



Dalfad Wind Farm

Environmental Impact Assessment Report

Technical Appendix 9.3: Noise Calculations and Predictions

APPENDIX 9.3 – NOISE CALCULATIONS & PREDICTIONS

1. INTRODUCTION

- 1.1 This Technical Appendix sets out the details of the noise calculations and predictions 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 9.4: Noise Curtailment Strategy** presents the indicative noise curtailment strategy for the operational wind turbine noise assessment.
- 1.3 This appendix presents the noise prediction and calculation assumptions and results for the Proposed Development, with reference to construction noise, construction traffic noise, operational wind turbine noise, and fixed-plant operational noise.

2. CONSTRUCTION NOISE

Overview

- 2.1 Construction noise predictions have been undertaken in accordance with the calculation methods set out in BS 5228-1 (BSI, 2014).
- 2.2 Noise levels from construction activities have been estimated using spreadsheet calculations based on assumed plant inventories, sound power levels and operating durations representative of the construction activities anticipated within each assessment phase.
- 2.3 The calculations represent realistic worst-case activity combinations likely to occur during the main construction works including in relation to the erection of wind turbines, formation of access tracks, and construction of the overhead line (OHL) grid connection.

Construction Activities and Receptors

- 2.4 No residential properties are located within 300 m of the main construction works. Calculations have therefore been undertaken at the closest or otherwise representative

receptors, including R2 Dalvene Cottage in relation to the northern access works and R8 Glenview Cottage.

- 2.5 The final overhead line route has not been confirmed. Calculations for these works have therefore been undertaken at reference distances, allowing the likely noise level to be identified once the final route and receptor separation distances are known.

Construction Plant Schedules

- 2.6 A representative plant schedule has been developed, which is set out in **Table 1**. All plant are assumed to comprise the equivalent of one plant item with 100% on-time. Where applicable, sound power levels are derived by a simplified +28 dB correction factor with reference to sound pressure level at 10 m.

Table 1 – Indicative Construction Plant Schedule

Plant Item	Reference	Octave Band (Hz) Sound Power Level, dB L _w								Total L _{WA}
		63	125	250	500	1k	2k	4k	8k	
Asphalt Paver (+tipper lorry)	BS 5228 C.5-32	115	112	109	108	107	104	102	93	119
Dozer	BS 5228 C.5-12	108	106	99	98	102	96	93	89	111
Dump Truck	BS 5228 C.9-16	114	117	116	116	114	111	104	98	123
Tracked Excavator 27kW	BS 5228 C.5-35	110	100	99	97	97	98	89	82	111
Vibratory Compacter (Asphalt)	BS 5228 C.5-29	104	106	102	105	105	105	101	98	113
Wheeled Backhoe Loader	BS 5228 C.2-8	102	94	92	92	91	88	87	78	104
Lorry	BS 5228 C.6-21	113	106	111	110	114	108	101	97	119

- 2.7 The plant schedules represent reasonable worst-case periods during which the principal items of plant could operate concurrently. They are not intended to represent the average noise level throughout the full construction programme.

- 2.8 The OHL construction is assumed to comprise multiple stages of activities, for which different indicative plant are assumed, including vegetation clearance, site preparation, excavation and foundations, tower erection, and reinstatement. The assumed plant for each activity are set out in **Table 2** to **Table 6**.

Table 2 – Indicative Vegetation Clearance Plant Schedule

Plant Item	Reference	Octave Band (Hz) Sound Power Level, dB L _w								Total L _{WA}
		63	125	250	500	1k	2k	4k	8k	
Chainsaw or brush cutter	D.5-14									114
Tracked Excavator 27kW	C.5-35	110	100	99	97	97	98	89	82	111
Dump Truck	C.9-16	114	117	116	116	114	111	104	98	123

Table 3 – Indicative Site Preparation Plant Schedule

Plant Item	Reference	Octave Band (Hz) Sound Power Level, dB L _w								Total L _{WA}
		63	125	250	500	1k	2k	4k	8k	
Tracked Excavator 27kW	C.5-35	110	100	99	97	97	98	89	82	111
Dozer	C.5-12	108	106	99	98	102	96	93	89	111
Vibratory Compacter (Asphalt)	C.5-29	104	106	102	105	105	105	101	98	113
Dump Truck	C.9-16	114	117	116	116	114	111	104	98	123

Table 4 – Indicative Excavation and Foundations Plant Schedule

Plant Item	Reference	Octave Band (Hz) Sound Power Level, dB L _w								Total L _{WA}
		63	125	250	500	1k	2k	4k	8k	
Tracked Excavator 27kW	C.5-35	110	100	99	97	97	98	89	82	111
Concrete mixer truck pumping	C.4-24	97	92	92	94	91	87	81	75	96
Diesel generator	C.4-76	108	102	85	82	81	76	73	65	89

Table 5 – Indicative Tower Erection Plant Schedule

Plant Item	Reference	Octave Band (Hz) Sound Power Level, dB L _w								Total L _{WA}
		63	125	250	500	1k	2k	4k	8k	
Wheeled mobile crane	C.4-43	108	104	99	91	92	91	84	78	98
Telescopic handler	C.4-54	107	101	94	93	106	94	82	102	108
Lorry	C.11-18	124	110	102	101	105	100	99	92	109
MEWP (Diesel scissor lift)	C.4-59	108	105	102	102	102	99	93	91	106

Table 6 – Indicative Reinstatement Plant Schedule

Plant Item	Reference	Octave Band (Hz) Sound Power Level, dB L _w								Total L _{WA}
		63	125	250	500	1k	2k	4k	8k	
Tracked Excavator 27kW	C.5-35	110	100	99	97	97	98	89	82	111
Dozer	C.5-12	108	106	99	98	102	96	93	89	111
Tractor and trailer	C.4-75	95	98	95	101	101	101.2	93	85.9	107

Access-Track Vehicle Movements

2.9 Noise from vehicle movements on the proposed access tracks has been calculated separately using the moving-source method set out in **Technical Appendix 9.1**. The calculations use the following assumptions:

- Sound power, L_{WA}, of 109 dB for a given HGV
- 232 HGV movements per day on every access track
- 32 km/h vehicle speed (approximately 20 miles per hour)
- 330 m separation between access tracks and R2 Dalvene Cottage.
- 350 m separation between access tracks and R8 Glenview Cottage.

2.10 The resulting access-track contribution has been logarithmically combined with noise from the associated construction activity where the two could reasonably occur during the same assessment period.

Construction Noise Results

2.11 Calculated façade noise levels are summarised in **Table 7**. The contribution from fixed-location and mobile construction plant is shown separately from access-track movements, followed by the logarithmically combined level.

Table 7 – Predicted Construction Noise Levels, dB

Receptor ID	Construction Plant Noise	Access-Track Movements Noise	Combined Façade Level	Assessment Criterion	Margin
R2	62.3	48.6	62.6	65	2.4
R8	61.7	48.4	62.1	65	2.9

2.12 The predictions represent temporary reasonable worst-case periods. Lower levels would occur while activities are farther from the receptor, fewer items of plant are operating, or intervening topography and temporary site structures provide additional screening.

Overhead Line Construction

2.13 Predicted overhead line construction noise levels are set out in **Table 8** for a series of activities, whereby the reference distance has been adjusted such that the predicted level is 65 dB. The relevant separation distance for the criteria to be exceeded are therefore the highest of these distances.

Table 8 – Predicted 65 dB OHL Construction Noise Distance

Activity	Façade Level	Distance
Vegetation clearance	65	139 m
Site preparation	65	138 m
Excavation and foundations	65	41 m
Tower erection	65	67 m
Reinstatement	65	55 m

3. CONSTRUCTION TRAFFIC NOISE CALCULATIONS

Traffic Data

3.1 Construction traffic calculations have been undertaken for the public-road links on which construction vehicles could materially alter existing traffic flows. Baseline traffic flows

and forecast construction movements have been obtained from **Chapter 10: Access, Traffic and Transport**.

- 3.2 The calculations use the total traffic flow, heavy-vehicle flow, percentage heavy vehicles and assumed mean traffic speed for each road link, as set out in **Table 9**. The construction scenario comprises the baseline traffic flow plus the forecast construction traffic.

