9. NOISE

Executive Summary

No significant impacts are predicted from the construction, operation and decommissioning of the Proposed Development.

Noise associated with the construction and operation of the Proposed Development has been assessed in line with national guidelines, current good practice and in consultation with Perth & Kinross Council (PKC). Construction noise arises from vehicles accessing the Site and the construction of the key components and infrastructure. Operational noise arises from the operation of the Proposed Development including noise from the battery energy storage system (BESS) and the wind turbine generators (WTGs) as they rotate to generate power. The significance of the noise impact depends on the levels arising during each phase of the Proposed Development, the duration of the noise exposure (i.e. noise from construction activities is permitted to be higher than operational noise due to the short-term nature of the impact), and the existing baseline noise levels.

Construction noise impacts have been largely scoped out of detailed assessment as typical noise limits referred to in relevant guidance (BS 5228-1:2009+A1:2014 – Code of Practice for Noise and Vibration Control on Construction and Open Sites) will be met at noise sensitive receptor locations in the vicinity of the Proposed Development. There may be temporary impacts associated with track construction and construction traffic accessing the Site and these have been considered in the assessment. The overall construction noise impact is determined to be **not significant**, and noise will be controlled and minimised as much as possible during the construction phase of the development via the Construction Environmental Management Plan (CEMP). The CEMP will be prepared and agreed with consultees prior to the commencement of construction. As decommissioning noise impacts will be the same or lower than construction impacts, they have similarly been scoped out of detailed assessment on the basis that if construction impacts are determined to be not significant, decommissioning impacts will also be **not significant.**

Operational noise from the proposed substation and adjacent BESS is assessed in according to BS 4142:2014+A1:2019, *Methods for rating and assessing industrial and commercial sound*. The significance of the impact is assessed by comparing the rating sound level (i.e. the sound level at receptor locations including any relevant character corrections) with existing background sound levels. In this case a detailed assessment has been scoped out given the significant distances between the proposed BESS adjacent to the substation and residential receptor locations. The minimum separation distance is about 4.8 km to the nearest residential receptor, and at such distances operational noise from the substation and BESS is very unlikely to be audible. Therefore, operational noise from these elements of the Proposed Development have been scoped out of the assessment and their impacts determined to be **not significant.**

Operational WTG noise impacts have been assessed in line with ETSU-R-97, The Assessment and Rating of Noise from Wind Farms, and the associated guidance provided by the Institute of Acoustics (IOA) document, A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise. Predicted operational noise levels have been compared with relevant noise limits for the

Proposed Development acting in isolation. Predicted operational noise levels meet the relevant ETSU-R-97 noise limits and therefore operational noise impacts are considered to be **not significant**. The ETSU-R-97 noise limits apply to cumulative WTG noise, as such, predicted cumulative noise levels have been compared with relevant noise limits. Predicted cumulative noise levels meet the relevant ETSU-R-97 noise limits and therefore operational noise impacts are considered to be **not significant**.

9.1 Introduction

9.1.1 This chapter considers the likely significant effects of noise associated with the construction, operation and decommissioning of the Proposed Development. The specific objectives of the Chapter are to:

- describe the assessment methodology and significance criteria used in completing the impact assessment;
- describe the potential effects, including direct, indirect, and cumulative effects;
- describe the mitigation measures proposed to address likely significant effects; and
- assess the residual effects remaining following the implementation of mitigation.

9.1.2 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 at the University of Southampton and has been carrying out wind farm noise assessments for over 18 years. Rob is a member of the Institute of Acoustics (MIOA), and Hayes McKenzie are members of the Association of Noise Consultants (ANC).

9.1.3 This Chapter is supported by the Figures (**EIAR Volume 2**) and Technical Appendices (TAs) (**EIAR Volume 4 and Volume 5**) listed in **Table 9-1**, which are referenced throughout the Chapter.

