



Dalfad Wind Farm

Environmental Impact Assessment Report

Technical Appendix 9.4: Noise Curtailment Strategy

APPENDIX 9.4 – NOISE CURTAILMENT STRATEGY

1. INTRODUCTION

- 1.1 This Technical Appendix sets out the details of the indicative noise curtailment strategy required for the noise assessment of the Proposed Development. It supports **Chapter 9: Noise** of the EIA Report and should be read, where applicable, alongside **Chapter 9** and its other technical appendices.
- 1.2 **Technical Appendix 9.1 Assessment Methodology** describes the assessment methods, criteria and general assumptions. **Technical Appendix 9.2: Baseline Noise Survey** presents details of the baseline noise survey, the measurement results, and derived background noise relationships. **Technical Appendix 9.3: Noise Calculations, Predictions and Assessment** presents the acoustic source data, calculation inputs and detailed prediction results for each assessment element.
- 1.3 The unrestricted operational noise predictions were identified to exceed the Site-Specific Noise Limits (SSNLs) during the daytime, requiring noise reductions to be achieved, absent changes to criteria resulting from financial involvement of relevant properties. This appendix presents an indicative noise curtailment strategy demonstrating how those reductions could be achieved through the use of noise-reduced operating modes at selected turbines. This indicative strategy only assumes downwind propagation to show how mitigation can enable the SSNLs to be met under downwind conditions. In practice mitigation would be applied that takes into account wind direction.
- 1.4 The final strategy would be prepared following selection of the turbine models and would use warranted sound power data for the selected turbines and their available operating modes. The precise allocation of modes may therefore be refined, provided that the final strategy demonstrates compliance with the applicable SSNLs at all noise-sensitive receptors and does not result in greater noise effects than assessed. Implementation of the approved strategy would be secured through an appropriately worded planning condition.

2. NOISE-REDUCED OPERATING MODE SOUND POWER LEVELS

Vestas V162 7.2 MW

- 2.1 The Vestas V162 7.2 MW turbine has seven noise-reduced modes, and its main power-optimised mode, PO7200. The sound power levels for each mode are set out in **Table 1** to **Table 7**.

2.2 Sound power levels for the Vestas V162 noise-reduced modes are taken from Vestas Technical Document no.: 0116-1715_03, dated 13th January 2023 one-third octave band data summed to octave bands. One-third octave bands 80 Hz and below are included within the 63 Hz octave band data. The reported levels do not include an uncertainty factor of +2 dB, which is added separately.

2.3 Sound power levels for the turbine's power-optimised mode PO7200 are set out in **Technical Appendix 9.3**.

Table 1 – V162 Mode SO0 Octave Band Sound Power Levels at Hub Height (dB L_{WA})

Standardised 10 m height wind speed, ms ⁻¹	Octave band centre frequency, Hz								Broadband
	63	125	250	500	1000	2000	4000	8000	
3	77.8	84.2	87.4	88.8	87.7	83.6	76.6	66.5	94.0
4	78.4	84.5	87.5	88.8	87.6	83.5	76.4	66.5	94.0
5	78.4	84.6	87.5	88.8	87.5	83.3	76.2	66.0	94.0
6	79.1	85.9	88.9	89.7	88.3	84.0	76.6	66.2	95.0
7	82.5	89.3	92.3	93.0	91.6	87.1	79.6	69.1	98.3
8	85.3	92.7	95.9	96.1	94.5	90.0	82.4	71.7	101.5
9	88.0	95.3	98.5	98.7	97.0	92.4	84.8	74.0	104.1
10	88.5	95.8	99.0	99.2	97.5	92.9	85.3	74.5	104.6
11	88.6	95.9	99.1	99.3	97.6	93.0	85.4	74.7	104.7
12	88.8	96.0	99.2	99.4	97.8	93.2	85.7	75.0	104.8
13	88.9	96.2	99.4	99.6	98.0	93.5	86.0	75.4	105.0
14	88.9	96.4	99.6	99.9	98.4	93.9	86.4	75.8	105.3
15+	88.8	96.4	99.8	100.2	98.7	94.2	86.6	75.9	105.5