Table 9 – Construction Traffic Calculation Inputs

Road Link	Assumed Mean Speed, km/h	Average 07:00 – 19:00 Weekday Vehicle Movements		Additional Vehicles Due to Construction		Baseline + Construction Traffic Flow	
		All	HGV	Light	HGV	All	HGV
A70 between access to Proposed Development and Muirkirk	80	2619	663 (25.3%)	77	232	2928	895 (31%)
A70 in Muirkirk west of B743	45	2619	663 (25.3%)	77	232	2928	895 (31%)
A70 in Muirkirk east of B743	45	2027	593 (29.3%)	77	232	2336	825 (35%)
A70 between Muirkirk and Glenbuck	80	2027	593 (29.3%)	77	232	2336	825 (35%)
A70 between access to Proposed Development and Lugar	80	2619	663 (25.3%)	77	232	2928	895 (31%)
A70 through Lugar	45	2619	663 (25.3%)	77	232	2928	895 (31%)
A70 between Lugar and Cumnock	60	2619	663 (25.3%)	77	232	2928	895 (31%)
A70 between Ayr Road and eastern edge of Cumnock	45	5262	697 (13.2%)	77	232	5571	929 (17%)
A70 between Ayr Road in Cumnock and A76	80	8236	912 (11.1%)	77	232	8545	1144 (13%)
A76 between Templeton and Dettingen roundabouts	80	5933	830 (14.0%)	77	232	6242	1062 (17%)
A76 between Dettingen and Skerrington roundabouts	80	7829	1,389 (17.7%)	77	232	8138	1621 (20%)

Construction Traffic Noise Prediction Results

- 3.3 The CRTN Basic Noise Level has been calculated separately for the baseline and baseline-plus-construction scenarios. The resulting change is presented in **Table 10**.

Table 10 – Construction Traffic Noise Prediction Results

Road Link	Existing Predicted Noise Level (18hr), dB	New Predicted Noise Level (18hr), dB	Predicted Relative Change in Traffic Noise Level, dB
A70 between access to Proposed Development and Muirkirk	63.7	64.8	+1.1
A70 in Muirkirk west of B743	61.5	62.7	+1.2
A70 in Muirkirk east of B743	60.6	62.0	+1.4
A70 between Muirkirk and Glenbuck	62.7	64.1	+1.3
A70 between access to Proposed Development and Lugar	63.7	64.8	+1.1
A70 through Lugar	61.5	62.7	+1.2
A70 between Lugar and Cumnock	62.4	63.5	+1.1
A70 between Ayr Road and eastern edge of Cumnock	62.9	63.7	+0.9
A70 between Ayr Road in Cumnock and A76	67.1	67.6	+0.5
A76 between Templeton and Dettingen roundabouts	66.1	66.7	+0.6
A76 between Dettingen and Skerrington roundabouts	67.8	68.3	+0.4

4. OPERATIONAL WIND TURBINE NOISE PREDICTIONS

Turbine Layouts

Proposed Development

4.1 The operational assessment is based on the 14-turbine layout set out in **Table 11**.

Table 11 – Proposed Development Turbine Details

Turbine ID	Easting	Northing	Assumed Turbine	Hub Height
T1	263440	623738	Vestas V136 4.5 MW	82 m
T2	263404	623264	Vestas V162 7.2 MW	119 m
T3	262784	623190	Vestas V136 4.5 MW	82 m
T4	262987	622731	Vestas V162 7.2 MW	119 m
T5	263446	622593	Vestas V162 7.2 MW	119 m
T6	262295	622773	Vestas V136 4.5 MW	82 m
T7	262917	622102	Vestas V162 7.2 MW	119 m
T8	262875	621607	Vestas V162 7.2 MW	119 m
T9	263075	621176	Vestas V162 7.2 MW	119 m
T10	263156	620707	Vestas V162 7.2 MW	119 m
T11	262499	621003	Vestas V162 7.2 MW	119 m
T12	262271	621337	Vestas V162 7.2 MW	119 m
T13	262639	620645	Vestas V136 4.5 MW	82 m
T14	263023	620036	Vestas V136 4.5 MW	82 m

Glen Water

- 4.1 The cumulative operational assessment is based on the six-turbine layout set out in **Table 12**.

Table 12 – Glen Water Turbine Details

Turbine ID	Easting	Northing	Assumed Turbine	Hub Height
G1	262442	617908	Nordex N163 6.X MW	118 m
G2	263136	617360	Nordex N163 6.X MW	118 m
G3	263110	618135	Nordex N163 6.X MW	118 m
G4	263626	617993	Nordex N163 6.X MW	118 m
G5	263684	617105	Nordex N163 6.X MW	118 m
G6	264388	617299	Nordex N163 6.X MW	118 m

The Drum

- 4.2 The potential cumulative scenario operational assessment is based on the eight-turbine layout set out in **Table 13**.

Table 13 – The Drum Turbine Details

Turbine ID	Easting	Northing	Assumed Turbine	Hub Height
D1	263820	622609	Vestas V162 7.2 MW	139
D2	263911	622163	Vestas V162 7.2 MW	139
D3	264371	622152	Vestas V162 7.2 MW	139
D4	263319	622012	Vestas V162 7.2 MW	139
D5	263649	621683	Vestas V162 7.2 MW	139
D6	264036	621529	Vestas V162 7.2 MW	139
D7	263290	621344	Vestas V162 7.2 MW	139
D8	263730	621164	Vestas V162 7.2 MW	139

Wind Shear Correction

- 4.3 Wind turbine source sound power levels are typically specified in one of two ways. The first is in terms of 'standardised' 10 m height wind speeds, accounting for the specific hub-height to which the sound power levels relate. In some cases, the sound power levels are specified for a given hub height, but an alternative hub height is proposed or installed. In other cases the sound power levels are specified based on the hub height wind speeds.
- 4.4 In order to allow like-for-like comparisons and appropriate usage in noise calculations, sound power levels are corrected, where applicable, to reflect the sound power level

based on standardised 10 m height wind speeds, with reference to the specific hub height proposed or installed.

4.5 The following equation is used for the purpose of this correction:

$$V_{10}=V_h \left(\frac{\ln \left(\frac{10}{Z_0} \right)}{\ln \left(\frac{h}{Z_0} \right)} \right)$$

where: h is the hub height
 V₁₀ is the 10 m wind speed
 V_h is the wind speed at hub height
 Z₀ is the ground roughness length, standardised to 0.05 m

4.6 As the correction is based on the specific hub height of turbines, this accounts for the fact that different hub height turbines would experience different wind speeds at their hub heights for the same 10 m wind speed conditions. Each turbine model and hub height configuration therefore has a unique derived sound power level specification.

Sound Power Levels

4.7 The sound power levels for each turbine type are shown in **Table 14**, **Table 15**, **Table 16** and **Table 17** by octave band frequency (63 Hz to 8000 Hz) against wind speed standardised to 10 m height (3 ms⁻¹ to 10 ms⁻¹), for the applicable hub heights (HH).

4.8 Data for the Vestas V162 is understood to be the most up to date data for this turbine model available at the time of writing and is applied to both the Proposed Development (where applicable) and The Drum for internal consistency, rather than adopting the sound power levels reported in The Drum EIA Report Noise chapter, which are lower in level.

Table 14 – Vestas V162 7.2 MW – 119 m HH Octave Band Sound Power Levels (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	80.0	86.5	89.5	90.8	89.6	85.4	78.3	68.3	96.0
4	80.7	87.8	90.7	91.6	90.2	85.9	78.6	68.2	96.9
5	85.1	92.5	95.5	96.1	94.5	90.1	82.6	72.0	101.4
6	89.2	96.8	100.0	100.2	98.5	93.9	86.3	75.6	105.6
7	90.2	97.9	101.0	101.2	99.6	95.0	87.3	76.6	106.6
8	90.5	98.0	101.1	101.4	99.7	95.2	87.6	77.0	106.8
9	90.6	98.2	101.4	101.7	100.1	95.6	88.1	77.5	107.1
10	90.5	98.4	101.7	102.1	100.6	96.1	88.5	77.9	107.4

Sound power levels for the Vestas V162 at 119 m hub height are taken from Vestas Technical Document DMS no.: 0116-1715_03, dated 13th January 2023, standardised to 10 m based on a hub height of 119 m, plus a 2 dB uncertainty factor.

