Spiorad na Mara Offshore Wind Farm

Offshore Project

Environmental Impact Assessment Report

Appendix 12.3: Overview of Percussive Piling Fish Ecology Mitigation, Volume 2c

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1 INTRODUCTION

1.1 OVERVIEW

1.1.1 INTRODUCTION

1.1.1.1 This appendix of the Environmental Impact Assessment Report (EIAR) presents the additional mitigation measures that are proposed for Spiorad na Mara Offshore Wind Farm (hereafter referred to as the 'Offshore Project') to reduce the potential impact of percussive piling installation on Fish Ecology receptors.

1.1.1.2 This appendix accompanies **Chapter 12: Fish Ecology, Volume 2a** of the EIAR and should be read in conjunction with the project description provided in **Chapter 3: Offshore Project Description, Volume 1a** and the relevant parts of the following chapters and appendices:

- **Appendix 3.1: Percussive Piling Installation Approach, Volume 1c;**
- **Chapter 13: Marine Mammals, Volume 2a;**
- **Appendix 13.3: Underwater Noise Modelling Assessment, Volume 2c.**

1.1.2 PROJECT BACKGROUND

1.1.2.1 Spiorad na Mara Limited (hereafter referred to as 'the Applicant') is proposing to develop the Project. The Project is an offshore wind farm (OWF) that will consist of up to 60 fixed-bottom wind turbine generators (WTGs).

1.1.2.2 The Project will include both offshore and onshore infrastructure. This Offshore EIAR supports the application for the offshore components of the Project as outlined in **Chapter 1: Introduction, Volume 1a**. The offshore components of the Project (the Offshore Project) includes all infrastructure and activities located seaward of Mean High Water Springs (MHWS) within the Array Area and Offshore Cable Area of Search (OCAS) (**Figure 1.2: Project Layout, Volume 1c**). Further detailed information is provided in **Chapter 3, Volume 1a**.

1.1.2.3 The Offshore Project is situated off the northwest coast of Isle of Lewis/*Eilean Leòdhais* and the Array Area is located approximately 5-13 km offshore and is approximately 161 km^2 in size. It will comprise WTGs, foundations, Offshore Cables, Offshore Substation Platform (OSP) (if required), and Landfall. The Array Area combined with the OCAS is defined as the Offshore Project Boundary. The water depths across the Turbine Area range from 37 m-67 m with the southwest corner of the Array Area reaching 72 m. The proposed WTGs and fixed foundations will be located within a Turbine Area of approximately 140 km^2, within the Array Area.

1.2 PURPOSE OF THIS APPENDIX

1.2.1.1 This appendix outlines the secondary environmental mitigation that has been developed to reduce the potential impact on Fish Ecology receptors as a result of the percussive piling installation, to reach an acceptable outcome.

2 NEED FOR FISH ECOLOGY SECONDARY MITIGATION

2.1 INTRODUCTION

2.1.1.1 This section provides background context and an overview of the Fish Ecology assessment presented in **Chapter 12, Volume 2a**. It outlines the key environmental sensitivities identified during the assessment and explains why additional secondary mitigation has been developed to mitigate potential impacts on fish ecology.

2.2 OVERVIEW

2.2.1.1 An EIAR has been prepared to assess the potential impacts of the Offshore Project on Fish Ecology receptors, during the construction, operation and maintenance and decommissioning phases (see **Chapter 12, Volume 2a**).

2.2.1.2 The Offshore Project's approach to percussive piling installation, including the Project Design Envelope (PDE) and embedded commitments relevant to the construction assessment, is outlined in **Chapter 3, Volume 1a** and **Appendix 3.1, Volume 1c**.

2.2.1.3 Underwater noise and vibration has the potential to affect Fish Ecology receptors in a number of ways, including mortality, recoverable injury, temporary shifts in hearing thresholds (Temporary Threshold Shift (TTS)) or behavioural changes. To inform the assessment, underwater noise modelling was undertaken for noise-producing activities, including percussive piling, in support of the EIAR assessment (see **Appendix 13.3, Volume 2c**).

2.2.1.4 These potential impacts on Fish Ecology receptors have been assessed during construction in **Chapter 12, Volume 2a.**

Significance of effect

2.2.1.5 A **Moderate** (**Potentially Significant**) effect was predicted for Atlantic salmon due to TTS (see Section 12.8.3 of **Chapter 12, Volume 2a**) and therefore additional secondary mitigation is required.

