Environmental Impact Assessment Report

Lairdmannoch Energy Park

Chapter 9: Noise

Lairdmannoch Energy Park Limited

May 2025

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Glossary of Terms

Term	Definition
The Applicant	Lairdmannoch Energy Park Limited
The Agent	Atmos Consulting Limited
Environmental Advisors and Planning Consultants	Atmos Consulting Limited
Environmental Impact Assessment	Environmental Impact Assessment (EIA) is a means of carrying out, in a systematic way, an assessment of the likely significant environmental effects from a development
Environmental Impact Assessment Regulations	The Electricity Works (Environmental Impact Assessment)(Scotland) Regulations 2017 (EIA Regulations)
Environmental Impact Assessment Report	A document reporting the findings of the EIA and produced in accordance with the EIA Regulations
The Proposed Development	Lairdmannoch Energy Park
The Proposed Development Site	The full application boundary as per Figure 1-1
Wind Development	The area of the Proposed Development that contains the Wind Turbines and associated infrastructure. As shown on Maps 1, 2 and 4 of Figure 3-1 Detailed Site Layout.
Solar Development	The area of the Proposed Development that contains the Solar Arrays and associated infrastructure. As shown on Maps 7, 8 and 9 of Figure 3-1 Detailed Site Layout.
Study Area	There is no specific defined study area for the operational noise assessment. Rather the study area includes all noise sensitive receptors and residential properties that have the potential to be affected by operational noise.
dB or dB(A)	A measure of sound level using a logarithmic scale. The 'A' suffix denotes a filtering or 'weighting' of frequencies such that the defined decibel level provides a representative level relating to the sensitivity of human hearing.
dB L_{A90}	The level of noise, in dB, exceeded for 90 percent of the specified time, usually used to define the A-weighted sound pressure level background level, but also used for wind turbine measurement and prediction.
Hertz (Hz)	The unit of frequency representing cycles per second.
L_{WA} – Sound Power Level	The fundamental measure of sound power. Sound power is the total sound energy radiated by a source per unit time. The subscript 'A' refers to an A-weighted sound power level.

List of Abbreviations

Abbreviation	Description
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
NTS	Non-Technical Summary
ECU	Energy Consents Unit
CEMP	Construction Environmental Management Plan
CTMP	Construction Traffic Management Plan
GPG	Good Practice Guide
IOA	Institute of Acoustics

9 Noise

9.1 Introduction

This chapter of the EIAR presents an assessment of the likely effects arising from the construction, operation (including maintenance) and decommissioning of the Proposed Development upon noise and should be read in conjunction with the following technical appendices and figures in **Volume 3** and **Volume 4**, respectively:

- Technical Appendix 9-1: Noise Prediction Methodology;
- Figure 9-1: Predicted Solar Operational Noise Contours; and
- Figure 9-2: Predicted Operational Noise Contours at 10 m/s.

The specific objectives of the noise chapter are to:

- Describe the noise baseline;
- Describe the assessment methodology and significance criteria used in completing the impact assessment;
- Describe the potential effects and cumulative effects;
- Describe the mitigation measures proposed to address likely significant effects; and
- Assess the residual effects remaining following the implementation of mitigation.

The assessment has been carried out by Rob Shepherd, Director, Hayes McKenzie Partnership Ltd. Rob has a master's degree (MEng) in Acoustical Engineering from the Institute of Sound and Vibration Research (ISVR) at the University of Southampton and has been carrying out wind farm noise assessments for 20 years. Rob is a member of the Institute of Acoustics (MIOA), and Hayes McKenzie are members of the Association of Noise Consultants (ANC).

9.2 Consultation

Table 9-1 provides a summary of the consultation undertaken to date to inform this assessment.

Table 9-1: Consultation Undertaken

Consultee	Summary of Consultee Response	Where addressed within this Report
Dumfries & Galloway Council Pre-application Enquiry Advisory Report (April 2021)	Section 11.37 states that Policy IN2 of the LDP2 and section E of SG on Wind Energy Development requires, in considering development proposals, an assessment of the extent of any detrimental impact on communities, individual dwellings, residents and local amenity, including assessment of the impacts of noise. Section 11.38 states that the operational noise impact assessment should be undertaken in accordance with ETSU-R-97 and the Institute of Acoustics methodology. It states that cumulative effects should be considered and that the EIA report should include background noise monitoring at the nearest noise sensitive receptors.	This chapter describes the operational noise impact assessment which has been carried out according to the requirements of ETSU-R-97 and the accompanying guidance published by the Institute of Acoustics. No background noise measurements were undertaken because the lower limiting values that apply irrespective of the levels of background noise are met at all noise sensitive receptors. Nevertheless, the baseline noise environment is described in Section

