VALERO PEMBROKESHIRE OIL TERMINAL LTD

JETTY – BERTH 2 PILE REPAIR

Marine Environmental Appraisal

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1 INTRODUCTION

1.1 Overview

Valero Pembrokeshire Oil Terminal Ltd is seeking consent from Natural Resources Wales - Marine Licencing Team (NRW–MLT) for a Band 2 Marine Licence, to undertake Jetty maintenance activities at the Valero Pembrokeshire Oil Terminal (VPOT), Milford Haven, Wales. The scope of these maintenance activities involves the replacement of a defective dual pile with a monopile arrangement (the ‘Project’), similar to the previous maintenance works carried out in 2007 for Berthing Dolphin (BD) 6[1].

The VPOT is situated in the Milford Haven Waterway (MHW) in Pembrokeshire, Wales, known for its significant role in oil transport and refining. The Jetty of the VPOT, specifically Berth 2, requires structural improvement due to the aging and loosening of a 2-pile mooring dolphin (BD7). The purpose of the Project is to enhance safety and efficiency by replacing the old dolphin with a modern monopile system. The process involves removing the existing dolphin and installing a new monopile securely grouted into a casing in the bedrock, ensuring the integrity and functionality of the Jetty.

The aim of the Project is to:

- Enhance Structural Stability: To address the issue of the loose mooring dolphin by removing the old structure and implementing a new monopile system that offers superior structural stability and longevity.
- Upgrade Berth Infrastructure: To upgrade the existing berthing infrastructure at Jetty - Berth 2 thereby enhancing the safety and reliability of berthing operations for vessels.

RPS has been commissioned by VPOT Ltd. to prepare and submit the Marine Licence application to NRW-MLT for the works proposed below Mean High Water Springs (MHWS) which are licensable under the Marine and Coastal Access Act 2009. This Marine Environmental Appraisal has been prepared to support the Marine Licence application.

1.2 Consultation

Consultation with NRW-MLT in September 2023 confirmed that the Project requires a Band 2 marine licence application. As part of this consultation, RPS submitted to NRW-MLT a Preliminary Marine Environmental Appraisal on behalf of VPOT Ltd and on 01 March 2024, NRW provided advice on the Preliminary Marine Environmental Appraisal. This advice is presented in Table 1-1, alongside where the advice has been considered in this document.

A copy of the Preliminary Marine Environmental Appraisal was also sent to the Port of Milford Haven, as the Project is within their port jurisdiction. Milford Haven Port Authority has confirmed they will review the application alongside this Marine Environmental Appraisal.

Further consultation was undertaken to determine whether a Flood Risk Activity Permit (FRAP) would be required. NRW-Flood Risk Team advised that no FRAP would be required.

[1] Note: RPS have been in contact with the NRW-MLT and the 2007 application was not available as a reference on their system.

Table 1-1: Advice on the Preliminary Marine Environmental Appraisal, by Natural Resources Wales

Consultee and date	Queries raised	Response to query raised and/or where it has been addressed in this report
Benthic Ecology		
Natural Resources Wales (NRW) – 01 March 2024	*"Section 3.2.3 Construction Method - Clarification required NRW (A) advise that the likelihood of grout being spilled into the marine environment should be assessed. If so, consideration of the mitigation measures required to negate this potential impact should be provided"*	The impact of grout spilling has been assessed for benthic ecology receptors in section 4.3.4. Appropriate mitigation against grout spilling has been committed to (i.e. adoption by the Contractor of the Marine Pollution Management Plan; see section 2.4).
	"Section 3.4 Embedded Mitigation Measures - Further assessment required "Disturbance of seabed outside works area footprint will be minimised where possible i.e. only one or two placement(s) of the jack-up barge spud legs." - NRW (A) advise that the worst-case scenario should be assessed i.e. two placement (s) of the jack-up barge spud legs"	As detailed in section 2, the worst case scenario of two placements of the jack up barge have been used to calculate the maximum footprint of temporary habitat loss and disturbance. This has been used to inform the appraisal of effects in section 4.3.1 for benthic ecology (and section 4.4.1 for fish and shellfish ecology).
	"Section 4.4 Benthic Ecology - Further assessment required NRW (A) advise the zone of influence (ZoI) should be defined in order to assess the spatial extent of the impacts i.e. spatial extent of suspended sediment plume. Please refer to NRW Physical Process Specialist for further details."	A desk-based physical processes assessment has been undertaken for the impact of increased Suspended Sediment Concentrations (SSCs) and associated deposition (see section 4.2). This involved the 45 m^3 of drilled material that will be deposited on the seabed during installation of the casing and considered the sediment fractions of two samples collected from the VPOT. In addition, dredging and similar drilling projects from within the MHW were compared to that of the Project. This physical processes assessment has been used to inform the equivalent impact upon benthic ecology (including maerl beds), in section 4.3.3).
	"Section 4.4.1 (Intertidal) & 4.4.2 (Subtidal) - Further assessment required It is unclear what data sources will be used to characterise the benthic habitats potentially impacted by the development. This	A desktop study of relevant data sources has been undertaken to characterise the benthic ecology baseline, and is provided in section 3.4.

Consultee and date	Queries raised	Response to query raised and/or where it has been addressed in this report
	information has not been defined in the PEA although it is noted that a high level desktop review has been provided in these sections."	
	"Temporary/long term habitat loss/disturbance NRW (A) advise these impacts are assessed separately in order to differentiate between those impacts that could result in temporary loss and/or disturbance of habitat vs those that could result in long term habitat loss. The assessment should consider not only the potential impacts from the installation of the new monopile (including drilling of a new socket, installation of permanent casing etc), but also from the removal of the historic dolphin (potentially leading to temporary habitat disturbance) and the placement of the jack up barge legs."	The project description in section 2 details and quantifies the activities associated with the Project that will result in temporary habitat loss (i.e. the use of a jack up barge). The installation of the new monopile will result in a very localised area of long term habitat loss (4.91 m^2; see section 2). Both footprints of temporary and long term habitat loss will be in the immediate vicinity of one another, and be highly localised. Given this limited scale, temporary and long term habitat loss have been assessed as a single impact in section 4.3.1 for benthic ecology (and section 4.4.1 for fish and shellfish ecology).
	"Introduction of Invasive Non-Native Species (INNS) NRW (A) agree this impact should be scoped in and advise that a full Biosecurity Risk Assessment and invasive non-native species (INNS) Management Plan is completed in relation to all marine operation activities associated to the current proposal (We note this is being proposed under 3.4 Embedded Mitigation measures). The risk assessment and management plan should include consideration of all activities, vehicles and equipment used as well as how the risk will be minimised through appropriate mitigation and adherence to best practice guidance and management measures. The risk assessment should include a review of all the available data in relation to the presence of marine INNS where applicable to the current proposal, and the potential risks associated to each species identified. Consideration of INNS is particularly important in Milford Haven due to the presence of invasive species such as the slipper limper Crepidula fornicata and the carpet sea squirt Didemnum vexillum, recently recorded in the area."	The INNS risk assessment is to be undertaken by the Contractor on award of contract (see section 2.4).
	"Increased suspended sediment concentration and associated sediment deposition NRW (A) agree this impact should be scoped in for the potential activities identified. We advise the assessment should consider impacts to all benthic receptors but in particular to Maerl,	The importance of maerl beds is recognised within the existing environment in section 3.4, and has therefore been specifically considered throughout the appraisal of effects for benthic

Consultee and date	Queries raised	Response to query raised and/or where it has been addressed in this report
	which are highly sensitive to changes in suspended sediment concentrations and are found in close proximity to the proposed activity."	ecology, including for the impact of increased SSCs and associated deposition (section 4.3).
	"Accidental release of pollutants NRW (A) agree that this impact can be scoped out provided standard pollution prevention control measures are followed such as production and adherence to a CEMP."	Please see Appendix A where justification for scoping out this impact is provided and the commitment to standard pollution control measures is detailed.
	"Release of sediment bound contaminants NRW (A) advise this impact should be scoped in as disturbance to intertidal/subtidal habitats associated with construction activities could lead to remobilisation of sediment bound contaminants that may impact benthic communities. Please also refer to NRW Physical Process Specialist comment for further detail"	The impact of the release of sediment bound contaminants has been included, see section 4.3.5.
Fish and Shellfish		
NRW – 01 March 2024	*"Section 4.5.2 Effects not considered in Marine Environmental Appraisal - Further assessment required 'Project activities which may result in noise emissions leading to disturbance of fish' has been scoped out of the assessment. NRA (A) do not agree with the statement that 'vibro piling…is determined as having negligible impact to the marine environment such that would represent a risk of injury of disturbance to fish or shellfish species'. Although vibro piling can result in less noise impacts than impact piling, it is not without any impact. As piling and other construction work could have an adverse impact on fish species from underwater noise and vibration, especially for sensitive species including those migrating or utilising nursery areas, NRW (A) advise that noise impacts from construction activities are scoped in for fish. This should contain an assessment of the potential noise impacts on the fish species present with quantification of that risk in relation to the 'worst case scenario' that may be encountered through the Project. Information that would be helpful to document, includes the timing, duration and method of piling, with specific*	The impact of underwater noise due to the installation of the monopile has been scoped in, and assessed for fish and shellfish in section 4.4.4 for the Project alone and section 5.3 for the Project cumulatively with other plans and projects.

Consultee and date	Queries raised	Response to query raised and/or where it has been addressed in this report
	information on the sound source levels for the piling methods, working hours and amount of non-piling time during the installation period. The information used in the document to justify scoping out noise (RPS 2019b noise assessment) relates to sheet piling using a vibro hammer with impact driver. The work proposed for the monopile work within this project will use vibro piling on a 2.35m diameter steel pile which is likely to create a different sound profile to sheet piling. Although the works used in the RPS assessment are based in close vicinity to the Project, the methodology, timeframe and type of piles used are not the same, so it is not a suitable assessment to use as a proxy. In addition, where this information has been used there remains potential impacts to fish species as illustrated in table 4.4 of the referenced document RPS 2019b. This illustrates a risk to behavioural impacts from non-impulsive sound ranging from high within 'near' field for fish utilising their swim bladder in hearing and moderate for other fish receptors. Table 4.3 also shows an exceedance in the criteria for onset of injury within the recoverable injury column for fish that utilise their swim bladder in hearing."	
	"Figure 3-2 (Defective dual pile) & Figure 3-3 (Monopile replacement) - Clarification required The methodology states that vibro piling will be used until bedrock refusal, but does not state what method will be then utilised. The provided diagrams seem to show the pile extending below the level of the bedrock. NRW (A)'s assumption is that impact piling would be required for the last section of piling if vibro piling should fail. NRW (A) advise that the piling methodology should be assessed using the worst-case scenario."	The permanent casing will be lowered to the seabed using a crane and held in position. A vibro-hammer will then drive the permanent casing approximately 10 m into the seabed to the top level of bedrock, or as far as ground conditions will allow. The vibro-hammer will operate using a 15 minute soft start, where the power is gradually increased. An impact hammer will not be required to install the casing. Should the permanent casing not reach the correct depth using the vibro-hammer alone, it will settle to the correct depth during drilling. Please see Appendix E for the full Method Statement.
	"Additional minor comments: - 'Disturbance and loss of potential spawning and nursery grounds' was listed as a topic to be scoped in within the text in section 4.5.1 and the summary within section 5 but is not included in the table of receptor topics (table 4.1). NRW (A) agree	These impacts have been scoped in for fish and shellfish ecology and assessed in section 4.4.

Consultee and date	Queries raised	Response to query raised and/or where it has been addressed in this report
	with the inclusion of this topic as well as the inclusion of the impacts of INNS and suspended sediments on fish and shellfish."	
	"Additional minor comments: There are a number of designated fish species in the sites within the footprint of the Project e.g. Pembrokeshire Marine SAC is designated for Twaite Shad, Allis Shad, Sea Lamprey and River Lamprey. You have identified a number of other fish species with conservation interest in table 4-2 which NRW (A) welcome."	Further information on relevant designated sites with qualifying fish and shellfish features within the vicinity of the Project site is presented in section 3.2.
Marine Mammals		
NRW – 01 March 2024	*"Further assessment required NRW (A) do not agree with mammals being scoped out of the marine environmental appraisal based on the arguments presented. The amount and type of information provided in Preliminary Marine Environmental Appraisal Table 4.1: Summary of receptor topics scoped for further appraisal exceeds what would usually be presented at a scoping stage, and instead constitutes the type of analysis normally carried out post-scoping during the assessment."*	Marine mammals have been scoped back into the assessment, a brief baseline environment is provided in section 3.6, and assessments of the Project alone and cumulatively with other plans and projects are presented in sections 4.5 and 5.3, respectively.
	"Further evidence required to support conclusions NRW (A) advise that in order to carry out a robust assessment for marine mammals, the cited noise assessment from 2019 should be supplied alongside justification for it being a suitable proxy to establish the impact of the works, including but not limited to the compatibility of construction methodologies."	An underwater noise modelling study has been conducted, the results of which have been used to inform the assessment on marine mammal receptors in section 4.5.
Physical Processes		

Consultee and date	Queries raised	Response to query raised and/or where it has been addressed in this report
NRW – 01 March 2024	*"Section 3.2.3 – Construction Method (Drilling New Socket) – Clarification required Section 3.2.3 states that "drill arisings to be disposed of within the immediate vicinity of the pile, approximately 45m3 of drill arisings". NRW (A) advise that consideration is given to www.naturalresourceswales.gov.uk Page 5 of 5 how the Drill Arisings will be disposed of. Consideration should be given as to whether the arisings would be released into the water column during the drilling action or whether they would be captured and disposed of in one area of the seabed. If the material is to be disposed of in one area, consideration of the height and area of the deposited mound and how it could affect the water levels should be provided. Additionally, consideration should be given to how long it could take for the deposited sediment to disperse. Consideration should also be given to the direct and indirect impact on sensitive receptors caused by the disposal of the drilled arisings. Please refer to NRW guidance on sediment disposal of dredged/drilled spoil."*	During drilling, the excavated material will pass through the drill pipe and returned though a spoil discharge hose. All drill arisings will be discharged to the seabed, not into the water column. Water levels are not expected to be affected during the deposition of up to 45 m^3 of drill arisings upon the seabed. The dispersal and settlement of these has been assessed as part of the physical processes assessment in section 4.2, and has used to inform impacts upon sensitive receptors (such as benthic ecology, including maerl beds, and fish and shellfish).
	"SSC Plume (ZoI) – Further assessment required NRW (A) advise that the ZoI for SSC plume impact caused by the construction of the monopile on sensitive receptors downstream of the work site should be determined using the spring tide maximum tidal excursion."	A desk-based physical processes assessment has been undertaken for the impact of increased SSCs and associated deposition (see section 4.2). This involved the 45 m^3 of drilled material that may be deposited on the seabed during Project activities and considered the sediment fractions of two samples collected from the VPOT. In addition, dredging and similar drilling projects from within the MHW were compared to that of the Project. This physical processes assessment has been used to inform the equivalent impact upon sensitive receptors (such as benthic ecology, including maerl beds, and fish and shellfish).
	"Sediment Deposition – Further assessment required The re-deposition of the sediment from the SSC plume during the drilling works and following deposition of the drilled arisings should be assessed. NRW (A) advise that the spatial size distribution of the sediments settling on the seabed and the depth of sediment smothering following the drilled arisings disposal are assessed."	

Consultee and date	Queries raised	Response to query raised and/or where it has been addressed in this report
	"Toxic Contamination - Further assessment required No consideration has been given to the release of sediment bound contaminants during monopile construction. NRW (A) advise the investigation of the possibility of the presence of contaminants in the seabed sediments prior to drilling the seabed. The potential impacts of contaminant remobilisation in the water column should also be assessed. We note from previous correspondence that the customer has access to sediment samples taken within close proximity of the Project."	The impact of the release of sediment bound contaminants has been assessed for benthic subtidal and intertidal ecology (section 4.3.5).
	"Use of Grout - Further assessment required NRW (A) advise that the likelihood of grout being spilled into the marine environment is assessed. If so, consideration of the mitigation measures required to negate this potential impact should be provided."	The impact of grout spilling has been assessed where relevant (i.e. for benthic ecology receptors in section 4.3.4). Appropriate mitigation against grout spilling has been committed (i.e. adoption by the Contractor of the Marine Pollution Management Plan; see section 2.4).
Marine Water Quality and Water Framework Directive (WFD)		
NRW – 01 March 2024	*"We note that a WFD Assessment will be undertaken. We also advise that the Marine Environmental Appraisal should also consider impacts to Water Quality, as mentioned in the Benthic Ecology, Fish and Physical Processes chapters above."*	The WFD Assessment is presented in section 7, with additional detail presented in Appendix B. Impacts to water quality have been assessed in section 4.3.5 in the Marine Environmental Appraisal.

1.3 Report Structure

The structure of this document is as follows:

- **Section 2 – Project Description:** this section provides a description of the Project construction methodology and the licensable activities that will be the subject of the application;
- **Section 3 – Existing Environment:** this section provides details on the marine ecology baseline environment within the vicinity of the Project;
- **Section 4 – Appraisal of Effects:** this section provides an appraisal of the potential implications of the licensable activities on marine ecology receptors outlined in section 3.
- **Section 5 – Consideration of Other Projects:** this section considers the implication of the other known activities alongside the Project;
- **Section 6 – Habitat Regulations Assessment (HRA):** this section screens the impacts associated with the Project to determine if there are any likely significant effects on the identified European sites in light of their conservation objectives;
- **Section 7 – WFD Assessment:** this section screens the Project to determine whether there are any effects on the immediate and linked water bodies compliance with the river basin management plans (RBMP); and
- **Section 8 – Summary:** this section provides a summary of the Marine Environmental Appraisal.

2 PROJECT DESCRIPTION

2.1 Background

Valero Pembrokeshire Oil Terminal Ltd plans to improve the structural integrity and functionality of Jetty - Berth 2 at VPOT in the MHW. The Jetty-Berth 2 extends 120 m in a south-by-south-westerly direction from the northern bank into the MHW (Figure 2-1).

Over time, the existing 2-pile mooring dolphin (BD7) has become loose in its socket. To ensure safe and efficient berthing operations, VPOT Ltd has decided to undertake maintenance activities. This involves removing the deteriorating historic structure and replacing it with a modern monopile system.

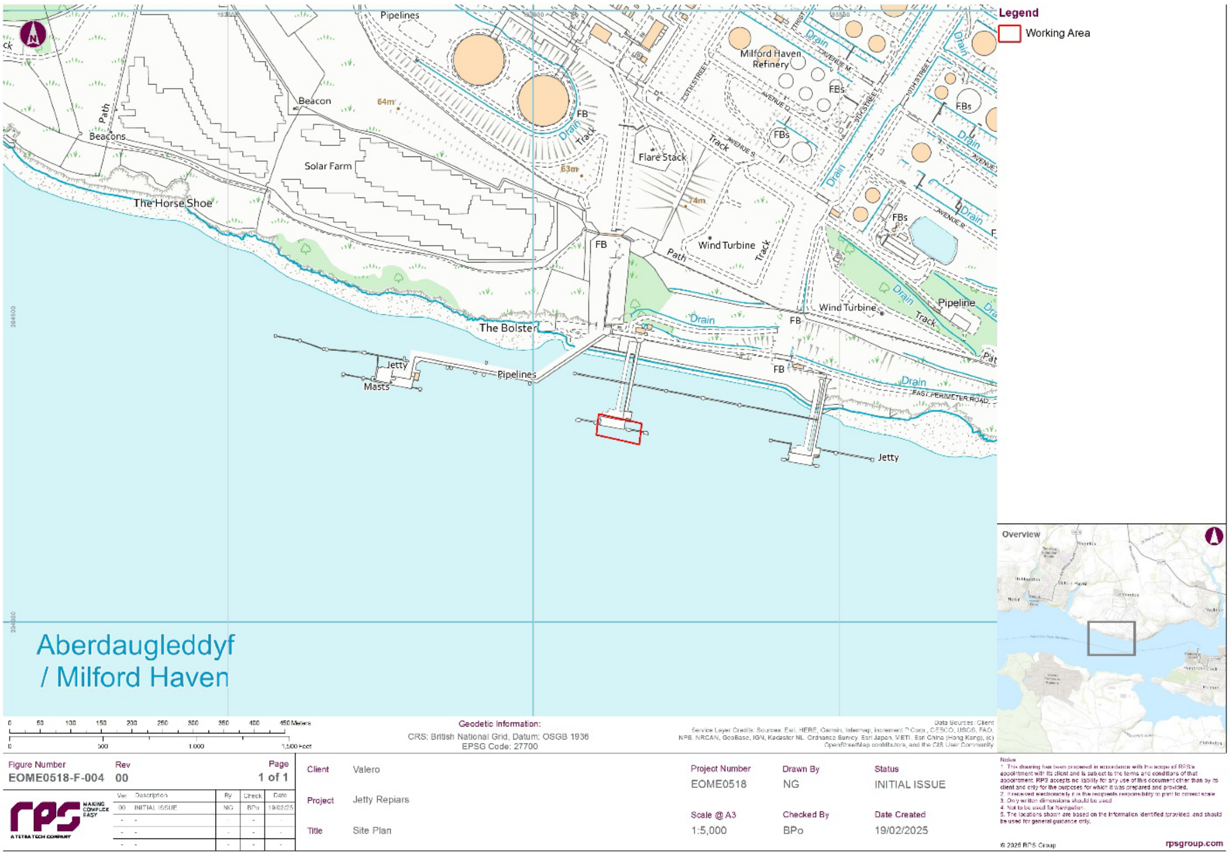

Figure 2-1: Site location of the Project.

2.2 Method Statement

2.2.1 Berth Pile Design and Footprint

The Project will involve the removal of the 2 x 1,300 mm diameter defective dual pile, dolphin platform and cross pile braces and the replacement of it with a 2,100 mm diameter monopile, installed into a 2,500 mm (2.5 m) diameter permanent casing. The casing and monopile will not be installed directly within the original footprint, but adjacent to one of the defective dual piles and within the footprint of BD7 existing platform (see Appendix D for the construction plan drawings).

As the defective dual pile will be cut at the seabed then removed, the footprint of long term loss of seabed habitat will be confined to the footprint of the new permanent casing installed to house the new monopile. With a diameter of 2.5 m, the permanent casing will therefore have a seabed footprint area of 4.91 m^2 after being driven into the seabed. The permanent construction footprint of the Project will be located within this area.

The Project site will also include the temporary footprint of disturbance that will extend beyond the permanent casing footprint of 4.91 m^2 defined above. This temporary footprint of disturbance will occur due to the placement of a jack up barge (the Tyhpoon barge (or similar jack up barge) described in Appendix E: Method Statement) spud legs on the seabed. As per consultation received from NRW (see Table 1-1) this footprint of temporary disturbance has been assessed as two placements of the jack up barge spud legs. As per the revised method statement from December 2024, the jack up barge will have four spud legs with a diameter of 2 m (therefore area of 3.14 m^2) each. The total footprint associated with jack up barge placement is therefore up to 25.12 m^2.

2.2.2 Materials

Construction material that will be used as part of the proposed permanent works below MHWS includes 70 tonnes of grout, and steel monopile. All materials are expected to be sourced in the United Kingdom (UK) and brought to the site via barge. The estimated volume of drilled arisings material is approximately 45 m^3. The dual pile which will be removed will be transported away via barge.

2.2.3 Construction Method

The Project involves the removal of the defective dual pile, installation of the permanent casing, drilling of the permanent casing and installation/grouting of the monopile within the casing. An outline of the method is provided under the sub headings below and further details are provided in Appendix E: Method Statement.