Table 9-1: Supporting Figures and Technical Appendices

Document Location	Document Description
Figure 1.1: Site Location	Figure showing the site layout
Technical Appendix 9.1: Noise Assessment Methodology	Technical appendix setting out the policy and guidance, assessment methodology, and noise modelling methodology and assumptions.
Confidential Technical Appendix 9.2: Source Turbine Sound Power Level Data (Volume 5)	Sets out the source noise levels for the candidate turbine assumed for the Proposed Development.
Figure 9.1: Predicted Operational Noise Contours	Predicted operational noise contour plot for the Proposed Development acting in isolation.
Figure 9.2: Predicted Cumulative Operational Noise Contours	Predicted operational noise contour plot for the Proposed Development acting cumulatively with the proposed Glen Lednock wind farm.

9.2 Assessment Methodology and Significance criteria

Scope of Assessment

9.2.1 The scope of the assessment has been informed by consultation responses summarised in **Table 9-2** and the following key legislation, planning policy and guidance:

Legislation

- Control of Pollution Act 1974
- Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017

Planning Policy

- 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;
- Scottish Government 2011, Planning Advice Note 1/2011 and Technical Advice Note;
- Perth and Kinross Council 2019, Local Development Plan; and
- Perth and Kinross Council (draft), Renewable & Low Carbon Energy Supplementary Guidance.

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

Consultation

9.2.2 **Table 9-2** below summarises the consultation undertaken throughout the Environmental Impact Assessment (EIA) process, including Scoping and further pre-application consultation, relevant to noise.

Table 9-2: Summary of Consultation Responses Relevant to Noise

Organisation and Type of Consultation	Response	How Response has been Considered
Perth & Kinross Council	Scoping Opinion response. PKC agreed the modelling and assessment methodology set out in the Scoping Report.	The assessment has been carried out in line with the assessment methodology set out in the Scoping Report.
Perth & Kinross Council	Scoping Opinion response. It is recommended that the applicant consult with PKC Environmental Health directly to agree the Noise Sensitive Receptors.	Hayes McKenzie emailed PKC in June 2024 to enquire as to who to liaise with to agree the noise sensitive receptors. Response received in July advising of the Environmental Heath (EH) officer to liaise with, and details sent to EH setting out the nearest noise sensitive receptors (NSRs). Response received in July from the Environmental Health Officer confirming that they were happy with the NSRs selected, and that Wester Glentarken (derelict) and Gillies Bothy (commercial) are not considered noise sensitive residential properties and can be scoped out of the assessment.

9.2.3 Full details of all consultation undertaken is provided in **TA 1.2: Consultation Register (Volume 4**).

Potential Effects Scoped Out

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

Vibration

9.2.5 Vibration during the construction, operational, and decommissioning phases of the Proposed Development has been scoped out of the assessment.

9.2.6 The construction phase of the Proposed Development will involve vibration-generating activities. However, these effects will be short-term, and negligible due to the large separation distances between receptors and the closest areas of works. BS 5228: Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration (BS 5228-2) provides example criteria for the assessment of the significance of construction vibration effects, a method for the prediction of vibration levels from construction activities, and practical information on construction vibration reduction measures, promoting a 'Best Practicable Means' (BPM) approach to noise and vibration control. Nevertheless, levels of vibration from construction activities associated with the construction of the Proposed Development

beyond 100 m are unlikely to be potentially significant, and therefore construction vibration has been scoped and is not significant.

9.2.7 The levels of ground-borne vibration generated by operational wind turbines are very low, although ground-borne vibration from wind turbines can be measured at large distances by sensitive equipment. At noise sensitive receptor locations, vibration from the operation of the wind farm will not be perceptible. Therefore, the assessment of vibration during the operational phase of the development is not considered to be necessary and has been scoped out of the assessment.

9.2.8 Levels of vibration during the decommissioning phase of the Proposed Development will be similar to those arising during construction, and as such has been scoped out of the assessment.