Consultee	Summary of Consultee Response	Where addressed within this Report
		9.5.
Energy Consents Unit (EIA Scoping Response)	The noise assessment should be carried out in line with relevant legislation and standards as detailed in section 5.8 of the scoping report. The noise assessment report should be formatted as per Table 6.1 of the IOA "A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise.	The noise assessment has been carried out in line with relevant legislation and standards as detailed at section 9.3. The noise assessment report follows the guidance at Table 6.1 of the IOA GPG.
Dumfries & Galloway Council EHO (EIA Scoping Response)	The site-specific assessment should be carried out following the principles detailed in the Assessment & Rating of Noise from Wind Farms ETSU Report ETSU-R-97, 1996.	The noise assessment has been carried out following the principles of ETSU-R-97.
Dumfries & Galloway Council EHO (EIA Scoping Response)	The proposal should be designed to meet the lower noise limits as specified in the ETSU-R-97 document, but where lower limits cannot be achieved the detailed reasons as to why this cannot be accomplished should be detailed in the ETSU-R-97 report within the Environmental Impact Assessment.	Section 9.4.4 sets out the lower noise limits from ETSU-R-97 that the proposal has been designed to meet.
Dumfries & Galloway Council EHO (EIA Scoping Response)	Suggest that a method statement for the construction project should be provided within the EIA for approval by Dumfries & Galloway Council. This should include an assessment of potentially noisy operations and outline the noise mitigation measures proposed. This will also include a programme and phases for each stage of work. Guidance as to construction noise prediction methodology may be found within BS5228:2009.	Construction noise is discussed in sections 9.4.4, 9.6.1, and 9.7.1.

9.3 Planning Policy and Guidance

9.3.1 Planning Policy

Planning policy relevant to this assessment comprises:

- Scottish Government (2023), National Planning Framework 4;
- Scottish Government (2022), Onshore Wind Policy Statement 2022;
- Scottish Government (2014), Web Based Planning Advice, Onshore Wind Turbines; and
- Scottish Government (2011), Assessment of Noise: Technical Advice Note.

9.3.2 Guidance

The following guidance documents have been used during the preparation of this assessment:

- British Standard (BS) 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Noise;

- BS 5228-2:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Vibration;
- BS 4142:2014+A1:2019 Methods for rating and assessing industrial and commercial sound;
- ETSU-R-97 The Assessment and Rating of Noise from Wind Farms; and
- Institute of Acoustics (IOA), A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise (the IOA GPG).

9.4 Methodology

9.4.1 Study Area

Receptor locations where predicted operational noise levels from the Proposed Development wind turbines are above 30 dB L_{A90} have been scoped into the assessment. In addition, the nearest noise sensitive receptors to the solar array are also scoped in. This is defined as the study area.

The receptor locations included in the assessment are shown in **Table 9-2** and in **Figure 9-1** and **Figure 9-2** of **Volume 4** of this EIA Report. All receptors considered in the assessment are occupied residential properties. All other noise sensitive receptors are unlikely to experience significant noise effects, if the relevant limits are met at the assessed locations, and accordingly are scoped out.

Table 9-2: Summary of Receptors

Receptor	Easting	Northing	Relevant Element of Development
1 Gordons Cairn Glengap	265205	559431	Wind turbines
2 Gordons Cairn Glengap	265212	559438	Wind turbines
3 Gordons Cairn Glengap	265210	559457	Wind turbines
4 Gordons Cairn Glengap	265215	559462	Wind turbines
5 Gordons Cairn Glengap	265211	559477	Wind turbines
6 Gordons Cairn Glengap	265215	559480	Wind turbines
Cot Cottage	266568	563365	Wind turbines
Edgarton Farm	267002	563008	Wind turbines
Glengap	265214	559254	Wind turbines
Grobdale of Balmaghie	262481	564179	Wind turbines
Lochenbreck Byre	264179	565074	Wind turbines
Lochenbreck Cottage	264797	565065	Wind turbines
Miefield Farm*	265359	559404	Wind turbines
The Waterhouse*	265217	559501	Wind turbines
Kirkconnel Farm*	267568	560274	Solar Array
Kirkconnel Cottages	267712	560246	Solar Array
2 Kirkconnel Cottages	267729	560234	Solar Array
Backfell	268107	560689	Solar Array

It should be noted that the location Upper Lairdmannoch (Grid Reference 267113, 561887) is derelict and, as such, has not been included in the assessment.

Receptor locations that are financially involved with the Proposed Development are identified in **Table 9-2** with an asterisk '*'.

9.4.2 Baseline Data Collection

No baseline data has been collected as part of the noise assessment, as the predicted noise effects meet the limits assigned in relevant guidance irrespective of the baseline noise levels. Therefore, it was considered that baseline noise monitoring was not required.

