





## Contents

---

|            |                                                            |             |
|------------|------------------------------------------------------------|-------------|
| <b>10.</b> | <b>Noise and Vibration</b>                                 | <b>10-1</b> |
| 1.1        | Introduction                                               | 10-1        |
| 10.2       | Assessment Methodology                                     | 10-2        |
| 10.3       | Existing Conditions                                        | 10-9        |
| 10.4       | Implications of Climate Change for Existing Conditions     | 10-9        |
| 10.5       | Future Baseline in the Absence of the Proposed Development | 10-10       |
| 10.6       | Embedded Design Mitigation                                 | 10-10       |
| 10.7       | Good Practice Mitigation Measures                          | 10-10       |
| 10.8       | Micrositing                                                | 10-10       |
| 10.9       | Scope of the Assessment                                    | 10-11       |
| 10.10      | Assessment of Effects                                      | 10-12       |
| 10.11      | Interrelationship Between Effects                          | 10-25       |
| 10.12      | Further Survey Requirements and Monitoring                 | 10-25       |
| 10.13      | Summary of Likely Significant Effects                      | 10-25       |

## 10. Noise and Vibration

### 10.1 Introduction

- 10.1.1 This chapter considers the likely significant effects of the proposed Glenouther Wind Farm (the Proposed Development) in relation to noise and vibration. It details the assessment methodology for assessing impacts during the construction, operational, and decommissioning of the Proposed Development, where relevant, together with an assessment against the relevant criteria, and has been undertaken in accordance with best practice guidance and standards. An assessment of effects of the Likely Grid Connection Route works (as defined in **Chapter 4: Development Description**) (including in-combination with the Proposed Development) is also included.
- 10.1.2 Vibration effects associated with the construction, operation, and decommissioning of the Proposed Development and Likely Grid Connection Route have been scoped out of the assessment (as set out within the Scoping Report) on the basis that no significant vibration effects are predicted.
- 10.1.3 This chapter should be read in conjunction with **Chapter 11: Access, Traffic and Transport** and **Technical Appendix 11.1: Transport Assessment**.
- 10.1.4 The noise and vibration assessment was undertaken by the Hayes McKenzie Partnership. Further details are included in **Technical Appendix 1.1: Statement of Expertise**.
- 10.1.5 This chapter is supported by the following figures which are referenced throughout the text and can be found in **Volume 3a: Figures** of the EIA Report:
- **Figure 10.1: Predicted Operational Noise Levels of Proposed Development Only at 10 m/s Wind Speed;** and
  - **Figure 10.2: Cumulative Predicted Operational Noise Levels at 10 m/s Wind Speed.**
- 10.1.6 The following appendices are also referred to throughout the chapter and can be found in **Volume 4: Technical Appendices** of the EIA Report:
- **Technical Appendix 10.1: Baseline Noise Measurements;**
  - **Technical Appendix 10.2: Noise Prediction Methodology;**
  - **Technical Appendix 10.3: Cumulative Modelling Assumptions;**
  - **Technical Appendix 10.4: Cumulative Modelling Results;** and
  - **Technical Appendix 10.5: Site-Specific Noise Limits.**
- 10.1.7 The following terminology will be referred to throughout this chapter and is included in the Glossary at the end:
- AM – Amplitude Modulation;
  - ARWTN – Assessment and Rating of Wind Turbine Noise;
  - CEMP – Construction Environmental Management Plan;
  - CRTN – Construction Road Traffic Noise;
  - CTMP – Construction Traffic Management Plan;
  - dB – Decibel;
  - DEMP – Decommissioning Environmental Management Plan;
  - EAC – East Ayrshire Council;
  - EHO – Environmental Health Officer;
  - EIA – Environmental Impact Assessment;
  - IOA – Institute of Acoustics;
  - IOA GPG – A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Noise from Wind Turbines;

- LLV – Lower Limiting Value;
- NML – Noise Measurement Location;
- NSR – Noise Sensitive Receptor;
- RNB – Remaining Noise Budget;
- SSNL – Site-specific Noise Limit; and
- TNAC – Total Noise Assessment Criteria.

## 10.2 Assessment Methodology

### Legislation, Policy and Guidance

#### Legislation

10.2.1 This assessment is carried out in accordance with the principles contained within the following legislation:

- The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2017 (the EIA Regulations); and
- Control of Pollution Act 1974.

#### Policy

10.2.2 The following policies of relevance to the assessment have been considered:

- Scottish Government 2023, National Planning Framework 4;
- Scottish Government 2022, Onshore Wind Policy Statement 2022;
- East Ayrshire Council Local Development Plan 2; and
- East Ayrshire Council Supplementary Guidance, Planning for Wind Energy, December 2017.

#### Guidance

10.2.3 This assessment is carried out in accordance with the principles contained within the following documents:

- Scottish Government 2011, Assessment of noise: technical advice note;
- Scottish Government 2011, Planning Advice Note 1/2011: planning and noise;
- 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;
- Department of Transport, Welsh Office, 1988, Calculation of Road Traffic Noise (CRTN);
- Department for Energy Security and Net Zero (2026), Assessment and Rating of Wind Turbine Noise (ARWTN);
- UK Department of Trade and Industry (1996), ETSU-R-97 The Assessment and Rating of Noise from Wind Farms<sup>1</sup>; 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).

<sup>1</sup> ETSU-R-97 was replaced by ARWTN by the UK Government in June 2026, but has not yet been formally endorsed by Scottish Government. The Scoping Report and consultation were based on ETSU-R-97 as it was the assessment methodology that prevailed at the time. Where relevant, this chapter reflects the ARWTN guidelines and terminology therein.

## Consultation

10.2.4 In undertaking the assessment, consideration has been given to the consultation which has been undertaken as detailed in **Table 10.1**. Further details are included in **Technical Appendix 2.1: Scoping Consultation Table**.

**Table 10.1 Consultation Responses**

| Consultee and Date                                                     | Scoping/Other Consultation                                                                                                      | Issue Raised                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Response/Action Taken                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Local Planning Authority;<br>East Ayrshire Council (EAC),<br>June 2025 | Pre-scoping consultation focussing on baseline noise measurements and setting out the operational noise assessment methodology. | The baseline measurement locations were agreed with the Environmental Health Department who were invited to attend the installation of the noise monitoring equipment and indicated that a representative would like to attend the installation.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | At the time of the baseline measurements, the Environmental Health Officer was unable to attend the installation of the noise monitoring equipment.<br><br>The noise measurement equipment was installed at the locations originally proposed, except at Marramead where it was not possible to gain consent, and therefore an alternative location at North Drumboy was used – see <b>Figure 10.1</b> .                                                                                                                                                                                   |
| East Ayrshire Council (EAC).<br>December 2025                          | Formal Scoping consultation                                                                                                     | <p>The Scoping Report set out the proposed operational noise assessment methodology, to which the EAC Environmental Health Service responded;</p> <p><i>“We have no objection to the proposed noise assessment methodology and adopted noise limits”</i></p> <p>The Scoping report set out the likely baseline monitoring locations and noise-sensitive receptors that would be scoped into the assessment. to which the EAC Environmental Health Service responded;</p> <p><i>“We have no objection to the selected baseline noise measurement locations and consider these to be representative of all noise-sensitive receptors. We do not wish to add any further receptors to the operational noise impact assessment”.</i></p> <p>The Scoping report set out the wind turbine developments that would be scoped into the cumulative assessment. to which the</p> | <p>This chapter assesses noise from the Proposed Development in line with the methodology set out in the Scoping Report which was agreed with EAC.</p> <p>As EAC agreed with the noise assessment methodology no specific changes or updates to the assessment methodology were required.</p> <p>The ARWTN TNAC applies the same noise limits to cumulative noise as ETSU-R-97 and requires derivation of limits from background sound level measurements in the same way as ETSU-R-97 and the IOA GPG, not additional consultation on the adoption of ARWTN was considered necessary.</p> |

| Consultee and Date                            | Scoping/Other Consultation  | Issue Raised                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Response/Action Taken                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|-----------------------------------------------|-----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                               |                             | <p>EAC Environmental Health Service responded;</p> <p><i>"We are not aware of any other wind turbine developments in the vicinity of the proposed development that should be considered for inclusion in the cumulative operational noise impact assessment".</i></p>                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| East Ayrshire Council (EAC).<br>December 2025 | Formal Scoping consultation | <p><i>"The Council would advise that in addition to discussions with the Council's Environmental Health Service, the Planning Service would largely be led by advice from the Council's independent noise consultant, and the detailed methodology should be agreed with them, with input from Environmental Health as required, for the purposes of carrying out the noise assessment to inform the EIA Report. The Planning Authority would encourage the use of the lower end of the ETSU limits."</i></p> | <p>It was noted that EAC would use an independent noise consultant to review the noise assessment, and that EAC encourage the use of limits at the lower end of the ETSU-R-97 noise limit.</p> <p>It is noted that since the Scoping Report, ARWTN has replaced ETSU-R-97, but the same day limit range applies.</p> <p>Although the ARWTN upper day noise limit of 40 dB L<sub>A90</sub> has been applied as the cumulative day LLV (i.e., at the maximum of the day lower limiting values), at all baseline noise measurement locations background sound levels were sufficiently high that adopting the lowest LLV (35 dB L<sub>A90</sub>) would make no difference to the derived noise limits. The only exception to this is at Glenouther Farm at wind speeds below 5 m/s where the lower day noise limits would also be met.</p> <p>As the baseline measurement locations and assessment methodology were agreed with EAC and there have been no deviations made to the agreed methodology, it was considered that there was no additional detailed methodology required and therefore further consultation was not necessary. It is noted that the overarching (TNAC) noise limits within ARWTN are same as in ETSU-R-97.</p> |

## Study Area

- 10.2.5 The operational noise study area is based on predicted noise levels from the Proposed Development. The study area encompasses the nearest noise sensitive receptors (NSRs) where predicted operational noise levels from the Proposed Development acting alone are above 30 dB LA90. This is on the basis that the minimum total noise assessment criteria (TNAC) applicable is 40 dB LA90, as set out within the Scoping Report and consultation with EAC as there are existing wind turbine developments scoped into the cumulative assessment that have a day LLV of 40 dB LA90. Where the predicted operational noise levels from the Proposed Development acting alone are 10 dB or more below the TNAC its contribution can be considered to be negligible and not significant. **Figure 10.1** and **Table 10.2** therefore show all NSRs which fall within at least the 30 dB LA90 operational noise threshold based on a standardised 10 m height wind speed of 10 m/s.

