Ben Sca Wind Farm Limited

Ben Sca Redesign Wind Farm EIA Report

TA9.3: Noise and Vibration Impact Assessment Report

Project Number: 23104

Document Reference: 23104-R1 V2

Document Date: 08/11/2023

Contents

1 Non-Technical Summary

1.1.1 Bow Acoustics has been appointed by Ben Sca Wind Farm Limited to conduct a noise and vibration assessment for the Ben Sca Redesign Wind Farm comprising proposed minor adjustments to the blade tip height, rotor diameter and associated infrastructure of the consented Ben Sca Wind Farm (20/00013/FUL) and Ben Sca Wind Farm Extension (21/05767/FUL) ('Proposed Development'). The site is located approximately 2.5km to the southwest of Edinbane and 7km to the east of Dunvegan in the northwest of the Isle of Skye.

1.1.2 A noise assessment was carried out for each of the previous two applications and planning consent was granted by The Highland Council (THC) which included conditioned noise limits at nearby noise sensitive receptors (NSRs).

1.1.3 The Proposed Development would not alter the construction noise and vibration impacts previously reported in the EIA Reports for Ben Sca Wind Farm and Ben Sca Wind Farm Extension.

1.1.4 An updated operational noise impact assessment for the Proposed Development has been undertaken in accordance with current policy, latest good practice guidance and agreed with THC. The operational wind turbine noise from the Proposed Development has been assessed against the combined consented noise limits for Ben Sca Wind Farm and Ben Sca Wind Farm Extension. It is demonstrated that the Proposed Development can operate within the consented noise limits; and, therefore, would be acceptable.

1.1.5 A cumulative noise assessment was not necessary as the impacts previously reported have not changed and any alterations in the cumulative situation surrounding the Ben Sca Wind Farm and Ben Sca Wind Farm Extension have already been taken into account within the noise assessments for subsequent cumulative developments. This approach has been agreed with THC Environmental Health Department in September and October 2023.

2 Introduction

2.1.1 This assessment has been carried out by Richard Carter CEng, BEng(Hons), MIOA, a Director at Bow Acoustics Ltd. Richard has worked in the field of acoustics for over 18 years, with over 13 years' experience specialising in the assessment of wind farm noise. Richard has a Bachelor of Engineering (BEng (Hons)), a post graduate diploma in acoustics and noise control, is a member of the Institute of Acoustics (MIOA) and is a Chartered Engineer (CEng). He has extensive experience in all aspects of environmental surveying, noise modelling and impact assessment for various sectors including wind energy, industrial, commercial and residential.

2.1.2 The noise assessment has undertaken the following:

- consultation with the Highland Council (THC) Environmental Health Department to discuss and agree on the approach to the assessment;
- determined site-specific noise limits from consented noise levels of Ben Sca Wind Farm (20/00013/FUL) and Ben Sca Wind Farm Extension (21/05767/FUL); and
- calculated the operational wind turbine noise from the Proposed Development and assessed against the site-specific noise limits in accordance with the Department of Trade and Industry Noise Working Group ETSU-R-97 'The Assessment and Rating of Noise from Wind Farms' and IOA GPG.

2.1.3 Wind turbines may emit two types of noise when operating. Firstly, aerodynamic noise produced as the blades pass through the air. Secondly, mechanical noise from components within the nacelle of a wind turbine. Aerodynamic noise can be characterised as a more natural 'swish' sound, whereas mechanical noise is generally characterised by its tonal content. Over the years

mechanical noise has been engineered to much lower levels owing to its reduced acceptability when compared with aerodynamic noise. At very low wind speeds the turbine blades do not rotate or rotate very slowly and so negligible aerodynamic noise is generated. In higher winds, background noise, such as wind disturbed vegetation, will increase, along with aerodynamic noise from the turbine blades. The subjective audibility of the wind farm will be determined by the relative difference between background noise and wind turbine aerodynamic noise. This difference forms the basis of the noise assessment.

3 Policy and Guidance Documents

3.1 Legislation

3.1.1 In the UK, noise and vibration and nuisance are controlled using the Environmental Protection Act 1990 (EPA)[i].

Environmental Protection Act (1990)

3.1.2 The EPA provides powers to control noise where a statutory noise nuisance exists. Section 80 of the EPA states that where a statutory nuisance exists, or is likely to occur or reoccur, then the responsible Local Authority shall serve a notice requiring the abatement of the nuisance; or prohibiting its occurrence or reoccurrence, as well as requiring any such steps as may be necessary to abate the nuisance including a specification of the timescales in which to take such action. Section 82 of the EPA provides an individual subject to a statutory nuisance the right to make representations to the courts and for the courts to take such action, as may be appropriate, against the originator of that nuisance such that the nuisance is abated.