Operational Substation and BESS Noise

9.2.9 Given the large separation distances (i.e. at least 4.8 km) between the proposed substation and BESS and the nearest residential (noise sensitive) receptors, operational noise associated with the operation of the substation and BESS has been scoped out on the basis that it is very unlikely to be audible at residential receptor locations. If such noise was required to be assessed, it would be assessed in line with BS 4142:2014+A1:2019, *Methods for rating and assessing industrial and commercial sound.*

Operational Wind Turbine Tonal Noise

9.2.10 ETSU-R-97 specifies that, in line with other noise guidance, a penalty should be added to measured or predicted WTG noise levels if there is a 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 Proposed Development which would give rise to such a penalty as most modern turbines operate without significant tonal noise. If deemed necessary, 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 Proposed Development has therefore been scoped out of the assessment.

Low Frequency and Infrasound

9.2.11 Low frequency sound is typically defined as sound in the audible hearing frequency range of 20 Hz up to about 200 Hz. Noise from WTGs is not inherently low-frequency and it is typically broad-band in nature, and close to a WTG 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 the 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 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.

9.2.12 Work carried out in 2006 by Hayes McKenzie for the UK Department of Trade and Industry (DTU, 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.

9.2.13 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 WTG 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-Württemberg (Landesanstalt für Umwelt, Messungen und Naturschutz Baden-Württemberg, 2016) that contained a comprehensive review of low frequency and infrasound from WTGs and evaluated such noise in relation to other sources. The results state that *"the infrasound level in the vicinity of wind turbine 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 turbine, 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".*

9.2.14 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

9.2.15 The variation in noise level associated with WTG 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).

9.2.16 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).

9.2.17 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 applies if AM is deemed to be a significant issue. 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.

9.2.18 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. Where operational noise levels are more than 5 dB below the relevant noise limit, this is an indication that operational noise levels are very low (and therefore significant AM is much less likely than at a site with higher operational noise levels and turbine noise is clearly audible above background). In addition, where operational noise levels are more than 5 dB below the relevant limit, an AM condition is unnecessary as any penalty associated with it would not cause a breach of the noise limit as the maximum AM character correction is 5 dB. AM has therefore been scoped out of the assessment.

Decommissioning Effects

9.2.19 Noise arising from decommissioning activities will meet the relevant noise limits that apply to noise from construction, and 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.

Method of Baseline Characterisation

9.2.20 Baseline measurements have not been undertaken as the ETSU-R-97 simplified noise 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 as they would only be needed to calculate potentially higher limits that are set relative to background.

Method of Assessment

9.2.21 The full assessment methodology, including criteria for assessing sensitivity of receptors, magnitude of change and cumulative effects, as well as overall significance criteria and approach to mitigation, is detailed in **TA 9.1: Noise Assessment Methodology (Volume 4).**

Limitations and Assumptions

9.2.22 The operational noise impact assessment is based on a candidate worst case WTG which may not be the turbine that is installed in practice. However, operational noise limits will be set for the Proposed 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 farm.

9.3 Baseline Conditions

Current Baseline

9.3.1 Baseline noise measurements are usually undertaken where predicted operational WTG noise levels are above the simplified lower ETSU limit of 35 dB L_{A90}. In this case, the ETSU-R-97 simplified noise limit is met, and therefore no baseline noise measurements have been undertaken. 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 A85 affecting properties on that road;
- Localised sources from human activities including farming; and
- Birdsong and animal activity.

Future Baseline

9.3.2 The future baseline conditions under the "do nothing" scenario (i.e., the conditions in the event that the Proposed Development does not go ahead), are expected to remain similar to the current baseline noise conditions. In this case, as the relevant construction and operational noise limits are not set relative to baseline noise levels, although no significant changes in the future baseline are predicted, if they were to change, it would not affect the outcome of the assessment.

Sensitive Receptors

9.3.3 A summary of identified closest operational noise receptors is provided within **Table 9-3.**

Table 9-3: Summary of Identified Noise Receptors

Receptor	Easting	Northing
Woodhouse	267075	724681
The Kopje	267965	724854
Brae Farm	266201	734360
Roadside Cottage	273936	727473

9.3.4 A summary of identified closest construction noise receptors is provided within **Table 9-4**. These are receptors that are not considered sensitive to operational noise from the wind farm but are within closer proximity to the access track.