Table 15 – Vestas V162 7.2 MW – 139 m HH Octave Band Sound Power Levels (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	80.0	86.5	89.5	90.8	89.6	85.4	78.3	68.3	96.0
4	80.8	87.9	90.9	91.7	90.3	86.0	78.6	68.2	97.0
5	85.6	92.9	96.0	96.5	95.0	90.5	83.0	72.4	101.8
6	89.6	97.3	100.4	100.7	99.0	94.4	86.7	76.0	106.0
7	90.2	97.9	101.0	101.3	99.6	95.0	87.3	76.6	106.6
8	90.5	98.0	101.1	101.4	99.8	95.2	87.7	77.0	106.8
9	90.6	98.3	101.5	101.8	100.2	95.7	88.2	77.6	107.1
10	90.5	98.4	101.8	102.2	100.6	96.2	88.6	77.9	107.5

Sound power levels for the Vestas V162 at 139 m hub height are taken from Vestas Technical Document DMS no.: 0116-1715_03, dated 13th January 2023, standardised to 10 m based on a hub height of 139 m, plus a 2 dB uncertainty factor.

Table 16 – Vestas V136 4.5 MW – 82 m HH Octave Band Sound Power Levels (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	72.8	80.9	86.2	88.9	88.6	85.7	80.0	71.4	94.1
4	76.1	84.3	89.6	91.8	91.0	87.1	80.3	70.3	96.6
5	80.8	89.1	94.3	96.6	95.8	92.0	85.3	75.5	101.4
6	84.6	92.8	98.1	100.3	99.6	95.8	89.1	79.3	105.2
7	85.2	93.5	98.7	101.0	100.3	96.5	89.8	80.0	105.9
8	85.0	93.2	98.4	100.9	100.4	97.0	90.7	81.5	105.9
9	84.2	92.3	97.7	100.5	100.5	97.9	92.7	84.6	105.9
10	83.2	91.3	96.9	100.0	100.6	98.8	94.4	87.6	105.9

Sound power levels for the Vestas V136 at 82 m hub height are taken from Vestas Technical Document DMS no.: 0101-0973_00, dated 7th December 2020, standardised to 10 m based on a hub height of 82 m, plus a 2 dB uncertainty factor.

Table 17 – Nordex N163 6.X MW – 118 m HH Octave Band Sound Power Levels (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	77.0	86.2	88.7	90.0	91.9	92.6	85.8	71.4	97.8
4	78.6	87.8	90.3	91.6	93.5	94.2	87.4	73.0	99.4
5	83.4	92.6	95.1	96.4	98.3	99.0	92.2	77.8	104.2
6	87.8	97.0	99.5	100.8	102.7	103.4	96.6	82.2	108.6
7	88.6	97.8	100.3	101.6	103.5	104.2	97.4	83.0	109.4
8	88.6	97.8	100.3	101.6	103.5	104.2	97.4	83.0	109.4
9	88.6	97.8	100.3	101.6	103.5	104.2	97.4	83.0	109.4
10	88.6	97.8	100.3	101.6	103.5	104.2	97.4	83.0	109.4

Sound power levels for the Nordex N163 at 118 m hub height are taken from Nordex technical document F008_277a_A13_EN Revision 05, dated 3rd May 2024, based standardised sound power levels for a turbine hub height of 118 m, plus a 2 dB uncertainty factor.

Ground Profile and Barrier Corrections

4.9 The ground-profile and barrier corrections in **Table 18** to **Table 20** are applied to the calculations (see **Technical Appendix 9.1** for further details).

Table 18 – Ground Profile and Barrier Corrections for the Proposed Development, dB

T-ID	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15	R16	R17	R18	R19	R20	R21	R22	R23
T1	0	0	0	0	0	0	-2	-2	-2	0	-2	-2	-2	0	0	0	-2	0	0	0	-2	-2	-2
T2	0	0	0	0	0	0	0	-2	-2	0	-2	0	-2	0	0	0	-2	0	0	0	0	-2	0
T3	0	0	0	0	0	0	0	-2	-2	0	-2	-2	-2	0	0	0	-2	0	0	0	0	-2	-2
T4	0	0	0	0	0	0	0	0	0	0	-2	0	0	0	0	0	-2	0	0	0	0	-2	0
T5	0	0	0	0	0	0	0	-2	0	0	-2	0	0	0	0	0	-2	0	0	0	0	-2	0
T6	0	0	0	0	0	0	0	0	-2	0	-2	-2	-2	0	0	0	-2	0	0	0	0	-2	0
T7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-2	0	0	0	0	0	0
T8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T14	0	0	-2	-2	-2	0	0	0	0	0	0	0	0	0	0	0	0	0	-2	0	0	0	0

Other Operational Wind Turbine Model Inputs

4.10 The project-specific implementation of the operational turbine noise model is summarised in **Table 21**.

Table 21 – Operational Wind Turbine Noise Model Inputs

Parameter	Adopted Input
Calculation method	ISO 9613-2:2024 with IOA GPG assumptions
Receptor height	4 m
Source heights	Candidate turbine hub heights
Ground factor	0.5
Temperature	10 °C
Relative humidity	70%
Atmospheric absorption	Calculated by octave band (ISO 9613-1:1993)
Source directivity	None
L _{Aeq} to L _{A90} conversion	-2 dB
Propagation condition	Simultaneous favourable propagation
Calculation precision	0.1 dB

Predicted Noise Levels

Proposed Development

4.11 Predicted operational wind turbine noise from the Proposed Development is presented in **Table 22**.

Table 22 – Predicted Proposed Development Noise Levels, dB L_{A90}

Receptor ID	Standardised 10 m height wind speed (ms ⁻¹)							
	3	4	5	6	7	8	9	10
R1	24.2	26.1	30.8	34.8	35.6	35.6	35.6	35.6
R2	24.7	26.7	31.4	35.4	36.2	36.2	36.2	36.2
R3	27.6	29.6	34.3	38.3	39.1	39.1	39.1	39.0
R4	24.6	26.3	31.0	35.1	36.0	36.0	36.0	36.1
R5	24.2	25.8	30.5	34.5	35.5	35.5	35.6	35.7
R6	24.8	26.3	30.9	35.0	36.0	36.1	36.2	36.3
R7	27.9	29.4	34.0	38.1	39.1	39.1	39.2	39.4
R8	30.2	32.1	36.8	40.8	41.7	41.7	41.7	41.7
R9	30.2	32.2	36.9	40.8	41.6	41.7	41.6	41.6
R10	26.6	28.6	33.3	37.3	38.1	38.1	38.1	38.1
R11	27.6	29.7	34.4	38.4	39.2	39.2	39.1	39.1
R12	24.5	26.4	31.0	35.1	35.9	35.9	35.9	35.9
R13	25.1	26.7	31.3	35.4	36.3	36.4	36.5	36.6
R14	23.3	24.8	29.4	33.5	34.5	34.5	34.6	34.8

Receptor ID	Standardised 10 m height wind speed (ms ⁻¹)							
	3	4	5	6	7	8	9	10
R15	21.2	22.8	27.5	31.6	32.5	32.6	32.6	32.7
R16	19.7	21.2	25.8	30.0	30.9	31.0	31.0	31.2
R17	20.7	22.1	26.7	30.9	31.9	31.9	32.0	32.2
R18	18.9	20.4	25.1	29.2	30.2	30.2	30.3	30.4
R19	19.0	20.4	25.1	29.2	30.2	30.2	30.3	30.5
R20	19.0	20.6	25.2	29.3	30.3	30.3	30.4	30.4
R21	21.3	23.1	27.7	31.8	32.7	32.7	32.7	32.8
R22	21.1	22.7	27.4	31.5	32.4	32.4	32.5	32.5
R23	18.8	20.3	25.0	29.1	30.0	30.1	30.2	30.3

