Scottish & Southern Electricity Networks

# Fanellan Hub 400 kV Substation and Converter Station Environmental Impact Assessment Report

## Volume 2 | EIA Report

## Chapter 14 – Noise and Vibration

## February 2025

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# 14. NOISE AND VIBRATION

## 14.1 Introduction

14.1.1 Wood was appointed by SSEN Transmission to provide noise consultancy services to support a detailed planning application for the proposed Fanellan Hub (the Proposed Development).

14.1.2 Wood has investigated the potential effects of noise and vibration from the Proposed Development. The assessment includes the potential effects upon noise sensitive receptors (NSRs) during both the construction and operation of the Proposed Development. The evaluation of the current noise baseline has been made through a combination of desk-based study, field survey and consultation.

14.1.3 This chapter identifies the likely impacts on noise sensitive receptors from construction and operation of the Proposed Development and includes an assessment of cumulative impacts from the Proposed Development and relevant Cumulative Projects listed in **Table 5-2** in **Volume 2: Chapter 5 EIA Process and Methodology**. The objectives of the chapter are to:

- identify the NSRs in the vicinity of the Proposed Development and the baseline noise environment;
- describe the assessment methodology and significance criteria used in the assessment;
- describe and define the baseline noise environment;
- identify the dominant sound sources associated with the operation and construction of the Proposed Development;
- calculate and assess the potential impacts on NSRs,
- assess any potential cumulative impacts; and
- indicate any requirements for mitigation measures, if applicable, to provide sufficient levels of protection for all NSRs.

14.1.4 This report is necessarily technical in nature so, to assist the reader, a glossary of acoustic terminology is included in **Volume 4, Appendix 14.1 – Acoustics Glossary.**

## 14.2 Site Description

14.2.1 The full project description is located in Chapter 3. A layout of the Proposed Development is illustrated by the drawing provided in **Volume 4, Appendix 14.2 - Proposed Development Layout**.

14.2.2 HVDC Converter stations contain similar equipment to substations. These contain various potential sources of industrial noise, the most significant of which are transformers and associated cooling equipment. Additional sources in HVDC converter stations are items such as reactors and capacitors. The noise from these sources is usually steady state and is assessed using standard noise assessment techniques.

## 14.3 Scope of Assessment

14.3.1 This report is an investigation into the existing background noise and acoustic environment in the area within and surrounding the Proposed Development. It has considered the potential operational noise effects that could arise due to the Proposed Development at the closest noise sensitive receptors (NSRs) in the vicinity of the Site.

14.3.2 The assessment has taken account of applicable planning policy and current guidance.

## 14.4 Methodology

14.4.1 The Proposed Development and methodology of assessment has been discussed and consulted upon with The Highland Council's Environmental Health Officer (EHO), see **Section 2.3** below. The methodology and assessment approach outlined below is standard for this type of development.

**Planning Advice Note (PAN) 1/2011: 'Planning and Noise'**

14.4.2 Published by the Scottish Government in March 2011, this document provides advice on the role of the planning system in helping to prevent and limit adverse effects of noise. Information and advice on noise assessment methods are provided in the accompanying Technical Advice Note (TAN): *Assessment of Noise*. Included within the PAN document and the accompanying TAN are details of the legislation, technical standards and codes of practice for specific noise issues.

14.4.3 Neither PAN 1/2011 nor the associated TAN provides specific guidance on the assessment of noise from fixed plant, but the TAN includes an example assessment scenario for 'New noisy development (incl. commercial and recreation) affecting a noise sensitive building', which is based on BS 4142:1997: *Method for rating industrial noise affecting mixed residential and industrial areas*. This British Standard has been replaced by BS 4142:2014: *Methods for rating and assessing industrial and commercial sound,* which was further amended in 2019**.**

**British Standard 4142:2014+A1:2019: Methods for rating and assessing industrial and commercial sound (hereafter referred to as BS 4142)[1]**

14.4.4 BS 4142 describes methods for rating and assessing the following:

- sound from industrial and manufacturing processes;
- sound from fixed installations which comprise mechanical and electrical plant and equipment;
- sound from the loading and unloading of goods and materials at industrial and/or commercial premises; and
- sound from mobile plant and vehicles that is an intrinsic part of the overall sound emanating from premises or processes, such as that from forklift trucks, or that from train movements on or around an industrial and/or commercial site.

14.4.5 The methods use outdoor sound levels to assess the likely effects of sound on people who might be inside or outside a dwelling or premises used for residential purposes upon which sound is incident.