3.2 Local Policy

3.2.1 The Scottish planning system is designed to be applied by local government and communities. Local government administers much of the planning system, including the preparation of Local Development Plans which sets out the vision of future development in the area and are often tailored for different types of development. In determining planning applications decision makers have to consider the development against the Local Development Plans, unless other material considerations indicate otherwise. This includes national planning policy and guidance documentation.

The Highland-wind Local Plan

3.2.2 The Highland-wide Local Development Plan (HwLDP)[ii] was adopted by THC on 05 April 2012. The HwLDP sets out the overarching spatial planning policy for the whole of the Highland Council area, except the area covered by the Cairngorms National Park Local Plan, which is subject to a separate Development Plan.

3.2.3 Chapter 22 of HwLDP addresses sustainable development and climate change and recognises the great potential the Highlands area has for renewable energy generation. Onshore wind is recognised as one of the technologies making substantial contributions to renewable energy production in The Highlands.

3.2.4 Policy 67, Renewable Energy Developments, of the HwLDP states:
"… Subject to balancing with these considerations and taking into account any mitigation measures to be included, the Council will support proposals [for renewable energy generation] where it is satisfied that they are located, sited and designed such that they will not be significantly detrimental overall, either individually or cumulatively with other developments (see Glossary), having regard in particular to any significant effects on the following: … the safety and amenity of any regularly occupied buildings and the grounds that they occupy- having regard to visual intrusion or the likely effect of noise generation…"

Onshore Wind Energy Supplementary Guidance

3.2.5 The Onshore Wind Energy Supplementary Guidance (OWESG)[iii] sets out how THC intend to manage onshore wind energy development proposals. Section 4 of the OWESG details key development plan considerations and has a sub-section on noise assessments which recognises ETSU-R-97 and the Institute of Acoustics Good Practice Guide as best practice when assessing noise from wind turbines. Both these documents are discussed further below.

3.2.6 In response to the largely undeveloped nature of, and generally lower levels of background noise found in, the Highlands, THC seek to achieve noise limits at sensitive locations that are at the lower end of the range indicated in national guidance. Advice is given to consult with THC over the suitability of survey locations. Cumulative noise from other wind farms in the area are to be adequately assessed in accordance with best practice, which includes consideration of both predicted and consented levels.

3.3 National Noise Planning Policy

National Planning Framework 4

3.3.1 National Planning Framework 4 (NPF4)[iv] sets out national spatial strategy for Scotland which reflect Scottish Ministers' priorities for operation of the planning system and for the development and use of land with the objective of playing a key role in delivering on the United Nations Sustainable Development Goals. It states, in the Energy section that Local Development Plans should seek to realise their area's full potential for electricity from renewable, low carbon and zero emission sources. Policy 11 supports development proposals for all forms of renewable energy, including wind farms. It further states in Policy 11 that any such development will require project design and mitigation to demonstrate how impacts such as residential amenity have been addressed.

Planning Advice Note PAN 1/2011

3.3.2 PAN 1/2011[v] provides advice on the role of the planning system in helping to prevent and limit the adverse effects of noise. PAN1/2011 provides general advice on a range of noise related planning matters, including references to noise associated with both construction activities and operational wind farms. In relation to operational noise from wind farms, Paragraph 29 states that:
"There are two sources of noise from wind turbines - the mechanical noise from the turbines and the aerodynamic noise from the blades. Mechanical noise is related to engineering design. Aerodynamic noise varies with rotor design and wind speed, and is generally greatest at low speeds. Good acoustical design and siting of turbines is essential to minimise the potential to generate noise. Web based planning advice on renewable technologies for Onshore wind turbines provides advice on 'The Assessment and Rating of Noise from Wind Farms' (ETSU-R-97) published by the former Department of Trade and Industry [DTI] and the findings of the Salford University report into Aerodynamic Modulation of Wind Turbine Noise."

3.3.3 PAN 1/2011 advises the preference to control construction noise through the Control of Pollution Act 1974 and the Pollution Prevention Control Act 1999, over the use of planning conditions.

Onshore Wind Turbines: Planning Advice

3.3.4 The Scottish Government's Onshore Wind Turbine[vi] web-based guidance document provides further advice on noise from wind turbines. It too confirms that ETSU-R-97 should be followed to assess and rate noise from wind turbines until such a time an update is available. Further reference is made to the Institute of Acoustics 'Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise' as current industry good practice and the appropriate document to be used by all IOA members and those undertaking assessments to ETSU-R-97.

Assessment of Noise: Technical Advice Note

3.3.5 The Technical Advice Note[vii] provides guidance aimed to assist in the technical evaluation of noise assessment and the significance of impact. This document refers to the web-based planning advice and ETSU-R-97 when assessing noise from wind turbines.