9.4.3 Potential Effects Scoped Out

The following potential effects have been scoped out of the assessment.

Substation and Battery Energy Storage System (BESS)

Operational noise from the proposed substation is assessed according to BS 4142:2014+A1:2019, where rating noise levels (noise levels at receptor locations corrected for any distinguishing character) associated with the operation of the plant are compared with background sound levels to determine the significance of the noise impact. Where rating and background sound levels are low, the significance of the impact is low, and it is considered that if the rating level of noise from on-site infrastructure (excluding the operational wind turbines) are 35 dB $L_{Ar,Tr}$ or lower, then the noise impact can be considered to be not significant.

The main source of noise associated with the substation, BESS, and solar inverters is typically associated with fans that are required for ventilation/cooling of the plant; as such, the operational noise output is typically related to ambient temperature and electrical demand.

In this case, the proposed substation and BESS are located more than 1.7 km from the nearest noise sensitive receptor, Cot Cottage, and all other receptors are significantly more distant. It is considered that, at such distances, given the proposed scale of the Proposed Development substation and BESS, operational noise is unlikely to be audible at noise sensitive receptors. As such, operational noise from the Proposed Development substation and BESS has been scoped out of further assessment.

Solar Farm Operational Noise

Initial predictions for the Solar Development assumed the use of central inverters, shown as 'Power Stations' on **Figure 3-1**, with the sound power levels presented in **Table 9-3**.

Table 9-3: Sound Power Levels for Assumed Solar Plant (dB L_{WA})

Plant	Octave band centre frequency (Hz)								Broadband
	63	125	250	500	1000	2000	4000	8000	
Central Inverter (individual level)	72.3	82.7	85.9	84.7	84.1	80.9	75.2	69.8	91.2

The sound power level data used assumes Freemaq PCS storage inverters that are operating at 70% of their maximum output and fitted with their noise attenuation kit, and this is likely to be representative of typical operating conditions. Note that 100% fan speed (and hence highest sound power levels) only occur when ambient temperatures exceed 40˚C. The predictions assumed 5 of these inverters at the central inverter stations for each solar panel cluster, which is considered to be a relatively conservative assumption.

The resultant predicted noise levels are significantly below 35 dB L_{Aeq}, and as such, operational noise from the Solar Development is considered to be not significant at the nearest noise sensitive receptors.

Predicted contours for the Solar Development noise are shown in **Figure 9-1** in **Volume 4** of this EIA Report**.** Operational noise from the Solar Development has, therefore, been scoped out of detailed assessment.

Tonal Noise

ETSU-R-97 specifies that, in line with other noise guidance, a penalty should be added to measured or predicted wind turbine noise levels if there is tonal noise above a certain level which is audible at residential properties. In this assessment, it has been assumed that there would be no tonal noise associated with the operation of the Wind Development which would give rise to such a penalty, as most modern turbines operate without significant tonal noise. It is anticipated that a penalty would be included in an appropriately worded planning condition, such that a tonal penalty would need to be added to measured noise levels, where required, before comparing them with the noise limits. Warranty agreements with turbine suppliers seek to ensure that any such penalties will not occur in practice. Tonal noise during the operational phase of the development has therefore been scoped out of the assessment.

Low Frequency and Infrasound

Low frequency sound is typically defined as sound in the audible hearing frequency range of 20 Hz up to about 200 Hz. Noise from wind turbines is not inherently low-frequency and it is typically broad-band in nature, and close to a wind turbine the dominant frequencies are usually in the 250 to 2000 Hz range. As the distance from a wind farm increases, the noise level decreases as a result of the spreading out of the sound energy and also due to air absorption which increases with increasing frequency. This means that, although the energy across the whole frequency range is reduced, higher frequencies are reduced more than lower frequencies, with the effect that as distance from the Proposed Development Site increases, the ratio of low to high frequencies also increases. This effect may be observed with road traffic noise or natural sources, such as the sea, where higher frequency components are diminished relative to lower frequency components at long distances. At such distances, however, the overall noise level is so low, such that any bias in the frequency spectrum can usually be considered to be insignificant.

Work carried out in 2006 by Hayes McKenzie for the UK Department of Trade and Industry (DTI, 2006) to investigate the extent of low frequency and infrasonic noise from three UK wind farms concluded that:

> "*the common cause of complaints associated with noise at all three wind farms is not associated with low frequency noise, but is the audible modulation of the aerodynamic noise, especially at night*".

It is therefore considered that low frequency noise can be scoped out of the assessment.