Removal of Historic Dolphin

The first phase of the Project will be to demolish the existing twin pile dolphin structure. This will involve the following steps:

- All electrical connections will be isolated and removed prior to demolition.
- The two linkspans will be removed and stored
- The dolphin structure will then be demolished in sections and lifted onto the barge. The piles will be drilled and tapped to ensure there is no build-up of gases within the pile.
- The piles (2 x 1,300 mm diameter pile), will be cut off as close to bed level as reasonably practicable (circa -14.63 Chart Datum (CD)).
- All material from the demolition of BD07 will be loaded onto the barge and towed to Valero Quay facility in Pembroke Dock, where they will be unloaded onto the quayside for disposal or recycling.

Geological Exploration

Geological and engineering assessments undertaken for the adjacent BD6 will be used to determine the optimal location and depth for the casing and pile.

Permanent Casing Installation

A permanent casing (17m long and 2.5m diameter) will be driven into the sediments through the use of vibro-piling approximately 10m into the seabed to the top of the bedrock, or as far as ground conditions will allow, approximately -39.00 CD, using a jack-up barge.

The vibro-piling hammer will operate at a “soft-start” where the power of the hammer is gradually increased over a period of 15 minutes. This will allow fish time to swim away from the area. On completion, the piling hammer will be returned.

An impact hammer is not required to install the casing. Should the casing not reach the correct depth using the vibro-hammer alone, the casing will settle to the correct depth during drilling.

Drilling New Socket

Drilling to be undertaken, removing sediments within the casing to a depth of approximately -29.00 CD. Drilling will continue into bedrock from -29.00 CD to a depth of approximately -39.00 CD. Excavated material will pass through the drill pipe and be returned through a spoil discharge hose. All drill arisings will be discharged to the seabed within the immediate vicinity of the pile. The volume of arising will be approximately 45 m^3.

Monopile Installation

Once the casing is in place, the new permanent pile will be lifted into the water at Valero Quay facility. The pile will be towed to BD07, to the inside of the berth and installed using the jack-up barge, inside the casing in the seabed. The pile will be lowered into the casing hole until it sits on the bottom of the socket. It will be held in position until it has been grouted into the rock socket. Up to 70 tonnes of grout may be used, to secure the monopile within the newly installed casing.

Ancillary Operations

Following the installation of the monopile there will be ancillary operations to install electrical services and access platforms.

2.2.4 Plant and Equipment

Figure 2-2 and Figure 2-3 illustrate a typical casing and jetty pile.

Figure 2-2: Example casing, with vibro-hammer.

Figure 2-3: Example jetty pile.

2.3 Licensable Marine Activities

Most works associated with the Project are below MHWS, which are licensable under the Marine and Coastal Access Act 2009. A summary of licensable activities relevant to this Marine Environmental Appraisal is described in Table 2-1.

Table 2-1: Licensable activities

Licensable Activity	Description
Removal of an object from the subtidal zone	• Removal of mooring dolphin as part of the installation of a new monopile on the jetty.
Removal of material	• Drilling and removal of seabed material from casing.
Deposit of material, & Construction	• Drill arisings will be allowed to disperse into the MHW during the drilling of the casing. • Installation of a monopile with the addition of grout. • Jack-up barge vessel will stand temporarily on spud legs. • Installation of ancillary services.

2.4 Embedded Mitigation Measures

A number of embedded mitigation measures are proposed to be incorporated into the design and construction method to manage the risk to the environment. These include:

- Disturbance of seabed will be minimised where possible i.e. only one or two placement(s) of the jack-up barge spud legs.
- Adoption by the Contractor of Milford Haven's existing Marine Pollution Management Plan.
- INNS risk assessment by the Contractor on award of contract.
- Notice to Mariners issued prior to the commencement of works.
- Vibro-piling will be used to pile in the monopile casing.

2.5 Timescale and Duration

The works associated with the Project are anticipated to be completed over a period of 3 to 4 weeks and commence on the 3rd June 2025. However, a longer licence window of until the 30th of September 2025 has been applied for to allow for any potential delays in either obtaining consents and/or the availability of vessels for the works.

3 EXISTING ENVIRONMENT

3.1 Study area

The MHW has been used as the study area for this Marine Environmental Appraisal. A review of existing baseline data from within the MHW is provided in the following sections (NRW, 2023a).

3.2 Designated Sites

Designated sites with qualifying features that have the potential to be impacted by the Project were identified using the following approach:

- Step 1: All designated sites of international, national and local importance were identified using the Joint Nature Conservation Committee (JNCC) Marine Protected Area (MPA) mapper and the JNCC website.
- Step 2: Information was compiled on the relevant qualifying features for each of these sites by examining JNCC databases; and
- Step 3: Using the above information and expert judgment, sites were included in the assessment if:
  - A designated site directly overlaps with the Project;
  - Sites and associated features were situated along or around the coast of Pembrokeshire. Given the scale and nature of the Project, this was deemed an appropriate search area based on expert judgement; and
  - Qualifying features of a designated site were either recorded as present during historic surveys within the Project site, or identified during the desktop study as having the potential to occur within Project site.

The Project is located within the Pembrokeshire Marine / Sir Benfro Forol Special Area of Conservation (SAC), which is designated primarily for estuaries, large shallow inlets and bays, reefs and grey seal (*Halichoerus grypus*). A list of all identified desigated sites, distances from the Project site and their relevant qualifying features is presented in Table 3-1 and Figure 3-1. The Limestone Coast of South West Wales/ Arfordir Calchfaen de Orllewin Cymru SAC (4.6 km from the Project site) was not included in Table 3-1 due to highly localised qualifying features which were deemed not at risk from the Project.

These designated sites are afforded protection under The Conservation of Habitats and Species Regulations 2017 (as amended), known as the Habitat Regulations. The Habitat Regulations require that where a plan or project is likely to have a significant effect on a European site (specifically SACs and Special Protection Areas (SPA), but also Ramsar sites as a matter of Government policy), either individually or in combination with other plans or projects, it shall be subject to appropriate assessment of its implications for the site in view of the site's conservation objectives. Natural Resources Wales, as the competent authority, must therefore consider whether the Project is likely to have significant effects on the conservation objectives of the sites considered. Where a Likely Significant Effect (LSE) cannot be excluded at the screening stage, and in the absence of mitigation measures, an 'Appropriate Assessment' of the implications of the plan or project must be undertaken by the competent authority before consent may be given for the proposed project.

The nearest SPA is Castlemartin Coast SPA, which is 4.8 km from the Project site and is designated for bird species. However, as per Appendix A, marine ornithology has been scoped out of this assessment, and therefore SPAs (designated solely for birds) have not been considered further.

Table 3-1: Designated sites in the vicinity of the Project site

Protected Area	Distance from the Project site	Relevant Qualifying features
Pembrokeshire Marine / Sir Benfro Forol SAC	0 km	Sandbanks which are slightly covered by sea water all the time[2] Estuaries* Mudflats and sandflats not covered by seawater at low tide Coastal lagoons[2] Large shallow inlets and bays* Reefs* Atlantic sea meadows (*Glauco-Puccinellietalia maritimae*) Submerged or partially submerged sea caves[2] Grey seal* Sea lamprey *Petromyzon marinus* River lamprey *Lampetra fluviatilis* Allis shad *Alosa alosa* Twaite shad *Alosa fallax* Otter *Lutra lutra*
West Wales Marine / Gorllewin Cymru Forol SAC	6.6 km	Harbour porpoise *Phocoena phocoena*
Bristol Channel Approaches / Dynesfeydd Môr Hafren SAC	11.0 km	Harbour porpoise
Cleddau Rivers/ Afonydd Cleddau SAC	11.2 km	Brook lamprey *Lampetra planeri*[1] River Lamprey[1] Sea lamprey Otter[1]

* Denotes that the qualifying feature is a Priority feature. As defined by JNCC is "*one in danger of disappearance and for which there is a particular responsibility to conserve*".

[1] Is defined as a primary reason for selection of European protected area.

[2] Qualifying features of the site that are not considered, due to approach taken in Step 3 outlined in section 3.2

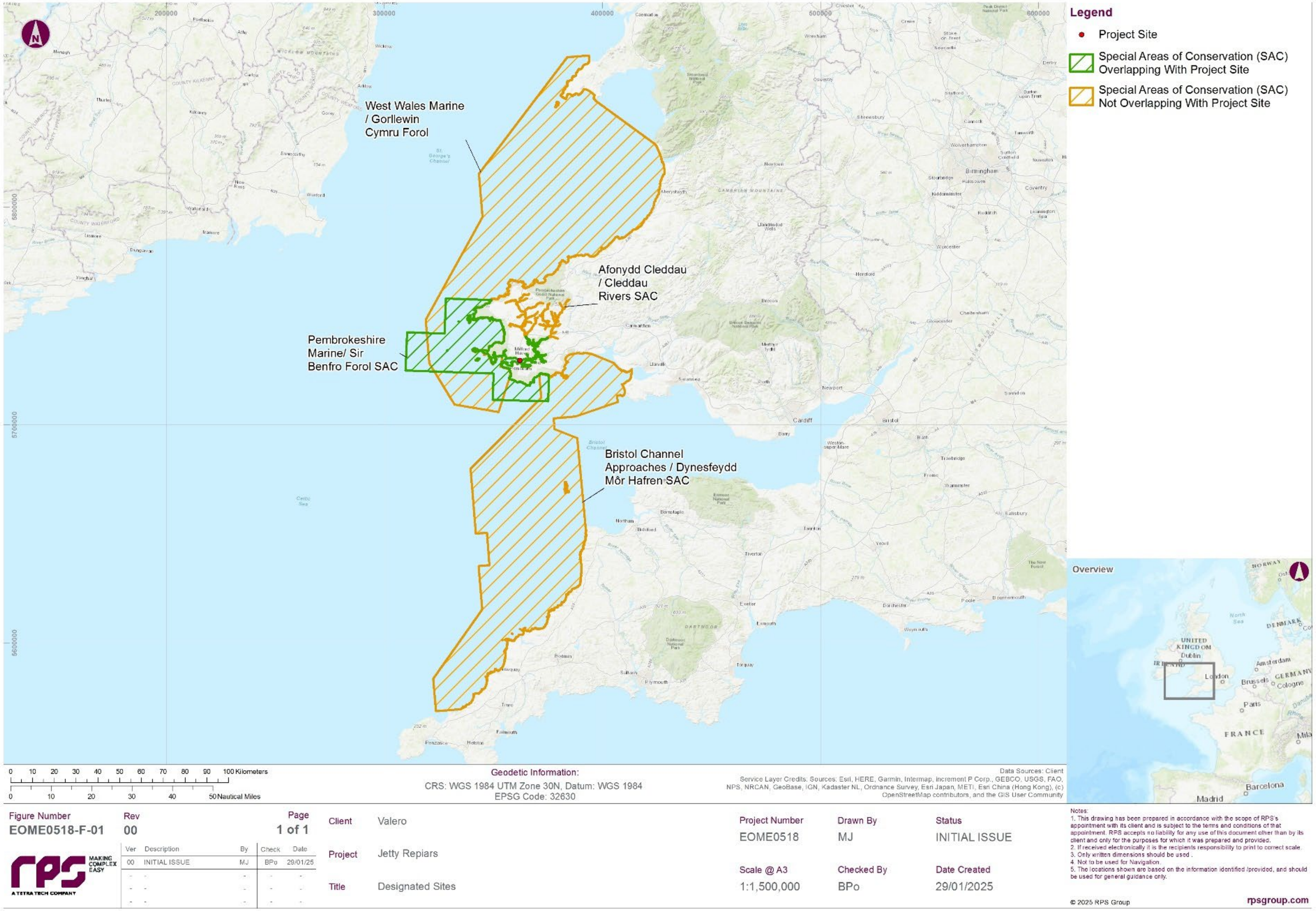

Figure 3-1: Designated sites in the vicinity of the Project

3.3 Physical Processes

3.3.1 Geomorphology and Bathymetry

The Project is located in a large ria which was initially formed along a major fault line (the Ritec Fault) which was eroded further by glacial activity. The geology is varied along the MHW, with a mixture of Ordovocian, Silurian, Devonian and Carboniferous rocks and mudstones, with the Project site neighbouring old red sandstone (NRW, 2014; Pembrokeshire Coast, 2023). The floor of the ria is comprised of glacially eroded sand and gravels on top of a mudstone and sandstone bedrock (NRW, 2015).

According to sediment profile and plan-view image sampling carried out by Carey *et al.,* (2015), the areas surrounding the Project site towards the channel primarily consist of 'central sand physical' and 'central mixed physical', with 'central mud physical' closer to the upper intertidal zone.

Due to the geological formation and subsequent flooding of the MHW, a natural deep harbour was created, with depths of approximately 26 m allowing large vessels to be accommodated (NRW, 2015; Benson *et al.,* 2021). According to chart datum, the mid channel of the MHW is approximately just under 20 m, with a dredged area extending 500 m either side of the VPOT jetty, 1 km in total and to a depth of approximately 10 – 15 m. The majority of the VPOT structure is within shallower waters of 5 to 10 m (iBoating, 2023).

Within the Project site and based on geophysical surveys undertaken for the adjacent BD6 pile, borehole data indicates that initial sediments are soft silts with gravel and clay progressing into silty clay factions (-8 CD to -21 CD), with fine to medium coarse gravel with fragments of red marl at -25 CD, and red silty mudstone and siltstone to -40 CD.

3.3.2 Wave and Tidal Regime

The MHW extends approximately 35 km from the mouth at St Anne's Head to the tidal limits close to Haverfordwest and Canaston Bridge. The MHW has a high tidal range, with the mean tidal range varying from 6.3 m mean spring tides to 2.8 m mean neap tides. Predictions by the Proudman Oceanographic Laboratory for the period 2008 to 2026 provide the highest astronomical tide height of 7.85 m.

Due to the high tidal range in the MHW the water movements within the waterway are substantial. The tidal excursion varies along the length of the MHW, with approximately twice as great for springs as for neaps. The prevailing wind direction for the MHW is strong south-westerlies, causing noticeable changes to the height and times of tidal movements. The tidal currents within the MHW are much lower than those outside in the open water of the west Welsh coast, with lower currents in the main channel which are then lower again in the adjacent embayments and shallower intertidal areas.

The general summary of the tidal flow in the MHW is flowing from the lower reaches to the east up into the MHW on the flooding tide and west out of the MHW into open coastal area on the ebb, with the maximum flow within the middle of the main channel. The Coastal Surveys Group of Hyder Laboratories and Sciences conducted a tidal stream study between January 1997 and October 1999 (Hyder Consulting, 1999), to study the tidal velocities withing the MHW. Atlases were created from data recorded between the approaches to the MHW, which showed that the lower reaches of the MHW had minimum tidal flows around slack water and increasing to a maximum of 1.5 knots for ~ three hours before high water on a spring tide, with tidal flow in an easterly direction. Neap tides showed a maximum tidal flow of 0.7 knots in a predominantly westerly direction for ~ 2.5 hours before high water. The high tidal flows can act as transportation mechanisms for suspended sediments within the water column as well as the aiding diadromous fish species on their migration.

Due to the natural geological formations and meandering nature of the MHW the tidal flow is slowed at certain locations along the waterway. From the Project site at VPOT Jetty east up the channel to Wear spit the channel narrows considerably, from here to Carr spit the main channel width is reduced to 100 – 200 m. Due to this narrowing from Wear Spit and Carr Spit the tidal flow increases compared to downstream with Carr Spit deflecting the tidal currents and flow to the north side of the MHW, providing some shelter in their lee (The Milford Haven Port Authority, 2021). Towards the mouth of the MHW, where the waterway is exposed to the prevailing westerly and south-westerly swell waves, features such as St Ann's Head and Angle Peninsula reduce their reach into the MHW itself.

A study by Little *et al.* 2016 found that within the MHW sediment transport rates of spoil during dredging at Neyland marina showed that silt-grade, fluorescent tracers were found in high concentrations

(>100,001 particle counts/ml) from dredging plumes and these reached Garron Pill 5 km up-estuary on spring flood tides and Llanstadwell 1.5 km down-estuary on the ebb (Little *et al*., 2016). These show sediment transport rates of 110-455 m/day (flood tide) and 150-335 m/day (ebb). Medium tracer concentrations (10,001-100,000 counts/ml) reached Llangwm Pill 7 km up-estuary, and Wear Point, Pwllcrochan and Pennar Gut (3-4 km) down-estuary, representing transport rates of 280-2,300 m/day (flood) and on the ebb 120-500 m/day (ETS, 2002).

3.3.3 Water quality

Due to the nature of the MHW there is a dynamic salinity regime, data has suggested that offshore salinity remains between 34.5 -35‰ but water column data from the Skomer MNR indicates that inshore salinity is more variable in range with 33.5‰ during the winter months to 36‰ in the summer months (NRW, 2018b).

The dissolved oxygen in the water column within the MHW is suggested by NRW data (2018b) to be approximately 100% saturation but more recent survey data has shown levels as low as 86% in parts of the MHW.

The MHW catchment has two main rivers of the Western and Eastern Cleddau which then form the Daugleddau estuary before the MHW. The MHW has the capacity to be a large sediment sink due to its morphology but there is limited sediment input from onshore area and rivers that enter the MHW (Halcrow, 2012). The closest river the Project site is the Pembroke River, which is southeast to the Project site and on the southern shore of the MHW, which contributes to the suspended sediment and freshwater into the MHW. Work undertaken as part of the Marine Environment Statement chapter for Pembroke Dock (RPS, 2019b) identified that the SSCs as measured by the turbidity and water transparency and found that values ranged between a minimum of 2.3 formazin turbidity units (FTU) and a maximum of 19 FTU with a mean value over the period of 9.5 FTU. Water transparency, determined by a Secchi disk, recorded values between 2009 and 2011 ranged from 1.2 m to 3.1 m.

The MHW has a variable level of nutrient and contaminant levels throughout, with dynamic water movement, spoken about previously, impacting the level of contaminants to below detectable limits. An exception of this is chronic hydrocarbon residues which are of a low level within sediment sink areas in St Bride's Bay (Countryside Council for Wales (CCW), 2009). The raised levels of nutrients within the MHW are considered to be due to agricultural sources. Although, nutrient levels are high within MHW in they are comparable to background levels for the open coasts. Concentration of nutrients, such as phosphates and nitrates, indicate hypertrophication and under certain conditions the MHW is considered to be at risk of eutrophication. The levels of green macroalgae within the MHW are shown to be very high within sheltered areas, which are indicative eutrophication. However, the phytoplankton within the MHW are largely below the guideline standards, possibly due to estuarine flushing (CCW, 2009).

3.4 Benthic Ecology

This section describes the benthic ecology present at both the subtidal and intertidal zones at the Project site and wider area.

3.4.1 Intertidal Ecology

Intertidal habitats along the northern shore and the mid Waterway, where the Project site is situated, are typically characterised by moderately to low exposed rocky shores in the upper littoral zone. With benthic communities comprised of fucoid seaweeds and acorn barnacles *Semibalanus balanoides* and *Austrominius modestus* (Moore, 1997; RPS, 2013; RPS, 2019; RPS, 2020).

According to sediment profile and plan-view image sampling carried out by Carey *et al.,* (2015), the areas surrounding the Project site towards the channel are consistent primarily of 'central sand physical' and 'central mixed physical', with 'central mud physical' closer to the upper intertidal zone. Surface grain size is mostly of very fine sand, with *Arenicola* and other polychaetes dominant within the sand. It was also recorded within this study that *Mysella* (*syn. Kurtiella*) *bidentata* and *Thyasira sp. Crepidula* were present. The intertidal mudflats present at Pwllcrochan Flats, just over 1km southeast of the Project site show a similar benthic features, with predominantly sandy muddy shores (LSD.LMU.SMu) and common species including polychaetes such as the ragworm, *Hediste diversicolor* (RPS, 2007). This is typical for the MHW as a qualifying feature of the Pembrokeshire Marine / Sir Benfro Forol SAC within the MHW includes mudflats and sandflats not covered by seawater at low tide.

RPS (2013) conducted surveys in October 2012 of the rocky northern shore of MHW, in support of the South Hook CHP project. During the intertidal survey of jetty pilings, similar to the Project site, it was observed that they provided a wave sheltered habitat with dominant species including frilled anemone *Metridium senile*, sea squirt *Ascidiella aspersa*, rosy feather star *Antedon bifida*, sponge *Mycale macilenta*, pink-hearted hydroid *Tubularia larynx* and mermaid's glove sponge *Haliclona oculate*). Providing a unique intertidal habitat as they are only found together in abundance on artificial substrata (e.g. jetty pilings and ship wrecks). Introduced or 'alien' species were also recorded during a RPS 2003 study on the former ESSO Refinery jetty in the MHW. This included the seaweeds *Anotrichium furcellatum* and *Antithamnionella ternifolia* and the sea squirt *Styela clava*, and of scientific interest was the red seaweed *Dasysiphonia sp.* on one of the jetty piles (RPS, 2003).

3.4.2 Subtidal Ecology

Following the Sea Empress oil spill Hobbs and Smith (1998) conducted a benthic survey and the results concluded that the MHW showed distinct regions of different fauna assemblages along the MHW due to the marine and estuarine features of the ria. This was supported by Warwick in 2017 and a review of the European Marine Observation and Data Network (EMODnet). These studies, and one conducted by RPS (2007d), showed annelids to be the most abundant organisms within the MHW. The entrance of the MHW includes cirratulid species and bivalves, such as *Abra alba* and *Nucula nitidosa* (SS.SSa.CMuSa.AalbNuc). Within the middle waterway of the MHW, where the Project site is located, the biotope changes to *Mysella bidentata* and *Thyasira* spp. (SS.SMx.CMx.MysThyMx) and different cirratulid species (*Chaetozone gibber* and *Caulleriella zetlandical*) along with vast subtidal kelp beds covering 48,000 m^2. Upriver of the Cleddau Bridge Hobbs and Smith (1998) recorded polychaete/oligochaete dominated estuarine muddy shores (LS.LMu.UEst) and additionally the review of EMODnet recorded biotopes including red seaweeds and kelps (SS.SMp.KSwSS.LsacR.CbPb). Further upstream to Lawrenny Quay it is dominated by communities of *Crepidula fornicate* and *Mediomastus fragilis* (SS.SMx.SMxVS.CreMed) and at Blackatar Point, *Hesionura elongata* and *Protodorvillea kefersteini* (SS.SCS.CCS.MedLumVen).

Hebog Environmental Ltd conducted benthic surveys from 2002 to 2005, at the Texaco and Petroplus jetties. Similarly, organisms which dominated included cirratulid and capitellid worms as well as amphipods *Ampelisca* spp. Slower growing, equilibrium species like molluscs *Venerupis* spp. and *Gari* spp., as well as the reef building polychaete *Sabellaria spinulosa* (without the presence of reefs at the time) were present. Seasearch also conducted a survey on the Dragon LNG Jetty (a concrete pile approximately 1 m in diameter and 15 m in depth less than 1 km from the Project site), for INNS. Species recorded near the surface included a 0.5 m band of *Laminaria hyperborea* and red seaweeds. Below 0.5 m the piles were covered in feather stars *Antedon bifida*, plumose anemone *Metridium dianthus*, sponges and solitary and colonial sea squirts. INNS species included leathery sea squirt *Styela clava*, slipper limpet *Crepidula fornicata*, orange tipped sea squirt *Corella eumyota*, and compass sea squirt *Asterocarpa humilis*. It can be assumed that similar assemblages are on present on the historic 2-pile mooring dolphin (BD7) at VPOT.