14.4.6 In accordance with the assessment methodology, the specific sound level ($L_{Aeq,T}$) of the noise source being assessed is corrected, by the application corrections for acoustic features, such as tonal qualities and/or distinct impulses, to give a "rating level" ($L_{Ar,Tr}$). BS 4142 effectively compares and rates the difference between the rating level and the typical background sound level ($L_{A90,T}$) in the absence of the noise source being assessed.

14.4.7 BS 4142 advises that the time interval ('T') of the background sound measurement should be sufficient to obtain a representative or typical value of the background sound level at the time(s) when the noise source in question is likely to operate or is proposed to operate in the future. The time interval used for this survey was 15 minutes.

[1] British Standard 4142: *Methods for rating and assessing industrial and commercial sound* (BS 4142), BSI, 2014, Amended 2019

14.4.8 Comparing the rating level with the background sound level, BS 4142 states:

> "*Typically, the greater this difference, the greater the magnitude of impact.*
>
> *A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.*
>
> *A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.*
>
> *The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.*"

**British Standard 5228-1:2009 +A1:2014: Code of Practice for Noise and Vibration Control on Construction and Open Sites (hereafter referred to as BS 5228)** [2]

14.4.9 Guidance on the prediction and assessment of noise and vibration from construction sites is provided in British Standard (BS) 5228 2009 +A1:2014 Code of Practice for Noise and Vibration Control on Construction and Open Sites – Part 1: Noise. BS 5228-1 provides recommended limits for noise from construction sites.

14.4.10 The construction noise impact assessment (CNIA) has been carried out according to the ABC method specified in **Table E.1** of BS 5228-1, in which noise sensitive receptors (NSRs) are classified in categories A, B or C according to their measured or estimated background noise level.

14.4.11 Part 2: Vibration. BS 5228-2 provides recommended limits for vibration from construction sites. The construction vibration impact assessment (CVIA) will be carried out against the guidance on effects of vibration levels specified in **Table B.1** of BS 5228-2. The level of vibration ranging from 0.14 mm.s-1 to 10 mm.s-1 indicates where vibration may be perceptible however acceptable, or intolerable.

**ISO 9613-2:2024, Acoustics — Attenuation of sound during propagation outdoors, Part 2: Engineering method for the prediction of sound pressure levels outdoors**

14.4.12 This document specifies an engineering method for calculating the attenuation of sound during propagation outdoors in order to predict the levels of environmental noise at a distance from a variety of sources. The method predicts the equivalent continuous A-weighted sound pressure level (as described in ISO 1996-series) under meteorological conditions favourable to propagation from sources of known sound emission.

14.4.13 The operational noise impact assessment will be based on a 3D digital model of the Proposed Development and Study Area to industry standard in in accordance with ISO 9613-2.

**British Standard 8233:2014**[3] **and Noise Rating Curves**

14.4.14 British Standard 8233:2014: Guidance on sound insulation and noise reduction for buildings provides guidance for the control of noise in and around buildings. The guidance provided within BS 8233:2014 is applicable to the design of new buildings, or refurbished buildings undergoing a change of use, but does not provide guidance on assessing the effects of changes in the external noise levels to occupants of an existing building.

2 British Standard 5228: Code of practice for noise and vibration control on construction and open sites (BS 5228), BSI, 2009, amended 2014

3 British Standard 8233: Guidance on sound insulation and noise reduction for buildings (BS 8233), BSI, 2014

14.4.15 BS 8233:2014 includes appropriate internal and external noise level criteria which are applicable to dwellings exposed to steady-state external noise sources. It is stated in BS 8233:2014 that it is desirable for internal ambient noise level not to exceed the criteria which are set out in **Table 14-1**.

**Table 14-1: Summary of Internal Ambient Noise Level Criteria for Dwellings from BS 8233:2014**

| Activity | Location | 07:00 to 23:00 Hours, i.e. Daytime | 23:00 to 07:00 Hours, i.e. Nighttime |
|---|---|---|---|
| Resting | Living Room | 35 dB LAeq,16 hour | |
| Dining | Dining Room/Area | 40 dB LAeq,16 hour | |
| Sleeping (daytime resting) | Bedroom | 35 dB LAeq,16 hour | 30 dB LAeq,8 hour |

14.4.16 Noise Rating (NR) curves were developed by the International Organization for Standardization (ISO) to determine the acceptable indoor environment for hearing preservation, speech communication and annoyance.

14.4.17 The noise rating curves for different sound pressure levels are plotted as acceptable sound pressure levels at different frequencies. Acceptable sound pressure level varies with the room and the use of it. Different curves are obtained for each type of use. Each curve is referenced by a NR number as set out in **Table 14-2**.