**Table 10.2 Scoped in Noise-Sensitive Receptors (NSRs)**

| ID    | Location                | Easting | Northing | ID    | Location                        | Easting | Northing |
|-------|-------------------------|---------|----------|-------|---------------------------------|---------|----------|
| NSR1  | Best Friends Cottage    | 249731  | 647272   | NSR24 | Laverockhall Cottage            | 246199  | 649255   |
| NSR2  | Blacklaw Cottage        | 246325  | 649330   | NSR25 | Lintbrae Cottage                | 245877  | 647384   |
| NSR3  | Blacklawhill Farm       | 246381  | 649861   | NSR26 | Lintbrae Farm                   | 245811  | 647381   |
| NSR4  | Blair Farm*             | 248672  | 647393   | NSR27 | Low Blacklaw                    | 246656  | 649894   |
| NSR5  | Corsehouse Cottage*     | 247346  | 650018   | NSR28 | Lowtoun of Blacklaw Farm        | 246641  | 649909   |
| NSR6  | Corsehouse*             | 247771  | 650263   | NSR29 | Marramead                       | 249403  | 648916   |
| NSR7  | Crofthead of Gree Farm  | 247063  | 646558   | NSR30 | Meadowlands Farm                | 246627  | 650221   |
| NSR8  | Dounne Law Cottage      | 246248  | 649310   | NSR31 | Mid Floak Bungalow              | 249314  | 650067   |
| NSR9  | East Whitelee Farm      | 246040  | 649003   | NSR32 | Mid Floak Farm                  | 249281  | 650132   |
| NSR10 | Easter Blacklaw Farm    | 246724  | 650560   | NSR33 | North Drumboy*                  | 249351  | 648839   |
| NSR11 | Easterhouse of Whitelee | 246030  | 648980   | NSR34 | Owl Cottage Upper Hairshaw Farm | 245997  | 648375   |
| NSR12 | Floak                   | 249344  | 649974   | NSR35 | Pebblebank East Whitelee        | 246008  | 649004   |
| NSR13 | Glen-a-Moor             | 245794  | 649050   | NSR36 | Raithburn Farm                  | 247749  | 646118   |
| NSR14 | Glenouther Farm*        | 246501  | 648218   | NSR37 | Raithill Farm                   | 248247  | 646592   |
| NSR15 | Gree Cottage            | 246676  | 646764   | NSR38 | South Drumboy Farm              | 249472  | 648440   |
| NSR16 | Greelaw Farm*           | 247215  | 647152   | NSR39 | Sunrise Lodge                   | 249419  | 648786   |
| NSR17 | Greenfinch              | 249373  | 648791   | NSR40 | The Stables                     | 249383  | 648836   |
| NSR18 | Hairshaw Cottage        | 245536  | 648005   | NSR41 | Townhead of Floak Bungalow      | 249230  | 650218   |
| NSR19 | Harelaw Farm            | 248913  | 647048   | NSR42 | Townhead Of Floak Farm          | 249194  | 650237   |
| NSR20 | High Clunch Farm        | 246709  | 647238   | NSR43 | Townhead of Gree Farm           | 246817  | 646710   |
| NSR21 | Highfield Farm          | 250372  | 649632   | NSR44 | Upper Hairshaw Farm             | 245986  | 648397   |
| NSR22 | Kelvedon Cottage        | 245912  | 648971   | NSR45 | Windmill Cottage                | 245703  | 649020   |



| ID    | Location                | Easting | Northing | ID    | Location        | Easting | Northing |
|-------|-------------------------|---------|----------|-------|-----------------|---------|----------|
| NSR23 | Kingswell Country House | 250034  | 647750   | NSR46 | Windy-Yett Farm | 247747  | 650805   |

*\*denotes properties which were chosen as baseline noise measurement locations (NMLs)*

- 10.2.6 It should be noted that not all NSRs within the study area are necessarily assessed individually, but the nearest receptors are assessed, such that if the relevant operational noise limits are met at the NSRs, they will also be met at more distant receptors.
- 10.2.7 The construction and decommissioning study area is based on the distance set out in the Scoping Report, which proposed that construction noise effects would be considered where NSRs are within 200 m of construction activities. In addition, worst-case construction noise levels have been determined at the nearest NSR to onsite construction which is further than 200 m. It can therefore be concluded that if the relevant construction noise limits are met at the nearest NSR, then they will be met at all NSRs. It is noted that there are no noise-sensitive receptors within 200 m of any onsite construction activities.
- 10.2.8 For the Likely Grid Connection Route, the same separation distance has been applied as for onsite construction, and therefore construction effects considered where NSRs are within 200 m of construction. As an underground grid route is proposed, there will be no audible noise from the grid route at NSRs during the operational phase and therefore this aspect is not assessed.
- 10.2.9 For construction traffic, the predicted increase in road traffic noise has been considered, rather than applying a fixed separation distance to scope in NSRs.

### Desk Based Research and Data Sources

- 10.2.10 The following data sources have informed the assessment:
- Ordnance Survey and AddressBase Mapping;
  - Ordnance Survey 50 m topography data;
  - Noise datasheets for wind turbine sound power levels and construction plant data; and
  - Planning conditions for wind turbine developments in the vicinity.

### Field Survey

- 10.2.11 The following field surveys were carried out to inform the assessment:
- Baseline noise measurements were undertaken at six residential receptor locations (see **Table 10.2**) to determine baseline noise levels for derivation of appropriate noise limits between 12 November and 29 December 2025.

### Assessing Significance

#### Sensitivity

- 10.2.12 The sensitivity of all NSRs is high as they are all residential dwellings, and therefore no variation of sensitivity of receptor has been applied in the assessment.

#### Magnitude

- 10.2.13 For the operational assessment the magnitude of change has been assessed by comparing predicted noise levels with noise limits derived in line with ARWTN from existing baseline noise levels for each NSR. However, it is noted that where typical background sound levels are low, lower limiting values (LLVs) apply.
- 10.2.14 In terms of the construction (and decommissioning) noise assessments, the magnitude of change has not been evaluated due to the relatively short-term impacts. Construction noise effects have been assessed against absolute noise limits taken from BS 5228 that apply in low background sound environments.

### Significance

- 10.2.15 The predicted significance of the effect was determined through a comparison of predicted construction and operational noise levels with the relevant noise limits as detailed in **Table 10.3**, **Table 10.4** and **Table 10.5** below. If the relevant noise limits are met, then no significant noise effects are predicted in EIA terms. Where predicted noise levels are above the relevant noise limits, effects which are considered significant in the context of the EIA Regulations would arise which would require mitigation.

**Table 10.3 Construction Noise Limits**

| Time period                                                                       | Limit        |
|-----------------------------------------------------------------------------------|--------------|
| Weekday day-time (07:00-19:00) and Saturday morning (07:00-13:00)                 | 65 dB LAeq,t |
| Evenings (19:00-23:00) and weekends (Saturday 13:00-19:00 and Sunday 07:00-19:00) | 55 dB LAeq,t |
| Night time (23:00-07:00)                                                          | 45 dB LAeq,t |

- 10.2.16 The construction noise limits apply to construction activities with a duration of more than one month, and shorter terms exceedances of the limits set out at **Table 10.3** are typically acceptable. In this case, onsite construction has been compared with these limits as a conservative approach.
- 10.2.17 In respect of road traffic noise, and when calculated in accordance with the Calculation of Road Traffic Noise (CRTN), the significance of the effects are determined according to **Table 10.4** below.

**Table 10.4 Construction Road Traffic Noise Effects**

| Predicted Increase (dB(A)) | Magnitude of effect | Significance of effect                       |
|----------------------------|---------------------|----------------------------------------------|
| 0                          | No impact           | Not significant                              |
| 0-1                        | Negligible          | Not significant                              |
| 1-3                        | Minor               | Not significant                              |
| 3-5                        | Moderate            | Potentially significant depending on context |
| >5                         | Major               | Potentially significant depending on context |

- 10.2.18 If the predicted increase is more than 3 dB(A), a potentially significant effect may occur. The significance of such an effect depends on the context which includes the duration of the effect and existing baseline noise levels. Where predicted increases are more than 3 dB(A), this is discussed in context to determine the significance.
- 10.2.19 The TNAC that applies to noise from all wind turbine developments is set out at **Table 10.5** below and applies at standardised<sup>2</sup> wind speeds up to 10 m/s. The LLVs that apply during the day and night are different. The night LLV is 43 dB LA90, and the day LLV is set in the range 35-40 dB LA90. The choice of day LLV is based on, in priority order, the generating capacity of the wind farm (including consideration of exiting turbines), the number of dwellings in the vicinity, and the duration and level of exposure. In this case, as discussed in the Scoping Report, other wind turbine developments have already been consented at the maximum day LLV of 40 dB LA90 and it is therefore appropriate to apply a day LLV of 40 dB LA90. Given the generating capacity of the Proposed Development, together with the generating capacity of other wind turbine developments included in the cumulative noise assessment, the application of the maximum day LLV is considered appropriate.

<sup>2</sup> The standardised wind speed is the 10 m height wind speed calculated using the hub height wind speed, corrected to 10 m above ground level assuming a logarithmic wind shear profile and a ground roughness length of 0.05 m.

**Table 10.5 Total Noise Assessment Criteria (TNAC)**

| Time period                                       | Limit                                                               |
|---------------------------------------------------|---------------------------------------------------------------------|
| Day (07:00-23:00)                                 | The greater of 40 dB L <sub>A90</sub> or plus 5 dB above background |
| Night (23:00-07:00)                               | The greater of 43 dB L <sub>A90</sub> or plus 5 dB above background |
| Night and day (financially involved) <sup>3</sup> | The greater of 45 dB L <sub>A90</sub> or plus 5 dB above background |

- 10.2.20 Where the predicted operational noise levels from the Proposed Development on its own meet 30 dB L<sub>A90</sub> during the day, or 33 dB L<sub>A90</sub> at night, the predicted noise effects are considered to be not significant in EIA terms, irrespective of potential cumulative operational wind turbine noise levels. This is because the noise impact is considered to be negligible where it is 10 dB or more below the TNAC that applies to noise from all wind turbines.
- 10.2.21 In order to set appropriate noise limits for the Proposed Development that would be enforced via a suitably worded planning condition should planning permission be granted, site-specific noise limits (SSNLs) have been calculated. The SSNLs are based on the TNAC, but with the contribution from consented and operational wind turbine developments (including an additional margin) subtracted. The derivation of the SSNLs is described in **Technical Appendix 10.5** where the day LLV for the Proposed Development in the absence of other developments was set at 35 dB L<sub>A90</sub> as a conservative approach. Where the SSNLs are met, no significant operational noise effects are predicted, including cumulative effects. Operational noise effects have therefore been assessed against these SSNLs.

### Assessment Assumptions

- 10.2.22 The following assumptions have been made when undertaking the assessment:
- The operational noise impact assessment is based on a candidate wind turbine (Vestas V162 7.2 MW) which may not be the turbine that is eventually installed. However, operational noise limits will be set for the Proposed Development via a planning condition which will stipulate operational noise levels that cannot be exceeded at NSRs. Therefore, regardless of the model of turbine installed, these limits must be met throughout the operational lifetime of the Proposed Development.
  - It has been assumed that there are no noise-sensitive receptors scoped into the noise assessment that are financially involved with the Proposed Development which would have qualified for the financially involved noise limits set out at **Table 10.5** above.
  - Wind farms scoped into the cumulative assessment (see **Technical Appendix 10.3**) are those where initial modelling indicates that predicted operational noise levels are above 30 dB L<sub>A90</sub> at NSRs scoped into the assessment. Any other wind farms for which modelling indicates that noise levels are below 30 dB L<sub>A90</sub> at NSRs are excluded as they will make an acoustically negligible contribution relative to the TNAC.
  - Baseline noise measurements were carried out over a relatively short-term period, although it is noted that the survey duration was in line with industry good practice (i.e. the IOA GPG). A reasonable range of wind speed and direction conditions were encountered such that the data is considered appropriate for deriving operational noise limits for the Proposed Development.
  - The construction noise assessment is based on assumed plant and operating conditions. Nevertheless, conservative assumptions have been applied such that construction noise effects in practice are likely to lower than predicted.
  - It is assumed that noise during the decommissioning phase of the Proposed Development will result in noise levels at NSRs that are similar or lower than during construction.
  - Any increase in road traffic noise during the construction phase has been assessed in terms of the worst-case predicted daily delivery total which is estimated to occur during concrete pours as set out in **Chapter 11**.

<sup>3</sup> It is noted that in this case there are no NSRs that are financially involved with the Proposed Development, although there may be scoped in receptors that are financially involved with other wind turbine developments. To ensure a conservative assessment the financially involved noise limits have not been applied to any NSR.

Therefore, road traffic noise effects during all other days of construction outside of periods of continuous concrete pouring would be lower.

- The Likely Grid Connection Route will be constructed as detailed in **Chapter 4: Development Description** i.e. as an underground cable within roadside verges along the entire route. It is assumed that noise during the decommissioning phase of the Likely Grid Connection Route will result in noise levels at NSRs that are similar or lower than during construction.

### Assessment Limitations

- 10.2.23 Whilst some assumptions have been made in the assessment, it is considered that there is sufficient information to enable an informed decision to be taken in relation to the identification and assessment of likely significant environmental effects of noise on NSRs.