3.4 Guidance Documentation

ETSU-R-97 The Assessment and Rating of Noise from Wind Farms

3.4.1 As introduced above, the ETSU report ETSU-R-97 'The Assessment and Rating of Noise from Wind Farms' (ETSU-R-97)[viii] is endorsed by national planning policy as the appropriate guidance document for the assessment of noise from wind turbines. The basic aim of ETSU-R-97 is to provide indicative noise levels thought to offer reasonable protection to wind farm neighbours without placing unreasonable restrictions on wind farm developments, or adding unduly to the costs and administrative burdens on wind farm developers or local authorities.

3.4.2 ETSU-R-97 recommends that the acceptability of wind farm noise should be assessed relative to existing background noise levels at nearby properties. It recognises that both background noise and wind turbine noise vary with wind speed and suggests that noise from wind turbines should be limited to 5 dB above the background noise at all times. It does however also suggest absolute lower fixed limits of between 35 and 40 dB L_{A90} for daytime and 43 dB L_{A90} for night-time.

3.4.3 An increased noise limit of 45 dB L_{A90}, or background noise plus 5 dB, whichever is greater, is suggested for both daytime and night-time periods for properties where the occupier has financial involvement in the wind farm.

3.4.4 Where noise at the nearest property is limited to 35 dB L_{A90} up to wind speeds of 10 m/s, then it need not be considered in the noise assessment, as protection of the amenity of these properties can be controlled through a simplified noise limit.

3.4.5 Where the need for a background noise survey is required, ETSU-R-97 provides guidance on the appropriate positioning, equipment, and duration of survey.

Institute of Acoustics' Good Practice Guide to ETSU-R-97

3.4.6 'A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise' (IOA GPG)[ix] was published by the Institute of Acoustics in 2013. This document provides guidance on noise assessment of wind turbines above 50 kW, reflecting the original principles within ETSU-R-97. The IOA GPG contains six Supplementary Guidance Notes that covers data collection, data processing, wind turbine sound power levels, wind shear, post completion measurements and propagation over water for onshore.

3.4.7 The IOA GPG does not replace the limits within ETSU-R-97, but it does provide good practice guidance on the use of ETSU-R-97 in relation to background noise surveys and on the prediction of wind turbine noise. This is on the proviso that the appropriate input parameters and correction factors are used for the prediction of wind turbine noise, as follows:

- downwind propagation;
- a receptor height of 4m;
- atmospheric conditions of 10°C and 70% humidity;
- a ground absorption factor of G = 0.5; and
- turbine noise emission levels which include a margin for uncertainty.

3.4.8 The guidance document has been endorsed, on behalf of Scottish Government[x], for use on wind turbine noise assessments.

ISO 9613-2

3.4.9 ISO 9613-2: 1996 'Acoustics – Attenuation of sound during propagation outdoors Part 2: General method of calculation'[xi] provides a robust prediction method for calculating the noise levels at receiver locations, endorsed by the IOA GPG as method to use when calculating wind turbine noise propagation.

4 Methodology

4.1 Consultation

4.1.1 The Environmental Health Officer (EHO) at THC was consulted on 28 September 2023, when a letter was issued that set out the approach to the assessment. In their response dated 09 October 2023, THC EHO agreed to the proposed approach to consider all turbines together under one combined limit and provided that the revised design meets the combined limits, no further cumulative assessment was required to be undertaken. The EHO did advise that if the limits can only be met through the use of noise reduction operating modes, further consideration may be required as this has the potential to result in an increase in noise exposure. This is discussed further in paragraph 5.1.2.

4.2 Operational Impacts

4.2.1 It is set out in ETSU-R-97, and subsequently the IOA GPG, that noise limits for wind turbines should be set relative to existing background noise levels at the nearest properties and that these limits should reflect the variation in both turbine source noise and background noise with wind speed. The wind speed range which should be considered is that of the operation of the turbines, typically between the cut-in speed and 12m/s. It should be noted that within this assessment, unless specified otherwise, all references to wind speeds are to a standardised 10m height, derived in accordance with Section 2.6 of the IOA GPG. Furthermore, when deriving existing background noise levels, it is important to ensure that noise from existing wind turbines is not contributing to this level.

4.2.2 Separate noise limits apply for the daytime and night-time, chosen to protect a property's external amenity and to prevent sleep disturbance indoors, respectively. As set out in paragraph 3.4.2, noise limits comprise two elements: a lower fixed value; and a derived relative value equal to the prevailing background curve plus 5 dB(A). The noise limit will be equal to the greater of these two elements. It is important to understand that the noise limits defined in ETSU-R-97 relate to the cumulative noise from all operational wind turbines. The assessment will therefore need to consider the combined operational noise of the Proposed Development with the other wind farms in the area to ensure that the combined cumulative noise levels are within the relevant ETSU-R-97 Criterion.