With regard to important habitats such as subtidal seagrass beds within the MHW, both *Zostera marina* (common eelgrass) and *Zostera noltii* (dwarf eelgrass) are present. The MHW is identified as an important site for *Zostera sp.* (Brazier *et al*., 2007), with *Z. noltii* showcasing an expanding distribution (Bertelli *et al*., 2018). A substantial *Z. noltii* bed is recorded on the Pwllcrochan Flats, southeast of the Project site (SeagrassSpotter, 2023).

The other notable habitat present in the MHW is the only known bed of live maerl in Wales, alongside other isolated patches of maerl (Burton, 2013). The area lies over 4 km away from the Project site to the west, on the north side of the MHW in the vicinity of Littlewick Bay to Stack Rock. Maerl beds are formed by slow-growing coralline algae and typically occur either on the open coast or in tide-swept channels of marine inlets. Maerl forms a unique habitat that supports a diverse assemblage of infauna and epifaunal species. This is the only known living maerl bed in Wales, excluding small amounts of maerl not constituting a bed. Maerl is legally protected under several designations including Annex V (b) of the EC Habitats Directive (92/43/EEC) as amended in 2010 on the Conservation of Natural Habitats and of Wild Fauna and Flora, the UK BAP for the diversity of flora and fauna (1994), and the Welsh Government's Habitats and Species of Principal Importance for Wales list. Maerl is a sub-feature of 'large, shallow inlets and bays', 'estuaries' and 'subtidal sandbanks' which are designated features of the Pembrokeshire Marine/ Sir Benfro Forol SAC (see section 3.2).

3.5 Fish and Shellfish

This section describes the regional and local fish and shellfish assemblages found within the MHW. Providing information on diadromous fish, elasmobranchs, shellfish, and fish spawning and nursery grounds.

3.5.1 Fish Assemblage

The MHW provides a variety of habitats and therefore a wide variety of fish and shellfish species. A part of the variety of habitats includes the many artificial structures which are present in the Waterway due to the range of industry in the MHW, such as jetty piles, docks, harbours, and wrecks (RPS, 2020). Species found in the MHW are typical for a deep water harbour (RPS, 2020).

Fish species recorded within the MHW commonly and those which are of conservation importance are listed in Table 3-2 taken from RPS, (2020).

Table 3-2: Fish species commonly occurring or of conservation interest within MHW (RPS, 2020)

Common name	Scientific name	Common name	Scientific name
Herring	*Clupea harengus*	Pollack	*Pollachius pollachius*
Sole	*Solea solea*	Saithe	*Pollachius virens*
Plaice	*Pleuronectes platessa*	Bib	*Trisoptreus luscus*
Cod[4]	*Gadus morhua*	Thornback ray[4]	*Raja clavata*
Whiting	*Merlangius merlangus*	Greater pipefish	*Syngnathus acus*
Snake pipefish	*Entelurus* aequoreus	Sand gobies	*Pomatoschistus* spp.
Dragonet	*Callionymus sp.*	Sand smelt	*Atherina presbyter*
Red mullet	*Mullus surmuletus*	Wrasse	*Crenilabrus melops*
Sprat	*Sprattus sprattus*	Bass	*Dicentrachus labrax*
Haddock	*Melanogrammus aeglefinus*	Atlantic salmon[24]	*Salmo salmar*
European eel[234]	*Anguilla anguilla*	Sea trout[2]	*Salmo trutta*
Allis shad[234]	*Alosa alosa*	Twaite shad[234]	*Alosa fallax*
River lamprey[234]	*Lampetra fluviatilis*	Sea lamprey[234]	*Petromyzon marinus*

Many of these fish species are listed on Section 7 of the Environment (Wales) Act 2016, such as cod, herring, plaice, sole, sandeel, and whiting.

3.5.2 Diadromous Fish

The MHW supports several migrating diadromous fish, which move between marine and freshwater environments in order to complete their lifecycle. The Pembrokeshire Marine / Sir Benfro Forol SAC within the MHW has qualifying features which include four of these species; sea lamprey, river lamprey, allis shad and twaite shad. These species alongside Atlantic salmon *Salmo salar* and sea trout *Salmo trutta* all take advantage of the fast currents within the MHW to reach spawning sites towards the Daugleddau estuary and the Cleddau rivers (RPS, 2020). All the diadromous species present in the MHW are classified as UK

[2] Diadromous fish passing through Milford Haven Waterway.

[3] Annex II of the Habitats Directive (species whose conservation requires the designation of SACs).

[4] OSPAR threatened or declining species.

Biodiversity Action Plan (BAP) Priority Species, are species of principal importance for the purpose of the conservation of biodiversity under the Natural Environment and Rural Communities (NERC) Act 2006 (NERC, 2006), and listed on Section 7 of the Environment (Wales) Act 2016.

Allis and twaite shad are both classified as rare and are listed in Appendix III the Bern Convention and Annexes II and V of the EC Habitats Directive, protected under the Schedule 5 of the Wildlife and Countryside Act (1981) and are included within Section 9(4)(a) of the Act (Aprahamian *et al*, 1999). Although there are few records of the shad in the SAC, they are both included as a qualifying feature of Pembrokeshire Marine /Sir Benfro Forol SAC, using the MHW as a migratory route between the open sea and the riverine habitat where they spawn (CCW, 2009). For the Allis shad mature fish, migration through the estuary for spawning between March and June and migration for twaite shad between April and June, this is dependent on water temperature (Apprahamian, 1988; Aprahamian *et al*, 1999; Maitland and Hatton-Ellis, 2003). Shad are known to feed on crustaceans such as copepods, decapods, euphausiids and small fish (CCW, 2009). These species are vulnerable due to a decline in spawning sites, modification of migratory routes (such as weirs) and overfishing (Lloyd, 1941; Henderson, 2001; Jolly *et al*., 2012).

Salmonid species such as the Atlantic salmon and sea trout also use the MHW to migrate to spawning sites in river habitats (RPS, 2020). Salmonids migrate up through the MHW to riverine habitats from November to December (extending from October to Late February) to spawn where juveniles, once hatched, spend one to four years before migrating back through the MHW to the sea (SNH, 2017). Adult salmon migration through estuaries typically takes a period of a few tides. Smolts and adults tend to use the faster currents to aid migration. Sea trout are generally stated to behave in the same manner as salmon in estuaries although sea trout smolt remain in estuarine waters longer and many fish return to their rivers within four months of leaving.

The National Rivers Authority (1991), now the Environment Agency estimated that the annual spawning run of salmon and sea trout in the MHW numbered some 13,250 fish, the majority being trout (Hobbs and Morgan, 1992). Since the assessment is based on angling returns only (assuming an exploitation rate of 10%), these findings can only be taken as a very general indication of the numbers of these fish which use the waterway. Natural Resources Wales (NRW) have carried out a salmon and trout monitoring project based on declared number of catches from the eastern and western Cleddau rivers. This information is then used to inform the stock status, which is then assessed using ‘Conservations Limits’. Salmon ‘Conservation Limits’ is currently set at 1.55 million eggs; egg deposition between 2006 to 2015 has shown a gradual decline, putting the stock class as ‘at risk’. The assessment for trout is under development with the current trend in stock decreasing (RPS, 2020). Welsh populations of Atlantic salmon have declined in recent years with low juvenile abundance, due to extreme environmental conditions and lower spawning success, as well as overfishing at sea, pollution and migration barriers (Chaput, 2012; Krkosek, 2013; Bewes *et al*., 2019; Gregory *et al*., 2020).

River lamprey are widespread in the UK and spend the majority of their adult life in estuaries and inshore waters, such as the MHW, but spawn and carry out their juvenile years in rivers. Sea lampreys have a similar life cycle to the river lamprey where they need suitable riverine habitats to spawn after migrating from the sea. However, sea lampreys spawn in the lower to middle reaches of rivers, needing deep and fast-flowing waters (CCW, 2009). Regarding the exact population numbers of river and sea lamprey in the Pembrokeshire Marine / Sir Benfro Forol SAC, little is known except that there are populations within the Cleddau rivers where there is suitable gravel / silt habitat for spawning (Hurford and Guest, 2010; RPS, 2020). However, it was reported by Bird *et al.* (1994), that sea lampreys have been found in the MHW is large numbers. Both species feed on other species of fish, river lampreys are known to feed on flounder, herring and sprat and sea lampreys on bass and bigger elasmobranch species, such as basking sharks (CCW, 2009).

Unlike the aforementioned species the European eel is catadromous, and spawns at sea. The European eel spawn in the western central Atlantic Ocean with the larval eel recruiting to European estuaries (Kettle and Haines, 2011). Adults arrive in UK waters as glass eels, carried by the Gulf Stream from their spawning grounds in the Sargasso Sea (Bonhommeau *et al*., 2008). They then enter estuaries during the spring and migrate upstream into freshwater, becoming elvers in the process. Mainly tidal currents govern the timing of their arrival (Bonhommeau *et al*., 2008; Arribas *et al*., 2012). The European eel pass through MHW at least twice during their complete life cycle.

Management of the European eel stock is a community-wide issue because the fish form a single stock (for reproduction) that is distributed across the European continent (Hanel *et al*., 2019). Recent recruitments of eel have been as low as 1% of historic levels, and adult eel that are migrating to the sea to spawn suffer high mortality rates (Bonhommeau *et al*., 2008).

3.5.3 Elasmobranchs

During a seasonal otter trawl survey conducted by RPS (2007) within the MHW, two elasmobranch species were recorded; thornback ray *Raja clavata* and the lesser-spotted dogfish *Scyliorhinus caniculus*.

The thornback ray has been included in the OSPAR List of Threatened and/or Declining Species and Habitats since 2008 (OSPAR Agreement 2008-6) as well as assessed as 'Near Threatened' with a declining population by the IUCN Red List of Threatened Species and included in the Welsh Environment Act 2016 List of Species of Principal Importance for conservation of Biological Diversity (Ellis, 2016; Welsh Government, 2016; OSPAR, 2021a). Although population levels are not well known the life-history traits of the thornback ray which means as a consequence of moderate fishing pressure and the impacts of by-catch the species is slow to recover (OSPAR, 2021a). The thornback ray occupies a variety of benthic substrate types, including those found within the MHW, and are found in coastal areas between 10-200 m in depth, with the species occupying shallower depths in cold temperate waters. Outer estuarine areas and coastlines with shallow bays in the UK are important for spawning grounds, nurseries and feeding areas, such as those found within the MHW (Wheeler 1969, Ellis *et al.* 2005, Hunter *et al.* 2006, Wirtz *et al.* 2008)

The lesser-spotted dogfish or small-spotted catshark is listed as of 'Least Concern' by the IUCN Red List of Threatened Species (Ellis *et al.* 2009). Populations are abundant in the Northeast Atlantic with some scientific surveys suggesting that populations are stable or increasing in certain regions (Ellis *et al.* 2009). Although this species is # in the UK studies suggest that species that are caught as by-catch and subsequently discarded have high post-discard survival rates (Ellis *et al.* 2009). Similar to the thornback ray *S. caniculus* is found in waters of 10-100 m in depth and are found on sandy, gravel or muddy benthic substrate (as well as coralline and algal) (Fishbase, 2024).

Other elasmobranchs recorded within the MHW include the spotted ray and tope shark which also have some commercial importance and low intensity nursery areas throughout the MHW.

The spotted ray *Raja montagui*, has been included in the OSPAR List of Threatened and/or Declining Species and Habitats since 2001, with the last assessment in 2010 (although the key criteria for the species being listed was due to the decline, sensitivity and rarity within Belgian waters), but assessed as of 'Least Concern' by the IUCN Red List of Threatened Species (Ellis *et al.,* 2007; OSPAR, 2021b). The species is recorded around the British Isles and is found at depths between 8 m to 530 m, with a preference of soft sandy substratum and juveniles inhabiting shallower waters < 100 m.

The tope shark *Galeorhinus galeus* occupies temperate waters in the bentho-pelagic found on continental shelves as well as upper to mid slopes and shallow inshore areas such as the MHW (Walker *et al.,* 2020). Areas such as the MHW are favoured by Tope for pupping and nursery areas as they require shallow, protected bays and estuaries where juveniles then remain for two years (Stevens and West, 1997; Walker, 1999; Walker *et al.,* 2006; Bovcon,, 2018; McMillan *et al.,* 2018). The species is assessed as 'Critically Endangered' by the IUCN Red List due to exploitation and bycatch globally in fisheries, with an estimated >80% reduction in the global population in the past three generations (79 years). Recovery of this species is slow due to their low biological reproductivity, late age-at-maturity and triennial reproductive cycle (Walker *et al.,*2020). The species is also listed under the UK BAP Priority Marine Species (2007) and habitats and species of principle importance in England and Wales (Section 41 habitats and species).

3.5.4 Shellfish Assemblage

The EU Food Hygiene Regulations (852/2004, 853/2004 and 854/2004) are implemented in Wales through the Food Hygiene (Wales) Regulations 2006 (SI 2006/31) which came into force 11 January 2006. In accordance with the Regulations, bivalve production areas are classified according to the level of treatment they require prior to their sale. The competent authority for the purpose of the Food Hygiene (Wales) Regulations 2006 is the Agency except where it has delegated competencies. Local authorities collect this information and send it to the Centre for Environment, Fisheries and Aquaculture Science (CEFAS), who manage the program on behalf of the Food Standards Agency, who compile the data. Standards are set in terms of concentrations of coliform bacteria and Salmonella. Harvesting sites are classified from A to C; Grade A sites do not require pre-treatment and Grade C sites require intensive purification. A fourth category exists, from which harvesting is prohibited.

The EC Shellfish Waters Directive (79/923/EEC), adopted 30 October 1979, aims to protect or improve shellfish waters in order to support shellfish life and growth, therefore contributing to the high quality of shellfish products directly edible by man. There are two areas within MHW that have been designated as shellfish waters under this directive. The waters within the Carew River were designated as shellfish waters from 11 October 1999. The Milford Haven Cleddau (Eastern and Western) River was also designated in 1999, however, following a review of designations in 2003/2004, the area was extended in March 2004.

Historically, MHW has been harvested for wild cockles and Pacific oyster and in recent years the small scale market has grown to include permits for carpet shell clams (*Ruditapes decussatus*), razor clams (*Pharidae spp.*) and designated oyster aquaculture sites.

The large area, diverse marine habitats and sediment types, results in a variety of shellfish species. These include the native oyster, mussels (*Mytilus edulis*), lobsters (*Homarus gammarus*) and prawn (*Palaemon serratus*), some of which have conservation and commercial interests.

The native oyster is classified as a threatened species and is covered by a UK BAP, with the species of principle importance for the purpose of conservation of biodiversity under the Natural Environment and Rural Communities Act 2006 and is on the OSPAR list of threatened and/or declining species. Distributions of native oyster are found widely in the UK, but main stocks are found in the south east, including the MHW (Perry *et al.*, 2023). Native oysters are widespread throughout the MHW, from Milford Haven town to Picton Point and historically native oyster beds were upstream of the Cleddau Bridge from Burton to Llangwn which supported a fishery (Hobbs and Morgan, 1992). The population of native oyster have decreased as water quality has decreased as well as impacts of overfishing, increasing suspended sediment and pollution and the introduction of the INNS *Crepidula fornicata* (see section 3.6) within the waterway. As a result, oyster fecundity, recruitment has decreased and can no longer sustain a commercial fishery (Little *et al.,* 2016; Bohn *et al.,* 2015; Cefas, 2012).

The Pacific oyster, *Crassostrea gigas,* is another INNS (see section 3.6), that has been recorded within the MHW in small numbers, this is due to historical aquaculture which were within the Cresswell/ Carew River and in the Cleddau channel to Carron Pill, upstream from the Project site (Robins *et al.,* 2017). Although this is a species cultivated primarily as a food source in the UK, the MHW shellfisheries are not in active operation for the production of Pacific oysters. Recruitment of Pacific oysters within the MHW is not consistent due to the temperatures needed (Syvret *et al.* 2008). However, modelling data has suggested that with an increase in sea temperatures could facilitate the reproduction and dispersal of the Pacific oyster in the MHW from the source population, increasing their spread (Robins *et al.,*2017).

Mussel beds are classed as a UK BAP Priority Habitat and currently on the OSPAR List of Threatened and/or Declining Species and Habitats. Blue mussel *M. edulis*, beds can also be key features of habitats listed in Annex I of the Habitats Directive. Wild stocks of mussels are found in patches throughout the MHW, on rocky shores or raised beds which act as ‘nursery’ areas for larvae (Cefas, 2012). The main raised beds are found between the Cleddau Bridge and Picton Point at Lawrenny Quay, Coedcanlas and Sprinkle Pill. Jenkins Point, at the confluence of the Daugleddau the Carew and the Creswell Rivers, and Mount Pleasant are both Class B mussel beds. Spawning of mussels occurs partially in spring and then later between August and October, although a second spawning is dependent on favourable conditions and is often opportunistic (Seed, 1969).

Other species of shellfish found within the MHW include the common cockle, *Cerastoderma edule,* carpet shell clam, *Venerupis corrugata*, common periwinkle, *Litorina littorea*, the king scallop, *Pecten maximus*, and the queen scallop, *Aequipecten opercularis*.

The MHW is a common site for potting for decapods such as European lobster, green shore crab, spider crab, velvet crab and edible or brown crab (Pawson *et al.,* 2002). General statistics on the collection of these species is gathered by the Welsh Government however this data is confidential and unspecific to an area. Although specific information is not available, potting is chiefly seaward of Pembroke and sold into overseas markets.

European lobster *H. gammarus*, is found throughout Europe and the UK, and within the MHW lobsters can be found as high up as Lawrenny Quay, up stream of the Project site. The populations within the MHW have been noted as breeding and have been recorded at depths of approximately 60 m and live within the rocky substrata, sheltering in crevices, excavated tunnels or holes (RPS, 2019).

Spider crabs *Maja brachydactyla*, also have a similar distributions throughout Europe and the UK, and have been recorded within the MHW from Angle Bay to Milford Haven Dock, downstream from the Project site, and sighted around the Pembrokeshire coast. Spider crabs are also present on rocky substrata and generally feed on algae (Cefas, 2012).

The velvet crab *Necora puber*, and green (shore) crabs *Carcinus maenas*, are both commonly found in the intertidal and sublittoral up to depths of 80 m and 60 m, respectively (Clark, 1986; QPI Global Ventures Ltd, 2013). Velvet crabs is also associated with rocky substrata in both adults and juveniles with has a widespread occurrence around the UK coastline, and therefore can be assumed to be present within the MHW where it meets the requirements for spawning and nursery environments. Green crabs are found throughout the year in the MHW, feeding on other invertebrates, such as worms and molluscs and barnacles.

Prawns *Palaemon serratus* are also present throughout the UK and within the MHW up to the Lawrenny Quay (RPS, 2007). The common prawn is omnivorous and breeds between November and June, with planktonic larvae settling in June or August.

3.5.5 Spawning and/or nursery grounds

According to Ellis *et al.,* (2012), the MHW provides a suitable spawning and/or nursery habitat for sandeel (Ammodytidae), anglerfish *Lophius piscatorius*, sole, herring, mackerel, whiting, spotted ray and plaice. Spawning times for these fish are given in Table 3-3 though it should be noted that herring are omitted due to the very small spawning ground in the MHW which has not been assessed for spawning times by Ellis *et al.* (2012).

Only low intensity nursery grounds overlap with the Project site, for whiting, anglerfish, plaice, and sole. These low intensity nursery grounds are vast; low intensity nursery grounds for whiting exist throughout the Irish and Celtic Seas, North Sea, and eastern and western most points of the English Channel (Ellis *et al.,* 2012). Low intensity nursery grounds for plaice exist throughout coastal waters around England and Wales, the east coast of Ireland, and the northern North Sea (Ellis *et al.,* 2012). Low intensity nursery grounds for anglerfish exist throughout the Celtic and Irish Seas, northern North Sea, and western English Channel (Ellis *et al.,* 2012). Low intensity nursery grounds for sole exist throughout most English coasts, and high intensity nursery grounds exist off north Wales, throughout the English Channel, and along England's southeast coast (Ellis *et al.,* 2012).

Table 3-3: Spawning times for fish with spawning grounds in the MHW (from Ellis *et al.,* 2012)

	Sandeel	Anglerfish	Sole	Mackerel	Whiting	Spotted ray	Plaice
Jan	X	X					X - peak
Feb	X	X			X		X - peak
Mar		X	X	X	X		X
Apr		X	X - peak	X	X		
May		X	X	X - peak	X	X	
Jun		X		X - peak	X	X	
Jul				X	X	X	
Aug							
Sep							
Oct							
Nov	X						
Dec	X						

3.6 Marine Mammals

Given the nature and scale of the Project, no site-specific marine mammal baseline surveys were undertaken. Across the literature, there are a range of marine mammal species that have been recorded in Welsh waters:

- harbour porpoise;
- bottlenose dolphin *Tursiops truncatus*;
- common dolphin *Delphinus delphis;*
- Risso's dolphin *Grampus griseus*;

- striped dolphin *Stenella coeruleoalba;*
- white-beaked dolphin *Lagenorhynchus albirostris*;
- white-sided dolphin *Lagenorhynchus acutus*;
- fin whale *Balaenoptera physalus;*
- humpback whale *Megaptera novaeangliae;*
- killer whale *Orcinus orca;*
- long-finned pilot whale *Globicephala melas*;
- minke whale *Balaenoptera acutorostrata;*
- grey seal*;*
- harbour seal *Phoca vitulina;* and
- otter (Baines and Evans, 2012, Carter *et al.,* 2022, Evans and Waggitt, 2023, Gilles *et al*., 2023, Hammond *et al.,* 2021, Hammond *et al*., 2013).

While a wide range of marine mammals have been recorded in Welsh waters, including those around Pembrokeshire and Milford Haven, some of these species occur in very low numbers and are regarded as 'occasional visitors' to the area. Therefore, only the marine mammal species most likely to occur within the vicinity of the Project within the MHW are considered further in the assessment. These are harbour porpoise, bottlenose dolphin, grey seal, and otter. This proposed approach is supported by the highly localised nature and extent of the impacts associated with the Project and the aim to undertake a proportionate assessment.

3.6.1 Harbour Porpoise

Harbour porpoise are the most abundant cetacean species in the UK, with persistent presence in Welsh waters Harbour (Baines and Evans, 2012, Evans *et al.,* 2015, Evans and Waggitt, 2023, Gilles *et al.,* 2023, Heinänen and Skov, 2015). They are also one of the smallest marine mammals in the UK, and therefore have a high body surface area to volume ratio (Kastelein *et al*., 2019). Due to this, harbour porpoise has a high metabolic rate and must feed often to maintain a stable body temperature (Kastelein *et al*., 1997, Rojano-Doñate *et al.,* 2018). This high metabolic rate means that this species is particularly sensitive to any disruption of foraging and is susceptible to starvation (Wisniewska *et al.,* 2016).

The harbour porpoise is protected under a range of international and national designations, such as under Annex II of the Habitats Directive. This species is therefore a qualifying feature of various SACs around the UK, such as the West Wales Marine SAC and Bristol Channel Approaches SAC which are 6.6 km and 11 km away from the Project, respectively (section 3.2). Therefore, the Pembrokeshire coast represents an internationally important area for harbour porpoise, with persistent high densities modelled in both summer and winter (Heinänen and Skov, 2015), and this area is regarded as a population hotspot (Evans *et al.,* 2015). Recent modelling from Evans and Waggitt (2023) illustrates the high densities of harbour porpoise in Welsh waters, particularly around Pembrokeshire. The harbour porpoise is also listed on Section 7 of the Environment (Wales) Act 2016.