Table 9-4: Summary of Identified Access Track Construction Noise Receptors

Receptor	Easting	Northing
Glenbeich Lodge	261592	724936
Keeper's Cottage	261590	724797
Glenbeich Farm	261524	724621
Ardveich Cottage	261749	724568
Ardveich House	261760	724535
Drummond Fish Farm	261822	724225
Woodend Cottage	262457	724289

9.4 Assessment of Likely Effects

Embedded Mitigation

Proposed Mitigation during Construction

9.4.1 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.

9.4.2 Any specific mitigation measures that may be required for certain activities will be set out within the detailed CEMP, likely to be secured by means of a planning condition.

9.4.3 The relevant BS5228 noise limits that would apply to construction activities with a duration of greater than one month are set out at **Table 9-5**.

Table 9-5: 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

9.4.4 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 14:00 on Saturdays) and excluding Sundays and public holidays, unless specifically agreed with PKC. Where construction on a Saturday is carried out up to 14:00 is it considered acceptable to apply the standard daytime noise limit of 65 dB L_{Aeq}. 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 PKC. 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.

9.4.5 It is possible that blasting at the on-site borrow pits 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 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 operator would inform the nearest residents of the proposed times of blasting and of 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.

9.4.6 With regard to noise from construction traffic, a site management regime will be developed to control the movement of vehicles to and from the site. This will be implemented through a Construction Traffic Management Plan (CTMP), as discussed further in **Chapter 11 Traffic and Transport (Volume 1).**

Embedded Mitigation During Operation

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

9.4.8 Details of all mitigation via design are presented in **Chapter 3: Evolution of Design and Alternatives (EIAR, Volume 1).**

Mitigation during Decommissioning

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

Potential Construction Effects

9.4.10 A detailed assessment of construction noise is not included because it is deemed unnecessary and impractical at this stage of the Proposed Development. The two main construction activities that have been considered are that of blasting at the borrow pits and track construction. All other construction activities are likely to result in significantly lower levels of noise at noise sensitive properties.

9.4.11 Due to the relatively large distance (>700 m) between the borrow pits and sensitive receptors, general excavation activities can be deemed to have no significant effect, and therefore does not require detailed assessment as the limits set out in **Table 9-5** will be met. Blasting may be required for the extraction of aggregate, and 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. Whilst it is likely that blasting noise could be heard at nearby residential locations, the average construction noise levels will still be below relevant construction limits, but best practice is to mitigate and minimise the impact. Mitigation to reduce the noise impact from blasting activities is set out in Section 9.4.5**.**

9.4.12 The closest sensitive receptor to the proposed track route is Woodend Cottage at a distance of approximately 230 m. At a distance of 230 m between a sensitive receptor and track construction, the worst case predicted noise levels are likely to be below 65 dB L_{Aeq} (i.e. the daytime construction noise limit). Therefore, the noise levels predicted for Woodend Cottage, and all other noise sensitive properties, will meet the applicable noise limit.

9.4.13 Noise from vehicles accessing the site along the access track will result in lower levels than during the construction of the track at the nearest noise sensitive properties, and therefore noise from vehicles accessing the site will be significantly below the 65 dB L_{Aeq} daytime criterion.

9.4.14 As construction noise from track construction, which is considered to be the on-site construction activity likely to give rise to the highest noise levels at receptor locations, is not significant, and noise from blasting is short-term and will be mitigated and minimise such that the impact is considered to be not significant, noise from all other construction activities can also be considered to be **not significant.**

Potential Operational Effects

9.4.15 Operational noise impacts have been assessed by comparing predicted operational noise levels with the simplified ETSU-R-97 noise limit of 35 dB $L_{A90.}$

9.4.16 Operational noise predicted results are presented for all receptors scoped into the assessment that are shown in **Table 9-3.** The noise prediction methodology is included in **TA 9.1 (EIAR Volume 4),** and the source sound power level data is included in **Confidential TA 9.2 (EIAR Volume 5).**

9.4.17 The prediction results are presented at **Table 9-6.**

Table 9-6: Predicted Operational Noise Levels (dB L_{A90})