Table 2 – V162 Mode SO1 Octave Band Sound Power Levels at Hub Height (dB L_{WA})

Standardised 10 m height wind speed, ms ⁻¹	Octave band centre frequency, Hz								Broadband
	63	125	250	500	1000	2000	4000	8000	
3	77.8	84.2	87.4	88.8	87.7	83.6	76.6	66.5	94.0
4	78.4	84.5	87.5	88.8	87.6	83.5	76.4	66.5	94.0
5	78.4	84.6	87.5	88.8	87.5	83.3	76.2	66.0	94.0
6	79.1	85.9	88.9	89.7	88.3	84.0	76.6	66.2	95.0
7	82.5	89.3	92.3	93.0	91.6	87.1	79.6	69.1	98.3
8	85.3	92.7	95.9	96.1	94.5	90.0	82.4	71.7	101.5
9	87.0	94.5	97.7	98.0	96.3	91.6	83.9	73.1	103.3
10	86.9	94.5	97.7	98.0	96.3	91.6	83.8	72.9	103.3
11	87.2	94.6	97.8	98.1	96.4	91.7	84.0	73.2	103.4
12	87.5	94.7	97.9	98.1	96.5	92.0	84.5	73.9	103.5
13	87.3	94.6	97.9	98.1	96.5	92.1	84.6	74.2	103.5
14	87.1	94.5	97.8	98.1	96.6	92.2	84.7	74.2	103.5
15+	86.8	94.4	97.7	98.2	96.7	92.3	84.8	74.2	103.5

Table 3 – V162 Mode SO2 Octave Band Sound Power Levels at Hub Height (dB L_{WA})

Standardised 10 m height wind speed, ms ⁻¹	Octave band centre frequency, Hz								Broadband
	63	125	250	500	1000	2000	4000	8000	
3	77.8	84.2	87.4	88.8	87.7	83.6	76.6	66.5	94.0
4	78.4	84.5	87.5	88.8	87.6	83.5	76.4	66.5	94.0
5	78.4	84.6	87.5	88.8	87.5	83.3	76.2	66.0	94.0
6	79.1	85.9	88.9	89.7	88.3	84.0	76.6	66.2	95.0
7	82.5	89.3	92.3	93.0	91.6	87.1	79.6	69.1	98.3
8	85.1	92.5	95.7	95.9	94.3	89.8	82.2	71.5	101.3
9	85.5	93.1	96.4	96.7	95.0	90.4	82.6	71.7	102.0
10	85.2	93.0	96.4	96.7	95.0	90.3	82.5	71.4	102.0
11	85.6	93.1	96.4	96.7	95.0	90.4	82.7	71.9	102.0
12	85.9	93.2	96.4	96.6	95.0	90.5	83.0	72.5	102.0
13	85.9	93.1	96.3	96.6	95.0	90.6	83.2	72.8	102.0
14	85.6	93.0	96.3	96.6	95.1	90.7	83.3	72.9	102.0
15+	85.3	92.9	96.2	96.7	95.2	90.8	83.4	72.9	102.0

Table 4 – V162 Mode SO3 Octave Band Sound Power Levels at Hub Height (dB L_{WA})

Standardised 10 m height wind speed, ms ⁻¹	Octave band centre frequency, Hz								Broadband
	63	125	250	500	1000	2000	4000	8000	
3	77.8	84.2	87.4	88.8	87.7	83.6	76.6	66.5	94.0
4	78.4	84.5	87.5	88.8	87.6	83.5	76.4	66.5	94.0
5	78.4	84.6	87.5	88.8	87.5	83.3	76.2	66.0	94.0
6	79.1	85.9	88.9	89.7	88.3	84.0	76.6	66.2	95.0
7	82.4	89.2	92.2	92.9	91.5	87.0	79.5	69.0	98.2
8	84.5	91.9	95.2	95.5	93.8	89.3	81.7	70.9	100.8
9	84.1	91.9	95.2	95.6	93.9	89.3	81.4	70.5	100.9
10	84.0	91.9	95.4	95.8	94.1	89.4	81.4	70.3	101.0
11	84.5	92.1	95.4	95.7	94.0	89.4	81.7	70.9	101.0
12	84.9	92.2	95.4	95.6	94.0	89.6	82.1	71.6	101.0
13	84.9	92.1	95.3	95.6	94.0	89.7	82.2	71.9	101.0
14	84.7	92.0	95.3	95.6	94.1	89.8	82.4	72.0	101.0
15+	84.4	91.9	95.2	95.6	94.2	89.9	82.4	72.1	101.0

