

8 Noise

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8 Noise

8.1 Executive Summary

- 8.1.1 This assessment considers potential noise effects associated with the 2020 Layout of the Proposed Development and supersedes the findings of the 2019 EIA Report to the extent specified.
- 8.1.2 The assessment has included an update to predictions of operational wind noise; all other aspects have been assumed to be the same as those considered in the 2019 EIA Report. Additional consultation has been undertaken with Shetland Islands Council with regard to a change to the method of consideration of cumulative noise effects.
- 8.1.3 This assessment has determined that operational noise from wind turbines associated with the 2020 Layout will be not significant, both in isolation and cumulatively.

8.2 Introduction

- 8.2.1 This chapter considers the potential changes in noise and vibration effects associated with the Proposed Development, following the changes to the 2019 Layout, as set out in the 2019 EIA Report.
- 8.1.1 The 2020 Layout incorporates six fewer turbines, nine turbines of lower tip heights, and a reduction in infrastructure, compared with the 2019 Layout, which will affect potential construction and operational noise. This assessment assumes that the lower tip heights of the nine reduced height turbines will correspond to lower hub heights (i.e. consistent rotor size), based on a single candidate turbine model.
- 8.1.2 The noise chapter (Chapter 8) of the 2019 EIA Report is complemented by **Appendix 8.1** which contains a glossary of terminology, which may assist the reader in their interpretation of the 2020 SEI.

Scope of Assessment

- 8.1.3 The scope of this assessment has comprised the following:
- evaluation of noise effects associated with the Proposed Development candidate turbine (in isolation and cumulatively with other wind farm developments);
 - specification of appropriate mitigation, where necessary; and
 - evaluation of residual effects.
- 8.1.4 The 2020 Layout comprises less infrastructure than the 2019 Layout; there are fewer turbines, borrow pits, construction compounds and a smaller distance of access track. As such, construction noise effects will be lesser than those evaluated in the 2019 EIA Report.
- 8.1.5 No updated predictions of construction noise have therefore been undertaken; the predicted levels considered in the 2019 EIA Report have been assumed to be representative of 'worst-case' levels for the 2020 Layout. Predicted construction-phase effects are therefore the same as those reported in the 2019 EIA Report and therefore remain not significant.
- 8.1.6 Similarly, fixed non-turbine plant (i.e. substations and transformers) remain unchanged from the 2019 Layout, and therefore no updated assessment of such plant is required. Predicted operational phase effects are therefore the same as those reported in the 2019 EIA Report and remain not significant.

8.3 Response to Consultation Responses

Shetland Islands Council

- 8.3.1 Shetland Islands Council (SIC) Environmental Health confirmed that they accepted the findings of the 2019 EIA Report, and confirmed that any potential cumulative effects will be not significant.
- 8.3.2 Supplementary consultation has been undertaken with SIC as part of the 2020 SEI, with regard to the evaluation of cumulative effects, and the derivation of noise limits. Supplementary correspondence between ITPE and SIC to agree the revised approach is provided in 2020 SEI **Appendix 8.1**.

8.4 Residual Effects Considered in 2019 EIA Report

- 8.4.1 Following the change in design of the Proposed Development a re-assessment of the residual effects of the Proposed Development upon the receptors identified in the 2019 EIA Report has been undertaken. This assessment assumes that all mitigation detailed within the 2019 EIA Report is undertaken.

8.5 Assessment Methodology and Significance Criteria

Legislation, Policy and Guidelines

- 8.5.1 A review has been undertaken of legislation, policy and guidance documents which informed the 2019 EIA Report. The majority of the guidance and legislation remains unchanged, however, an updated version of BS4142 has been issued. British Standard BS4142:2014+A1:2019 Methods for rating and assessing industrial and commercial sound was updated in 2019, however, the changes are minor, and are not significant in the context of this assessment.

Study Area and Noise Sensitive Receptors

- 8.5.2 The study area and Noise Sensitive Receptors (NSRs) at which potential noise effects have been evaluated in this assessment are the same as those considered in the 2019 EIA Report. The study area and NSRs are shown in **Figure 8.1** of the 2020 SEI, NSRs are listed in **Table 8.1**, with distances reported correct for the current layout.