## 10.3 Existing Conditions

- 10.3.1 The results of the baseline noise measurements (presented in **Technical Appendix 10.1**) have been used to derive noise limits (which are applicable to all NSRs assessed) as required by ARWTN. The typical background sound levels during the quiet day and night periods recorded at the six NMLs are provided at **Table 10.6** below. It is noted that although the TNAC applies up to wind speeds of 10 m/s, the typical background sound levels are presented up to 12 m/s.

**Table 10.6 Typical Background Sound Levels at NMLs**

| ID   | Location           | Time period | Standardised 10 m height wind speed (m/s) |      |      |      |      |      |      |      |      |      |
|------|--------------------|-------------|-------------------------------------------|------|------|------|------|------|------|------|------|------|
|      |                    |             | 3                                         | 4    | 5    | 6    | 7    | 8    | 9    | 10   | 11   | 12   |
| NML1 | Blair Farm         | Night       | 35.2                                      | 37.3 | 39.3 | 41.2 | 43.1 | 45.1 | 47.2 | 49.6 | 52.2 | 55.2 |
|      |                    | Quiet Day   | 48.2                                      | 50.3 | 51.4 | 51.8 | 51.9 | 51.9 | 52.0 | 52.7 | 54.1 | 56.6 |
| NML2 | Corsehouse Cottage | Night       | 29.2                                      | 31.6 | 33.5 | 35.2 | 36.9 | 38.9 | 41.6 | 45.2 | 50.0 | 50.0 |
|      |                    | Quiet Day   | 37.3                                      | 39.3 | 40.6 | 41.5 | 42.2 | 42.8 | 43.5 | 44.4 | 45.9 | 48.1 |
| NML3 | Corsehouse         | Night       | 27.6                                      | 30.0 | 32.6 | 35.3 | 38.2 | 41.1 | 44.1 | 46.9 | 49.7 | 52.4 |
|      |                    | Quiet Day   | 36.0                                      | 39.0 | 41.5 | 43.5 | 45.3 | 46.8 | 48.1 | 49.5 | 51.0 | 52.6 |
| NML4 | Glenouther Farm    | Night       | 26.9                                      | 27.5 | 28.6 | 30.3 | 32.5 | 34.9 | 37.7 | 40.5 | 43.4 | 46.2 |
|      |                    | Quiet Day   | 31.4                                      | 33.7 | 35.5 | 36.9 | 38.1 | 39.2 | 40.4 | 41.9 | 43.8 | 46.2 |
| NML5 | Greelaw Farm       | Night       | 29.0                                      | 31.2 | 33.4 | 35.7 | 38.0 | 40.5 | 43.3 | 46.4 | 49.9 | 53.8 |
|      |                    | Quiet Day   | 36.3                                      | 38.6 | 40.4 | 41.9 | 43.2 | 44.5 | 45.9 | 47.6 | 49.8 | 52.6 |
| NML6 | North Drumboy      | Night       | 46.1                                      | 46.7 | 47.3 | 47.9 | 48.5 | 49.1 | 49.7 | 50.3 | 50.8 | 51.4 |
|      |                    | Quiet Day   | 60.5                                      | 60.5 | 60.6 | 60.7 | 60.7 | 60.8 | 60.9 | 60.9 | 61.0 | 61.1 |

## 10.4 Implications of Climate Change for Existing Conditions

- 10.4.1 It is unlikely that the effects of climate change will have a material effect on existing conditions, as the typical background sound levels, as they vary with wind speed, are predominantly related to relatively local wind induced noise effects, such as wind in the trees and foliage. At lower wind speeds background sound levels are often related to road traffic noise levels at NSRs in the vicinity of the Proposed Development, and the levels of road traffic are unlikely to be significantly affected by climate change.

- 10.4.2 For the purpose of this assessment, periods of rainfall are excluded from the baseline noise dataset used for deriving noise limits, and therefore variation in rainfall events due to climate change are unlikely to significantly affect the baseline as considered within this report.

## 10.5 Future Baseline in the Absence of the Proposed Development

- 10.5.1 The future baseline in the absence of the Proposed Development is likely to remain largely similar to the baseline noise levels recorded to inform this assessment.

## 10.6 Embedded Design Mitigation

- 10.6.1 Maintaining a reasonable set back distance from surrounding residential properties throughout the design process (see **Chapter 3: Site Selection and Design Strategy**) has been the key method of ensuring that operational noise limits at NSRs will be achieved. In this way, each design iteration was 'tested' with regards to compliance with established noise limits, and changes were implemented as necessary to improve the results. The Proposed Development has therefore been designed to ensure that it can achieve the SSNLs (see **Technical Appendix 10.5**) which will be enforceable through a planning condition should planning permission be granted

## 10.7 Good Practice Mitigation Measures

- 10.7.1 Noise during the construction phase of the Proposed Development and the Likely Grid Connection Route will be managed in line with best practice techniques set out within the CEMP. Examples of best practice techniques will include:
- Restrictions on working hours (see below);
  - Advance notification of nearby residents of likely construction work schedules where there are grid connection works within 125 m;
  - Maintaining good community liaison, information distribution, and treating any noise complaints fairly and expeditiously;
  - Appropriate plant selection and maintenance, including use of equipment fitted with appropriate noise control measures;
  - Considerate siting of temporary plant;
  - Positioning temporary site compounds as far as practicably possible from NSRs;
  - Switching off plant when not in use; and
  - Adherence with the CEMP.
- 10.7.2 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), unless specifically agreed otherwise with EAC. Outside these hours, construction activities at the Proposed Development will be limited to turbine delivery and erection, maintenance, emergency works, dust suppression, and the testing of plant and equipment, unless otherwise approved in advance in writing by EAC. 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.
- 10.7.3 Noise during the decommissioning phase of the Proposed Development will be mitigated in line the practices set out within the Decommissioning Environmental Management Plan (DEMP), and will follow the same best practice techniques as described above for the CEMP.

## 10.8 Micrositing

- 10.8.1 Where construction micrositing (up to 50 m) results in activities closer than 200 m from noise-sensitive receptors, the resultant construction noise levels will be reviewed in line with the CEMP to determine whether any additional mitigation measures are necessary to ensure compliance with the construction noise limits (see **Table 10.3**).
- 10.8.2 The operational noise impact assessment has been based on the turbine locations and candidate turbine specified for the Proposed Development (see **Chapter 4**). Nevertheless, if the turbines are micrositied by up to 50 m closer to

NSRs, this would result in no material change in operational noise levels and the SSNLs would continue to be achieved and enforced through a planning condition.

## 10.9 Scope of the Assessment

### Effects Assessed in Full

10.9.1 Baseline conditions and professional judgement has identified the following effects for detailed assessment:

- Direct noise effects during construction of the Proposed Development and Likely Grid Connection Route (including in-combination with the Proposed Development) on the closest NSRs to construction works (despite the EIA Scoping Report proposing that such effects would be limited to within 200 m of NSRs for which there are none) and construction traffic.
- Direct noise effects during operation of the Proposed Development on NSRs (includes cumulative effects);
- Direct noise effects during decommissioning of the Proposed Development on the closest NSRs to construction works (despite these being further than 200 m);
- Cumulative noise effects during construction of the Proposed Development on NSRs.

### Effects Scoped Out

10.9.2 On the basis of the desk based work undertaken, the professional judgement of the EIA team, experience from other relevant projects and policy guidance or standards, and feedback received from consultees, the following effects have been 'scoped out' of detailed assessment, as proposed in the EIA Scoping Report:

- Vibration during the construction, operation, and decommissioning of the Proposed Development and Likely Grid Connection Route, as vibration during the construction phase will be significantly below allowable levels, and during the operational phase will not be perceptible at NSRs;
- Construction noise effects of the Proposed Development and Likely Grid Connection Route at NSRs beyond the closest NSR to onsite construction works;
- Noise from forestry works has been scoped out on the basis that no forestry work will be carried out within 200 m of noise-sensitive receptors and given that the highest construction noise immissions will be from track construction and piling;
- Operational noise levels at NSRs where they are 30 dB LA90 or lower (in line with the IOA GPG);
- Wind turbines with a generating capacity of less than 50 kW have been scoped out of the cumulative operational noise impact assessment, (i.e., those at Corsehouse, High Clunch, Whitelee Poultry Farm, and South Drumboy) as set out within the Scoping Report and in line with the requirements of ARWTN;
- Operational and decommissioning noise effects of the Likely Grid Connection Route (including in-combination effects with the Proposed Development) on the basis that there will be no audible operational noise from the Likely Grid Connection Route once installed, and during decommissioning construction noise will be similar or lower than during construction and therefore these effects are not assessed further;
- Cumulative construction effects of the Proposed Development with other potential construction in the vicinity on the basis that noise from construction activities will be controlled via the CEMP which will specify the relevant noise limits and the way in which noise is minimised. If there is the potential for concurrent construction activities with other neighbouring development, these will be assessed and controlled at the time of construction;
- Other potential operational noise effects including tonal noise, amplitude modulation, infrasound, and low frequency sound as discussed in the Scoping Report. ARWTN confirms that infrasound and low frequency sound don't need to be assessed, and that tonal and amplitude modulation are typically not assessed at the planning stage. It is noted, however, that the planning conditions on noise will include a clause to cover tonal noise and amplitude modulation should it require assessing in practice;
- Cumulative decommissioning effects are scoped out and considered to be not significant. This is because it is unlikely that any significant cumulative decommissioning effects will occur as the relevant construction noise limits are predicted to be met. This implies that the decommissioning noise limits will also be met. If other

construction activities are identified at the time of decommissioning, cumulative effects will be evaluated in the DEMP.

## 10.10 Assessment of Effects

- 10.10.1 The assessment of effects identified above is based on the project description as outlined in **Chapter 4**, and assumes that good practice measures (as identified above) are implemented as standard. Unless otherwise stated, potential effects identified are considered to be adverse.

### Construction Effects

#### Predicted Construction Effects

##### The Proposed Development

- 10.10.2 A detailed assessment of construction noise has been deemed unnecessary due to the large separation distances between the Proposed Development onsite construction activities and nearby NSRs. Nevertheless, construction impacts are discussed, and results presented for the closest NSRs to on-site construction activities, despite that being greater than 200 m (as proposed at EIA Scoping).
- 10.10.3 The elements of onsite construction of the Proposed Development that could give rise to the greatest levels of noise are track construction and piling foundations for turbine and crane pads. All other construction activities will be further from NSRs and/or generate lower levels of audible noise.
- 10.10.4 The construction noise limits applied are set out in **Table 10.3**. 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  $L_{Aeq}$ .
- 10.10.5 Noise from piling has been considered due to the potential for impact sounds, depending on the type of piling method used. The separation distance between piling activities (i.e. at and adjacent to the turbine locations for T1, T2 and T3 only) and the closest NSR (Marramead) is 1.1 km (although there is a possibility of noise from piling being audible at other NSRs (depending on the technique used and existing background sound levels). However, at such distances average noise levels from piling activities will be below 65 dB  $L_{Aeq}$  at all NSRs such that no significant effects are anticipated, and detailed predictions have not been carried out. Although no significant effects are anticipated, the CEMP will determine any specific noise reduction measures required for piling activities when the method of piling is known.
- 10.10.6 The nearest NSR to the track construction activities is also Marramead which is approximately 245 m from the nearest access track. As a conservative approach, construction noise is therefore assessed at this location, whilst also determining the minimum separation distance at which the adopted day construction noise limit is met based on the plant assumed for track construction. If noise impacts are acceptable at a distance of 245 m then it can be concluded that construction noise will be not significant at all NSRs.
- 10.10.7 Standard best practice measures to minimise noise during construction will be implemented in accordance with a detailed CEMP, which can be secured by means of an appropriately worded planning condition. An Outline CEMP is included as **Technical Appendix 4.2**. A simplified day 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.
- 10.10.8 The predicted increase in road traffic noise levels during concrete pouring (the worst-case daily totals for HGVs accessing the Site) have been calculated for the survey locations assessed and predicted increases in road traffic presented in **Chapter 11: Access, Traffic and Transport**. The increase in predicted noise level has been calculating using the methods set out in CRTN. It should be noted that the predicted increase in road traffic noise for NSRs only accounts for the increase in noise of the road being assessed, and where the A77 runs alongside the M77 the existing road traffic noise from the M77 is not included and therefore overestimates the overall road traffic noise increase. Floak Road has been excluded from the assessment because construction traffic accessing the Site will not pass any NSRs along this road as construction traffic will turn south immediately to the west of the M77. The results of the traffic noise predictions at the remaining six survey locations are presented at **Table 10.7** below.



