Spiorad na Mara Offshore Wind Farm

Offshore Project

Environmental Impact Assessment Report

Appendix 19.9: Modelled Receptor Noise Levels, Volume 2c

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1 INTRODUCTION

1.1 OVERVIEW

1.1.1.1 This appendix of the Environmental Impact Assessment Report (EIAR) presents the results of wind turbine generator (WTG) noise level predictions relevant to the assessment of offshore airborne noise of the proposed Spiorad na Mara Offshore Wind Farm (hereafter referred to as 'the Offshore Project'). This appendix accompanies **Chapter 19: Offshore Airborne Noise, Volume 2a** of the EIAR.

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

- **Chapter 19, Volume 2a**;
- **Appendix 19.1: Policy, Guidance and Legislative Context, Volume 2c**;
- **Appendix 19.2: Noise Modelling and Prediction, Volume 2c**;
- **Appendix 19.3: Baseline Noise Survey, Volume 2c**;
- **Appendix 19.4: Wind Shear Correction, Volume 2c**;
- **Appendix 19.5: Baseline Noise Conditions - All Wind Directions, Volume 2c**;
- **Appendix 19.6: Baseline Noise Analysis Comparison – Design Option 1 vs Design Option 2, Volume 2c**;
- **Appendix 19.7: Baseline Noise Conditions - Directional Split, Volume 2c**;
- **Appendix 19.8: Existing Wind Turbine Contribution Check, Volume 2c**;
- **Appendix 19.10: Noise Limits, Volume 2c**;
- **Appendix 19.11: Cumulative Wind Turbine Noise 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 WTGs.

1.1.2.2 The Project will include both offshore and onshore infrastructure. This 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: Offshore Project Location, Volume 1b**). 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.