**Table 14-2: Noise Rating Descriptions**

| Noise Rating | Application |
|---|---|
| NR 20 | Quiet rural area for protection of amenity |
| NR 25 | Concert halls, broadcasting and recording studios, churches |
| NR 30 | Private dwellings, hospitals, theatres, cinemas, conference rooms |
| NR 35 | Libraries, museums, court rooms, schools, hospitals operating theatres and wards, flats, hotels, executive offices |
| NR 40 | Halls, corridors, cloakrooms, restaurants, night clubs, offices, shops |
| NR 45 | Department stores, supermarkets, canteens, general offices |
| NR 50 | Typing pools, offices with business machines |
| NR 60 | Light engineering works |
| NR 70 | Foundries, heavy engineering works |

14.4.18 The NR curve NR 20 equates to a similar total noise level of 30 dB(A) and therefore is an appropriate consideration in respect to indoor noise levels as specified in BS 8233:2014.

***NANR116 – Open/closed window research: Sound Insulation Through Ventilated Domestic Windows***

14.4.19 The insulation of an open window has been generally accepted as being 10-15 dBA although its precision and effect on opening style, open area and window size, are not readily available. A programme of laboratory measurements has been undertaken by the Building Performance Centre at Napier University on behalf of the Department for Environment, Food and Rural Affairs, in order to quantify the sound insulation provided by a variety of window types, opening styles, areas of opening and ventilator devices.

## 14.5 Consultation Undertaken to Date

**Table 14-3: Consultation to Date**

| Body/ organisation | Type of consultation/ date | Response | How response has been considered |
|---|---|---|---|
| The Highland Council (THC) – Environmental Health Officer (EHO) | Pre-Application advice (23/04003/PREMAJ)<br>November 2023 | The EHO has advised that the noise assessment must demonstrate that the operational noise arising from the proposed development will not have any adverse impact on existing noise sensitive properties and the operational noise from the proposed substation must meet the following criteria:<br>• Operational noise from the proposed substation when measured and/or calculated as an $L_{Zeq,\ 5min}$, in the 100 Hz one third octave frequency band must not exceed 30 dB, at any noise sensitive premises; and<br>• The Rating Level of the operational noise from the proposed substation must not exceed the current background noise levels at noise sensitive premises.<br>The EHO has noted that THC does not consider the proposed criteria of +5dB above background would be acceptable. BS 4142 states +5dB would indicate adverse impact (depending on context.)<br>The applicant has advised that a BS 4142 assessment will be undertaken. Given the low background noise levels, in addition to the BS 4142 assessment, the Environmental Health Service would require the noise to be assessed against the NR20 curve criterion for internal noise levels at night. The NIA should also take into account any cumulative impact from other sites and comparing against NR20 internal noise curve.<br>Cumulative noise from overhead line developments should also be considered.<br>Cumulative noise from Wester Balblair Substation should also be considered due to the issuance of a Noise Abatement Notice and must not worsen. | Noise is a key issue, and therefore has been thoroughly assessed to relevant guidance, with the recommended criteria for operational noise.<br>The assessment methodology has been discussed and agreed with the local authority prior to submission of the NIA report.<br>The assessment seeks to be below 5 dB excess in a BS 4142 assessment. Given low background noise, assessing against an NR20 curve is also important for context.<br>Cumulative construction noise has been assessed from Associated Projects.<br>The cumulative operational noise from the Beauly-Denny OHL, proposed Spittal-Beauly OHL and proposed Beauly-Peterhead OHL is all considered with the predicted operational noise from the Proposed Development.<br>Existing noise from Wester Balblair Substation will have no impact within the study area due to the distance |

| Body/ organisation | Type of consultation/ date | Response | How response has been considered |
|---|---|---|---|
| | | A construction noise impact assessment must be conducted according to BS 5228-1. | between the source and surrounding NSRs associated with the Proposed Development. The Proposed Development will not exacerbate any current noise issues for noise sensitive receptors associated with Wester Balblair Substation for the same reason. Therefore **cumulative noise from Wester Balblair is scoped out of the assessment**.<br><br>The worst-case construction noise of all activities is assessed according to BS 5228-1 with the addition of a vibration assessment according to BS 5228-2. |
| The Highland Council (THC) – Environmental Health Officer | Scoping Opinion (24/02655/SCOP)<br><br>August 2024 | The above criteria from the pre-application advice for operational noise are to be maintained.<br><br>The working hours of construction must be within Monday to Friday: 08:00 to 19:00 and Saturday: 08:00 to 13:00. | The construction noise limit is determined by the restricted working hours, as per BS 5228.<br><br>The construction programme requires working from 0700 – 1900 every day, and therefore construction activities will be fully assessed to BS 5228 using the 55 dB limit due to working hours falling outwith Monday to Friday: 08:00 to 19:00 and Saturday: 08:00 to 13:00.<br>Traffic movements of Heavy Goods Vehicles (HGVs) are restricted to |