**Table 10.7 Construction Traffic Noise Predictions**

| Survey Location                                | Existing Baseline Traffic Flow |             | Baseline + Construction Traffic Flow |            | Predicted Relative Change in Traffic Noise Level | Magnitude of Impact |
|------------------------------------------------|--------------------------------|-------------|--------------------------------------|------------|--------------------------------------------------|---------------------|
|                                                | Total Traffic Flow             | Total HGV   | Total Traffic Flow                   | Total HGV  |                                                  |                     |
| A77, south-west of junction with Mearns Road   | 1,884                          | 332 (18%)   | 1897                                 | 332 (18%)  | 0.0 dB(A)                                        | No impact           |
| A77, south of Floak Bridge                     | 1,348                          | 135 (10%)   | 1775                                 | 549 (31%)  | 4.1 dB(A)                                        | Moderate            |
| A77, south-west of junction with A719          | 2,875                          | 105 (4%)    | 3302                                 | 519 (16%)  | 2.5 dB(A)                                        | Minor               |
| A77, south-west of M77 Junction 7 on-slip road | 4847                           | 408 (8%)    | 5274                                 | 822 (16%)  | 1.4 dB(A)                                        | Minor               |
| M77, between Junctions 5 and 6                 | 52,535                         | 5,238 (10%) | 52535                                | 5238 (10%) | 0.0 dB(A)                                        | No impact           |
| M77, near Junction 7                           | 47,928                         | 5,012 (10%) | 47928                                | 5012 (10%) | 0.0 dB(A)                                        | No impact           |

10.10.9 The results of the construction traffic noise modelling show that the maximum increase in road traffic noise due to construction traffic (i.e. during concrete pouring) is less than 3 dB at all locations except the A77 south of Floak Bridge. At the A77 south of Floak Bridge location, a predicted increase in road traffic noise from the A77 of 4.1 dB(A) is predicted. However, this does not take into account existing road traffic noise from the adjacent M77 and therefore significantly over-estimates the overall predicted increase. Given the relatively short-term effects during the worst-case months of construction and existing road traffic noise from the M77, the significance of the noise impact at this location is also determined to be **not significant** despite a moderate magnitude of impact being calculated. Nevertheless, the movement of construction vehicles to and from the Proposed Development Site will be controlled through the Construction Traffic Management Plan (CTMP).

10.10.10 Predictions have been made of construction noise levels, using the methods prescribed in BS 5228-1:2009 +A1:2014. It is assumed that all construction works will occur during day hours (07:00-19:00) including Saturdays (07:00-13:00). The assumed plant during track construction with source noise levels taken from BS 5228 are shown in **Table 10.8**.

**Table 10.8 Construction Plant Source Noise Levels**

| Plant                        | Quantity | BS5228 table ref | 63 Hz | 125 Hz | 250 Hz | 500 Hz | 1000 Hz | 2000 Hz | 4000 Hz | 8000 Hz | A-weighted at 10 m (dB) |
|------------------------------|----------|------------------|-------|--------|--------|--------|---------|---------|---------|---------|-------------------------|
| Dozer 104 kW                 | 1        | C.5_12           | 80    | 78     | 71     | 70     | 74      | 68      | 65      | 61      | 77                      |
| Wheeled Backhoe Loader 62 kW | 1        | C.2_8            | 74    | 66     | 64     | 64     | 63      | 60      | 59      | 50      | 68                      |
| Tracked Excavator 27 kW      | 1        | C.5_35           | 82    | 72     | 71     | 69     | 69      | 70      | 61      | 54      | 74                      |
| Dump Truck 669 kW            | 1        | C.9_16           | 86    | 89     | 88     | 88     | 86      | 83      | 76      | 70      | 91                      |
| Road Roller                  | 1        | C.5_19           | 87    | 85     | 75     | 73     | 75      | 73      | 69      | 63      | 80                      |

10.10.11 At a distance of 245 m between the nearest NSR (Marramead, NSR29) and track construction, the worst-case predicted noise level is 57 dB  $L_{Aeq}$  assuming that all plant is operating for 100% of the working day. In practice, plant



will not be operating for 100% of the time, and most construction activities will be more distant. Noise during the construction phase is therefore predicted to be considerably below 65 dB  $L_{Aeq}$  (i.e. the day construction noise limit) for all NSRs. Therefore, the noise levels predicted for all NSRs will meet the applicable construction noise limits. Overall, noise from construction activities is considered to be **not significant**.

- 10.10.12 In addition, it has been determined that based on these worst-case assumptions, the day 65 dB  $L_{Aeq}$  construction noise limit would be met at a distance of 125 m, and this confirms that it is appropriate to scope out construction effects at NSRs where the separation distances are greater than 200 m.

#### Committed Additional Mitigation

- 10.10.13 As construction effects will be not significant at all NSRs, no additional mitigation is required.

#### Residual Construction Effects

- 10.10.14 As predicted construction noise levels associated with the Proposed Development meet the relevant noise limits at all NSRs without the need for additional mitigation, the construction noise residual effects will remain as **not significant**.
- 10.10.15 The predicted increase in road traffic during the worst-case month of construction is negligible and not significant and therefore the residual effect is **not significant**.

#### The Likely Grid Connection Route (including in-combination with the Proposed Development)

- 10.10.16 Construction of the Likely Grid Connection Route includes the installation of a 33 kV underground cable adjacent to NSRs. Where construction of the Likely Grid Connection Route is within 125 m of NSRs there is a possibility of short-term noise impacts above 65 dB  $L_{Aeq}$  albeit these will occur for less than one month and will reduce at each NSR as construction progresses along the route. Whilst these short-term impacts are considered acceptable, NSRs will be notified in advance of the works to minimise disruption. In addition, there will be special consideration made of any NSRs within 125 m that may be particularly sensitive to day noise levels such as schools and hospitals which will be separately contacted so that any additional measures required to minimise impacts are considered.
- 10.10.17 Construction of the Likely Grid Connection Route will generate additional construction traffic, however any additional road traffic is considered to be negligible given the low numbers of vehicles required and relative to the levels of noise generated during construction. Noise from construction traffic associated with the Likely Grid Connection Route is therefore determined to be **not significant**.
- 10.10.18 The construction noise effects associated with the Likely Grid Connection Route will therefore be **not significant**. There is the potential for onsite construction works to be carried out at the same time as the construction of the Proposed Development. However, the relative locations of both onsite construction works giving rise to significant cumulative construction noise effects is very unlikely given their temporary nature. Construction noise at an NSR will be dominated by either onsite construction noise or grid construction noise such that any contribution from the other will not be significant. Therefore, in-combination construction noise effects are predicted to be **not significant**.

### Operational Effects

#### Predicted Operational Effects

##### The Proposed Development

- 10.10.19 Operational noise impacts have been assessed by comparing predicted operational noise levels with the SSNLs (which take into account noise contributions from cumulative wind farms).
- 10.10.20 The TNAC derived from the baseline measurement results presented at **Table 10.5** above, which apply to the cumulative operational noise from all wind farm developments in the vicinity are set out in **Table 10.9** below. The limits are set at plus 5 dB above background, subject to LLVs of 43 dB  $L_{A90}$  at night and 40 dB  $L_{A90}$  during the day.

**Table 10.9 Derived Total Noise Assessment Criteria (TNAC)**

| ID   | Location           | Time Period  | Standardised 10 m height wind speed (m/s) |             |             |             |             |             |             |             |
|------|--------------------|--------------|-------------------------------------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
|      |                    |              | 3                                         | 4           | 5           | 6           | 7           | 8           | 9           | 10          |
| NML1 | Blair Farm         | Night        | 43.0                                      | 43.0        | 44.3        | 46.2        | 48.1        | 50.1        | 52.2        | 54.6        |
|      |                    | Day          | 53.2                                      | 55.3        | 56.4        | 56.8        | 56.9        | 56.9        | 57.0        | 57.7        |
| NML2 | Corsehouse Cottage | Night        | 43.0                                      | 43.0        | 43.0        | 43.0        | 43.0        | 43.9        | 46.6        | 50.2        |
|      |                    | Day          | 42.3                                      | 44.3        | 45.6        | 46.5        | 47.2        | 47.8        | 48.5        | 49.4        |
| NML3 | Corsehouse         | Night        | 43.0                                      | 43.0        | 43.0        | 43.0        | 43.2        | 46.1        | 49.1        | 51.9        |
|      |                    | Day          | 41.0                                      | 44.0        | 46.5        | 48.5        | 50.3        | 51.8        | 53.1        | 54.5        |
| NML4 | Glenouther Farm    | Night        | 43.0                                      | 43.0        | 43.0        | 43.0        | 43.0        | 43.0        | 43.0        | 45.5        |
|      |                    | Day          | 40.0                                      | 40.0        | 40.5        | 41.9        | 43.1        | 44.2        | 45.4        | 46.9        |
| NML5 | Greelaw Farm       | Night        | 43.0                                      | 43.0        | 43.0        | 43.0        | 43.0        | 45.5        | 48.3        | 51.4        |
|      |                    | Day          | 41.3                                      | 43.6        | 45.4        | 46.9        | 48.2        | 49.5        | 50.9        | 52.6        |
| NML6 | North Drumboy      | Night        | 51.1                                      | 51.7        | 52.3        | 52.9        | 53.5        | 54.1        | 54.7        | 55.3        |
|      |                    | Day          | 65.5                                      | 65.5        | 65.6        | 65.7        | 65.7        | 65.8        | 65.9        | 65.9        |
| -    | <b>Lowest TNAC</b> | <b>Night</b> | <b>43.0</b>                               | <b>43.0</b> | <b>43.0</b> | <b>43.0</b> | <b>43.0</b> | <b>43.0</b> | <b>43.0</b> | <b>45.5</b> |
|      |                    | <b>Day</b>   | <b>40.0</b>                               | <b>40.0</b> | <b>40.5</b> | <b>41.9</b> | <b>43.1</b> | <b>44.2</b> | <b>45.4</b> | <b>46.9</b> |

- 10.10.21 In this case, to ensure a conservative assessment approach, the lowest TNAC at each integer wind speed have been applied to each NSR location, even where baseline measurements were carried out. At locations close to the motorway, this results in operational noise limits that are significantly lower than the baseline derived noise limits for that specific location i.e. Blair Farm and North Drumboy.
- 10.10.22 In addition to the TNAC, SSNLs for the Proposed Development have been calculated that take into account potential cumulative noise levels from other wind farms in the vicinity. The derivation of the SSNLs is described at **Technical Appendix 10.5** and uses the remaining noise budget (RNB) method. The RNB method allows the available headroom to the TNAC to be calculated enabling appropriate SSNLs to be derived. The SSNLs have been set in a conservative manner by:
- Setting the TNAC at each noise-sensitive receptor at the lowest TNAC at each integer wind speed derived from the baseline noise measurements;
  - Assuming that each NSR is simultaneously downwind of all wind turbines which cannot occur in practice;
  - Adding an additional 2 dB to the predicted contribution from other wind turbine developments;
  - Subtracting the predicted contribution from other wind turbine developments from the cumulative day and night noise limits;
  - Setting the day limit no higher than the TNAC based on the lowest day LLV (i.e. 35 dB or 5 dB above background);
  - Applying the lower of the day and night derived noise limits; and
  - Limiting the SSNL to a maximum of 43 dB  $L_{A90}$  (even where typical background sound levels are higher).
- 10.10.23 The SSNLs are presented at **Table 10.10** below and are taken from **Technical Appendix 10.5**. The predicted operational noise levels for the Proposed Development are assessed against the SSNLs.

