural Resources Wales (NRW) to fulfil its function as a ‘competent authority’ under the Habitats Regulations and determine if the proposed works are likely to have a significant effect on the conservation objectives of a European Site, either alone, or in-combination with other plans or projects.

1.2 Project details

McMahon Design and Management Ltd (MDM) is working to identify a cable route to support the proposed installation of a new subsea telecoms cable system, Tuskar, which will link Ireland to the United Kingdom, from a landfall at Kilmore Quay, County Wexford to a landfall at Newgale beach, in Pembrokeshire, southwest Wales. Only works carried out in Welsh waters are being considered in the marine licence application to NRW (works carried out in Irish waters will be covered under the Irish regulatory system).

The site investigation works (hereafter referred to as ‘S. I. works’) will be predominately composed of a geophysical survey and a geotechnical survey (Table 1). A cable route corridor of approximately 500 m width will be surveyed for the marine survey and S. I. works (hereafter referred to as the ‘S. I. Survey Area’), as shown in Figure 1.

1.3 Habitats Regulations Assessments

The Habitats Regulations require that an Appropriate Assessment of the implications of any development consent must be made by the relevant competent authority, in this case NRW,

if a project (or plan) is likely to have a significant effect on the conservation objectives of a European Site (defined below), either alone, or in-combination with other plans or projects.

HRA is generally understood to be a progressive, four stage process which determines Likely Significant Effect (LSE) and, where required, assesses potential adverse impacts on the integrity of a European Site, examines alternative solutions and provides justification of Imperative Reasons of Overriding Public Interest (IROPI) (Planning Inspectorate 2017). Further detail on the process followed and the definition of particular terms, is provided in the methodology (Section 3).

1.4 Structure and purpose of the report

This report provides information on the work activities and the HRA Screening and Appropriate Assessment process. It then carries out that process and presents the results and conclusion. This report provides information to allow NRW (as the competent authority) to determine whether there will be an adverse effect on the integrity of any European Site(s) in view of their Conservation Objectives (COs) as a result of the project.

In the context of a HRA, where the potential for Likely Significant Effects cannot be excluded for a Site, a competent authority must make an Appropriate Assessment of the implications of the plan or project for that site, in view of the Site's Conservation Objectives. The competent authority may agree to the plan or project only after having ruled out adverse effects on the integrity of the European Site. Where an adverse effect on the site's integrity cannot be ruled out, and where there are no alternative solutions, the plan or project can only proceed if there are imperative reasons of overriding public interest (IROPI) and if the necessary compensatory measures can be secured. This RIAA has been undertaken to support the marine licence application for the geotechnical S. I. works. Due to the nature of the geophysical survey, this element of the works is considered to be exempt from requiring a marine licence because it does not involve a deposit or removal from the seabed, however, assessment of potential effects on European Sites is included in this report for completeness.

2. The proposed works

2.1 Location and context

The proposed S. I. works area boundary extends approximately 47 km off the coast of Pembrokeshire, south Wales, to the UK/Ireland Exclusive Economic Zone (EEZ) boundary, with an overall area of approximately 3,427.64 ha. The S. I. Survey Area is indicated in Figure 1, and is comprised of the cable corridor and landfall location. The survey area is not uniform in

width but is predominately 500 m, with some sections varying between 450 – 950 m in width (See Figure 1).

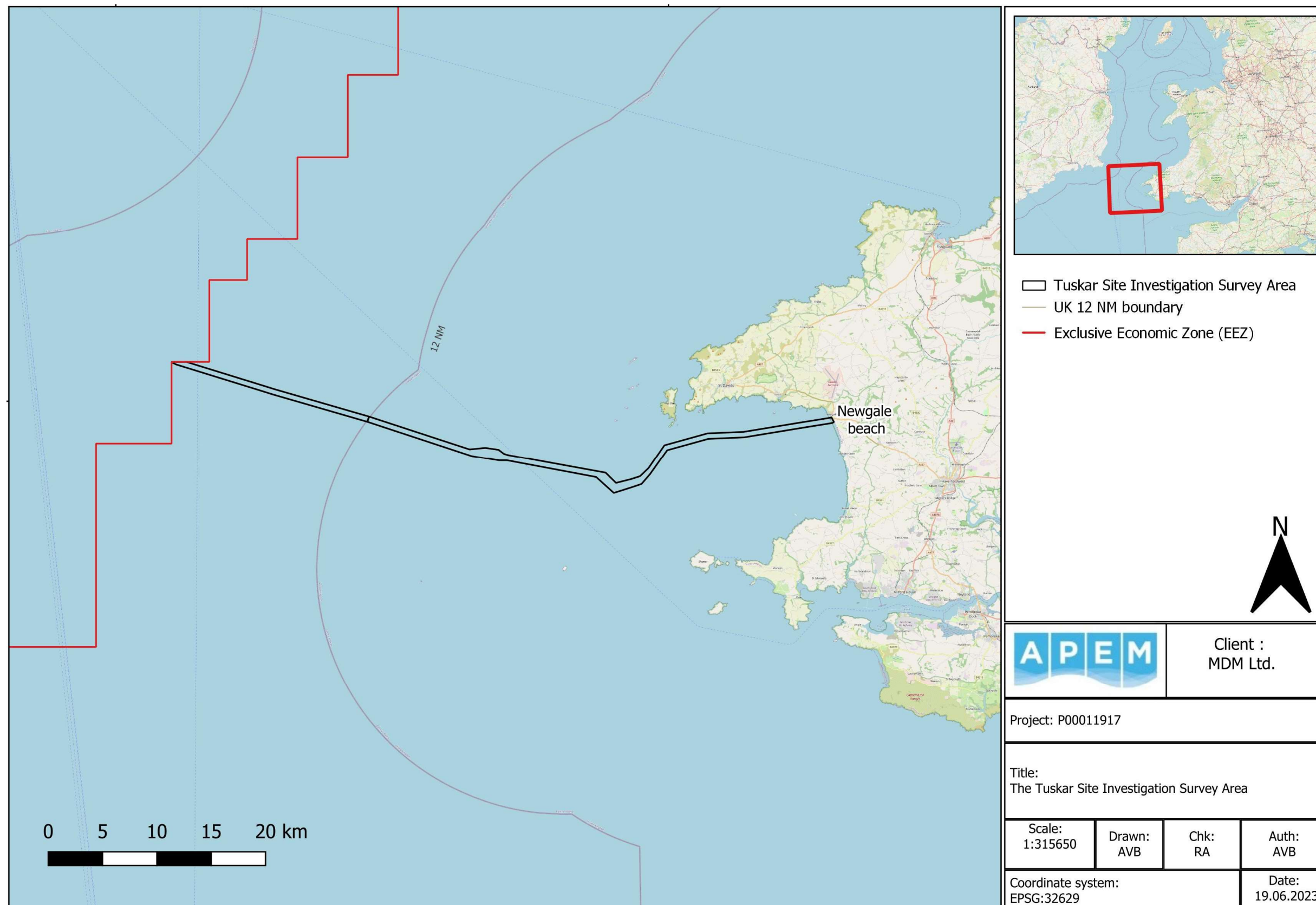


Figure 1. The proposed location for the Site Investigation works.

2.2 Summary of marine works

The objective of the S. I. works is to identify a feasible and safe route for the cable system design, deployment, survivability and subsequent maintenance. The works will also enable further understanding of site conditions including benthic characteristics, bathymetry, underlying geology, possible obstructions and environmental characteristics. A geophysical survey will be conducted using the equipment outlined in Table 1. This will then be followed by a geotechnical and sampling survey using the methods in Table 1. The proposed programme of surveys is also summarised in Table 1. Further information regarding survey methods can be found in the Marine Licence Application Methodology (MDM 2023) that accompanies this RIAA.

Two survey vessels are proposed for this project, namely:

- The Lady Kathleen; and
- The Roman Rebel.

The Lady Kathleen is proposed for acquisition of the geophysical data in shallow water areas within the 12 NM boundary. The Roman Rebel is proposed to survey the deeper areas of the cable routes and to service the geotechnical survey scope. Further details of the vessels proposed to undertake the works can be found in Appendix 2 – Survey Vessels and Equipment.

Should these vessels not be available at the planned commencement of works then comparable alternative vessels will be sourced.

Table 1. Summary of proposed survey methodology and timings.

Category	Survey	Purpose	Sampling / Area	Duration
Geophysical	Multibeam Echo Sounder (MBES)	Map seabed features and/or other cables and pipelines, obstructions, wrecks, debris etc.	Full coverage of Survey Area.	Expected Q3 2023 for a duration of approximately 4 weeks
	Side Scan Sonar (SSS)	Provide interpretation of seabed sediments and identification of any object on seabed larger than 0.5 m.		
	Sub-Bottom Profiler (SBP)	Identify character of shallow geology, locating any structural complexities or geohazards.	Minimum of five lines.	
	Magnetometer Survey	Map any metallic obstacles or hazards, including UXO		
Geotechnical	Grab samples	Representative samples of surficial seabed sediments for laboratory testing.	12 – 16 grab samples (two per location). <i>In situ</i> surficial sampling, at approximately 8 km intervals along the cable route corridor.	Expected to commence August 2023 for a duration of approximately 6 weeks
	Bar probes		8-10 locations on the intertidal and 8-10 locations from low water mark to 3 m.	
	Vibrocore (VC) /		Up to eight samples (120 mm diameter) up	

Category	Survey	Purpose	Sampling / Area	Duration
	Gravity Cores		to 3 m depth along the cable route corridor.	
	Cone Penetration Testing (CPT)		Up to nine CPTs along the cable route corridor up to 3 m depth.	
	Slit Trenches		Four trenches on the beach, using a mini digger/JCB to excavate 0.8 – 1 m width trenches, up to 2.5 m depth.	

3. Assessment Methodology

3.1 Legislative and policy context

3.1.1 *UK (domestic) legislation*

This section describes the legislation as it applies now that the UK has left the European Union (EU). Guidance from the Department for Environment, Food, and Rural Affairs (DEFRA) has been provided on the application of the relevant legislation in the post-Brexit period in their policy paper published on 1st January 2021². The Habitats Regulations provide for the protection of particular habitats, plants and animals through the creation of, and specific decision-making procedures applied to, the 'national site network' (Regulation 3 'Interpretation'). This 'national site network' consists of Special Areas of Conservation (SACs) and Special Protection Areas (SPAs) that were designated both in that period when the UK was a member of the EU and since the UK left the EU.

Since those particular parts of the Habitats Regulations relating to the HRA process continue to refer to the designated sites collectively as 'European Sites', rather than as the 'national site network', that approach has been followed in this HRA Report.

3.1.2 *Policy requirements additional to domestic legislation*

It is UK Government policy that all competent authorities should treat candidate SACs (cSACs) and potential SPAs (pSPAs) as being within the requirements of the Habitats Regulations. In England this is identified in paragraph 176 of the National Planning Policy Framework (DEFRA 2021). In Wales this is identified in paragraph 4.6 and 4.7 of the Developments of National Significance Guidance (The Planning Inspectorate 2019).

Accordingly, in this report the term 'European Site' is used to refer collectively to SACs, cSACs, SPAs and pSPAs.

3.1.3 *International legal and policy obligations*

The UK is a contracting party to the Convention on wetlands of international importance especially as waterfowl habitat, Ramsar, Iran, 1971 (the 'Ramsar Convention') which seeks to protect wetlands of international importance, especially those wetlands utilised as waterfowl habitat.

² Available at: <https://www.gov.uk/government/publications/changes-to-the-habitats-regulations-2017/changes-to-the-habitats-regulations-2017>.

It is UK Government policy that all competent authorities should treat Ramsar Sites in their decision-making processes as if they are SACs or SPAs and hence Ramsar Sites are considered within the requirements for HRA of the Habitats Regulations. In England this is identified in paragraph 176 of the National Planning Policy Framework (DEFRA 2021). In Wales this is identified in paragraph 4.6 and 4.7 of the Developments of National Significance Application Guidance (The Planning Inspectorate 2019). As a consequence, in this report Ramsar Sites are referred to alongside European Sites collectively as European and Ramsar Sites.

3.1.4 *Areas that are functionally linked to European and Ramsar Sites*

Species that are interest features of European and Ramsar Sites may be mobile and not confined to the boundary of the designated site. For example, wintering waterbirds may forage or roost on agricultural land outside of the designated site. Although that agricultural land is not part of the European or Ramsar Site, it is ‘functionally linked’ because it serves a function for waterfowl that are interest features of the designated site. Account has to be taken of such functionally linked land in the HRA process since, for instance, the loss of such land to development could potentially adversely affect the survival of those wintering waterbirds and lead to a reduction in the population of birds within the designated site.

Functionally linked land has been defined as follows (Chapman & Tyldesley 2016):

“The term ‘functional linkage’ refers to the role or ‘function’ that land or sea beyond the boundary of a European Site might fulfil in terms of ecologically supporting the populations for which the site was designated or classified. Such land is therefore ‘linked’ to the European Site in question because it provides an important role in maintaining or restoring the population of qualifying species at favourable conservation status.”

3.2 The HRA process

3.2.1 *Overview*

The requirements of the Habitats Regulations with regard to the implications of plans or projects are set out within Regulation 63. The step-based approach implicit within this Regulation is referred to as a ‘Habitats Regulations Assessment’ (HRA), which is the term that has been used throughout this report.

It is a requirement of any public body, referred to as a ‘competent authority’ within the Habitats Regulations, to carry out a HRA when they are proposing to carry out a project, implement a plan or authorise another party to carry out a plan or project. Competent authorities are required to record the process undertaken, ensuring that there will be no

adverse effects on the integrity of any European or Ramsar Site as a result of a plan or project whether alone or in combination with other plans or projects.

3.2.2 Assessment stages

The assessment of a plan or project goes through a number of stages, with guidance having been published to aid competent authorities to fulfil their responsibilities. Those stages are summarised in Table 2.

Table 2. Stages in the HRA process

Stage	Description	Legislative Context
Purpose	Determines if the purpose of the plan or project is directly connected with, or necessary, to the management of a European or Ramsar Site. If it is, then no further assessment is necessary.	Regulation 63(1)(b)
Identification of sites	The identification of any European or Ramsar Site that are to be considered within a HRA i.e. those sites that should be taken forward to the screening stage based on a wide consideration of spatial and ecological factors. Such a site may be located within the plan or project area but may also include sites located in neighbouring authority areas.	
Screening	Assessment of whether a plan or project, either alone or in combination with other plans or projects, is likely to have a significant effect on any qualifying feature (habitats and species) and the achievement of the conservation objectives of a European or Ramsar Site. This is also known as the 'test of likely significant effect' (ToLSE).	Regulation 63(1)(a)
Appropriate Assessment	Consideration of the effects of the proposals to determine whether or not it is possible to conclude with certainty that the development will not result in any adverse effect on the integrity of European or Ramsar Site, either alone or in combination with other plans or projects and with reference to the conservation objectives of the European or Ramsar Site. This is also known as the test of 'adverse effect on integrity' (AEoI). At this stage consent may be granted for the plan or project if it is possible to conclude with certainty that the proposal will not result in any adverse effect on the integrity of any European or Ramsar Site, either alone or in combination with other plans or projects.	Regulation 63(5)
If it cannot be concluded with certainty that the proposal will not result in any adverse effect on the integrity of any European or Ramsar Site then proceed to:		
Assessment of alternative solutions	Assess whether there is an alternative solution to the plan or project i.e. one that better respect the European or Ramsar Sites. If no such alternative solution exists, the process continues to Assessment of IROPI.	Regulation 64(1)
Assessment of IROPI	Assess whether a plan or project can be justified as being needed for 'imperative reasons of overriding public interest' (IROPI).	Regulation 64(1)
Compensatory measures	Identify and secure any necessary compensatory measures to ensure that the overall coherence of the 'national site network' is protected.	Regulation 68

3.2.3 *In-combination assessment*

The Habitats Regulations, taken with Government policy, require the consideration of the potential effects of a project on European and Ramsar Sites both alone and in-combination with other plans or projects.

The identification of plans and projects to include in the in-combination assessment will be based on:

- approved plans;
- approved, but as yet unconstructed projects; and
- projects for which an application has been made, are currently under consideration and will be consented before the proposed development begin.

3.3 **Guidance on the HRA process**

In preparing this report, consideration has been given to the relevant guidance issued by a number of Governmental, statutory and industry bodies.

Guidance from Government bodies includes:

- Ministry of Housing, Communities and Local Government online Guidance on the use of Habitats Regulations Assessment <https://www.gov.uk/guidance/appropriate-assessment>
- Defra, NE, Welsh Government and NRW guidance on Habitat Regulations Assessments <https://www.gov.uk/guidance/habitats-regulations-assessments-protecting-a-european-site>

Guidance from the Statutory Bodies includes:

- MMO online guidance on Marine Licensing: impact assessments <https://www.gov.uk/guidance/marine-licensing-impact-assessments>
- NRW online guidance on HRA in the marine licensing process <https://naturalresources.wales/permits-and-permissions/marine-licensing/marine-licence-habitats-regulations-assessment/?lang=en>
- NRW's position on the use of Marine Mammal Management Units for screening and assessment in Habitats Regulations Assessments for Special Areas of Conservation with marine mammal features <https://cdn.cyfoethnaturiol.cymru/media/695250/ps006-mmmus-in-hra-position-statement-may22.pdf>

4. Identification of European and Ramsar Sites and features potentially affected by the proposed works

4.1 European and Ramsar Site Identification process

For the screening process, European and Ramsar Sites in the vicinity of the proposed works activities which could potentially be influenced by the proposed works were identified. The different interest features within these sites were then considered individually.

It only requires one site interest feature to be considered to be potentially impacted by the work activities for the European and/or Ramsar Site to be screened into the HRA, along with each of its associated interest features.

This screening used the conceptual 'source-pathway-receptor' model. The model was used to identify potential environmental effects resulting from the works activities. This process provides an easy-to-follow assessment route between impact sources and potentially sensitive receptors ensuring a transparent impact assessment. The parameters of the model are defined as follows:

- source – the origin of a potential effect (noting that one source may have several pathways and receptors);
- pathway – the means by which the effect of the activity could impact a receptor; and
- receptor – the element of the receiving environment that is impacted.

Where there is no pathway, or the pathway is so long that the effect from the source has dissipated to a negligible level before reaching the receptor, there is justification for the screening out of that particular receptor.

Where the receptor (site interest feature) only occurs in the area on a seasonal basis and/or that receptor is not present in the period in which particular activities of the proposed works are a source of a potential effect, there is justification for the screening out of that particular receptor.

4.2 European and Ramsar Sites considered for assessment

The proposed S. I. works area extends from Newgale beach on the southwest Pembrokeshire coastline, south Wales, out to 47 km off the Welsh coast to the EEZ boundary.

The following criteria were used to identify European sites that should be taken through to screening, using a precautionary approach:

- Inclusion of any site within a potential Zone of Influence (Zoi) of 2 km of the investigation area (i.e. including sites with only habitat features, only mobile features, or a combination of the two). This is considered to be highly precautionary for sites with just habitat features;
- Inclusion of any site up to 50 km from the investigation area that contains mobile receptors (not including birds) that have the potential to occur within the investigation area – this applies to marine mammals and fish species;
- For marine mammals, protected sites can be incorporated at greater distances for this receptor, based on NRW guidance (NRW 2022). Where the NRW guidance is not applicable, the Zoi is set at 50 km, which should be regarded as precautionary.
- Inclusion of sites within a 10 km Zoi from the investigation area for coastal birds and within a 20 km Zoi for sites with geese as a qualifying feature given typical commuting ranges between roosting and foraging grounds (Mitchell 2012; SNH 2016); and
- Zoi based on mean max foraging ranges for seabirds (Woodward *et al.* 2019).

Further detail indicating how these distances were determined is provided below.

For benthic habitat features, a 2 km Zoi will be applied. The potential impacts of the expected survey activities include abrasion/penetration of substrate, smothering/siltation rate change and pollution, which pose a potential risk to benthic habitat features. Given the nature of the activities, potential effects will be restricted to the immediate survey area with the exception of an accidental spill event, which may extend beyond the immediate survey area. However, the 2 km Zoi is considered highly precautionary for habitat features.

For some species of marine mammal, such as grey seals and bottlenose dolphins, telemetry data (seal species) and photo-identification data (seal species and bottlenose dolphins), can assist in identifying connectivity to protected areas. These data are often used in the process of designating protected areas. For example, grey seals along the Welsh coast show connectivity between haul-out sites up to 230 km apart; however, photo-identification studies show that on average, grey seals typically remain within 50 km of their preferred haul-out site (Langley *et al.* 2020). As stated above, protected sites can be incorporated at greater distances for marine mammal species, based on NRW guidance (NRW 2022) which takes into account relevant Marine Mammal Management Units, so the 50 km only applies where the NRW guidance is not applicable.

There is no guidance or literature to support a specific distance for the consideration of sites with mobile fish features. Consequently, a distance of 50 km has been used for mobile marine fish species (including anadromous species) as a precautionary approach. Migratory fish could potentially pass through the Zoi if transiting to sites near the S. I. area, however, there would likely also be many routes for migration available outside the Zoi. For migratory fish features

of sites further than 50 km from the S. I. area it is considered that individuals will likely not need to transit through the S. I. area during migration, and if they did, it would only be a small proportion of the population of migratory fish from the SAC. In addition, they would also be able to avoid an area during S. I. works, if required.

For SPAs with birds as qualifying features, an area of interest of 10 km has been adopted for coastal and intertidal bird species, extended to 20 km for geese and swans given typical commuting ranges between roosting and foraging grounds (Mitchell 2012; SNH 2016). For breeding seabird species, published mean-maximum foraging ranges have been used to establish potential connectivity between the S.I Survey Area and designated sites (Woodward *et al.* 2019). For those sites with features where there could be connectivity, they have been considered in the screening stage. There is no guidance or literature to support a specific distance for the consideration of sites with seabird features, however, using professional judgement sites up to 230 km from the S. I. Survey Area have been included in the screening stage to include all sites for seabirds with a lower mean-maximum foraging range (e.g. lesser black-backed gull or kittiwake) which may have connectivity to the S. I. Survey Area. In addition, more distant SPAs which have the potential to be functionally linked (see Section 3.1.4) may be connected to the S. I. Survey Area should they host seabirds with extremely large foraging ranges, such as Manx shearwater, Leach's storm petrel, European storm petrel, fulmar and gannet which have mean maximum foraging ranges between 315.2 and 1,346.8 km. However, no sites over 230 km from the S. I. Survey area have been considered in this report as it is not anticipated that birds from these colonies will reach the S. I. Survey Area in sufficient numbers to warrant inclusion within the assessment. These locations, over 230 km from the S. I. Survey Area, also have no straight-line route to the site without crossing over land and as seabirds generally avoid overland flights this means that foraging distances that would need to be travelled to fly to the S. I. Survey Areas are in effect, much greater than they would be if measured in a straight line.

The European Sites that fall within the criteria described above are listed below. No Ramsar sites were included in the assessment. A total of 11 sites were identified, including six SACs and five SPAs. These protected sites are designated for a variety of habitats and / or bird, fish and marine mammal species as listed in Table 3.