4.2.3 For the case of the Proposed Development, noise limits have already been determined in accordance with ETSU-R-97 which account for existing levels of background noise and other wind energy development in the area. These limits are summarised as follows and below in Table 1:

- Ben Sca (20/00013/FUL) 7 turbines – Condition 29 limits the total noise from the 7 turbines to not exceed 30 dB L_{A90} at any noise sensitive location existing at the time of consent; and
- Ben Sca Extension (21/05767/FUL) 2 turbines – Condition 25 limits the total noise from the 2 turbines to not exceed a value of more than 2 dB above the predicted levels contained in the EIAR, Table 6-3. This table included the three nearest noise sensitive receptors (NSR) which are also assessed in this report and shown on Figure 1.

Table 1: Noise Limits for Ben Sca and Extension Wind Farm

		Noise Limit, dB L_{A90} at standardised 10m wind speed, m/s								
NSR ID	Scenario	4	5	6	7	8	9	10	11	12
NSR1	Ben Sca Limit	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0
	Extension Limit	20.0	24.9	28.9	31.0	31.6	32.3	32.3	32.3	32.3
	Total Limit	30.4	31.2	32.5	33.5	33.9	34.3	34.3	34.3	34.3
NSR2	Ben Sca Limit	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0
	Extension Limit	15.8	20.7	24.7	26.8	27.4	28.1	28.1	28.1	28.1
	Total Limit	30.2	30.5	31.1	31.7	31.9	32.2	32.2	32.2	32.2
NSR3	Ben Sca Limit	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0
	Extension Limit	12.5	17.4	21.4	23.5	24.1	24.8	24.8	24.8	24.8
	Total Limit	30.1	30.2	30.6	30.9	31.0	31.1	31.1	31.1	31.1

4.2.4 Where the NSRs are given in Table 2. Table 1 above summarises the consented noise limits at the NSRs for Ben Sca Wind Farm and Ben Sca Wind Farm Extension separately and also the combined total noise limit which is the logarithmic sum of the two limits.

Table 2: Noise Sensitive Receptors

NSR ID	Name	Easting	Northing
NSR1	Upperglen	131978	851178
NSR2	Coishletter Woodlands	133696	851068
NSR3	Blackhill	134519	850404

4.2.5 The agreed assessment method is to calculate the noise immission levels from the Proposed Development of all 9 turbines as amended, and assess against the 'Total Limit', as set out in Table 1. The calculation follows the same agreed approach as applied in the respective noise assessments that accompanied the former planning applications, as summarised below, and is in accordance with the IOA GPG. The same limit will be applied regardless of the time of day.

4.2.6 Note that in the above, and subsequently in this assessment, the term 'noise emission' relates to the sound power level actually radiated from each wind turbine, whereas the term 'noise immission' relates to the sound pressure level (the perceived noise) at any receptor location due to the combined operation of all wind turbines.

4.2.7 If the total noise from the Proposed Development does not exceed the 'Total limit', which is derived from the individual consented noise limits, then it will be considered to be acceptable.

4.2.8 The candidate turbine for the Proposed Development is a different machine to the original applications. The Nordex N133 4.8 MW turbine with serrated trailing edges has been identified as representative of those models likely to be installed on site and has therefore been selected as the candidate turbine for this assessment. The candidate turbine is a variable speed, pitch regulated machine with a rotor diameter of 133m and a hub height of 83.4m. Due to its variable

speed operation the sound power output of the turbine varies considerably with wind speed, being quieter at the lower wind speeds when the blades are rotating more slowly.

4.2.9 Nordex have supplied noise emission data for the N133 4.8 MW turbine which represent the values that the manufacturer specify will not be exceeded in practice. In the absence of specific information about uncertainty allowances in the data, a further correction factor of +2 dB was added to the specification data in line with advice in the IOA GPG. The sound power data has been made available for standardised wind speeds of 3 m/s to 12 m/s inclusive. In addition to the overall sound power data, typical sound power frequency distribution for the turbine has been specified, based on an energetic average of the available information at each octave band. The overall sound power and spectral data for the N133 4.8 MW turbine are presented in Table 3 and Table 4 respectively.