Glen Water

4.12 Predicted operational wind turbine noise from Glen Water is presented in **Table 23**.

Table 23 – Predicted Glen Water Noise Levels, dB L_{A90}

Receptor ID	Standardised 10 m height wind speed (ms ⁻¹)							
	3	4	5	6	7	8	9	10
R1	5.6	7.2	12.0	16.4	17.2	17.2	17.2	17.2
R2	5.7	7.3	12.1	16.5	17.3	17.3	17.3	17.3
R3	5.5	7.1	11.9	16.3	17.1	17.1	17.1	17.1
R4	8.5	10.1	14.9	19.3	20.1	20.1	20.1	20.1
R5	7.6	9.2	14.0	18.4	19.2	19.2	19.2	19.2
R6	10.4	12.0	16.8	21.2	22.0	22.0	22.0	22.0
R7	16.0	17.6	22.4	26.8	27.6	27.6	27.6	27.6
R8	18.7	20.3	25.1	29.5	30.3	30.3	30.3	30.3
R9	19.5	21.1	25.9	30.3	31.1	31.1	31.1	31.1
R10	22.0	23.6	28.4	32.8	33.6	33.6	33.6	33.6
R11	22.7	24.3	29.1	33.5	34.3	34.3	34.3	34.3
R12	24.2	25.8	30.6	35.0	35.8	35.8	35.8	35.8
R13	19.0	20.6	25.4	29.8	30.6	30.6	30.6	30.6
R14	14.8	16.4	21.2	25.6	26.4	26.4	26.4	26.4
R15	8.2	9.8	14.6	19.0	19.8	19.8	19.8	19.8
R16	9.3	10.9	15.7	20.1	20.9	20.9	20.9	20.9
R17	10.3	11.9	16.7	21.1	21.9	21.9	21.9	21.9
R18	10.3	11.9	16.7	21.1	21.9	21.9	21.9	21.9
R19	13.7	15.3	20.1	24.5	25.3	25.3	25.3	25.3
R20	18.9	20.5	25.3	29.7	30.5	30.5	30.5	30.5
R21	25.6	27.2	32.0	36.4	37.2	37.2	37.2	37.2
R22	21.9	23.5	28.3	32.7	33.5	33.5	33.5	33.5
R23	20.0	21.6	26.4	30.8	31.6	31.6	31.6	31.6

The Drum

4.13 Predicted operational wind turbine noise from The Drum is presented in **Table 24**.

Table 24 – Predicted The Drum Noise Levels, dB L_{A90}

Receptor ID	Standardised 10 m height wind speed (ms ⁻¹)							
	3	4	5	6	7	8	9	10
R1	19.2	20.3	25.3	29.6	30.2	30.3	30.6	30.9
R2	19.4	20.5	25.5	29.8	30.4	30.5	30.8	31.1
R3	20.9	22.0	26.9	31.2	31.8	31.9	32.2	32.5
R4	19.2	20.3	25.3	29.6	30.1	30.3	30.6	30.9
R5	19.0	20.1	25.1	29.4	30.0	30.1	30.4	30.7
R6	19.5	20.6	25.6	29.9	30.4	30.6	30.9	31.2
R7	21.0	22.1	27.1	31.3	31.9	32.1	32.4	32.7
R8	22.4	23.5	28.4	32.7	33.3	33.4	33.7	34.0
R9	22.4	23.5	28.4	32.7	33.3	33.4	33.7	34.0
R10	20.3	21.4	26.4	30.6	31.2	31.4	31.7	32.0
R11	21.8	22.9	27.8	32.1	32.7	32.8	33.2	33.4
R12	20.8	21.9	26.9	31.1	31.7	31.9	32.2	32.5
R13	24.6	25.7	30.6	34.8	35.4	35.6	35.9	36.2
R14	17.9	19.0	24.0	28.3	28.9	29.0	29.3	29.6
R15	16.6	17.8	22.7	27.0	27.6	27.7	28.0	28.3
R16	15.3	16.4	21.4	25.7	26.3	26.4	26.7	26.9
R17	16.1	17.2	22.2	26.5	27.1	27.2	27.5	27.8
R18	14.6	15.7	20.7	25.0	25.6	25.7	26.0	26.3
R19	14.7	15.8	20.8	25.1	25.7	25.8	26.1	26.3
R20	14.8	15.9	20.9	25.2	25.8	25.9	26.2	26.4
R21	19.2	20.3	25.2	29.5	30.1	30.2	30.5	30.8
R22	20.1	21.2	26.1	30.4	31.0	31.1	31.5	31.7
R23	18.7	19.8	24.7	29.0	29.6	29.7	30.1	30.3

Cumulative Noise Levels

4.14 Cumulative noise from the Proposed Development and Glen Water is shown in **Table 25**.

Table 25 – Predicted Cumulative Noise Levels without The Drum, dB L_{A90}

Receptor ID	Standardised 10 m height wind speed (ms ⁻¹)							
	3	4	5	6	7	8	9	10
R1	24.2	26.2	30.9	34.9	35.7	35.7	35.7	35.7
R2	24.8	26.8	31.5	35.5	36.3	36.3	36.2	36.2
R3	27.6	29.6	34.3	38.3	39.1	39.1	39.1	39.1
R4	24.7	26.4	31.1	35.2	36.1	36.1	36.1	36.2

Receptor ID	Standardised 10 m height wind speed (ms ⁻¹)							
	3	4	5	6	7	8	9	10
R5	24.3	25.9	30.6	34.7	35.6	35.6	35.7	35.8
R6	25.0	26.4	31.1	35.2	36.2	36.2	36.3	36.5
R7	28.2	29.7	34.3	38.4	39.4	39.4	39.5	39.7
R8	30.5	32.4	37.1	41.1	42.0	42.0	42.0	42.0
R9	30.5	32.5	37.2	41.2	42.0	42.0	42.0	42.0
R10	27.9	29.8	34.5	38.6	39.4	39.4	39.4	39.4
R11	28.8	30.8	35.5	39.6	40.4	40.4	40.3	40.3
R12	27.3	29.1	33.8	38.0	38.9	38.9	38.9	38.9
R13	26.0	27.6	32.3	36.5	37.3	37.4	37.5	37.5
R14	23.9	25.4	30.0	34.2	35.1	35.2	35.3	35.4
R15	21.4	23.0	27.7	31.8	32.7	32.8	32.8	32.9
R16	20.0	21.5	26.2	30.4	31.3	31.4	31.4	31.5
R17	21.1	22.5	27.1	31.3	32.3	32.3	32.4	32.6
R18	19.5	21.0	25.7	29.9	30.8	30.8	30.9	31.0
R19	20.1	21.6	26.3	30.5	31.4	31.4	31.5	31.6
R20	21.9	23.5	28.3	32.5	33.4	33.4	33.4	33.5
R21	27.0	28.6	33.4	37.7	38.5	38.5	38.5	38.5
R22	24.5	26.2	30.9	35.2	36.0	36.0	36.0	36.1
R23	22.4	24.0	28.7	33.0	33.9	33.9	33.9	34.0

4.15 Cumulative noise from the Proposed Development, Glen Water and The Drum is shown in **Table 26**.

Table 26 – Predicted Potential Cumulative Noise Levels with The Drum, dB L_{A90}

Receptor ID	Standardised 10 m height wind speed (ms ⁻¹)							
	3	4	5	6	7	8	9	10
R1	25.4	27.2	31.9	36.0	36.8	36.8	36.9	36.9
R2	25.9	27.7	32.4	36.5	37.3	37.3	37.3	37.4
R3	28.5	30.3	35.0	39.1	39.8	39.9	39.9	39.9
R4	25.8	27.4	32.1	36.2	37.1	37.1	37.2	37.3
R5	25.4	26.9	31.6	35.8	36.6	36.7	36.8	36.9
R6	26.1	27.5	32.2	36.3	37.2	37.3	37.4	37.6
R7	29.0	30.4	35.1	39.2	40.1	40.2	40.3	40.5
R8	31.1	32.9	37.7	41.7	42.5	42.5	42.6	42.6
R9	31.1	33.0	37.8	41.8	42.6	42.6	42.6	42.6
R10	28.6	30.4	35.1	39.2	40.0	40.1	40.1	40.1
R11	29.6	31.5	36.2	40.3	41.1	41.1	41.1	41.1
R12	28.2	29.9	34.6	38.8	39.6	39.7	39.7	39.8
R13	28.4	29.8	34.5	38.7	39.5	39.6	39.8	39.9
R14	24.9	26.3	31.0	35.2	36.0	36.1	36.2	36.4
R15	22.7	24.2	28.9	33.1	33.9	34.0	34.1	34.2

Receptor ID	Standardised 10 m height wind speed (ms ⁻¹)							
	3	4	5	6	7	8	9	10
R16	21.3	22.7	27.4	31.6	32.5	32.6	32.7	32.8
R17	22.3	23.6	28.4	32.6	33.4	33.5	33.7	33.8
R18	20.7	22.1	26.9	31.1	31.9	32.0	32.1	32.3
R19	21.2	22.6	27.4	31.6	32.4	32.5	32.6	32.7
R20	22.7	24.2	29.0	33.3	34.1	34.1	34.2	34.3
R21	27.6	29.2	34.0	38.3	39.1	39.1	39.2	39.2
R22	25.9	27.4	32.1	36.4	37.2	37.2	37.3	37.4
R23	23.9	25.4	30.2	34.5	35.3	35.3	35.4	35.5

Background Noise Levels

4.16 Background noise levels are set out in **Table 27**. See **Technical Appendix 9.2** for further details of the noise survey and **Technical Appendix 9.1** for further details of the derivation.