4.1.1 SACs

- Pembrokeshire marine / Sir Benfro Forol SAC (UK0013116)
- West Wales Marine / Gorllewin Cymru Sarnau SAC (UK0030397)
- Bristol Channel Approaches / Dynesteydd Mor Hafren SAC (UK0030396)
- Cardigan Bay / Bae Ceredigion SAC (UK0012712)
- Saltee Islands SAC (IE000707)

- Llyn Peninsula and the Sarnau / Pen Llyn a'r Sarnau SAC (UK0013117)

4.1.2 SPAs

- Skomer, Skokholm and the Seas off Pembrokeshire/ Sgomer, Sgogwm a Moroedd Penfro SPA (UK9014051)
- Grassholm SPA (UK9014041)
- Saltee Islands SPA (004002)
- Wexford Harbour and Slobs SPA (004076)
- Ribble and Alt Estuaries SPA (UK9005103)

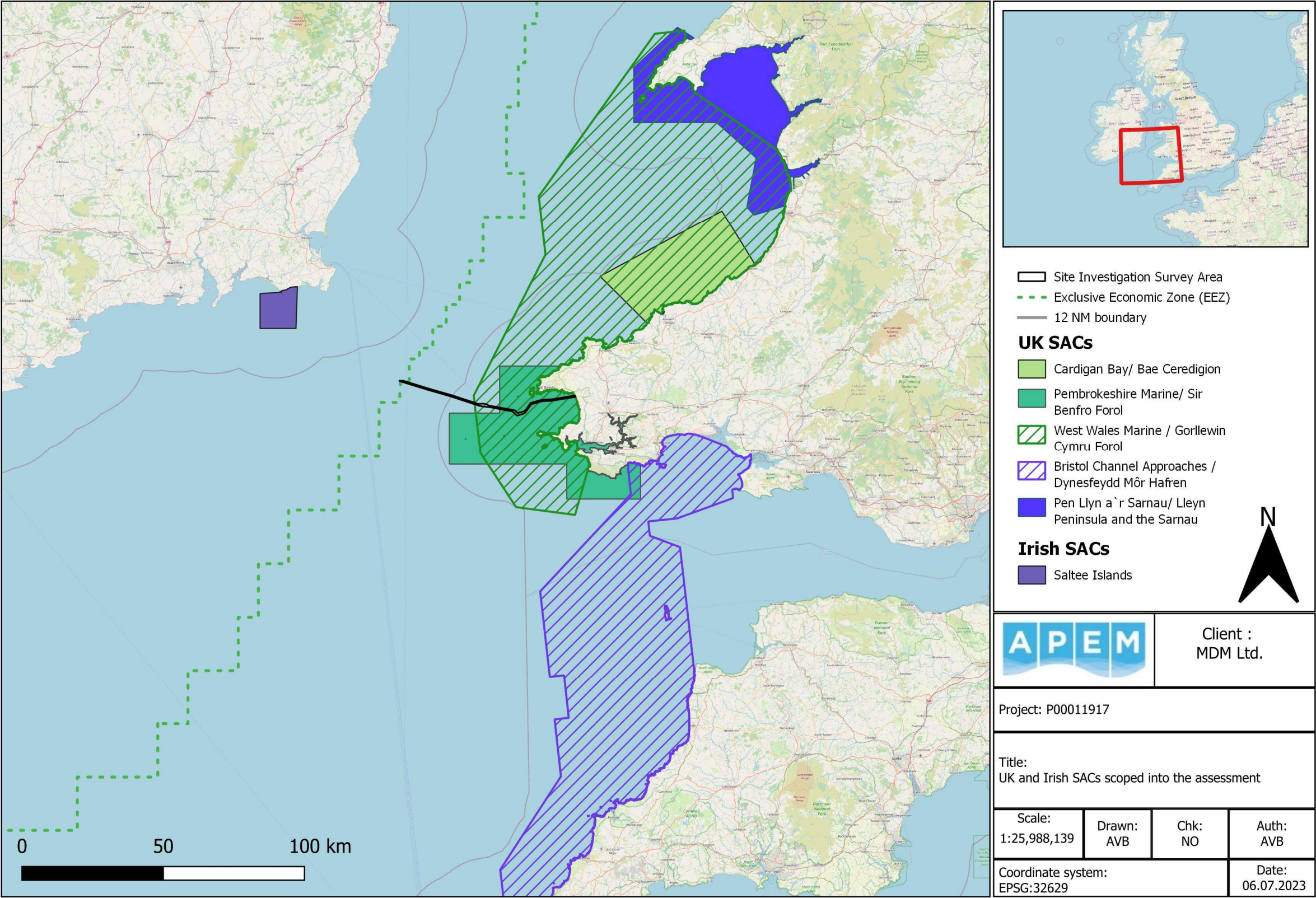


Figure 2. SACs scoped into the assessment based on NRW guidance and/or are within the ZOI (relevant to qualifying features) of the Site Investigation Study Area.

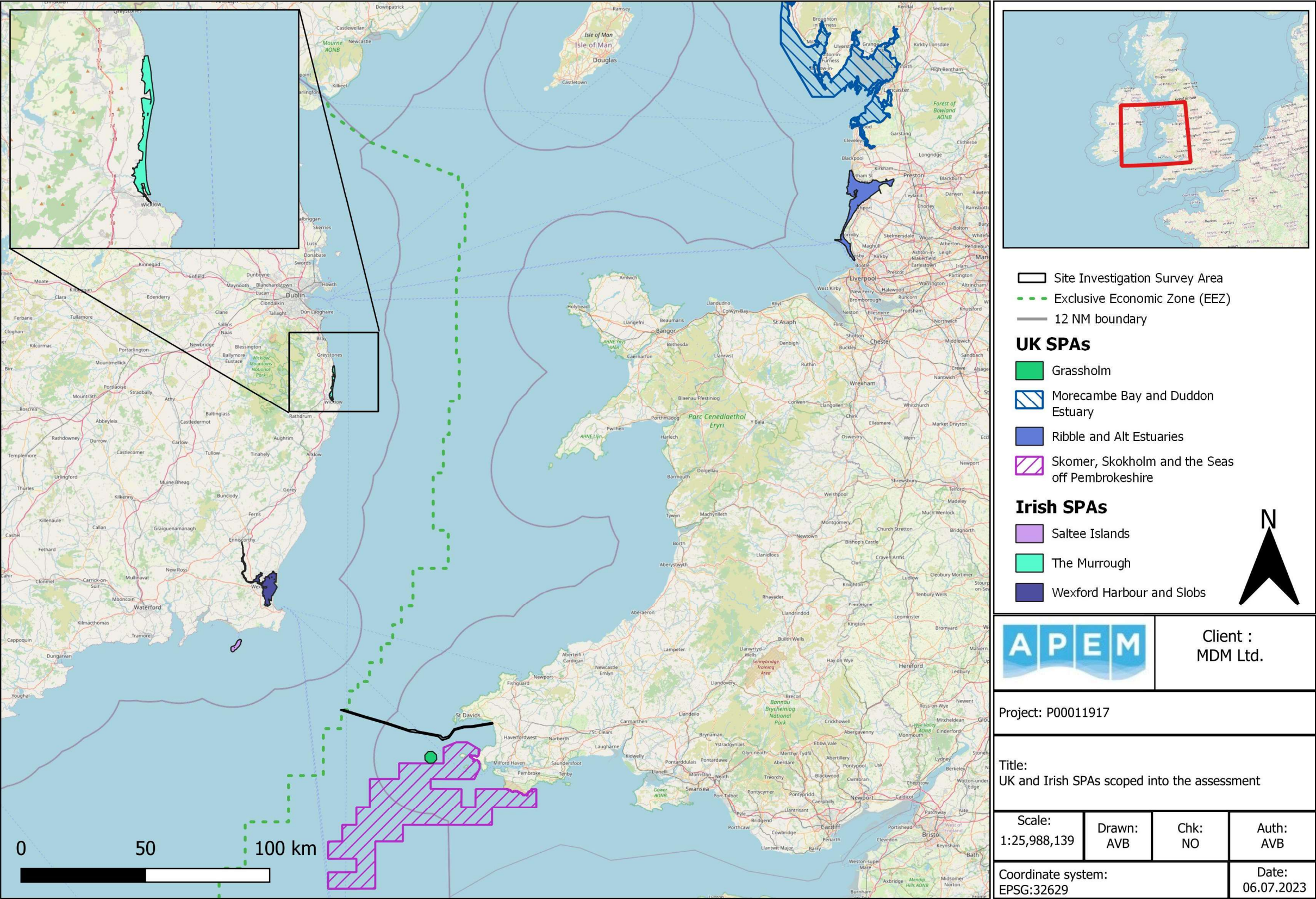


Figure 3. SPAs scoped into the assessment based on NRW guidance and/or are within the Zol (relevant to qualifying features) of the Site Investigation Study Area.

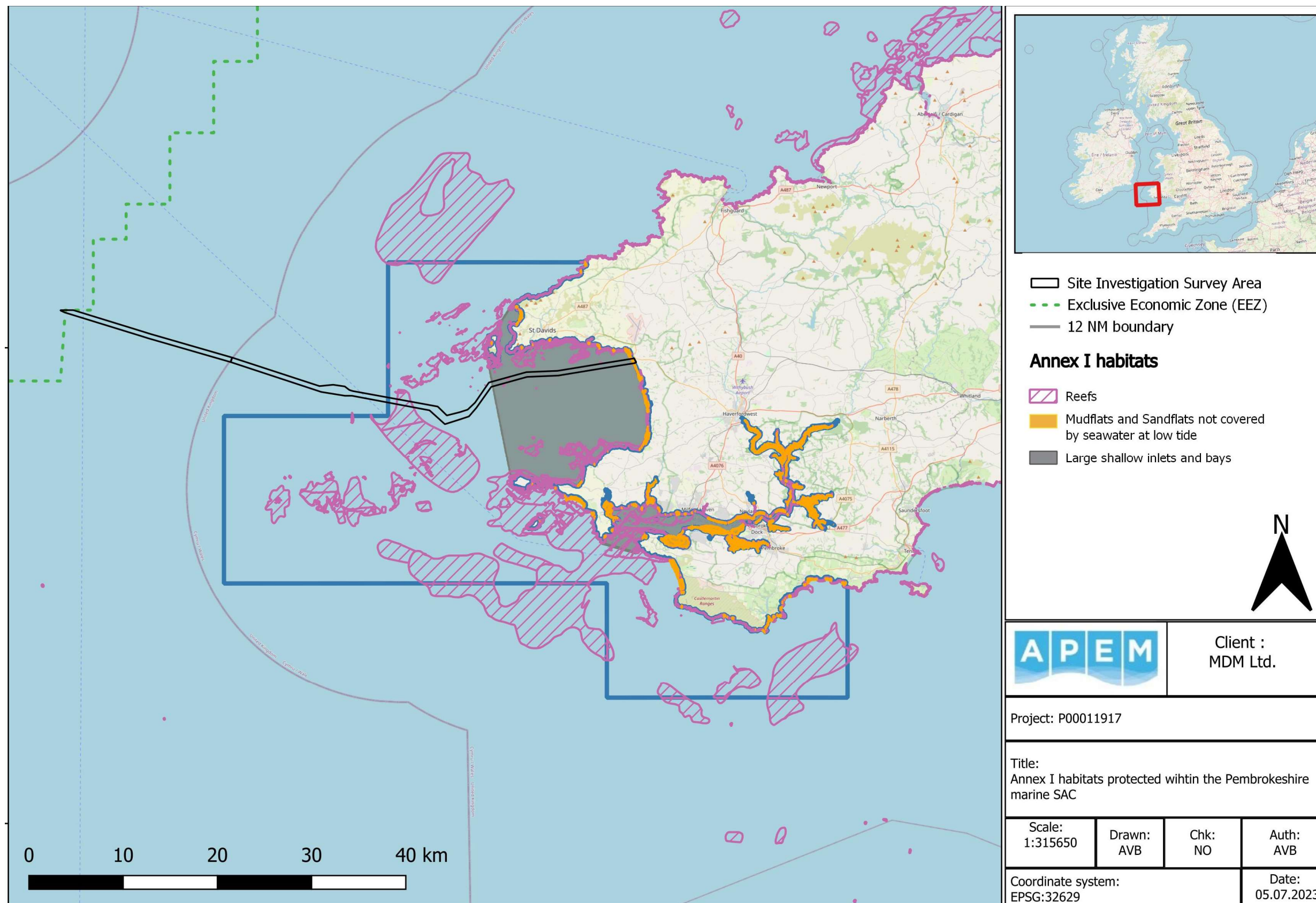


Figure 4. Annex I habitats protected within the Pembrokeshire marine SAC that overlap with the S. I. Survey Area.

4.3 European Site features of interest

Qualifying features of the European Sites that fell within the site selection criteria (as indicated in Section 4.2) and the distance of these sites from the S. I. Survey Area are indicated in Table 3.

Table 3. European Sites included in the assessment. *= Priority, numbers in brackets are site codes

Site	Distance from S. I. Area (km)	Qualifying Features
SACs		
Pembrokeshire marine / Sir Benfro Forol SAC (UK0013116)	0	[1364] Grey seal (<i>Halichoerus grypus</i>) [1140] Mudflats and sandflats not covered by seawater at low tide [1160] Large shallow inlets and bays [1170] Reefs [1095] Sea lamprey (<i>Petromyzon marinus</i>) [1099] River lamprey (<i>Lampetra fluviatilis</i>) [1102] Allis shad (<i>Alosa alosa</i>) [1103] Twaite shad (<i>Alosa fallax</i>) [1355] Otter (<i>Lutra lutra</i>) [1441] Shore dock (<i>Rumex rupestris</i>) [1130] Estuaries [1110] Sandbanks which are slightly covered by sea water all the time [1150] Coastal lagoons [1330] Atlantic salt meadows (<i>Glauco-Puccinellietalia maritimae</i>) [8330] Submerged or partially submerged sea caves
West Wales Marine / Gorllewin Cymru Sarnau SAC (UK0030397)	0	[1351] Harbour Porpoise (<i>Phocoena phocoena</i>)
Bristol Channel Approaches / Dynestydd Mor Hafren SAC (UK0030396)	29.5	[1351] Harbour Porpoise (<i>Phocoena phocoena</i>)
Cardigan Bay / Bae Ceredigion SAC (UK0012712)	35	[1349] Bottlenose dolphin (<i>Tursiops truncatus</i>) [1364] Grey seal (<i>Halichoerus grypus</i>) [1095] Sea lamprey (<i>Petromyzon marinus</i>) [1099] River lamprey (<i>Lampetra fluviatilis</i>) [1110] Sandbanks which are slightly covered by sea water all the time

Site	Distance from S. I. Area (km)	Qualifying Features
		[1170] Reefs [8330] Submerged or partially submerged sea caves
Saltee Islands SAC (IE000707)	39.5	[1364] Grey Seal (<i>Halichoerus grypus</i>) [1140] Mudflats and sandflats not covered by seawater at low tide [1160] Large shallow inlets and bays [1170] Reefs [1230] Vegetated Sea cliffs of the Atlantic and Baltic coasts [8330] Submerged or partially submerged sea caves
Llyn Peninsula and the Sarnau / Pen Llyn a'r Sarnau SAC (UK0013117)	107.8	[1349] Bottlenose dolphin (<i>Tursiops truncatus</i>) [1355] Otter (<i>Lutra lutra</i>) [1364] Grey seal (<i>Halichoerus grypus</i>) [1110] Sandbanks which are slightly covered by sea water all the time [1130] Estuaries [1150] Coastal lagoons [1160] Large shallow inlets and bays [1170] Reefs [1140] Mudflats and sandflats not covered by seawater at low tide [1310] Salicornia and other annuals colonizing mud and sand [1330] Atlantic salt meadows (<i>Glauco-Puccinellietalia maritimae</i>) [8330] Submerged or partially submerged sea caves
SPAs		
Skomer, Skokholm and the Seas off Pembrokeshire/ Sgomer, Sgogwm a Moroedd Penfro (UK9014051)	3.04	[A183] Lesser black-backed gull (<i>Larus fuscus</i>) [A013] Manx shearwater (<i>Puffinus puffinus</i>) [A222] Short-eared owl (<i>Asio flammeus</i>) [A204] Puffin (<i>Fregata arctica</i>) [A014] European storm petrel (<i>Hydrobates pelagicus</i>) [A346] Chough (<i>Pyrrhocorax pyrrhocorax</i>)

Site	Distance from S. I. Area (km)	Qualifying Features
Grassholm (UK9014041)	5.8	[A016] Northern gannet (<i>Morus bassanus</i>)
Saltee Islands SPA (004002)	47.8	[A009] Fulmar (<i>Fulmarus glacialis</i>) [A016] Gannet (<i>Morus bassanus</i>) [A184] Herring Gull (<i>Larus argentatus</i>) [A188] Kittiwake (<i>Rissa tridactyla</i>) [A017] Cormorant (<i>Phalacrocorax carbo</i>) [A018] Shag (<i>Gulosus aristotelis</i>) [A183] Lesser Black-backed Gull (<i>Larus fuscus</i>) [A199] Guillemot (<i>Uria aalge</i>) [A200] Razorbill (<i>Alca torda</i>) [A204] Puffin (<i>Fratercula arctica</i>)
Wexford Harbour and Slobbs SPA (004076)	50.6	[A179] Black-headed Gull (<i>Chroicocephalus ridibundus</i>) [A183] Lesser Black-backed Gull (<i>Larus fuscus</i>) [A004] Little Grebe (<i>Tachybaptus ruficollis</i>) [A005] Great Crested Grebe (<i>Podiceps cristatus</i>) [A017] Cormorant (<i>Phalacrocorax carbo</i>) [A028] Grey Heron (<i>Ardea cinerea</i>) [A037] Bewick's Swan (<i>Cygnus columbianus bewickii</i>) [A038] Whooper Swan (<i>Cygnus cygnus</i>) [A046] Light-bellied Brent Goose (<i>Branta bernicla hrota</i>) [A048] Shelduck (<i>Tadorna tadorna</i>) [A050] Wigeon (<i>Mareca penelope</i>) [A052] Teal (<i>Anas crecca</i>) [A053] Mallard (<i>Anas platyrhynchos</i>) [A054] Pintail (<i>Anas acuta</i>) [A062] Scaup (<i>Aythya marila</i>) [A067] Goldeneye (<i>Bucephala clangula</i>)

Site	Distance from S. I. Area (km)	Qualifying Features
		[A069] Red-breasted Merganser (<i>Mergus serrator</i>) [A082] Hen Harrier (<i>Circus cyaneus</i>) [A125] Coot (<i>Fulica atra</i>) [A130] Oystercatcher (<i>Haematopus ostralegus</i>) [A140] Golden Plover (<i>Pluvialis apricaria</i>) [A141] Grey Plover (<i>Pluvialis squatarola</i>) [A142] Lapwing (<i>Vanellus vanellus</i>) [A143] Knot (<i>Calidris canutus</i>) [A144] Sanderling (<i>Calidris alba</i>) [A149] Dunlin (<i>Calidris alpina</i>) [A156] Black-tailed Godwit (<i>Limosa limosa</i>) [A157] Bar-tailed Godwit (<i>Limosa lapponica</i>) [A160] Curlew (<i>Numenius arquata</i>) [A162] Redshank (<i>Tringa totanus</i>) [A195] Little Tern (<i>Sternula albifrons</i>) [A395] Greenland White-fronted Goose (<i>Anser albifrons flavirostris</i>) [A999] Wetland and Waterbirds
Ribble and Alt Estuaries (UK9005103)	228.5	[A183] Lesser black-backed gull (<i>Larus fuscus</i>) [A054] Pintail (<i>Anas acuta</i>) [A052] Teal (<i>Anas crecca</i>) [A050] Wigeon (<i>Mareca penelope</i>) [A040] Pink-footed goose (<i>Anser brachyrhynchus</i>) [A062] Greater scaup (<i>Aythya marila</i>) [A144] Sanderling (<i>Calidris alba</i>) [A672] Dunlin (<i>Calidris alpina alpina</i>) [A143] Knot (<i>Calidris canutus</i>) [A137] Ringed plover (<i>Charadrius hiaticula</i>)

Site	Distance from S. I. Area (km)	Qualifying Features
		[A037] Bewick's swan (<i>Cygnus columbianus bewickii</i>) [A038] Whooper swan (<i>Cygnus cygnus</i>) [A130] Oystercatcher (<i>Haematopus ostralegus</i>) [A179] Black-headed gull (<i>Chroicocephalus ridibundus</i>) [A157] Bar-tailed godwit (<i>Limosa lapponica</i>) [A616] Black-tailed godwit (<i>Limosa limosa islandica</i>) [A065] Common scoter (<i>Melanitta nigra</i>) [A160] Curlew (<i>Numenius arquata</i>) [A158] Whimbrel (<i>Numenius phaeopus</i>) [A017] Cormorant (<i>Phalacrocorax carbo</i>) [A151] Ruff (<i>Calidris pugnax</i>) [A140] Golden plover (<i>Pluvialis apricaria</i>) [A141] Grey plover (<i>Pluvialis squatarola</i>) [A193] Common tern (<i>Sterna hirundo</i>) [A048] Shelduck (<i>Tadorna tadorna</i>) [A162] Redshank (<i>Tringa totanus</i>) [A142] Lapwing (<i>Vanellus vanellus</i>)

5. Potential effects of proposed works

5.1 The Assessment Process

The process of testing for significant effects considers the adverse effects that might arise from the work activities and identifies whether or not there is a probability that each adverse effect can affect each European Site and their qualifying features.

The process that is followed is to identify if the works will generate effects that could affect any of the interest features of the relevant European Sites. At this point, the pathway will be identified and what may reduce or prevent the effects reaching the relevant European Sites. Only when there is a source, a pathway and an effect that reaches the interest feature is it judged that there is an LSE that requires the more detailed assessment that is carried out at the Appropriate Assessment stage.

Potential adverse effects of the work activities on European Sites have been identified using a combination of:

- Conservation Advice for European Marine Sites under regulation 37(3) of the Habitats Regulations (2017)³;
- Natural England's Advice on Operations (AoO); and
- Professional judgement based on experience of conducting numerous assessments of similar work activities in the vicinity of European Sites.

In Section 6 a table is provided for the Screening Stage of the HRA which tests for LSEs indicating:

- The impact pathway being considered (derived from the above sources and professional judgment);
- The features being assessed;
- Whether alone, or in-combination, there is an LSE for each impact pathway / feature combination; and
- Justification for the assessment.

³ Accessed via <https://naturalresources.wales/guidance-and-advice/environmental-topics/wildlife-and-biodiversity/protected-areas-of-land-and-seas/conservation-advice-for-european-marine-sites/?lang=en>

Impact pathways indicated as being of medium-high risk which could be associated with the work activities and that could affect European Site features were considered in this screening, in line with the AoO guidance. These impact pathways were as follows:

- Above water noise;
- Abrasion / disturbance of the substrate on the surface of the seabed;
- Penetration and/or disturbance of the substratum below the surface of the seabed, including abrasion;
- Visual disturbance;
- Underwater noise changes and vibration;
- Collision (below water and static or moving objects not naturally found in the marine environment);
- Pollution (from vessels and equipment including Hydrocarbon & Polycyclic Aromatic Hydrocarbon (PAH) contamination); and
- Reduction in prey availability (all aspects of survey generating underwater noise and vibration).

Low risk impact pathways would not usually be taken through to screening. However, for some impact pathways indicated as low risk for habitats within the SAC, the feature habitats are indicated to be sensitive to these impact pathways in the AoO. Consequently, a precautionary approach has been taken and the following low risk impact pathways were also considered in this screening:

- Introduction or spread of invasive non-native species (INNS).