Table 3: Wind Turbine Sound Power Data Nordex N133 4.8MW with STE Hub Height 83.4m

	Sound Power Level, dB(A) at standardised 10m wind speed, m/s									
Turbine	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
N133 4.8MW (STE) 83.4m hub [derived from report F008-272A13-EN R05 13/01/22]	95.0	96.2	101.7	105.9	106.5	106.5	106.5	106.5	106.5	106.5

Table 4: Octave Band Sound Power Data Nordex N133 4.8MW with STE Hub Height 83.4m

	Sound Power Level, dB(A) at Octave Band Centre Frequency, Hz									
Turbine	**31.5**	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	**(A)**
N133 4.8MW (STE) 83.4m hub [derived from report F008-272A14-EN R05 13/01/22]	77.5	88.2	95.3	99.0	99.9	100.4	99.1	94.8	85.6	106.5

4.2.10 Wind turbines are assumed to be operating in their normal unconstrained mode.

4.2.11 The ISO 9613-2 model has been used to calculate the noise immission levels at the NSRs as advised in the IOA GPG. The model accounts for the attenuation due to geometric spreading, atmospheric absorption, and barrier and ground effects. All attenuation calculations have been made on an octave band basis and therefore account for the sound frequency characteristics of the turbines.

4.2.12 Noise level predictions have been undertaken using a receiver height of four metres above local ground level, mixed ground (G=0.5) and an air absorption based on a temperature of 10°C and 70% relative humidity. A receiver height of four metres will be typical of first floor windows and result in slightly higher predicted noise levels than if a 1.2 to 1.5 metre receiver height were chosen in the ISO 9613 algorithm. The attenuation due to terrain screening accounted for in the calculations has been limited to a maximum of 2 dB(A). In situations of propagation above concave ground, a correction of +3dB was added.

4.2.13 The above method for calculating wind turbine noise immission levels at NSR locations provide results using the L_{Aeq} noise parameter. To obtain the L_{A90} parameter required by ETSU-R-97, it is necessary to apply a correction to the prediction results. A correction of -2 dB has been applied, in line with current best practice and the IOA GPG.

4.2.14 The above parameters and calculation method is consistent with the IOA GPG. The IOA GPG also allows for directional effects to be taken into account within the noise modelling: under upwind propagation conditions between a given receiver and the wind farm the noise immission level at that receiver can be as much as 10 dB(A) to 15 dB(A) lower than the level predicted using the ISO 9613 2 model. However, predictions have been made assuming downwind propagation from every turbine to every receptor at the same time as a worst case.

4.3 Cumulative Impacts

4.3.1 The Proposed Development would operate within the combined consented noise limits of the two developments it would replace. Therefore, the Proposed Development will not alter the impacts previously assessed and any alterations in the cumulative situation since the planning consents would have been accounted for in the noise assessments for any subsequent cumulative developments. Therefore, a cumulative noise assessment is not required.

4.3.2 The above approach to scope out a cumulative noise assessment was discussed and agreed during consultation with THC EHO, on the basis that the combined consented noise limit is not exceeded and compliance does not rely upon the turbines operating in noise reduced modes.

4.4 Construction Impacts

4.4.1 The Proposed Development would not introduce any amendment to the methods employed to construct the wind farm that would materially change the noise assessments previously undertaken. Therefore, an additional construction noise assessment has not been undertaken.

4.4.2 The above approach to scope out a construction noise assessment was discussed and agreed during consultation with THC EHO.

4.5 Uncertainties and Assumptions

4.5.1 The assessment follows the IOA GPG approved methodology for the calculation of wind turbine noise immission level. This includes an inherent degree of uncertainty, which has been accounted for with the inclusion of +2dB in the turbine sound power data, see paragraph 4.2.9 and the conservative calculation parameters as set out in paragraph 4.2.12. Furthermore, the calculation assumes downwind propagation with no reduction for directional effects, as discussed in paragraph 4.2.14.

5 Assessment

5.1.1 The result of the noise assessment for the Proposed Development are summarised in tabular form in Table 5 and show that the predicted wind turbine noise (WTN) immission levels would meet the noise limits at all wind speeds. A negative margin indicates that the WTN is below the limit. Figure 2 to Figure 4 show this information graphically. It should be noted that noise levels are shown to one decimal place and in some cases rounding may occur such that the margin might not exactly equal the difference between the values for the limit and WTN shown.

Table 5: Operational Noise Impact Assessment for the Proposed Development

		Noise Limit, dB L_{A90} at standardised 10m wind speed, m/s								
NSR ID	**Scenario**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
NSR1	Limit (Table 1)	30.4	31.2	32.5	33.5	33.9	34.3	34.3	34.3	34.3
	WTN immission	21.5	27.0	31.2	31.8	31.8	31.8	31.8	31.8	31.8
	Margin	**-8.9**	**-4.2**	**-1.3**	**-1.7**	**-2.1**	**-2.5**	**-2.5**	**-2.5**	**-2.5**
NSR2	Limit (Table 1)	30.2	30.5	31.1	31.7	31.9	32.2	32.2	32.2	32.2
	WTN immission	19.9	25.4	29.6	30.2	30.2	30.2	30.2	30.2	30.2
	Margin	**-10.2**	**-5.1**	**-1.5**	**-1.5**	**-1.7**	**-1.9**	**-1.9**	**-1.9**	**-1.9**
NSR3	Limit (Table 1)	30.1	30.2	30.6	30.9	31.0	31.1	31.1	31.1	31.1
	WTN immission	19.8	25.3	29.5	30.1	30.1	30.1	30.1	30.1	30.1
	Margin	**-10.3**	**-4.9**	**-1.1**	**-0.8**	**-0.9**	**-1.1**	**-1.1**	**-1.1**	**-1.1**