**Table 10.10 Site-Specific Noise Limits (SSNLs) for each NSR**

| ID    | Location                 | Standardised 10 m height wind speed (m/s) |      |      |      |      |      |      |      |
|-------|--------------------------|-------------------------------------------|------|------|------|------|------|------|------|
|       |                          | 3                                         | 4    | 5    | 6    | 7    | 8    | 9    | 10   |
| NSR1  | Best Friends Cottage     | 36.4                                      | 38.7 | 39.8 | 40.2 | 41.0 | 40.7 | 40.6 | 43.0 |
| NSR2  | Blacklaw Cottage         | 36.4                                      | 38.7 | 40.0 | 41.3 | 42.4 | 42.3 | 42.2 | 43.0 |
| NSR3  | Blacklawhill Farm        | 36.4                                      | 38.0 | 38.7 | 40.0 | 41.1 | 40.7 | 40.3 | 43.0 |
| NSR4  | Blair Farm               | 36.4                                      | 38.7 | 40.1 | 41.1 | 42.0 | 41.9 | 41.9 | 43.0 |
| NSR5  | Corsehouse Cottage       | 36.4                                      | 38.7 | 40.3 | 41.6 | 42.6 | 42.6 | 42.6 | 43.0 |
| NSR6  | Corsehouse               | 36.4                                      | 38.7 | 40.2 | 41.5 | 42.5 | 42.5 | 42.4 | 43.0 |
| NSR7  | Crofthead of Gree Farm   | 36.4                                      | 38.7 | 40.3 | 41.5 | 42.5 | 42.4 | 42.4 | 43.0 |
| NSR8  | Dounne Law Cottage       | 36.4                                      | 38.7 | 40.0 | 41.3 | 42.4 | 42.3 | 42.2 | 43.0 |
| NSR9  | East Whitelee Farm       | 36.4                                      | 38.7 | 40.2 | 41.6 | 42.6 | 42.6 | 42.5 | 43.0 |
| NSR10 | Easter Blacklaw Farm     | 36.4                                      | 38.7 | 40.1 | 41.4 | 42.5 | 42.4 | 42.4 | 43.0 |
| NSR11 | Easterhouse of Whitelee  | 36.4                                      | 38.7 | 40.2 | 41.6 | 42.6 | 42.6 | 42.6 | 43.0 |
| NSR12 | Floak                    | 36.4                                      | 38.7 | 40.1 | 41.1 | 42.1 | 42.0 | 42.0 | 43.0 |
| NSR13 | Glen-a-Moor              | 36.4                                      | 38.7 | 40.2 | 41.6 | 42.6 | 42.6 | 42.5 | 43.0 |
| NSR14 | Glenouther Farm          | 36.4                                      | 38.7 | 40.3 | 41.6 | 42.6 | 42.5 | 42.5 | 43.0 |
| NSR15 | Gree Cottage             | 36.4                                      | 38.7 | 40.3 | 41.5 | 42.4 | 42.3 | 42.3 | 43.0 |
| NSR16 | Greelaw Farm             | 36.4                                      | 38.7 | 40.3 | 41.5 | 42.5 | 42.5 | 42.4 | 43.0 |
| NSR17 | Greenfinch               | 36.4                                      | 38.7 | 40.1 | 41.1 | 42.1 | 42.0 | 42.0 | 43.0 |
| NSR18 | Hairshaw Cottage         | 36.4                                      | 38.7 | 40.4 | 41.7 | 42.8 | 42.8 | 42.7 | 43.0 |
| NSR19 | Harelaw Farm             | 36.4                                      | 38.7 | 40.1 | 41.0 | 41.9 | 41.7 | 41.7 | 43.0 |
| NSR20 | High Clunch Farm         | 36.4                                      | 38.7 | 40.3 | 41.6 | 42.6 | 42.5 | 42.5 | 43.0 |
| NSR21 | Highfield Farm           | 36.4                                      | 38.7 | 39.2 | 39.2 | 40.1 | 39.8 | 39.8 | 43.0 |
| NSR22 | Kelvedon Cottage         | 36.4                                      | 38.7 | 40.2 | 41.6 | 42.7 | 42.6 | 42.6 | 43.0 |
| NSR23 | Kingswell Country House  | 36.4                                      | 38.7 | 39.6 | 39.9 | 40.6 | 40.3 | 40.3 | 43.0 |
| NSR24 | Laverockhall Cottage     | 36.4                                      | 38.7 | 40.1 | 41.4 | 42.5 | 42.4 | 42.3 | 43.0 |
| NSR25 | Lintbrae Cottage         | 36.4                                      | 38.7 | 40.3 | 41.6 | 42.6 | 42.5 | 42.4 | 43.0 |
| NSR26 | Lintbrae Farm            | 36.4                                      | 38.7 | 40.3 | 41.6 | 42.6 | 42.5 | 42.5 | 43.0 |
| NSR27 | Low Blacklaw             | 36.4                                      | 38.7 | 39.9 | 41.2 | 42.3 | 42.1 | 42.0 | 43.0 |
| NSR28 | Lowtoun of Blacklaw Farm | 36.4                                      | 38.7 | 39.8 | 41.1 | 42.2 | 42.1 | 42.0 | 43.0 |
| NSR29 | Marramead                | 36.4                                      | 38.7 | 40.1 | 41.0 | 42.0 | 41.9 | 41.9 | 43.0 |

| ID    | Location                        | Standardised 10 m height wind speed (m/s) |      |      |      |      |      |      |      |
|-------|---------------------------------|-------------------------------------------|------|------|------|------|------|------|------|
|       |                                 | 3                                         | 4    | 5    | 6    | 7    | 8    | 9    | 10   |
| NSR30 | Meadowlands Farm                | 36.4                                      | 38.7 | 40.0 | 41.3 | 42.4 | 42.3 | 42.3 | 43.0 |
| NSR31 | Mid Floak Bungalow              | 36.4                                      | 38.7 | 40.1 | 41.1 | 42.1 | 42.0 | 42.0 | 43.0 |
| NSR32 | Mid Floak Farm                  | 36.4                                      | 38.7 | 40.1 | 41.1 | 42.1 | 42.1 | 42.0 | 43.0 |
| NSR33 | North Drumboy                   | 36.4                                      | 38.7 | 40.1 | 41.1 | 42.1 | 42.0 | 42.0 | 43.0 |
| NSR34 | Owl Cottage Upper Hairshaw Farm | 36.4                                      | 38.7 | 40.3 | 41.6 | 42.6 | 42.6 | 42.5 | 43.0 |
| NSR35 | Pebblebank East Whitelee        | 36.4                                      | 38.7 | 40.2 | 41.6 | 42.6 | 42.6 | 42.5 | 43.0 |
| NSR36 | Raithburn Farm                  | 36.4                                      | 38.7 | 40.3 | 41.4 | 42.4 | 42.3 | 42.3 | 43.0 |
| NSR37 | Raithill Farm                   | 36.4                                      | 38.7 | 40.2 | 41.3 | 42.3 | 42.1 | 42.1 | 43.0 |
| NSR38 | South Drumboy Farm              | 36.4                                      | 38.7 | 39.9 | 40.6 | 41.5 | 41.3 | 41.3 | 43.0 |
| NSR39 | Sunrise Lodge                   | 36.4                                      | 38.7 | 40.1 | 41.0 | 42.0 | 42.0 | 41.9 | 43.0 |
| NSR40 | The Stables                     | 36.4                                      | 38.7 | 40.1 | 41.1 | 42.1 | 42.0 | 42.0 | 43.0 |
| NSR41 | Townhead of Floak Bungalow      | 36.4                                      | 38.7 | 40.1 | 41.2 | 42.2 | 42.1 | 42.1 | 43.0 |
| NSR42 | Townhead Of Floak Farm          | 36.4                                      | 38.7 | 40.2 | 41.2 | 42.2 | 42.1 | 42.1 | 43.0 |
| NSR43 | Townhead of Gree Farm           | 36.4                                      | 38.7 | 40.3 | 41.5 | 42.5 | 42.4 | 42.4 | 43.0 |
| NSR44 | Upper Hairshaw Farm             | 36.4                                      | 38.7 | 40.3 | 41.6 | 42.6 | 42.6 | 42.5 | 43.0 |
| NSR45 | Windmill Cottage                | 36.4                                      | 38.7 | 40.2 | 41.6 | 42.7 | 42.6 | 42.6 | 43.0 |
| NSR46 | Windy-Yett Farm                 | 36.4                                      | 38.7 | 40.3 | 41.6 | 42.6 | 42.6 | 42.6 | 43.0 |

- 10.10.24 As the SSNLs take into account the potential contribution from other wind turbine developments in the vicinity, if the SSNLs are met, then it can also be concluded that the TNAC will also be met. Thus, the operational assessment compares the predicted noise levels of the Proposed Development with these SSNLs to determine if the operational effect will be significant or not significant. Nevertheless, a cumulative operational noise assessment where predicted cumulative operational noise levels are compared with the TNAC has also been provided for completeness.
- 10.10.25 The details of the prediction model are included in **Technical Appendix 10.2**, along with the source noise data shown in **Table 10.11 below**. The details of the SSNL derivation can be found in **Technical Appendix 10.5** and the relevant TNAC are set out in **Table 10.9** above.
- 10.10.26 The assessment is based on the Proposed Development as described in **Chapter 4**. For the purposes of the EIA and this noise assessment, use of a Vestas V162 7.2 MW with Serrated Trailing Edges (STEs) and a 119 m hub height has been assumed.
- 10.10.27 The source noise levels for the candidate turbine assumed for the Proposed Development are set out in **Table 10.11**. The octave band noise data taken from the manufacturer's technical specification document are also set out in the table. The sound power levels include the plus 2 dB uncertainty described in line with the requirements of the IOA GPG.

**Table 10.11 Proposed Development Candidate Turbine Sound Power Levels (dB L<sub>WA</sub>)**

| Standardised 10 m height wind speed (m/s) | 63 Hz | 125 Hz | 250 Hz | 500 Hz | 1000 Hz | 2000 Hz | 4000 Hz | 8000 Hz | Overall |
|-------------------------------------------|-------|--------|--------|--------|---------|---------|---------|---------|---------|
| 3                                         | 80.0  | 86.5   | 89.5   | 90.8   | 89.6    | 85.4    | 78.3    | 68.3    | 96.0    |
| 4                                         | 80.7  | 87.8   | 90.7   | 91.6   | 90.2    | 85.9    | 78.6    | 68.2    | 96.9    |
| 5                                         | 85.1  | 92.5   | 95.5   | 96.1   | 94.5    | 90.1    | 82.6    | 72.0    | 101.4   |
| 6                                         | 89.2  | 96.8   | 100.0  | 100.2  | 98.5    | 93.9    | 86.3    | 75.6    | 105.6   |
| 7                                         | 90.2  | 97.9   | 101.0  | 101.2  | 99.6    | 95.0    | 87.3    | 76.6    | 106.6   |
| 8                                         | 90.5  | 98.0   | 101.1  | 101.4  | 99.7    | 95.2    | 87.6    | 77.0    | 106.8   |
| 9                                         | 90.6  | 98.2   | 101.4  | 101.7  | 100.1   | 95.6    | 88.1    | 77.5    | 107.1   |
| 10                                        | 90.5  | 98.4   | 101.7  | 102.1  | 100.6   | 96.1    | 88.5    | 77.9    | 107.4   |
| 11                                        | 90.5  | 98.4   | 101.8  | 102.2  | 100.7   | 96.2    | 88.6    | 77.9    | 107.5   |
| 12                                        | 90.5  | 98.4   | 101.8  | 102.2  | 100.7   | 96.2    | 88.6    | 77.9    | 107.5   |

10.10.28 Operational noise prediction results (for the Proposed Development operating in isolation) are presented for the NSRs scoped into the assessment in **Table 10.12**. It is noted that the TNAC applies up to 10 m/s, but that the sound power levels increase by 0.1 dB between 10 and 11 m/s which is a negligible increase, and negligible relative to the increase in typical background sound at these wind speeds.