The Project is situated within SCANS survey blocks CS-C in the 2022 survey and block D in the 2016 survey (these are largely the same area, just with different names) (Gilles *et al*., 2023, Hammond *et al.,* 2021). In the 2022 survey, there were an estimated 564 harbour porpoise within this block (95% Confidence Interval (CI): 104 – 1,183 animals), with an estimated density of 0.506 animals per km^2 (Gilles *et al.,* 2023). In the 2016 survey, there were an estimated 5,734 harbour porpoise within this block (95% CI: 1,697– 12,354), with an estimated density of 0.118 animals per km^2 (Hammond et al., 2021).

The Project is located within the Celtic and Irish Seas Management Unit (MU) for harbour porpoise. The most recent abundance estimate for this MU is 62,517 animals (95% CI: 48,324 – 80,877 animals) (Inter-Agency Marine Mammal Working Group (IAMMWG) (2023), based on data from Hammond *et al.* (2021) and Rogan *et al*. (2018)).

3.6.2 Bottlenose Dolphin

Bottlenose dolphins are large odontocetes (i.e. toothed whales) which are distributed worldwide in temperate and tropical waters. They display highly flexible foraging behaviour and habitat use (Fernandez-Betelu et *al.,* 2019, Genov *et al*., 2019) and typically prey upon fish. As above for harbour porpoise, the bottlenose dolphin is protected under a range of international and national designations, such as under Section 7 of the Environment (Wales) Act 2016 and under Annex II of the Habitats Directive. This species is therefore a qualifying feature of various SACs around the UK, with the Cardigan Bay/Bae Ceredigion SAC the closest to the Project (81.9 km). Cardigan Bay is one of only two semi-residential bottlenose dolphin populations in the UK, with the other being in the Moray Firth, in northern Scotland (Evans *et al.,* 2015, Feingold and Evans, 2014). This SAC, which is located 81.9 km from the Planning Boundary, is therefore an important area for bottlenose dolphin, providing justification for the proposed inclusion of this species. The wider Cardigan Bay area has been surveyed annually since 2005, with estimates in recent years some of the lowest recorded (Evans and Waggitt, 2023). Robust models indicate that there may have been some permanent emigration from Cardigan Bay (Lohrengel *et al.,* 2018). Modelling from Evans and Waggitt (2023) illustrates the hotspot of bottlenose dolphin density within Cardigan Bay, although lower densities are predicted for the MHW.

The Project is situated within SCANS survey blocks CS-C in the 2022 survey and block D in the 2016 survey (these blocks are largely the same area, however were updated between the two years) (Gilles et al., 2023, Hammond et al., 2021). In the 2022 survey, there were an estimated 15,117 bottlenose dolphin within this block (95% CI: 4.966 – 29,157 animals), with an estimated density of 0.406 animals per km^2 (Gilles *et al.,* 2023). In the 2016 survey, there were an estimated 2,938 bottlenose dolphin within this block (95% CI: 914 – 5,867 animals), with an estimated density of 0.447 animals per km^2 (Hammond *et al.,* 2021). The difference in estimated abundance and density of bottlenose dolphin between these two SCANS surveys should be highlighted. Further clarification was sought from the authors of SCANS, who highlighted that the particular survey block contains both coastal and offshore ecotypes of bottlenose dolphin (the coastal ecotype here is referring to the semi-resident population within Cardigan Bay) (A. Gilles, *pers. comm*.).

The Project is located within the Offshore Channel, Celtic Sea and South West England MU for bottlenose dolphin, and close to the Irish Sea MU. The most recent abundance estimate for the Offshore Channel, Celtic Sea and South West England MU is 10,653 animals (95% CI: 6,533 – 17,372 animals) (IAMMWG (2023), based on data from Hammond *et al*. (2021) and Rogan *et al*. (2018)). The most recent abundance estimate for the Irish Sea MU is 293 animals (95% CI: 108 – 793 animals) (IAMMWG (2023), based on data from Hammond *et al*. (2021) and Rogan *et al.* (2018)).

3.6.3 Grey Seal

Grey seals are one of the two pinniped species that live and breed within the UK, with the other being harbour seal (which is not considered further in this assessment). Grey seal are distributed across the North Atlantic Ocean, North Sea, Barents Sea, and Baltic Sea, with their main concentrations in North-West Europe and the east coasts of Canada and the United States of America (Special Committee on Seals (SCOS), 2023). They are larger than harbour seal, with males reaching over 300 kg (SCOS, 2023). They forage in open waters and regularly return to land to haul out, rest, moult, and breed (SCOS, 2023). They can travel over 100 km from haul out sites to forage, with trips lasting for up to 30 days at a time (Jones *et al.,* 2015). Their prey species include gadoids, flatfish, and sandeel and vary spatially and seasonally. As above for harbour porpoise and bottlenose dolphin, the grey seal is protected under a range of international and national designations, such as under Annex II of the Habitats Directive. This species is therefore a qualifying feature of various SACs around the UK, such as the Pembrokeshire Marine SAC, wherein the Project is situated (see section 3.2). Pupping takes place throughout the Pembrokeshire Marine SAC on open coast in suitable habitat (i.e., physically accessible, remote and/or undisturbed rocky coast beaches, coves, and caves).

The Project is located within the Wales Seal MU. The annual SCOS reports present counts of grey seals at haul-out sites around the UK which are undertaken in August (with frequency varying across MUs). August haul-out counts of grey seal within the Wales MU have increased from an estimated 750 animals in the 2000 – 2006 survey period to an estimated 900 animals in 2021, the most recently available survey period (SCOS, 2023). These estimates were compiled by counts undertaken by organisations other than SCOS (see full list compiled in SCOS (2023)) and it should be noted that the apparent increase may partly be due to increased reporting. Within Wales, the most recent pup production estimate was 2,250 pups in 2019, from which a 2022 population estimate of 5,400 animals was derived (SCOS, 2023). The grey seal colonies around

Pembrokeshire are not regularly monitored and have lower pup production than other areas of the UK, such as Orkney, the Hebrides, and the east coast of Scotland and England (SCOS, 2023).

3.6.4 Otter

Otter inhabit freshwater, brackish and marine environments and are known to occur coastal waters around Wales. The otter is protected under a range of international and national designations, such as under Section 7 of the Environment (Wales) Act 2016 and under Annex II of the Habitats Directive.

Otters are widely distributed throughout Pembrokeshire, including within the MHW (known from spraint records and foreshore access points from watercourses with suitable breeding and feeding habitat; CCW, 2009, Liles, 2003). The Project is located within the Pembrokeshire Marine SAC which is designated for otter, and it 11.2 km from the Cleddau Rivers SAC, which is also designated for this species (see section 3.2).

Due to the high levels of otter activity recorded within the MHW, it is possible that this species could be present within the vicinity of the Project, although there is less likely to be breeding sites in this area due to the potential disturbance from the existing anthropogenic activities associated with the VPOT.

3.7 INNS

An INNS is defined as any non-native animal or plant that has the ability to spread causing damage to the environment, the economy, our health and the way we live (NNSS, http://www.nonnativespecies.org/).

Table 3-4 identifies INNS known to occur throughout the MHW, as well as identifying the risk that each species represents to Great Britain's native species. Data on the presence of INNS within the MHW was sought from the National Biodiversity Network (NBN) Gateway (nbnatlas.org) and via personal communications with the environmental manager for the Port of Milford Haven (PoMH). The risk of INNS to native UK species is derived from the INNS risk analysis process.

Table 3-4: INNS known to be present throughout the Milford Haven area

<table>
<tr><th>Invasive Non-native Species</th><th>Risk to native UK species</th></tr>
<tr><td>Common slipper limpet Crepidula fornicata</td><td>High Risk</td></tr>
<tr><td>Japanese skeleton shrimp Caprella mutica</td><td rowspan="4">Medium Risk</td></tr>
<tr><td>Japweed Sargassum muticum</td></tr>
<tr><td>Jenkins' Spire Snail Potamopyrgus antipodarum</td></tr>
<tr><td>Pacific oyster Crassostrea gigas</td></tr>
<tr><td>Australian tubeworm Ficopomatus enigmaticus</td><td rowspan="11">Risk not assessed/available</td></tr>
<tr><td>Bay barnacle Amphibalanus improvisus</td></tr>
<tr><td>Bryozoan Bugula neritina</td></tr>
<tr><td>Bryozoan Bugula simplex</td></tr>
<tr><td>Bryozoan Bugula stolonifera</td></tr>
<tr><td>Bryozoan Tricellaria inoptiata</td></tr>
<tr><td>Bryozoan Watersipora subatra</td></tr>
<tr><td>Colonial sea squirt Aplidium cf. glabrum</td></tr>
<tr><td>Colonial sea squirt Botrylloides c.f. diegensis</td></tr>
<tr><td>Colonial sea squirt Botrylloides violaceus</td></tr>
<tr><td>Colonial sea squirt Perophora japonica</td></tr>
<tr><td>Compass sea squirt Asterocarpa humilis</td><td rowspan="3"></td></tr>
<tr><td>Crustacean Eusarsiella zostericola</td></tr>
<tr><td>Crustacean Mytilicola intestinalis</td></tr>
</table>

Invasive Non-native Species	Risk to native UK species
Darwin's barnacle *Austrominius modestus*	
Filamentous red alga *Solieria chordalis*	
Green sea fingers *Codium fragile*	
Japanese algae *Caulacanthus okamurae*	
Leathery Sea Squirt *Styela clava*	
Mediterranean mussel *Mytilus galloprovincialis*	
Mudshrimp *Monocorophium sextonae*	
Orange-striped anemone *Diadumene lineata*	
Orange-tipped sea squirt *Corella eumyota*	
Oyster Thief *Colpomenia peregrina*	
Red seaweed *Anotrichium furcellatum*	
Red seaweed *Antithamnionella spirographidis*	
Red seaweed *Antithamnionella ternifolia*	
Red seaweed *Grateloupia turuturu*	
Red seaweed *Polysiphonia harvey*	
Soft-shelled clam *Mya arenaria*	
Stalked sea squirt *Styela clava*	
Wakame *Undaria pinnatifida*	

4 APPRAISAL OF EFFECTS

4.1 Approach

The following sections present the findings of an environmental appraisal of potential impacts from the licensable activities associated with the Project on specific receptors. Receptor groups which may be impacted by the Project and which are the focus of this appraisal are the following topics:

- Physical Processes;
- Benthic Ecology;
- Fish and Shellfish; and
- Marine Mammals.

Topics screened out of the assessment are presented and discussed in Appendix A.

An assessment has been undertaken of the licensable activities for each of the identified receptor groups described in section 3. Impacts scoped out of the assessment are presented and discussed in Appendix A.

Each assessment concludes whether the licensable activities are likely to result in a negligible, minor, moderate or major effect on the receptor.

For the purpose of this assessment the following has been assumed:

- Negligible effects are those that are not considered to be detectable above natural variation;
- Minor effects are those that may be detectable above natural variation but are not considered likely to affect receptors in the medium term (months).
- Moderate effects are those that may affect receptors in the medium to long-term (months – years);
- Major effects are those that may affect receptors in the long term (years).

Consideration of the potential for LSE on European sites is presented in Section 6 and an assessment against the Water Framework Directive is presented in Section 7.

4.2 Physical Processes

4.2.1 Increased SSCs and associated deposition

As outlined in section 2.2.3, drilling will be required during the installation of the permanent casing. Approximately 45 m^3 of drilled arisings will be discharged to the seabed and could lead to increased SSCs and associated deposition. As per the NRW Position Statement on The Sustainable Management of Marine and Coastal Sediment (2022), the preferred option is to retain the sediment as close as possible to where it originated and within the same sediment system if feasible to do so. Therefore, the discharge of the drill arisings to the surrounding seabed corresponds with NRW's position.

It is assumed that levels of SCCs generated from the drilling of the casing would be of a lower extent to those arising from the periodic dredging that occurs at VPOT berths and within the MHW already, which can last up to 12 weeks (Marine Licence Number: DML2166 Milford Haven Port Authority maintenance dredging 2022 to 2032). Dredging typically disturbs volumes of sediment in the tens of thousands of cubic metres, as opposed to the approximate 45 m^3 of drilled material associated with the Project. For example, dredging activities in Pembroke Port (approximately 3 km east of the Project) assessed dredged volumes of up to 45,840 m^3 as part of their Marine License application (RPS, 2019c, 2020, 2021). It was predicted that this volume (which is several orders of magnitude higher than the 45 m^3 associated with the Project), would remain in the immediate area, with up to 3 mm of deposition (RPS, 2019c, 2020, 2021).

Particle size data were available from four samples taken from within the VPOT (two from 2021 and two from 2023). These samples predominantly comprised of particle sizes corresponding to coarse, medium, and fine muds, with some fine and very fine sand fractions. Due to these lower particle sizes, suspended sediments associated with the Project would travel further but be diluted and settle with a finer veneer than sediments with coarser grain sizes. Similar drilling activity from within the Pembroke Port predicted the finest sediment fractions to travel no more than the low hundreds of metres (RPS, 2021). This can be reasonably be applied to the Project, given the similarity in location within the MHW.

The MHW also regularly experiences elevations of SSCs due to construction development and vessel activity, which can cause sediment plumes which extend for several kilometres, depending on the tidal flow and currents (Little *et al.* 2009). As detailed in section 3.3.2, the strong tidal flow and currents within the main channel of the MWH (where the Project is located) are predicted to ensure that SSCs associated with the Project are unlikely to be detectable above baseline conditions.

Overall, this impact is therefore considered to be of **minor** significance.

4.3 Benthic Ecology

4.3.1 Temporary and long term habitat loss and/or disturbance

Both temporary and long term benthic habitat loss and/or disturbance may occur as part of the Project. Temporary habitat disturbance may occur due to the placement of jack up barge spud legs on the seabed. As detailed in section 2, up to two placements of the jack up barge have been assumed, with a total footprint of temporary disturbance of 25.12 m^2. Should any temporary disturbance to the seabed occur outside of this footprint, embedded mitigation measures (see section 2.4) have been proposed to reduce the risk to sensitive receptors (such as benthic ecology).

As outlined in section 2, the aim of the Project is to replace a defective dual pile, dolphin platform and cross pile braces and replace it with a monopile inside a permanent casing. The installation of the permanent casing and monopile will represent a footprint of up to 4.91 m^2 of long term habitat seabed loss, which is highly localised, and does not represent a significant loss of seabed habitat within the wider location of the VPOT and the MHW.

Temporary and long term seabed habitat loss could result in the mortality of sessile benthic communities associated with the intertidal and the sand and mud sediments within the direct footprint of the temporary placement of jack up barge spud legs and permanent installation of the casing within the Project site. Benthic habitats in the vicinity of the Project site are dominated by polychaetes such as *Arenicola* spp., and by annelids and bivalves in the subtidal areas as well as those that have colonised the actual historic dual pile itself, such as anemones and sea squirts. This could lead to a localised loss of abundance in the described benthic communities (section 3.4).

Recovery is expected with the re-colonisation of a similar diversity of benthic species once the Project is complete and levels of disturbance is reduced to pre-Project levels. The recovery rate of these benthic assemblages will depend on the reproductive strategy of the disturbed species. Species within the localised area are likely to be tolerant to a level of disturbance due to the location of Project site which experiences dredging periodically within the immediate area (section 4.2.1), is part of an operational port within the MHW where there are high levels of vessel traffic and the Project site itself is an existing mooring point for VPOT which accommodates large vessels (~ 180 m in length with draughts of ~10.5 m). Benthic habitats are therefore predicted to recover quickly following the completion of the Project and removal of the jack up barge. The Project is expected to occur over a period of 3 to 4 weeks, with a maximum of 4 weeks, therefore jack up barge placements will be very short term. Identified benthic habitats within the Project site are extensive throughout the MHW and therefore the potential temporary and long term habitat loss/disturbance of these habitats at the Project site will not cause significant change to these benthic habitats within the MHW.

As detailed in section 3.4.2, maerl beds have been identified within the MHW, however, these are located over 4 km away from the Project site and therefore are outside the footprint of this impact.

Therefore, due to the temporary nature of the jack up barge usage and highly localised footprint of long term habitat loss, the high potential for recovery of benthic communities and habitats (with the potential for new colonisation on the new monopile itself), and the restricted extent of this impact relative to the scale of the MHW, this impact is considered to be of **minor significance**.

4.3.2 Introduction and spread of INNS

The use of vessels, machinery, and material associated with the Project may facilitate the introduction or spread of INNS. These could act as a vector for the introduction and spread of INNS via fouling on vessel hulls or through ballast water.

There are expected to be a low number of vessel movements associated with the Project. The materials used as part of the Project are expected to be sourced from within the UK and brought to the Project site via a barge. Although it can be expected that there is the potential for INNS species to be introduced via delivery of materials and the stationing of the jack up barge, as mentioned in section 4.3.1, the Project site is within the MHW which is part of an operational port which experiences high levels of vessel traffic and manoeuvring. The high levels of vessel traffic and operations include:

- A twice daily, year-round Irish Ferries service from the Pembroke ferry port to Rosslare in Ireland;
- Cargo ships (bulk, break bulk and heavy lift cargoes) arriving from international locations and the associated pilotage;
- Deployment of marine energy devices;
- Commercial fisheries vessels and services at Milford Fish Docks; and
- Recreational activities such as private boats, yachts, and tourism services.

Therefore, it is concluded that the Project will not have a significant effect on the benthic communities and habitats through the introduction of INNS due to the risk that they already face from ongoing daily vessel traffic and operations within the MHW. In addition, an INNS risk assessment will be undertaken by the Contractor on award of contract (section 2.4). If it is identified that there is a risk of INNS, then suitable additional mitigation will be implemented. The impact from the introduction of INNS from the Project on benthic ecology is therefore considered to be **negligible**.

4.3.3 Increased SSCs and associated deposition

As outlined in section 4.2.1 drilling and removal of rock and sediments associated with the Project could result in increased SSCs and associated deposition, with the anticipated volume of drilled material equalling 45 m^3. This will be discharged to the seabed within the immediate vicinity of the drilled pile (see section 2.2.3). This has the potential to impact the benthic habitats and communities there due to increased SSCs and sediment deposition which could smother the current benthos.

Species most vulnerable to smothering such as sessile and low mobility species are expected to be impacted more than mobile species such as annelids or molluscs as they may be able to move from the site of deposited material. Many of the sessile benthic species mentioned previously (section 3.4) rely upon a filter feeding which would be impeded by increased levels of suspended sediment. Sediments are expected to fall out of suspension from the discharged drilling material which has the potential to smoother benthic species and communities. Despite these impacts, it is expected that the benthic ecology at the Project site and in the immediate area will recover due to the tidal and current movement within the MHW which will transport some of the suspended sediments away from the site (see section 3.3) and due to the short term duration of the Project. The benthic ecology baseline is also expected to recover as the identified benthic species within the Project site are extensive throughout the MHW and, depending on their reproduction strategy, are likely to re-colonise and experience rapid recovery following the completion of the Project.

As discussed for physical processes in section 4.2.1, this impact was concluded to be of negligible to minor significance, which is also applicable to benthic ecology. This is due to the highly limited volume of drilled material (45 m^3), which is orders of magnitude lower than the tens to hundreds of thousands of cubic metres of material that is dredged in harbours and ports throughout the MHW, such as in Pembroke Port (RPS, 2019c, 2020, 2021). In addition, the particle size data analysed from four samples points at the VPOT highlighted that sediments within the vicinity of the Project are coarse to fine muds, with some fine and very fine sand fractions (see section 4.2.1). This suggests that although these finer particle sizes may travel further than coarser sediments, such as gravels, they would be diluted quickly and settle with a fine veneer. Similar drilling activity from within the Pembroke Port predicted the finest sediment fractions to travel no more than the low hundreds of metres, with up to 3 mm of deposition (RPS, 2019c, 2020, 2021). This can reasonably be applied to the Project, given the similarity in location within the MHW. Therefore, increased SSCs and associated deposition associated with the Project are unlikely to reach and smother the highly sensitive maerl beds, which were identified at least 4 km away from the Project.

Therefore, due to the temporary nature of the activities proposed, the high potential for recovery of benthic ecology, with the potential for new colonisation on the new monopile itself, and the restricted extent of the potential impact on the identified habitats relative to the MHW, this impact is predicted to be **minor**.

4.3.4 Effects on benthic ecology associated with pumping grout

Pumping grout into the monopile casing may impact benthic ecology receptors through habitat disturbance and minor changes in the water pH directly adjacent to the works. It is not possible to quantify the area of seabed that may disturbed by the pumping of grout, however, it is likely to be very small, especially in the context of the similar habitats in the wider area in the MHW.

Grout is alkaline and therefore, when pumped underwater, has the potential to change the water pH where it contacts the water. The grout used will be designed for use in the marine environment and will set quickly. Any pH change is likely to be minor and will dissipate quickly with the currents and high turbidity caused by the works. Therefore, the effect of pumping grout underwater on benthic ecology is considered to be **negligible**.

4.3.5 Changes in water quality, including the release of sediment bound contaminants

Drilling associated with the Project could result in changes in water quality through the release of sediment bound contaminants. To assess this impact, four sediment samples that were collected in 2021 and 2023 from the VPOT were analysed for a range of contaminants:

- Metals (Arsenic, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, and Zinc); and
- Polycyclic Aromatic Hydrocarbons (PAHs; acenaphthene, acenaphthylene, anthracene, benzo[a]anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, dibenzo[a,h]anthracene, chrysene, fluorene, fluoranthene, indeno(1,2,3-cd)pyrene, naphthalene, phenanthrene, and pyrene).

The contaminants tested were all on the Environmental Quality Standards Directive (EQSD) list of priority substances, and contamination levels were compared to a range of different thresholds:

- Centre for Environment Fisheries and Aquaculture (Cefas) Action Level (AL) 1 and AL2;
- Marine Scotland AL1 and AL2;
- Canadian Council of Ministers of the Environment (CCME) Threshold Effect Level (TEL) and Probable Effect Level (PEL); and
- The Environmental Protection Agency (EPA) Effect Range Low (ERL) and Effect Range Medium (ERM).

The sediment contamination results from the four samples are presented in Table 4-1. Of the metals, nickel exceeded the Cefas AL1 and the EPA ERL. Arsenic, copper, lead, and zinc exceeded the CCME TEL, with arsenic also exceeding the EPA ERL (Table 4-1). Although these metals exceeded several of the different contamination thresholds, they did so at the lower threshold levels (e.g. Cefas AL1, CCME TEL, and the EPA ERL), as opposed to the higher threshold levels (such as Cefas AL2, CCME PEL, and the EPA ERM). For the 16 PAHs tested, 10 of them exceeded the Marine Scotland AL1 in both surveys, 10 exceeded the CCME TEL in 2021 and 11 in 2023, and two exceeded the EPA ERL in both surveys (Table 4-1). Similar to the metals, the PAHs only exceeded the lower threshold levels and not the higher ones, wherein impacts to benthic ecology would be more likely.