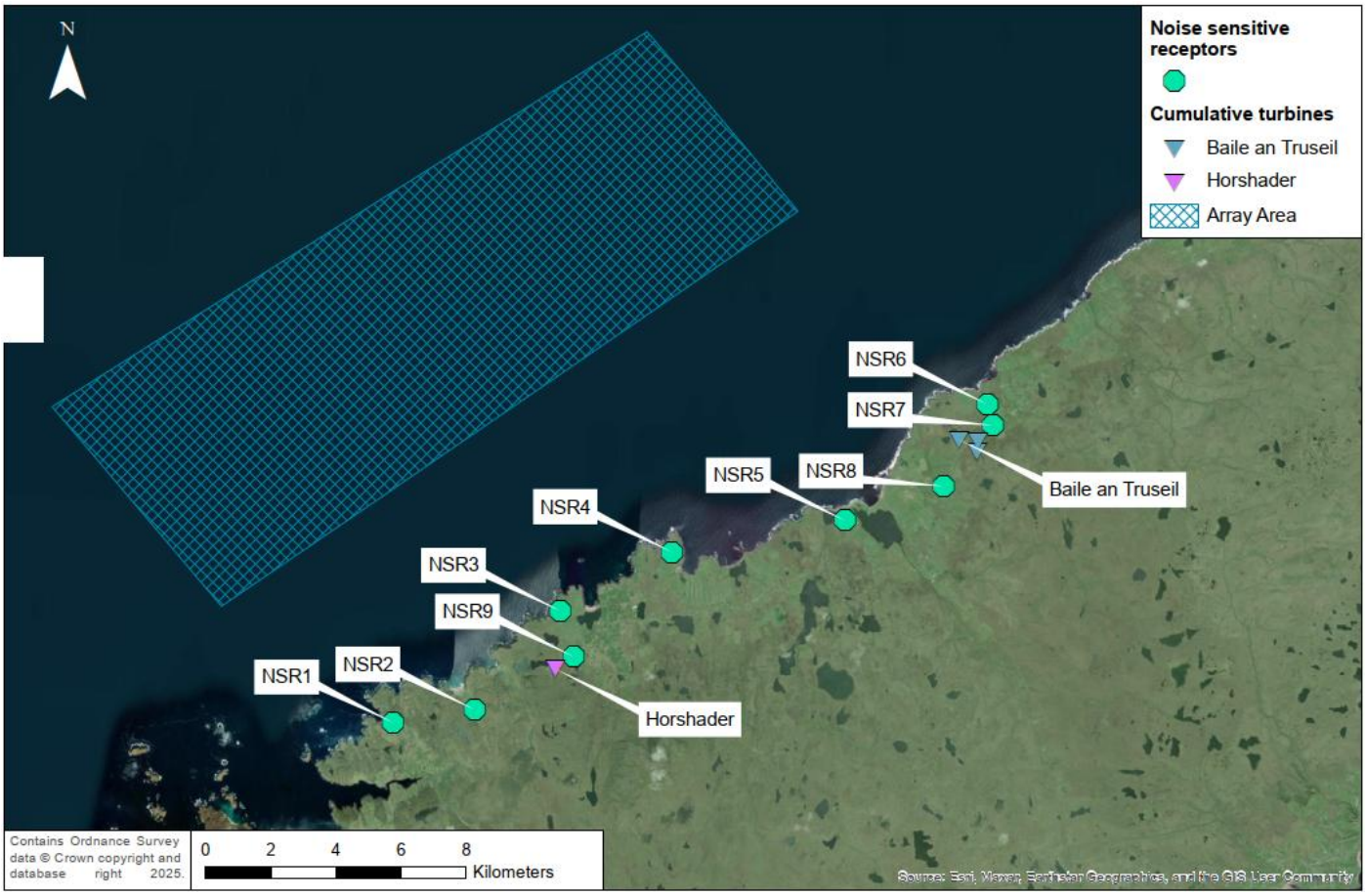
1.2 PURPOSE OF THIS APPENDIX

1.2.1.1 Wind turbine noise levels for the Offshore Project WTG scenarios and identified cumulative developments have been predicted at noise sensitive receptors (NSRs), see **Plate 1-1**.

1.2.1.2 This appendix describes the following:

- Offshore Project - Turbine Layout Option 1 (Option 1) predicted NSR noise levels for downwind, crosswind, and upwind conditions;
- Offshore Project – Turbine Layout Option 2 (Option 2) predicted NSR noise levels for downwind, crosswind, and upwind conditions;
- Cumulative wind turbine development - Horshader Wind Farm predicted NSR noise levels for downwind conditions;
- Cumulative wind turbine development - Baile an Truiseil (BaT) Wind Farm predicted NSR noise levels for downwind conditions.

Plate 1-1: Noise sensitive receptors



2 PREDICTED NSR NOISE LEVELS – PROJECT IN ISOLATION

2.1.1.1 Operational wind farm noise levels have been predicted at NSR1 to NSR9 for the 2 Turbine Layout Options under appraisal. Further details of the NSRs are presented in **Chapter 19, Volume 2a**, Table 19-16. Predictions have been undertaken in accordance with the methodology presented in **Appendix 19.2, Volume 2c** for offshore wind turbines.

2.1.1.2 For both Turbine Layout Options, predictions have been undertaken for downwind, crosswind and upwind propagation conditions, and include a +2 dB uncertainty factor. All wind speeds are referenced to 10 m height (standardised U_{10}), m/s.

2.1.1.3 Drawing on the flat landscape directional corrections presented in Figure 6a of the Institute of Acoustics: *A Good practice guide to the application of ETSU-R-97 for the assessment and rating of wind turbine noise* (IOA GPG), the following corrections have been applied:

- Downwind: 0 dB all turbines (as applicable for 80° either side of 0° (direct downwind));
- Crosswind: -2 dB all turbines;
- Upwind: -6 dB all turbines (a conservative application).

2.1.1.4 Details of the modelled Turbine Layout Options are summarised in **Table 2-1**. The assessment of results is detailed in **Appendix 19.11, Volume 2c**.

Table 2-1 Modelled Offshore Project scenarios

Parameter	**Option 1 (smallest WTG type)**	**Option 2 (largest WTG type)**
Number of turbines	60	44
Turbine power rating (MW)	15	22
Maximum rotor diameter (m)	236	280
Maximum hub height for Option (m)	175.8	198.4
Maximum sound power level (dB(A))	115.3	122 (assumed)

2.2 OPTION 1: MODELLED NSR NOISE LEVELS

Table 2-2 NSR noise levels - Option 1 - Downwind conditions ($L_{A90,T}$, dB(A))