Infra-sound is noise occurring at frequencies below that at which sound is normally audible, i.e. at less than about 20 Hz, due to the significantly reduced sensitivity of the ear at such frequencies. In this frequency range, for sound to be perceptible, it has to be at very high amplitude, which is not the case for wind turbine noise. In November

2016 a study into low frequency and infrasound was published by the State Office for the Environment, Measurement and Nature Conservation of the Federal State of Baden-Wuerttemberg (Landesanstalt für Umwelt, Messungen und Naturschutz Baden-Württemberg, 2016) that contained a comprehensive review of low frequency and infrasound from wind turbines and evaluated such noise in relation to other sources. The results state that

> "*the infrasound level in the vicinity of wind turbines is – at distances between 120 m and 300 m – well below the threshold of what humans perceive*" and that "*at a distance of 700 m from the wind turbines, it was observed by means of measurements that when the turbine is switched on, the measured infrasound level did not increase or only increased to a limited extent. The infrasound was generated mainly by the wind and not by the turbines*".

The report concludes that:

> "*Infrasound is caused by a large number of different natural and technical sources. It is an everyday part of our environment that can be found everywhere. Wind turbines make no considerable contribution to it. The infrasound level generated by them lie clearly below the limits of human perception. There is no scientifically proven evidence of adverse effects in this level range*".

It is therefore considered that infrasound can be scoped out of the assessment.

Amplitude Modulation

The variation in noise level associated with wind turbine operation, at the rate at which turbine blades pass any fixed point of their rotation (the blade passing frequency), is often referred to as blade swish or Amplitude/ Aerodynamic Modulation (AM). This effect is identified within ETSU-R-97 where it is envisaged that:

> "… *modulation of blade noise may result in variation of the overall A-Weighted noise level by as much as 3 dB(A) (peak to trough) when measured close to a wind turbine*…" and that at distances further from the turbine where there are "… *more than two hard, reflective surfaces, then the increase in modulation depth may be as much as 6 dB(A) (peak to trough*)".

There have been instances where level of AM rates are higher than this, which results in the noise being perceived as more intrusive (in the same way as tonal content makes the noise more intrusive).

The Department of Energy & Climate Change (DECC) commissioned a Wind Turbine AM Review report that was published in two phases: Phase 1 in September 2015 and Phase 2 in October 2016 (although the Phase 2 report is dated August 2016) (DECC, 2016). Phase 1 of the report sets out the approach and methodology to the review and research, and the Phase 2 report includes a literature review, research into human response to AM, and recommends how excessive AM might be controlled through the use of a planning condition. The report includes recommendations on how AM should be addressed when quantified according to the recommendations of a separate Institute of Acoustics (IOA) working group document, A Method for Rating Amplitude Modulation in Wind Turbine Noise (IOA, 2016).

The AM Review reports recommend a two-tier approach whereby the first tier seeks a reduction in the depth and/or occurrence of AM with a rating level (according to the

IOA Amplitude Modulation Working Group method) ≥3 dB. Whether remedial action is required depends on the prevalence of any complaints, and how often AM rating levels ≥3 dB occur. The second tier is that if AM is deemed to be a significant issue, and if nothing can be done to reduce the level of AM, then a penalty scheme is proposed whereby a penalty ranging from 3 dB (for a rating level of 3 dB) up to a maximum of 5 dB (for a rating level of 10 dB and above) could be added to the measured level before measured levels are compared with the relevant noise limits.

It should be noted that most wind farms operate without significant AM, and that it is not possible to predict the likely occurrence of AM. At the time of writing there has been no official response to those recommendations from the IOA Noise Working group or endorsement from any Scottish Government Minister or Department. The IOA GPG (IOA, 2013), states that

> *"the evidence in relation to "Excess" or "other" Amplitude Modulation (AM) is still developing. At the time of writing, current practice is not to assign a planning condition to deal with AM."*

Although it is possible to control such noise with an appropriately worded planning condition if necessary. Therefore, AM has been scoped out of the assessment.

Decommissioning

Noise arising from decommissioning activities will meet the relevant noise limits that apply to noise from construction. Decommissioning operations will be undertaken in line with the relevant standards and limits that apply at the time. Therefore, noise effects during decommissioning have been scoped out of further assessment.

Cumulative Effects

There are no identified wind farm or solar farm developments within the vicinity of the Proposed Development and as such, cumulative effects have been scoped out of the assessment.

9.4.4 Assessment Methodology

Construction Noise Assessment Methodology

A detailed assessment of construction noise has been deemed unnecessary due to the large separation distances between construction activities at the Proposed Development and nearby noise sensitive receptors. Nevertheless, construction impacts are discussed.

Construction activities at the Proposed Development that could give rise to the greatest levels of noise are:

- Track construction activity has the potential to pass closest to residential properties; and
- Blasting, if required, will generate the highest levels of noise at the source.