Location	Standardised 10 m height wind speed (m/s)								
	4	5	6	7	8	9	10	11	12
Woodhouse	14.4	19.3	23.8	25.4	25.4	25.5	25.6	25.7	25.7
The Kopje	15.4	20.3	24.8	26.4	26.4	26.4	26.6	26.6	26.6
Brae Farm	14.3	19.2	23.7	25.3	25.3	25.4	25.5	25.6	25.6
Roadside Cottage	7.7	12.7	17.2	18.8	18.8	18.9	19.2	19.3	19.3

9.4.18 **Figure 9.1 (EIAR Volume 2**) shows the predicted noise contours (dB L_{A90}) for the Proposed Development operating at 10 m/s (which is the wind speed up to 10 m/s at which the maximum noise levels at noise sensitive receptors arises).

9.4.19 It can be seen that all properties meet the ETSU-R-97 simplified noise limit of 35 dB L_{A90}. It can therefore be concluded that operational noise impacts are **not significant** at all noise sensitive properties.

Potential Decommissioning Effects

9.4.20 As discussed in Section 9.2.19 decommissioning effects have been scoped out of further consideration, and as construction noise effects are considered to be not significant, decommissioning noise effects are also considered to be **not significant.**

Potential Cumulative Operational Effects

9.4.21 Two wind farms have been considered for inclusion in the cumulative operational noise impact assessment; the operational Braes O'Doune and the consented Strathallan wind farms. However, they are sufficiently distant (16 and 17 km distant respectively) such that no significant cumulative operational effects are anticipated, and they have not been included in the cumulative operational noise impact assessment.

9.4.22 The Proposed Development is adjacent to the proposed Glen Lednock wind farm, for which a scoping report was submitted in November 2023 (ECU reference no. ECU00004966). Usually only operational, consented, or submitted planning applications are considered in the cumulative operational noise impact assessment. However, in this case, cumulative operational predicted noise levels based on the submitted Glen Lednock scoping layout have been included. The modelling assumptions are set out in **TA 9.1 (EIAR Volume 4**). Cumulative operational noise impacts have been assessed by comparing predicted cumulative operational noise levels with the simplified ETSU-R-97 noise limit of 35 dB L_{A90}.

9.4.23 Cumulative operational noise predicted results are presented for all receptors scoped into the assessment that are shown in **Table 9-3.**

9.4.24 The cumulative prediction results are presented at **Table 9-7**.

Table 9-7: Predicted Cumulative Operational Noise Levels (dB L_{A90})

Location	Standardised 10 m height wind speed (m/s)								
	4	5	6	7	8	9	10	11	12
Woodhouse	19.1	24.0	27.5	28.2	28.1	28.1	28.2	28.2	28.2
The Kopje	20.4	25.3	28.8	29.4	29.3	29.4	29.4	29.5	29.5
Brae Farm	18.0	22.9	26.6	27.4	27.3	27.3	27.4	27.5	27.5
Roadside Cottage	19.7	24.5	27.5	27.6	27.4	27.5	27.5	27.5	27.5

9.4.25 **Figure 9.2** (**EIAR Volume 2**) shows the predicted noise contours (dB L_{A90}) for the cumulative scenario operating at 10 m/s (which is the wind speed up to 10 m/s at which maximum noise levels at receptor locations arise).

9.4.26 It can be seen that cumulative predicted operational noise levels at all properties meet the ETSU-R-97 simplified noise limit of 35 dB L_{A90}. It can therefore be concluded that cumulative operational noise impacts are **not significant** at all properties. Predicted cumulative operational noise levels are at least 5 dB below the ETSU-R-97 simplified noise limit, such that any changes to the Glen Lednock development between scoping and submitting a section 36 application are unlikely to cause any predicted exceedance of the relevant limit.

9.5 Additional Mitigation

Mitigation During Construction

9.5.1 No additional mitigation is required as there are no significant effects as a result of the construction of the Proposed Development. As discussed in Section 9.4, noise during the construction phase of the development will be managed though the CEMP and CTMP. An Outline CEMP is provided in **TA 2.1 (EIAR Volume 4).**

Mitigation During Operation

9.5.2 No mitigation is required as there are no significant effects as a result of the operation of the Proposed Development. It is likely that operational noise limits will be applied via planning conditions for the Site, and this will ensure that operational noise levels are restricted to relevant limits for the operational duration of development.