Table 5 – V162 Mode SO4 Octave Band Sound Power Levels at Hub Height (dB L_{WA})

Standardised 10 m height wind speed, ms ⁻¹	Octave band centre frequency, Hz								Broadband
	63	125	250	500	1000	2000	4000	8000	
3	77.8	84.2	87.4	88.8	87.7	83.6	76.6	66.5	94.0
4	78.4	84.5	87.5	88.8	87.6	83.5	76.4	66.5	94.0
5	78.4	84.6	87.5	88.8	87.5	83.3	76.2	66.0	94.0
6	79.1	85.9	88.9	89.7	88.3	84.0	76.6	66.2	95.0
7	82.4	89.2	92.2	92.9	91.5	87.0	79.5	69.0	98.2
8	83.6	91.1	94.4	94.7	93.1	88.5	80.8	70.1	100.0
9	83.0	90.9	94.4	94.8	93.1	88.4	80.5	69.4	100.0
10	82.9	90.8	94.4	94.8	93.1	88.4	80.5	69.4	100.0

Standardised 10 m height wind speed, ms ⁻¹	Octave band centre frequency, Hz								Broadband
	63	125	250	500	1000	2000	4000	8000	
11	83.4	91.1	94.3	94.7	93.1	88.4	80.7	69.9	100.0
12	83.9	91.2	94.4	94.6	93.0	88.6	81.1	70.7	100.0
13	84.3	91.0	94.0	94.7	93.3	88.9	81.5	71.2	100.0
14	84.1	90.9	93.9	94.7	93.3	89.0	81.7	71.3	100.0
15+	83.9	90.8	93.9	94.7	93.4	89.1	81.7	71.4	100.0

Table 6 – V162 Mode SO5 Octave Band Sound Power Levels at Hub Height (dB L_{WA})

Standardised 10 m height wind speed, ms ⁻¹	Octave band centre frequency, Hz								Broadband
	63	125	250	500	1000	2000	4000	8000	
3	77.8	84.2	87.4	88.8	87.7	83.6	76.6	66.5	94.0
4	78.4	84.5	87.5	88.8	87.6	83.5	76.4	66.5	94.0
5	78.4	84.6	87.5	88.8	87.5	83.3	76.2	66.0	94.0
6	79.1	85.9	88.9	89.7	88.3	84.0	76.6	66.2	95.0
7	82.4	89.2	92.2	92.9	91.5	87.0	79.5	69.0	98.2
8	82.8	89.9	93.0	93.8	92.3	87.7	80.0	69.2	99.0
9	82.3	89.7	93.0	93.9	92.4	87.7	79.8	68.6	99.0
10	82.3	89.7	93.0	93.9	92.4	87.7	79.8	68.7	99.0
11	82.8	89.9	93.0	93.8	92.3	87.7	80.0	69.1	99.0
12	83.3	90.0	93.0	93.7	92.3	87.8	80.3	69.9	99.0
13	83.3	90.0	92.9	93.7	92.3	87.9	80.6	70.3	99.0
14	83.2	89.9	92.9	93.7	92.3	88.0	80.7	70.4	99.0
15+	83.0	89.8	92.9	93.7	92.4	88.1	80.8	70.5	99.0

Table 7 – V162 Mode SO6 Octave Band Sound Power Levels at Hub Height (dB L_{WA})