Figure 2: Operational Noise Assessment NSR1 Upperglen

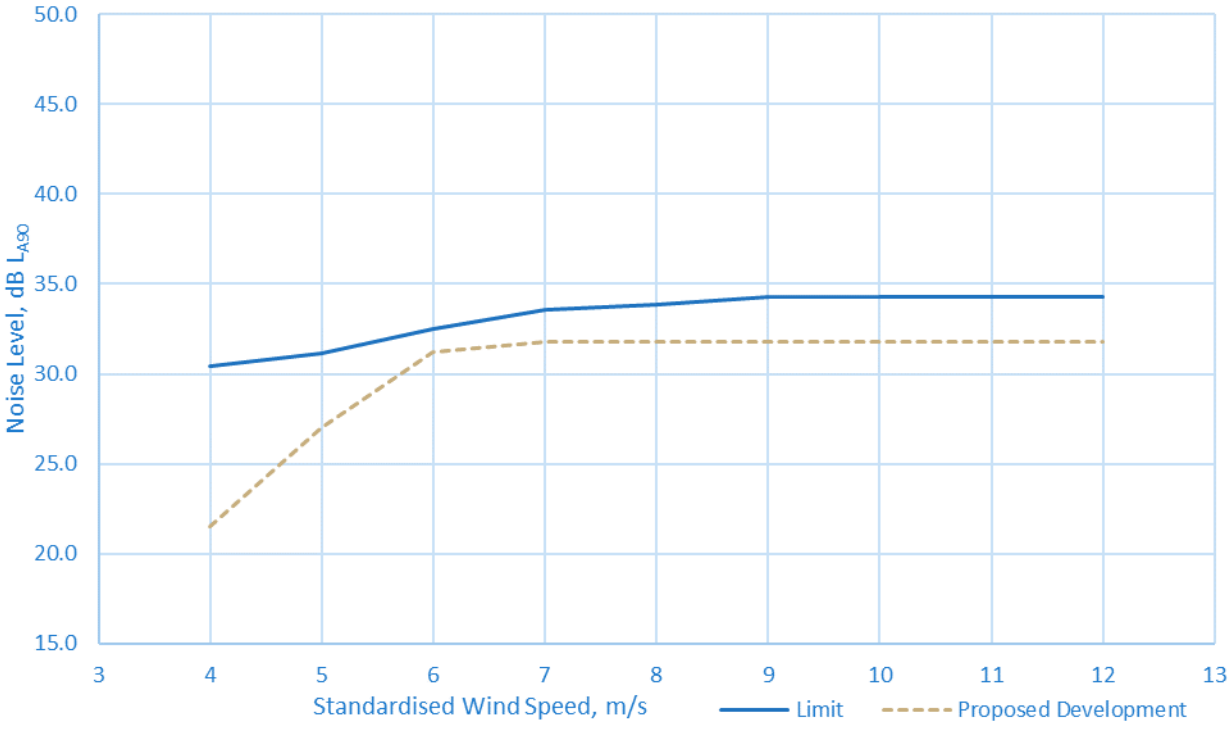


Figure 3: Operational Noise