2.2.1.6 Section 3 of this appendix outlines the specific Fish Ecology secondary mitigation measures. These measures are designed to supplement the embedded mitigation already built into the PDE (outlined in **Appendix 3.1**) and secondary mitigation for marine mammals which has a bearing on fish ecology (**Chapter 13, Volume 2a** and **Marine Mammal Mitigation Plan, Volume 3**), and factored into the assessment to understand the significance of residual effect.

Stakeholder Engagement

2.2.1.7 The Applicant has engaged with key stakeholders (Marine Directorate - Licensing Operations Team (MD-LOT), NatureScot, Marine Directorate - Science, Evidence, Digital and Data (MD-SEDD))

throughout the development of the Fish Ecology assessment, including the presentation of proposed embedded and secondary mitigation measures. An overview of the consultation undertaken to support the Fish Ecology assessment and evolution of the Fish Ecology secondary mitigation is provided in **Chapter 12, Volume 2a**, and **Appendix 12.2: Consultation on Atlantic salmon underwater noise assessment and associated data analysis, Volume 2c**.

3 FISH ECOLOGY SECONDARY MITIGATION

3.1 INTRODUCTION

3.1.1.1 The Fish Ecology secondary mitigation measures are designed to supplement the embedded mitigation already built into the PDE and includes both spatial and temporal mitigation:

- **Spatial mitigation:** Splitting the Percussive Piling Area, in which percussive piling can take place, into 2 zones with different restrictions associated with each;
- **Temporal mitigation:** Provision of quiet periods between percussive piling events and complete percussive piling restriction for April to 25 May, during sensitive migration windows.

3.2 OBJECTIVE

3.2.1.1 The objective of the secondary mitigation is to sequence the percussive piling installation programme to ensure that percussive piling is not permitted during Atlantic salmon smolt migratory movements, and that a coastal migration zone is outside of the TTS zone during the most sensitive periods for Atlantic salmon adult migratory movements.

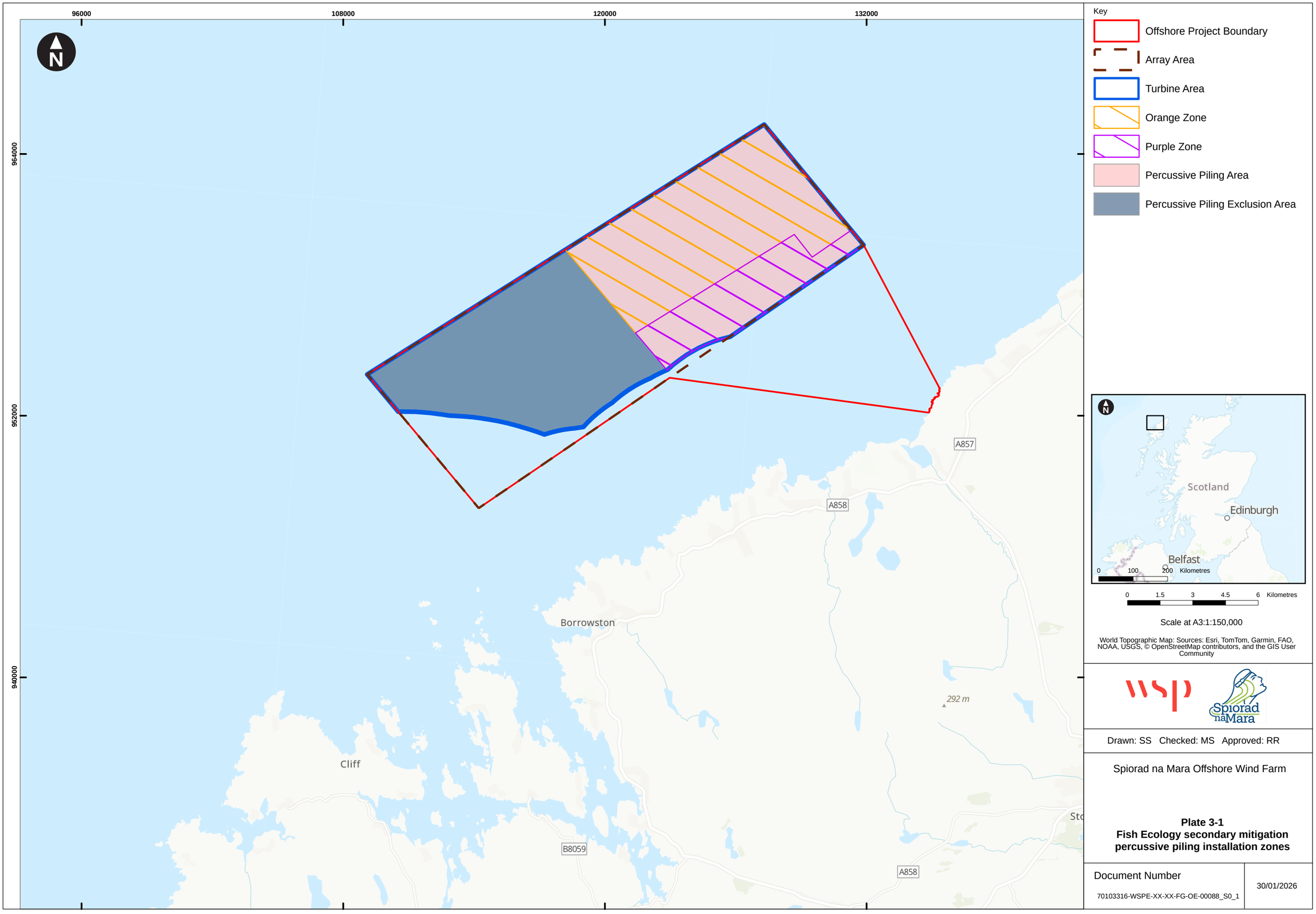
3.2.1.2 The mitigation measures will also apply to Atlantic salmon and to sea trout (as a potential host of freshwater pearl mussel) from North Harris SAC further reducing the potential impact on these species.