Standardised 10 m height wind speed, ms ⁻¹	Octave band centre frequency, Hz								Broadband
	63	125	250	500	1000	2000	4000	8000	
3	77.8	84.2	87.4	88.8	87.7	83.6	76.6	66.5	94.0
4	78.4	84.5	87.5	88.8	87.6	83.5	76.4	66.5	94.0
5	78.4	84.6	87.5	88.8	87.5	83.3	76.2	66.0	94.0
6	79.1	85.9	88.9	89.7	88.3	84.0	76.6	66.2	95.0
7	81.9	88.7	91.8	92.5	91.1	86.6	79.1	68.6	97.8
8	81.6	88.8	92.0	92.8	91.4	86.7	78.9	68.0	98.0
9	81.2	88.6	92.0	92.9	91.4	86.7	78.8	67.7	98.0
10	81.3	88.6	92.0	92.9	91.4	86.7	78.8	67.8	98.0
11	81.7	88.8	92.0	92.8	91.4	86.7	79.0	68.2	98.0
12	82.2	89.0	92.0	92.7	91.3	86.9	79.4	69.0	98.0
13	82.3	89.0	91.9	92.7	91.3	87.0	79.7	69.4	98.0
14	82.2	88.9	91.9	92.7	91.3	87.0	79.8	69.6	98.0
15+	82.0	88.8	91.9	92.7	91.4	87.1	79.9	69.6	98.0

Vestas V136 4.5 MW

- 2.4 The Vestas V136 4.5 MW turbine has three noise-reduced modes, and its main power-optimised mode, PO4. The sound power levels for each mode are set out in **Table 8** to **Table 10**.
- 2.5 Sound power levels for the Vestas V136 noise-reduced modes are taken from Vestas Technical Document no.: 0067-7055.V01, dated 31st August 2021. The reported levels do not include an uncertainty factor of +2 dB, which is added separately.
- 2.6 Sound power levels for the turbine's power-optimised mode PO4 are set out in **Technical Appendix 9.3**.

Table 8 – V136 Mode SO12 Octave Band Sound Power Levels at Hub Height (dB L_{WA})

Standardised 10 m height wind speed, ms ⁻¹	Octave band centre frequency, Hz								Broadband
	63	125	250	500	1000	2000	4000	8000	
3	69.2	77.2	82.8	86.0	86.8	85.2	81.2	74.7	92.1
4	71.0	79.0	84.4	87.1	87.0	84.3	78.8	70.7	92.4
5	72.5	80.7	86.0	88.2	87.3	83.4	76.6	66.5	93.0
6	74.3	82.6	87.8	90.1	89.2	85.4	78.6	68.6	94.9
7	76.5	84.7	90.0	92.2	91.5	87.7	80.9	71.1	97.1
8	78.1	86.3	91.6	93.9	93.2	89.5	82.8	73.2	98.8
9	79.1	87.4	92.6	94.9	94.0	90.1	83.3	73.2	99.7
10	79.2	87.5	92.7	95.0	94.3	90.6	83.9	74.2	99.9
11	79.0	87.2	92.5	94.9	94.4	90.9	84.5	75.2	99.9
12	78.6	86.8	92.1	94.7	94.5	91.5	85.7	77.1	99.9
13	77.9	85.9	91.4	94.3	94.6	92.3	87.4	79.8	99.9
14	77.2	85.3	90.9	94.0	94.6	92.8	88.5	81.7	99.9
15	76.4	84.5	90.2	93.6	94.6	93.2	89.5	83.5	99.9
16	75.7	83.9	89.7	93.2	94.5	93.5	90.3	84.7	99.9
17	75.1	83.2	89.1	92.9	94.4	93.8	90.9	85.9	99.9
18	74.5	82.7	88.6	92.6	94.3	93.9	91.4	86.7	99.9
19	73.8	82.1	88.1	92.2	94.1	94.1	91.9	87.6	99.9
20+	73.3	81.5	87.7	91.9	94.1	94.1	92.2	88.3	99.9

Table 9 – V136 Mode SO11 Octave Band Sound Power Levels at Hub Height (dB L_{WA})