Although the discharged arisings may contain some contaminants, the relatively small volume of discharged drilling arisings (45m^3) are likely to be rapidly diluted and dispersed. As per section 4.2.1, particle size data were available from four samples taken from the VPOT. These samples predominantly comprised of particle sizes corresponding to coarse, medium, and fine muds, with some fine and very fine sand fractions. Due to these lower particle sizes, suspended sediments associated with the Project would travel further but be diluted and settle with a finer veneer than sediments with coarser grain sizes. Similar drilling activity from within the Pembroke Port predicted the finest sediment fractions to travel no more than the low hundreds of metres (RPS, 2021). This can be reasonably be applied to the Project, given the similarity in location within the MHW. Therefore, any contaminants potentially released during drilling of the Project would likely be diluted quickly and be dispersed until they are not detectable above background levels.

The drilling associated with the Project will result in an estimated 45 m^3 of arisings, which will be deposited on the seabed. This is orders of magnitude lower than the maintenance dredging already occurring within the

VPOT and wider MHW, therefore, does not represent an additional significant impact compared to baseline levels. The significance of effect of this impact upon benthic ecology, is therefore considered to be **minor.**

Table 4-1: Combined sediment contaminant levels in samples from 2021 and 2023 at the VPOT (N/E = Threshold Not Exceeded)

Contaminant	Cefas AL1	Cefas AL2	EQSD Priority Substance?	Marine Scotland AL1	Marine Scotland AL2	CCME		EPA	
						TEL	PEL	ERL	ERM
Arsenic	N/E	N/E	Yes	N/E	N/E	Exceeds	N/E	Exceeds	N/E
Cadmium	N/E	N/E	Yes	N/E	N/E	N/E	N/E	N/E	N/E
Chromium	N/E	N/E	Yes	N/E	N/E	N/E	N/E	N/E	N/E
Copper	N/E	N/E	Yes	N/E	N/E	Exceeds	N/E	N/E	N/E
Lead	N/E	N/E	Yes	N/E	N/E	Exceeds	N/E	N/E	N/E
Mercury	N/E	N/E	Yes	N/E	N/E	N/E	N/E	N/E	N/E
Nickel	Exceeds	N/E	Yes	N/E	N/E	No threshold	No threshold	Exceeds	N/E
Zinc	N/E	N/E	Yes	N/E	N/E	N/E	N/E	N/E	N/E
PAHs (total = 16)	No threshold	No threshold	8 are	Exceeded for 10 of the 16 PAHs tested in 2021 and 11 in 2023	No threshold	Exceeds for 10 out of the 11 that have a threshold in both 2021 and 2023. 5 PAHs tested do not have a CCME threshold.	N/E for all 11 that have a threshold	Exceeds for 2 out of the 15 that have a threshold in both 2021 and 2023. 1 does not have an EPA threshold	N/E for all 15 that have a threshold
Total hydrocarbons (PAHs)	No threshold	No threshold	8 are	N/E	No threshold	No threshold	No threshold	N/E	N/E

4.4 Fish and Shellfish

4.4.1 Disturbance and/or loss of potential spawning and nursery grounds

As identified in section 3.5.5, MHW provides a suitable spawning and nursery habitat for sandeel, sole, herring, mackerel, whiting, sprat and spotted ray (Ellis *et al.*, 2012). The activities associated with the Project may cause physical disturbance to the benthic and pelagic habitat located in the immediate vicinity of the Project site, which provide spawning and nursery grounds for fish and shellfish species.

As detailed in section 2, the Project involves the replacement of the existing dual pile structure with a new permanent casing and monopile, which represents a footprint area of 4.91 m^2 of long term seabed habitat loss. Temporary habitat loss and disturbance may occur over a limited footprint of 25.2 m^2 due to jack up barge spud leg placements on the seabed. Given highly localised footprint of both long term and temporary habitat loss, and the wide availability of suitable habitat within the MWH, this impact is not considered to result in significant disturbance or loss to potential spawning and nursery grounds of fish and shellfish. In addition, the Project site is located within the regularly disturbed MWH and highly anthropogenically altered environment around the VPOT. Fish and shellfish species that use the immediate footprint of this impact (up to 25.2 m^2) as spawning and nursey grounds are likely to already be acclimatised to regular disturbance and non-pristine environmental conditions, and are considered to have some level of tolerance to this impact as a result, Overall, therefore, this impact is considered to be **negligible.**

4.4.2 Introduction and spread of INNS

As detailed in section 4.3.2 for benthic ecology, vessels and machinery associated with the Project could act as a vector for the introduction and spread of INNS via marine fouling on vessel hulls or ballast water.

A low number of vessel movements are expected as part of the Project and will remain in the local geographical area (as described in section 4.3.2 for benthic ecology). This will reduce the potential risk of the introduction and spread of INNS within the Project site. In addition, an INNS risk assessment will be undertaken by the Contractor on award of contract (section 2.4). If it is identified that there is a risk of INNS, then suitable additional mitigation will be implemented. The impact from the introduction of INNS therefore considered to be **negligible**.

4.4.3 Increased SSCs and associated deposition

As outlined in section 4.2.1, drilling and removal of rock and sediments associated with the Project could result in increased SSCs and associated deposition, with the anticipated volume of drilled material equalling 45 m^3. This will be disposed of within the immediate vicinity of the drilled pile (see section 2.2.3). This has the potential to impact fish and shellfish receptors within the vicinity of sediment plumes and associated deposition. As detailed in section 4.2.1, this impact was deemed to be of **minor** significance for physical processes. This significance is also applicable to fish and shellfish ecology.

4.4.4 Underwater noise effects on fish and shellfish

Underwater noise has the potential to affect fish in different ways depending on the noise level and characteristics. The activities related to the installation of monopiles can result in non-impulsive (continuous) noise. If the frequency of noise emissions overlap with the frequencies audible by fish, this may influence the animal (Weilgart, 2007). The level of influence varies with distance from the source and level.

Underwater noise associated with the Project was modelled to understand the potential impacts on fish. The full noise report can be found in Appendix C. The source levels used in the assessment are summarised in Table 4-2.

Table 4-2: Noise Source Levels used in the Underwater Noise Assessment

Source level	Date source	Sound Level
Vibro-piling	Alpha ventus offshore wind farm 2.6 m monopile installation	Measured sound level: 142 dB re 1 μPa (rms) @ 750 m

Source level	Date source	Sound Level
		Scaled source level: 183 dB re 1 µPa (rms) re 1 m
Drilling	Kongsberg (2011)	Source SPL: 163 dB re 1 µPa (rms) re 1 m
Jack up vessel	Evans (1996)	Source SPL: 127 dB re 1 µPa @ 1 m (rms)

For fish, the most relevant criteria for injury from noise are considered to be those contained in the recent Sound Exposure Guidelines for Fishes and Sea Turtles (Popper *et al*. 2014). These guidelines do not group by species but instead broadly group fish into the following categories based on their anatomy and the available information on hearing of other fish species with comparable anatomies:

- Group 1 fish: species with no swim bladder or other gas chamber (e.g., elasmobranchs, flatfishes and lampreys). These species are less susceptible to barotrauma and are only sensitive to particle motion, not sound pressure. Basking shark, which does not have a swim bladder, falls into this hearing group;
- Group 2 fish: fishes with swim bladders but the swim bladder does not play a role in hearing (e.g., salmonids). These species are susceptible to barotrauma, although hearing only involves particle motion, not sound pressure;
- Group 3: Fishes with swim bladders that are close, but not connected, to the ear (e.g., gadoids and eels). These fishes are sensitive to both particle motion and sound pressure and show a more extended frequency range than groups 1 and 2, extending to about 500 Hz;
- Group 4: Fishes that have special structures mechanically linking the swim bladder to the ear (e.g., clupeids such as herring, sprat and shads). These fishes are sensitive primarily to sound pressure, although they also detect particle motion. These species have a wider frequency range, extending to several kHz and generally show higher sensitivity to sound pressure than fishes in Groups 1, 2 and 3; and
- Eggs and larvae (Popper *et al.,* 2014).

Regarding Annex II species that are designated features of SACs within the vicinity of the Project (see Table 3-1), allis shad and twaite shad have been identified as group 3 and 4 species. Sea lamprey, and river lamprey are group 1 fish, therefore less sensitive to underwater noise than the shads.

The guidelines set out criteria for injury effects due to different sources of noise. The criteria include a range of indices including Sound Exposure Level (SEL), Root Mean Square (rms) and peak Sound Pressure Level (SPL). Where insufficient data exist to determine a quantitative guideline value, the risk is categorised in relative terms as “high”, “moderate” or “low” at three distances from the source: “near” (i.e. in the tens of metres), “intermediate” (i.e. in the hundreds of metres) or “far” (i.e. in the thousands of metres). It should be noted that these qualitative criteria cannot differentiate between exposures to different noise levels and therefore all sources of noise, no matter how loud, would theoretically elicit the same assessment result. However, because the qualitative risks are generally qualified as “low”, with the exception of a moderate risk at “near” range (i.e. within tens of metres) for some types of hearing groups and impairment effects, this is not considered to be a significant issue with respect to determining the potential effect of noise on fish.

The criteria used in this underwater noise assessment for non-impulsive and continuous noise sources, such as vessels, are given in Table 4-3.The only numerical criteria for these sources are for recoverable injury and TTS for fish with a swim bladder involved in hearing. Physiological effects relating to injury criteria are as follows:

- Mortality and potential mortal injury: either immediate mortality or tissue and/or physiological damage that is sufficiently severe (e.g. a barotrauma) that death occurs sometime later due to decreased fitness. Mortality has a direct effect upon animal populations, especially if it affects individuals close to maturity.
- Recoverable injury: Tissue and other physical damage or physiological effects, that are recoverable, but which may place animals at lower levels of fitness, may render them more open to predation, impaired feeding and growth, or lack of breeding success, until recovery takes place.
- TTS: Short term changes in hearing sensitivity may, or may not, reduce fitness and survival. Impairment of hearing may affect the ability of animals to capture prey and avoid predators, and also cause deterioration in communication between individuals affecting growth, survival, and reproductive

success. After termination of a noise that causes TTS, normal hearing ability returns over a period that is variable, depending on many factors, including the intensity and duration of noise exposure.

Table 4-3: Criteria for the Onset of Injury to Fish due to Non-Impulsive Noise (Popper *et al.,* 2014)

Hearing Group	Mortality and Potential Mortal Injury	Recoverable Injury	TTS
Group 1	(Near) Low (Intermediate) Low (Far) Low	(Near) Low (Intermediate) Low (Far) Low	(Near) Moderate (Intermediate) Low (Far) Low
Group 2	(Near) Low (Intermediate) Low (Far) Low	(Near) Low (Intermediate) Low (Far) Low	(Near) Moderate (Intermediate) Low (Far) Low
Group 3 and 4	(Near) Low (Intermediate) Low (Far) Low	170 dB re 1μPa (rms) for 48 hours	158 dB re 1μPa (rms) for 12 hours
Eggs and larvae	(Near) Low (Intermediate) Low (Far) Low	(Near) Low (Intermediate) Low (Far) Low	(Near) Low (Intermediate) Low (Far) Low

Behavioural reaction of fish to noise has been found to vary between species based on their hearing sensitivity. Typically, fish sense noise via particle motion in the inner ear which is detected from noise-induced motions in the fish's body. The detection of sound pressure is restricted to those fish which have air filled swim bladders; however, particle motion (induced by noise) can be detected by fish without swim bladders.

Highly sensitive species such as herring have elaborate specialisations of their auditory apparatus, known as an otic bulla – a gas filled sphere, connected to the swim bladder, which enhances hearing ability. The gas filled swim bladder in species groups such as cod and salmon may be involved in their hearing capabilities, so although there is no direct link to the inner ear, these species are able to detect lower noise frequencies and as such are considered to be of medium sensitivity to noise. Flat fish and elasmobranchs have no swim bladders and as such are considered to be relatively less sensitive to sound pressure.

The most recent criteria for disturbance are considered to be those contained in Popper et al. (2014) which set out qualitative criteria for disturbance due to different sources of noise. The risk of behavioural effects is categorised in relative terms as "high", "moderate" or "low" at three distances from the source: "near" (i.e. in the tens of metres), "intermediate" (i.e. in the hundreds of metres) or "far" (i.e. in the thousands of metres), as shown in Table 4-4.

Table 4-4: Criteria for the onset of behavioural effects in fish due to non-impulsive noise (Popper *et al.,* 2014)

Hearing Group	Relative Risk of Behavioural Effects
Group 1	(Near) Moderate (Intermediate) Moderate (Far) Low
Group 2	(Near) Moderate (Intermediate) Moderate (Far) Low
Group 3 and 4	(Near) High (Intermediate) Moderate (Far) Low
Eggs and larvae	(Near) Moderate (Intermediate) Moderate (Far) Low

It is important to note that the Popper *et al*. (2014) criteria for disturbance due to underwater noise are qualitative rather than quantitative. Consequently, a noise source of a particular type (e.g. vibro-piling) would result in the same predicted impact, no matter the level of noise produced or the propagation characteristics.

The results of the noise modelling for fish species where a swim bladder is involved in hearing (and are therefore more sensitive to underwater noise) are summarised in Table 4-5. It should be noted that fish would need to be exposed within these potential impact ranges for a period of 48 hours continuously in the case of recoverable injury and 12 hours continuously in the case of TTS for the effect to occur. It is therefore considered that these ranges are highly precautionary, and injury is unlikely to occur.

Table 4-5: Summary of Potential Injury and Disturbance Ranges for Fish with a Swim Bladder involved in Hearing (Groups 3 and 4) (N/E = Threshold Not Exceeded)

Noise Source	Injury Zone Radius (m)	
	Recoverable injury: 170 dB re 1 µPa (rms) for 48 hrs	TTS: 158 dB re 1 µPa (rms) for 12 hrs
Vibro-piling	59	103
Drilling	N/E	N/E
Jack up vessel	N/E	N/E

Overall, the results of the noise modelling (Table 4-5) suggest that there is little potential for injury to fish within hearing groups 3 and 4, which are the most sensitive to underwater noise, with lower potential for injury for fish hearing groups that are less sensitive to underwater noise.

Fish within the immediate injury ranges are expected to be able to vacate the area and avoid physical injury. Furthermore, the Project sits within the MHW, which has high levels of anthropogenic background noise. Fish species that are sensitive to noise are therefore unlikely to frequent this area. Based on the highly limited impact ranges modelled for vibro-piling, this impact is considered to be of **minor significance.**

4.5 Marine Mammals

4.5.1 Underwater noise effects on marine mammals

Underwater noise has the potential to affect marine mammals in different ways depending on the noise level and characteristics. The activities related to the installation of the monopile can result in non-impulsive (continuous) noise. If the frequency of non-impulsive noise emissions overlaps with the frequencies audible by marine mammals, this may influence the animal (Weilgart, 2007). The level of influence varies with distance from the source and level. Noise associated with the Project was modelled to understand the potential impact on marine mammals, with the full report available in Appendix C.

The auditory injury (Permanent Threshold Shift (PTS)/TTS) threshold criteria proposed by Southall *et al.* (2019), and injury/TTS threshold criteria proposed by National Marine Fisheries Service (NMFS, 2024a) are based on a combination of unweighted peak pressure levels and mammal hearing weighted SEL. The hearing weighting function is designed to represent the frequency characteristics (bandwidth and noise level) for each group within which acoustic signals can be perceived and therefore assumed have auditory effects. The categories relevant to this study are:

- low-frequency (LF) cetaceans (i.e., marine mammal species such as baleen whales);
- high-frequency (HF) cetaceans (i.e., marine mammal species such as dolphins, toothed whales, beaked whales and bottlenose whales);
- very high-frequency (VHF) cetaceans (i.e., marine mammal species such as true porpoises, river dolphins and pygmy/dwarf sperm whales and some oceanic dolphins, generally with auditory centre frequencies above 100 kHz);
- phocid pinnipeds in water (PCW) (i.e., true seals; hearing in air is considered separately in the group PCA); and
- other marine carnivores in water (OCW) (including otariid pinnipeds (e.g., sea lions and fur seals), sea otters and polar bears; air hearing considered separately in the group OCA).

Auditory injury criteria proposed in Southall *et al. (*2019) and NMFS (2024a) are for two different types of noise as follows:

- Impulsive noises which are typically transient, brief (less than one second), broadband, and consist of high peak sound pressure with rapid rise time and rapid decay. This category includes noise sources such as seismic surveys, impact piling and underwater explosions.
- Non-impulsive noises which can be broadband, narrowband or tonal, brief or prolonged, continuous or intermittent and typically do not have a high peak sound pressure with rapid rise/decay time that impulsive noises do. This category includes noise sources such as continuous running machinery, sonar, and vessels.

The criteria for non-impulsive noise have been adopted for the noise modelling given the nature of the variety of noise source used during the various activities.

The zone of auditory injury in this study was classified as the distance over which a marine mammal may suffer PTS leading to non-reversible auditory injury. UK Industry guidelines on the prevention of injury to marine mammals recommend that PTS is the relevant threshold considered likely to result in injury and for which appropriate mitigation should be followed (JNCC, 2010).

A marine mammal may experience a TTS at lower hearing thresholds than those that could cause instantaneous injury resulting in PTS. The distinction between TTS and PTS depends on whether there is complete recovery of the individual's hearing. The most likely response of a marine mammal to noise levels that could induce TTS is to flee from the ensonified area (Southall *et al.,* 2007) and subsequently the onset of TTS is referred to as the fleeing response. The duration of effect can vary widely from 1 hour up to several days and, as described above, indicates the level of noise exposure which could induce any measurable shift.

This range in response makes it difficult to interpret the biological consequences of TTS, and as described for PTS, the noise modelling makes a number of precautionary assumptions that lead to the prediction of very conservative ranges. For these reasons, the TTS ranges should be interpreted with caution since in reality the injury ranges are likely to be smaller than those predicted by the modelling. The potential ranges presented for injury and disturbance are not a hard and fast 'line' where an impact will occur on one side and not on the other. Potential impact is more probabilistic than that; dose dependency in PTS onset, individual variations and uncertainties regarding behavioural response and swim speed/direction all mean that it is much more complex than drawing a contour around a location. Therefore, it is also necessary to calculate the SEL for a mammal using the relevant weightings described previously considering the amount of noise energy to which it is exposed over the course of a 24-hour period. In order to carry out this calculation, it has been assumed that a mammal will swim away from the noise source at an average speed of 1.5 m/s. As the mammal swims away, the noise will become progressively quieter. The real-world situation is more complex, and the noise source will vary in space and time and the animal is likely to move in a more complex manner.

Harbour porpoise, bottlenose dolphin, grey seal, and otter have been carried forward for assessment, as detailed in section 3.6. The relevant criteria proposed by Southall *et al.,* (2019) and in NMFS (2024a) are as summarised in Table 4-6.

Table 4-6: Summary of PTS and TTS Onset Acoustic Thresholds for the Relevant Marine Mammal Hearing Groups (Southall *et al.,* 2019 and NMFS, 2024a)

Hearing Group	Parameter	Southall *et al.,* (2019) non-impulsive		NMFS (2024a) non-impulsive	
		PTS	TTS	TTS	Injury
VHF cetaceans (harbour porpoise)	SEL, VHF weighted	173	153	160	181
HF cetaceans (bottlenose dolphin)	SEL, HF weighted	198	178	181	201
PCW (grey seal)	SEL, PCW (PW) weighted	201	181	175	195
OCW (otter)	SEL, OCW (OW) weighted	219	199	178	198

Beyond the area in which auditory injury may occur, effects on marine mammal behaviour are an important measure of potential impact. Non-trivial disturbance may occur when there is a risk of animals incurring sustained or chronic disruption of behaviour or when animals are displaced from an area, with subsequent redistribution being significantly different from that occurring due to natural variation.

To consider the possibility of disturbance resulting from the project, it is necessary to consider:

- whether or not a noise can be detected/heard by an animal above background noise levels or level of acclimatisation above background levels;
- the likelihood that the noise could cause non-trivial disturbance;
- the likelihood that the sensitive animals will be exposed to that noise; and
- whether the number of animals exposed are likely to be significant at the population level.

Assessing these impacts is however a very difficult task due to the complex and variable nature of noise propagation, the variability of documented animal responses to similar levels of noise, and the availability of population estimates and regional density estimates for all marine mammal species. Behavioural responses are widely recognised as being highly variable and context specific (Southall *et al.,* 2007; 2019; 2021). Assessing the severity of such potential impacts and development of probability-based response functions continues to be an area of ongoing scientific research interest.

Southall *et al*. (2007) recommended that at the time the only feasible way to assess whether a specific noise could cause disturbance is to compare the circumstances of the situation with empirical studies. JNCC guidance in the United Kingdom (JNCC, 2010) indicates that a score of five or more on the Southall *et al*. (2007) behavioural response severity scale could be significant. The more severe the response on the scale, the lower the amount of time that the animals will tolerate it before there could be adverse consequences to life functions, which would constitute a disturbance. The severity scale was revised in Southall *et al*. (2021), which included splitting severity assessment methods on captive studies from assessments on field studies. Behavioural responses related to field studies included impacts to survival, reproduction and foraging.

Southall *et al*. (2007 and 2021) both present a summary of observed behavioural responses for various mammal groups exposed to different types of noise: continuous (non-pulsed) or impulsive (single or multiple pulsed).

For non-impulsive noise (e.g. vibro-piling, drilling, vessels etc.), the lowest sound pressure level at which a score of five or more on the Southall *et al.* (2007) behavioural response severity scale occurs for low frequency cetaceans is 90 dB to 100 dB re 1 μPa (rms). However, this relates to a study involving only migrating gray whales *Eschrichtius robustus*. A study for minke whale showed a response score of three at a received level of 100 dB to 110 dB re 1 μPa (rms), with no higher severity score encountered for this species. For mid frequency cetaceans, a response score of eight was encountered at a received level of 90 dB to 100 dB re 1 μPa (rms), but this was for one mammal (a sperm whale *Physeter macrocephalus*) and might not be applicable for the species likely to be encountered in the vicinity of the Project. For white-beaked dolphin, a response score of three was encountered for received levels of 110 dB to 120 dB re 1 μPa (rms), with no higher severity score encountered. For high frequency cetaceans such as bottlenose dolphins a number of individual responses with a response score of six are noted ranging from 80 dB re 1 μPa (rms) and upwards. There is a significant increase in the number of mammals responding at a response score of six once the received SPL is greater than 140 dB re 1 μPa (rms).

It is worth noting that the above SPLs are based on the rms SPL metric, which was historically often reported in such studies. More recent studies often use other metrics such as the SEL and care must be taken not to directly compare noise levels quoted using different parameters (see Appendix C for a discussion of these different metrics).

The NMFS (2024b) guidance sets the marine mammal Level B harassment threshold (analogous to disturbance) for continuous noise at 120 dB re 1 μPa (rms). This threshold is based on studies by Malme *et al*. (1984) which investigate the effects of noise from the offshore petroleum industry on migrating gray whale behaviour offshore Alaska. This value sits approximately mid-way between the range of values identified in Southall *et al.* (2007) for continuous noise but is lower than the value at which the majority of marine mammals responded at a response score of six (i.e. once the received rms sound pressure level is greater than 140 dB re 1 μPa). Considering the paucity and high level variation of data relating to onset of behavioural effects due to continuous noise, any ranges predicted using this number are likely to be probabilistic and potentially over precautionary.

It is worth noting that the distinction between impulsive and non-impulsive noise was removed from Southall *et al.* (2021) as "some source types, such as airguns, may produce impulsive noises near the source and non-impulsive noises at greater ranges". However, Southall *et al*. (2021) does not present thresholds for assessing disturbance, therefore the threshold of 120 dB re 1 µPa (rms) (NMFS, 2024b) discussed in the preceding paragraphs has been adopted.