NSR	Wind Speed Referenced to 10 m (U_{10}) m/s								
	2	3	4	5	6	7	8	9	10+
NSR1 - Garenin	-	22.5	25.5	31.0	34.9	37.3	37.5	37.5	37.5
NSR2 - Dalmore	-	22.5	25.5	31.0	34.9	37.3	37.5	37.5	37.5
NSR3 - South Shawbost	-	24.2	27.2	32.7	36.6	39.0	39.2	39.2	39.2
NSR4 - Labost	-	24.1	27.1	32.6	36.5	38.9	39.1	39.1	39.1
NSR5 - Brue	-	22.0	25.0	30.5	34.4	36.8	37.0	37.0	37.0
NSR6 - Baile an Truiseil	-	20.9	23.9	29.4	33.3	35.7	35.9	35.9	35.9
NSR7 - 17A Baile an Truiseil	-	20.6	23.6	29.1	33.0	35.4	35.6	35.6	35.6
NSR8 - Morven	-	20.8	23.8	29.3	33.2	35.6	35.8	35.8	35.8
NSR9 - 4 Cnoc a Charnain	-	22.9	25.9	31.4	35.3	37.7	37.9	37.9	37.9

Table 2-3 NSR noise levels - Option 1 - Crosswind conditions ($L_{A90,T}$, dB(A))

NSR	Wind Speed Referenced to 10 m (U_{10}) m/s								
	2	3	4	5	6	7	8	9	10+
NSR1 - Garenin	-	20.5	23.5	29.0	32.9	35.3	35.5	35.5	35.5
NSR2 - Dalmore	-	20.5	23.5	29.0	32.9	35.3	35.5	35.5	35.5
NSR3 - South Shawbost	-	22.2	25.2	30.7	34.6	37.0	37.2	37.2	37.2
NSR4 - Labost	-	22.1	25.1	30.6	34.5	36.9	37.1	37.1	37.1
NSR5 - Brue	-	20.0	23.0	28.5	32.4	34.8	35.0	35.0	35.0
NSR6 - Baile an Truiseil	-	18.9	21.9	27.4	31.3	33.7	33.9	33.9	33.9
NSR7 - 17A Baile an Truiseil	-	18.6	21.6	27.1	31.0	33.4	33.6	33.6	33.6
NSR8 - Morven	-	18.8	21.8	27.3	31.2	33.6	33.8	33.8	33.8
NSR9 - 4 Cnoc a Charnain	-	20.9	23.9	29.4	33.3	35.7	35.9	35.9	35.9

Table 2-4 NSR noise levels - Option 1 - Upwind conditions ($L_{A90,T}$, dB(A))

NSR	Wind Speed Referenced to 10 m (U_{10}) m/s								
	2	3	4	5	6	7	8	9	10+
NSR1 - Garenin	-	16.5	19.5	25.0	28.9	31.3	31.5	31.5	31.5
NSR2 - Dalmore	-	16.5	19.5	25.0	28.9	31.3	31.5	31.5	31.5
NSR3 - South Shawbost	-	18.2	21.2	26.7	30.6	33.0	33.2	33.2	33.2
NSR4 - Labost	-	18.1	21.1	26.6	30.5	32.9	33.1	33.1	33.1
NSR5 - Brue	-	16.0	19.0	24.5	28.4	30.8	31.0	31.0	31.0
NSR6 - Baile an Truiseil	-	14.9	17.9	23.4	27.3	29.7	29.9	29.9	29.9
NSR7 - 17A Baile an Truiseil	-	14.6	17.6	23.1	27.0	29.4	29.6	29.6	29.6
NSR8 - Morven	-	14.8	17.8	23.3	27.2	29.6	29.8	29.8	29.8

NSR	Wind Speed Referenced to 10 m (U_{10}) m/s								
	2	3	4	5	6	7	8	9	10+
NSR9 - 4 Cnoc a Charnain	-	16.9	19.9	25.4	29.3	31.7	31.9	31.9	31.9

2.3 OPTION 2: MODELLED NSR NOISE LEVELS

Table 2-5 NSR noise levels - Option 2 - Downwind conditions ($L_{A90,T}$, dB(A))