Due to the relatively short duration of construction activities, residential properties that are financially involved with the Proposed Development are not considered sensitive receptors.

The nearest noise sensitive receptors to the proposed locations of these construction activities are:

- For track construction, The Waterhouse, approximately 500m from the nearest potential track location; and
- For blasting, Cot Cottage, approximately 1300m of the nearest borrow pit location.

BS 5228:2009 + A1:2014 provides example criteria for the assessment of the significance of construction noise effects and method for the prediction of noise levels from construction activities. Two example methods are provided for assessing significance.

The first is based on the use of criteria defined in Department of the Environment Advisory Leaflet (AL) 72, Noise Control on Building Sites (DoE, 1976), which sets a fixed limit of 70 dB(A) in rural suburban and urban areas away from main roads and traffic. Noise levels are generally taken as façade L_{Aeq} values with free-field levels taken to be 3 dB lower giving an equivalent noise criterion of 67 dB L_{Aeq}.

The second is based on noise change but applies minimum criteria of 45, 55 and 65 dB L_{Aeq} for night-time (23:00-07:00), evening and weekends (19:00-23:00 weekdays, 13:00-23:00 Saturdays and 07:00-23:00 Sundays), and daytime (07:00-19:00) including Saturdays (07:00-13:00) respectively. These limits are applicable irrespective of existing baseline noise levels, and where construction activities have a duration of one month or more. It should be noted that the time period to which each limit applies also defines the time averaging period for the calculated L_{Aeq}.

Standard best practice measures to minimise noise during construction will be implemented in accordance with a detailed Construction Environmental Management Plant (CEMP), which can be secured by means of an appropriately worded planning condition. For more information, see **Technical Appendix 15-1 outline CEMP**.

A simplified daytime construction noise limit of 65 dB L_{Aeq} during normal working hours will be applied in accordance with the second method from BS5228 discussed above. Further information on noise mitigation during construction is provided in Section 9.6, including mitigating noise from blasting at borrow pits at the Proposed Development.

Potential noise effects occur at noise sensitive receptors along the construction access route where there are significant increases in the traffic flow during the construction phase. It has been considered that no significant noise effects will occur during the construction phase where the increase in road traffic results in a 3 dB or lower increase in noise level along the access route. In general, a 3 dB increase would occur if there were a doubling of road traffic, although corrections to account for the percentage of heavy vehicles are required.

Operational Noise Assessment Methodology (Wind Development)

The assessment follows guidance set out in ESTU-R-97 on the assessment of noise from wind turbines which includes the following stages:

- Predicted noise levels have been calculated / modelled using ISO 9613-2 methodology implemented using noise modelling software;
- Noise contour plots have been produced showing predicted L_{A90} at a height of 4m above ground level assuming downwind conditions in all directions (not possible in practice but represents worst-case for all receptor locations); and

- Worst-case downwind predicted noise levels have been compared to the relevant noise limits.

In this case the simplified lower ETSU-R-97 limit of 35 dB L_{A90} has been applied. The simplified noise limit is not set relative to background noise levels, and therefore, baseline measurements are not necessary. If they had been carried out, they would result in higher limits that are set relative to background.

Assessment Criteria

Criteria for Assessing the Sensitivity of Receptors

For the purposes of the noise assessment, all residential property locations are treated as noise sensitive receptors with a high receptor sensitivity for noise effects. Properties which are derelict or required planning permission to return to habitable use are not classed as noise sensitive and have been scoped out of the assessment.

Criteria for Assessing the Operational Magnitude of Change

ETSU-R-97 requires that overall turbine levels (including for the effect of other cumulative development) do not exceed derived noise limits, which take into account the balance of the need for renewable energy and the protection of the noise environment at neighbouring properties. Accordingly, no scale of magnitude is applied to the assessment, and whether or not an effect is significant depends solely on whether the derived noise limits are predicted to be met.

Criteria for Assessing Operational Cumulative Effects (Wind Development)

The criteria set out in the paragraph above would equally apply to the combined cumulative operational noise impacts including neighbouring wind farm sites.

Criteria for Assessing Construction Significance

The specific daytime criterion to be applied to the Proposed Development for construction noise activities with a duration of greater than one month is 65 dB $L_{Aeq-8hr}$. This, along with evening and night limits, are detailed in **Table 9-4**. If the criterion is met at a specific receptor location, then the noise effect at that location is considered to be not significant.