Estimated ranges for industry and disturbance to marine mammals due to the continuous noise sources (vibro-piling, drilling, and jack up vessel usage) during all phases of the project are presented in Table 4-7. Swim speeds of 1.5 m/s were applied for otter and harbour porpoise, 1.52 m/s for bottlenose dolphin, and 1.8 m/s for grey seal (see Appendix Cfor further information).

It should be noted that there is a considerable degree of uncertainty and variability in the onset of disturbance and therefore and disturbance ranges should be treated as potentially over precautionary. Another important consideration is that vessels and construction noise will be temporary and transitory, as opposed to permanent and fixed. In this respect, construction noise is unlikely to differ significantly from vessel traffic already in the area.

Table 4-7: Potential impact ranges (m) for marine mammals, incorporating the Southall *et al.* 2019 weightings and thresholds, and NMFS (2024a) weightings and thresholds included in brackets were they differ. (N/E refers to a threshold not exceeded).

Species and Noise Source	Range of Effect (m)		
	PTS	TTS	Disturbance
Harbour porpoise (VHF)			
Vibro-piling	N/E	N/E	606
Drilling	N/E	7 (N/E)	277
Jack up vessel	N/E	N/E	N/E
Bottlenose dolphin (HF)			
Vibro-piling	N/E	N/E	606
Drilling	N/E	N/E	277
Jack up vessel	N/E	N/E	N/E
Grey seal (PCW)			
Vibro-piling	N/E	5 (N/E)	606
Drilling	N/E	N/E	277
Jack up vessel	N/E	N/E	N/E
Otter (OCW)			
Vibro-piling	N/E	N/E	606
Drilling	N/E	N/E	277
Jack up vessel	N/E	N/E	N/E

The noise modelling therefore suggests that PTS nor TTS are likely to occur for any of the marine mammals included in the assessment, with disturbance ranges in the hundreds of metres.

4.5.1.1 Harbour Porpoise

The noise modelling results indicate that the thresholds for PTS and TTS are unlikely to be exceeded for harbour porpoise during vibro-piling, drilling or jack up usage, only a TTS range of 7 m for drilling was modelled. Disturbance may occur out to a distance of 606 m. Overall, vibro-piling and drilling are expected to occur intermittently over a period of up to three days, therefore do not represent a long term impact and any disturbance will be temporary over a very short duration.

4.5.1.2 Bottlenose Dolphin

The noise modelling results indicate that the thresholds for PTS and TTS are unlikely to be exceeded for bottlenose dolphin during vibro-piling, drilling or jack up usage. Disturbance may occur out to a distance of 606 m. Overall, vibro-piling and drilling are expected to occur intermittently over a period of up to three days, therefore do not represent a long term impact and any disturbance will be temporary over a very short duration.

4.5.1.3 Grey Seal

The noise modelling results indicate that the thresholds for PTS and TTS are unlikely to be exceeded for grey seal during vibro-piling, drilling or jack up usage, only a TTS range of 5 m for vibro-piling was modelled. Disturbance may occur out to a distance of 606 m. Overall, vibro-piling and drilling are expected to occur intermittently over a period of up to three days, therefore do not represent a long term impact and any disturbance will be temporary over a very short duration.

4.5.1.4 Otter

The noise modelling results indicate that the thresholds for PTS and TTS are unlikely to be exceeded for otter during vibro-piling, drilling or jack up usage. Disturbance may occur out to a distance of 606 m. Overall, vibro-piling and drilling are expected to occur intermittently over a period of up to three days, therefore do not represent a long term impact and any disturbance will be temporary over a very short duration.

4.5.1.5 Conclusion

The noise assessment has demonstrated that there is no risk of PTS to any marine mammal as a result of and any behavioural disturbance will be limited to within 606 m of the works during vibro-piling. The noise produced by these activities and high level of anthropogenic noise already associated with the VPOT renders it unlikely that marine mammals will venture close to the works and the noise-producing activities associated with the Project are unlikely to exceed the existing background noise levels. Therefore, this impact is considered to be **negligible** and no mitigation is considered necessary.

5 CONSIDERATIONS OF OTHER PROJECTS

5.1 Screening of Projects

This section considers the potential for effects arising from the Project alongside other known activities. The Project is located within the MHW, in the vicinity of the Port of Milford Haven, which is an operating commercial port which provides a range of services and activities. Projects within the MHW were screened in to consider if there was a potential for cumulative environmental effects; these are listed in Table 5-1.

Table 5-1: Other projects within the MHW with the potential to cause a cumulative effect

Application number	Description	Applicant	Start date	End date
DEML1875	Marine Energy Test Area Phase 1 sites	Pembrokeshire Coastal Forum CIC	10/06/2019	09/06/2029
ORML2170	Project Erebus Offshore Floating Wind Farm	Blue Gem Wind Ltd	17/02/2023	31/12/2054
CML2057	Pembroke Dock Infrastructure Project	Milford Haven Port Authority	10/07/2021	01/10/2026
RML138	Removal of objects from below mean high water springs.	RWE Npower plc	05/07/2013	Unknown
DML2166	Disposal of dredge material	Milford Haven Port Authority	16/08/2022	08/03/2032
ORML1957	META Phase 2	Pembrokeshire Coastal Forum CIC	15/12/2020	15/12/2035
RML2362	Geotechnical Investigations	Port of Milford Haven	22/12/2023	Unknown

The screening considered any developments that are at the Scoping stage or later in the consenting process. Developments that are built and operational at the time of assessment have been considered as part of the baseline. A highly precautionary buffer of 1 km was used to screen projects in for consideration of cumulative effects. This 1 km buffer is highly precautionary for most impacts which will have a lower ZoI, including underwater noise, where behavioural disturbance was modelled out to 606 m; section 4.5.1). As there are no maerl beds identified within 1 km of the Project (a minimum of 4 km away), there will be no cumulative impact upon these highly sensitive maerl habitats as a result of the Project.

Within this 1 km buffer, there was no temporal overlap and/or impact pathway identified between the Project and the majority of projects listed in Table 5-1. However, there was both spatial and temporal overlap between dredge activities by Milford Haven Port Authority (DML2166) and the Project. Therefore, there may be a potential for cumulative impacts from dredging and disposal activities which may present potential cumulative effects with the activities associated with this project.

Given the highly localised nature of the following impacts listed below, they are not considered to be relevant at a cumulative scale, as they will be localised within the footprint of the Project:

- Temporary and long term habitat loss (for both benthic ecology and fish and shellfish ecology);
- Effects on benthic ecology associated with pumping grout; and
- Changes in water quality, including the release of sediment bound contaminants.

5.2 Physical Processes, Benthic Ecology, and Fish and Shellfish Ecology

5.2.1 Increases in SSCs and associated deposition

Milford Haven maintenance dredging is an annual occurrence which is likely to increase suspended sediments, however this activity will also be brief and is unlikely to overlap temporally with the Project. The cumulative impact on SSCs is, therefore, expected to be **minor**.

5.3 Benthic Ecology and Fish and Shellfish Ecology

5.3.1 Introduction and spread of INNS

Milford Haven maintenance dredging is conducted annually by the Milford Haven Port Authority. The dredging vessel used will be travelling from within the MHW, and not represent a significant vector for the transmission of INNS from an external area. Vessel use associated with the Project will be very short in duration, and unlikely to overlap with that of the annual maintenance dredging. Therefore, the cumulative impact is expected to be **minor**.

5.4 Fish and Shellfish Ecology and Marine Mammals

5.4.1 Underwater noise effects

Milford Haven maintenance dredging operations and disposal of material are potentially able to contribute to the cumulative impact of underwater noise on fish and shellfish and marine mammals. The sources of noise from these operations involve dredging and vessel movement which involve a low level of noise. The noise from these operations is also similar to the regular baseline noise produced by the daily port operations which fish and shellfish and marine mammals are routinely exposed to. It is also unlikely that the dredging will occur at the same time as the noise producing activities proposed within this Project as it only occurs once a year. The cumulative impact of this noise is therefore unlikely to be greater than the impact of the vibro-piling alone, therefore the cumulative impact of underwater noise is likely to be **minor.**

6 HRA STAGE 1 LSE SCREENING

HRA Stage 1 Screening step (i.e. LSE Screening) is the first stage of the HRA process which considers if the likely effects of a project upon a European site, (both alone or in combination with other plans and projects), may be significant. The Stage 1 LSE Screening must conclude that there will be no LSE upon any identified European site, and if there is any uncertainty or where it cannot be determined that there is no LSE, a Stage 2: Report to Inform Appropriate Assessment (RIAA) is required. The Stage 1 LSE Screening is presented in the following sections for the European sites identified in section 3.2 (see Figure 3-1). The conclusion of the Stage 1 LSE Screening and rationale to not proceed forwards to Stage 2 are presented in section 6.5.

6.1 Pembrokeshire Marine / Sir Benfro Forol SAC

The Pembrokeshire Marine/ Sir Benfro Forol SAC is located within the MHW where the Project site is located at VPOT and covers an area of 1,380.38 km^2. The SAC extends from just north of Abereiddy on the north Pembrokeshire coast, to just east of Manorbier in the south, and includes the coast of the islands of Ramsey, Skomer, Grassholm, Skokholm, the Bishops and Clerks and The Smalls.

6.1.1 Estuaries, Reefs and Large shallow inlets and bays (Primary habitat feature), Mudflats and Sandflats not covered by seawater at low tide (Secondary habitat feature)

The habitat features of the Pembrokeshire Marine/ Sir Benfro Forol SAC; large shallow inlets and bays, estuaries, reefs and mudflats and sandflats not covered by seawater at low tide is assessed as “Unfavourable” (NRW, 2018a). Whilst there may be some potential for these habitats to be disturbed through increased SSCs and deposition of material during the drilling and removal of rock and sediments as well as the construction of the project, the effects are all considered to be localised and reversible (i.e. once the Project is completed and activity ceased the SSC is anticipated to reduce back to pre-construction levels) and negligible/minor, especially as there is a high level of activity in the MHW including regular dredging activity which is assumed to have similar impacts on these habitats in the Pembrokeshire Marine/ Sir Benfro Forol SAC. Therefore, the Project is not considered to result in a LSE upon the Annex I habitat features of the Pembrokeshire Marine/ Sir Benfro Forol SAC.

6.1.2 Migratory fish species

The allis shad (*Alosa alosa*) and twaite shad (*Alosa fallax*) features of the Pembrokeshire Marine/ Sir Benfro Forol SAC are assessed as “Favourable” (NRW, 2018a). Both species migrate through the SAC in order to reach spawning grounds such as the Cleddau Rivers (see section 6.4) and travel back through to coastal environments. Timings of these migratory movements has been linked to water temperature (section 3.5.2). Similarly river lamprey (*Lampetra fluviatilis*) and sea lamprey (*Petromyzon marinus*) which are other diadromous fish qualifying features of the Pembrokeshire Marine/ Sir Benfro Forol SAC have been assessed as “Unfavourable” and also migrate through the SAC, although at different times of the year (see section 3.5.2) (NRW, 2018a). Although, all species are thought to be present and migrate through the Pembrokeshire Marine/ Sir Benfro Forol SAC, and there is the potential for fish to occupy or pass the Project site at VPOT, no barrier to migration or potential impact have been identified and the Project site is not used for spawning. In addition, based on the results of the underwater noise modelling conducted for the Project, underwater noise is not likely to present a barrier to migration for these Annex II diadromous fish species (see section 4.4.4). Therefore, the Project is not considered to result in a LSE upon the Annex II diadromous fish features of the Pembrokeshire Marine/ Sir Benfro Forol SAC

6.1.3 Marine Mammals

Marine mammal features of the Pembrokeshire Marine/ Sir Benfro Forol SAC include otters and the grey seal both of which are assessed as “Favourable” (NRW, 2018a). The grey seal population on the Pembrokeshire coast contains the main colony in Wales. Here average pup production increased from 2009 to 2015 (NRW, 2018b).

Grey seals are highly mobile and can travel great distances and although they have been spotted near the Project in the SAC, in the MHW, they have not been recorded in significant numbers compared to sites such as Skomer just beyond the MHW (NRW, 2018b). As they have been seen in the vicinity of the Project they may be affected by underwater noise associated with the Project. However, the number of grey seals potentially affected is assumed to be very low and effects are assessed as being localised, short term and reversable (i.e. once the activity has ceased normal behaviour will resume and animals will return to the area where disturbance occurred). Based on the results of the noise modelling assessment, Project activities will not result in negative effects on grey seal as features of the Pembrokeshire Marine/ Sir Benfro Forol SAC (see section 4.5.1).

The otter population in Wales is increasing and there has been an increase in areas used by otters. Any otters present within the SAC are part of a wider population living around freshwater habitats in Pembrokeshire. It is likely that there are movements and exchanges between areas supporting otters. The proportion of the otter population within the SAC at any time, and its distribution, is likely to be dynamic and it is not known whether the numbers of animals that use the site are a fixed or variable proportion of the wider population with a preference for using marine habitat. The risk to otters from the Project would most likely be due to underwater noise which may affect behaviour, including foraging. However, the number of otters potentially affected is assumed to be extremely low, considering their terrestrial ecology and the Project effects being localised, short term and reversable. Further, the noise modelling conducted for the Project suggests that injury and disturbance thresholds of otters will not be exceeded (see section 4.5.1).

Overall, therefore, it can be concluded that there is no potential for LSE as a result of the Project upon the Annex II marine mammal features of the Pembrokeshire Marine/ Sir Benfro Forol SAC.

6.2 West Wales Marine / Gorllewin Cymru Forol SAC

The West Wales Marine SAC is located off the coast of Wales, from the Llŷn peninsula in the north, to Pembrokeshire in the south-west, covering 7,376 km^2. It was designated in 2019 for harbour porpoise. This SAC overlaps with a number of other SACs including parts of the Pembrokeshire Marine/ Sir Benfro Forol and Pen Llŷn a'r Sarnau SACs and overlaps entirely with the Cardigan Bay SAC. Along the westward boundary, water depths of up to 100 m are reached, though much of the site is 50 m or shallower. The area included within the site covers important summer habitat for harbour porpoise, while part of the site in Cardigan Bay was also identified as important during the winter.

6.2.1 Harbour porpoise

The West Wales Marine /Gorllewin Cymru Forol SAC has been identified as being within the top 10% of persistent high-density areas for harbour porpoise in UK waters during the summer season (NRW and JNCC, 2016). Although there is the potential for harbour porpoise to enter the MHW, there are no records of this species occurring within the Waterway on the NBN gateway, and therefore the abundance within the MHW itself is predicted to be extremely low/negligible, with any animals that do occur more likely to be present at the mouth of the MHW.

The main potential impact of the Project activities on marine mammals is disturbance due to vibro-piling and other noise producing activities. In the unlikely event that a harbour porpoise is present within the VPOT jetty area, it can be assumed that the animal would be tolerant of existing levels of vessel noise already in the MHW, and no disturbance of the animal would therefore be likely. It is likely marine mammals will avoid the area due to background noise levels already occurring within the MHW therefore avoiding direct contact with vessel movements. Underwater noise associated with the Project is not expected to cause injury to harbour porpoise, with PTS thresholds not exceeded and a low TTS range of up to 7 m modelled (see section 4.5.1). Behavioural disturbance effects may extend out to 606 m, although these are temporary and animals within this range are expected to recover from any behavioural disturbance. On this basis, no significant injury or disturbance to harbour porpoise is predicted, and harbour porpoise will remain a viable component of the SAC.

Overall, therefore, it can be concluded that there is no potential for a LSE as a result of the Project upon the Annex II harbour porpoise feature of the West Wales Marine /Gorllewin Cymru Forol SAC.

6.3 The Bristol Channel Approaches / Dynesfeydd Môr Hafren SAC

The Bristol Channel Approaches /Dynesfeydd Môr Hafren SAC is approximately 11 km from the Project site at VPOT. The site covers an area of 5,851 km^2, stretching from the north coasts of Cornwall and Devon across the Bristol Channel Approaches to Carmarthen Bay in Wales and also overlaps with the designated site Pembrokeshire Marine /Sir Benfro Forol SAC (section 6.1). The water depths range between Mean Low Water Tide levels and 70 m, with the majority of the site at 50 m deep, decreasing towards the coastline. The depth and seabed energy levels, both current and wave energy, which is evaluated as a medium level across the majority of the site with high energy at the coasts, including south Wales which increases the probability of presence and density of harbour porpoise (JNCC, 2016). As mentioned in the West Wales Marine/ Gorllewin Cymru Forol SAC (section 6.2), the northern part of the site in Welsh waters is an important area in summer for harbour porpoise in addition to the winter season.

6.3.1 Harbour porpoise

The Bristol Channel Approaches/ Dynesfeydd Môr Hafren SAC has been recognised as an area with a predicted persistent high densities of harbour porpoise (JNCC, 2016). As mentioned previously for the West Wales Marine/ Gorllewin Cymru Forol SAC (section 6.2.1) the number of harbour porpoises within the MHW is extremely low/negligible and therefore this qualifying feature of the SAC is unlikely to be affected by the Project. In addition, the noise modelling results suggest that this species will not experience PTS as a result of the Project, and TTS and behavioural disturbance ranges are low (see section 4.5.1). On this basis, no significant disturbance of the species is predicted, and harbour porpoise will remain a viable component of the SAC.

Overall, therefore, it can be concluded that there is no potential for a LSE as a result of the Project upon the Annex II harbour porpoise feature of the Bristol Channel Approaches/ Dynesfeydd Môr Hafren SAC.

6.4 Cleddau Rivers/ Afonydd Cleddau SAC

The Cleddau Rivers/Afonydd Cleddau SAC lies 11.2 km north east upstream from the Project site. The River Cleddau is one of the westernmost rivers in Britain and can be broadly divided into the eastern and western arms. The Eastern Cleddau River, starting at an altitude of 225 m and approximately 1.5 km from Mynachlog-ddu at the foot of the Preseli hills of north Pembrokeshire, flows for 26 km (74 km including tributaries) south to its tidal limit at Blackpool Bridge, where it discharges into the Pembrokeshire Marine/ Sir Benfro Forol SAC. The main channel of the Western Cleddau River stretches for 30 km between its source at Mathry, which lies at an altitude of 112 m, to the tidal limit of the Daugleddau Estuary at Haverfordwest, flowing over sands and gravels deposited as the ice sheets from the last glaciation retreated.

6.4.1 Migratory fish species

Brook lamprey and river lamprey are both primary features for the Cleddau Rivers/ Afonydd Cleddau SAC, other features include the sea lamprey. As mentioned previously lampreys migrate through MHW, where the Project site is located mid channel in order to reach spawning grounds at the SAC (section 3.5.2). Although, all species are thought to be present and migrate through the MHW in order to reach the SAC, no barrier to migration or potential impact have been identified or is expected given that it is unlikely that these species will be within the Project site any behavioural effects will be limited to this area. In addition, based on the results of the underwater noise modelling conducted for the Project, underwater noise is not likely to present a barrier to migration for these Annex II diadromous fish species (see section 4.4.4). Therefore, it can be concluded that there is no potential for a LSE as a result of the Project upon the Annex II diadromous fish features of the Cleddau Rivers/ Afonydd Cleddau SAC.

6.4.2 Otter

The SAC is capable of supporting 11 breeding females on the Western Cleddau, and eight breeding females on the Eastern Cleddau. This is determined by the number of existing breeding territories as identified by Jones, (2004). Food availability is an important factor. Fish biomass should stay within expected natural fluctuations as there is no spatial overlap with the SAC and the Project site. As detailed in the noise modelling assessment, PTS and TTS thresholds will not be exceeded for otter as a result of noise producing activities associated with the Project, and behavioural disturbance effects would be limited to less than a kilometre (see section 4.5.1). On this basis, no significant disturbance of the species is predicted, and otter will remain a viable component of the site. Due to the considerable distance within the known territorial ranges (1 – 40 km) of otter as a qualifying feature of the SAC and the Project, it can be concluded that there is no potential for a LSE as a result of the Project upon the Annex II otter feature of the Cleddau Rivers/ Afonydd Cleddau SAC.

6.5 HRA Screening Conclusions

Given the limited ZoI of the Project (and other plans and projects in-combination with it; see section 5), there is no potential for LSE identified for the relevant qualifying features of any of the European sites screened in for the Stage 1 LSE Screening in sections 6.1 to 6.4. Therefore, there are no European sites proposed to be carried forward to Stage 2 Appropriate Assessment, and no RIAA has been written with respect to the relevant qualifying features of the SACs identified.

7 WATER FRAMEWORK DIRECTIVE ASSESSMENT

EU Directive 2000/60/EC, better known as the Water Framework Directive (WFD), established a framework for community action in the field of water policy. The WFD came into force in 2000 and requires EU Member States to ensure that all inland and coastal waters achieved 'good' water quality status by 2015. The aims of the WFD are for member states to:

1. Implement the necessary measures to prevent deterioration of the status of all bodies of surface water;
2. Protect, enhance and restore all bodies of surface water, subject to the application of subparagraph (iii) for artificial and heavily modified bodies of water, with the aim of achieving good surface water status by 2015;
3. Protect and enhance all artificial and heavily modified bodies of water, with the aim of achieving good ecological potential and good surface water chemical status by 2015; and
4. Implement the necessary measures in accordance with Article 16 (1) and (8), with the aim of progressively reducing pollution from priority substances and ceasing or phasing out emissions, discharges and losses of priority hazardous substances.

The Water Framework Directive 2000/60/EC (WFD) was transposed into United Kingdom (UK) law by the Water Environment (Water Framework Directive) (England and Wales) Regulations 2003 (as amended). These Regulations were revoked in April 2017 by the Water Environment (Water Framework Directive) (England and Wales) Regulations 2017.

The WFD was adopted by the European Commission in December 2000 and was transposed into law in England and Wales by The Water Environment Water Framework Directive) (England and Wales) Regulations 2017 (the 2017 Regulations). Following the EU Exit, the WFD is retained European Union (EU) legislation and is applicable in England and Wales as set out in sections 2 and 3 of the European Union (Withdrawal) Act 2018 and the Floods and Water (Amendment etc.) (EU Exit) Regulations 2019.

The legislative framework sets out the legal requirements to protect and improve the water environment and sets out environmental objectives that must be met for all water bodies. The foundation of this is an ecosystem-based approach that requires measures to be taken to encourage the sustainable use of water and to protect and improve surface waters (including rivers, lakes, transitional and coastal waters), and groundwater bodies, with the aim of achieving good status. Recommended guidance for undertaking WFD assessments for England and Wales is provided by the UK Government guidance 'Clearing the Waters for All' (Environment Agency, 2023) which has been followed for this WFD assessment.

In Wales, regard to the Environment (Wales) Act 2016 and the Well-being of Future Generations (Wales) Act 2015 is also to be considered. The overarching aims of the Environment Act (2016) is to enable Wales' resources to be managed in a more proactive, sustainable and joined-up way. The Well-being of Future Generations Act asks 44 Public Bodies in Wales to work in a sustainable way and consider the impact our work can have for people living in Wales, now and in the future.

The WFD must also be taken into account in the planning and licensing of all new activities in water bodies (rivers, estuarine and coastal waters). NRW is the competent authority in Wales for delivering the aim of the WFD, which is for all water bodies to achieve "good status". "Good status" comprises two parts. The first is "good ecological status", or "good ecological potential" for water bodies. The second is "good chemical status". "Good ecological status/potential" includes biological, hydromorphological and physicochemical quality elements, and specific pollutants. "Good chemical status" concerns a series of priority substances, including a number of priority hazardous substances. The WFD also requires that relevant protected area objectives are achieved.