Table 27 – Day and Night Background Noise Levels, dB L_{A90}

Measurement Location & ID	Time Period	Standardised 10 m height wind speed (ms ⁻¹)							
		3	4	5	6	7	8	9	10
M1 – Whiteholm	Day	27.0	28.3	29.8	31.5	33.0	34.4	35.5	36.1
M2 – Springhill		23.1	24.9	26.9	29.0	31.0	32.6	33.5	33.6
M3 – Boghead		33.0	33.6	34.2	34.8	35.3	35.9	36.5	37.1
M4 – Stonebriggs		34.2	35.3	35.6	35.5	35.1	34.7	34.5	34.9
M5 – Nether Guelt		23.0	24.2	25.9	28.2	30.8	33.7	36.9	40.3
M1 – Whiteholm	Night	22.7	23.9	25.8	28.2	31.1	34.3	37.7	41.3
M2 – Springhill		18.1	19.4	21.4	24.1	27.4	31.1	35.3	39.9
M3 – Boghead		26.8	27.7	28.8	30.1	31.7	33.6	35.7	38.0
M4 – Stonebriggs		22.2	23.6	25.2	26.8	28.5	30.3	32.3	34.3
M5 – Nether Guelt		20.5	22.6	25.4	28.7	32.2	35.8	39.4	42.6

Total Noise Assessment Criteria

4.17 The derived Total Noise Assessment Criteria (TNAC) are set out in **Table 28** and **Table 29**, based on background noise levels in **Table 27** and financial involvement status (receptors R9 and R11 are understood to be financially involved with the Proposed Development).

Table 28 – Operational Wind Turbine Day TNAC, dB L_{A90}

Receptor ID	Standardised 10 m height wind speed (ms ⁻¹)							
	3	4	5	6	7	8	9	10
R1	39.0	39.0	39.2	39.8	40.3	40.9	41.5	42.1

Receptor ID	Standardised 10 m height wind speed (ms ⁻¹)							
	3	4	5	6	7	8	9	10
R16	43.0	43.0	43.0	43.0	43.0	43.0	43.0	44.9
R17	43.0	43.0	43.0	43.0	43.0	43.0	43.0	44.9
R18	43.0	43.0	43.0	43.0	43.0	43.0	43.0	44.9
R19	43.0	43.0	43.0	43.0	43.0	43.0	43.0	44.9
R20	43.0	43.0	43.0	43.0	43.0	43.0	43.0	44.9
R21	43.0	43.0	43.0	43.0	43.0	43.0	44.4	47.6
R22	43.0	43.0	43.0	43.0	43.0	43.0	44.4	47.6
R23	43.0	43.0	43.0	43.0	43.0	43.0	44.4	47.6

Comparison to TNAC without The Drum

4.18 The predicted cumulative noise levels without The Drum are compared against the TNAC in **Table 30** and **Table 31**.

Table 30 – Day TNAC Minus Predicted Cumulative Noise Levels, dB

Receptor ID	Standardised 10 m height wind speed (ms ⁻¹)							
	3	4	5	6	7	8	9	10
R1	14.8	12.8	8.3	4.9	4.6	5.2	5.8	6.4
R2	14.2	12.2	7.7	4.3	4.0	4.6	5.3	5.9
R3	11.6	10.7	6.3	2.2	1.0	0.6	0.4	0.8
R4	14.3	12.6	8.1	4.6	4.2	4.8	5.4	5.9
R5	14.7	13.1	8.6	5.1	4.7	5.3	5.8	6.3
R6	14.0	12.6	7.9	3.8	2.8	2.8	2.7	2.5
R7	10.8	9.3	4.7	0.6	-0.4	0.0	1.0	1.4
R8	8.5	6.6	1.9	-2.1	-3.0	-2.6	-1.5	-0.9
R9	14.5	12.5	7.8	3.8	3.0	3.0	3.0	3.0
R10	11.1	9.2	4.5	0.4	-0.4	0.0	1.1	1.7
R11	16.2	14.2	9.5	5.4	4.6	4.6	4.7	5.0
R12	11.7	9.9	5.2	1.0	0.1	0.1	3.0	6.4
R13	13.0	11.4	6.7	2.5	1.7	1.6	1.5	1.5
R14	15.1	13.6	9.0	4.8	3.9	3.8	3.7	3.6
R15	17.6	16.0	11.3	7.2	6.3	6.2	6.2	6.1
R16	19.0	17.5	12.8	8.6	7.7	7.6	7.6	7.5
R17	17.9	16.5	11.9	7.7	6.7	6.7	6.6	6.4
R18	19.5	18.0	13.3	9.1	8.2	8.2	8.1	8.0
R19	18.9	17.4	12.7	8.5	7.6	7.6	7.5	7.4
R20	17.1	15.5	10.7	6.5	5.6	5.6	5.6	5.5
R21	12.0	10.4	5.6	1.3	0.5	0.5	3.4	6.8
R22	14.5	12.8	8.1	3.8	3.0	3.0	5.9	9.2
R23	16.6	15.0	10.3	6.0	5.1	5.1	8.0	11.3

Table 31 – Night TNAC Minus Predicted Cumulative Noise Levels, dB

Receptor ID	Standardised 10 m height wind speed (ms ⁻¹)							
	3	4	5	6	7	8	9	10
R1	18.8	16.8	12.1	8.1	7.3	7.3	7.3	7.3
R2	18.2	16.2	11.5	7.5	6.7	6.7	6.8	6.8
R3	15.4	13.4	8.7	4.7	3.9	3.9	3.9	3.9
R4	18.3	16.6	11.9	7.8	6.9	6.9	6.9	6.8
R5	18.7	17.1	12.4	8.3	7.4	7.4	7.3	7.2
R6	18.0	16.6	11.9	7.8	6.8	6.8	6.7	8.4
R7	14.8	13.3	8.7	4.6	3.6	3.6	3.5	6.6
R8	12.5	10.6	5.9	1.9	1.0	1.0	1.0	4.3
R9	14.5	12.5	7.8	3.8	3.0	3.0	3.0	4.3
R10	15.1	13.2	8.5	4.4	3.6	3.6	3.6	6.9
R11	16.2	14.2	9.5	5.4	4.6	4.6	4.7	7.3
R12	15.7	13.9	9.2	5.0	4.1	4.1	5.5	8.7
R13	17.0	15.4	10.7	6.5	5.7	5.6	5.5	7.4
R14	19.1	17.6	13.0	8.8	7.9	7.8	7.7	9.5
R15	21.6	20.0	15.3	11.2	10.3	10.2	10.2	12.0
R16	23.0	21.5	16.8	12.6	11.7	11.6	11.6	13.4
R17	21.9	20.5	15.9	11.7	10.7	10.7	10.6	12.3
R18	23.5	22.0	17.3	13.1	12.2	12.2	12.1	13.9
R19	22.9	21.4	16.7	12.5	11.6	11.6	11.5	13.3
R20	21.1	19.5	14.7	10.5	9.6	9.6	9.6	11.4
R21	16.0	14.4	9.6	5.3	4.5	4.5	5.9	9.1
R22	18.5	16.8	12.1	7.8	7.0	7.0	8.4	11.5
R23	20.6	19.0	14.3	10.0	9.1	9.1	10.5	13.6

Site-Specific Noise Limits

4.19 The derived Site-Specific Noise Limits (SSNLs) apply solely to noise from the Proposed Development and are intended to ensure that its contribution can be controlled independently of other developments.