The following medium-high risk impact pathways that were not anticipated to be associated with the proposed works and / or did not have the potential to affect designated site features were not included in the screening, in line with the AoO guidance:

- Habitat structure changes - removal of substratum (extraction);
- Barrier to species movement;
- Changes in suspended solids (water clarity);
- Smothering and siltation rate changes (light);
- Physical change (to another seabed type);
- Physical change (to another sediment type);
- Physical loss (to land or freshwater habitat);
- Smothering and siltation rate changes (heavy);

The following low risk impact pathways were also not included in the screening, in line with the AoO guidance:

- Deoxygenation;
- Genetic modification & translocation of indigenous species;
- Introduction of light;
- Introduction of microbial pathogens;
- Introduction of other substances (solid, liquid or gas);
- Litter;
- Nutrient enrichment;
- Organic enrichment;
- Radionuclide contamination;
- Salinity decrease;
- Salinity increase;
- Synthetic compound contamination (inc. pesticides, antifoulants, pharmaceuticals);
- Temperature decrease;
- Temperature increase;
- Transition elements & organo-metal contamination;
- Water flow (tidal current) changes, including sediment transport considerations; and
- Wave exposure changes.

6. Screening: Testing for LSE

The test for LSE for the qualifying features within the European Sites taken forward for assessment is shown in Table 4.

Table 4. HRA screening for European Sites within the vicinity of the Project.

Site name	Qualifying features included for screening (include sub-features and supporting habitats)	Impact Pathway	LSE?	Justification	Screened in / Screened out?
SACs					
Pembrokeshire Marine/ Sir Benfro Forol SAC (UK0013116)	[1364] Grey seal (<i>Halichoerus grypus</i>) [1355] Otter (<i>Lutra lutra</i>)	Underwater noise and vibration	Yes	Survey activities could disturb mobile marine mammal features including grey seals due to underwater noise and vibration, therefore there is potential for LSE. Otters can be found near the coastline where there is a freshwater source. They can use the marine environment to forage; however, foraging is usually close to shore, often within 100 m (Watson 1986). This means they are unlikely to be in the survey area and they have been screened out from further assessment.	Screened In Grey seal Reefs Large shallow inlets and bays Mudflats and sandflats not covered by seawater at low tide Sea lamprey River lamprey Twaite shad Allis shad
		Collision risk	No	The risk of and outcome (e.g. injury or mortality) of collision between marine mammals and vessels is directly influenced by the type of vessel and the speed at which it is travelling (Laist et al. 2001). A review of collisions between vessels and large marine megafauna did find reports of vessel collisions with grey seals (Schoeman et al. 2020). However, vessel collisions appear to be rare, although a lack of reporting and/or witnessing of such events should not be ruled out. Slow speeds and predictable movement (as would be the case for vessels involved in the S. I. works) are known to be key factors in minimising collision risk between vessels and marine mammals (Lusseau 2003, Lusseau et al. 2006). Given	

Site name	Qualifying features included for screening (include sub-features and supporting habitats)	Impact Pathway	LSE?	Justification	Screened in / Screened out?
				the slow speeds and predictable movement of the vessels on survey, the risk of collision is considered negligible and as such, there is no LSE from this impact pathway.	
		Pollution	No	Pollution will be controlled by adhering to relevant MARPOL guidance for pollution prevention and marine pollution legislation for which compliance is required by law. All vessels will be MARPOL compliant. Published guidelines and best working practices will be followed to ensure that the likelihood of accidental spills is extremely low. This compliance is a basic requirement under UK law and should be adhered to even when no European Sites are involved and is therefore not considered mitigation for the purposes of HRA. Furthermore, in the event of a spill, the volumes of potential contaminants released would likely be small and would rapidly disperse, thus any effects would be anticipated to be negligible, and therefore will have no LSE.	
		Reduction in prey availability (all aspects of survey generating underwater noise and vibration)	No	Prey species of grey seals may be disturbed by the survey activities; however, the number of individuals affected will be small in relation to the availability of prey in the wider area. The activity is relatively short in nature, meaning any displacement of prey is likely to be short term. Grey seals are highly mobile and could move to other nearby prey patches, therefore, any potential impact on prey species is likely to have negligible to no effect and there will be no LSE.	

Site name	Qualifying features included for screening (include sub-features and supporting habitats)	Impact Pathway	LSE?	Justification	Screened in / Screened out?
				As indicated above, otters are unlikely to be in the survey area and they have been screened out from further assessment.	
	[1095] Sea lamprey (<i>Petromyzon marinus</i>) [1099] River lamprey (<i>Lampetra fluviatilis</i>) [1102] Allis shad (<i>Alosa alosa</i>) [1103] Twaite shad (<i>Alosa fallax</i>)	Underwater noise and vibration	Yes	Survey activities could disturb mobile fish features including sea lamprey, river lamprey, twaite shad and allis shad due to underwater noise and vibration, therefore there is potential for LSE.	
		Pollution	No	Pollution will be controlled by adhering to relevant MARPOL guidance for pollution prevention and marine pollution legislation for which compliance is required by law. All vessels will be MARPOL compliant. Published guidelines and best working practices will be followed to ensure that the likelihood of accidental spills is extremely low. This compliance is a basic requirement under UK law and should be adhered to even when no European Sites are involved and is therefore not considered mitigation for the purposes of HRA. Furthermore, in the event of a spill, the volumes of potential contaminants released would likely be small and would rapidly disperse, thus any effects would be anticipated to be negligible, and therefore will have no LSE.	

Site name	Qualifying features included for screening (include sub-features and supporting habitats)	Impact Pathway	LSE?	Justification	Screened in / Screened out?
	[1140] Mudflats and sandflats not covered by seawater at low tide. [1160] Large shallow inlets and bays [1170] Reefs [1441] Shore dock (<i>Rumex rupestris</i>) [1130] Estuaries [1110] Sandbanks which are slightly covered by sea water all the time	Abrasion / disturbance of the surface of the seabed	Yes	The proposed S. I. Survey Area directly overlaps with Reefs, Large shallow inlets and bays as well as Mudflat and sandflats not covered by sea water at low tide within the Pembroke Marine SAC. Survey activities could cause abrasion/disturbance of the seabed, especially relating to invasive survey activities such as grab sampling, Cone Penetration Testing (CPT) and vibrocoring. There is therefore the potential for LSE for these habitats from this impact pathway. The survey activities do not overlap with the designated habitat features Estuaries, Sandbank which are slightly covered by sea water all the time, Coastal lagoons, Atlantic salt meadows or Submerged or partially submerged sea caves. Similarly, there is no overlap with the designated feature Shore dock. There is therefore no potential for LSE for these features from this impact pathway.	
	[1150] Coastal lagoons [1330] Atlantic salt meadows (<i>Glauco-Puccinellietalia maritima</i>) [8330] Submerged or partially submerged sea caves	Penetration and/or disturbance of the substratum below the surface of the seabed, including abrasion	Yes	The proposed S. I. Survey Area directly overlaps with reef, large shallow inlets and bay as well as mudflat habitats within the Pembroke Marine SAC. Survey activities could cause abrasion / penetration / disturbance of the seabed, especially pertaining to invasive survey activities such as grab sampling, Cone Penetration Testing (CPT) and vibrocoring. There is therefore the potential for LSE for these habitats from this impact pathway. The survey activities do not overlap with the designated habitat features Estuaries, Sandbank which are slightly covered by sea water all the time, Coastal lagoons, Atlantic salt meadows or Submerged or partially	

Site name	Qualifying features included for screening (include sub-features and supporting habitats)	Impact Pathway	LSE?	Justification	Screened in / Screened out?
				submerged sea caves. Similarly, there is no overlap with the designated feature Shore dock. There is therefore no potential for LSE for these features from this impact pathway.	
		Pollution	No	Pollution will be controlled by adhering to relevant MARPOL guidance for pollution prevention and marine pollution legislation for which compliance is required by law. All vessels will be MARPOL compliant. Published guidelines and best working practices will be followed to ensure that the likelihood of accidental spills is extremely low. This compliance is a basic requirement under UK law and should be adhered to even when no European Sites are involved and is therefore not considered mitigation for the purposes of HRA. Furthermore, in the event of a spill, the volumes of potential contaminants released would likely be small and would rapidly disperse, thus any effects would be anticipated to be negligible, and therefore will have no LSE.	
		Introduction or spread of invasive non-native species (INNS)	No	All activities will follow best practice guidance for cleaning and maintenance of equipment and vessels to reduce the potential of transporting or introducing INNS. The transport of INNS through ballast water is unlikely as the vessels used are expected not to require ballast due to their size. As such, there would be no LSE on the qualifying features of the Pembrokeshire Marine / Sir Benfro Forol SAC as a result of Introduction of INNS.	

Site name	Qualifying features included for screening (include sub-features and supporting habitats)	Impact Pathway	LSE?	Justification	Screened in / Screened out?
West Wales Marine / Gorllewin Cymru Sarnau SAC (UK0030397)	[1351] Harbour Porpoise (<i>Phocoena phocoena</i>)	Underwater noise & Vibration	Yes	Survey activities could disturb harbour porpoise due to underwater noise and vibration, therefore there is potential for LSE.	Screened In Harbour porpoise
		Collision risk	No	The risk of and outcome (e.g. injury or mortality) of collision between marine mammals and vessels is directly influenced by the type of vessel and the speed at which it is travelling (Laist et al. 2001). Studies from the UK suggest that incidents of mortality or injury of harbour porpoise caused by vessels remain a very rare occurrence, although numerous instances are expected to remain unreported (Thompson et al. 2013; Deaville et al. 2018). Of 537 post-mortem examinations on stranded harbour porpoises in the UK between 2011 and 2017, 10 deaths (1.9%) were attributed to probable effect of a vessel collision (Deaville et al. 2018). A further 33 harbour porpoises died from physical trauma of unknown origin, which may be the result of vessel strike but could also be undiagnosed bycatch or caused by bottlenose dolphin attacks (Deaville et al. 2018). Slow speeds and predictable movement (as would be the case for vessels involved in the S. I. works) are known to be key factors in minimising collision risk between vessels and marine mammals (Lusseau 2003; Lusseau et al. 2006). Given the slow speeds and predictable movement of the vessels on survey, the risk of collision is considered negligible and as such, there is no LSE from this impact pathway.	

Site name	Qualifying features included for screening (include sub-features and supporting habitats)	Impact Pathway	LSE?	Justification	Screened in / Screened out?
		Pollution	No	Pollution will be controlled by adhering to relevant MARPOL guidance for pollution prevention and marine pollution legislation for which compliance is required by law. All vessels will be MARPOL compliant. Published guidelines and best working practices will be followed to ensure that the likelihood of accidental spills is extremely low. This compliance is a basic requirement under UK law and should be adhered to even when no European Sites are involved and is therefore not considered mitigation for the purposes of HRA. Furthermore, in the event of a spill, the volumes of potential contaminants released would likely be small and would rapidly disperse, thus any effects would be anticipated to be negligible, and therefore will have no LSE.	
		Reduction in prey availability (all aspects of survey generating underwater noise and vibration)	No	Prey species of harbour porpoise may be disturbed by the survey activities; however, the number of individuals affected will be small in relation to the availability of prey in the wider area. The activity is relatively short in nature, meaning any displacement of prey is likely to be short term. Harbour porpoises are highly mobile and could move to other nearby prey patches, therefore, any potential impact on prey species is likely to have negligible to no effect and there will be no LSE.	
Bristol Channel Approaches / Dynestydd Mor	[1351] Harbour Porpoise (<i>Phocoena phocoena</i>)	Underwater noise & Vibration	Yes	Survey activities could disturb harbour porpoise due to underwater noise and vibration, therefore there is potential for LSE.	Screened In Harbour porpoise
		Collision risk	No	The risk of and outcome (e.g. injury or mortality) of collision between marine mammals and vessels is directly influenced by the type of vessel	

Site name	Qualifying features included for screening (include sub-features and supporting habitats)	Impact Pathway	LSE?	Justification	Screened in / Screened out?
Hafren (UK0030396)				and the speed at which it is travelling (Laist et al. 2001). Studies from the UK suggest that incidents of mortality or injury of harbour porpoise caused by vessels remain a very rare occurrence, although numerous instances are expected to remain unreported (Thompson et al. 2013; Deaville et al. 2018). Of 537 post-mortem examinations on stranded harbour porpoises in the UK between 2011 and 2017, 10 deaths (1.9%) were attributed to probable effect of a vessel collision (Deaville et al. 2018). A further 33 harbour porpoises died from physical trauma of unknown origin, which may be the result of vessel strike but could also be undiagnosed bycatch or caused by bottlenose dolphin attacks (Deaville et al. 2018). Slow speeds and predictable movement (as would be the case for vessels involved in the S. I. works) are known to be key factors in minimising collision risk between vessels and marine mammals (Lusseau 2003; Lusseau et al. 2006). Given the slow speeds and predictable movement of the vessels on survey, the risk of collision is considered negligible and as such, there is no LSE from this impact pathway.	

Site name	Qualifying features included for screening (include sub-features and supporting habitats)	Impact Pathway	LSE?	Justification	Screened in / Screened out?
		Pollution	No	Pollution will be controlled by adhering to relevant MARPOL guidance for pollution prevention and marine pollution legislation for which compliance is required by law. All vessels will be MARPOL compliant. Published guidelines and best working practices will be followed to ensure that the likelihood of accidental spills is extremely low. This compliance is a basic requirement under UK law and should be adhered to even when no European Sites are involved and is therefore not considered mitigation for the purposes of HRA. Furthermore, in the event of a spill, the volumes of potential contaminants released would likely be small and would rapidly disperse, thus any effects would be anticipated to be negligible, and therefore will have no LSE.	
		Reduction in prey availability (all aspects of survey generating underwater noise and vibration)	No	Prey species of harbour porpoise may be disturbed by the survey activities; however, the number of individuals effected will be small in relation to the availability of prey in the wider area. The activity is relatively short in nature, meaning any displacement of prey is likely to be short term. Harbour porpoise are highly mobile and could move to other nearby prey patches, therefore, any potential impact on prey species is likely to have negligible to no effect and there will be no LSE.	
Cardigan Bay / Bae Ceredigion (UK0012712)	[1349] Bottlenose dolphin (<i>Tursiops truncatus</i>)	Underwater noise & Vibration	Yes	Survey activities could disturb designated mobile features (bottlenose dolphin, grey seals, sea lamprey and river lamprey) due to underwater noise and vibration, therefore there is potential for LSE.	Screened in Bottlenose dolphin

Site name	Qualifying features included for screening (include sub-features and supporting habitats)	Impact Pathway	LSE?	Justification	Screened in / Screened out?
	[1364] Grey seal (<i>Halichoerus grypus</i>)	Collision risk	No	The risk of and outcome (e.g. injury or mortality) of collision between marine mammals and vessels is directly influenced by the type of vessel and the speed at which it is travelling (Laist et al. 2001). A review of collisions between vessels and large marine megafauna did find reports of vessel collisions with grey seals (Schoeman et al. 2020). However, vessel collisions appear to be rare, although a lack of reporting and/or witnessing of such events should not be ruled out. Of 23 post-mortem examinations on stranded bottlenose dolphins in the UK between 2011 and 2017, no deaths were attributed to probable effect of a vessel collision, and one animal died from physical trauma of unknown origin (Deaville et al. 2018). Slow speeds and predictable movement (as would be the case for vessels involved in the S. I. works) are known to be key factors in minimising collision risk between vessels and marine mammals (Lusseau 2003; Lusseau et al. 2006). Given the slow speeds and predictable movement of the vessels on survey, the risk of collision is considered negligible and as such, there is no LSE from this impact pathway.	Grey seal Sea lamprey River lamprey

Site name	Qualifying features included for screening (include sub-features and supporting habitats)	Impact Pathway	LSE?	Justification	Screened in / Screened out?
		Pollution	No	Pollution will be controlled by adhering to relevant MARPOL guidance for pollution prevention and marine pollution legislation for which compliance is required by law. All vessels will be MARPOL compliant. Published guidelines and best working practices will be followed to ensure that the likelihood of accidental spills is extremely low. This compliance is a basic requirement under UK law and should be adhered to even when no European Sites are involved and is therefore not considered mitigation for the purposes of HRA. Furthermore, in the event of a spill, the volumes of potential contaminants released would likely be small and would rapidly disperse, thus any effects would be anticipated to be negligible, and therefore will have no LSE.	
		Reduction in prey availability (all aspects of survey generating underwater noise and vibration)	No	Prey species of bottlenose dolphins and grey seals may be disturbed by the survey activities; however, the number of individuals effected will be small in relation to the availability of prey in the wider area. The activity is relatively short in nature, meaning any displacement of prey is likely to be short term. Bottlenose dolphins and grey seals are highly mobile and could move to other nearby prey patches, therefore, any potential impact on prey species is likely to have negligible to no effect and there will be no LSE.	
	[1095] Sea lamprey (<i>Petromyzon marinus</i>)	Underwater noise & Vibration	Yes	Survey activities could disturb designated mobile features (bottlenose dolphin, grey seals, sea lamprey and river lamprey) due to underwater noise and vibration, therefore there is potential for LSE.	

Site name	Qualifying features included for screening (include sub-features and supporting habitats)	Impact Pathway	LSE?	Justification	Screened in / Screened out?
	[1099] River lamprey (<i>Lampetra fluviatilis</i>)	Pollution	No	Pollution will be controlled by adhering to relevant MARPOL guidance for pollution prevention and marine pollution legislation for which compliance is required by law. All vessels will be MARPOL compliant. Published guidelines and best working practices will be followed to ensure that the likelihood of accidental spills is extremely low. This compliance is a basic requirement under UK law and should be adhered to even when no European Sites are involved and is therefore not considered mitigation for the purposes of HRA. Furthermore, in the event of a spill, the volumes of potential contaminants released would likely be small and would rapidly disperse, thus any effects would be anticipated to be negligible, and therefore will have no LSE.	
	[1110] Sandbanks which are slightly covered by sea water all the time	Abrasion / disturbance of the surface of the seabed	No	There is no overlap between the survey activities and the designated habitat features. As such, there is no potential for LSE on these features from this impact pathway.	Screened out
	[1170] Reefs [8330] Submerged or partially submerged sea caves	Penetration and/or disturbance of the substratum below the surface of the seabed, including abrasion	No	There is no overlap between the survey activities and the designated habitat features. As such, there is no potential for LSE on these features from this impact pathway.	

Site name	Qualifying features included for screening (include sub-features and supporting habitats)	Impact Pathway	LSE?	Justification	Screened in / Screened out?
		Pollution	No	Pollution will be controlled by adhering to relevant MARPOL guidance for pollution prevention and marine pollution legislation for which compliance is required by law. All vessels will be MARPOL compliant. Published guidelines and best working practices will be followed to ensure that the likelihood of accidental spills is extremely low. This compliance is a basic requirement under UK law and should be adhered to even when no European Sites are involved and is therefore not considered mitigation for the purposes of HRA. Furthermore, in the event of a spill, the volumes of potential contaminants released would likely be small and would rapidly disperse, thus any effects would be anticipated to be negligible, and therefore will have no LSE.	
		Introduction or spread of invasive non-native species (INNS)	No	All activities will follow best practice guidance for cleaning and maintenance of equipment and vessels to reduce the potential of transporting or introducing INNS. The transport of INNS through ballast water is unlikely as the vessels used are expected not to require ballast due to their size. As such, there would be no LSE on the qualifying features of the Pembrokeshire Marine / Sir Benfro Forol SAC as a result of Introduction of INNS.	
Saltee Islands (IE000707)	[1364] Grey Seal (<i>Halichoerus grypus</i>)	Underwater noise & Vibration	Yes	Survey activities could disturb grey seals due to underwater noise and vibration, therefore there is potential for LSE.	Screened in Grey seal

Site name	Qualifying features included for screening (include sub-features and supporting habitats)	Impact Pathway	LSE?	Justification	Screened in / Screened out?
		Collision risk	No	The risk of and outcome (e.g. injury or mortality) of collision between marine mammals and vessels is directly influenced by the type of vessel and the speed at which it is travelling (Laist et al. 2001). A review of collisions between vessels and large marine megafauna did find reports of vessel collisions with grey seals (Schoeman et al. 2020). However, vessel collisions appear to be rare, although a lack of reporting and/or witnessing of such events should not be ruled out. Slow speeds and predictable movement (as would be the case for vessels involved in the S. I. works) are known to be key factors in minimising collision risk between vessels and marine mammals (Lusseau 2003, Lusseau et al. 2006). Given the slow speeds and predictable movement of the vessels on survey, the risk of collision is considered negligible and as such, there is no LSE from this impact pathway.	