Standardised 10 m height wind speed, ms ⁻¹	Octave band centre frequency, Hz								Broadband
	63	125	250	500	1000	2000	4000	8000	
3	69.2	77.2	82.8	86.0	86.8	85.2	81.2	74.7	92.1
4	71.0	79.0	84.4	87.1	87.0	84.3	78.8	70.7	92.4
5	72.4	80.6	85.9	88.1	87.2	83.3	76.5	66.4	92.9
6	73.9	82.2	87.4	89.7	88.8	85.0	78.2	68.2	94.5
7	74.9	83.1	88.4	90.6	89.9	86.1	79.3	69.5	95.5
8	76.1	84.3	89.6	91.9	91.2	87.5	80.8	71.2	96.8

Standardised 10 m height wind speed, ms ⁻¹	Octave band centre frequency, Hz								Broadband
	63	125	250	500	1000	2000	4000	8000	
9	77.4	85.7	90.9	93.2	92.3	88.4	81.6	71.5	98.0
10	78.1	86.4	91.6	93.9	93.2	89.5	82.8	73.1	98.8
11	78.1	86.3	91.6	94.0	93.5	90.0	83.6	74.3	99.0
12	77.9	86.1	91.4	94.0	93.8	90.8	85.0	76.4	99.2
13	77.2	85.2	90.7	93.6	93.9	91.6	86.7	79.1	99.2
14	76.5	84.6	90.2	93.3	93.9	92.1	87.8	81.0	99.2
15	75.7	83.8	89.5	92.9	93.9	92.5	88.8	82.8	99.2
16	75.0	83.2	89.0	92.5	93.8	92.8	89.6	84.0	99.2
17	74.4	82.5	88.4	92.2	93.7	93.1	90.2	85.2	99.2
18	73.8	82.0	87.9	91.9	93.6	93.2	90.7	86.0	99.2
19	73.1	81.4	87.4	91.5	93.4	93.4	91.2	86.9	99.2
20+	72.6	80.8	87.0	91.2	93.4	93.4	91.5	87.6	99.2

Table 10 – V136 Mode SO13 Octave Band Sound Power Levels at Hub Height (dB L_{WA})

Standardised 10 m height wind speed, ms ⁻¹	Octave band centre frequency, Hz								Broadband
	63	125	250	500	1000	2000	4000	8000	
3	69.2	77.2	82.8	86.0	86.8	85.2	81.2	74.7	92.1
4	71.0	79.0	84.4	87.1	87.0	84.3	78.8	70.7	92.4
5	72.0	80.2	85.5	87.7	86.8	82.9	76.1	66.0	92.5
6	71.9	80.2	85.4	87.7	86.8	83.0	76.2	66.2	92.5
7	72.5	80.7	86.0	88.2	87.5	83.7	76.9	67.1	93.1
8	73.5	81.7	87.0	89.3	88.6	84.9	78.2	68.6	94.2
9	75.2	83.5	88.7	91.0	90.1	86.2	79.4	69.3	95.8
10	75.7	84.0	89.2	91.5	90.8	87.1	80.4	70.7	96.4
11	76.0	84.2	89.5	91.9	91.4	87.9	81.5	72.2	96.9
12	75.7	83.9	89.2	91.8	91.6	88.6	82.8	74.2	97.0
13	75.0	83.0	88.5	91.4	91.7	89.4	84.5	76.9	97.0
14	74.3	82.4	88.0	91.1	91.7	89.9	85.6	78.8	97.0
15	73.5	81.6	87.3	90.7	91.7	90.3	86.6	80.6	97.0
16	72.8	81.0	86.8	90.3	91.6	90.6	87.4	81.8	97.0
17	72.2	80.3	86.2	90.0	91.5	90.9	88.0	83.0	97.0
18	71.6	79.8	85.7	89.7	91.4	91.0	88.5	83.8	97.0
19	70.9	79.2	85.2	89.3	91.2	91.2	89.0	84.7	97.0
20+	70.4	78.6	84.8	89.0	91.2	91.2	89.3	85.4	97.0

3. NOISE CURTAILMENT STRATEGY

- 3.1 The strategy set out in **Table 11** has been developed using the candidate turbine model data set out above and in **Technical Appendix 9.3**. It identifies the operating mode required for each relevant turbine and standardised wind speed for the day SSNLs to be achieved for the Proposed Development.