10.10.29 It should be noted that the predictions assume that each receptor location is downwind of the Proposed Development to provide a worst-case assessment. Under non-downwind conditions, operational noise levels will be lower. In addition, downwind noise contours for 10 m/s, showing the NSR locations, are provided at **Figure 10.1**.

**Table 10.12 Proposed Development Predicted Downwind Noise Levels (dB L<sub>A90</sub>)**

| ID    | Location                | Standardised 10 m height wind speed (m/s) |      |      |      |      |      |      |      |
|-------|-------------------------|-------------------------------------------|------|------|------|------|------|------|------|
|       |                         | 3                                         | 4    | 5    | 6    | 7    | 8    | 9    | 10   |
| NSR1  | Best Friends Cottage    | 20.1                                      | 21.0 | 25.6 | 29.9 | 30.9 | 31.1 | 31.3 | 31.6 |
| NSR2  | Blacklaw Cottage        | 22.5                                      | 23.5 | 28.0 | 32.3 | 33.3 | 33.5 | 33.8 | 34.1 |
| NSR3  | Blacklawhill Farm       | 21.5                                      | 22.4 | 27.0 | 31.3 | 32.3 | 32.5 | 32.7 | 33.0 |
| NSR4  | Blair Farm              | 25.3                                      | 26.3 | 30.8 | 35.1 | 36.1 | 36.3 | 36.5 | 36.9 |
| NSR5  | Corsehouse Cottage      | 24.9                                      | 25.9 | 30.4 | 34.7 | 35.7 | 35.9 | 36.1 | 36.5 |
| NSR6  | Corsehouse              | 24.2                                      | 25.1 | 29.7 | 33.9 | 35.0 | 35.1 | 35.4 | 35.7 |
| NSR7  | Crofthead of Gree Farm  | 19.5                                      | 20.5 | 25.1 | 29.4 | 30.4 | 30.5 | 30.8 | 31.1 |
| NSR8  | Dounne Law Cottage      | 22.4                                      | 23.3 | 27.9 | 32.2 | 33.2 | 33.3 | 33.6 | 33.9 |
| NSR9  | East Whitelee Farm      | 21.5                                      | 22.5 | 27.1 | 31.3 | 32.4 | 32.5 | 32.8 | 33.1 |
| NSR10 | Easter Blacklaw Farm    | 19.9                                      | 20.9 | 25.5 | 29.8 | 30.8 | 30.9 | 31.2 | 31.5 |
| NSR11 | Easterhouse of Whitelee | 21.5                                      | 22.4 | 27.0 | 31.3 | 32.3 | 32.5 | 32.7 | 33.1 |

| ID    | Location                        | Standardised 10 m height wind speed (m/s) |      |      |      |      |      |      |      |
|-------|---------------------------------|-------------------------------------------|------|------|------|------|------|------|------|
|       |                                 | 3                                         | 4    | 5    | 6    | 7    | 8    | 9    | 10   |
| NSR12 | Floak                           | 22.5                                      | 23.4 | 28.0 | 32.3 | 33.3 | 33.5 | 33.7 | 34.1 |
| NSR13 | Glen-a-Moor                     | 20.1                                      | 21.0 | 25.6 | 29.9 | 30.9 | 31.1 | 31.4 | 31.7 |
| NSR14 | Glenouther Farm                 | 24.2                                      | 25.1 | 29.7 | 34.0 | 35.0 | 35.1 | 35.4 | 35.8 |
| NSR15 | Gree Cottage                    | 19.5                                      | 20.4 | 25.0 | 29.3 | 30.3 | 30.5 | 30.8 | 31.1 |
| NSR16 | Greelaw Farm                    | 23.1                                      | 24.1 | 28.6 | 32.9 | 33.9 | 34.1 | 34.4 | 34.7 |
| NSR17 | Greenfinch                      | 25.6                                      | 26.6 | 31.1 | 35.4 | 36.4 | 36.6 | 36.8 | 37.2 |
| NSR18 | Hairshaw Cottage                | 18.4                                      | 19.3 | 23.9 | 28.2 | 29.3 | 29.4 | 29.7 | 30.0 |
| NSR19 | Harelaw Farm                    | 22.2                                      | 23.2 | 27.8 | 32.0 | 33.1 | 33.2 | 33.5 | 33.8 |
| NSR20 | High Clunch Farm                | 21.7                                      | 22.6 | 27.2 | 31.5 | 32.5 | 32.7 | 32.9 | 33.3 |
| NSR21 | Highfield Farm                  | 18.5                                      | 19.4 | 24.0 | 28.3 | 29.3 | 29.5 | 29.8 | 30.1 |
| NSR22 | Kelvedon Cottage                | 20.8                                      | 21.8 | 26.3 | 30.6 | 31.7 | 31.8 | 32.1 | 32.4 |
| NSR23 | Kingswell Country House         | 20.0                                      | 21.0 | 25.6 | 29.8 | 30.9 | 31.0 | 31.3 | 31.6 |
| NSR24 | Laverockhall Cottage            | 22.2                                      | 23.1 | 27.7 | 32.0 | 33.0 | 33.1 | 33.4 | 33.7 |
| NSR25 | Lintbrae Cottage                | 18.7                                      | 19.6 | 24.2 | 28.5 | 29.6 | 29.7 | 30.0 | 30.3 |
| NSR26 | Lintbrae Farm                   | 18.4                                      | 19.4 | 24.0 | 28.2 | 29.3 | 29.4 | 29.7 | 30.0 |
| NSR27 | Low Blacklaw                    | 22.7                                      | 23.6 | 28.2 | 32.5 | 33.5 | 33.6 | 33.9 | 34.2 |
| NSR28 | Lowtoun of Blacklaw Farm        | 22.5                                      | 23.5 | 28.1 | 32.3 | 33.4 | 33.5 | 33.8 | 34.1 |
| NSR29 | Marramead                       | 25.3                                      | 26.3 | 30.8 | 35.1 | 36.1 | 36.3 | 36.5 | 36.9 |
| NSR30 | Meadowlands Farm                | 21.1                                      | 22.0 | 26.6 | 30.9 | 31.9 | 32.1 | 32.4 | 32.7 |
| NSR31 | Mid Floak Bungalow              | 22.2                                      | 23.2 | 27.7 | 32.0 | 33.1 | 33.2 | 33.5 | 33.8 |
| NSR32 | Mid Floak Farm                  | 22.1                                      | 23.0 | 27.6 | 31.9 | 32.9 | 33.0 | 33.3 | 33.6 |
| NSR33 | North Drumboy                   | 25.8                                      | 26.7 | 31.3 | 35.6 | 36.6 | 36.7 | 37.0 | 37.3 |
| NSR34 | Owl Cottage Upper Hairshaw Farm | 21.2                                      | 22.2 | 26.8 | 31.0 | 32.1 | 32.2 | 32.5 | 32.8 |
| NSR35 | Pebblebank East Whitelee        | 21.3                                      | 22.3 | 26.9 | 31.2 | 32.2 | 32.3 | 32.6 | 32.9 |
| NSR36 | Raithburn Farm                  | 18.3                                      | 19.3 | 23.8 | 28.1 | 29.2 | 29.3 | 29.6 | 29.9 |
| NSR37 | Raithill Farm                   | 20.8                                      | 21.7 | 26.3 | 30.6 | 31.6 | 31.8 | 32.1 | 32.4 |
| NSR38 | South Drumboy Farm              | 24.7                                      | 25.7 | 30.2 | 34.5 | 35.5 | 35.7 | 36.0 | 36.3 |
| NSR39 | Sunrise Lodge                   | 25.3                                      | 26.2 | 30.8 | 35.0 | 36.1 | 36.2 | 36.5 | 36.8 |
| NSR40 | The Stables                     | 25.5                                      | 26.5 | 31.0 | 35.3 | 36.3 | 36.5 | 36.7 | 37.1 |
| NSR41 | Townhead of Floak Bungalow      | 21.9                                      | 22.8 | 27.4 | 31.7 | 32.7 | 32.8 | 33.1 | 33.4 |

| ID    | Location               | Standardised 10 m height wind speed (m/s) |      |      |      |      |      |      |      |
|-------|------------------------|-------------------------------------------|------|------|------|------|------|------|------|
|       |                        | 3                                         | 4    | 5    | 6    | 7    | 8    | 9    | 10   |
| NSR42 | Townhead Of Floak Farm | 21.9                                      | 22.9 | 27.4 | 31.7 | 32.7 | 32.9 | 33.2 | 33.5 |
| NSR43 | Townhead of Gree Farm  | 19.6                                      | 20.6 | 25.2 | 29.5 | 30.5 | 30.7 | 30.9 | 31.2 |
| NSR44 | Upper Hairshaw Farm    | 21.2                                      | 22.1 | 26.7 | 31.0 | 32.0 | 32.2 | 32.4 | 32.7 |
| NSR45 | Windmill Cottage       | 19.6                                      | 20.6 | 25.2 | 29.5 | 30.5 | 30.6 | 30.9 | 31.2 |
| NSR46 | Windy-Yett Farm        | 20.7                                      | 21.7 | 26.2 | 30.5 | 31.6 | 31.7 | 32.0 | 32.3 |

10.10.30 The results of the operational noise modelling have been compared with the SSNLs included at **Table 10.10** above. **Table 10.13** below shows the margin between the predicted operational noise levels and these SSNLs (i.e. the **Table 10.12** predicted noise levels subtracted from the **Table 10.10** SSNLs). Positive values mean that the SSNLs are met at that wind speed.

**Table 10.13 Margin Between Predicted Downwind Noise Levels and SSNLs (dB) for each NSR**

| ID    | Location                | Standardised 10 m height wind speed (m/s) |      |      |      |      |      |      |      |
|-------|-------------------------|-------------------------------------------|------|------|------|------|------|------|------|
|       |                         | 3                                         | 4    | 5    | 6    | 7    | 8    | 9    | 10   |
| NSR1  | Best Friends Cottage    | 16.3                                      | 17.7 | 14.2 | 10.3 | 10.1 | 9.6  | 9.3  | 11.4 |
| NSR2  | Blacklaw Cottage        | 13.9                                      | 15.2 | 12.0 | 9.0  | 9.1  | 8.8  | 8.4  | 8.9  |
| NSR3  | Blacklawhill Farm       | 14.9                                      | 15.6 | 11.7 | 8.7  | 8.8  | 8.2  | 7.6  | 10.0 |
| NSR4  | Blair Farm              | 11.1                                      | 12.4 | 9.3  | 6.0  | 5.9  | 5.6  | 5.4  | 6.1  |
| NSR5  | Corsehouse Cottage      | 11.5                                      | 12.8 | 9.9  | 6.9  | 6.9  | 6.7  | 6.5  | 6.5  |
| NSR6  | Corsehouse              | 12.2                                      | 13.6 | 10.5 | 7.6  | 7.5  | 7.4  | 7.0  | 7.3  |
| NSR7  | Crofthead of Gree Farm  | 16.9                                      | 18.2 | 15.2 | 12.1 | 12.1 | 11.9 | 11.6 | 11.9 |
| NSR8  | Dounne Law Cottage      | 14.0                                      | 15.4 | 12.1 | 9.1  | 9.2  | 9.0  | 8.6  | 9.1  |
| NSR9  | East Whitelee Farm      | 14.9                                      | 16.2 | 13.1 | 10.3 | 10.2 | 10.1 | 9.7  | 9.9  |
| NSR10 | Easter Blacklaw Farm    | 16.5                                      | 17.8 | 14.6 | 11.6 | 11.7 | 11.5 | 11.2 | 11.5 |
| NSR11 | Easterhouse of Whitelee | 14.9                                      | 16.3 | 13.2 | 10.3 | 10.3 | 10.1 | 9.9  | 9.9  |
| NSR12 | Floak                   | 13.9                                      | 15.3 | 12.1 | 8.8  | 8.8  | 8.5  | 8.3  | 8.9  |
| NSR13 | Glen-a-Moor             | 16.3                                      | 17.7 | 14.6 | 11.7 | 11.7 | 11.5 | 11.1 | 11.3 |
| NSR14 | Glenouther Farm         | 12.2                                      | 13.6 | 10.6 | 7.6  | 7.6  | 7.4  | 7.1  | 7.2  |
| NSR15 | Gree Cottage            | 16.9                                      | 18.3 | 15.3 | 12.2 | 12.1 | 11.8 | 11.5 | 11.9 |
| NSR16 | Greelaw Farm            | 13.3                                      | 14.6 | 11.7 | 8.6  | 8.6  | 8.4  | 8.0  | 8.3  |
| NSR17 | Greenfinch              | 10.8                                      | 12.1 | 9.0  | 5.7  | 5.7  | 5.4  | 5.2  | 5.8  |
| NSR18 | Hairshaw Cottage        | 18.0                                      | 19.4 | 16.5 | 13.5 | 13.5 | 13.4 | 13.0 | 13.0 |
| NSR19 | Harelaw Farm            | 14.2                                      | 15.5 | 12.3 | 9.0  | 8.8  | 8.5  | 8.2  | 9.2  |