Site name	Qualifying features included for screening (include sub-features and supporting habitats)	Impact Pathway	LSE?	Justification	Screened in / Screened out?
		Pollution	No	Pollution will be controlled by adhering to relevant MARPOL guidance for pollution prevention and marine pollution legislation for which compliance is required by law. All vessels will be MARPOL compliant. Published guidelines and best working practices will be followed to ensure that the likelihood of accidental spills is extremely low. This compliance is a basic requirement under UK law and should be adhered to even when no European Sites are involved and is therefore not considered mitigation for the purposes of HRA. Furthermore, in the event of a spill, the volumes of potential contaminants released would likely be small and would rapidly disperse, thus any effects would be anticipated to be negligible, and therefore will have no LSE.	
		Reduction in prey availability (all aspects of survey generating underwater noise and vibration)	No	Prey species of grey seals may be disturbed by the survey activities; however, the number of individuals effected will be small in relation to the availability of prey in the wider area. The activity is relatively short in nature, meaning any displacement of prey is likely to be short term. Grey seals are highly mobile and could move to other nearby prey patches, therefore, any potential impact on prey species is likely to have negligible to no effect and there will be no LSE.	
	[1140] Mudflats and sandflats not covered by seawater at low tide	Abrasion / disturbance of the surface of the seabed	No	There is no overlap between the survey activities and the designated habitat features. As such, there is no potential for LSE on these features from this impact pathway.	Screened out

Site name	Qualifying features included for screening (include sub-features and supporting habitats)	Impact Pathway	LSE?	Justification	Screened in / Screened out?
	[1160] Large shallow inlets and bays [1170] Reefs [1230] Vegetated Sea cliffs of the Atlantic and Baltic coasts [8330] Submerged or partially submerged sea caves	Penetration and/or disturbance of the substratum below the surface of the seabed, including abrasion	No	There is no overlap between the survey activities and the designated habitat features. As such, there is no potential for LSE on these features from this impact pathway.	
		Pollution	No	Pollution will be controlled by adhering to relevant MARPOL guidance for pollution prevention and marine pollution legislation for which compliance is required by law. All vessels will be MARPOL compliant. Published guidelines and best working practices will be followed to ensure that the likelihood of accidental spills is extremely low. This compliance is a basic requirement under UK law and should be adhered to even when no European Sites are involved and is therefore not considered mitigation for the purposes of HRA. Furthermore, in the event of a spill, the volumes of potential contaminants released would likely be small and would rapidly disperse, thus any effects would be anticipated to be negligible, and therefore will have no LSE.	
		Introduction or spread of invasive non-native species (INNS)	No	All activities will follow best practice guidance for cleaning and maintenance of equipment and vessels to reduce the potential of transporting or introducing INNS. The transport of INNS through ballast water is unlikely as the vessels used are expected not to require ballast due to their size. As such, there would be no LSE on the qualifying	

Site name	Qualifying features included for screening (include sub-features and supporting habitats)	Impact Pathway	LSE?	Justification	Screened in / Screened out?
				features of the Pembrokeshire Marine / Sir Benfro Forol SAC as a result of Introduction of INNS.	
Lleyn Peninsula and the Sarnau / Pen Llyn a'r Sarnau (UK0013117)	[1349] Bottlenose dolphin (<i>Tursiops truncatus</i>) [1355] Otter (<i>Lutra lutra</i>) [1364] Grey seal (<i>Halichoerus grypus</i>)	Underwater noise & Vibration	Yes	Survey activities could disturb bottlenose dolphins and grey seals due to underwater noise and vibration, therefore there is potential for LSE.	Screened in Bottlenose dolphin Grey seal
		Collision risk	No	The risk of and outcome (e.g. injury or mortality) of collision between marine mammals and vessels is directly influenced by the type of vessel and the speed at which it is travelling (Laist <i>et al.</i> 2001). A review of collisions between vessels and large marine megafauna did find reports of vessel collisions with grey seals (Schoeman <i>et al.</i> 2020). However, vessel collisions appear to be rare, although a lack of reporting and/or witnessing of such events should not be ruled out. Of 23 post-mortem examinations on stranded bottlenose dolphins in the UK between 2011 and 2017, no deaths were attributed to probable effect of a vessel collision, and one animal died from physical trauma of unknown origin (Deaville <i>et al.</i> 2018). Slow speeds and predictable movement (as would be the case for vessels involved in the S. I. works) are known to be key factors in minimising collision risk between vessels and marine mammals (Lusseau 2003; Lusseau <i>et al.</i> 2006). Given the slow speeds and predictable movement of the vessels on survey, the risk of collision is considered negligible and as such, there is no LSE from this impact pathway. Otters can be found near the coastline where there is a freshwater source. They can use the marine environment to forage; however,	

Site name	Qualifying features included for screening (include sub-features and supporting habitats)	Impact Pathway	LSE?	Justification	Screened in / Screened out?
				foraging is usually close to shore, often within 100 m (Watson 1986). This means they are unlikely to be in the survey area. Otters can travel a number of kilometres, ca. 5 km in coastal waters, however, this site is >100 km from the survey area. As such, they are highly unlikely to be in the survey area and it is considered that there will be no LSE to otters.	
		Pollution		Pollution will be controlled by adhering to relevant MARPOL guidance for pollution prevention and marine pollution legislation for which compliance is required by law. All vessels will be MARPOL compliant. Published guidelines and best working practices will be followed to ensure that the likelihood of accidental spills is extremely low. This compliance is a basic requirement under UK law and should be adhered to even when no European Sites are involved and is therefore not considered mitigation for the purposes of HRA. Furthermore, in the event of a spill, the volumes of potential contaminants released would likely be small and would rapidly disperse, thus any effects would be anticipated to be negligible, and therefore will have no LSE.	

Site name	Qualifying features included for screening (include sub-features and supporting habitats)	Impact Pathway	LSE?	Justification	Screened in / Screened out?
		Reduction in prey availability (all aspects of survey generating underwater noise and vibration)	No	Prey species of bottlenose dolphins and grey seals may be disturbed by the survey activities; however, the number of individuals effected will be small in relation to the availability of prey in the wider area. The activity is relatively short in nature, meaning any displacement of prey is likely to be short term. Bottlenose dolphins and grey seals are highly mobile and could move to other nearby prey patches, therefore, any potential impact on prey species is likely to have negligible to no effect and there will be no LSE.	
	[1110] Sandbanks which are slightly covered by sea water all the time [1130] Estuaries [1150] Coastal lagoons [1160] Large shallow inlets and bays [1170] Reefs [1140] Mudflats and sandflats not covered by seawater at low tide	Abrasion / disturbance of the surface of the seabed	No	There is no overlap between the survey activities and the designated habitat features. As such, there is no potential for LSE on these features from this impact pathway.	Screened out
		Penetration and/or disturbance of the substratum below the surface of the seabed, including abrasion	No	There is no overlap between the survey activities and the designated habitat features. As such, there is no potential for LSE on these features from this impact pathway.	
		Pollution	No	Pollution will be controlled by adhering to relevant MARPOL guidance for pollution prevention and marine pollution legislation for which compliance is required by law. All vessels will be MARPOL compliant. Published guidelines and best working practices will be followed to	

Site name	Qualifying features included for screening (include sub-features and supporting habitats)	Impact Pathway	LSE?	Justification	Screened in / Screened out?
	[1310] Salicornia and other annuals colonizing mud and sand [1330] Atlantic salt meadows (<i>Glauco-Puccinellietalia maritimae</i>) [8330] Submerged or partially submerged sea caves			ensure that the likelihood of accidental spills is extremely low. This compliance is a basic requirement under UK law and should be adhered to even when no European Sites are involved and is therefore not considered mitigation for the purposes of HRA. Furthermore, in the event of a spill, the volumes of potential contaminants released would likely be small and would rapidly disperse, thus any effects would be anticipated to be negligible, and therefore will have no LSE.	
		Introduction or spread of invasive non-native species (INNS)	No	All activities will follow best practice guidance for cleaning and maintenance of equipment and vessels to reduce the potential of transporting or introducing INNS. The transport of INNS through ballast water is unlikely as the vessels used are expected not to require ballast due to their size. As such, there would be no LSE on the qualifying features of the Pembrokeshire Marine / Sir Benfro Forol SAC as a result of Introduction of INNS.	
SPAs					
Ribble and Alt Estuaries (UK9005103)	[A037] Bewick’s swan (<i>Cygnus columbianus bewickii</i>) [A038] Whooper swan (<i>Cygnus cygnus</i>)	Short term reduction in prey availability; Visual and noise disturbance	No	Gull species are wide ranging and rarely dive. They show minimal disturbance response to boat presence and are often attracted to them due to local fishing activities and with the small increase in vessel numbers compared to the vessel traffic already present in the area it is unlikely the S.I. works will have any significant effect. The proposed S.I. works location is within the mean max foraging range +1 S.D for lesser black-backed gull. The proposed work is not expected to	Screened Out

Site name	Qualifying features included for screening (include sub-features and supporting habitats)	Impact Pathway	LSE?	Justification	Screened in / Screened out?
	[A040] Pink-footed goose (<i>Anser brachyrhynchus</i>) [A048] Shelduck (<i>Tadorna tadorna</i>) [A050] Wigeon (<i>Mareca penelope</i>) [A052] Teal (<i>Anas crecca</i>) [A054] Pintail (<i>Anas acuta</i>) [A130] Oystercatcher (<i>Haematopus ostralegus</i>) [A137] Ringed plover (<i>Charadrius hiaticula</i>) [A140] Golden plover (<i>Pluvialis apricaria</i>) [(A141] Grey plover (<i>Pluvialis squatarola</i>) [A143] Knot (<i>Calidris canuta</i>) [A144] Sanderling (<i>Calidris alba</i>)			significantly impact the foraging or breeding behaviour as a) the work is carried over short time scales intermittently over the breeding and post-breeding seasons, b) activities carry a low degree of disturbance effects, c) there are low densities of these species over the majority of the S.I works area and d) the proposed work are unlikely to exclude the protected species from significant proportions of the habitat, minimising effects on behaviours and foraging opportunities. All species, with the exception of lesser black-backed gull are screened out on the basis of distance of the site from the ZoI. Non-breeding waders and wildfowl have potential connectivity of up to 10km from SPAs (20km for some species of geese). When breeding, common tern has a mean max foraging range +1 S.D. of 26.9km. The distance to the site exceeds this and thus these species have been screened out.	

Site name	Qualifying features included for screening (include sub-features and supporting habitats)	Impact Pathway	LSE?	Justification	Screened in / Screened out?
	[A149] Dunlin (<i>Calidris alpina alpina</i>) [A151] Ruff (<i>Calidris pugnax</i>) [A156] Black-tailed godwit (<i>Limosa limosa islandica</i>) [A157] Bar-tailed godwit (<i>Limosa lapponica</i>) [A162] Redshank (<i>Tringa totanus</i>) [A183] Lesser black-backed gull (<i>Larus fuscus</i>) [A193] Common tern (<i>Sterna hirundo</i>)				
Skomer, Skokholm and the Seas off Pembrokeshire/ Sgomer, Sgogwm	[A013] Manx shearwater (<i>Puffinus puffinus</i>)	Short term reduction in prey availability; Visual and noise disturbance	No	Gull species are wide ranging and rarely dive. They show minimal disturbance response to boat presence and are often attracted to them due to local fishing activities and with the small increase in vessel numbers compared to the vessel traffic already present in the area it is unlikely the S.I. works will have any significant effect.	Screened Out

Site name	Qualifying features included for screening (include sub-features and supporting habitats)	Impact Pathway	LSE?	Justification	Screened in / Screened out?
a Moroedd Penfro (UK9014051)	[A014] Storm petrel (<i>Hydrobates pelagicus</i>) [A183] Lesser black-backed gull (<i>Larus fuscus</i>) [A204] Puffin (<i>Fratercula arctica</i>) [A222] Short-eared owl (<i>Asio flameus</i>) [A346] Chough (<i>Pyrrhocorax pyrrhocorax</i>)			The proposed S.I. works location is within the mean max foraging range +1 S.D for some of the species under protection at this site, namely Manx shearwater, storm petrel, lesser black-backed gull and puffin. The proposed work is not expected to significantly impact the foraging or breeding behaviour as a) the work is carried over short time scales intermittently over the breeding and post-breeding seasons, b) activities carry a low degree of disturbance effects, c) there are low densities of these species over the majority of the S.I works area and d) the proposed work are unlikely to exclude the protected species from significant proportions of the habitat, minimising effects on behaviours and foraging opportunities. The habitats within the Zol are not suitable for short-eared owl or chough as these are terrestrial species and it is highly unlikely that they would be present within the Zol.	
Grassholm (UK9014041)	[A016] Northern gannet (<i>Morus bassanus</i>)	Short term reduction in prey availability; Visual and noise disturbance	No	The proposed S.I. works location is within the mean max foraging range +1 S.D for some of the species under protection at this site. The proposed work is not expected to significantly impact the foraging or breeding behaviour as a) the work is carried over short time scales intermittently over the breeding and post-breeding seasons, b) activities carry a low degree of disturbance effects, c) there are low densities of these species over the majority of the S.I works area and d) the proposed work are unlikely to exclude the protected species from significant proportions of the habitat, minimising effects on behaviours and foraging opportunities.	Screened Out

Site name	Qualifying features included for screening (include sub-features and supporting habitats)	Impact Pathway	LSE?	Justification	Screened in / Screened out?
Wexford Harbour and Slob SPA (004076)	[A004] Little grebe (<i>Tachybaptus ruficollis</i>) [A005] Great crested grebe (<i>Podiceps cristatus</i>) [A017] Cormorant (<i>Phalacrocorax carbo</i>) [A028] Grey heron (<i>Ardea cinerea</i>) [A037] Bewick's swan (<i>Cygnus columbianus bewickii</i>) [A038] Whooper swan (<i>Cygnus cygnus</i>) [A046] Light-bellied brent goose (<i>Branta bernicla hrota</i>) [A048] Shelduck (<i>Tadorna tadorna</i>)	Short term reduction in prey availability; Visual and noise disturbance	No	Gull species are wide ranging and rarely dive. They show minimal disturbance response to boat presence and are often attracted to them due to local fishing activities and with the small increase in vessel numbers compared to the vessel traffic already present in the area it is unlikely the S.I. works will have any significant effect. The proposed S.I. works location is within the mean max foraging range +1 S.D for some of the species under protection at this site, namely lesser black-backed gull. The proposed work is not expected to significantly impact the foraging or breeding behaviour as a) the work is carried over short time scales intermittently over the breeding and post-breeding seasons, b) activities carry a low degree of disturbance effects, c) there are low densities of these species over the majority of the S.I works area and d) the proposed work are unlikely to exclude the protected species from significant proportions of the habitat, minimising effects on behaviours and foraging opportunities. All other species, with the exception of lesser black-backed gull are screened out on the basis of distance of the site from the ZoI. Non-breeding waders and wildfowl have potential connectivity of up to 10km from SPAs (20km for some species of geese). When breeding common tern has a mean max foraging range +1 S.D. of 26.9km. Similarly, black-headed gull has a mean max foraging range of 18.5km. The distance to the site exceeds these and thus these species have been screened out.	Screened Out

Site name	Qualifying features included for screening (include sub-features and supporting habitats)	Impact Pathway	LSE?	Justification	Screened in / Screened out?
	[A050] Wigeon (<i>Mareca penelope</i>) [A052] Teal (<i>Anas crecca</i>) [A053] Mallard (<i>Anas platyrhynchos</i>) [A054] Pintail (<i>Anas acuta</i>) [A062] Scaup (<i>Aythya marila</i>) [A067] Goldeneye (<i>Bucephala clangula</i>) [A069] Red-breasted merganser (<i>Mergus serrator</i>) [A082] Hen harrier (<i>Circus cyaneus</i>) [A125] Coot (<i>Fulica atra</i>) [A130] Oystercatcher (<i>Haematopus ostralegus</i>) [A140] Golden plover (<i>Pluvialis apricaria</i>)			The habitats within the ZOI are unsuitable for hen harrier and it is highly unlikely they would be present within the ZOI.	

Site name	Qualifying features included for screening (include sub-features and supporting habitats)	Impact Pathway	LSE?	Justification	Screened in / Screened out?
	[A141] Grey plover (<i>Pluvialis squatarola</i>) [A142] Lapwing (<i>Vanellus vanellus</i>) [A143] Knot (<i>Calidris canuta</i>) [A144] Sanderling (<i>Calidris alba</i>) [A149] Dunlin (<i>Calidris alpina alpina</i>) [A156] Black-tailed godwit (<i>Limosa limosa islandica</i>) [A157] Bar-tailed godwit (<i>Limosa lapponica</i>) [A160] Curlew (<i>Numenius arquata</i>) [A162] Redshank (<i>Tringa totanus</i>) [A179] Black-headed gull (<i>Chroicocephalus ridibundus</i>)				

Site name	Qualifying features included for screening (include sub-features and supporting habitats)	Impact Pathway	LSE?	Justification	Screened in / Screened out?
	[A183] Lesser Black-backed Gull (<i>Larus fuscus</i>) [A195] Little tern (<i>Sternula albifrons</i>) [A395] Greenland white-fronted goose (<i>Anser albifrons flavirostris</i>)				
Saltee Islands SPA (004002)	[A009] Fulmar (<i>Fulmarus glacialis</i>) [A016] Gannet (<i>Morus bassanus</i>) [A017] Cormorant (<i>Phalacrocorax carbo</i>) [A018] Shag (<i>Gulosus aristotelis</i>) [A183] Lesser black-backed gull (<i>Larus fuscus</i>) [A184] Herring gull (<i>Larus argentatus</i>)	Short term reduction in prey availability; Visual and noise disturbance	No	Gull species are wide ranging and rarely dive. They show minimal disturbance response to boat presence and are often attracted to them due to local fishing activities and with the small increase in vessel numbers compared to the vessel traffic already present in the area it is unlikely the S.I. works will have any significant effect. The proposed S.I. works location is within the mean max foraging range +1 S.D for some of the species under protection at this site, namely fulmar, gannet, lesser black-backed gull, herring gull, kittiwake, guillemot, razorbill and puffin. The proposed work is not expected to significantly impact the foraging or breeding behaviour as a) the work is carried over short time scales intermittently over the breeding and post-breeding seasons, b) activities carry a low degree of disturbance effects, c) there are low densities of these species over the majority of the S.I works area and d) the proposed work are unlikely to exclude the protected species	

Site name	Qualifying features included for screening (include sub-features and supporting habitats)	Impact Pathway	LSE?	Justification	Screened in / Screened out?
	[A188] Kittiwake (<i>Rissa tridactyla</i>) [A199] Guillemot (<i>Uria aalge</i>) [A200] Razorbill (<i>Alca torda</i>) [A204] Puffin (<i>Fratercula arctica</i>)			from significant proportions of the habitat, minimising effects on behaviours and foraging opportunities. All other species are screened out on the basis of distance of the SPA from the Zol, which is beyond the mean max foraging range (+1 S.D. where applicable) and thus there is no potential for connectivity for cormorant and shag. The distance to the site exceeds these and thus these species have been screened out.	

6.1 LSE Conclusion

European Sites determined to have potential for LSE and therefore taken through to AA are presented in Table 5.

Table 5. European Sites where impact pathways were identified as potentially having an LSE and site features potentially affected

Site name	Qualifying features screened into AA	Impact Pathway
Pembrokeshire Marine/ Sir Benfro Forol SAC (UK0013116)	Reefs	Abrasion / disturbance of the surface of the seabed
	Large shallow inlets and bays; Mudflats and sandflats not covered by seawater at low tide	Penetration and/or disturbance of the substratum below the surface of the seabed, including abrasion
	Sea lamprey (<i>Petromyzon marinus</i>)	Underwater noise and vibration
	River Lamprey (<i>Lampetra fluviatilis</i>)	
	Grey seal (<i>Halichoerus grypus</i>)	
	Allis Shad (<i>Alosa alosa</i>)	
	Twaite Shad (<i>Alosa fallax</i>)	
West Wales Marine / Gorllewin Cymru Sarnau SAC (UK0030397)	Harbour porpoise (<i>Phocoena phocoena</i>)	Underwater noise and vibration
Bristol Channel Approaches / Dynesteydd Mor Hafren SAC (UK0030396)	Harbour porpoise (<i>Phocoena phocoena</i>)	
Cardigan Bay/ Bae Ceridigion SAC (UK0012712)	Bottlenose dolphin (<i>Tursiops truncatus</i>)	
	Grey seal (<i>Halichoerus grypus</i>)	
Saltee Islands SAC (IE000707)	Grey seal (<i>Halichoerus grypus</i>)	
Pen Llyn a'r Sarnau/ Llyn Peninsula and the Sarnau SAC (UK0013117)	Bottlenose dolphin (<i>Tursiops truncatus</i>)	
	Grey seal (<i>Halichoerus grypus</i>)	

7. Appropriate Assessment

As described in Section 3, European Sites and their qualifying features were progressed to AA (Stage 2) where it was not possible to exclude potential for LSE. Information to inform the AA is provided below and includes a description of the European Sites and the qualifying features under consideration.

AA requires the consideration of impacts on the integrity of a European Site, in relation to the site's structure and function and its Conservation Objectives, which aim to define favourable conservation condition for particular habitats and species. As such, the assessment below considers the Conservation Objectives of the European Sites included for assessment.

7.1 Assessment

7.1.1 Underwater noise and vibration

In total six sites were screened into Stage 2 Appropriate Assessment due to potential LSE on designated features from underwater noise and vibration. (Table 6).

Table 6. Sites screened into Appropriate Assessment for underwater noise and vibration.

Site name	Qualifying Features Screened into AA
Pembrokeshire Marine/ Sir Benfro Forol SAC (UK0013116)	Grey seal (<i>Halichoerus grypus</i>) Sea lamprey (<i>Petromyzon marinus</i>) River lamprey (<i>Lampetra fluviatilis</i>) Allis shad (<i>Alosa alosa</i>) Twaite shad (<i>Alosa fallax</i>)
West Wales Marine / Gorllewin Cymru Sarnau SAC (UK0030397)	Harbour porpoise (<i>Phocoena phocoena</i>)
Bristol Channel Approaches / Dynesfeydd Môr Hafren SAC (UK0030396) (UK0030396)	Harbour porpoise (<i>Phocoena phocoena</i>)
Cardigan Bay/ Bae Ceridigion SAC (UK0012712)	Bottlenose dolphin (<i>Tursiops truncatus</i>) Grey seal (<i>Halichoerus grypus</i>) Sea lamprey (<i>Petromyzon marinus</i>) River lamprey (<i>Lampetra fluviatilis</i>)
Llein Peninsula and the Sarnau / Pen Llyn a'r Sarnau SAC (UK0013117)	Bottlenose dolphin (<i>Tursiops truncatus</i>) Grey seal (<i>Halichoerus grypus</i>)
Saltee Islands SAC (IE000707)	Grey seal (<i>Halichoerus grypus</i>)

Marine Mammals

Marine mammal features of screened in sites are grey seal, harbour porpoise and bottlenose dolphin. It is widely documented that marine mammals are sensitive to underwater noise (Richardson *et al.* 1995; Nowacek *et al.* 2007; OSPAR 2009; Southall *et al.* 2019; Southall *et al.* 2021). Evidence indicates that types of anthropogenic sound, such as vessel noise (Pirodda *et al.* 2012; Dunlop 2016; Wisniewska *et al.* 2018) and seismic surveys (Pirodda *et al.* 2014; Stone *et al.* 2017) can have direct impacts on marine mammals. Indirect impacts, such as negative effects on prey species may also occur (Sivle *et al.* 2021).

These impacts have varying degrees of severity, ranging from changes in behaviour and masking effects (e.g. effects on communication and listening space, and/or locating prey (Pirodda *et al.* 2012; Dunlop 2016; Erbe *et al.* 2016; Heiler *et al.* 2016; Wisniewska *et al.* 2018; Pine *et al.* 2019; Basran *et al.* 2020)), to displacement and disturbance (Brandt *et al.* 2011; Pirodda *et al.* 2014; Culloch *et al.* 2016; Stone *et al.* 2017; Graham *et al.* 2019) to injury and even mortality (Schaffeld *et al.* 2019).

With respect to noise assessments, using the criteria outlined in Southall *et al.* (2019), there are often two types of impacts which are considered: TTS and PTS, the latter of which is typically regarded as injury. To assess this, sound sources are typically divided into two categories, 'impulsive' and 'non-impulsive', based on attributes of the sound source:

- **Impulsive sound sources**, such as impact pile driving and seismic airguns, are transient and brief (less than a second), broadband and typically consist of high peak pressure with rapid rise time and decay.
- **Non-impulsive sound sources**, such as shipping, cone penetration testing (CPT), rotary core borehole (BH), and vibrocores, can be broadband, narrowband or tonal, brief or prolonged, continuous or intermittent and typically do not have a high peak pressure with rapid rise time.

Behavioural responses are challenging to assess, therefore deriving disturbance thresholds for behaviour is often not possible, and recent research has shown that attempting to derive simple all-or-nothing thresholds for behavioural responses to noise exposure across broad taxonomic groups and sound sources can lead to significant errors in predicting effects (Southall *et al.* 2021). Noise exposure criteria outlined in Southall *et al.* (2019) grouped all marine mammals into functional hearing groups (FHGs) based on their hearing ability (Table 7).

For true seals (phocids, which includes grey seal) the underwater hearing range is between 50 Hz – 86 kHz (Table 7). The peak SPL for TTS in hearing is 212 dB 1μPa @ 1 m and PTS in

hearing is 218 dB 1µPa @ 1 m (Table 7). Neurophysiological studies have reported that grey seals have an underwater hearing range of <1.4 kHz – 100 kHz (Southall *et al.* 2019).