Table 8.1 – NSRs Considered in Assessment

<i>NSR ID</i>	<i>NSR Name</i>	<i>Distance from closest proposed turbine, m</i>	<i>Direction from closest proposed turbine</i>
NSR1	Gloup	1,800	North
NSR2	Hill of Breckon	2,400	North-east
NSR3	Cullivoe (northern end)	2,300	East
NSR4	Cullivoe (southern end)	2,400	East
NSR5	Gutcher (Laurenlea)	3,000	East-south-east
NSR6	Sellafirth	1,700	South

- 8.5.3 Under the revised layout, with the removal of T4 and T29, the distance between NSR1, NSR2 and NSR3 and the closest turbine has increased compared with the 2019 Layout.
- 8.5.4 The NSR locations were selected to represent clusters of properties at the closest approach to the turbines of the Proposed Development. Noise effects at properties further away will be lesser, and therefore less significant.

Changes to prediction method

- 8.5.5 The prediction method used in this assessment is the same as that reported in the 2019 EIA Report. The exception being the change in sound power levels for turbines when corrected to 10 m height, for those turbines with an assumed reduced hub height. The sound power data for the proposed turbines has been derived from hub-height data to 10 m wind speed in accordance with the method provided in the Institute of Acoustics' Good Practice Guide (IoA GPG¹). The sound power levels have been derived to 10 m height wind speed for both proposed hub heights (100 m and 130 m), and applied to each turbine accordingly, rather than to a single hub height (130 m in 2019 EIA Report).

Evaluation Criteria

Wind Turbine Noise

- 8.5.6 The noise limits applicable to the construction and operation phases are reported in the 2019 EIA Report. These were derived in accordance with appropriate guidance from measured baseline noise levels. The guidance used, approach to derivation of the criteria, and results of the baseline survey are provided in the 2019 EIA Report.
- 8.5.7 The derived wind-turbine noise limits provided in the 2019 EIA Report are provided in **Table 8.2**.

Table 8.2 – Operational Noise Limits by Noise Monitoring Position – Wind Turbine Noise

Period	Wind Speed (m/s)								
	4	5	6	7	8	9	10	11	12
NMP1 – Gloop									
Daytime noise limit, dBL _{A90,10min}	40.0	40.0	40.0	40.0	40.0	40.0	40.0	41.3	45.8
Night-time noise limit, dBL _{A90,10min}	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
Applicable at:	NSR1 Gloop								
NMP2 – Hill of Breckon									
Daytime noise limit, dBL _{A90,10min}	40.0	40.0	40.0	40.0	40.0	40.0	42.0	44.7	46.7
Night-time noise limit, dBL _{A90,10min}	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
Applicable at:	NSR2 Hill of Breckon, NSR3 Cullivoe north and NSR4 Cullivoe south								

¹ A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise.

Period	Wind Speed (m/s)								
	4	5	6	7	8	9	10	11	12
NMP4 – Sellafirth									
Daytime noise limit, dBL _{A90,10min}	40.0	40.0	40.0	40.0	40.0	41.3	42.2	42.3	41.8 ²
Night-time noise limit, dBL _{A90,10min}	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.8	44.3
Applicable at:	NSR6 Sellafirth								

- 8.5.8 Monitoring data from NMP3 was reported in the 2019 EIA Report, however, it was not used to derive noise limits for any NSRs as the sound level meter ceased recording due to water damage. Measured levels at NMP3 were higher than those at NMP2, therefore in a robust and precautionary approach NMP2 was used to derive noise limits across Cullivoe. The same approach is followed here, and baseline data from NMP3 has not been used.
- 8.5.9 Potential cumulative noise effects with Garth Wind Farm have been identified at NSR5 – Gutcher. At all other NSRs, potential cumulative effects with Garth Wind Farm have been determined through prediction to be negligible/not occur. The noise limits applicable at Garth therefore require further consideration.
- 8.5.10 Cumulative effects arising from the two single turbines at Sellafirth were considered in the 2019 EIA Report in the derivation of the noise limits from background levels, whereby predicted noise levels from these turbines were subtracted from the measured background level recorded at the Sellafirth monitoring location. This approach is maintained in the 2020 assessment and no further consideration of cumulative noise is therefore required at Sellafirth.
- 8.5.11 There are existing consented noise limits applicable to the operational Garth Wind Farm for the receptor “Smithfield” at Gutcher. The 2019 EIA Report considered cumulative compliance with noise limits, such that the predicted noise levels from the Proposed Development and Garth operating together should not breach the existing Garth noise limits³.
- 8.5.12 In line with best practice, and to protect the Proposed Development and existing Garth Wind Farm from potential future changes in the cumulative situation, this assessment goes one step further, and determines a noise limit specifically applicable to the Proposed Development. The IoA GPG describes methods by which noise limits may be apportioned between cumulative developments, according to different scenarios.
- 8.5.13 In the scenario whereby an existing wind farm is present, consented to the full ETSU limits, then one of the following alternative approaches may be applied:
- **Consent the new wind farm to noise limits 10 dB below that of the existing wind farm** – this approach is robust, however, it is potentially over-conservative if the existing wind farm is operating at substantially below its noise limits and there is therefore ‘headroom’ available for use by the new wind farm; or