A WFD assessment can comprise of up to three stages. All stages may not require completion dependent on the outcomes of each stage. The stages are:

- Screening (section 7.2) – excludes any activities that do not need to go through the scoping or impact assessment stages.
- Scoping (section 7.3) – identifies the receptors that are potentially at risk from a project and need impact assessment.
- Impact assessment (section 7.4) – considers the potential impacts of a project, identifies ways to avoid or minimise impacts, and shows if the project may cause deterioration or jeopardise the water body achieving good status. The WFD assessment has been undertaken using the guidance for WFD

assessment in estuarine and coastal waters (Environment Agency, 2023) and the 2024 Guidance Note GN078 from NRW (NRW, pers comm.).

7.1 WFD Waterbodies

The project has the potential to impact two WFD water bodies either directly or indirectly: transitional water body Milford Haven Inner, and coastal waterbody Milford Haven Outer. Milford Haven Inner waterbody is located just under 1 km to the east of the Project site footprint which is located within the Milford Haven Outer waterbody (Figure 7-1).

A baseline description of the biological, physico-chemical and hydromorphological quality elements, as presented in the Water Framework Directive (2000/60/EC) are provided in section 7.1.1 and 7.1.2 for Milford Haven Inner and Milford Haven Outer, respectively.

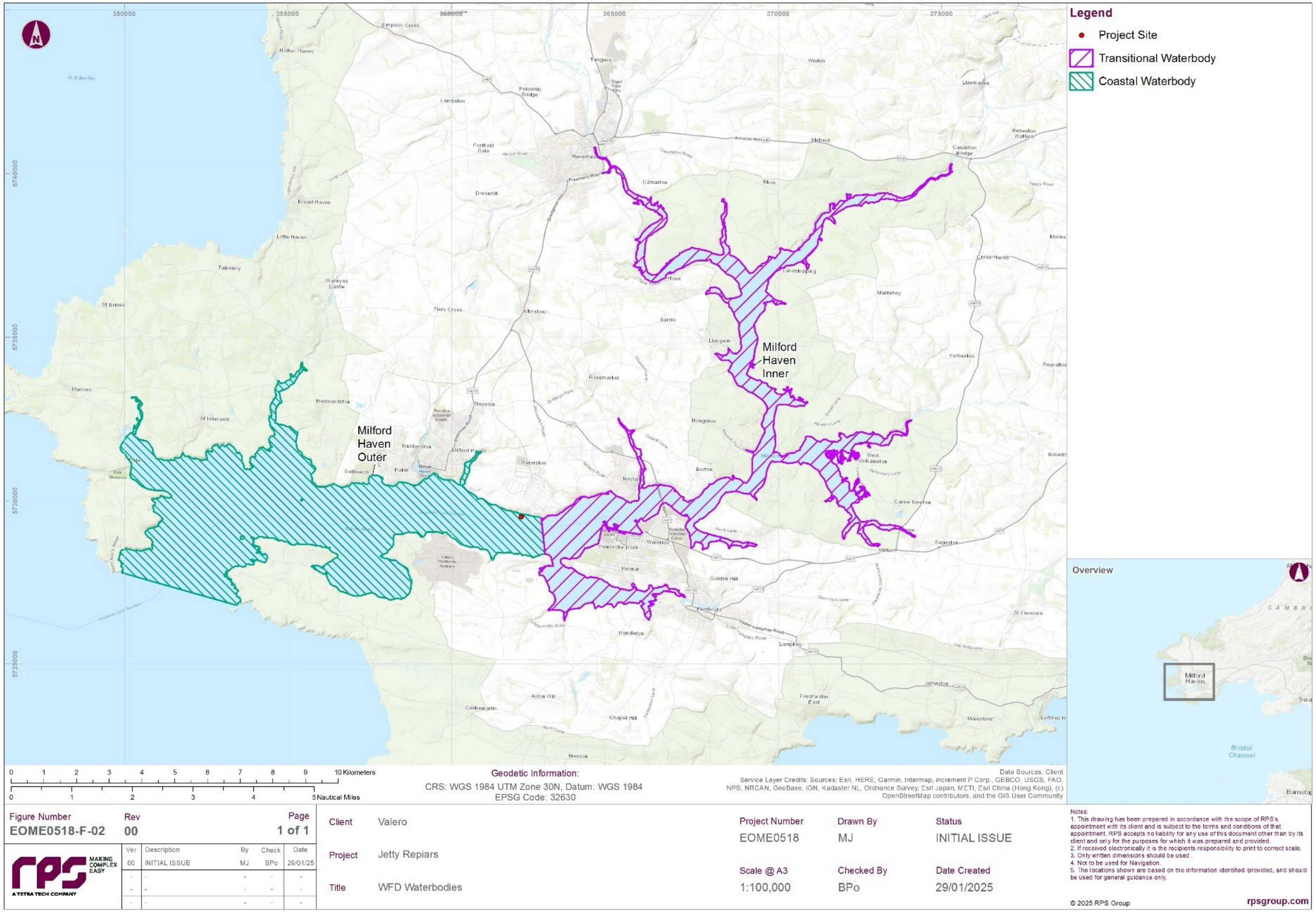

Figure 7-1: Waterbodies in the vicinity of the Project site

7.1.1 Milford Haven Inner Waterbody

The Milford Haven Inner waterbody current overall potential to meet its objectives is ‘Moderate’ with ecological potential as ‘Moderate (very certain)’ and chemical status as ‘Moderate’ (WWW, 2021). Current justification for not meeting the overall status objective of ‘Good’ is that proposed mitigation measures are disproportionately expensive or technically not feasible (WWW, 2021) (Table 7-1).

The elements driving the overall classification status of ‘Moderate’ is due to ‘Moderate’ status of Brominated diphenylether (BDPE) Calc, ‘Moderate’ Polyaromatic hydrocarbons (PAH), ‘Moderate’ Macroalgae and ‘Moderate (uncertain)’ dissolved inorganic nitrogen (DIN) (WWW, 2021).

The current status objective for this waterbody is to attain an overall objective of ‘Good’ by 2027 (WWW, 2021).

Table 7-1: Milford Haven Inner waterbody WFD features and objectives

Water body[5]	Description, notes or more information
WFD water body name	Milford Haven Inner
Water body ID	GB531006114100
River basin district name	Western Wales
Catchment	Cleddau and Pembrokeshire Coastal Rivers TraC
Water body type (estuarine or coastal)	Transitional
Water body total area (km^2)	21.02
Overall waterbody status (2021)	Moderate
Ecological status	Moderate
Chemical status	Moderate
Target water body status and deadline	Good 2027
Heavily modified waterbody and for what use	No - Natural
Phytoplankton Status	High
Angiosperm Status	Good
Invertebrate status	Good
Macroalgae status	Moderate
Fish status	Good
WFD protected areas within 2km	Yes

7.1.2 Milford Haven Outer Waterbody

The Milford Haven Outer waterbody current overall potential to meet its objectives is ‘Moderate’ with ecological potential as ‘Good’ and chemical status as ‘Moderate’ (WWW, 2021). Current justification for not meeting the overall status objective of ‘Good’ is that proposed mitigation measures are disproportionately expensive or technically not feasible (WWW, 2021) (Table 7-2).

[5] Water body information was extracted from Water Watch Wales website. Magic maps provide additional information on habitats and protected areas.

The elements driving the overall classification status of ‘Moderate’ is due to levels of ‘Moderate’ status of Mercury and ‘Moderate’ status of DIN (WWW, 2021).

As such the current status objective for this waterbody is to attain an overall objective of ‘Good’ by 2027.

Table 7-2: Milford Haven Inner waterbody WFD features and objectives

Water body[6]	Description, notes or more information
WFD water body name	Milford Haven Outer
Water body ID	GB641008220000
River basin district name	Western Wales
Catchment	Cleddau and Pembrokeshire Coastal Rivers TraC
Water body type (estuarine or coastal)	Coastal
Water body total area (km^2)	35.39
Overall water body status (2021)	Moderate
Ecological status	Moderate
Chemical status	Moderate
Target water body status and deadline	Good 2027
Heavily modified water body and for what use	No - Natural
Phytoplankton status	Good
Angiosperm status	Good
Invertebrate status	Good
Macroalgae status	Good

7.2 Screening

The aim of the WFD assessment screening stage is to ensure that only those activities that may cause deterioration or prevent a water body from meeting its objectives are assessed further. The screening stage excludes any low risk activities that do not require a WFD scoping to be undertaken and therefore associated impact assessment.

According to the WFD assessment guidance for estuarine and coastal waters (Environment Agency, 2023) and the NRW Guidance Note GN078 (NRW, *pers comm.*), activities associated with the Project are not considered to be low risk. Therefore, the Project must advance to the WFD scoping stage.

7.3 Scoping

Scoping assists with identifying elements within water bodies which may be impacted as a result of the Project activity, these will then progress to detailed compliance assessment. As part of scoping, the focus is on identifying components of the activity or project that have the potential to cause an impact and the quality elements potentially impacted (NRW 2018). A scoping assessment should be undertaken for each water

[6] Water body information was extracted from Water Watch Wales website. Magic maps provide additional information on habitats and protected areas.

body potentially affected by the Project. Water bodies can be scoped out at this stage if it can be robustly demonstrated that there will be no impacts.

WFD scoping was completed for Project activities against the receptors and criteria provided in the Environment Agency's guidance on the WFD Assessment in estuarine and coastal waters (Environment Agency, 2023) and the NRW Guidance Note GN078 (NRW, *pers comm.*) for the two waterbodies that were identified as being potentially impacted by the Project: Milford Haven Inner and Milford Haven Outer. Results of the scoping assessment are provided in Appendix B. A summary of the scoping results is provided below in Table 7-3.

Table 7-3: Summary of results from the WFD scoping assessment undertaken

Receptor	Waterbody	Potential risk to receptor?	Note the risk issue(s) for impact assessment
Hydromorphology	Milford Haven Inner	No	There is no potential for the Project to impact the hydromorphology of the water body.
	Milford Haven Outer	No	
Biology	Milford Haven Inner	No	No Biological Quality Elements (BEQs) have been taken forward for assessment.
	Milford Haven Outer	Yes	Benthic invertebrates have been taken forward for further assessment
Fish	Milford Haven Inner	Yes	Underwater noise effects has the potential to cause disturbance effects to fish associated with the waterbody.
	Milford Haven Outer	Yes	
Water quality	Milford Haven Inner	Yes	There is a potential risk as sediment samples from the VPOT (in the vicinity of the Project) were analysed to contain contaminants on the EQSD list and nickel was above the Cefas Action Level 1. These contaminants could potentially be disturbed during Project activities.
	Milford Haven Outer	Yes	
Protected areas	Milford Haven Inner	Yes	The Project is within or hydrologically connected to the following WFD protected areas: 1) Pembrokeshire Marine SAC (overlaps with the Project). 2) Lower Cleddau Shellfish waters (overlaps with the Project). Therefore, an assessment is required.
	Milford Haven Outer	Yes	
Habitats in transitional and coastal water bodies	Milford Haven Inner	No	The footprint of the Project did not meet any the criteria for the inclusion of any higher or lower sensitivity habitats in coastal and transitional water bodies as per the NRW GN078.
	Milford Haven Outer	No	
INNS	Milford Haven Inner	No	The Project equipment will be based onshore and the support vessel will be transported to site from within the waterbodies.
	Milford Haven Outer	No	
Section 7 habitats and species	Milford Haven Inner	Yes	Underwater noise during vibro-piling could cause disturbance to Section 7 marine mammal and fish species.
	Milford Haven Outer	Yes	
Groundwater	Milford Haven Inner	No	No potential for impacts to groundwater as a result of the Project.
	Milford Haven Outer	No	

7.4 Impact Assessment

This section considers relevant impacts associated with the Project, identifies ways to avoid or minimise impacts, and concludes if the impacts may prevent the identified water bodies from achieving good status or cause deterioration of the water bodies.

Receptors identified as part of the scoping stage (Table 7-3) have been brought through for detailed assessment. Section 6 addresses the potential for LSE on identified protected areas (namely SACs) within the two waterbodies, which forms part of the HRA and the overall licence application.

7.4.1 Milford Haven Outer only

7.4.1.1 Biology: benthic invertebrates

As identified in the WFD scoping (Appendix B), the Milford Haven Outer water body has been scoped in for benthic invertebrates. This water body has an invertebrate status of ‘good’. The Project may have direct and immediate impacts on benthic invertebrates within this water body as it overlaps with the Project. These impacts are the potential for morphological alterations to the seabed through localised temporary and long term habitat loss, and also the potential for the release of sediment bound contaminants.

As discussed in section 4.3.1, a small area of seabed habitat may be temporarily disturbed through the use of a jack up vessel (25.12 m^2) and long term seabed habitat loss will occur within an area of 4.91 m^2 due to the installation of the permanent casing and monopile. This would therefore represent a highly localised impact upon benthic invertebrates in the immediate vicinity of these works due to the Project alone. This impact could lead to a temporary, localised loss of abundance of benthic invertebrates; however, recovery is likely to occur with a similar suite of species re-colonising the temporarily disturbed areas. Recovery rates will depend on the reproductive strategy of the disturbed species, however the species disturbed would likely be tolerant to disturbance events given that the Project is located within an active jetty which features regular disturbance. Benthic invertebrates and their associated habitats within the Project site are extensive throughout the Milford Haven Outer and therefore the minor temporary and long term habitat loss will cause the extent of their habitats to significantly change within the Milford Haven Outer. Cumulative impacts are not predicted to occur due to the highly localised footprint of disturbance and habitat loss.

Similarly, benthic invertebrates were scoped in as they could potentially be impacted by the release of sediment bound contaminants during drilling associated with the Project. Cumulative effects are not predicted, due to the highly localised drilling activity and the low volume of drill arisings associated with it (45 m^3). As detailed in section 4.3.5, sediment samples from the vicinity of the Project were analysed to exceed several thresholds on the lower level, such as Cefas AL1, the CCME TEL and the EPA ERL. As stated, the drilling associated with the Project will result in an estimated 45 m^3 of arisings, which will be deposited on the seabed. This is orders of magnitude lower than the maintenance dredging already occurring within the VPOT and elsewhere within the Milford Haven Outer, therefore, does not represent an additional significant impact compared to baseline levels. In addition, it is likely that any disturbed sediments during drilling will be rapidly diluted, due to their fine particle sizes (see section 4.3.5 for further information).

Overall, the limited footprints of seabed morphological alterations will be minor in the context of the large extent of similar habitat throughout the Milford Haven Outer and high potential for recovery of benthic communities. Further, the potential for the release of contaminants will not occur at levels higher than already occurring as part of maintenance dredging in the vicinity of the Project and are likely to be rapidly diluted. Therefore, the Project is not predicted to result in the deterioration of benthic invertebrates or restrict the WFD objectives of the Milford Haven Outer water body from being achieved.

7.4.2 Milford Haven Inner and Milford Haven Outer

7.4.2.1 Biology: Fish

As identified in the WFD scoping (Appendix B), the Milford Haven Outer and Milford Haven Inner water bodies has been scoped in for further assessment for fish. Both of these water bodies have a fish status of ‘moderate’. Underwater noise from vibro-piling may have direct and immediate impacts on fish within the water bodies. Cumulative effects are not predicted, due to the highly localised impact ranges modelled for vibro-piling associated with the Project (see section 4.4.4).

The fish assemblages of the water bodies and the MHW are typical of an estuarine environment with different characterising species towards the outer reaches of the estuary compared to the inner estuary, reflecting the changes in environmental conditions present, including substrate type, water flow and salinity. Several diadromous fish species migrate through the MHW between seawater and freshwater, all of which are of conservation importance. Four of the species of diadromous fish are qualifying interest features of the Pembrokeshire Marine/ Sir Benfro Forol SAC (within which the Project is located): sea lamprey, river lamprey, allis shad and twaite shad (section 3.2). There are also a number of other fish species which are listed under Section 7 of the Environment (Wales) Act 2016, which are assessed specifically in section 7.4.2.4

As discussed in section 4.4.4, increases in underwater noise will be generated during vibro-piling. The results of the noise modelling assessment suggested that vibro-piling could result in a TTS range of up to 103 m and 59 m for recoverable injury. This was for fish which are most susceptible to auditory injury as they have a swim bladder involved in hearing (Group 4; Popper *et al.,* (2014)). Fish with lower sensitivities to noise due to different auditory anatomy (such as lampreys and flatfish) would therefore have even lower impact ranges than the 103 m for TTS and 59 m for recoverable injury. In addition, the noise assessment caveated that fish would need to be exposed within these potential impact ranges for 48 hours continuously for recoverable injury effects or for 12 hours continuously for TTS effects to occur. Therefore, these modelled injury ranges are highly precautionary, and injury to fish species is unlikely to occur.

Therefore, the Project is not predicted to result in the deterioration of fish communities or restrict the WFD objectives of the Milford Haven Outer and Milford Haven Inner water bodies from being achieved.

7.4.2.2 Water quality

As identified in the WFD scoping (Appendix B), the Milford Haven Outer and Milford Haven Inner water bodies has been scoped in for water quality associated with chemical contamination. Both of these water bodies have an overall status of ‘moderate’ and chemical status of ‘moderate’. The Project may have direct and immediate impacts on water quality within the water bodies. Cumulative effects are not predicted, due to the highly localised drilling activity and the low volume of drill arisings associated with it (45 m^3).

As detailed in section 4.3.5, sediment samples from the vicinity of the Project were analysed to contain contaminants on the ESQD list, with nickel exceeding the Cefas AL1 in all four samples. No contaminants were found to exceed Cefas AL2, wherein more serious impacts to water quality could occur. In addition, it is likely that any disturbed sediments during drilling will be rapidly diluted, due to their fine particle sizes (see section 4.3.5 for further information). The Project is located within an area that is subject to regular maintenance dredging, which will regularly disturb sediments and have the potential to release sediment bound contaminants. Therefore, drilling associated with the Project is unlikely to release contaminants above the baseline levels that occur within the footprint of the Project within the Milford Haven Outer. Given that sediment plumes associated with Project are not expected to extend beyond tens to the low hundreds of metres (section 4.2.1), contaminants released are not predicted to be transported into the Milford Haven Inner water body, which is >1 km from the Project.

Overall, the Project is not predicted to result in the deterioration of water quality with respect to chemical contamination nor restrict the WFD objectives of the Milford Haven Outer and Milford Haven Inner water bodies from being achieved.

7.4.2.3 Protected areas

As identified in the WFD scoping (Appendix B), the Milford Haven Outer and Milford Haven Inner water bodies has been scoped in for protected areas. Both of these water bodies have an overall status of ‘moderate’. The Project may have direct and immediate impacts on protected areas within the water bodies. Cumulative effects are not predicted, due to the highly localised potential impacts associated with the Project.

The Project is within the Pembrokeshire Marine SAC and the Lower Cleddau shellfish waters. With respect to the Pembrokeshire Marine SAC, the Project is not anticipated to result a LSE upon the SAC’s qualifying features, as detailed in section 6.1. Therefore, the Project is not predicted to restrict the conservation objectives of this SAC nor restrict the WFD objectives of the Milford Haven Outer and Milford Haven Inner water bodies from being achieved.

The current status of Lower Cleddau shellfish waters is ‘failed’, with an objective to lower the *E. coli* levels to <300/100 ml in the shellfish flesh and intravalvular fluid by 2027. Activities associated with the Project that could impact shellfish water quality include increased SSCs and changes in water quality (including the release of sediment bound contaminants). As detailed in the environmental appraisal of the Project alone and cumulatively with other plans and projects, these impacts are not considered to result in significant effects upon benthic ecology and fish and shellfish ecology (see sections 4.3, 4.4, and 5), and are therefore not considered to effect the status of the Lower Cleddau shellfish waters or prevent them from achieving the objective to lower the *E. coli* levels by 2027.

7.4.2.4 Section 7 habitats and species

As identified in the WFD scoping (Appendix B), the Milford Haven Outer and Milford Haven Inner water bodies has been scoped in for Section 7 habitats and species under the Environment (Wales) Act 2016. Both of these water bodies have an overall status of ‘moderate’. The Project may have direct and immediate impacts on Section 7 habitats and species within the water bodies. Cumulative effects are not predicted, due to the highly localised potential impacts associated with the Project.

A range of Section 7 habitats and species (such as several species of fish and marine mammals, such as harbour porpoise, bottlenose dolphin, and otter) may be present within the two water bodies and the MHW (see section 3 for further information). Section 7 habitats and species have been considered for a range of impacts of both the Project alone (sections 4.3, 4.4, and 4.5) and cumulatively (section 5), with no significant effects concluded to occur. Therefore, it can reasonably be assumed that the Project will not result in the deterioration of Section 7 habitats and species nor restrict the WFD objectives of the Milford Haven Outer and Milford Haven Inner water bodies from being achieved.

8 SUMMARY

A description, summary and assessment of the impact scenarios presented in this Environmental Appraisal is provided in the Table 8-1.

Table 8-1: Description, summary and assessment of impact scenarios

Description of Potential Effect	Appraisal of Effects	Conclusion
Physical Processes		
Increased SSCs and associated deposition	Increases in SSCs from drilling associated with the installation of the monopile and permanent casing.	Minor
Benthic Ecology		
Temporary and long term habitat loss and/or disturbance	Temporary habitat loss associated with jack up vessel spud leg placements on the seabed. Long term habitat loss from the installation of the permanent casing and monopile.	Minor
Introduction and spread of INNS	The use of vessels and equipment may act as a vector for the introduction and spread of INNS.	Negligible
Increased SSCs and associated deposition	Increases in SSCs from drilling associated with the installation of the monopile and permanent casing.	Minor
Effects on benthic ecology associated with pumping grout	Pumping grout into the monopile casing may impact benthic ecology receptors through habitat disturbance and minor changes in the water pH directly adjacent to the works.	Negligible
Changes in water quality, including the release of sediment bound contaminants	Drilling associated with the Project could result in changes in water quality through the release of sediment bound contaminants.	Minor
Fish and Shellfish		
Disturbance and loss of potential spawning and nursery grounds	Temporary habitat loss associated with jack up vessel spud leg placements on the seabed. Long term habitat loss from the installation of the permanent casing and monopile.	Negligible
Introduction and spread of INNS	The use of vessels and equipment may act as a vector for the introduction and spread of INNS.	Negligible
Increased SSCs and associated sediment deposition.	Increases in SSCs from drilling associated with the installation of the monopile and permanent casing.	Minor
Underwater noise effects on fish and shellfish	Vibro-piling and other noise producing activities associated with the Project may cause injury or disturbance to fish and shellfish.	Minor
Marine Mammals		
Underwater noise effects on marine mammals	Vibro-piling and other noise producing activities associated with the Project may cause injury or disturbance to marine mammals.	Negligible
Cumulative Effects		
Increases in SSCs and associated deposition upon physical processes, benthic ecology, and fish and shellfish	Increases in SSCs from drilling associated with the installation of the monopile and permanent casing and with maintenance dredging by the Milford Haven Port Authority (DML2166).	Minor
Introduction and spread of INNS on benthic and fish and shellfish ecology	Increased risk of introduction and spread of INNS associated with Project activities and with maintenance dredging by the Milford Haven Port Authority (DML2166).	Minor
Underwater noise effects on fish and marine mammals	Increases in underwater noise due to vibro-piling at the Project and underwater noise associated with maintenance dredging by the Milford Haven Port Authority (DML2166).	Minor
LSE Screening		
Pembrokeshire Marine SAC	Impacts of the Project upon the qualifying features of the SACs.	No LSE predicted, therefore SACs not

Description of Potential Effect	Appraisal of Effects	Conclusion
West Wales Marine SAC		advanced to a Stage 2 RIAA.
The Bristol Channel Approaches SAC		
Cleddau Rivers SAC		
WFD		
Biology: Benthic invertebrates	Benthic invertebrates have been taken forward for further assessment based on the potential for seabed morphological changes and release of contaminants.	Overall, the Project is not predicted to result in the deterioration of the Milford Haven Inner and Milford Haven Outer water bodies nor prevent their WFD objectives from being achieved.
Biology: Fish	Underwater noise effects have the potential to cause disturbance effects to fish associated with the waterbody.	
Water quality	There is a potential risk as sediment samples from the VPOT (in the vicinity of the Project) were analysed to contain contaminants on the EQSD list and nickel was above the Cefas Action Level 1. These contaminants could potentially be disturbed during Project activities.	
Protected areas	The Project is located within two WFD protected areas.	
Section 7 habitats and species	Underwater noise during vibro-piling could cause disturbance to Section 7 marine mammal and fish species.	