Harbour porpoises are dependent on sound to detect their prey and are sensitive to anthropogenic induced underwater noise. With respect to their classification within the FHGs, harbour porpoises are defined as very high frequency (VHF) cetaceans, with a vocal repertoire (and hearing range) ranging between 275 Hz to 160 kHz (NMFS 2018; Southall *et al.* 2019; Table 7) including their very high frequency (VHF), short-range and narrow-band (NBHF) echolocation clicks. The hearing sensitivity of harbour porpoise is greatest in the higher part of this range. The peak sound pressure level (SPL) for temporary threshold shift (TTS) in hearing is 196 dB 1µPa @ 1 m and permanent threshold shift (PTS) in hearing is 202 dB 1µPa @ 1 m (Table 7). Their high sensitivity to sound means they are often a key species of concern when assessing risks of impacts from impulsive sound sources, such as geophysical surveys.

Bottlenose dolphins are sensitive to underwater noise and use sound to detect their prey, which includes a wide range of pelagic and demersal fish, crustaceans and molluscs. Bottlenose dolphins are defined as high frequency (HF) cetaceans, with respect to their classification within the FHGs, with a hearing range of 150 Hz – 160 kHz (NMFS 2018 Southall *et al.* 2019; Table 7).

The noise level thresholds outlined in Table 7 are peak Sound Pressure Level (SPL), which is the maximum absolute value, which is used to assess the potential risk of instantaneous TTS or PTS. These are based on the animal being close to the sound source (within 1 m), which is unlikely and, therefore, extremely precautionary. The cumulative Sound Exposure Level (SEL_{cum}) is used to assess the potential risk of TTS or PTS through exposure to noise accumulated over time.

Table 7. Generalised hearing ranges and noise exposure criteria from Southall *et al.* (2019) for Temporary Threshold Shift (TTS) and Permanent Threshold Shift (PTS) in hearing for the functional hearing groups Phocid in Water (PW), High Frequency cetaceans (HF), and Very High Frequency cetaceans (VHF), (NMFS 2018; Southall *et al.* 2019).

Functional hearing group	Relevant species	Generalised hearing range	Estimated peak region of sensitivity	Noise exposure criteria					
				Impulsive				Non-impulsive	
				TTS		PTS		TTS	PTS
				SEL	Peak SPL	SEL	Peak SPL	SEL	SEL
Phocids in water	Grey seal	50 Hz – 86 kHz	1.9 – 30 kHz	170	212	185	218	181	201
High Frequency Cetaceans	Bottlenose dolphin	150 Hz – 160 kHz	8.8 – 110 kHz	170	224	185	230	178	198
Very High Frequency Cetaceans	Harbour porpoise	275 Hz – 160 kHz	12 – 140 kHz	140	196	155	202	153	173

The VHF FHG is the most sensitive to impulsive (e.g. geophysical surveys) and non-impulsive (e.g. vessel/engine noise) sound sources. Consequently, all the exposure criteria for this FHG are lower than those of the other FHGs for the respective sound source and exposure criteria. In the context of the proposed S. I. surveys, the only VHF cetacean species in this site is the harbour porpoise, which is the most abundant cetacean species in UK and Irish waters (Baines and Evans 2012; Wall *et al.* 2013; Rogan *et al.* 2018; Hague *et al.* 2020).

Indicative SPLs associated with different types of marine S. I. surveys are presented in Table 8. Geophysical survey equipment types incorporated in the S. I. surveys are multi beam echosounder (MBES), side scan sonar (SSS), sub-bottom profiler (SBP), magnetometer survey, and the ultra-short baseline (USBL) subsea positioning. Geophysical survey equipment is typically an impulsive sound source, which is broadly regarded as a higher risk to marine mammals when compared to non-impulsive sound sources. One exception in the S. I. surveys, whilst often included in geophysical survey equipment lists, is magnetometers, which are a completely passive device, meaning they do not produce any sound while in operation. The MBES and SSS operate outside of the hearing range of the marine mammal species included in this assessment. As there is no impact pathway associated with MBES, SSS, and magnetometer surveys, they have been scoped out of further assessment.

The operating frequency of the SBP is within the generalised hearing range of seals in water, bottlenose dolphin, and harbour porpoise, and within the estimated peak region of sensitivity of bottlenose dolphin and harbour porpoise (Table 7 and Table 8). Although the operating frequency of the SBP is outside the estimated peak region of sensitivity of seals in water, it is considered that the SBP may cause instantaneous PTS and TTS in grey seals following a precautionary approach to assessment. The operating frequency of the USBL system is within the generalised hearing range and estimated region of peak sensitivity of seals in water, bottlenose dolphin, and harbour porpoise, but the SPL is not likely to cause instantaneous PTS or TTS in grey seals, bottlenose dolphins, and harbour porpoise (Table 7). Therefore, the only activity involved in the geophysical S. I. works that may cause an instantaneous PTS in grey seals, bottlenose dolphins, and harbour porpoise is the SBP (Table 8).

Although these sound sources (e.g. SBP) can be relatively loud with high duty cycles, they are typically highly directional with expected low levels of propagation both vertically and horizontally, with many of these devices operating at high frequencies and therefore subject to high transmission loss (Crocker and Frantantonio 2016; Crocker *et al.* 2019). Directionality must also be considered, as well as propagation. For example, sound propagation through the water column on the horizontal for side-scanning sonar is minimal; therefore, the noise level decreases rapidly with distance from the source (Trabant 2013). Once the sound pulse has been emitted, the intensity is greatly reduced within a few metres due to scattering and absorption (Medwin 1970; Deane and Stokes 2010; Farcas *et al.* 2016).

Table 8. Marine survey noise sources and the risk of an instantaneous TTS and PTS in hearing from impulsive noise sources for each of the functional hearing groups where Y (red) indicates onset is possible and N (green) indicates that it is not.

Noise Source	Frequency (kHz)	Sound Pressure Level (dB re 1µPa @ 1m)	PCW		HF		VHF	
			TTS	PTS	TTS	PTS	TTS	PTS
Innomar Medium-100	85 to 100 (primary)	247	Y	Y	Y	Y	Y	Y
SBP	2 to 22 (secondary)	247	Y	Y	Y	Y	Y	Y
Kongsberg µPAP 201-H USBL system	20 to 30*	190*	N	N	N	N	N	N

*Information taken from online specification (Kongsberg Maritime, 2023)

The geotechnical equipment and activities associated with the proposed S. I. surveys are vibrocorer and CPT. For all activities the SPL range is between 118 and 187.4 dB re 1µPa @1m (Table 9), and in the case of the operating frequencies, both the vibrocorer and CPT are outside the generalised hearing ranges of harbour porpoise, bottlenose dolphin, and seals in water (Table 7). As such, it is concluded that there is no risk of instantaneous or cumulative TTS or PTS to harbour porpoises, bottlenose dolphins or seals during the geotechnical surveys.

With respect to disturbance, as the activities are transient and short in duration, any disturbance effects would be negligible, particularly given the extensive suitable foraging habitat elsewhere in the Irish Sea and beyond.

Table 9. Marine survey noise sources where N (green) indicates that it is not in the hearing range of the marine mammal species considered in this assessment.

Noise Source	Frequency (Hz)	Sound Pressure Level (dB re 1µPa @ 1m)	PCW	HF	VHF
FT0551 Vibrocorer ¹	30	187.4	N	N	N
Geomil Manta 100DW CPT ²	28	118-145	N	N	N

¹ Values taken from (LGL, 2010)

² Values taken from (Campanella *et al.* 1986; BOEM, 2012; EIRGRID, 2014)

In summary, the SBP is the only equipment used in the survey with the potential for instantaneous PTS and is therefore the only sound source taken through to further assessment for marine mammals.

Fish

Fish features of screened in sites are sea and river lamprey, and allis and twaite shad. Anthropogenic underwater noise and vibration can cause detrimental effects to fish through physical harm and behavioural impact. Popper *et al.* (2014) provides criteria that can be applied to assess the potential effects of noise and vibration on fish from different marine activities. The approach assesses the potential effects of underwater noise and vibration on fish based on the following groupings, which will be applied to determine potential effects for specific species:

- Fish with no swim bladder. Less susceptible to barotrauma and only sensitive to particle motion (e.g. elasmobranchs, adult flatfish, lampreys);
- Fish with swim bladders that don't play a part in hearing. Susceptible to barotrauma and only sensitive to particle motion (e.g. Atlantic salmon, trout); and

- Fish in which swim bladder is involved in hearing. Sensitive to both particle motion and sound pressure, with higher sensitivity to sound pressure than above groups (e.g. clupeids such as Atlantic herring, gadoids such as Atlantic cod) – includes shad.

Sound pressure levels for different fish hearing groups are presented in Table 10.

Table 10. Peak and rms sound pressure levels dB re 1 μ Pa; SEL dB re 1 μ Pa²·s for different fish grouping. All criteria are presented as sound pressure even for fish without swim bladders since no data for particle motion exist. Relative risk (high, moderate, low) is given for animals at three distances from the source defined in relative terms as near (N; tens of metres from source), intermediate (I; hundreds of metres from source), and far (F; thousands of metres from source; Popper *et al.* 2014).

Fish grouping	Mortality and potential mortal injury High Sensitivity	Impairment			
		Recoverable injury Medium Sensitivity	Temporary Threshold Shift Low Sensitivity	Masking High - Low Sensitivity	Behaviour High - Low Sensitivity
No swim bladder (particle motion detection)	>219 db SEL _{cum} or >213 dB peak SPL	>216 db SEL _{cum} or >213 dB peak SPL	>186 db SEL _{cum}	(N) Moderate (I) Low (F) Low	(N) High (I) Moderate (F) Low
Swim bladder is not involved in hearing (particle motion detection)	210 db SEL _{cum} or >207 dB peak SPL	203 db SEL _{cum} or >207 dB peak SPL	>186 db SEL _{cum}	(N) Moderate (I) Low (F) Low	(N) High (I) Moderate (F) Low
Swim bladder is involved in hearing (primarily pressure detection)	207 db SEL _{cum} or >207 dB peak SPL	203 db SEL _{cum} or >207 dB peak SPL	186 db SEL _{cum}	(N) High (I) High (F) Moderate	(N) High (I) High (F) Moderate
Eggs and larvae	210 db SEL _{cum} or >207 dB peak SPL	(N) Moderate (I) Low (F) Low	(N) Moderate (I) Low (F) Low	(N) Moderate (I) Low (F) Low	(N) Moderate (I) Low (F) Low

Due to the absence of a swim bladder, a lack of otolith organs and their gelatinous skeletons, lamprey are assumed to have poor hearing in the 20 to 600Hz frequency band. Previous experiments on sea lamprey suggest that lamprey can respond to sound in the 20 to 100Hz frequency band, however, the response was largely due to vibration (pressure) rather than water column noise and individuals only responded when resting on the walls of the tank (Lenhardt and Sismor 1995; Natural England 2016). In general, fish without a swim bladder

like lamprey are less sensitive to noise disturbance compared to species with swim bladders close to the inner ear which are the most sensitive to underwater noise and vibration.

Certain species have special adaptations to detect the pressure component of underwater noise, which gives them a wider frequency sensitivity and lower hearing thresholds (e.g. clupeids and carp fishes; Enger, 1967, Fay and Popper, 1974). A few species, including both allis and twaite shad, are even capable of detecting sound in a higher frequency range than most species (up to 100 kHz), however, only at high sound intensities (> 140 dB; Wilson *et al.*, 2008, 2011; Gregory and Clabburn, 2003). Allis shad have been known to exhibit an intensity graded behavioural response when exposed to ultrasound, with adults of this species responding to ultrasonic pulses, showing a response threshold of between 161 and 167 dB re 1 μ Pa (Shack *et al.* 2017). Shad are therefore extremely sensitive to changes to sound pressure levels, with effects on behaviour being more relevant than direct physical effects (Popper *et al.* 2014).

As mentioned previously in the marine mammal assessment for underwater noise, the geophysical survey equipment used in the S. I. surveys are MBES, SSS, SBP, magnetometer survey, and USBL subsea positioning. Impulsive sound generated by geophysical surveys can pose a high risk to fish as they can cause rapid motion of the walls of the cavities resulting in damage to important tissue such as kidneys and gonads (Popper *et al.* 2014). As magnetometers are completely passive devices and MBES and SSS operate outside the hearing range of the fish species included in this assessment, they have been scoped out of further assessment.

The SBP operating frequency exceeds the peak region of sensitivity for fish species with and without swim bladders (Table 10), therefore there is a possibility of instantaneous TTS and physical injury or mortality to shad and lamprey species if individuals are within tens of metres of the source during operation, and there could be effects on behaviour at greater distances (Table 10 and Table 11). The operating frequency of USBL is within the peak sensitivity range for the shad and lamprey species and may cause shifts in behaviour in twaite shad and allis shad due to higher sensitivity thresholds. However, it is unlikely to cause physical injury or TTS to allis shad, twaite shad, river lamprey or sea lamprey (Table 10 and Table 11).

Table 11. Geophysical survey noise sources and fish sensitivity ranges (Table 10) where red indicates the equipment can operate within the peak sensitivity range of the relevant functional hearing group, orange indicates it is in the sensitivity range but not in the peak sensitivity range and green indicates that it is not in the hearing range.

Noise Source	Frequency (kHz)	Sound Pressure Level (dB re 1µPa @ 1m)	Allis shad		Twaite shad		Sea lamprey		River lamprey	
			Injury/death	TTS	Injury/death	TTS	Injury/death	TTS	Injury/death	TTS
Innomar Medium-100 SBP	85 to 100 (primary)	247	Y	Y	Y	Y	Y	Y	Y	Y
	2 to 22 (secondary)	247	Y	Y	Y	Y	Y	Y	Y	Y
Kongsberg µPAP 201-H USBL system	20 to 30*	190*	N	N	N	N	N	N	N	N

*Information taken from online specification (Kongsberg Maritime, 2023)

For geotechnical survey activities, the SPL range is between 118 and 187.4 dB re 1 µPa @1 m (Table 12), and in the case of the operating frequencies, both the vibrocorer and CPT are outside the generalised sensitivity ranges of the shad and lamprey species considered in this assessment.

Table 12. Geotechnical marine survey noise sources where N (green) indicates that it is not in the hearing range of the fish species considered in this assessment.

Noise Source	Frequency (Hz)	Sound Pressure Level (dB re 1µPa @ 1m)	Allis shad	Twaite shad	Sea lamprey	River lamprey
FT0551 Vibrocorer ¹	30	187.4	N	N	N	N
Geomil Manta 100DW CPT ²	28	118-145	N	N	N	N

¹ Values taken from (LGL, 2010)

² Values taken from (Campanella *et al.* 1986; BOEM, 2012; EIRGRID, 2014)

Pembrokeshire Marine SAC (UK0013116)

This site was screened into AA due to the potential for LSE on grey seal, allis shad, twaite shad, river lamprey and sea lamprey from underwater noise and vibration.

The Conservation Objectives for these species in Pembrokeshire Marine SAC, and individual attributes with targets are provided in Table 13.

Table 13. Conservation Objective information for grey seal, allis shad, twaite shad, sea lamprey and river lamprey in Pembrokeshire Marine SAC (UK0013116; NRW, 2018a).

Conservation Objective information for: Pembrokeshire Marine SAC (UK0013116)			
[1364] Grey seal			
To ensure that the integrity of the site is maintained and that it makes the best possible contribution to maintaining Favourable Conservation Status (FCS) for grey seal in UK waters, which is defined by the following list of attributes and targets:			
Attribute	Measure	Target	Notes
Population	Size, structure, production and physiological health.	The population is maintaining itself on a long-term basis as a viable component of its natural habitat.	As part of this objective, it should be noted that for grey seal, contaminant burdens derived from human activity are below levels that may cause physiological damage, or immune or reproductive suppression. Grey seal populations should not be reduced as a consequence of human activity.
Range	Areas of the site which the population/individuals use.	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.	As part of this objective, it should be noted that for grey seal, their range within the SAC and adjacent inter-connected areas is not constrained or hindered, there are appropriate and sufficient food resources within the SAC and beyond
Supporting habitats and species	Distribution and extent, structure, function and quality and prey availability and quality.	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.	Not applicable.
[1102] Allis shad and [1103] Twaite shad			

To ensure that the integrity of the site is maintained and that it makes the best possible contribution to maintaining Favourable Conservation Status (FCS) for Allis and Twaite shad in UK waters, which is defined by the following list of attributes and targets:			
Attribute	Measure	Target	Notes
Population	Size, structure, production and physiological health.	The population is maintaining itself on a long-term basis as a viable component of its natural habitat.	The site is used as an access corridor between the sea and riverine breeding habitat. Population numbers are unknown but are likely to be seasonal (NRW 2018d)
Range	Areas of the site which the population/individuals use.	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.	Range data for shad in the area is deficient.
Habitats and species	Distribution and extent, structure, function and quality and prey availability and quality.	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. Suitable habitats must include abundant, suitable prey and adequate water quality.	Marine habitat requirements of shad include salt wedge at the head of the tide and warm shallow inshore waters and estuaries (NRW 2018d)
[1095] Sea lamprey			
To ensure that the integrity of the site is maintained and that it makes the best possible contribution to maintaining Favourable Conservation Status (FCS) for Sea lamprey in UK waters, which is defined by the following list of attributes and targets:			
Attribute	Measure	Target	Notes
Population	Size, structure, production and physiological health.	The population is stable or increasing on a long-term basis as a viable component of its natural habitat.	Inferences about lamprey population are based on the condition monitoring of the Afonydd Cleddau SAC and they are difficult to sample in the marine environment.
Range	Areas of the site which the population/individuals use.	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.	Range data for sea lamprey in the area is deficient. There is currently a lack of data regarding current and historical sea lamprey spawning sites (Countryside Council for Wales 2008)
Habitats and species	Distribution and extent, structure, function and quality and prey availability and quality.	The presence, abundance, condition and diversity of habitats and species required to support this species is such that the distribution,	Sea lamprey are not thought to be restricted to any particular habitat and are likely to follow a range of

		abundance and populations dynamics of the species within the site and population beyond the site is stable or increasing. Suitable habitats must include abundant, suitable prey and adequate water quality.	prey with a preference for demersal species.
[1099] River lamprey			
To ensure that the integrity of the site is maintained and that it makes the best possible contribution to maintaining Favourable Conservation Status (FCS) for River lamprey in UK waters, which is defined by the following list of attributes and targets:			
Attribute	Measure	Target	Notes
Population	Size, structure, production and physiological health.	The population is stable or increasing on a long-term basis as a viable component of its natural habitat.	Inferences about lamprey population are based on the condition monitoring of the Afonydd Cleddau SAC and they are difficult to sample in the marine environment.
Range	Areas of the site which the population/individuals use.	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.	Range data for river lamprey in the area is deficient.
Habitats and species	Distribution and extent, structure, function and quality and prey availability and quality.	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. Suitable habitats must include abundant, suitable prey and adequate water quality.	River lamprey depend on estuarine and coastal fish species, specifically herring, sprat and flounder.

Pembrokeshire Marine SAC is an important breeding site for grey seals and represents 2% of the annual UK pup production (SCOS 2021; NRW 2018a). The population within the SAC fluctuates seasonally, with higher numbers during pupping and moulting periods (NRW 2018a). A portion of the SAC and the S. I. Area overlap (Figure 2), therefore, grey seals, allis shad, twaite shad, river lamprey and sea lamprey located within the SAC could be affected by the SBP element of the geophysical survey. However, sound attenuates increasingly from the source and any individual would have to be very close to the source at the time of maximum output for injury to occur, which is considered extremely unlikely. If an individual were to be that close to the source, any event of injury would be to that sole individual and would not incur a population level effect.

There is extensive suitable foraging and haul-out habitat elsewhere in the Irish Sea and beyond enabling grey seal to avoid the S.I. survey area if required.

The S. I. works are expected to take place outside sensitive fish migration periods (Table 14), therefore it is unlikely to have significant effects on shad and lamprey migration and the limited spatial extent of the surveys will not have a barrier effect (i.e. it will not prevent movement of these species between coastal and estuarine waters).

Table 14. Shad and lamprey species migration and spawning periods.

	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Adult twaite / allis shad migration												
Twaite / allis shad spawning												
Sea lamprey immigration												
Sea lamprey spawning												
Sea lamprey transformer emigration												
River lamprey immigration												
River lamprey spawning												
River lamprey transformer emigration												

The S. I. surveys are also anticipated to be relatively short term (over a four-month period across the whole survey area in Irish and UK waters), and activities will be transient, meaning exposure to underwater noise will be short-term, both spatially and temporally. Therefore, short-term localised disturbances, such as the S. I. surveys proposed here would have negligible impact on the designated features in the SAC.

Conclusion

Consequently, it is considered that targets, with respect to Conservation Objectives listed in Table 13, would not be significantly affected and that there would be **no AEoI** on the qualifying interest features of the Pembrokeshire Marine SAC as a result of this impact pathway. Mitigation is not required to reach a conclusion of no AEoI on the SAC, however, following best practice guidance, mitigation to avoid effects on individual marine mammals from the geophysical survey activities have been proposed and detailed in Section 7.3 and Appendix 1.

West Wales Marine SAC (UK0030397)

This site was screened into AA due to the potential for LSE on harbour porpoise from underwater noise and vibration.

The Conservation Objectives for harbour porpoise for West Wales Marine SAC, and individual attributes with targets are provided in Table 15.

Table 15. Conservation Objective information for harbour porpoise in West Wales Marine SAC (UK0030397) (JNCC 2019a).

Conservation Objective information for West Wales Marine SAC (UK0030397)		
[1351] Harbour porpoise		
To ensure that the integrity of the site is maintained and that it makes the best possible contribution to maintaining Favourable Conservation Status (FCS) for harbour porpoise in UK waters, which is defined by the following list of attributes and targets:		
Attribute	Target	Notes
Species is a viable component of the site	Maintained or restored in the long term – subject to natural change	Not applicable
Disturbance	No significant disturbance of the species	Not applicable
Habitats and processes	Habitats and processes relevant to harbour porpoise and its prey are maintained or restore in the long term – subject to natural change	Not applicable

Harbour porpoise are a primary feature of the West Wales Marine SAC, which is estimated to support 5.4% of the UK Celtic and Irish Sea management unit (MU) population. The site provides relatively good foraging habitat and may be used for breeding and calving (JNCC 2019a). The West Wales Marine SAC features one of the top 10% of persistent high-density areas for harbour porpoise in UK waters during both winter and summer seasons (NRW and JNCC 2017; Heinänen and Skov 2015). A portion of the SAC and the S. I. Survey Area overlap (Figure 2), therefore, porpoise located within the SAC could be affected by S. I. surveys. However, sound attenuates increasingly from the source and any individual would have to be very close to the source at the time of maximum output for injury to occur, which is considered extremely unlikely. If an individual were to be that close to the source, any event of injury would be to that sole individual and would not incur a population level effect.

There is extensive suitable foraging habitat elsewhere in the Irish Sea and beyond enabling harbour porpoise to avoid the survey area if required. The S. I. surveys are also anticipated to be relatively short term (over a four-month period across the whole survey area in Irish and UK waters) and activities will be transient, meaning exposure to underwater noise will be

short-term, both spatially and temporally. Therefore, short-term localised disturbances, such as the S. I. surveys proposed here would have negligible to no impact on porpoise in the SAC.