3.3 OVERVIEW OF SECONDARY MITIGATION

3.3.1.1 The Percussive Piling Area, as shown on **Plate 3-1**, has been divided into 2 distinct zones based on proximity to the coast of the Isle of Lewis/*Eilean Leòdhais*:

- **Purple Zone:** located closest to the coast;
- **Orange Zone:** located furthest from the coast.

Plate 3-1 Fish Ecology secondary mitigation percussive piling installation zones



Key

- Offshore Project Boundary
- Array Area
- Turbine Area
- Orange Zone
- Purple Zone
- Percussive Piling Area
- Percussive Piling Exclusion Area

0 1.5 3 4.5 6 Kilometres

Scale at A3:1:150,000

World Topographic Map: Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community

Drawn: SS Checked: MS Approved: RR

Spiorad na Mara Offshore Wind Farm

Plate 3-1
Fish Ecology secondary mitigation percussive piling installation zones

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3.4 PERCUSSIVE PILING INSTALLATION SEQUENCING

3.4.1 OVERVIEW

3.4.1.1 The Applicant has incorporated further spatial and temporal restrictions to the construction sequencing of the percussive piling installation within these zones to reduce the potential impact during key periods for Atlantic salmon migration.

3.4.1.2 The construction sequencing requirements for each zone and the reasoning for this approach is discussed in Section 3.4.4 to 3.4.5 and summarised in **Table 3-1**.

3.4.2 PERCUSSIVE PILING PROGRAMME RESTRICTION

3.4.2.1 In order to minimise the potential impact on Atlantic salmon smolt from percussive piling, the Applicant will not undertake this activity during the period when smolts are anticipated to leave freshwater environments. Following consultation with NatureScot (see **Appendix 12.2: Consultation on Atlantic salmon underwater noise assessment and associated data analysis, Volume 2c**), the Applicant was advised to utilise the anticipated migration period identified in Malcolm *et al.* 2015 (13 April to 25 May inclusive).

3.4.2.2 The percussive piling installation activity will therefore be restricted to only take place between 26 May to 31 October, outside of the anticipated smolt migration period (hereafter referred to as the 'Percussive Piling Programme').

3.4.2.3 As Malcolm *et al.* 2015 study is over 10 years old, the Applicant may choose to undertake a dedicated study (prior to construction commencing) to understand if the Percussive Piling Programme could be extended into April/May. The purpose of this study would be to provide further information on the timing of smolt emigration through Loch Roag/*Loch Ròg*.

3.4.2.4 Should the dedicated study indicate that smolt migrate in a shorter temporal window, the Applicant would seek to revise the Percussive Piling Programme accordingly. This revision would involve adjusting the duration of the Percussive Piling Programme to cover the period between 1 April to 25 May where smolt migration does not occur. Any changes to the Percussive Piling Programme would only be implemented following agreement with MD-LOT, based on the outcomes of the smolt monitoring study.