| ID    | Location                        | Standardised 10 m height wind speed (m/s) |      |      |      |      |      |      |      |
|-------|---------------------------------|-------------------------------------------|------|------|------|------|------|------|------|
|       |                                 | 3                                         | 4    | 5    | 6    | 7    | 8    | 9    | 10   |
| NSR20 | High Clunch Farm                | 14.7                                      | 16.1 | 13.1 | 10.1 | 10.1 | 9.8  | 9.6  | 9.7  |
| NSR21 | Highfield Farm                  | 17.9                                      | 19.3 | 15.2 | 10.9 | 10.8 | 10.3 | 10.0 | 12.9 |
| NSR22 | Kelvedon Cottage                | 15.6                                      | 16.9 | 13.9 | 11.0 | 11.0 | 10.8 | 10.5 | 10.6 |
| NSR23 | Kingswell Country House         | 16.4                                      | 17.7 | 14.0 | 10.1 | 9.7  | 9.3  | 9.0  | 11.4 |
| NSR24 | Laverockhall Cottage            | 14.2                                      | 15.6 | 12.4 | 9.4  | 9.5  | 9.3  | 8.9  | 9.3  |
| NSR25 | Lintbrae Cottage                | 17.7                                      | 19.1 | 16.1 | 13.1 | 13.0 | 12.8 | 12.4 | 12.7 |
| NSR26 | Lintbrae Farm                   | 18.0                                      | 19.3 | 16.3 | 13.4 | 13.3 | 13.1 | 12.8 | 13.0 |
| NSR27 | Low Blacklaw                    | 13.7                                      | 15.1 | 11.7 | 8.7  | 8.8  | 8.5  | 8.1  | 8.8  |
| NSR28 | Lowtoun of Blacklaw Farm        | 13.9                                      | 15.2 | 11.7 | 8.8  | 8.8  | 8.6  | 8.2  | 8.9  |
| NSR29 | Marramead                       | 11.1                                      | 12.4 | 9.3  | 5.9  | 5.9  | 5.6  | 5.4  | 6.1  |
| NSR30 | Meadowlands Farm                | 15.3                                      | 16.7 | 13.4 | 10.4 | 10.5 | 10.2 | 9.9  | 10.3 |
| NSR31 | Mid Floak Bungalow              | 14.2                                      | 15.5 | 12.4 | 9.1  | 9.0  | 8.8  | 8.5  | 9.2  |
| NSR32 | Mid Floak Farm                  | 14.3                                      | 15.7 | 12.5 | 9.2  | 9.2  | 9.1  | 8.7  | 9.4  |
| NSR33 | North Drumboy                   | 10.6                                      | 12.0 | 8.8  | 5.5  | 5.5  | 5.3  | 5.0  | 5.7  |
| NSR34 | Owl Cottage Upper Hairshaw Farm | 15.2                                      | 16.5 | 13.5 | 10.6 | 10.5 | 10.4 | 10.0 | 10.2 |
| NSR35 | Pebblebank East Whitelee        | 15.1                                      | 16.4 | 13.3 | 10.4 | 10.4 | 10.3 | 9.9  | 10.1 |
| NSR36 | Raithburn Farm                  | 18.1                                      | 19.4 | 16.5 | 13.3 | 13.2 | 13.0 | 12.7 | 13.1 |
| NSR37 | Raithill Farm                   | 15.6                                      | 17.0 | 13.9 | 10.7 | 10.7 | 10.3 | 10.0 | 10.6 |
| NSR38 | South Drumboy Farm              | 11.7                                      | 13.0 | 9.7  | 6.1  | 6.0  | 5.6  | 5.3  | 6.7  |
| NSR39 | Sunrise Lodge                   | 11.1                                      | 12.5 | 9.3  | 6.0  | 5.9  | 5.8  | 5.4  | 6.2  |
| NSR40 | The Stables                     | 10.9                                      | 12.2 | 9.1  | 5.8  | 5.8  | 5.5  | 5.3  | 5.9  |
| NSR41 | Townhead of Floak Bungalow      | 14.5                                      | 15.9 | 12.7 | 9.5  | 9.5  | 9.3  | 9.0  | 9.6  |
| NSR42 | Townhead Of Floak Farm          | 14.5                                      | 15.8 | 12.8 | 9.5  | 9.5  | 9.2  | 8.9  | 9.5  |
| NSR43 | Townhead of Gree Farm           | 16.8                                      | 18.1 | 15.1 | 12.0 | 12.0 | 11.7 | 11.5 | 11.8 |
| NSR44 | Upper Hairshaw Farm             | 15.2                                      | 16.6 | 13.6 | 10.6 | 10.6 | 10.4 | 10.1 | 10.3 |
| NSR45 | Windmill Cottage                | 16.8                                      | 18.1 | 15.0 | 12.1 | 12.2 | 12.0 | 11.7 | 11.8 |
| NSR46 | Windy-Yett Farm                 | 15.7                                      | 17.0 | 14.1 | 11.1 | 11.0 | 10.9 | 10.6 | 10.7 |

10.10.31 The results show that the site-specific day and night noise limits are met at all NSRs with a minimum margin of 5.0 dB. The results therefore indicate that the operational noise effect will be **not significant**.



- 10.10.32 As the SSNLs take into account noise from other wind turbines in the vicinity, it can also be concluded that no significant cumulative operational effects are predicted. Nevertheless, a cumulative operational noise impact assessment is presented in the cumulative effects section below.

#### Committed Additional Mitigation

- 10.10.33 No specific additional mitigation is proposed as the relevant SSNLs are met.

#### Residual Operational Effects

- 10.10.34 The residual operational noise effect will remain as **not significant**.

### Decommissioning Effects

#### Predicted Decommissioning Effects

- 10.10.35 Decommissioning noise predictions (both for decommissioning works onsite and traffic) haven't been carried out as they are expected to give rise to similar or lower levels than during the construction phase. As the relevant construction noise limits are expected to be met at all NSRs, it can be concluded that the relevant decommissioning noise limits will also be met, and where possible will be minimised through the implementation of good practice measures through the DEMP. As such, the predicted decommissioning noise effects are **not significant**.

#### Committed Additional Mitigation

- 10.10.36 No additional mitigation is proposed as decommissioning noise effects are likely to be **not significant**, and will be managed through good practice measures set out in the DEMP.

#### Residual Decommissioning Effects

- 10.10.37 No significant decommissioning residual effects are predicted as the relevant noise limits are predicted to be met. Also decommissioning noise effects will be re-evaluated at the time of decommissioning via the DEMP.

### Cumulative Effects During Operation

#### Predicted Cumulative Effects During Operation

- 10.10.38 The ARWTN TNAC apply to noise from all wind turbines in the vicinity. Therefore, a cumulative operational noise impact assessment has been carried out for completeness in addition to an assessment against the SSNLs. The cut-off date for determining which developments require assessing in the cumulative operational noise assessment was 26<sup>th</sup> January 2026.
- 10.10.39 The wind turbine developments included in the cumulative operational noise assessment are shown below. As set out within the Scoping Report, all phases of Whitelee Wind Farm are included in the cumulative modelling although the predicted contribution from extension Phase 1 and Phase 2 are predicted to contribute negligibly to overall cumulative noise effects at scoped in NSRs. Although Clonherb was scoped out of the cumulative assessment in the Scoping Report, its predicted operational noise level at the nearest scoped in NSRs is only just below 30 dB LA90, and is therefore included to ensure a conservative assessment. The grid references of the turbines and assumed turbine models for each development are included in **Technical Appendix 10.3**.
- Blacklaw Hill (single turbine, consented, approximately 2 km north-west of Proposed Development)
  - Clonherb (single turbine, operational, approximately 2.5 km south-west of Proposed Development I)
  - Moorshield (three turbines, operational, approximately 3 km east of Proposed Development)
  - Whitelee (140 turbines, operational, approximately 3 km east of Proposed Development)
  - Whitelee Extension Phase 1 (36 turbines, operational, approximately 4.5 km south-west of Proposed Development)
  - Whitelee Extension Phase 2 (39 turbines, operational, approximately 7 km north-west of Proposed Development)

10.10.40 Wind turbine developments initially considered for inclusion in the cumulative operational noise assessment but excluded because their predicted operational noise levels at scoped in NSRs are below 30 dB L<sub>A90</sub> are shown below.

- Carswell Hill;
- Dareduff Hill;
- Harelaw Wood;
- Middleton;
- Myres Hill;
- Neilston Community (and extension);
- Nether Carswell III;
- Over Enoch and Ardoch; and
- Sneddon Law.

10.10.41 The source sound power level data used for the cumulative operational noise modelling is included in **Technical Appendix 10.3**. The results of the cumulative operational noise modelling are presented in **Table 10.14**. It should be noted that the predictions assume that each receptor location is downwind of all wind turbines simultaneously to provide a worst-case assessment. Under non-downwind conditions, operational noise levels will be lower. In addition, cumulative downwind noise contours for 10 m/s, for the area that includes scoped in NSRs, are provided at **Figure 10.2**.