Table 11 – Day Noise Curtailment Strategy Operational Modes by Wind Speed

Turbine ID	Turbine Model	Standardised 10 m height wind speed, ms ⁻¹							
		3	4	5	6	7	8	9	10
T1	V136	PO4	PO4	PO4	PO4	PO4	PO4	PO4	PO4
T2	V162	PO7200	PO7200	PO7200	PO7200	PO7200	PO7200	PO7200	PO7200
T3	V136	PO4	PO4	PO4	PO4	PO4	PO4	PO4	PO4
T4	V162	PO7200	PO7200	PO7200	PO7200	PO7200	PO7200	PO7200	PO7200
T5	V162	PO7200	PO7200	PO7200	PO7200	PO7200	PO7200	PO7200	PO7200
T6	V136	PO4	PO4	PO4	PO4	PO4	PO4	PO4	PO4
T7	V162	PO7200	PO7200	PO7200	PO7200	PO7200	PO7200	PO7200	PO7200
T8	V162	PO7200	PO7200	PO7200	PO7200	PO7200	PO7200	PO7200	PO7200
T9	V162	PO7200	PO7200	PO7200	PO7200	PO7200	PO7200	PO7200	PO7200
T10	V162	PO7200	PO7200	PO7200	PO7200	SO2	SO2	PO7200	PO7200
T11	V162	PO7200	PO7200	PO7200	SO2	SO3	SO2	SO1	PO7200
T12	V162	PO7200	PO7200	PO7200	PO7200	PO7200	PO7200	PO7200	PO7200
T13	V136	PO4	PO4	PO4	SO11	SO13	SO13	SO12	SO12
T14	V136	PO4	PO4	PO4	SO12	SO11	SO11	SO12	SO12

4. POTENTIAL NOISE CURTAILMENT STRATEGY

- 4.1 In a potential scenario where The Drum wind energy development appeal against its refusal is successful, a revised day noise curtailment strategy would be required, due to there being altered SSNLs.
- 4.2 The strategy set out in **Table 12** has been developed using the candidate turbine model data set out above and in **Technical Appendix 9.3**. It identifies the operating mode required for each relevant turbine and standardised wind speed for the potential day SSNLs to be achieved for the Proposed Development.

Table 12 – Potential Day Noise Curtailment Strategy Operational Modes by Wind Speed

Turbine ID	Turbine Model	Standardised 10 m height wind speed, ms ⁻¹							
		3	4	5	6	7	8	9	10
T1	V136	PO4	PO4	PO4	PO4	PO4	PO4	PO4	PO4
T2	V162	PO7200	PO7200	PO7200	PO7200	PO7200	PO7200	PO7200	PO7200
T3	V136	PO4	PO4	PO4	PO4	PO4	PO4	PO4	PO4
T4	V162	PO7200	PO7200	PO7200	PO7200	PO7200	PO7200	PO7200	PO7200
T5	V162	PO7200	PO7200	PO7200	PO7200	PO7200	PO7200	PO7200	PO7200
T6	V136	PO4	PO4	PO4	PO4	PO4	PO4	PO4	PO4
T7	V162	PO7200	PO7200	PO7200	PO7200	PO7200	PO7200	PO7200	PO7200
T8	V162	PO7200	PO7200	PO7200	PO7200	PO7200	PO7200	PO7200	PO7200
T9	V162	PO7200	PO7200	PO7200	PO7200	SO2	SO1	PO7200	SO2
T10	V162	PO7200	PO7200	PO7200	SO3	SO4	SO3	SO2	SO4
T11	V162	PO7200	PO7200	PO7200	SO4	SO5	SO4	SO2	PO7200
T12	V162	PO7200	PO7200	PO7200	PO7200	SO2	SO2	PO7200	PO7200
T13	V136	PO4	PO4	PO4	SO13	SO13	SO13	SO11	SO12
T14	V136	PO4	PO4	PO4	SO11	SO13	SO13	SO11	SO12