Assessment NSR2 Coishletter Woodlands

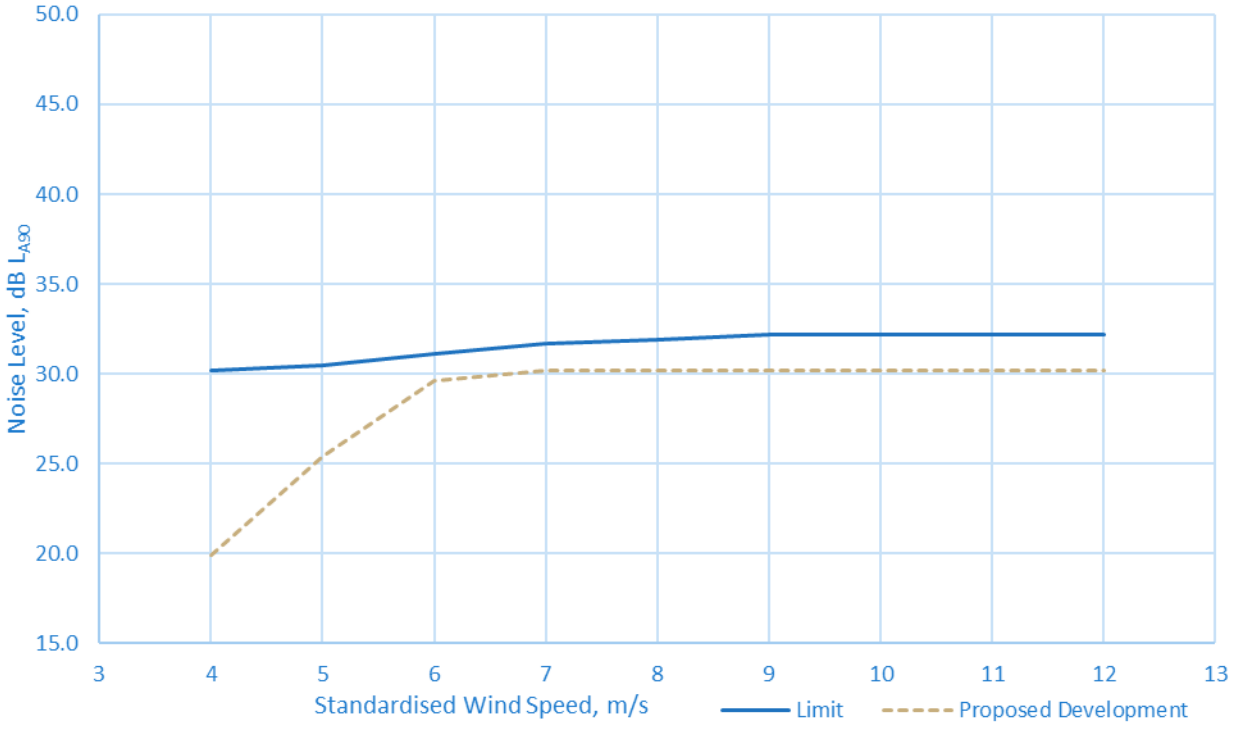
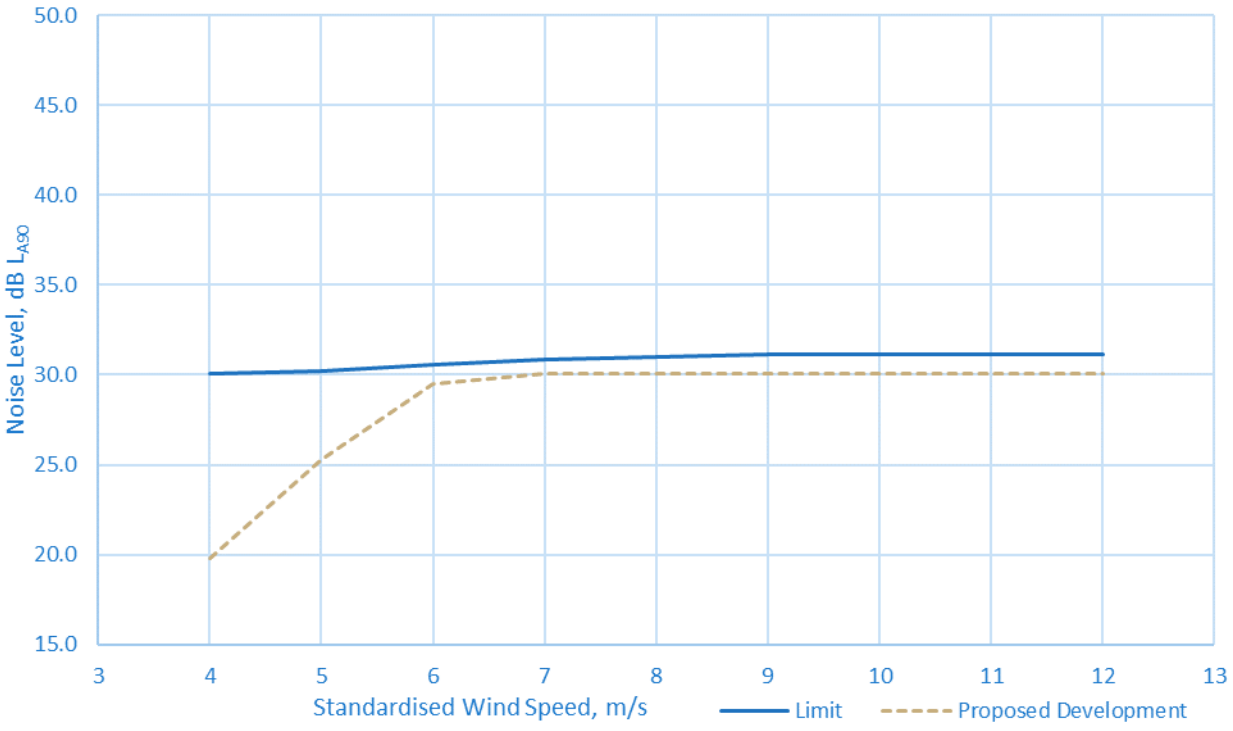