NSR	Wind Speed Referenced to 10 m (U_{10}) m/s								
	2	3	4	5	6	7	8	9	10+
NSR1 – Garenin	-	27.8	31.2	36.3	40.4	42.7	42.7	42.7	42.7
NSR2 – Dalmore	-	27.8	31.2	36.3	40.4	42.7	42.7	42.7	42.7
NSR3 - South Shawbost	-	29.4	32.8	37.9	42.0	44.3	44.3	44.3	44.3
NSR4 – Labost	-	29.3	32.7	37.8	41.9	44.2	44.2	44.2	44.2
NSR5 – Brue	-	27.2	30.6	35.7	39.8	42.1	42.1	42.1	42.1
NSR6 - Baile an Truiseil	-	26.2	29.6	34.7	38.8	41.1	41.1	41.1	41.1
NSR7 - 17A Baile an Truiseil	-	25.9	29.3	34.4	38.5	40.8	40.8	40.8	40.8
NSR8 – Morven	-	26.1	29.5	34.6	38.7	41.0	41.0	41.0	41.0
NSR9 - 4 Cnoc a Charnain	-	28.2	31.6	36.7	40.8	43.1	43.1	43.1	43.1

Table 2-6 NSR noise levels - Option 2 - Crosswind conditions ($L_{A90,T}$, dB(A))

NSR	Wind Speed Referenced to 10 m (U_{10}) m/s								
	2	3	4	5	6	7	8	9	10+
NSR1 - Garenin	-	25.8	29.2	34.3	38.4	40.7	40.7	40.7	40.7
NSR2 - Dalmore	-	25.8	29.2	34.3	38.4	40.7	40.7	40.7	40.7
NSR3 - South Shawbost	-	27.4	30.8	35.9	40.0	42.3	42.3	42.3	42.3
NSR4 - Labost	-	27.3	30.7	35.8	39.9	42.2	42.2	42.2	42.2
NSR5 - Brue	-	25.2	28.6	33.7	37.8	40.1	40.1	40.1	40.1
NSR6 - Baile an Truiseil	-	24.2	27.6	32.7	36.8	39.1	39.1	39.1	39.1
NSR7 - 17A Baile an Truiseil	-	23.9	27.3	32.4	36.5	38.8	38.8	38.8	38.8
NSR8 - Morven	-	24.1	27.5	32.6	36.7	39.0	39.0	39.0	39.0
NSR9 - 4 Cnoc a Charnain	-	26.2	29.6	34.7	38.8	41.1	41.1	41.1	41.1

Table 2-7 NSR noise levels - Option 2 - Upwind conditions ($L_{A90,T}$, dB(A))

NSR	Wind Speed Referenced to 10 m (U_{10}) m/s								
	2	3	4	5	6	7	8	9	10+
NSR1 - Garenin	-	21.8	25.2	30.3	34.4	36.7	36.7	36.7	36.7
NSR2 - Dalmore	-	21.8	25.2	30.3	34.4	36.7	36.7	36.7	36.7

NSR	Wind Speed Referenced to 10 m (U_{10}) m/s								
	2	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10+**
NSR3 - South Shawbost	-	23.4	26.8	31.9	36.0	38.3	38.3	38.3	38.3
NSR4 - Labost	-	23.3	26.7	31.8	35.9	38.2	38.2	38.2	38.2
NSR5 - Brue	-	21.2	24.6	29.7	33.8	36.1	36.1	36.1	36.1
NSR6 - Baile an Truiseil	-	20.2	23.6	28.7	32.8	35.1	35.1	35.1	35.1
NSR7 - 17A Baile an Truiseil	-	19.9	23.3	28.4	32.5	34.8	34.8	34.8	34.8
NSR8 - Morven	-	20.1	23.5	28.6	32.7	35.0	35.0	35.0	35.0
NSR9 - 4 Cnoc a Charnain	-	22.2	25.6	30.7	34.8	37.1	37.1	37.1	37.1

3 PREDICTED NSR NOISE LEVELS – HORSHADER WIND FARM IN ISOLATION

3.1.1.1 Prediction of operational wind farm noise levels for Horshader Wind Farm have also been undertaken for NSR2, NSR3 and NSR9. Predictions have been undertaken in accordance with the methodology presented in **Appendix 19.2, Volume 2c** for onshore wind turbines.

3.1.1.2 Predictions have been undertaken for downwind propagation conditions (-0 dB directivity correction) and include a +2 dB uncertainty factor. All wind speeds are referenced to 10 m height (standardised U_{10}), m/s.