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Appendix A: Receptor Groups Scoped Out

Table A1 below provides a summary of the receptor topics that have been scoped out including a brief justification. Impacts that have been scoped out from further assessment for each receptor topic and a justification have also been provided below.

Table A. 1: Summary of receptor topics scoped for further assessment.

Receptor Topic	Justification
Marine Ornithology	No impact receptor pathway identified. No significant marine bird populations identified within project footprint.
Commercial Fisheries	The Project will not interfere with commercial fishing activities due to all works being undertaken in an area restricted to commercial fishing. A notification to mariners will also be issued prior to commencement of works.
Shipping and Navigation	The Project will be undertaken in the MHW and subsequently within the Port of Milford Haven jurisdiction, where there are significant levels of marine traffic. However, only one jack-up barge is to be used and is unlikely to affect shipping and navigation within the MHW. A notification to mariners will also be issued prior to commencement of works.
Marine Archaeology	No artefacts identified within construction footprint.
Landscape, Seascape and Visual Impact Assessment	The Project will be undertaken primarily at the existing jetty and will not change the seascape and character of the location.
Other Sea Users	No effect pathway for other sea users to be affected by the Project. A notification to mariners will also be issued prior to commencement of works.
Socio-economic and Tourism	No effect pathway as the Project will be short term and identical to the current use.

A.1 Impacts scoped out from further assessment

Physical Processes

Impacts to physical environment that have been scoped out from further assessment include:

- **Placement of the spud legs has the potential to increase the SSCs in the water column.**

This potential effect is unlikely to raise the total SSCs above the baseline levels within the MHW. Once the spud legs have been placed and the jack-up barge is in position there is unlikely to be another placement event. Only a small volume of sediments are expected to be resuspended into the water column and immediately dispersed due to the currents within the MHW.

Benthic Ecology

Impacts to benthic ecology that have been scoped out from further assessment include:

- **Project activities may result in accidental release of pollutants from vessels leading to toxic effects on benthic species.**

The potential for accidental release of pollutants affecting benthic ecology receptors will not be considered further on the basis that the designed-in mitigation measures, including pollution prevention, control measures and adherence to International Convention for the Prevention of Pollution from Ships (MARPOL) regulations will reduce the likelihood and magnitude of effects to a negligible level.

Fish

Impacts to fish that have been scoped out from further assessment include:

- **Project activities may result in accidental release of pollutants leading to toxic effects on benthic species.**

The potential for accidental release of pollutants affecting benthic ecology receptors will not be considered further on the basis that the designed-in mitigation measures, including pollution prevention, control measures and adherence to MARPOL regulations will reduce the likelihood and magnitude of effects to a negligible level.

Appendix B: WFD Scoping Table

The scoping assessment for the project has been undertaken in accordance with the guidance for WFD assessment in estuarine and coastal waters (Environment Agency, 2023) and the 2024 Guidance Note GN078 from NRW (NRW, pers comm.). Findings from the assessment have been undertaken with respect to two identified water bodies that could be potentially affected by the Project:

- Milford Haven Inner is located approximately < 1km east of the Project; and
- Milford Haven outer, within which the Project is located (see Figure 7-1).

Table B. 1: WFD Scoping Table

Your activity	Description, notes or more information
Applicant name	Valero Pembrokeshire Oil Terminal Ltd
Application reference number (where applicable)	Not applicable
Name of activity	Jetty maintenance
Brief description of activity	The scope of these maintenance activities involves the replacement of a defective dual pile with a monopile arrangement, similar to the previous maintenance works carried out in 2007 for Berthing Dolphin
Location of activity (central point XY coordinates or national grid reference)	Latitude and Longitude (WGS 1984): 51.6994, -4.9946
Footprint of activity	The permanent construction footprint of the Project will cover a total footprint area of up to 4.91 m^2 due to the installation of the new monopile and permanent casing.

Your activity	Description, notes or more information
	The temporary footprint area of the Project extending beyond the permanent construction footprint, due to the placement of the jack up barge spud legs, will be approximately 25.12 m^2 (each spud leg has a diameter of diameter of 2 m and area of 3.14 m^2).
Timings of activity (including start and finish dates)	3 to 4 weeks with an estimated start date of 3rd June 2025 but a longer licence window of until the 30th of September 2025 has been applied for to allow for potential delay in availability of vessels for the works.
Extent of activity (for example size, scale frequency, expected volumes of output or discharge)	The Project aims to remove the 2 x 1,300 mm diameter defective dual pile, dolphin platform and cross pile braces and replace it with a 2,100 mm diameter monopile, installed into a 2,500 mm diameter permanent casing. The defective dual pile system will be cut at the seabed and removed, and the new monopile and permanent casing will be installed via vibro-piling, close to the footprint of the original dual pile. Construction material that will be used as part of the proposed permanent works below MHWS includes 70 tonnes of grout, and steel monopile. The estimated volume of drilled material is approximately 45 m^3 which will be deposited on the seabed, adjacent to the Project work. All materials are expected to be sourced in the United Kingdom (UK) and brought to the site via barge. The dual pile which will be removed will also be transported away via barge.
Use or release of chemicals (state which ones)	Use of chemicals is not predicted during the Project, but there is potential for the release of sediment bound contaminants at very low levels, given the location and nature of the Project (the jetty berth for an oil refinery).

B.1.1 Specific risk information

Potential risks of the activities were considered for each of the following receptors: hydromorphology, biology, water quality, protected areas, and INNS within each identified waterbody. Potential cumulative impacts have also been assessed.

B.1.1.1 Hydromorphology

A scoping assessment has been undertaken on hydromorphology and how it could be affected by the Project is provided in the table below.

Table B. 2: Waterbody assessment for Hydromorphology

Consider if your activity:	Yes	No	Hydromorphology risk issue(s) to Milford Haven Inner Waterbody	Hydromorphology risk issue(s) to Milford Haven Outer Waterbody
NRW GN078: Involves any of the following: - changes to flow quantity (for example abstraction and discharge), the speed of flow (velocity) and flow variability (patterns of faster and slower water); - changes to the form and structure of a river or lake (including the bed, banks and the marginal zone); - changes to river continuity (such as removing or adding any barriers or other restrictions within the channel); - altering the connectivity between a river and its floodplain; - changes to processes of sediment transport (erosion, deposition, or transfer); and/or - changes to connection between surface water and groundwater, for example mine water remediation projects - seeking to disconnect surface waters from subsurface groundwater to limit pollution.	Requires impact assessment	Impact assessment not required	No; impact assessment not required. The limited activities associated with the Project could not impact any of the hydromorphological aspects listed.	
NRW GN078: Involves any of the following: - morphological conditions, for example depth variation, the seabed and intertidal zone structure; - tidal patterns, for example, dominant currents; - freshwater flow; and - wave exposure.	Requires impact assessment	Impact assessment not required	No; impact assessment not required. The limited activities associated with the Project could not impact any of the hydromorphological aspects listed.	
Environment Agency (2023): Could impact on the hydromorphology (for example morphology or tidal patterns) of a water body at high status	Requires impact assessment	Impact assessment not required	No; impact assessment not required. The limited activities associated with the Project could not impact on the hydromorphology (such as morphology or tidal patterns) of the waterbody at high status.	
Environment Agency (2023): Could significantly impact the hydromorphology of any water body	Requires impact assessment	Impact assessment not required	No; impact assessment not required. The limited activities associated with the Project could not impact on the hydromorphology of any water body.	
Environment Agency (2023): Is in a water body that is heavily modified for the same use as your activity	Requires impact assessment	Impact assessment not required	No; impact assessment not required. The waterbody is not considered as heavily modified in accordance with extracted data.	

B.1.1.2 Water quality

A scoping assessment has been undertaken on water quality and how physicochemical parameters could be affected by the Project is provided in the table below (Table B. 3):

Table B. 3: Waterbody assessment for water quality

Consider if your activity:	Yes	No	Water quality risk issue(s) to Milford Haven Inner Waterbody	Water quality risk issue(s) to Milford Haven Outer Waterbody
Environment Agency (2023): Could affect water clarity, temperature, salinity, oxygen levels, nutrients or microbial patterns continuously for longer than a spring neap tidal cycle (about 14 days).	Requires impact assessment	Impact assessment not required	No. Impact assessment not required. Sediment plumes generated by the Project will be highly localised and not affect the receptors listed continuously for longer than 14 days.	
NRW GN078: Scope in water quality if your Project could affect water clarity, temperature, salinity/conductivity, oxygen levels, nutrients (phosphate, ammonia and/or dissolved inorganic nitrogen), microbial patterns (TraC only), or acidification (rivers and lakes only).	Requires impact assessment	Impact assessment not required	No. Impact assessment not required. Sediment plumes generated by the Project will be highly localised and not affect the receptors listed.	
Environment Agency (2023): Is in a water body with a phytoplankton status of moderate, poor or bad	Requires impact assessment	Impact assessment not required	No. Impact assessment not required Phytoplankton status of the water body is classified as high.	No. Impact assessment not required Phytoplankton status of the water body is classified as good.
Environment Agency (2023): Is in a water body with a history of harmful algae	Requires impact assessment	Impact assessment not required	No. Impact assessment not required. Not previously monitored.	

Potential for release or disturbance of chemicals has been considered in the table below (Table B. 4):

Table B. 4: Chemical disturbance risk assessment

If your activity uses or releases chemicals (for example through sediment disturbance or building works) consider if:	Yes	No	Water quality risk issue(s) to Milford Haven Inner Waterbody	Water quality risk issue(s) to Milford Haven Outer Waterbody
Environment Agency (2023) and NRW GN078: The chemicals are on the Environmental Quality Standards Directive (EQSD) list.	Requires impact assessment	Impact assessment not required	Yes, impact assessment is required as sediment samples from the VPOT (in the vicinity of the Project) were analysed to contain contaminants on the EQSD list. These could potentially be disturbed during Project activities.	
Environment Agency (2023) and NRW GN078: It disturbs sediment with contaminants above Cefas Action Level (AL) 1.	Requires impact assessment	Impact assessment not required	Yes, impact assessment is required as nickel levels within the sediment samples from the VPOT were above the Cefas AL 1.	
If your activity has a mixing zone (like a discharge pipeline or outfall) consider if:	**Yes**	**No**	**Water quality risk issue(s) to Milford Haven Inner Waterbody**	**Water quality risk issue(s) to Milford Haven Outer Waterbody**
Environment Agency (2023) and NRW GN078: The chemicals released are on the EQSD list.	Requires impact assessment	Impact assessment not required	No. Impact assessment not required, as the Project will not have a mixing zone, such as a discharge pipeline or outfall.	

B.1.1.3 Biology

Annex V of the Directive sets out Biological Quality Elements (BQEs) which are used to classify ecological status using five classes from high to bad including elements such as fish, benthic invertebrates or algae (Table B. 5).

Table B. 5: Ecological classification summary

Quality Element	Pressure Description
Phytoplankton	Nutrient enrichment
Macroalgae	Nutrient enrichment, hazardous chemicals
Angiosperms	Nutrient enrichment, morphological alterations
Benthic invertebrates	Organic pollution, hazardous chemicals and some morphological alterations
Fish (transitional only)	Organic enrichment (dissolved oxygen), habitat destruction

Following consideration of the activities associated with the Project and the pressure descriptions for each receptor, **benthic invertebrate** receptors have been taken forward for further assessment for the Milford Haven Outer water body. Given the non-mobile nature of benthic invertebrates and that the Project does not overlap with the Milford Haven Inner water body, it was concluded that no further assessment for benthic invertebrates would be required for the Milford Haven Inner.

The Project will not cause nutrient enrichment of either water body that could potentially impact phytoplankton or macroalgae, and the nearest seagrass (angiosperms) beds are located between Quay 1 (site 4) and Criterion (site 5) are outside the area of impact with respect to changes to morphology. Finally, the Project will not result in habitat destruction or organic enrichment, and no impacts to fish (transitional) are therefore predicted.

Fish

A scoping assessment has been undertaken on whether fish could be potentially affected by the Project and the results are provided in the table below (Table B. 6):

Table B. 6: Waterbody assessment for fish

<table>
<tr><th>Consider if your activity:</th><th>Yes</th><th>No</th><th>Biology fish risk issue(s) to Milford Haven Inner Waterbody</th><th>Biology fish risk issue(s) to Milford Haven Outer Waterbody</th></tr>
<tr><td>Environment Agency (2023) and NRW GN078: Could impact on normal fish behaviour like movement, migration or spawning (for example creating a physical barrier, a sediment plume, noise or vibration, chemical change, change in habitat, or a significant change in the water quality (including quantity, depth or flow of the water body)).</td><td>Requires impact assessment</td><td>Impact assessment not required</td><td>Yes; requires impact assessment. Although the Project does not overlap with the Milford Haven Inner Waterbody (<1 km away), fish are mobile and may travel from the water body into the ZoI of the Project. Underwater noise associated with vibro-piling has the potential to cause disturbance effects to fish.</td><td>Yes; requires impact assessment. Underwater noise associated with vibro-piling has the potential to cause disturbance effects to fish.</td></tr>
<tr><td>Environment Agency (2023) and NRW GN078: Could cause mechanical injury or death to fish through:

1) Entrainment, e.g. fish being drawn into cooling water systems or turbines

2) Impingement, e.g. fish trapped against debris screens</td><td>Requires impact assessment</td><td>Impact assessment not required</td><td colspan="2">No; impact assessment not required. There are no cooling water systems or turbines or debris screens associated with the Project that could cause entrainment or impingement to fish within the waterbody.</td></tr>
</table>

B.1.1.4 WFD protected areas

An assessment of the following WFD protected areas have been considered at risk if the Project is within them or hydrologically connected (Table B. 7):

- Designated sites (Special Areas of Conservation (SAC), Special Protection Areas (SPA), and Ramsar sites);
- Shellfish waters;
- Bathing waters;
- Drinking water protected areas (surface and ground); and
- Sensitive areas (designated under the Urban Waste Water Treatment Regulations).

Table B. 7: Waterbody assessment for protected areas

Consider if your activity is:	Yes	No	Protected areas risk issue(s)
NRW GN078: Within or hydrologically connected to any WFD protected area	Requires impact assessment	Impact assessment not required	The Project is within or hydrologically connected to the following WFD protected areas: 1) Pembrokeshire Marine SAC (overlaps with the Project). 2) Lower Cleddau Shellfish waters (overlaps with the Project). Therefore an assessment is required.

B.1.1.5 Habitats in transitional and coastal water bodies

As per NRW GN078, for transitional and coastal water bodies, habitats should be included in the assessment if the footprint of the Project meets any of the criteria outlined in Table B. 8.

Table B. 8: Waterbody assessment on habitats

Consider if the footprint of your activity is:	Yes	No	Habitat risk associated with Milford Haven Inner Waterbody	Habitat risk associated with Milford Haven Outer Waterbody
NRW GN078 and Environment Agency (2023): 0.5 km^2 or larger	Requires impact assessment	Impact assessment not required	A footprint may also include sediment plumes. As detailed in section 4.2, there will be a total volume of approximately 45 m^3 of drilled material, which could lead to a sediment plume. It is assumed that sediment plumes generated from the drilling would be of a lower extent to those arising from the periodic dredging that occurs at VPOT berths and within the MHW already, which can last up to 12 weeks (Marine Licence Number: DML2166 Milford Haven Port Authority maintenance dredging 2022 to 2032). Similar drilling activity from within the Pembroke Port predicted the finest sediment fractions to travel no more than the low hundreds of metres (RPS, 2021). This can be reasonably be applied to the Project, given the similarity in location within the MHW, and sediment plumes are not predicted to extend more than the tens to low hundreds of metres at best. Regarding a physical footprint, a total footprint of temporary disturbance of 25.12 m^2 is predicted from the use of a jack up vessel and a total long term footprint of 4.91 m^2 is predicted from the installation of the permanent casing and monopile. Therefore, no footprints associated with the Project will be over 0.5 km^2 and no assessment is required.	
NRW GN078 and Environment Agency (2023): 1% or more of the water body's area	Requires impact assessment	Impact assessment not required	The Milford Haven Inner water body is 21.02 km^2, therefore, the footprint of the Project does not represent 1% or more of its area. Therefore, no assessment is required.	The Milford Haven Inner water body is 35.39 km^2, therefore, the footprint of the Project does not represent 1% or more of its area. Therefore, no assessment is required.
NRW GN078 and Environment Agency (2023): Within 500 m of any higher sensitivity habitat: - Chalk reef; - Clam, cockle and oyster beds; - Intertidal seagrass; - Maerl; - Mussel beds; - Polychaete reef; - Saltmarsh; - Subtidal kelp beds; and - Subtidal seagrass	Requires impact assessment	Impact assessment not required	Using the Data Map Wales Portal, no higher sensitivity habitats were identified within 500 m of the Project. Therefore, no assessment is required.	
NRW GN078 and Environment Agency (2023): 1% or more of any lower sensitivity habitat: - Cobbles, gravel and shingle; - Intertidal soft sediments like sand and mud;	Requires impact assessment	Impact assessment not required	Given the highly limited footprint of the Project, it does not constitute 1% or more of any lower sensitivity habitats within the water body.	

Consider if the footprint of your activity is:	Yes	No	Habitat risk associated with Milford Haven Inner Waterbody	Habitat risk associated with Milford Haven Outer Waterbody
- Rocky shore; - Subtidal boulder fields; - Subtidal rocky reef; and - Subtidal soft sediments.				

B.1.1.6 INNS

An assessment was undertaken to determine whether the project could introduce or spread INNS (Table B. 9).

Risks of introducing or spreading INNS include:

- materials or equipment that have come from other locations and in particular, had use in or travelled through, other water bodies or coastal waters e.g. ships arriving from >1 nm, and
- activities that help spread existing INNS, either within the immediate water body or other water bodies.

Table B. 9: Waterbody assessment on INNS

Consider if your activity could:	Yes	No	INNS risk associated with Milford Haven Inner Waterbody	INNS risk associated with Milford Haven Outer Waterbody
NRW GN078 and Environment Agency (2023): Introduce or spread INNS	Requires impact assessment	Impact assessment not required	No: The new monopile and permanent casing will be transported from a jack up vessel that will transit to site from within the waterbodies.	

B.1.1.7 Section 7 habitats and species

Under the Environment (Wales) Act, 2016, all public authorities have a duty to maintain and enhance biodiversity and promote the resilience of ecosystems. Under Section 7 of the Environment (Wales) Act 2016, the Welsh Government have published lists of priority habitats and species. Although the extent or physical impact of a project may be minimal, it may directly impact upon a priority habitat or species and therefore should be considered as part of the assessment.

Table B. 10: Waterbody assessment on Section 7 habitats and species

Consider if:	Yes	No	Section 7 habitats and species risk associated with Milford Haven Inner Waterbody	Section 7 habitats and species risk associated with Milford Haven Outer Waterbody
There are Section 7 species and habitats within the water body and the Project could impact upon them	Requires impact assessment	Impact assessment not required	Yes; requires impact assessment. Several listed migratory and non-migratory fish species as well as harbour porpoise, bottlenose dolphin, grey seal and otter, may occur within the waterbodies. Several listed habitats also occur.	
There could be an impact upon identified Section 7 species	Requires impact assessment	Impact assessment not required	Yes; requires impact assessment, as underwater noise during vibro-piling could cause disturbance to Section 7 marine mammal and fish species.	
There could be an impact upon identified Section 7 habitats	Requires impact assessment	Impact assessment not required	No; impact assessment not required as the Project will not have an impact on any Section 7 habitats within the water bodies.	

B.1.1.8 Groundwater

As per NRW GN078, the potential for impacts upon groundwater must be considered. As the Project will not cause a change in groundwater flows, abstraction of groundwater, or a change in groundwater quality, this receptor is not considered further in the WFD assessment.

B.1.1.9 Summary

A summary of the results of the scoping assessment on the Milford Haven Inner and outer waterway are provided below (Table B. 11):

Table B. 11: Waterbody assessment summary

Receptor	Waterbody	Potential risk to receptor?	Note the risk issue(s) for impact assessment
Hydromorphology	Milford Haven Inner	No	There is no potential for the Project to impact the hydromorphology of the water body.
	Milford Haven Outer	No	
Biology	Milford Haven Inner	No	No BEQs have been taken forward for assessment.
	Milford Haven Outer	Yes	Benthic invertebrates have been taken forward for further assessment

Receptor	Waterbody	Potential risk to receptor?	Note the risk issue(s) for impact assessment
Fish	Milford Haven Inner	Yes	Underwater noise effects have the potential to cause disturbance effects to fish associated with the waterbody.
	Milford Haven Outer	Yes	
Water quality	Milford Haven Inner	Yes	There is a potential risk as sediment samples from the VPOT (in the vicinity of the Project) were analysed to contain contaminants on the EQSD list and nickel was above the Cefas Action Level 1. These contaminants could potentially be disturbed during Project activities.
	Milford Haven Outer	Yes	
Protected areas	Milford Haven Inner	Yes	The Project is within or hydrologically connected to the following WFD protected areas: 1) Pembrokeshire Marine SAC (overlaps with the Project). 2) Lower Cleddau Shellfish waters (overlaps with the Project). Therefore, an assessment is required.
	Milford Haven Outer	Yes	
Habitats in transitional and coastal water bodies	Milford Haven Inner	No	The footprint of the Project did not meet any the criteria for the inclusion of any higher or lower sensitivity habitats in coastal and transitional water bodies as per the NRW GN078.
	Milford Haven Outer	No	
INNS	Milford Haven Inner	No	The Project equipment will be based onshore and the support vessel will be transported to site from within the Waterbodies
	Milford Haven Outer	No	
Section 7 habitats and species	Milford Haven Inner	Yes	Underwater noise during vibro-piling could cause disturbance to Section 7 marine mammal and fish species.
	Milford Haven Outer	Yes	
Groundwater	Milford Haven Inner	No	No potential for impacts to groundwater as a result of the Project.
	Milford Haven Outer	No	

Appendix C: Underwater Noise Modelling Report

See attached report.

Appendix D: Project Plans

See attached drawings.

Appendix E: Method Statement

See attached document.

Appendix F: Welsh National Marine Plan Signposting

See attached Microsoft Excel sheet.

Appendix G: Location Plan and Coordinates

See attached drawings, shapefile, and Microsoft Excel sheet.