3.4.3 CONTINUOUS QUIET PERIODS

3.4.3.1 Continuous daily quiet periods will be used as a secondary mitigation that provide periods of quiet time (i.e. no percussive piling activity), allowing fish to migrate through the area with reduced disturbance. These quiet periods are not fixed to a specific time of day but are instead built into the construction sequencing, taking advantage of natural pauses as vessels move between locations.

3.4.3.2 The continuous daily quiet period will be 12 hours long. This length of time has been determined through review of Atlantic salmon movement speeds and their ability to migrate through the area between separate percussive piling installations. Additionally, for fish that are milling about in coastal waters, the continuous daily quiet period provides respite between installations reducing potential disturbance.

3.4.3.3 The continuous daily quiet period will be employed following a percussive piling activity. For example, if a percussive piling activity was undertaken 12:00 – 17:30, this would be followed by a 12 hour continuous quiet period where no percussive piling is permitted. Therefore, the next percussive piling activity could begin at 05:30 the following day. Due to the embedded mitigation measures, percussive piling is restricted to a maximum of 5.5 hours per day (see **Appendix 3.1, Volume 1c**). Therefore, if a percussive piling activity was undertaken earlier in the day, a second percussive piling activity would not be permitted till the following day even though a continuous 12 hour quiet period had been employed (i.e. percussive piling activity undertaken 04:00 – 09:30, quiet period followed 09:30 – 21:30, the next percussive piling activity could not begin until 00:00 the following day).

3.4.4 PURPLE ZONE:

3.4.4.1 **Spatial mitigation**: Percussive piling in this zone will be restricted to September and October only (unless otherwise agreed with MD-LOT following the smolt migration study).

3.4.4.2 **Temporal mitigation**: A continuous quiet period will not be required throughout the percussive piling installation within this zone.

3.4.4.3 **Justification**: This timing is intended to avoid the returning adult Atlantic salmon migration periods to the Langavat SAC, North Harris SAC, and populations from other salmon rivers along the coast in May to August (**Table 3-1**). This allows for a coastal migration zone for the returning adults. Further to this, through the Percussive Piling Programme restriction (A006), the Offshore Project will completely avoid the peak Atlantic salmon smolt migration period during 01 April to 25 May (**Table 3-1**).

3.4.5 ORANGE ZONE:

3.4.5.1 **Spatial mitigation**: Percussive piling in this zone can be undertaken between late May and October (unless otherwise agreed with MD-LOT following the smolt migration study).

3.4.5.2 **Temporal mitigation**: A continuous quiet period will be required within the construction sequencing in June to July.

Justification: This timing is intended to minimise disturbance during the peak period of returning adult Atlantic salmon migration periods to the Langavat SAC, North Harris SAC, and populations from other salmon rivers along the coast in June to July (**Table 3-1**). The percussive piling

installation works during this peak period will incorporate consistent daily quiet periods allowing fish to migrate through the area with reduced disturbance. Further to this, through the Percussive Piling Programme restriction (A006), the Offshore Project will completely avoid the peak Atlantic salmon smolt migration period during 01 April to 25 May (**Table 3-1**).

Table 3-1: Migration periods and percussive piling installation construction sequencing

	April	May*		June	July	August	September	October
		1st to 25th	26th to 31st					
Atlantic salmon migration								
Kelt Migration (seawards)								
Smolt Migration (seawards)	Peak period	Peak period						
Adult Migration				Peak period	Peak period			
Construction activity								
Orange Zone Piling								
Purple Zone Piling								

**May has been split into 2 columns to reflect the Percussive Piling Programme restriction (see Section 3.4.2)*

Key:

- Percussive piling installation permitted
- Percussive piling installation permitted – with continuous quiet period in percussive piling operations
- Percussive piling installation not permitted
- Percussive piling installation not permitted unless approved by MD-LOT following further smolt migration study
- Migration periods

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3.5 FISH ECOLOGY ADDITIONAL MITIGATION

3.5.1.1 As part of the Offshore Project design process, the Fish Ecology secondary mitigation measures have been adopted to reduce the potential for impacts from percussive piling installation. These measures have evolved as the EIA has progressed and are captured as additional mitigation stated in **Table 3-2**.