9.6 Assessment of Residual Effects

Residual Construction Effects

9.6.1 Noise associated with the construction of the Proposed Development is considered **not significant** as the relevant noise limits are met.

Residual Operational Effects

9.6.2 Noise associated with the operation of the Proposed Development is considered **not significant** as the relevant noise limits are met.

Residual Decommissioning Effects

9.6.3 Noise associated with the decommissioning of the Proposed Development is considered **not significant** as the relevant construction noise limits are predicted to be met.

Residual Cumulative Operational Effects

9.6.4 Noise associated with the operation of the Proposed Development cumulatively with nearby wind farms is considered **not significant** as the relevant noise limits are met.

9.7 Monitoring

9.7.1 No noise monitoring is proposed during any stage of the Proposed Development. However, noise from the construction and operation of the Proposed Development can be measured and assessed against the relevant noise limits if necessary (i.e. in response to noise complaints where PKC consider that the relevant noise limits may be breached).

9.8 Summary

9.8.1 Noise associated with the construction and operation of the Proposed Development has been assessed in line with national guidelines and current good practice, and in consultation with PKC. Construction noise arises from vehicles accessing the Site and the construction of the key components and infrastructure. Operational noise arises from the operation of the Proposed Development including noise from the BESS and the WTGs as they rotate to generate power.

9.8.2 Construction noise impacts have been largely scoped out of detailed assessment as typical noise limits referred to in relevant guidance (BS 5228-1:2009+A1:2014 – Code of Practice for Noise and Vibration Control on Construction and Open Sites) will be met at noise sensitive receptor locations in the vicinity of the Proposed Development. There may be temporary impacts associated with track construction and construction traffic accessing the site and these have been considered in the assessment. The overall construction noise impact is determined to be **not significant,** and noise will be controlled and minimised as much as possible during the construction phase of the development via the CEMP which will be prepared and agreed with consultees prior to the commencement of construction. As decommissioning noise impacts will be the same or lower than construction impacts, they have similarly been scoped out of detailed assessment on the basis that if construction impacts are determined to be not significant, decommissioning impacts will also be **not significant.**

9.8.3 Operational noise from the proposed substation and adjacent BESS has been scoped out given the significant distances between the proposed BESS adjacent to the substation and residential receptor locations, and their impacts are determined to be **not significant.**

9.8.4 Operational WTG noise impacts have been assessed in line with ETSU-R-97, The Assessment and Rating of Noise from Wind Farms, and the associated guidance provided by the Institute of Acoustics (IOA) document, A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise. Predicted operational noise levels have been compared with relevant noise limits for the Proposed Development acting in isolation. Predicted operational noise levels meet the relevant ETSU-R-97 noise limits and therefore operational noise impacts are considered to be not significant. The ETSU-R-97 noise limits apply to cumulative WTGs noise, as such, predicted cumulative noise levels have been compared with relevant noise limits. Predicted cumulative noise levels meet the relevant ETSU-R-97 noise limits and therefore operational noise impacts are considered to be **not significant.**

9.8.5 A summary of the potential noise effects associated with the Proposed Development are set out in **Table 9-8** below.

Table 9-8: Summary of Potential Significant Effects

Likely Significant Effect	Mitigation Proposed	Means of Implementation	Outcome/ Residual Effect
Construction			
Noise from construction activities at noise sensitive receptors.	Best practicable means to minimise noise impacts, although the relevant noise limits are predicted to be met.	The CEMP will set out how construction noise effects will be minimised during the construction phase of the development.	**Not significant**
Operation			
Operational noise from the substation and BESS at noise sensitive receptors.	No specific mitigation required.	Not required	**Not significant**
Operational noise from the WTGs at noise sensitive receptors.	No specific mitigation required.	Not required	**Not significant**