4.20 The available noise contribution from the Proposed Development was initially calculated by logarithmically subtracting the predicted contribution from Glen Water from the applicable TNAC. The resulting available noise budget was then reviewed and shaped in accordance with the ARWTN principles, including that the SSNL:

- does not exceed the TNAC;
- is not set more than 10 dB below the TNAC;
- follows a reasonable wind-speed profile;

- is not substantially higher than the Proposed Development predictions; and
- provides an appropriate allowance for cumulative noise.

4.21 The derived SSNLs are set out in **Table 32** and **Table 33**.

Table 32 – Proposed Development Day SSNL, dB L_{A90}

Receptor ID	Standardised 10 m height wind speed (ms ⁻¹)							
	3	4	5	6	7	8	9	10
R1	39.0	39.0	39.2	39.8	40.3	40.9	41.5	42.1
R2	39.0	39.0	39.2	39.8	40.3	40.9	41.5	42.1
R3	39.2	40.3	40.6	40.5	40.1	39.7	39.5	39.9
R4	39.0	39.0	39.2	39.8	40.3	40.9	41.5	42.1
R5	39.0	39.0	39.2	39.8	40.3	40.9	41.5	42.1
R6	39.0	39.0	39.0	38.9	38.9	38.9	38.9	38.9
R7	39.0	39.0	38.9	38.7	38.7	39.1	40.3	40.9
R8	39.0	38.9	38.8	38.5	38.4	38.8	40.1	40.7
R9	45.0	45.0	44.9	44.9	44.8	44.8	44.8	44.8
R10	38.9	38.9	38.6	37.8	37.5	38.1	39.5	40.2
R11	45.0	45.0	44.9	44.7	44.6	44.6	44.6	44.9
R12	38.9	38.8	38.3	36.8	36.2	36.2	40.7	44.8
R13	39.0	38.9	38.8	38.4	38.3	38.3	38.3	38.3
R14	39.0	39.0	38.9	38.8	38.8	38.8	38.8	38.8
R15	39.0	39.0	39.0	39.0	38.9	38.9	38.9	38.9
R16	39.0	39.0	39.0	38.9	38.9	38.9	38.9	38.9
R17	39.0	39.0	39.0	38.9	38.9	38.9	38.9	38.9
R18	39.0	39.0	39.0	38.9	38.9	38.9	38.9	38.9
R19	39.0	39.0	38.9	38.8	38.8	38.8	38.8	38.8
R20	39.0	38.9	38.8	38.5	38.3	38.3	38.3	38.3
R21	38.8	38.7	38.0	35.5	34.3	34.3	40.1	44.5
R22	38.9	38.9	38.6	37.8	37.6	37.6	41.2	45.0
R23	38.9	38.9	38.8	38.3	38.1	38.1	41.5	45.1

Table 33 – Proposed Development Night SSNL, dB L_{A90}

Receptor ID	Standardised 10 m height wind speed (ms ⁻¹)							
	3	4	5	6	7	8	9	10
R1	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
R2	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
R3	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
R4	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
R5	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
R6	43.0	43.0	43.0	43.0	43.0	43.0	43.0	44.9
R7	43.0	43.0	43.0	42.9	42.9	42.9	42.9	46.2

Receptor ID	Standardised 10 m height wind speed (ms ⁻¹)							
	3	4	5	6	7	8	9	10
R8	43.0	43.0	42.9	42.8	42.8	42.8	42.8	46.2
R9	45.0	45.0	44.9	44.9	44.8	44.8	44.8	46.2
R10	43.0	42.9	42.8	42.6	42.5	42.5	42.5	46.1
R11	45.0	45.0	44.9	44.7	44.6	44.6	44.6	47.4
R12	42.9	42.9	42.7	42.3	42.1	42.1	43.8	47.3
R13	43.0	43.0	42.9	42.8	42.7	42.7	42.7	44.7
R14	43.0	43.0	43.0	42.9	42.9	42.9	42.9	44.8
R15	43.0	43.0	43.0	43.0	43.0	43.0	43.0	44.9
R16	43.0	43.0	43.0	43.0	43.0	43.0	43.0	44.9
R17	43.0	43.0	43.0	43.0	43.0	43.0	43.0	44.9
R18	43.0	43.0	43.0	43.0	43.0	43.0	43.0	44.9
R19	43.0	43.0	43.0	42.9	42.9	42.9	42.9	44.9
R20	43.0	43.0	42.9	42.8	42.7	42.7	42.7	44.7
R21	42.9	42.9	42.6	41.9	41.7	41.7	43.5	47.2
R22	43.0	43.0	42.9	42.6	42.5	42.5	44.0	47.4
R23	43.0	43.0	42.9	42.7	42.7	42.7	44.2	47.5

Comparison to SSNL

Table 34 – Day SSNL Minus Predicted Proposed Development Noise Levels, dB

Receptor ID	Standardised 10 m height wind speed (ms ⁻¹)							
	3	4	5	6	7	8	9	10
R1	14.8	12.9	8.4	5.0	4.7	5.3	5.9	6.5
R2	14.3	12.3	7.8	4.4	4.1	4.7	5.3	5.9
R3	11.6	10.7	6.3	2.2	1.0	0.6	0.4	0.9
R4	14.4	12.7	8.2	4.7	4.3	4.9	5.5	6.0
R5	14.8	13.2	8.7	5.3	4.8	5.4	5.9	6.4
R6	14.2	12.7	8.1	3.9	2.9	2.8	2.7	2.6
R7	11.1	9.6	4.9	0.6	-0.4	0.0	1.1	1.5
R8	8.8	6.8	2.0	-2.3	-3.3	-2.9	-1.6	-1.0
R9	14.8	12.8	8.0	4.1	3.2	3.1	3.2	3.2
R10	12.3	10.3	5.3	0.5	-0.6	0.0	1.4	2.1
R11	17.4	15.3	10.5	6.3	5.4	5.4	5.5	5.8
R12	14.4	12.4	7.3	1.7	0.3	0.3	4.8	8.9
R13	13.9	12.2	7.5	3.0	2.0	1.9	1.8	1.7
R14	15.7	14.2	9.5	5.3	4.3	4.3	4.2	4.0
R15	17.8	16.2	11.5	7.4	6.4	6.3	6.3	6.2
R16	19.3	17.8	13.2	8.9	8.0	7.9	7.9	7.7
R17	18.3	16.9	12.3	8.0	7.0	7.0	6.9	6.7
R18	20.1	18.6	13.9	9.7	8.7	8.7	8.6	8.5
R19	20.0	18.6	13.8	9.6	8.6	8.6	8.5	8.3

Receptor ID	Standardised 10 m height wind speed (ms ⁻¹)							
	3	4	5	6	7	8	9	10
R20	20.0	18.3	13.6	9.2	8.0	8.0	7.9	7.9
R21	17.5	15.6	10.3	3.7	1.6	1.6	7.4	11.7
R22	17.8	16.2	11.2	6.3	5.2	5.2	8.7	12.5
R23	20.1	18.6	13.8	9.2	8.1	8.0	11.3	14.8