Table 3-2 Additional mitigation relevant to Fish Ecology

Commitment ID	Environmental measure proposed	How the environmental measure will be secured
A006	The Piling Strategy will be developed to incorporate the percussive piling installation sequencing and periods of continuous quiet time as outlined in **Appendix 12.3: Overview of Percussive Piling Fish Ecology Mitigation, Volume 2c**.	Secured in the Marine Licence via the condition for a Piling Strategy to be submitted to MD-LOT for approval.

4 GLOSSARY OF TERMS AND ABBREVIATIONS

4.1.1.1 A list of key terms and acronyms used in this Appendix are provided in **Table 4-1** and **Table 4-2**.

Table 4-1 Acronyms and abbreviations

Term	Definition
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
MD-LOT	Marine Directorate – Licensing Operations Team
MD-SEDD	Marine Directorate - Science, Evidence, Digital and Data
MHWS	Mean High Water Springs
OCAS	Offshore Cable Area of Search
OSP	Offshore Substation Platform
PDE	Project Design Envelope
SAC	Special Area of Conservation
TTS	Temporary Threshold Shift
WTG	Wind Turbine Generator

Table 4-2 Glossary

Term	Meaning
the Applicant	Spiorad na Mara Limited (the Project owner)
Array Area	The offshore area within which the offshore wind turbine generators (WTGs), associated foundations, Offshore Cables, and Offshore Substation Platform (OSP) (if required), will be located. This area encompasses the Turbine Area that will contain all above water surface infrastructure (WTGs / OSP) and an additional area within which further below water infrastructure (foundations and cables) may also be located.
Environmental Impact Assessment Report (EIAR)	The Environmental Impact Assessment Report (EIAR) prepared to assess the likely significant effects of the Project on the environment.
Embedded or 'Designed-in' Mitigation	Mitigation measures to avoid or reduce environmental effects that are directly incorporated into the preferred design for the Project. This can include standard practice in accordance with or without guidance. Embedded mitigation is considered as part of the impact assessment, before effect significance is identified.
Impact	Change that is caused by an action; for example, land clearing (action) during construction which results in habitat loss (impact)
Jacket Foundation	A steel lattice framework structure with 3 or 4 legs used as a foundation for WTGs, secured to the seabed with pin piles or by gravity base.
Offshore Project	The offshore components of the Spiorad na Mara offshore wind farm (the Project) located seaward of Mean High Water Springs (MHWS).

Term	Meaning
Offshore Substation Platform (OSP)	The optional offshore substation located within the Array Area. Includes the platform and associated components which allows the voltage to be increased to meet onward transmission requirements.
Project Design Envelope	A description of the range of possible components that make up the Project design options under consideration when the exact engineering parameters are not yet known.
Percussive Piling	A method of installing piles and pile casings into the seabed using an impact hammer. This form of piling can be solely used if ground conditions are suitable. If pile depth cannot be achieved through percussive piling alone, a pile-drill-pile technique can be used to reach desired depths. The percussive piling technique can be used for the installation of the Wind Turbine Generators (WTGs) and the Offshore Substation Platform (OSP) (if required) located within the Percussive Piling Area.
Percussive Piling Area	The area within the Turbine Area where both percussive piling, and drill and grout construction methods can be used for the installation of the wind turbine generators (WTGs) and the Offshore Substation Platform (OSP) (if required) fixed foundations.
Percussive Piling Exclusion Area	An area in the southwest of the Turbine Area where there will be no percussive piling. Other methods including drill and grout or vibratory methods can be used in this area.
Percussive Piling Programme	The construction period that percussive piling can be undertaken.
Pin Pile	A long, slender steel pile installed into the seabed to anchor offshore structures such as WTGs and OSPs
Temporary Threshold Shift (TTS)	Reversible and temporary hearing loss.
Turbine Area	A reduced area within the Array Area where above water surface infrastructure would be located i.e. wind turbine generators (WTG) and Offshore Substation Platform (OSP) (if required). This area has been developed and refined through stakeholder engagement and environmental assessment.
Wind Turbine Generator (WTG)	The wind turbines that generate electricity consisting of tubular towers and blades attached to a nacelle housing mechanical and electrical generating equipment

5 REFERENCES

Malcolm, I.A., Millar, C.P. and Millidine, K.J. 2015. Spatio-temporal variability in Scottish smolt emigration times and sizes. Scottish Marine and Freshwater Science Vol 6 No 2. Edinburgh: Scottish Government, 15pp. https://www2.gov.scot/Resource/0047/00472202.pdf.