Table 9-4: Construction Noise Limits

Time Period	Limit (dB $L_{Aeq,t}$)
Weekday day-time (07:00-19:00) and Saturday morning (07:00-13:00)	65
Evenings (19:00-23:00) and weekends (Saturday 13:00-19:00 and Sunday (07:00-19:00)	55
Night time (23:00-07:00)	45

For construction vehicles along the access route, the impact is considered to be not significant if the increase in road traffic noise is 3 dB or lower.

Criteria for Assessing Operational Significance (Wind Development)

The specific operational noise limits applied to the Wind Development for operational noise are taken from ETSU-R-97 and are set out in **Table 9-5.**

If the relevant noise limits are met at a specific receptor location, then the noise effect at that location is considered to be not significant. In this case, as the nearest residential receptors are sufficiently distant from the Wind Development, the ETSU-R-97 simplified

noise limit of 35 dB L_{A90} has been applied, which is increased to 45 dB L_{A90} at noise sensitive properties that are inhabited by residents with a financial involvement in the Proposed Development.

Table 9-5: Operational Noise Limits

Receptor	Limit (dB L_{A90})
Noise sensitive receptor	35
Financially involved receptor	45

9.4.5 Difficulties and Uncertainties

As discussed above, the operational noise impact assessment is based on a the current reasonable worst-case candidate wind turbine which may not be the turbine that is installed in practice. However, operational noise limits will be set for the Wind Development via planning conditions which will stipulate operational noise levels that cannot be exceeded at noise sensitive properties. Therefore, regardless of the model of turbine installed, these limits must be met throughout the operational lifetime of the Wind Development.

9.5 Baseline Conditions

Baseline noise measurements were not undertaken as part of the assessment as the simplified lower ETSU-R-97 limit of 35 dB L_{A90} has been applied. However, the existing baseline environment is likely to consist of:

- Wind induced noise from trees and foliage surrounding each dwelling;
- Water flow within nearby burns;
- Traffic noise from the A762 affecting properties to the east of the site;
- Traffic noise from local roads;
- Commercial forestry works;
- Operational works at Bargatton Quarry;
- Localised sources from human activities; and
- Birdsong and animal activity.

9.5.1 Future Baseline

Baseline noise levels in the absence of the Proposed Development are likely to remain similar to those listed above.

9.6 Embedded Mitigation

9.6.1 Construction Noise

Construction noise will be minimised through the use of 'best practicable means' to reduce the potential level of noise generated as part of the construction activities. This will include the restriction of certain activities to certain times, use of quiet working methods and ensuring construction plant is in good working order.

Any specific mitigation measures that may be required for certain activities will be set out within **TA 15-1 CEMP**, expected to be secured by means of a suitably worded planning condition.

Noise during construction works will be controlled by generally restricting works to standard working hours (07:00 to 19:00 Monday to Friday, and 07:00 to 13:00 on Saturdays), and excluding Sundays and public holidays unless specifically agreed with Dumfries and Galloway Council (DCG). Outside these hours, construction activities on site will be limited to turbine erection, maintenance, emergency works, dust suppression, and the testing of plant and equipment, unless otherwise approved in advance in writing by DGC. It is therefore expected that only the weekday day-time noise limit will be applicable, but this is dependent on the working hours required at the time of construction.

It is possible that blasting at the on-site borrow pit will be required to extract aggregate for construction. The most appropriate way to address blasting noise is for a pre-blasting noise management programme to be prepared, which could be secured through the CEMP, which would identify the most sensitive receptors that could be potentially affected by blasting noise. The programme would address vibration and overpressure, as well as audible airborne noise, and contain details of the proposed frequency of blasting and proposed monitoring procedures.

The contractor would inform the nearest residents of the proposed times of blasting and any deviation from this programme in advance of the operations. The programme would also contain contact details which would be provided to local residents should concerns arise regarding construction and blasting activities. In addition, each blast will be designed carefully to maximise its efficiency and to reduce the transmission of noise.

The movement of construction vehicles to and from the Proposed Development has been assessed within **Chapter 11: Transport and Access**, which indicates that there would be a lower than doubling of vehicles during construction month 6 (the worst-case phase of construction) and therefore the increase in noise level will be less than 3 dB and, therefore, **not significant.** Construction traffic impacts will be minimised through a site management regime to control the movement of vehicles to and from the site. This will be implemented via a CTMP, as discussed further in **Chapter 11: Transport and Access** in **Volume 2** of this EIA Report and **Technical Appendix 11-2 Outline CTMP** in **Volume 3** of this EIA Report.

Decommissioning would be managed in a similar manner to construction and would be subject to similar mitigation and controls.

9.6.2 Operational Noise

Operational noise impacts have been mitigated during the design phase of the development through the siting of wind turbines and ancillary equipment. These have been located to ensure that no significant operational noise impacts are predicted to arise.