Figure 4: Operational Noise Assessment NSR3 Blackhill



5.1.2 Table 5 and Figure 2 to Figure 4 show that the predicted wind farm noise immission levels meet the combined consented noise limits under all wind speeds and at all locations. The calculations assume downwind propagation and that the turbines are operating in unconstrained mode. Therefore, no further consideration will be necessary with regard to noise exposure and the Proposed Development can operate within the noise limits set in the planning consents for Ben Sca Wind Farm (20/00013/FUL) and Ben Sca Wind Farm Extension (21/05767/FUL).

6 Conclusion

6.1.1 This report has presented an assessment of the potential impacts of operational noise from the Proposed Development on the residents of nearby dwellings. Guidance contained within ETSU-R-97, the IOA GPG and THC's Onshore Wind Energy Supplementary Guidance have been followed.

6.1.2 The Proposed Development is for minor adjustments to the associated infrastructure, tip height and rotor diameter of Ben Sca Wind Farm (20/00013/FUL) and Ben Sca Wind Farm Extension (21/05767/FUL). A noise assessment was carried out for each of the previous two applications and planning consent was awarded which included conditioned noise limits at nearby NSRs.

6.1.3 The Proposed Development would not alter the cumulative or construction noise and vibration impacts previously reported in the EIA Reports for Ben Sca Wind Farm and Ben Sca Wind Farm Extension.

6.1.4 The operational noise impact assessment has been undertaken in accordance with ETSU-R-97 which provides a robust basis for assessment as recommended by Scottish national policies: NPF4, PAN 1/2011, web-based 'Onshore Wind Turbines: Planning Advice' and the Technical Advice Note on Assessment of Noise; and guidance local to The Highland Council: Onshore Wind Energy Supplementary Guidance. The operational wind turbine noise from the Proposed Development has been assessed against the combined consented noise limits for Ben Sca Wind Farm and Ben Sca Wind Farm Extension.

6.1.5 It is demonstrated that the Proposed Development can operate within the combined consented noise limits at all assessment locations across all wind speeds without any operational constraint; and, therefore, would be acceptable.

7 References

[i] Legislation (1990). *Environmental Protection Act, Part III 1990* [Online]. [Viewed August 2021]. Available from: https://www.legislation.gov.uk/ukpga/1990/43/contents

[ii] The Highland Council (2012). *Highland-wide Local Development Plan* [online]. [Viewed August 2021]. Available from: https://www.highland.gov.uk/info/178/local_and_statutory_development_plans/199/highland-wide_local_development_plan

[iii] The Highland Council (2016). *Onshore wind energy: supplementary guidance* [online]. [Viewed August 2021]. Available from: https://www.highland.gov.uk/downloads/file/16949/onshore_wind_energy_supplementary_guidance-_nov_2016

[iv] Scottish Government (2023). *National Planning Framework 4* [online]. [Viewed October 2023]. Available from: https://www.gov.scot/publications/national-planning-framework-4/

[v] Scottish Government (2011). *Planning Advice Note PAN 1/2011* [online]. [Viewed September 2021]. Available from: https://www.gov.scot/publications/planning-advice-note-1-2011-planning-noise/

[vi] Scottish Government (2014). *Onshore Wind Turbines: Planning Advice* [online]. [Viewed September 2021]. Available from: https://www.gov.scot/publications/onshore-wind-turbines-planning-advice/

[vii] Scottish Government (2011). *Assessment of Noise: Technical Advice Note* [online]. [Viewed September 2021]. Available from: https://www.gov.scot/publications/technical-advice-note-assessment-noise/pages/0/

[viii] The Working Group for Noise from Wind Turbines (1996). *ETSU-R-97 The Assessment and Rating of Noise from Wind Farms* [online]. [Viewed August 2021]. Available from: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/49869/ETSU_Full_copy__Searchable_.pdf

[ix] Institute of Acoustics (2013). *A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise* [Viewed September 2021]. Available from: https://www.ioa.org.uk/publications/wind-turbine-noise

[x] John Swinney MSP (2013) Letter to Prof. B. Shield, 29 May

[xi] International Standards Organisation (1996). *ISO 9613-2 Acoustics – Attenuation of Sound During Propagation Outdoors – Part 2: General Method of Calculation*