3.1.1.3 Details of Horshader Wind Farm that have been modelled are summarised in **Table 3-1**.

Table 3-1 Modelled Horshader Wind Farm details

Parameter	**Horshader Wind Farm**
Number of turbines	1
Turbine power rating (kW)	900 kW
Hub height (m)	55
Installed turbine manufacturer	Enercon
Installed turbine model	E44
Maximum sound power level (dB(A))	101.5

3.2 HORSHADER WIND FARM: MODELLED NSR NOISE LEVELS

Table 3-2 NSR noise levels – Horshader Wind Farm - Downwind conditions ($L_{A90,T}$, dB(A))

NSR	**Wind Speed Referenced to 10 m (U_{10}) m/s**								
	2	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10+**
NSR2 - Dalmore	-	-	1.3	7.8	12.1	14.8	16.3	17.1	17.1
NSR3 - South Shawbost	-	-	6.2	12.7	17.0	19.7	21.2	22.1	22.1
NSR9 - 4 Cnoc a Charnain	-	-	17.1	23.6	27.9	30.6	32.3	33.0	33.0

4 PREDICTED NSR NOISE LEVELS – BAILE AN TRUISEIL WIND FARM IN ISOLATION

4.1.1.1 Prediction of operational wind farm noise levels for BaT Wind Farm have also been undertaken for NSR6, NSR7 and NSR8. Predictions have been undertaken in accordance with the methodology presented in **Appendix 19.2, Volume 2c** for onshore wind turbines.

4.1.1.2 Predictions have been undertaken for downwind propagation conditions (-0 dB directivity correction) and include a +2 dB uncertainty factor. All wind speeds are referenced to 10 m height (standardised U_{10}), m/s.

4.1.1.3 Details of BaT Wind Farm that have been modelled are summarised in **Table 4-1**.

Table 4-1 Modelled BaT Wind Farm details

Parameter	**BaT Wind Farm**
Number of turbines	3
Turbine power rating (kW)	900 kW
Hub height (m)	55
Installed turbine manufacturer	Enercon
Installed turbine model	E44
Maximum sound power level (dB(A))	101.5

4.2 BAT WIND FARM: MODELLED NSR NOISE LEVELS

Table 4-2 NSR noise levels – BaT Wind Farm - Downwind conditions ($L_{A90,T}$, dB(A))

NSR	**Wind Speed Referenced to 10 m (U_{10}) m/s**								
	2	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10+**
NSR6 - Baile an Truiseil	-	-	14.6	21.1	25.4	28.1	29.7	30.5	30.5
NSR7 - 17A Baile an Truiseil	-	-	19.6	26.1	30.4	33.1	34.8	35.5	35.6
NSR8 - Morven	-	-	12.5	19.1	23.3	26.1	27.6	28.4	28.4

5 GLOSSARY OF TERMS AND ABBREVIATIONS

5.1.1.1 A list of key terms and acronyms used in this appendix are provided in **Table 5-1** and **Table 5-2**.

Table 5-1 Acronyms and abbreviations

Term	Definition
BaT	Baile an Truiseil (an existing wind farm)
dB	Decibel
dB(A)	A-weighted decibel
EIAR	Environmental Impact Assessment Report
IOA GPG	The Institute of Acoustics' guidance document: *A Good practice guide to the application of ETSU-R-97 for the assessment and rating of wind turbine noise*
kW	Kilowatt
m	metres
m/s	metres per second
MHWS	Mean High Water Springs
MW	Megawatt
NSR	Noise Sensitive Receptor
OCAS	Offshore Cable Area of Search
OSP	Offshore Substation Platform
OWF	Offshore Wind Farm
WTG	Wind turbine generator

Table 5-2 Glossary

Term	Meaning
A-weighting	Frequency weighted sound level, weighted according to the A-scale, which takes into account the increased sensitivity of the human ear at some frequencies.
$L_{A90,T}$	A statistical noise index defined as the level that is exceeded for 90% of the time over the measurement time period T. The 'A' denotes that the level is determined with 'A-weighting' applied.
U_{10}	Wind speed at standardised 10 m height

6 REFERENCES

Institute of Acoustics (IOA). (2013). *A Good practice guide to the application of ETSU-R-97 for the assessment and rating of wind turbine noise*. St Albans, UK: Institute of Acoustics. Available at: https://www.ioa.org.uk/sites/default/files/IOA%20Good%20Practice%20Guide%20on%20Wind%20Turbine%20Noise%20-%20May%202013.pdf [Accessed 17 February 2026].