9.7 Potential Effects

9.7.1 Construction Effects

As per Section 9.4.4 a detailed assessment of construction noise is not included because it is deemed unnecessary due to the large separation distances between onsite construction activities and noise sensitive receptors. The two main construction activities that have been considered are that of blasting at the borrow pit and track construction. All other construction activities are likely to result in significantly lower levels of noise at noise sensitive properties.

Due to the large distance (>1300 m) between the borrow pit and the nearest sensitive receptor, general excavation activities can be deemed to have no significant effect, and therefore does not require detailed assessment. However, blasting may be required for the extraction of aggregate. This type of noise does not typically fall within the assessment of normal construction noise because of the extremely high amplitude and impulsive nature of the waveform. It is very likely that blasting noise could be heard at nearby residential locations, but a construction noise assessment would average noise levels across the day and is therefore not applicable to use for the assessment of blasting noise impacts. Mitigation to reduce the noise impact from blasting activities is set out in Section 9.6.1.

The closest sensitive receptor to the proposed track route is The Waterhouse at a distance of approximately 500m. At a distance of 500m between a sensitive receptor and track construction, the construction noise levels will be significantly below 65 dB L_{Aeq} (i.e. the daytime construction noise limit). Therefore, construction noise levels at The Waterhouse, and all other more distant noise sensitive properties, will meet the

applicable noise limit. Overall, noise from construction activities is considered to be **not significant**.

It should be noted that noise from construction activities will be assessed and mitigated through **TA 15-1 CEMP** that will be submitted at the time of construction, and although the limits are met at all noise sensitive receptors, noise from construction activities may still be audible.

9.7.2 Operational (Including Maintenance) Effects

Wind Turbine Operational Effects

Operational noise impacts have been assessed by comparing predicted operational noise levels with the simplified ETSU-R-97 noise limit of 35 dB L_{A90}. Operational noise prediction results are presented for all receptors scoped into the assessment.

The assessment is based on the Wind Development as described in **Chapter 3: Description of the Development** in **Volume 2** of this EIA Report and assumes the installation of 9 turbines up to 180 m tip height.

For the purposes of the EIA Report and this noise assessment, use of the Nordex N163 6800 KW candidate turbine have been assumed, which is a reasonable worst-case candidate turbine. The candidate turbine used for the Wind Development is assumed to have trailing edge serrations and a hub height of 98 m. It should be noted that the actual turbine selection will depend on a number of factors that will be taken into account during the post-consent procurement process, and it cannot be guaranteed that this candidate turbine would be installed at the Wind Development.

Operational noise predictions have been carried out for the candidate turbine under consideration for the Wind Development in line with the methodology set out in the IOA GPG (IOA, 2013).

Full details of the prediction methodology are set out in **Technical Appendix 9-1** in **Volume 3** of this EIA Report, but the main assumptions are described below:

- Receiver height of 4 m;
- Ground effect ground coefficient G=0.5;
- Atmospheric attenuation corresponding to a temperature of 10°C and a relative humidity of 70%;
- Topographical barriers and concave ground profile corrections have been applied according to the IOA GPG (IOA, 2013); and
- A margin of plus 2 dB has been added to manufacturer's sound power level data to account for uncertainty.

The source noise levels for the candidate turbine assumed for the Wind Development are set out at **Table 9-6**. The octave band noise data taken from the manufacturer's technical specification document is also set out at **Table 9-6**. The sound power levels include the plus 2 dB uncertainty discussed above.

Table 9-6: Nordex N163 STE Octave Band Sound Power Levels (dB L_{WA})

Standardised 10m height wind speed	Octave band centre frequency (Hz)								Broadband
	63	125	250	500	1000	2000	4000	8000	
3	79.0	86.6	88.7	89.9	91.7	92.4	86.8	72.4	97.8

Standardised 10m height wind speed	Octave band centre frequency (Hz)								Broadband
	63	125	250	500	1000	2000	4000	8000	
4	80.3	87.9	90.0	91.2	93.0	93.7	88.1	73.7	99.1
5	84.9	92.5	94.6	95.8	97.6	98.3	92.7	78.3	103.7
6	89.3	96.9	99.0	100.2	102.0	102.7	97.1	82.7	108.1
7	90.4	98.0	100.1	101.3	103.1	103.8	98.2	83.8	109.2
8	90.4	98.0	100.1	101.3	103.1	103.8	98.2	83.8	109.2
9	90.4	98.0	100.1	101.3	103.1	103.8	98.2	83.8	109.2
10	90.4	98.0	100.1	101.3	103.1	103.8	98.2	83.8	109.2
11	90.4	98.0	100.1	101.3	103.1	103.8	98.2	83.8	109.2
12	90.4	98.0	100.1	101.3	103.1	103.8	98.2	83.8	109.2

The prediction results are presented at **Table 9-7**. It should be noted that the predictions assume that each receptor is downwind of the Wind Development to provide a worst-case assessment. Under non-downwind conditions, operational noise levels will be lower.