² This limit (NMP4 daytime 12 m/s) has been revised slightly since the 2019 EIA Report, following a review of measured baseline data and a cross-check against reported limits, correcting a previous transcription error.

³ The noise limits for Garth Wind Farm are not tabulated in the Garth EIA. We note that the fixed minimum ETSU limits were set at 40 dB daytime / 43 dB night-time and have sought to interpolate the limits from the graphs provided in the Garth EIA appendix for Smithfield (monitoring location 2). Interpolated noise limits have been agreed with Shetland Islands Council.

- **Significant presented headroom** – where there is *significant headroom* (margin of 5 – 10 dB suggested by the IoA GPG) between the noise level of the existing wind farm and its noise limit, then the new wind farm may use this headroom.

8.5.14 This assessment adopts the second approach; while it has been established that the Proposed Development has a negligible contribution to total noise levels at NSR5, a noise limit 10 dB below the consented ETSU limits is considered highly conservative, and potentially restrictive to future turbine model choice for the Proposed Development. The approach followed is set out in detail below:

- The sound power levels for the installed model of turbine (Enercon E44) are provided for Garth Wind Farm on the OIC planning portal as part of the discharging of its planning conditions. These have been used to model operational noise from Garth Wind Farm.
- The predicted levels due to Garth Wind Farm have been subtracted from the consented noise limits, such that headroom may be identified at each integer wind speed.
- Predicted levels due to Garth Wind Farm are more than 5 dB below the applicable noise limits at all wind speeds. Accordingly, 'significant headroom' is available as per the IoA GPG definition.
- Predicted levels due to Garth Wind Farm, plus a +2 dB 'cautious prediction' correction, have been logarithmically subtracted from the total ETSU daytime and night-time limits to determine the residual limit available to the Proposed Development. The cautious prediction allows a further margin of safety to Garth Wind Farm predictions, allowing for any change in turbine noise over time.

8.5.15 The derived noise limits applicable at NSR5 (Gutcher) are provided in **Table 8.3**.

Table 8.3 – Derivation of Operational Noise Limits at NSR5 - Gutcher

Item	Wind Speed (m/s)								
	4	5	6	7	8	9	10	11	12
Total ETSU daytime limit, dBL _{A90,10min}	40.0	40.0	40.0	40.0	40.0	40.8	41.7	42.5	43.3
Predicted level due to Garth Wind Farm, dBL _{A90,10min}	32.3	32.3	32.3	32.3	33.8	34.6	34.6	34.6	34.6
Headroom	7.7	7.7	7.7	7.7	6.2	6.2	7.1	7.9	8.7
Cautious predicted level due to Garth Wind Farm, dB	34.3	34.3	34.3	34.3	35.8	36.6	36.6	36.6	36.6
Derived daytime noise limit applicable to Proposed Development, dBL _{A90,10min}	38.6	38.6	38.6	38.6	37.9	38.7	40.1	41.2	42.3
Total ETSU night-time limit, dBL _{A90,10min}	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.5

Item	Wind Speed (m/s)									
	4	5	6	7	8	9	10	11	12	
Predicted level due to Garth Wind Farm, dBL _{A90,10min}	32.3	32.3	32.3	32.3	33.8	34.6	34.6	34.6	34.6	
Headroom	10.7	10.7	10.7	10.7	9.2	8.4	8.4	8.4	8.9	
Cautious predicted level due to Garth, dB	34.3	34.3	34.3	34.3	35.8	36.6	36.6	36.6	36.6	
Derived night time noise limit applicable to Proposed Development, dBL _{A90,10min}	42.4	42.4	42.4	42.4	42.1	41.9	41.9	41.9	42.5	

Evaluation criteria

8.5.16 This assessment uses the same evaluation criteria as the 2019 EIA Report, which are reproduced in **Table 8.4**, **Table 8.5** and **Table 8.6** for ease of reference.