Table 35 – Night SSNL Minus Predicted Proposed Development Noise Levels, dB

Receptor ID	Standardised 10 m height wind speed (ms ⁻¹)							
	3	4	5	6	7	8	9	10
R1	18.8	16.9	12.2	8.2	7.4	7.4	7.4	7.4
R2	18.3	16.3	11.6	7.6	6.8	6.8	6.8	6.8
R3	15.4	13.4	8.7	4.7	3.9	3.9	3.9	4.0
R4	18.4	16.7	12.0	7.9	7.0	7.0	7.0	6.9
R5	18.8	17.2	12.5	8.5	7.5	7.5	7.4	7.3
R6	18.2	16.7	12.1	8.0	7.0	6.9	6.8	8.6
R7	15.1	13.6	9.0	4.8	3.8	3.8	3.7	6.8
R8	12.8	10.9	6.1	2.0	1.1	1.1	1.1	4.5
R9	14.8	12.8	8.0	4.1	3.2	3.1	3.2	4.6
R10	16.4	14.3	9.5	5.3	4.4	4.4	4.4	8.0
R11	17.4	15.3	10.5	6.3	5.4	5.4	5.5	8.3
R12	18.4	16.5	11.7	7.2	6.2	6.2	7.9	11.4
R13	17.9	16.3	11.6	7.4	6.4	6.3	6.2	8.1
R14	19.7	18.2	13.6	9.4	8.4	8.4	8.3	10.0
R15	21.8	20.2	15.5	11.4	10.5	10.4	10.4	12.2
R16	23.3	21.8	17.2	13.0	12.1	12.0	12.0	13.7
R17	22.3	20.9	16.3	12.1	11.1	11.1	11.0	12.7
R18	24.1	22.6	17.9	13.8	12.8	12.8	12.7	14.5
R19	24.0	22.6	17.9	13.7	12.7	12.7	12.6	14.4
R20	24.0	22.4	17.7	13.5	12.4	12.4	12.3	14.3
R21	21.6	19.8	14.9	10.1	9.0	9.0	10.8	14.4
R22	21.9	20.3	15.5	11.1	10.1	10.1	11.5	14.9
R23	24.2	22.7	17.9	13.6	12.7	12.6	14.0	17.2

Potential Scenario with The Drum

4.22 There is the potential for The Drum appeal to be successful, whereby The Drum would be included in the cumulative scenario. The same TNAC would apply but revised SSNLs would be applicable in such a scenario. Revised SSNLs are given in **Table 36** and **Table 37**.

Table 36 – Revised Day SSNL if The Drum Appeal is Successful, dB L_{A90}

Receptor ID	Standardised 10 m height wind speed (ms ⁻¹)							
	3	4	5	6	7	8	9	10
R1	39.0	38.9	39.0	39.3	39.9	40.5	41.1	41.7
R2	38.9	38.9	39.0	39.3	39.9	40.5	41.1	41.7
R3	39.1	40.2	40.4	39.9	39.3	38.8	38.6	39.0
R4	38.9	38.9	39.0	39.3	39.9	40.5	41.1	41.7
R5	39.0	38.9	39.0	39.3	39.9	40.5	41.1	41.7
R6	38.9	38.9	38.8	38.4	38.3	38.2	38.2	38.1
R7	38.9	38.9	38.6	37.9	37.6	38.2	39.5	40.2
R8	38.9	38.8	38.4	37.2	36.8	37.4	38.9	39.7
R9	45.0	45.0	44.9	44.6	44.5	44.5	44.5	44.4
R10	38.9	38.8	38.3	36.9	36.3	37.0	38.7	39.6
R11	45.0	44.9	44.8	44.4	44.3	44.3	44.3	44.6
R12	38.8	38.7	38.0	35.4	34.3	34.1	40.0	44.5
R13	38.8	38.7	38.1	36.0	35.1	35.0	34.7	34.3
R14	38.9	38.9	38.8	38.4	38.3	38.3	38.2	38.2
R15	39.0	39.0	38.9	38.7	38.6	38.6	38.6	38.6
R16	39.0	39.0	38.9	38.7	38.7	38.7	38.7	38.6
R17	39.0	39.0	38.9	38.7	38.6	38.6	38.6	38.6
R18	39.0	39.0	38.9	38.7	38.7	38.7	38.7	38.7
R19	39.0	39.0	38.9	38.7	38.6	38.6	38.6	38.6
R20	38.9	38.9	38.7	38.3	38.1	38.1	38.1	38.1
R21	38.7	38.6	37.8	34.3	32.1	32.1	39.6	44.3
R22	38.9	38.8	38.4	37.0	36.4	36.4	40.8	44.8
R23	38.9	38.9	38.6	37.7	37.5	37.4	41.2	44.9

Table 37 – Revised Night SSNL if The Drum Appeal is Successful, dB L_{A90}

Receptor ID	Standardised 10 m height wind speed (ms ⁻¹)							
	3	4	5	6	7	8	9	10
R1	43.0	43.0	42.9	42.8	42.8	42.7	42.7	42.7
R2	43.0	43.0	42.9	42.8	42.7	42.7	42.7	42.7
R3	43.0	43.0	42.9	42.7	42.6	42.6	42.6	42.6
R4	43.0	43.0	42.9	42.8	42.7	42.7	42.7	42.7
R5	43.0	43.0	42.9	42.8	42.8	42.8	42.7	42.7
R6	43.0	43.0	42.9	42.8	42.7	42.7	42.7	44.7
R7	43.0	43.0	42.9	42.6	42.5	42.5	42.5	46.1
R8	42.9	42.9	42.8	42.4	42.3	42.2	42.2	45.9
R9	45.0	45.0	44.9	44.6	44.5	44.5	44.5	45.9
R10	42.9	42.9	42.7	42.3	42.1	42.1	42.1	45.9
R11	45.0	44.9	44.8	44.4	44.3	44.3	44.3	47.2
R12	42.9	42.9	42.6	41.9	41.7	41.6	43.4	47.2
R13	42.9	42.9	42.7	42.0	41.8	41.8	41.7	44.1

Receptor ID	Standardised 10 m height wind speed (ms ⁻¹)							
	3	4	5	6	7	8	9	10
R14	43.0	43.0	42.9	42.8	42.7	42.7	42.7	44.7
R15	43.0	43.0	43.0	42.9	42.9	42.8	42.8	44.8
R16	43.0	43.0	43.0	42.9	42.9	42.9	42.9	44.8
R17	43.0	43.0	43.0	42.9	42.9	42.9	42.8	44.8
R18	43.0	43.0	43.0	42.9	42.9	42.9	42.9	44.8
R19	43.0	43.0	43.0	42.9	42.8	42.8	42.8	44.8
R20	43.0	43.0	42.9	42.7	42.7	42.7	42.6	44.7
R21	42.9	42.9	42.6	41.7	41.3	41.3	43.2	47.1
R22	42.9	42.9	42.8	42.3	42.1	42.1	43.8	47.3
R23	43.0	42.9	42.8	42.5	42.5	42.4	44.0	47.4

Comparison to SSNL if The Drum Appeal is Successful

Table 38 – Revised Day SSNL Minus Predicted Proposed Development Noise Levels, dB

Receptor ID	Standardised 10 m height wind speed (ms ⁻¹)							
	3	4	5	6	7	8	9	10
R1	14.8	12.8	8.2	4.5	4.3	4.9	5.5	6.1
R2	14.2	12.2	7.6	3.9	3.7	4.3	4.9	5.5
R3	11.5	10.6	6.1	1.6	0.2	-0.3	-0.5	0.0
R4	14.3	12.6	8.0	4.2	3.9	4.5	5.1	5.6
R5	14.8	13.1	8.5	4.8	4.4	5.0	5.5	6.0
R6	14.1	12.6	7.9	3.4	2.3	2.1	2.0	1.8
R7	11.0	9.5	4.6	-0.2	-1.5	-0.9	0.3	0.8
R8	8.7	6.7	1.6	-3.6	-4.9	-4.3	-2.8	-2.0
R9	14.8	12.8	8.0	3.8	2.9	2.8	2.9	2.8
R10	12.3	10.2	5.0	-0.4	-1.8	-1.1	0.6	1.5
R11	17.4	15.2	10.4	6.0	5.1	5.1	5.2	5.5
R12	14.3	12.3	7.0	0.3	-1.6	-1.8	4.1	8.6
R13	13.7	12.0	6.8	0.6	-1.2	-1.4	-1.8	-2.3
R14	15.6	14.1	9.4	4.9	3.8	3.8	3.6	3.4
R15	17.8	16.2	11.4	7.1	6.1	6.0	6.0	5.9
R16	19.3	17.8	13.1	8.7	7.8	7.7	7.7	7.4
R17	18.3	16.9	12.2	7.8	6.7	6.7	6.6	6.4
R18	20.1	18.6	13.8	9.5	8.5	8.5	8.4	8.3
R19	20.0	18.6	13.8	9.5	8.4	8.4	8.3	8.1
R20	19.9	18.3	13.5	9.0	7.8	7.8	7.7	7.7
R21	17.4	15.5	10.1	2.5	-0.6	-0.6	6.9	11.5
R22	17.8	16.1	11.0	5.5	4.0	4.0	8.3	12.3
R23	20.1	18.6	13.6	8.6	7.5	7.3	11.0	14.6