Conclusion

Consequently, it is considered that targets, with respect to Conservation Objectives listed in Table 15, would not be significantly affected and that there would be **no AEol** on harbour porpoise in West Wales Marine SAC due to the S. I. surveys. Mitigation is not required to reach a conclusion of no AEol on the SAC, however, following best practice guidance, mitigation to avoid effects on individual marine mammals from the geophysical survey activities have been proposed and detailed in Section 7.3 and Appendix 1.

Bristol Channel Approaches SAC (UK0030396)

This site was screened into AA due to a possible LSE on harbour porpoise from underwater noise and vibration.

The Conservation Objectives for harbour porpoise for Bristol Channel Approaches SAC, and individual attributes with targets are provided in Table 16.

Table 16. Conservation Objective information for harbour porpoise in Bristol Channel Approaches SAC (UK0030396) (JNCC 2019e).

Conservation Objective information for Bristol Channel Approaches SAC (UK0030396)		
[1351] Harbour porpoise		
To ensure that the integrity of the site is maintained and that it makes the best possible contribution to maintaining Favourable Conservation Status (FCS) for harbour porpoise in UK waters, which is defined by the following list of attributes and targets:		
Attribute	Target	Notes
Species is a viable component of the site	Maintained or restored in the long term – subject to natural change	Not applicable
Disturbance	No significant disturbance of the species	Not applicable
Habitats and processes	Habitats and processes relevant to harbour porpoise and its prey are maintained or restore in the long term – subject to natural change	Not applicable

Harbour porpoise are a primary feature of the Bristol Channel Approaches SAC, which is estimated to support 4.7% of the UK Celtic and Irish Sea management unit (MU) population. The site provides relatively good foraging habitat and may be used for breeding and calving (JNCC 2019a). The SAC features an area around Carmarthen Bay which has persistently high

densities of harbour porpoise during both winter and summer seasons (Heinänen and Skov 2015).

Overall, it is considered highly unlikely there will be an AEoI on the population of harbour porpoise within Bristol Channel Approaches SAC which is 29.5 km from the S. I. Area. Harbour porpoises show evasion behaviour to vessel presence so the likelihood that individuals spend a prolonged period near the S.I. survey vessel is unlikely. There is extensive suitable foraging habitat elsewhere in the Irish Sea and beyond, enabling harbour porpoise to avoid the survey area if required. If an individual was to be that close to the source, any event of injury would be to that sole individual and would not incur a population level effect as it is an extremely unlikely event. The S. I. surveys are also anticipated to be relatively short term (over a four-month period across the whole survey area in Irish and UK waters) and activities will be transient, meaning exposure to underwater noise will be short-term, both spatially and temporally. Therefore, short-term localised disturbances, such as the S. I. surveys proposed here would have negligible to no impact on porpoise in the SAC.

Conclusion

Consequently, it is considered that targets, with respect to Conservation Objectives listed in Table 16, would not be significantly affected and that there would be **no AEoI** on harbour porpoise in Bristol Channel Approaches SAC due to the S. I. surveys. Mitigation is not required to reach a conclusion of no AEoI on the SAC, however, following best practice guidance, mitigation to avoid effects on individual marine mammals from the geophysical survey activities have been proposed and detailed in Section 7.3 and Appendix 1.

Cardigan Bay SAC (UK0012712)

This site was screened into AA due to the potential for LSE on bottlenose dolphins, grey seals, sea lamprey and river lamprey from underwater noise and vibration.

The Conservation Objectives for bottlenose dolphin, grey seal, river lamprey and sea lamprey for Cardigan Bay SAC, and individual attributes with targets are provided in Table 17.

Table 17. Conservation Objective information for bottlenose dolphin, grey seal, sea lamprey and river lamprey in Cardigan Bay SAC (UK0012712) (NRW 2018b).

Conservation Objective information for Cardigan Bay SAC (UK0012712)			
[1349] Bottlenose dolphin			
To maintain (or restore) the habitat and species features, as a whole, at (or to) favourable conservation status (FCS) within the site. To achieve favourable conservation status all the following attributes and targets, subject to natural processes, need to be fulfilled and maintained in the long-term			
Attribute	Measure	Target	Notes

Conservation Objective information for Cardigan Bay SAC (UK0012712)			
Population	Size, structure, production, condition, of the species within the site.	The population is maintaining itself on a long-term basis as a viable component of its natural habitat.	As part of this objective, it should be noted that for bottlenose dolphin, contaminant burdens derived from human activity are below levels that may cause physiological damage, or immune or reproductive suppression.
Range	Areas of the site which the population/individuals use.	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.	As part of this objective, it should be noted that, for bottlenose dolphin, their range within the SAC and adjacent inter-connected areas is not constrained or hindered, there are appropriate and sufficient food resources within the SAC and beyond, and the sites and amount of supporting habitat used by these species are accessible and their extent and quality is stable or increasing.

Conservation Objective information for Cardigan Bay SAC (UK0012712)			
Supporting habitats and species	Distribution, extent, structure, function and quality of habitat, and prey availability and quality.	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.	As part of this objective, it should be noted that the abundance of prey species subject to existing commercial fisheries needs to be equal to or greater than that required to achieve maximum sustainable yield and secure in the long term; the management and control of activities or operations likely to adversely affect the species feature is appropriate for maintaining it in favourable condition and is secure in the long term; contamination of potential prey species should be below concentrations potentially harmful to their physiological health; and disturbance by human activity is below levels that suppress reproductive success, physiological health or long-term behaviour. As part of this objective it should be noted that for the bottlenose dolphin populations should be increasing.
[1364] Grey seal			
To maintain (or restore) the habitat and species features, as a whole, at (or to) favourable conservation status (FCS) within the site. To achieve favourable conservation status all the following attributes and targets, subject to natural processes, need to be fulfilled and maintained in the long-term			
Attribute	Measure	Target	Notes
Population	Size, structure, production, condition, of the species within the site.	The population is maintaining itself on a long-term basis as a viable component of its natural habitat.	As part of this objective, it should be noted that for grey seal, contaminant burdens derived from human activity are below levels that may cause physiological damage, or immune or reproductive suppression. For grey seal populations should not be reduced as a consequence of human activity.
Range	Areas of the site which the population/individuals use.	The species population within the site is such that the natural range of the	As part of this objective, it should be noted that, for grey seal, their range within

Conservation Objective information for Cardigan Bay SAC (UK0012712)			
		population is not being reduced or likely to be reduced for the foreseeable future.	the SAC and adjacent inter-connected areas is not constrained or hindered, there are appropriate and sufficient food resources within the SAC and beyond, and the sites and amount of supporting habitat used by these species are accessible and their extent and quality is stable or increasing.
Supporting habitats and species	Distribution, extent, structure, function and quality of habitat, and prey availability and quality.	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.	As part of this objective, it should be noted that the abundance of prey species subject to existing commercial fisheries needs to be equal to or greater than that required to achieve maximum sustainable yield and secure in the long term; the management and control of activities or operations likely to adversely affect the species feature is appropriate for maintaining it in favourable condition and is secure in the long term; contamination of potential prey species should be below concentrations potentially harmful to their physiological health; and disturbance by human activity is below levels that suppress reproductive success, physiological health or long-term behaviour.
[1095] Sea lamprey			
To ensure that the integrity of the site is maintained and that it makes the best possible contribution to maintaining Favourable Conservation Status (FCS) for Sea lamprey in UK waters, which is defined by the following list of attributes and targets:			
Attribute	Measure	Target	Notes
Population	Size, structure, production and physiological health.	The population is stable or increasing on a long-term basis as a viable component of its natural habitat.	Inferences about lamprey population are based on the condition monitoring of the Afonydd Cleddau SAC and they are difficult to sample in the marine environment.
Range	Areas of the site which the population/individuals use.	The species population within the site is such that the natural range of the population is not being reduced or likely to be	Range data for sea lamprey in the area is deficient. There is currently a lack of data regarding current and historical sea lamprey

Conservation Objective information for Cardigan Bay SAC (UK0012712)			
		reduced for the foreseeable future.	spawning sites (Countryside Council for Wales 2008)
Habitats and species	Distribution and extent, structure, function and quality and prey availability and quality.	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. Suitable habitats must include abundant, suitable prey and adequate water quality.	Sea lamprey are not thought to be restricted to any particular habitat and are likely to follow a range of prey with a preference for demersal species.
[1099] River lamprey			
To ensure that the integrity of the site is maintained and that it makes the best possible contribution to maintaining Favourable Conservation Status (FCS) for River lamprey in UK waters, which is defined by the following list of attributes and targets:			
Attribute	Measure	Target	Notes
Population	Size, structure, production and physiological health.	The population is stable or increasing on a long-term basis as a viable component of its natural habitat.	Inferences about lamprey population are based on the condition monitoring of the Afonydd Cleddau SAC and they are difficult to sample in the marine environment.
Range	Areas of the site which the population/individuals use.	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.	Range data for river lamprey in the area is deficient.
Habitats and species	Distribution and extent, structure, function and quality and prey availability and quality.	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. Suitable habitats must include abundant, suitable prey and adequate water quality.	River lamprey depend on estuarine and coastal fish species, specifically herring, sprat and flounder.

Bottlenose dolphins are a primary feature of the Cardigan Bay SAC, which is an important area for foraging and provides a nurse ground for females and young calves (NRW 2018b). Within the SAC, dolphins have been observed foraging for pelagic fish such as sea trout, salmon, bass,

mullet, mackerel, and garfish (NRW 2018b). Seasonal trends in dolphin presence are apparent within the SAC, with the highest number of individuals present between July and October, where they generally maintain a coastal distribution, compared to over the winter months where they are more dispersed (Bains and Evans 2012; NRW 2018b). Bottlenose dolphins within Cardigan Bay are highly mobile and represent a wide-ranging population which have been recorded north and south of the SAC (NRW 2018b). Cardigan Bay SAC is also an important site for grey seals for pupping and foraging.

Overall, it is considered highly unlikely there will be an AEoI of the populations of bottlenose dolphin or grey seal within Cardigan Bay SAC which is 35 km from the S. I. Area. As mentioned previously, sound attenuates increasingly from the source and the individual would have to be extremely close to the source at the time of maximum output. If an individual were to be that close to the source, any event of injury would be to that sole individual and would not incur a population level effect as it is an extremely unlikely event. There is extensive suitable foraging and haul-out (seal specific) habitat elsewhere enabling both bottlenose dolphin and grey seal to avoid the survey area if required.

This SAC is a considerable distance away from the S. I. Survey Area and considering the limited spatial extent of the surveys, they will not have a barrier effect that prevents the movement of these lamprey species between coastal and estuarine waters in this area. Additionally, the S. I. survey activities are due to take place outside of lamprey migration periods (Table 14). Furthermore, lamprey are known to have poor hearing and individuals would have to be extremely close to the source at the time of output for injury to occur. If an individual were to be that close to the source, any event of injury would be possible only for geophysical survey activities (SBP), with behavioural impacts and TTS being most likely.

The S. I. survey is also anticipated to be relatively short term (over a four-month period across the whole survey area in Irish and UK waters) and activities will be transient, meaning exposure to underwater noise will be short-term, both spatially and temporally. Therefore, short-term localised disturbances, such as the S. I. surveys proposed here, would have negligible to no impact on bottlenose dolphins, grey seals, sea lamprey or river lamprey in the SAC.

Conclusion

Consequently, it is considered that targets, with respect to Conservation Objectives listed in Table 17, would not be significantly affected and that there would be **no AEoI** on the qualifying interest features of the Cardigan Bay SAC as a result of this impact pathway. Mitigation is not required to reach a conclusion of no AEoI on the SAC, however, following

best practice guidance, mitigation to avoid effects on individual marine mammals from the geophysical survey activities have been proposed and detailed in Section 7.3 and Appendix 1.

Lleyn Peninsula and the Sarnau SAC (UK0013117)

This site was screened into AA due to a possible LSE on bottlenose dolphin and grey seal due to underwater noise and vibration.

The Conservation Objectives for bottlenose dolphin and grey seal for Lleyn Peninsula and the Sarnau SAC, and individual attributes with targets are provided in Table 18.

Table 18. Conservation Objective information for bottlenose dolphin and grey seal in Lleyn Peninsula and the Sarnau SAC (UK0013117) (NRW 2018c).

Conservation Objective information for Lleyn Peninsula and the Sarnau SAC (UK0013117)			
[1349] Bottlenose dolphin			
To maintain (or restore) the habitat and species features, as a whole, at (or to) favourable conservation status (FCS) within the site. To achieve favourable conservation status all the following attributes and targets, subject to natural processes, need to be fulfilled and maintained in the long-term			
Attribute	Measure	Target	Notes
Population	Size, structure, production and physiological health.	The population is maintaining itself on a long-term basis as a viable component of its natural habitat.	As part of this objective, it should be noted that for bottlenose dolphin, contaminant burdens derived from human activity are below levels that may cause physiological damage, or immune or reproductive suppression
Range	Areas of the site which the population/individuals use.	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.	As part of this objective, it should be noted that for bottlenose dolphin their range within the SAC and adjacent inter-connected areas is not constrained or hindered, there are appropriate and sufficient food resources within the SAC and beyond.
Supporting habitats and species	Distribution and extent, structure, function and quality and prey availability and quality.	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.	Not applicable.

Conservation Objective information for Llyn Peninsula and the Sarnau SAC (UK0013117)			
[1364] Grey seal			
To maintain (or restore) the habitat and species features, as a whole, at (or to) favourable conservation status (FCS) within the site. To achieve favourable conservation status all the following attributes and targets, subject to natural processes, need to be fulfilled and maintained in the long-term			
Attribute	Measure	Target	Notes
Population	Size, structure, production and physiological health.	The population is maintaining itself on a long-term basis as a viable component of its natural habitat.	As part of this objective, it should be noted that for grey seal, contaminant burdens derived from human activity are below levels that may cause physiological damage, or immune or reproductive suppression. Grey seal populations should not be reduced as a consequence of human activity.
Range	Areas of the site which the population/individuals use.	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.	As part of this objective, it should be noted that for grey seal, their range within the SAC and adjacent inter-connected areas is not constrained or hindered, there are appropriate and sufficient food resources within the SAC and beyond.
Supporting habitats and species	Distribution and extent, structure, function and quality and prey availability and quality.	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.	Not applicable.

The Llyn Peninsula and the Sarnau SAC is an important area for foraging for bottlenose dolphin and provides a nurse ground for females and young calves (NRW 2018c). Individual bottlenose dolphins within the Cardigan Bay SAC show high connectivity with the Llyn Peninsula and the Sarnau SAC, and there is strong evidence to suggest they make up a single population (NRW 2018c). The Llyn Peninsula SAC is also an important site for grey seals for pupping and foraging.

Overall, it is considered highly unlikely there will be an AEol of the populations of bottlenose dolphin or grey seal within Llyn Peninsula and the Sarnau SAC which is 107.8 km from the S.I. Area. As mentioned previously, sound attenuates increasingly from the source and, the individual would have to be extremely close to the source at the time of maximum output. If

an individual were to be that close to the source, any event of injury would be to that sole individual and would not incur a population level effect as it is an extremely unlikely event. There is extensive suitable foraging and haul-out (seal specific) habitat elsewhere enabling both bottlenose dolphin and grey seal to avoid the survey area if required. The S. I. survey is also anticipated to be relatively short term (over a four-month period across the whole survey area in Irish and UK waters) and activities will be transient, meaning exposure to underwater noise will be short-term, both spatially and temporally. Therefore, short-term localised disturbances, such as the S. I. surveys proposed here would have negligible to no impact on bottlenose dolphins or grey seals in the SAC.

Conclusion

Consequently, it is considered that targets, with respect to Conservation Objectives listed in Table 18, would not be significantly affected and that there would be **no AEol** on bottlenose dolphin or grey seal in the Llyn Peninsula and the Sarnau SAC due to the S. I. surveys. Mitigation is not required to reach a conclusion of no AEol on the SAC, however, following best practice guidance, mitigation to avoid effects on individual marine mammals from the geophysical survey activities have been proposed and detailed in Section 7.3 and Appendix 1.

Saltee Islands SAC (E0000707)

This site was screened into AA due to a possible LSE on grey seal from underwater noise and vibration.

The Conservation Objectives for grey seal for Saltee Islands SAC, and individual attributes with targets are provided in Table 19.

Table 19. Conservation Objective information for grey seal in Saltee Islands SAC (IE003000) (NPWS 2011).

Conservation Objective information for Saltee Islands SAC (E0000707)			
[1364] Grey seal			
To maintain the favourable conservation condition of grey seal in the Saltee Islands SAC, which is defined by the following list of attributes and targets:			
Attribute	Measure	Target	Notes
Access to suitable habitat	Number of artificial barriers	Species range within the site should not be restricted by artificial barriers to site use	Not applicable
Breeding behaviour	Breeding sites	The breeding sites should be maintained in a natural condition	Attribute and target based on background knowledge of Irish breeding populations;

Conservation Objective information for Saltee Islands SAC (E0000707)			
			review of data from Kiely et al. (2000); Lidgard et al. (2001); Lyons (2004); a comprehensive breeding survey in 2005 (Ó Cadhla et al. 2007); and unpublished National Parks & Wildlife Service records
Moulting behaviour	Moult haul-out sites	The moult haul-out sites should be maintained in a natural condition	Attribute and target based on background knowledge of Irish populations; research by Kiely et al. (2000); a national moult survey (Ó Cadhla and Strong, 2007); and unpublished National Parks & Wildlife Service records
Resting behaviour	Resting haul-out sites	The resting haul-out sites should be maintained in a natural condition	Attribute and target based on review of data from Kiely (1998); Kiely et al. (2000); Lyons (2004); Cronin et al. (2004); Ó Cadhla et al. (2007); Ó Cadhla and Strong (2007); and unpublished National Parks & Wildlife Service records
Population composition	Number of cohorts	The grey seal population occurring within this site should contain adult, juvenile and pup cohorts annually	Attribute and target based on review of data from Kiely (1998), Kiely et al. (2000), Lyons (2004), Ó Cadhla et al. (2007), Ó Cadhla and Strong (2007); and unpublished National Parks & Wildlife Service records
Disturbance	Level of impact	Human activities should occur at levels that do not adversely affect the grey	Not applicable

Saltee Islands SAC is an important area for grey seals for pupping and foraging, with grey seals using the site year-round (NPWS 2011). Seals within these SACs are not part of a discrete population, rather they form part of a larger breeding population which extends from south-west Scotland to south-west England and south-east Ireland (NRW 2018b).

Overall, it is considered highly unlikely there will be an AEol of the population of grey seal within Saltee Islands SAC which is 39.5 km from the S. I. Area. As mentioned previously, sound attenuates increasingly from the source and the individual would have to be extremely close to the source at the time of maximum output. If an individual were to be that close to the source, any event of injury would be to that sole individual and would not incur a population level effect as it is an extremely unlikely event. There is extensive suitable foraging and haul-out habitat elsewhere enabling grey seal to avoid the survey area if required. The S. I. survey is also anticipated to be relatively short term (over a four-month period across the whole survey area in Irish and UK waters) and activities will be transient, meaning exposure to underwater noise will be short-term, both spatially and temporally. Therefore, short-term localised disturbances, such as the S. I. surveys proposed here would have negligible to no impact on grey seals in the SAC.

Conclusion

Consequently, it is considered that targets, with respect to Conservation Objectives listed in Table 19, would not be significantly affected and that there would be **no AEol** on grey seal in Saltee Islands SAC due to the S. I. surveys. Mitigation is not required to reach a conclusion of no AEol on the SAC, however, following best practice guidance, mitigation to avoid effects on individual marine mammals from the geophysical survey activities have been proposed and detailed in Section 7.3 and Appendix 1.

7.1.2 Abrasion / disturbance of the substrate on the surface of the seabed

One site, the Pembrokeshire Marine / Sir Benfro Forol SAC, was screened into Stage 2 Appropriate Assessment due to potential LSE on Annex I Habitats (See Table 5).

Pembrokeshire Marine / Sir Benfro Forol SAC (UK0013116)

The Conservation Objectives for priority features in Pembrokeshire Marine / Sir Benfro Forol SAC, and individual attributes with targets are provided in Table 20.

Table 20. The Conservation Objectives for Pembrokeshire Marine / Sir Benfro Forol SAC, including targets and additional notes.

Conservation Objective information for: Pembrokeshire Marine SAC (UK0030398)		
[1160] Large Shallow Inlets and Bays		
To achieve favourable conservation status 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 favourable conservation status:		
Attribute	Target	Notes

Conservation Objective information for: Pembrokeshire Marine SAC (UK0030398)		
Distribution and extent	The overall distribution and extent of the habitat features within the site, and each of their main component parts is stable or increasing.	Assessed as 'Favourable' and extent and distribution is unchanged since designation.
Nutrient levels	Nutrient levels in the water column and sediments to be at or below existing statutory guideline concentrations and within ranges that are not potential detrimental to the long-term maintenance of the features species populations, their abundance and range.	Not applicable
Contaminant levels	At or below existing statutory guideline concentrations; below levels that would potentially result in increase in contaminant concentrations within sediments or biota and below levels potentially detrimental to the long-term maintenance of the feature species populations, their abundance or range.	Not applicable
[1170] Reefs		
To achieve favourable conservation status 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 favourable conservation status:		
Attribute	Target	Notes
Distribution and extent	The overall distribution and extent of the habitat features within the site, and each of their main component parts is stable or increasing.	Assessed as 'Favourable' and extent and distribution is unchanged since designation.
Nutrient levels	Nutrient levels in the water column and sediments to be at or below existing statutory guideline concentrations and within ranges that are not potential detrimental to the long-term maintenance of the features species populations, their abundance and range.	Not applicable
Contaminant levels	At or below existing statutory guideline concentrations; below levels that would potentially result in increase in contaminant concentrations within sediments or biota and below levels potentially detrimental to the long-term maintenance of the feature species populations, their abundance or range.	Not applicable
[1140] Mudflats and Sandflats not covered by seawater at low tide		

Conservation Objective information for: Pembrokeshire Marine SAC (UK0030398)		
To achieve favourable conservation status 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 favourable conservation status:		
Attribute	Target	Notes
Distribution and extent	The overall distribution and extent of the habitat features within the site, and each of their main component parts is stable or increasing.	Currently assessed as 'Favourable' but under threat of coastal squeeze, with a predicted worst case scenario loss of 1 ha between 2005 – 2025 across the whole site (Royal Haskoning DHV 2010).
Nutrient levels	Nutrient levels in the water column and sediments to be at or below existing statutory guideline concentrations and within ranges that are not potential detrimental to the long-term maintenance of the features species populations, their abundance and range.	Not applicable
Contaminant levels	At or below existing statutory guideline concentrations; below levels that would potentially result in increase in contaminant concentrations within sediments or biota and below levels potentially detrimental to the long-term maintenance of the feature species populations, their abundance or range.	Not applicable

Pembrokeshire Marine SAC includes intertidal sandy/muddy areas which support extensive beds of narrow-leaved eelgrass (*Zostera angustifolia*). High-salinity water and rocky substrates penetrate far upstream, and communities characteristic of fully saline conditions occur. A wide range of subtidal and intertidal rocky habitats are present, from rocky reefs and boulders to rich under boulders, crevices, overhangs and pools (JNCC 2023).