Table 8.4 - Receptor Sensitivity Criteria

Receptor Sensitivity	Description	Examples
High	Receptors where people or operations are particularly susceptible to noise and/or vibration.	Residential, quiet outdoor recreational areas, schools and hospitals.
Medium	Receptors moderately sensitive to noise and/or vibration, where it may cause some distraction or disturbance.	Offices and restaurants.
Low	Receptors where distraction or disturbance from noise and/or vibration is minimal.	Buildings not occupied, factories and working environments with existing levels of noise.

8.5.17 All identified NSRs are residential and are therefore considered to be of 'High' sensitivity.

Table 8.5 - Impact Magnitude Scale – Wind Turbine Noise

Difference (d) between cumulative turbine noise level and applicable limit (dB)	Impact magnitude
$d \geq +5$	High
$0 \leq d < +5$	Medium
$-10 \leq d < 0$	Low
< -10	Negligible

8.5.18 Exceedances of the derived noise limits will result in impact magnitudes of 'Medium' or 'High'.

Table 8.6 - Significance of effect matrix

Impact Magnitude	Receptor Sensitivity		
	High	Medium	Low
High	Major	Moderate	Minor
Medium	Moderate	Minor	Neutral
Low	Minor	Neutral	Neutral
Negligible	Neutral	Neutral	Neutral

- 8.5.19 Effects with a significance of ‘Medium’ or greater are considered ‘significant’. At High sensitivity receptors, predicted noise levels which exceed the noise limits will result in significant effects. Predicted compliance with the noise limits will result in effects which are ‘not significant’.

8.6 Assessment of Residual Effects

Operation

- 8.6.1 Predicted operational noise from the Proposed Development at NSRs are provided in **Table 8.7**, and evaluated against the noise limits (as provided in **Table 8.2**).

Table 8.7 – Evaluation of Predicted Operational Noise Levels

Impact Magnitude	Wind Speed, m/s								
	4	5	6	7	8	9	10	11	12
NSR1 – Gloop									
Predicted noise level, dBL_{A90}	24.1	30.5	33.8	34.2	34.2	34.2	34.2	34.2	34.2
Margin of compliance with daytime noise limit, dB	15.9	9.5	6.2	5.8	5.8	5.8	5.8	7.1	11.6
Margin of compliance with night-time noise limit, dB	18.9	12.5	9.2	8.8	8.8	8.8	8.8	8.8	8.8
Daytime Impact Magnitude: Low					Daytime Effect significance: Minor				
Night-time Impact Magnitude: Low					Night-time Effect significance: Minor				

Impact Magnitude	Wind Speed, m/s								
	4	5	6	7	8	9	10	11	12
NSR2 – Hill of Breckon									
Predicted noise level, dBL _{A90}	21.3	27.7	31.0	31.4	31.4	31.4	31.4	31.4	31.4
Margin of compliance with daytime noise limit, dB	18.7	12.3	9.0	8.6	8.6	8.6	10.6	13.3	15.3
Margin of compliance with night-time noise limit, dB	21.7	15.3	12.0	11.6	11.6	11.6	11.6	11.6	11.6
Daytime Impact Magnitude: Low					Daytime Effect significance: Minor				
Night-time Impact Magnitude: Negligible					Night-time Effect significance: Neutral				
NSR3 – Cullivoe (north)									
Predicted noise level, dBL _{A90}	21.4	27.8	31.1	31.5	31.5	31.5	31.5	31.5	31.5
Margin of compliance with daytime noise limit, dB	18.6	12.2	8.9	8.5	8.5	8.5	10.5	13.2	15.2
Margin of compliance with night-time noise limit, dB	21.6	15.2	11.9	11.5	11.5	11.5	11.5	11.5	11.5
Daytime Impact Magnitude: Low					Daytime Effect significance: Minor				
Night-time Impact Magnitude: Negligible					Night-time Effect significance: Neutral				
NSR4 – Cullivoe (south)									
Predicted noise level, dBL _{A90}	21.4	27.8	31.0	31.4	31.4	31.4	31.4	31.4	31.4
Margin of compliance with daytime noise limit, dB	18.6	12.2	9.0	8.6	8.6	8.6	10.6	13.3	15.3
Margin of compliance with night-time noise limit, dB	21.6	15.2	12.0	11.6	11.6	11.6	11.6	11.6	11.6