Worst-case downwind noise contours for the maximum operational noise level (i.e. corresponding to wind speeds of 7-12 m/s) are shown at **Figure 9-2** in **Volume 4** of this EIA Report, which also shows the scoped-in noise sensitive receptor locations.

Table 9-7: Operational Noise Prediction Results (dB L_{A90})

Location	Standardised 10m height wind speed (m/s)									
	3	4	5	6	7	8	9	10	11	12
1 Gordons Cairn Glengap	20.0	21.3	25.9	30.3	31.4	31.4	31.4	31.4	31.4	31.4
2 Gordons Cairn Glengap	20.0	21.3	25.9	30.3	31.4	31.4	31.4	31.4	31.4	31.4
3 Gordons Cairn Glengap	20.3	21.6	26.2	30.6	31.7	31.7	31.7	31.7	31.7	31.7
4 Gordons Cairn Glengap	20.2	21.5	26.1	30.5	31.6	31.6	31.6	31.6	31.6	31.6
5 Gordons Cairn Glengap	20.4	21.7	26.3	30.7	31.8	31.8	31.8	31.8	31.8	31.8
6 Gordons Cairn Glengap	20.3	21.6	26.2	30.6	31.7	31.7	31.7	31.7	31.7	31.7
Cot Cottage	21.8	23.1	27.7	32.1	33.2	33.2	33.2	33.2	33.2	33.2
Edgarton Farm	20.6	21.9	26.5	30.9	32.0	32.0	32.0	32.0	32.0	32.0
Glengap	18.9	20.2	24.8	29.2	30.3	30.3	30.3	30.3	30.3	30.3
Grobdale of Balmaghie	19.4	20.7	25.3	29.7	30.8	30.8	30.8	30.8	30.8	30.8
Lochenbreck Byre	19.0	20.3	24.9	29.3	30.4	30.4	30.4	30.4	30.4	30.4
Lochenbreck Cottage	19.0	20.3	24.9	29.3	30.4	30.4	30.4	30.4	30.4	30.4
Miefield Farm	18.9	20.2	24.8	29.2	30.3	30.3	30.3	30.3	30.3	30.3
The Waterhouse	20.4	21.7	26.3	30.7	31.8	31.8	31.8	31.8	31.8	31.8

It can be seen from **Table 9-7** that predicted levels at all noise sensitive receptors are below the simplified ETSU-R-97 limit of 35 dB L_{A90}, and as such, operational noise impacts are considered to be **not significant**.

Although the relevant noise limits are met, and the effects considered to be not significant, operational wind turbine noise may be audible at noise sensitive receptors.

Other Operational Effects

Operational noise from other on-site infrastructure including from the substation, BESS, and Solar Development (assuming the use of central inverters) is considered to be not significant, and was scoped out of detailed assessment as discussed in Section 9.4.3.

During the operational phase of the Proposed Development there will be a requirement for vehicles to access the site for performing routine maintenance. These low volumes of road traffic generated during the operational phase of the Proposed Development are considered to be **not significant**.

9.7.3 Decommissioning Effects

As discussed in Section 9.4.3, decommissioning effects have been scoped out of the assessment.

9.7.4 Cumulative Effects

As discussed in Section 9.4.3, cumulative effects have been scoped out of the assessment, and therefore no significant cumulative effects are predicted.

9.8 Additional Mitigation Measures

Noise associated with the construction, operation and decommissioning of the Proposed Development is considered to be not significant and no specific mitigation measures are considered necessary.

9.9 Assessment of Residual Effects

9.9.1 Construction Effects

Residual noise effects associated with the construction of the Proposed Development is considered **not significant**.

9.9.2 Operational Effects

Residual noise effects associated with the operation of the Proposed Development is considered **not significant**.

9.9.3 Decommissioning Effects

Residual noise effects associated with the decommissioning of the Proposed Development is considered **not significant**.

9.9.4 Cumulative Effects

Residual noise effects associated with the cumulative construction or operation of the Proposed Development is considered **not significant**.

9.10 Monitoring Requirements

Noise monitoring would only be required upon receipt of a valid noise complaint, and the exact conditions under which monitoring would be required will be set out by planning conditions.

9.11 Opportunities for Enhancement

There are no enhancement opportunities associated with noise for the Proposed Development.

9.12 Summary

Noise associated with the construction, operation, and decommissioning of the Proposed Development is considered to be **not significant**.

No significant cumulative construction or operational effects are predicted.

9.13 References

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