Mudflats and sandflats not covered by water at low tide occur from the lowest to highest astronomical tide across the whole site and are distributed across inlets, estuaries, embayment's and open coastal areas (Figure 4). Extensive areas of sublittoral rocky reef stretch offshore from the west Pembrokeshire coast between the Pembrokeshire islands and many small islets. Many of the reefs extend onto the shore and provide examples of both the most exposed and the most sheltered intertidal rock communities in southern Britain. The reefs present in the vicinity of the Pembrokeshire Marine SAC are considered to be 'outstanding' and of the highest grade by European standards (JNCC 2023).

The proposed route for the Tuskar S. I. works intersects with large shallow inlets and bays (1160), reefs (1170) and mudflats and sandflats not covered by seawater at low tide (1140), which have been screened into this assessment. There is therefore the potential for the geotechnical survey activities to impact the benthic habitat features of this SAC due to abrasion / disturbance of the habitats through contact with the grab sampler, CPT and vibrocore equipment. However, the geotechnical sampling activities are to be informed by the geophysical survey outputs, and the locations of grab samples, CPTs and gravity cores/vibrocores will be decided based upon the geophysical survey results. The geophysical outputs will identify potential areas of reef habitat, which is the most sensitive habitat feature to this impact pathway, and the geotechnical survey locations will be specifically sited to avoid these areas. As such, there will be no impact on reef habitat features from the geotechnical survey works.

Grab samples, CPTs and gravity cores/vibrocores will be taken in the SAC including within the shallow inlets and bays habitat feature. This feature in the Pembrokeshire Marine SAC constitutes the predominantly sandy embayment of St Brides Bay. Up to 12 grab samples, seven CPTs and six cores will be taken within the SAC. Grab samples will remove approximately 10 l of sediment per grab. The cores have a diameter of 120 mm and will remove a sediment core up to 3 m depth. This constitutes a very small surface area of disturbance and removal of sediment relative to the extent of the shallow inlets and bays habitat feature, which covers 22,086 ha of the SAC. The CPT is a steel rod with a conical tip of 35.7 mm diameter. This will be pushed into the sediment at a steady rate until the target penetration depth of 3 m or refusal. This also represents a very small surface area of disturbance relative to the extent of this habitat in the SAC.

Considering the above, significant effects on the shallow inlet and bays habitat feature are not predicted and the effects due to disturbance of the sediment will be limited in spatial extent and of short duration.

The intertidal works will involve small scale exploratory works within the intertidal mudflat and sandflat not covered by seawater at low tide habitat feature, which is predominantly sandy habitat at Newgale beach. Up to four slit trenches will be excavated (0.8 m width, 2 m length and up to 2.5 m in depth). All excavated material will be side-cast adjacent to the trench. Once the nature of the sediment layers has been determined, the material will be placed back in the trench with the separate sediment layers put back in the same sequence they were removed. The slit trenches will be excavated and reinstated within a single tidal cycle. The total surface area of a single trench is 1.6 m². If four trenches are excavated a total surface area of 6.4 m² (0.00064 ha) of the mudflat and sandflat habitat feature will be disturbed. This represents 0.000036% of the total area of this habitat within the SAC (1,780.7 ha) and as indicated it will be disturbed but reinstated, so there will not be any loss of habitat.

As such, given the limited spatial extent and temporary, short-term duration of the works, significant effects on this habitat feature are not predicted.

Conclusion

Given the above, it is concluded that the predicted effects will not compromise the Conservation Objectives of the Site (Table 20) and there will be no potential for AEoI on the qualifying features of the Site from this impact pathway.

7.1.3 Penetration and/or disturbance of the substratum below the surface of the seabed, including abrasion

The Conservation Objectives for priority features in Pembrokeshire marine / Sir Benfro Forol SAC, and individual attributes with targets are provided in Table 20.

The proposed route for the Tuskar S. I. works intersects with large shallow inlets and bays (1160), reefs (1170) and mudflats and sandflats not covered by seawater at low tide (1140), which have been screened into this assessment. There is therefore the potential for the geotechnical survey activities to impact the benthic habitat features of this SAC due to penetration and/or disturbance of substratum below the surface of the seabed including abrasion. This pressure relates to the disturbance of sediment below the surface of the seabed, typically >50 cm depth. As such, the geotechnical activities that will result in disturbance at these depths are the CPT tests and the gravity/vibrocoring. As discussed above, reef habitat features will be avoided and are not at risk from these activities. The sandy sediment habitat of the shallow inlets and bays habitat feature will be subject to subsurface penetration and disturbance. However, as discussed above, this disturbance will be spatially very limited and small scale relative to the extent of this habitat feature, which covers 22,086 ha within the SAC. The effects will be temporary with rapid recovery is expected. As such, significant effects are on this habitat feature are not predicted.

Conclusion

Given the above, it is concluded that the predicted effects will not compromise the Conservation Objectives of the Site (Table 20) and there will be no potential for AEoI on the qualifying features of the Site from this impact pathway.

7.2 Appropriate Assessment Conclusion

The Appropriate Assessment has concluded, based on consideration of the proposed works, no Adverse Effect on Integrity (AEoI) for those European Sites screened into Stage 2 of the assessment.

7.3 Best practice mitigation measures

Although it has been assessed there would be no AEoI on designated sites with marine mammal features, to further reduce any risk of potential injury to individuals, mitigation measures will be applied to reduce the impact of underwater noise and vibration on marine mammals. Geophysical acoustic survey guidance, as specified in 'JNCC guidelines for minimising the risk of injury to marine mammals from geophysical surveys' (2017) will be followed during all impulsive surveys (including: SBP). These guidelines specify procedures including, but not limited to the use of a Marine Mammal Observer and the implementation of a 'soft start' procedure, which shall be used, where applicable to the equipment being used, to ensure that any animals in the vicinity will have chance to leave. With the implementation of these guidelines there will be a negligible risk of disturbance to marine mammals (see Appendix 1 for Marine Mammal Observer protocols as recommended in the JNCC guidance).

8. In-combination Assessment

8.1 Projects considered

The identification of plans and projects to include in the in-combination assessment is based on:

- Approved plans or projects with relevant ongoing activities;
- Approved but as yet unconstructed projects; and
- Projects for which an application has been made, are currently under consideration and will be consented before the proposed works begin.

To identify the projects or plans, a combination of the NRW Public register, Data Map Wales and local knowledge was used. One project was identified that was within the vicinity (10 km) of the works and has the potential to have an in-combination effect with the work activities. Distances to the proposed works are provided within brackets:

- Celtic Deep Phase II floating wind farm (7.3 km)

Celtic Deep Phase II floating wind farm (7.3 km)

Currently in the concept and early planning stage, the Celtic Deep Phase 2 floating wind farm would be located 33 km off the Pembrokeshire coast, west of Milford haven. The development is expected to have the capacity to generate 300 MW of electricity and will expand on the 98 MW Phase 1 array.

The schedule for Celtic Deep Phase 2 development is unknown, however, given the nature of the proposed S. I. works and the temporary and short-term duration, it is concluded that there is no potential for the works and activities at the proposed Celtic Deep Phase 2 site and proposed S. I. works to have in-combination effects on the European Sites and therefore there would be no LSE.

8.2 In-combination assessment conclusion

The in-combination assessment of potential effects arising from identified projects, in-combination with the proposed works, concluded that the S. I. activities would not act in-combination to give rise to an LSE on any European Sites.

9. Conclusions

The activities required for S. I. works, including geotechnical and geophysical surveys, to investigate the feasibility of constructing a new subsea telecoms cable system, Tuskar, have the potential to interact with European Sites. This assessment identified protected sites in the vicinity of the proposed works that could potentially be influenced by effects arising from the works.

Consideration was given to the relevant guidance issued by a number of governmental, statutory and industry bodies including, but not limited to, Welsh Government and NRW guidance on Habitat Regulations Assessments, NRW online guidance on HRA in the marine licensing process, Natural England's Advice on Operations, and NRW's position on the use of Marine Mammal Management Units for screening and assessment in Habitats Regulations Assessments for Special Areas of Conservation with marine mammal features. Following reference to this guidance, the following impact pathways were assessed:

- Above water noise;
- Abrasion / disturbance of the substrate on the surface of the seabed;
- Penetration and/or disturbance of the substratum below the surface of the seabed, including abrasion;
- Visual disturbance;
- Underwater noise changes and vibration;
- Collision (below water and static or moving objects not naturally found in the marine environment);
- Pollution (from vessels and equipment including Hydrocarbon & Polycyclic Aromatic Hydrocarbon (PAH) contamination);
- Reduction in prey availability (all aspects of survey generating underwater noise and vibration); and
- Introduction or spread of invasive non-native species (INNS).

The test for LSE carried out on SACs concluded that there was potential for LSE from underwater noise and vibration, and sediment abrasion, penetration and disturbance impacts on the designated features of the following sites:

- Pembrokeshire marine / Sir Benfro Forol SAC (UK0013116)
- Cardigan Bay / Bae Ceredigion SAC (UK0012712)
- West Wales Marine / Gorllewin Cymru Sarnau SAC (UK0030397)
- Bristol Channel Approaches / Dynesteydd Mor Hafren SAC (UK0030396)
- Saltee Islands SAC (IE000707)

The test for LSE carried out on SPA sites concluded that there was no potential for LSE from the proposed works.

As such, the SAC sites listed above were taken through to Stage 2 Appropriate Assessment for consideration of adverse effects on site integrity (AEol).

The Appropriate Assessment considered the potential effects on site integrity, and whether the Conservation Objectives of sites could be compromised and concluded there would no AEol on any European sites, before consideration of any mitigation measures. Although mitigation was not required to avoid AEol, it was recommended that JNCC guidelines for geophysical surveys should be followed to reduce the risk of adverse effects on individual marine mammal and fish species.

The in-combination assessment concluded no LSE or AEol on any of the sites resulting from a combination of the projects considered.

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Appendix 1 Geophysical surveys operational guidance (JNCC, 2017)

The following section is taken directly from JNCC Guidelines for minimising the risk of injury to marine mammals from geophysical surveys (2017).

Section 2: Mitigation

2.1 Standard Airgun Mitigation Procedures

The following guidelines apply to all geophysical surveys that use airguns.

2.1.1 Pre-shooting search

Clear communication channels between the MMO/PAM operator and relevant crew must be established prior to the commencement of any operations. The MMO/PAM operator must be aware of the timings of the proposed operations. The crew must inform the MMO/PAM operators (or nominated lead) sufficiently in advance of airgun firing so that a full pre-shooting search can be completed prior to the soft start commencing.

Location of MMO/PAM

All monitoring (visual and PAM) should be undertaken from the source vessel (where the noise source is deployed from), unless alternative arrangements have been agreed with the Regulator. The MMO should be positioned on a high platform with a clear view of the horizon, mitigation zone and ahead of the vessel. The PAM operator should be positioned in the most appropriate location to allow them to monitor the PAM equipment for acoustic detections and maintain contact with both the MMO and relevant crew, for both mitigation purposes and ensuring the PAM equipment is deployed correctly.

Mitigation zone

The MMO/PAM operative will monitor the agreed mitigation zone and advise if any marine mammals are within it. The standard radius of the mitigation zone is 500m, estimated from the centre of the airgun array or noise source location. If the size of the mitigation zone is adjusted for any reason, this will be stipulated within the survey consent or licence conditions.

Duration of search

The MMO must monitor the mitigation zone for the full duration of the pre-shooting search and soft-start procedure. Where PAM is being used in conjunction with or in place of visual surveys, acoustic monitoring must also occur for the full duration of the pre-shooting search and soft-start procedure. Once the soft start has ended and data acquisition begins, monitoring can cease.

The duration of the pre-shooting search is determined as follows:

- Waters less than 200m deep: 30 minutes prior to the use of any airguns.
- Waters greater than 200m deep: 60 minutes prior to the use of any airguns.

The longer search period is to allow for deep diving species (e.g. sperm whale and beaked whale) which are known to dive for longer than 30 minutes. PAM may also be required on all pre-shooting searches in deeper waters (i.e. to complement visual surveys) to increase the potential to detect species with long dive times.

Due to the longer pre-shooting search time required in deeper waters, pre-shooting searches can commence before the end of a preceding survey line (whilst the airguns are still firing) IF line changes will take less time than the pre-shooting search and soft-start combined (i.e. 80 mins).

2.1.2 If marine mammals are detected within the mitigation zone

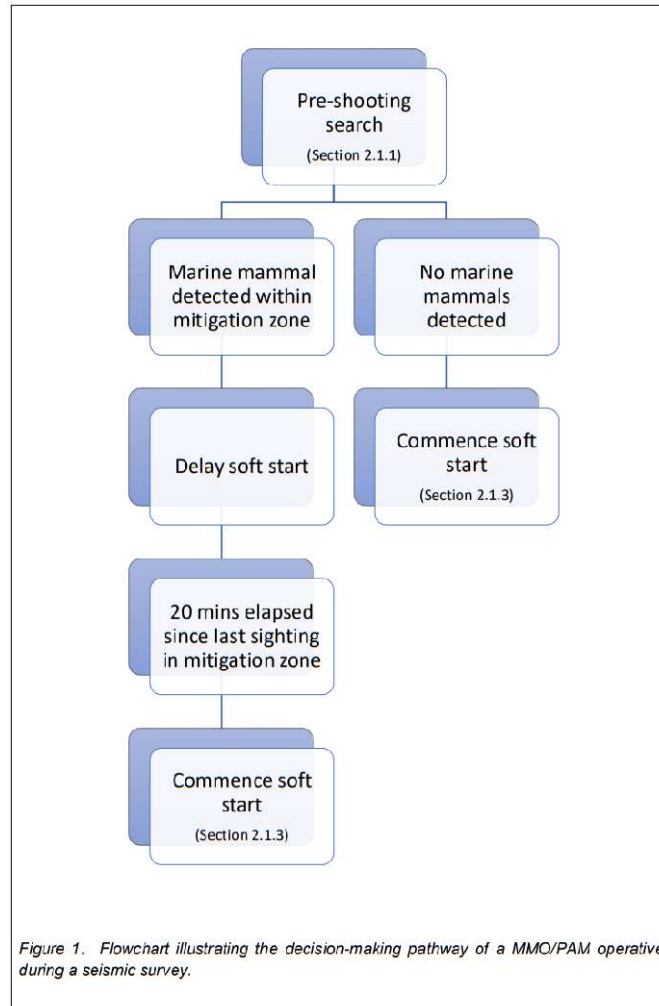
If marine mammals are detected within the mitigation zone during the pre-shooting search (visually or acoustically), the soft-start must be delayed until their passage, or the transit of the vessel, results in them being outside of the mitigation zone. There must be a minimum of a 20-minute delay from the time of the last detection within the mitigation zone and the commencement of the soft-start, to allow animals unavailable for detection (i.e. not re-surfacing in that time) to have moved outside of the mitigation zone.

A full soft-start must be undertaken after any delay due to the presence of marine mammals within the mitigation zone.

In situations where seal(s) are congregating around a fixed platform within a survey area, the soft-start should commence at a location at least 500m from the platform.

If marine mammals are detected within the mitigation zone whilst the airguns are firing, either during the soft-start procedure or when at full power, there is no requirement to stop firing.

Figure 1 illustrates a typical seismic survey with decision making pathways in the event a marine mammal is detected.



2.1.3 Soft-start

Two criteria define the standard duration of a soft start:

- From the start of the soft-start until full operational power: minimum of 20 minutes;
- From the start of the soft-start until the start of the survey line: maximum of 40 minutes.

One exception to these criteria is for surveys where the maximum airgun volume is <180 cubic inches, in which case:

- From the start of the soft-start until full operational power: minimum of 15 minutes;
- From the start of the soft-start until the start of the survey line: maximum of 25 minutes.

Regardless of duration, power should be built up gradually, in uniform stages from a low energy start-up (e.g. increasing the number of airguns starting with the smallest airgun in the array or increasing the airgun pressure).

There should be a soft-start every time the airguns are scheduled to be used, the only exceptions being for certain types of airgun testing, and the use of a 'mini-airgun' (single gun volume equal to or less than 10 cubic inches). Mini airguns do not require a soft start.

Surveys operations should be planned to avoid unnecessary firing at operational power before commencement of a survey line and to time operations to commence data collection as soon as possible once full operational power is achieved.

2.1.4. Line changes

Seismic data is usually collected along predetermined survey lines. Line change or line turn is the term used to describe the activity of turning the vessel at the end of one survey line prior to commencement of the next.

The following procedures depend on the duration of the line change. If an operator determines that an effective line change cannot be achieved using these procedures, then they should contact the Regulator and appropriate SNCB(s) at the earliest possible opportunity to discuss a proposed alternative. Details of any agreed alternative procedures should be described during the application process and reiterated, if appropriate, in the survey consent or licence conditions.

One example of airgun use that does not require a line change is Vertical Seismic Profiling (VSP), a technique where measurements are made at a series of depths in the wellbore using geophones inside the wellbore and an airgun source at the surface near the well. In this instance, the breaks in operations required to reposition geophones are treated in the same manner as line changes.

If monitoring operations are being undertaken using PAM and difficulties are encountered when deploying the PAM equipment, the line changes should be extended to allow the full pre-shooting search and soft start to be completed using PAM.

a) If line changes are expected to take longer than 40 minutes:

If line changes (or geophone repositioning) are expected to take longer than 40 minutes, regardless of airgun volume:

- Firing is to be terminated at the end of the survey line (or during geophone repositioning);
- A pre-shooting search is to be undertaken during the scheduled line change (or geophone repositioning);

- The soft-start is to be delayed if marine mammals are seen within the mitigation zone during the pre-shooting search; and
- A full 20-minute soft-start is to be undertaken before the start of the next line or VSP data collection.

Most seismic surveys with airgun array volumes of 500 cubic inches or more and extensive hydrophone arrays are not able to complete their line changes within 40 minutes (Stone, 2015b) and should therefore follow the procedures outlined above.

b) If line changes are expected to take less than 40 minutes:

If line changes (or geophone repositioning) are expected to be completed within 40 minutes, regardless of airgun volume:

- Airgun firing can continue during the line change only if power is reduced to 180 cubic inches (or as close as is practically feasible) at standard pressure. Airgun volumes of less than 180 cubic inches can continue to fire at their operational volume and pressure; AND
- The Shot Point Interval (SPI) is increased to provide a longer duration between shots, with the SPI not to exceed 5 minutes; AND
- The power is increased and the SPI is decreased in uniform stages during the final 10 minutes of the line change (or geophone repositioning), prior to data collection recommencing (i.e. a form of mini soft start).

If the above is not practical, and an alternative procedure has not been agreed with the Regulator, then airgun firing should be terminated and a pre-shooting search and soft-start implemented prior to the start of the next line.

2.1.5 Airgun testing

Airgun tests may be required to trial new equipment or to test damaged or misfiring airguns following repair. Individual airguns or several airguns may need testing and the airguns may also be tested at varying power levels. The following guidance is provided to clarify when a soft-start is required for airgun testing:

- If the intention is to test a single airgun, a soft-start is not required.
- If the intention is to test multiple airguns, a soft-start is required. This should be carried out over a time period proportional to the number and/or volume of guns being tested and should not exceed 20 minutes in duration. Airguns should be tested in order of volume, smallest first.
- A pre-shooting search must be undertaken before any instances of airgun testing.

Where feasible, it is recommended that airgun testing is incorporated into the soft start procedure and conducted before the start of a survey line to reduce the total amount of noise being introduced into the marine environment.

2.1.6 Undershoot operations

The MMO/PAM operatives should be located on the source vessel to ensure they are close enough to the airguns to effectively monitor the mitigation zone. If this is not possible, e.g. for logistical or health and safety reasons, the operator should explain this during the application process and suggest and agree any alternative mitigation arrangements with the Regulator.

A pre-shooting search and soft-start procedure must be followed prior to undertaking all undershoot operations.

2.1.7 Breaks in operations

Unplanned breaks: This refers to instances where the airguns cease firing unexpectedly during data acquisition, e.g. a technical problem or breakdown. In such circumstances, it is imperative the MMO/PAM operatives begin to monitor the mitigation zone as quickly as possible after an unplanned break has occurred.

- Unplanned breaks of less than 10 minutes: If the airguns can be restarted and data acquisition resumed in less than 10 minutes, there is no requirement for a soft-start and firing can recommence at the same power level as at prior to the break (or lower), provided no marine mammal(s) have been detected in the mitigation zone during the breakdown period.

If a marine mammal is detected in the mitigation zone during the breakdown period, the MMO/PAM operative will advise to delay recommencement of the airgun firing until their passage, or the transit of the vessel, results in the marine mammals being outside of the mitigation zone. There must be a minimum of a 20-minute delay from the time of the last detection within the mitigation zone and a soft-start must then be undertaken, as described in Section 2.1.3.

- Unplanned breaks of longer than 10 minutes: If it takes longer than 10 minutes to restart the airguns, a full pre-shooting search and soft-start should be carried out before the survey re-commences. If an MMO/PAM operative has been monitoring during the breakdown period, this time can contribute to the pre-shooting search time (30 or 60 minutes as appropriate).

If the breakdown occurs at night or during daylight conditions not conducive for a visual search, the mitigation zone should be monitored as described above using PAM. If PAM is not available, the survey must be delayed until conditions are suitable for visual observations.

Planned breaks: If breaks in data acquisition other than during a line change are required (e.g. to avoid a structure), these should be considered within the application to allow the Regulator and SNCB to fully understand the survey procedure.

The same procedures as above (for unplanned breaks) can be applied. However, if the planned break will be for less than 10 minutes, the MMO/PAM operatives must begin monitoring 20 minutes prior to the planned break and continue for the duration of the break.

2.2 High Resolution Surveys (HRS)

High resolution data can be achieved either using airguns or electromagnetic sources. Sub-bottom profiling (SBP, e.g. pingers, sparkers, boomers and CHIRP systems), side-scan sonar and multi-beam echosounders all use electromagnetic sources.

JNCC will provide advice on a case-by-case basis based on the following:

- **Airguns:** As a precautionary measure, JNCC advise that any HRS that uses airguns requires mitigation as described in Section 2.1 above. Note: mini airguns (single gun volume equal to or less than 10 cubic inches) do not require a soft start but do require a pre-shooting search.
- **Electromagnetic sources:**
 - o Pre-shooting search of the mitigation zone and a delay in proceeding if a marine mammal is observed as described in Sections 2.1.1 and 2.1.2. Typically, a non-dedicated MMO can be used.
 - o Soft start – where practical, ramp up the power in a uniform manner. However, it is acknowledged that this is not possible for some SBP equipment (i.e. it is either on or off). If such equipment is to be used, this should be highlighted during any relevant application process.
 - o Line change – as described in Section 2.1.4.

If several types of HRS equipment are to be started sequentially or interchanged during the operation, only one pre-shooting search is required prior to the start of acoustic output, only if there are no gaps in data acquisition of greater than 10 minutes (refer to Section 2.1.7 for breaks in operations).

Multi-beam surveys in deep waters

SNCB guidance on the protection of EPS18 highlights that some multi-beam systems used in deeper waters (>200m) utilise frequencies (<100Khz) at sound levels that may be of concern to cetacean species, both in relation to deliberate injury and disturbance offences (see Section 3.14, page 43 of the EPS guidance). Therefore, an assessment of the risk to EPS from

such surveys should be considered. JNCC (or the appropriate SNCB) will provide advice regarding mitigation requirements on a case by case basis as either directly to the operator or as part of any consultation process initiated by the relevant Regulator.