Impact Magnitude	Wind Speed, m/s								
	4	5	6	7	8	9	10	11	12
Daytime Impact Magnitude: Low					Daytime Effect significance: Minor				
Night-time Impact Magnitude: Negligible					Night-time Effect significance: Neutral				
NSR5 - Gutcher									
Predicted noise level, dBL _{A90}	19.2	25.8	29.0	29.3	29.3	29.3	29.3	29.3	29.3
Margin of compliance with daytime noise limit, dB	19.4	12.8	9.6	9.3	8.6	9.4	10.8	11.9	13.0
Margin of compliance with night-time noise limit, dB	23.2	16.6	13.4	13.1	12.8	12.6	12.6	12.6	13.2
Daytime Impact Magnitude: Low					Daytime Effect significance: Minor				
Night-time Impact Magnitude: Negligible					Night-time Effect significance: Neutral				
NSR6 – Sellafirth									
Predicted noise level, dBL _{A90}	25.1	31.8	34.9	35.2	35.2	35.2	35.2	35.2	35.2
Margin of compliance with daytime noise limit, dB	14.9	8.2	5.1	4.8	4.8	6.1	7.0	7.1	6.6
Margin of compliance with night-time noise limit, dB	17.9	11.2	8.1	7.8	7.8	7.8	7.8	8.6	9.1
Daytime Impact Magnitude: Low					Daytime Effect significance: Minor				
Night-time Impact Magnitude: Low					Night-time Effect significance: Minor				

- 8.6.2 Predicted noise levels arising due to operation of the Proposed Development are within the noise limits at all identified representative NSRs, by a margin of typically less than 10 dB during the daytime across the range of operational wind speeds. The derived effect significance at all representative NSRs is therefore minor during the daytime period.
- 8.6.3 During the night-time period, predicted operational noise levels are within the derived noise limits by a margin of more than 10 dB at NSR2, NSR3, NSR4 and NSR5 across the range of operational wind speeds. The resultant effect significance at these NSRs is therefore neutral during the night-time period. Operational noise levels are within the night-time noise limits by a margin of less than 10 dB

across the range of operational winds speeds at NSR1 and NSR6, and the resultant effect significance is minor.

8.6.4 Operational noise effects have therefore been determined to be not significant.

8.7 Additional Mitigation

8.7.1 Predicted operational noise from wind turbines has been demonstrated to comply with appropriate noise limits, both for the Proposed Development operating in isolation and cumulatively. No additional mitigation is therefore required.

8.8 Assessment of Cumulative Effects

8.8.1 As required by ETSU-R-97, the completed assessment of operational turbine noise includes potential cumulative impacts from other local wind farm developments which are operational, approved, and subject to valid planning applications. It has been demonstrated that the ETSU-R-97 noise level limits, which are applicable to cumulative noise, can be complied with.

8.8.2 For construction noise, construction vibration and noise from fixed (non-turbine) plant, the considered cumulative developments are sufficiently removed, such that no change in the identified effect significances is anticipated to arise should construction works or operation occur simultaneously.

8.9 Comparison of Effects

8.9.1 The change in effects between the EIAR layout and the revised layout and a summary of cumulative effects is provided in Table 8.8 and Table 8.9, respectively.

Table 8.8 – Summary of Effects

Description of Effect	2019 Effects		2020 Effects	
	Significance	Beneficial/ Adverse	Significance	Beneficial/ Adverse
Noise from operational wind turbines (daytime period)	Minor	Adverse	Minor	Adverse
Noise from operational wind turbines (night-time period)	Minor/Neutral	Adverse	Minor/Neutral	Adverse

Table 8.9 – Summary of Cumulative Effects

Receptor	Effect	Cumulative Developments	2019 Cumulative Effect		2020 Cumulative Effect	
			Significance	Beneficial/ Adverse	Significance	Beneficial/ Adverse
All identified NSRs	Noise from operational wind turbines	Garth	Minor/Neutral	Adverse	Minor/Neutral	Adverse

8.10 References

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