**Table 10.14 Cumulative Predicted Downwind Noise Levels Including Proposed Development (dB L<sub>A90</sub>)**

| ID    | Location                | Standardised 10 m height wind speed (m/s) |      |      |      |      |      |      |      |
|-------|-------------------------|-------------------------------------------|------|------|------|------|------|------|------|
|       |                         | 3                                         | 4    | 5    | 6    | 7    | 8    | 9    | 10   |
| NSR1  | Best Friends Cottage    | 26.9                                      | 27.5 | 31.7 | 36.1 | 37.8 | 38.1 | 38.2 | 38.3 |
| NSR2  | Blacklaw Cottage        | 29.7                                      | 29.9 | 31.6 | 34.7 | 35.8 | 36.2 | 36.5 | 36.8 |
| NSR3  | Blacklawhill Farm       | 33.9                                      | 33.9 | 34.6 | 36.8 | 37.9 | 38.5 | 38.9 | 39.1 |
| NSR4  | Blair Farm              | 27.6                                      | 28.3 | 32.6 | 36.9 | 38.2 | 38.5 | 38.7 | 38.9 |
| NSR5  | Corsehouse Cottage      | 27.2                                      | 27.9 | 31.6 | 35.6 | 36.7 | 37.0 | 37.2 | 37.5 |
| NSR6  | Corsehouse              | 27.0                                      | 27.7 | 31.3 | 35.3 | 36.5 | 36.7 | 37.0 | 37.2 |
| NSR7  | Crofthead of Gree Farm  | 23.9                                      | 24.3 | 28.0 | 32.3 | 33.9 | 34.3 | 34.5 | 34.6 |
| NSR8  | Dounne Law Cottage      | 29.4                                      | 29.7 | 31.4 | 34.5 | 35.6 | 36.0 | 36.3 | 36.6 |
| NSR9  | East Whitelee Farm      | 27.2                                      | 27.5 | 29.8 | 33.2 | 34.4 | 34.7 | 35.0 | 35.2 |
| NSR10 | Easter Blacklaw Farm    | 27.8                                      | 28.0 | 29.8 | 32.9 | 34.1 | 34.5 | 34.8 | 35.1 |
| NSR11 | Easterhouse of Whitelee | 27.0                                      | 27.3 | 29.7 | 33.1 | 34.3 | 34.6 | 34.9 | 35.2 |
| NSR12 | Floak                   | 25.4                                      | 26.6 | 31.0 | 35.3 | 36.6 | 36.9 | 37.0 | 37.2 |
| NSR13 | Glen-a-Moor             | 27.1                                      | 27.3 | 29.2 | 32.4 | 33.5 | 33.9 | 34.3 | 34.5 |
| NSR14 | Glenouther Farm         | 26.9                                      | 27.5 | 31.1 | 35.1 | 36.3 | 36.6 | 36.8 | 37.1 |
| NSR15 | Gree Cottage            | 24.4                                      | 24.8 | 28.2 | 32.5 | 34.3 | 34.8 | 35.0 | 35.1 |
| NSR16 | Greelaw Farm            | 25.5                                      | 26.2 | 30.2 | 34.5 | 35.8 | 36.1 | 36.3 | 36.5 |

| ID    | Location                        | Standardised 10 m height wind speed (m/s) |      |      |      |      |      |      |      |
|-------|---------------------------------|-------------------------------------------|------|------|------|------|------|------|------|
|       |                                 | 3                                         | 4    | 5    | 6    | 7    | 8    | 9    | 10   |
| NSR17 | Greenfinch                      | 27.3                                      | 28.4 | 32.9 | 37.1 | 38.4 | 38.6 | 38.8 | 39.0 |
| NSR18 | Hairshaw Cottage                | 22.5                                      | 23.0 | 26.1 | 30.2 | 31.5 | 31.9 | 32.1 | 32.3 |
| NSR19 | Harelaw Farm                    | 26.4                                      | 27.0 | 31.1 | 35.4 | 36.9 | 37.2 | 37.4 | 37.6 |
| NSR20 | High Clunch Farm                | 24.5                                      | 25.1 | 28.9 | 33.2 | 34.7 | 35.0 | 35.2 | 35.4 |
| NSR21 | Highfield Farm                  | 25.1                                      | 28.5 | 33.1 | 37.2 | 38.5 | 38.7 | 38.8 | 38.8 |
| NSR22 | Kelvedon Cottage                | 26.8                                      | 27.1 | 29.3 | 32.6 | 33.8 | 34.2 | 34.5 | 34.7 |
| NSR23 | Kingswell Country House         | 26.6                                      | 27.4 | 32.2 | 36.6 | 38.2 | 38.5 | 38.6 | 38.7 |
| NSR24 | Laverockhall Cottage            | 29.0                                      | 29.3 | 31.1 | 34.2 | 35.4 | 35.7 | 36.1 | 36.3 |
| NSR25 | Lintbrae Cottage                | 23.5                                      | 24.0 | 27.2 | 31.5 | 33.3 | 33.8 | 34.0 | 34.1 |
| NSR26 | Lintbrae Farm                   | 23.4                                      | 23.8 | 27.0 | 31.3 | 33.1 | 33.6 | 33.8 | 34.0 |
| NSR27 | Low Blacklaw                    | 30.2                                      | 30.5 | 32.1 | 35.2 | 36.3 | 36.7 | 37.0 | 37.3 |
| NSR28 | Lowtoun of Blacklaw Farm        | 30.4                                      | 30.6 | 32.2 | 35.2 | 36.3 | 36.7 | 37.1 | 37.3 |
| NSR29 | Marramead                       | 27.1                                      | 28.2 | 32.7 | 37.0 | 38.2 | 38.4 | 38.6 | 38.8 |
| NSR30 | Meadowlands Farm                | 28.7                                      | 28.9 | 30.7 | 33.8 | 35.0 | 35.4 | 35.7 | 35.9 |
| NSR31 | Mid Floak Bungalow              | 25.2                                      | 26.4 | 30.8 | 35.1 | 36.4 | 36.7 | 36.8 | 37.0 |
| NSR32 | Mid Floak Farm                  | 25.1                                      | 26.2 | 30.7 | 34.9 | 36.2 | 36.5 | 36.7 | 36.8 |
| NSR33 | North Drumboy                   | 27.4                                      | 28.5 | 32.9 | 37.2 | 38.4 | 38.6 | 38.8 | 39.0 |
| NSR34 | Owl Cottage Upper Hairshaw Farm | 26.1                                      | 26.5 | 29.2 | 33.0 | 34.2 | 34.6 | 34.8 | 35.0 |
| NSR35 | Pebblebank East Whitelee        | 27.1                                      | 27.4 | 29.7 | 33.1 | 34.2 | 34.6 | 34.9 | 35.1 |
| NSR36 | Raithburn Farm                  | 23.8                                      | 24.2 | 27.8 | 32.1 | 33.8 | 34.2 | 34.4 | 34.5 |
| NSR37 | Raithill Farm                   | 25.1                                      | 25.7 | 29.5 | 33.8 | 35.4 | 35.7 | 35.9 | 36.1 |
| NSR38 | South Drumboy Farm              | 27.5                                      | 28.5 | 33.0 | 37.3 | 38.6 | 38.9 | 39.1 | 39.2 |
| NSR39 | Sunrise Lodge                   | 27.0                                      | 28.2 | 32.7 | 36.9 | 38.2 | 38.4 | 38.6 | 38.8 |
| NSR40 | The Stables                     | 27.2                                      | 28.3 | 32.8 | 37.1 | 38.3 | 38.5 | 38.7 | 38.9 |
| NSR41 | Townhead of Floak Bungalow      | 24.9                                      | 26.0 | 30.4 | 34.7 | 36.0 | 36.3 | 36.4 | 36.6 |
| NSR42 | Townhead Of Floak Farm          | 24.9                                      | 26.0 | 30.4 | 34.7 | 36.0 | 36.2 | 36.4 | 36.5 |
| NSR43 | Townhead of Gree Farm           | 24.1                                      | 24.6 | 28.1 | 32.4 | 34.1 | 34.5 | 34.7 | 34.9 |
| NSR44 | Upper Hairshaw Farm             | 26.1                                      | 26.5 | 29.2 | 32.9 | 34.2 | 34.5 | 34.8 | 35.0 |
| NSR45 | Windmill Cottage                | 26.6                                      | 26.9 | 28.8 | 32.0 | 33.2 | 33.6 | 33.9 | 34.1 |
| NSR46 | Windy-Yett Farm                 | 24.1                                      | 24.8 | 28.5 | 32.6 | 33.8 | 34.1 | 34.3 | 34.5 |

- 10.10.42 The results of the operational noise modelling show that predicted cumulative operational noise levels are below the minimum day TNAC of 40 dB LA90 at all scoped in NSRs. As the minimum TNAC is met at all NSRs, it can be concluded that no significant cumulative effects are predicted at any NSR. The full cumulative noise modelling and assessment results are presented at **Technical Appendix 10.4** where the predicted cumulative operational noise levels are compared with the day and night TNAC.

#### **Committed Additional Mitigation**

- 10.10.43 No additional mitigation is proposed as the relevant cumulative operational noise limits are met.

#### **Residual Cumulative Effects During Operation**

- 10.10.44 Residual cumulative effects will continue to be **not significant**.

### **10.11 Interrelationship Between Effects**

- 10.11.1 No interrelationships between effects have been assessed. Operational noise and vibration effects have been assessed against stand-alone noise limits that are not reliant on the results of other topic areas. Construction noise effects relate to the location and type of construction activities and construction vehicles accessing the Site as set out within **Chapter 11: Access, Traffic and Transport**.

### **10.12 Further Survey Requirements and Monitoring**

- 10.12.1 No further surveys are required. However, it is likely that the planning condition on noise will include the provision for operational noise monitoring if requested by EAC.

### **10.13 Summary of Likely Significant Effects**

- 10.13.1 No likely significant noise effects have been identified in this assessment as all applicable construction and operational noise limits will be met by the Proposed Development and Likely Grid Connection Route (including in combination with the Proposed Development).

## Glossary/Abbreviations

Table 10.15 : Glossary

| Term in Full                                  | Abbreviation | Meaning                                                                                                                                                                                                                                                                          |
|-----------------------------------------------|--------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Amplitude Modulation                          | AM           | The variation in level (volume) of a noise at a regular and repetitive time interval (frequency). In relation to wind turbines it is change in noise level related to the blade passage frequency or rotational speed occurring at regularity of 0.3 to 2 seconds.               |
| Assessment and Rating of Wind Turbine Noise   | ARWTN        | The noise assessment guidance for wind turbine developments released by UK Government in June 2026.                                                                                                                                                                              |
| Construction Environmental Management Plan    | CEMP         | A document that sets out the approach to management and mitigation of effects during the construction phase of the Proposed Development.                                                                                                                                         |
| Calculation of Road Traffic Noise             | CRTN         | Reference document setting out a methodology for predicting noise levels generated by vehicular traffic on roads.                                                                                                                                                                |
| Construction Traffic Management Plan          | CTMP         | A document that sets out the approach to management and mitigation of effects from traffic associated with the construction phase of the Proposed Development.                                                                                                                   |
| Decibel                                       | dB           | A decibel is a logarithmic unit used to measure the relative loudness of sound.                                                                                                                                                                                                  |
| Decommissioning Environmental Management Plan | DEMP         | A document that sets out the approach to management and mitigation of effects during the decommissioning phase of the Proposed Development.                                                                                                                                      |
| East Ayrshire Council                         | EAC          | East Ayrshire Council is the local government authority responsible for public services and administration in the East Ayrshire council area of southwestern Scotland.                                                                                                           |
| Environmental Health Officer                  | EHO          | A professional employed by the local authority to oversee the protection of public health within their administrative area.                                                                                                                                                      |
| Environmental Impact Assessment               | EIA          | An Environmental Impact Assessment is a formal assessment that systematically evaluates the potential environmental consequences of a proposed development project.                                                                                                              |
| Institute of Acoustics Good Practice Guide    | IOA GPG      | The Institute of Acoustics 2013 publication; <i>A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Noise from Wind Turbines</i> .                                                                                                            |
| Institute of Acoustics                        | IOA          | The UK's professional body for those working in acoustics, noise and vibration.                                                                                                                                                                                                  |
| Lower Limiting Value                          | LLV          | The fixed limit that applies at low wind speeds. During the night it is set at 43 dB LA90 and during the day it set is within the range of 35-40 dB LA90.                                                                                                                        |
| Noise Monitoring Location                     | NML          | Abbreviation for the location where baseline measurements were undertaken.                                                                                                                                                                                                       |
| Noise Sensitive Receptor                      | NSR          | Abbreviation for an assessed noise-sensitive receptor location.                                                                                                                                                                                                                  |
| Remaining Noise Budget                        | RNB          | A way of describing the amount of noise that could be generated in a specific context where there are cumulative noise effects that would result in no exceedance of the cumulative noise limits if the existing cumulative noise and remaining noise budget are added together. |

| Term in Full                    | Abbreviation | Meaning                                                                                                                |
|---------------------------------|--------------|------------------------------------------------------------------------------------------------------------------------|
| Site-specific noise limit       | SSNL         | The noise limit that applies to the proposed development that applies to the proposed development turbines only.       |
| Total Noise Assessment Criteria | TNAC         | The limit for operational wind turbine noise that applies to noise from all wind turbine developments in the vicinity. |