Table 39 – Revised Night SSNL Minus Predicted Proposed Development Noise Levels, dB

Receptor ID	Standardised 10 m height wind speed (ms ⁻¹)							
	3	4	5	6	7	8	9	10
R1	18.8	16.9	12.1	8.0	7.2	7.1	7.1	7.1
R2	18.3	16.3	11.5	7.4	6.5	6.5	6.5	6.5
R3	15.4	13.4	8.6	4.4	3.5	3.5	3.5	3.6
R4	18.4	16.7	11.9	7.7	6.7	6.7	6.7	6.6
R5	18.8	17.2	12.4	8.3	7.3	7.3	7.1	7.0
R6	18.2	16.7	12.0	7.8	6.7	6.6	6.5	8.4
R7	15.1	13.6	8.9	4.5	3.4	3.4	3.3	6.7
R8	12.7	10.8	6.0	1.6	0.6	0.5	0.5	4.2
R9	14.8	12.8	8.0	3.8	2.9	2.8	2.9	4.3
R10	16.3	14.3	9.4	5.0	4.0	4.0	4.0	7.8
R11	17.4	15.2	10.4	6.0	5.1	5.1	5.2	8.1
R12	18.4	16.5	11.6	6.8	5.8	5.7	7.5	11.3
R13	17.8	16.2	11.4	6.6	5.5	5.4	5.2	7.5
R14	19.7	18.2	13.5	9.3	8.2	8.2	8.1	9.9
R15	21.8	20.2	15.5	11.3	10.4	10.2	10.2	12.1
R16	23.3	21.8	17.2	12.9	12.0	11.9	11.9	13.6
R17	22.3	20.9	16.3	12.0	11.0	11.0	10.8	12.6
R18	24.1	22.6	17.9	13.7	12.7	12.7	12.6	14.4
R19	24.0	22.6	17.9	13.7	12.6	12.6	12.5	14.3
R20	24.0	22.4	17.7	13.4	12.4	12.4	12.2	14.3
R21	21.6	19.8	14.9	9.9	8.6	8.6	10.5	14.3
R22	21.8	20.2	15.4	10.8	9.7	9.7	11.3	14.8
R23	24.2	22.6	17.8	13.4	12.5	12.3	13.8	17.1

Financial Involvement Sensitivity Check

4.23 The day SSNL is predicted to be exceeded at R7, R8 and R10, but most notably at R8 (as well as at R3, R12, R13 and R21 in the scenario that The Drum appeal is successful).

If these properties were financially involved in the Proposed Development, then the TNAC and SSNLs would be as set out in **Table 40** and **Table 41**, alongside comparisons of relevant predicted noise levels.

Table 40 – Financial Involvement Sensitivity Check – The Drum Appeal Unsuccessful

[illegible]

Receptor ID	Metric	Standardised 10 m height wind speed (ms ⁻¹)							
		3	4	5	6	7	8	9	10
R7	Day TNAC Minus Predicted Cumulative Noise Levels, dB	16.8	15.3	10.7	6.6	5.6	5.6	5.5	5.3
R8		14.5	12.6	7.9	3.9	3.0	3.0	3.0	3.0
R10		17.1	15.2	10.5	6.4	5.6	5.6	5.6	5.6
R7	Day SSNL, dB LA90	45.0	45.0	45.0	44.9	44.9	44.9	44.9	44.9
R8		45.0	45.0	45.0	44.9	44.9	44.9	44.9	44.9
R10		45.0	45.0	44.9	44.7	44.7	44.7	44.7	44.7
R7	Day SSNL Minus Predicted Noise Levels, dB	17.1	15.6	11.0	6.8	5.8	5.8	5.7	5.5
R8		14.8	12.9	8.2	4.1	3.2	3.2	3.2	3.2
R10		18.4	16.4	11.6	7.4	6.6	6.6	6.6	6.6

4.24 If The Drum appeal is not successful, financial involvement of these receptors would result in a smallest margin between predicted cumulative noise levels and the TNAC of 3.0 dB, and a smallest margin between predicted Proposed Development noise levels to the SSNL of 3.2 dB.

Table 41 – Financial Involvement Sensitivity Check – The Drum Appeal Successful

Receptor ID	Metric	Standardised 10 m height wind speed (ms ⁻¹)							
		3	4	5	6	7	8	9	10
R3	Day TNAC, dB LA90	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0
R7		45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0
R8		45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0
R10		45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0
R12		45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.2
R13		45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0
R21		45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.2
R3	Day TNAC Minus Predicted Cumulative Noise Levels, dB	16.5	14.7	10.0	5.9	5.2	5.1	5.1	5.1
R7		16.0	14.6	9.9	5.8	4.9	4.8	4.7	4.5
R8		13.9	12.1	7.3	3.3	2.5	2.5	2.4	2.4
R10		16.4	14.6	9.9	5.8	5.0	4.9	4.9	4.9
R12		16.8	15.1	10.4	6.2	5.4	5.3	5.3	5.4
R13		16.6	15.2	10.5	6.3	5.5	5.4	5.2	5.1
R21		17.4	15.8	11.0	6.7	5.9	5.9	5.8	6.0
R3	Day SSNL, dB LA90	45.0	45.0	44.9	44.8	44.8	44.8	44.8	44.7
R7		45.0	45.0	44.9	44.7	44.7	44.7	44.7	44.7
R8		45.0	45.0	44.9	44.6	44.5	44.5	44.5	44.5
R10		45.0	44.9	44.8	44.6	44.5	44.5	44.4	44.4
R12		44.9	44.9	44.8	44.3	44.2	44.2	44.2	44.4
R13		44.9	44.9	44.8	44.4	44.3	44.3	44.3	44.2
R21		44.9	44.9	44.7	44.2	44.0	44.0	44.0	44.3

Receptor ID	Metric	Standardised 10 m height wind speed (ms ⁻¹)							
		3	4	5	6	7	8	9	10
R3	Day SSNL Minus Predicted Noise Levels, dB	17.4	15.4	10.6	6.5	5.7	5.7	5.7	5.7
R7		17.1	15.6	10.9	6.6	5.6	5.6	5.5	5.3
R8		14.8	12.9	8.1	3.8	2.8	2.8	2.8	2.8
R10		18.4	16.3	11.5	7.3	6.4	6.4	6.3	6.3
R12		20.4	18.5	13.8	9.2	8.3	8.3	8.3	8.5
R13		19.8	18.2	13.5	9.0	8.0	7.9	7.8	7.6
R21		23.6	21.8	17.0	12.4	11.3	11.3	11.3	11.5

4.25 If The Drum appeal is successful, financial involvement of these receptors would result in a smallest margin between predicted cumulative noise levels and the TNAC of 2.4 dB, and between predicted Proposed Development noise levels to the SSNL of 2.8 dB.

5. FIXED-PLANT NOISE FROM THE BESS AND SUBSTATION

Numerical Assessment Basis

5.1 Detailed equipment source data are not available for the BESS, substation and associated fixed plant. Source-specific propagation predictions have therefore not been undertaken. This section records the numerical basis of the limits-led assessment.

5.2 The M1 – Whiteholm location has been adopted as representative of the controlling fixed-plant receptor context. The representative background sound levels at this location are shown in **Table 27** (see **Technical Appendix 9.2** for further details) as 28 dB L_{A90,T} during the daytime and 24 dB L_{A90,T} during the night.

5.3 Initial criteria of rating levels 5 dB above background sound levels are set intending to avoid significant adverse effects. However, low ambient sound levels and rating levels are identified based on professional judgement for this project to be 35 dB, whereby levels at or below 35 dB would be unlikely to result in significant adverse noise effects (see **Technical Appendix 9.1** for further details). The assessment basis is set out in **Table 42**.

Table 42 – Fixed-Plant Numerical Assessment Basis

Time Period	Representative Background Sound Level	Background Plus 5 dB	Assessed Combined Rating Level	Difference Above Background
Day	28	33	35	+7
Night	24	29	35	+11

5.4 The assessed level is a combined rating level and therefore includes any applicable corrections for tonality, impulsivity, intermittency or other distinctive acoustic

characteristics. Where a character correction applies, the corresponding permissible specific sound level would be lower.