Multi-beam surveys in shallower waters (<200m) are not subject to these requirements as it is thought the higher frequencies typically used fall outside the hearing frequencies of cetaceans and the sounds produced are likely to attenuate more quickly than the lower frequencies used in deeper waters. JNCC do not, therefore, advise that mitigation is required for multi-beam surveys in shallow waters.

Appendix 2 – Survey Vessels and Equipment

The Roman Rebel

The Roman Rebel is a purpose-built survey platform and is considered a top-of-the line vessel for its class. This vessel's unique design enables this boat to provide the performance of a much larger survey vessel in a smaller, more agile hull. She is a purpose-built survey platform with a semi-SWATH (Small Waterplane Area Twin Hull) hull design that optimises stability. The survey equipment plan essentially enables this vessel to be operated as two identical, harmonised platforms during survey work, ensuring the most productive hydrographic data collection while maintaining precision and efficiency.



Roman Rebel

Vessel Data (v2)



General

Builder:	Socarenam Boulogne, France
Designer:	Bureau Mauric, Marseilles
Launched:	2014
Length:	27.5 m
Beam:	10.0 m
Draught:	3.5 m
Tonnage:	134 GT
Ops Code:	UK MCA SCV Category 1 (150 miles)
Class:	Lloyd's Register 100A1SSC Catamaran, G6, DP1
Flag:	UK
Previous name:	Bibby Athena

Propulsion

Main:	2 x Cummins KTA19 M3 447 kW each (600 hp) marine diesels
Main Propellers:	5 blade fixed pitch
Main Gearbox:	MGS16C twin disk hydraulic gearboxes
Survey:	2 x Schottel SPJ57 azimuth pump jets 175 kW (235 hp)
Bow Thrusters:	2 x Schottel SPJ15 azimuth pump jets 60 kW (80 hp)
Max speed:	12 knots
Cruising speed:	10 knots
Survey speed:	3.5 – 6.0 knots

Generators

Main:	2 x Scania DI13-074M (340 kVA each)
Harbour:	1 x Cummins Onan 35 kVA
Deck Connection:	1 x 175 kVA and 1 x 50 kVA

Manning and Endurance

Berths:	16
Safe manning:	5
Endurance:	10 days (with 16 crew)

Capacities

Gas oil:	24 m ³
Fresh water:	8 m ³
Water maker:	2 m ³

Fuel Consumption

Transit:	2.5 m ³ · day ⁻¹
Survey:	1.2 m ³ · day ⁻¹
DP:	1.8 m ³ · day ⁻¹

Nav aids

Radar:	2 x 94m Furuno FAR 2117 Black Box
Autopilot:	Navico AP50 with remote control
ECDIS:	Navmaster
AIS:	Furuno FA150
dGPS:	C&C Tech C-Nav 3050 and Furuno GP150
Echosounder:	Furuno FE700
Heading INS Gyro:	iXBlue Quadrans
Secondary Heading:	2x iXBlue Hydrans
Speed log:	Skipper Electromagnetic
Navtex:	Furuno 700B
Weather:	2 x Furuno WS200
VHF:	2x Icom 603 DSC
MF:	Furuno FS1570
Sat Comms:	Furuno 250 Fleet Broadband; Furuno Felcom 15 Sat C
GNSS:	C-NAV and Hemisphere

Dynamic Positioning (DP1)

System:	Sirehna EasyDP BV - AM/AT
Modes:	Station keeping, ROV follow, slow speed line keeping, high speed line keeping, Auto heading
Ref Sensors:	2 x dGPS, 2 x MRU (Hydrans and Quadrans), dual axis log, 2 x wind sensors, Sonardyne Mini-Ranger 2 USBL acoustic navigation system

Roman Rebel

Vessel Data (v3)



Deck Equipment

Crane:	Palfinger PK23500-M, 5,450 kg at 4.2 m, 8 m reach
Crane remote:	Full function radio control
A-Frame:	Hydraulic 8,000 kg SWL with 6.5m deck clearance
A-Frame outriggers:	Full beam width for towing geophysical sensors
Lifting winch:	Hydraulic 8,000 kg line pull
Moonpool:	2.05 m x 2.30 m central moonpool
Main Survey Winch:	MacArtney "Cormac" 4 1,500 m of 8.2 mm coax cable
Secondary survey winch:	2x STR ESW-1500 600 m of 11.4 mm coax cable
Sonar well:	2x 600 mm x 540 mm
USBL well:	310 mm diameter
Capstan:	2 x deck mounted 2000 kg line pull

Survey Positioning

GNSS 1:	C&C Tech C-Nav 3050
GNSS 2:	Hemisphere R330
INS:	2x iXBlue Hydrans

Underwater Positioning

USBL transceiver:	Sonardyne HPT 3000 ("Mini Ranger 2")
Surface unit:	Sonardyne Hub
Transponder:	Sonardyne WSM 6+

Safety

Liferaft capacity:	2x 16 man
Lifejackets:	16x emergency; 8x deck work
Survival suits:	16x neoprene immersion suits
Emergency positioning:	EPIRB 406 kHz
Other:	2x SAR transponders

Multibeam Echosounder

Sonar heads:	2x Teledyne SeaBat T50-R (total 2,048 beams per ping)
Processor:	2x Teledyne Reson T50 IDH processor
SV sensor:	2x Reson SVP-70

Sub-Bottom Profilers

Pinger Transducer:	4x Neptune T335
Parametric Transducer:	Innomar Medium-100; 2-22 kHz secondary frequencies; vertical resolution better than 5 cm
Surface unit 1:	Kongsberg Geoacoustics Geopulse 5430A
Surface unit 2:	2x Coda DA4G Acquisition Unit - Simultaneous A/D System
Surface unit 3:	Innomar Medium topside

Side-Scan Sonar

Towfish:	EdgeTech 4205
Processor:	EdgeTech 701-DL

Magnetometers

Magnetometer:	Geomatrix G-882
TVG frames:	Geomatrix carbon fibre with telemetry
Gradiometer setups:	up to 3x 2-sensor TVG frames (6 sensors); up to 3x EIVA 4-sensor scanfish (12 sensors)

Deck space

Available:	7 m x 5 m (35 m ²)
Surface:	wooden planks
Typical uses:	ROV LARS systems; shallow coring and grabs; 20' storage container

Roman Rebel
Vessel Data (v3)

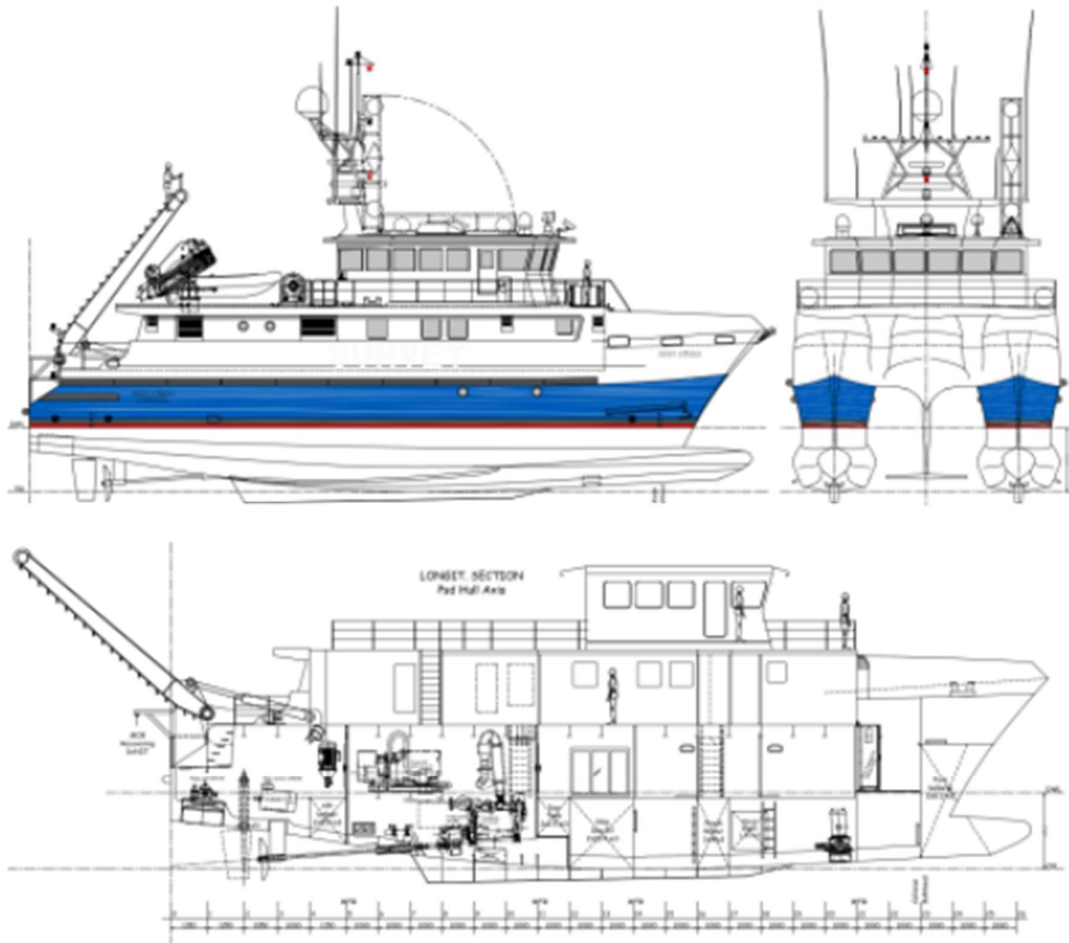


Specifications

Name:	Roman Rebel
Call Sign:	2ICAS
Lloyd's Register	Oceanographic Survey
Class:	Vessel, DP(AM)
IMO Number:	9714824

Inquiries

Contact:	Jared Peters
Email:	info@greenrebel.ie



The Lady Kathleen

The Lady Kathleen is a state-of-the-art 14 m survey vessel that provides a stable platform for reliable, cutting-edge sensor deployment. The vessel is purpose-built for hydrographic and geophysical data acquisition. She is a cutting-edge survey platform with exceptional manoeuvrability both at low and high speed and can conduct nearshore work in a wide range of water depths from 100 m. With top speeds of 25 knots, Lady Kathleen can get to site fast and brings a fuel consumption of 10 L per hour on survey operations.



LADY KATHLEEN

Technical Specifications

General Vessel Information		Propulsion & Generator	
Builder:	Blyth Workboats	Main Engines:	Twin Cummins QSC8.3
Designer:	Blyth Workboats	Gearbox:	ZF with PTO
Launched:	2021	Generator:	Fisher Panda 8KW
Length:	14 m	Max Speed:	25 knots
Beam:	5 m	Cruise:	15 knots
Draught:	1.4 m	Survey:	3.5 – 6 knots
Flag / License:	Irish – MSO P5 30nm	Prop(s):	Twin 5 blade
General Safety Information		Survey Equipment	
Duration:	12 hour Day or Night	MBES:	Teledyne SeaBat T50-R
Safe Manning:	Master & Deckhand	Processor:	Teledyne Reason T50 IDH
Limitations:	30nm to sea	SV Sensor:	Reason SVP-70
Liferaft:	1x 8man Port & Stb	SSS:	Edge Tech 4205
Lif jackets:	8x Solas	Magnetometer:	Geomatix G-882
EPIRB:	Yes	Gradiometers:	2-sensor TVG Frame
SART:	Yes	Parametric SBP:	Innomar SES-2000
Deck Equipment		USBL:	GAPS M5
Winch 1:	1T Hydraulic Tugger Winch	Navigation:	QPS QINSy 9.5.0
Winch 2:	STR ESW 500 – 500m Coax	SV Profiler:	Valeport Swift (x2)
Winch 3:	STR ESW 500 – 500m Coax	Attitude/Heading:	Applanix Integrated INS
A Frame:	Hydraulic 1T SWL		Teledyne Type-30 IMU
Moonpool:	700mm x 700mm	GNSS:	Applanix Integrated INS
Side Pole:	SS Duel Mount		Trimble AT1675-540TS (x2)
Side Winch:	1x 1T Capstan		
Navigation Equipment			
Plotter:	2x Axiom Pro RVX 16"		
Auto Pilot:	Simrad AP70		
AIS:	Class A		
DSC VHF:	2x Icom GM600 GMDSS		
DSC MF/HF:	1x Icom GM800 GMDSS		
Navtex:	Yes		
Internet:	4G Broadband		

Hydrographic Equipment

The Roman Rebel runs a dual-head MBES system driven by dual SeaBat RSP+ processors. A multi-unit Inertial Navigation System (INS) feeds positional data to the MBES (and other geophysical systems). An extremely dense array of 2,048 sound beams per ping is produced by two Teledyne SeaBat T50-R (TC2181 transmitter and EM2781 receiver) MBES sonar heads

that each use their own SeaBat RSP+ processing computer (Table 21). This setup maximises survey efficiency and precision.

Table 21. Teledyne Seabat T50-R MBES specifications.

Characteristic	Teledyne T50 (EM7218)
Low frequency (kHz)	190
High frequency (kHz)	420
Frequency adjustability	10 kHz steps
Swath coverage (°)	170
Beam width (° at 400 kHz)	0.5
Shortest pulse (µs)	15
Max depth at low frequency (m)	575
Max ping rate (pings/s, i.e. Hz)	66
Beams/swath	1,024 (per head, 2,048 per swath)

Local sound velocity will be recorded continuously at the surface (at the MBES heads using Teledyne SVP70s) and periodically through the water column. Water column measurements will be collected using a Valeport Swift prior to the initiation of data acquisition operations and whenever significant changes are observed in the surface sound velocity. Equipment specifications are provided in Table 22.

Table 22. SVP Specifications

Device	Deployment	Depth rating (m)	Resolution (m/s)	Accuracy (m/s)
Teledyne SVP70	Fixed at heads	6,000	0.01	± 0.05
Valeport Swift	Dips	500	0.001	± 0.02

Sub-bottom profiler (SBP)

A hull-mounted Innomar Medium-100 parametric SBP system is used from the Roman Rebel (Figure 4). This parametric system generates two simultaneous sound signals that create a controlled, subsequent signal (secondary frequency) that yields better penetration than comparable SBPs (Table 23). Data products can reach 70 m of penetration with vertical resolutions better than 5 cm.

Table 23. Innomar Medium-100 SBP specifications.

Characteristic	Innomar Medium - 100
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Primary frequencies	Low frequency (kHz)	85
	High frequency (kHz)	100
Secondary frequencies	Low frequency (kHz)	2
	High frequency (kHz)	22
Source level (dB/μPa re 1 m)		247
Maximum depth (m)		2,000
Penetration in mud (m)		70
Vertical resolution (cm)		Better than 5

Side-Scan Sonar (SSS)

Green Rebel proposes the use of a motion tolerant, multipulse EdgeTech 4205 SSS system capable of simultaneous dual-frequency operation. Variable signal frequencies allow range to be balanced with resolution to fit local conditions and survey needs while motion tolerance and multi-pulse capabilities ensure quality in demanding conditions. This unit is depth rated for use in up to 2,000 meters of water. Details are provided in Table 24.

Table 24. EdgeTech 4205 SSS Specifications.

Characteristic	Edgetech 4205
Low frequency (kHz)	230
High frequency (kHz)	850
Frequency adjustability	Dual
Horizontal beam width	0.70° @ 120 kHz; 0.44° @ 230 kHz; 0.28° @ 410 kHz; 0.26° @ 540 kHz; 0.23° @ 850 kHz
Best resolution across track (cm)	1
Worst resolution across track (cm)	8
Vertical beam width (°)	50
Towfish weight (kg in air)	52
Max depth (m)	2,000
Piggyback capabilities	Magnetometer or Gradiometer

Magnetometer

The Roman Rebel and Lady Kathleen will tow a single Geomatrix G-882 magnetometer piggybacked from the SSS towfish (Table 25). Height above seabed during survey operations is determined by the height-to-range ratio required by the SSS.

Table 25. Geomatrix G-882 Magnetometer Specifications.

Characteristic	Geomatrix G-88s
Operating principle	Self-Oscillating split beam Optically pumped Caesium Vapour cell
Typical sensitivity (nT)	0.02 (at 0.1 samples/second)
Heading error (nT)	< 1
Absolute accuracy (nT)	< 3
Power supply (VDC)	24 - 32
Max depth (m)	2,600
Operating zones	The earth's field vector should be at an angle of greater than 6° away from the sensor's equator and greater than 6° away from the sensor's long axis.

Surface positioning

The Roman Rebel uses two GNSS systems to ensure redundancy and enable cross-checking and validation of positioning data (Table 26). The primary system is provided by Oceaneering International Services Limited and consists of a C-Nav 3050 receiver using C-NavC2 corrections. The C-Nav 3050 receiver offers global decimetre-level accuracy. The secondary system consists of a Hemisphere R330 receiver using Atlas corrections.

Table 26. GNSS Specifications

Receiver	Corrections	XY accuracy (m)	Z accuracy (m)
C-Nav 3050	SBAS, PPP, RTK	0.08	0.15
Hemisphere R330	L1/L2, RTK, SBAS	0.30	0.30

Underwater Positioning

Towed sensors will be tracked with a Kongsberg μ PAP 201-H USBL system. This system can track multiple targets at ranges of up to 4,000 m. The expected accuracy is 0.45%, range: $\pm$ 0.02 m (Table 27).

Table 27. USBL Specifications.

Characteristic	Specification
Model	μ PAP 201-H
Operational models	SSBL, LBL, and data telemetry

Inbuilt motion sensor	Seatex MRU-
Motion sensor accuracy	0.05°
Operating range	1 – 4,000 m
Angular accuracy	0.25°
Position accuracy	0.45% (1 Sigma, SNR > 20dB rel. 1μPa in bandwidth)
Transducer beam width	± 80°
Data telemetry	up to 2.5 kBit/s

Roman Rebel Geotechnical Survey Equipment

The geotechnical investigation aims to collect high-quality data using various methods including vibrocores, CPTs and grab samples. These data will be collected after the geophysical dataset, which will help inform sampling locations, and will be used to determine the geotechnical properties of the seabed along the three proposed cable routes. The information gathered will enable assessments of cable burial and help ensure a successful cable installation. Details of the proposed equipment are provided in the sections below.

Vibrocorer

The proposed FT0551 Vibrocorer has a high-power electric motor providing 75 kN total force and an increased vibratory amplitude due to improved power to weight ratio. A modular frame structure reduces the mobilisation time for cores of 1-9 m long. For the collection of samples across the cable routes, the vibrocorer will be configured for 3 m cores. Cores will be recovered in 1-m sections.

Cone-Penetration test (CPT)

The Geomil Manta 100DW allows in situ sediment property measurements to be conducted in a wide range of water depths, up to 1,500 m. The Manta-100 is also by far the most compact system in its class when transported. Umbilical and umbilical winch are also included to ensure power and communication with the vessel. Penetration speed is variable from 0 -80 mm/s and the Thrust capacity of 0 -100 kN help ensure appropriate penetration.

Seabed Sampling

A 1 x 0.1 m² Van Veen grab is proposed as the primary grab sampler for seabed sample collection. The Van Veen is ideal for taking samples in shallow to medium water depths, for biological, hydrological and environmental studies. The lead-weighted jaws close positively,

capturing the sample for secure recovery to the surface. The weights also ensure reliable operation in strong currents.

All sampling is logged during operations both on deck and independently in the laboratory. This allows quality control and cross-checking of operations on completion of the project. All sample containers are labelled with a clear pre-printed label describing the Client, location, replicate, sample type, operator, sample number code (the latter can be cross-referenced with log sheets to provide additional information on description, time, easting, northing, water depth etc.).

Lady Kathleen Equipment Overview

Hydrographic Equipment

The Lady Kathleen uses a single-head Teledyne T50-R MBES system (Table 28). An integrated Applanix OceanMaster Inertial Navigation System (INS) pairs positional data to the MBES data (and other geophysical data).

Table 28. Seabat T50-R MBES specifications

Characteristic	Teledyne T50 (EM7218)
Low frequency (kHz)	190
High frequency (kHz)	420
Frequency adjustability	10 kHz steps
Swath coverage (°)	170
Beam width (° at 400 kHz)	0.5
Shortest pulse (µs)	15
Max depth at low frequency (m)	575
Max ping rate (pings/s, i.e. Hz)	66
Beams/swath	1,024 (per head, 2,048 per swath)

Sub-Bottom Profiler (SBP)

A pole-mounted Innomar Standard parametric SBP system is used from the Lady Kathleen (Table 29). This parametric system generates two simultaneous sound signals that create a controlled, subsequent signal (secondary frequency) that yields better penetration than comparable SBPs. Data products can reach 40 m of penetration with vertical resolutions better than 5 cm.

Table 29. Innomar Medium-100 SBP specifications

Characteristic		Innomar Medium - 100
Primary frequencies	Low frequency (kHz)	85
	High frequency (kHz)	100
Secondary frequencies	Low frequency (kHz)	2
	High frequency (kHz)	22
Source level (dB/μPa re 1 m)		247
Maximum depth (m)		2,000
Penetration in mud (m)		70
Vertical resolution (cm)		Better than 5

Side-Scan Sonar (SSS)

Green Rebel proposes the use of a motion tolerant, multipulse EdgeTech 4205 SSS system capable of simultaneous dual-frequency operation (Table 30). Variable signal frequencies allow range to be balanced with resolution to fit local conditions and survey needs while motion tolerance and multi-pulse capabilities ensure quality in demanding conditions. This unit is depth rated for use in up to 2,000 meters of water.

Table 30. EdgeTech 4205 SSS specifications.

Characteristic	Edgetech 4205
Low frequency (kHz)	230
High frequency (kHz)	850
Frequency adjustability	Dual
Horizontal beam width	0.70° @ 120 kHz; 0.44° @ 230 kHz; 0.28° @ 410 kHz; 0.26° @ 540 kHz; 0.23° @ 850 kHz
Best resolution across track (cm)	1
Worst resolution across track (cm)	8
Vertical beam width (°)	50
Towfish weight (kg in air)	52
Max depth (m)	2,000
Piggyback capabilities	Magnetometer or Gradiometer

Magnetometer

The Roman Rebel and Lady Kathleen will tow a single Geomatrix G-882 magnetometer piggybacked from the SSS towfish (Table 31). Height above seabed during survey operations is determined by the height-to-range ratio required by the SSS.

Table 31. Geomatrix G-882 magnetometer specifications.

Characteristic	Geomatrix G-88s
Operating principle	Self-Oscillating split beam Optically pumped Caesium Vapour cell
Typical sensitivity (nT)	0.02 (at 0.1 samples/second)
Heading error (nT)	< 1
Absolute accuracy (nT)	< 3
Power supply (VDC)	24 - 32
Max depth (m)	2,600
Operating zones	The earth's field vector should be at an angle of greater than 6° away from the sensor's equator and greater than 6° away from the sensor's long axis.

Surface Positioning

GNSS corrections for the Lady Kathleen are provided by an Applanix OceanMaster system, which also incorporates an Inertial Measurement Unit (IMU). Corrections are made at 1 Hz intervals and achieve positional accuracies of <0.1 m (XY) and <0.2 m (Z). Real-time correction services are acquired through Marinestar satellite service or Trimble VRS Now RTK corrections.

Underwater Positioning

Towed sensors will be tracked with a Kongsberg μ PAP 201-H USBL system. This system can track multiple targets at ranges of up to 4,000 m. The expected accuracy is 0.45%, range: ± 0.02 m. Specifications are provided in Table 27.