| Body/ organisation | Type of consultation/ date | Response | How response has been considered |
|---|---|---|---|
| | | | the times imposed by the THC. |
| The Highland Council (THC) – Environmental Health Officer | Microsoft Teams Meeting October 2024 | Further justification is required to explain the differences in tonal penalties applied in the noise assessment of the existing Beauly Substation Static Var Compensator (SVC) Area and the Fanellan Proposed Development due to the character and tonal components of the noise.<br><br>An explanation is required to explain in a BS 4142 how a noise rating excess above background noise of between 0 and 5 is acceptable given the context. | The severity of tones is defined and explained from the Proposed Development. The character of the noise is explained to show that the tones produced by the Proposed Development are not as severe to warrant maximum tonal penalty. The tones produced by the Proposed Development are more likely to be masked by broadband noise from cooling equipment. All major tonal electrical equipment is housed indoors and does not have dominant impact, avoiding significant tonal components associated with historic electrical infrastructure projects.<br><br>Absolute noise levels will be discussed to show the total predicted increase in noise and compared to what a perceptible change in noise level is. Noise levels are also assessed to NR20 to provide additional context to the BS 4142 assessment. |

## 14.6 Determining Magnitude of Change and Sensitivity of Receptors

*Sensitivity of Receptors*

14.6.1 The sensitivity of the NSR is estimated in its current state prior to any assessment of impact by the Proposed Development. The level of sensitivity is determined according to existing regulations and guidance, societal value, and vulnerability for the change. By the combination of the assessed value of these three components, the NSRs' sensitivity can be classified as Low, Medium or High, as recommended by TAN 2011. **Table 14-4** presents the definitions of receptor sensitivity.

**Table 14-4: Evaluation of Receptor Sensitivity**

| Level of Sensitivity | Definition |
|---|---|
| Low | Receptors where distraction or disturbance from noise is minimal. |
| | • Buildings not occupied during working hours.<br>• Factories and working environments with existing high noise levels.<br>• Sports grounds when spectator noise is a normal part of the event. Night Clubs. |
| Medium | Receptors moderately sensitive to noise, where it may cause some distraction or disturbance. |
| | • Offices.<br>• Bars/Cafes/Restaurants where external noise may be intrusive.<br>• Sports grounds when spectator noise is not a normal part of the event and where quiet conditions are necessary ( e.g. tennis, golf, bowls). |
| High | Receptors where people or operations are particularly susceptible to noise. |
| | • Residential, including private gardens where appropriate.<br>• Quiet outdoor areas used for recreation.<br>• Conference facilities.<br>• Theatres/Auditoria/Studios.<br>• Schools during the daytime.<br>• Hospitals/residential care homes.<br>• Places of worship. |

14.6.2 All NSRs considered in this assessment are residential in nature, with a semi-rural baseline noise environment. Therefore, the sensitivity of all NSRs is **High**.

## 14.7 Magnitude of Impact

14.7.1 The magnitude of an impact at a given receptor can be interpreted as the degree of alteration that is undergone by the receptor as a consequence of the impact. Magnitude criteria is quantitative using specified standards. As

reported in **Table 14-5**, the impact magnitude is worked out on a case-by-case basis for each NSR and classified as Negligible, Low, Medium, or High.

*Construction Noise and Vibration*

14.7.2 The noise criteria provided for the ABC method are detailed in BS 5228-1 are shown in **Table 14-5: Construction Noise Impact Assessment Criteria**.

**Table 14-5: Construction Noise Impact Assessment Criteria**

| Assessment category and threshold value period | Threshold value, LAeq (dB) | | |
|---|---|---|---|
| | **Category A** | **Category B** | **Category C** |
| Night-time | 45 | 50 | 55 |
| Evenings and weekends | 55 | 60 | 65 |
| Daytime and Saturdays | 65 | 70 | 75 |

14.7.3 Night-time is defined as between 23:00 and 07:00. Evenings and weekends are defined as 19:00 – 23:00 on weekdays, 13:00 – 23:00 on Saturdays and 07:00 – 23:00 on Sundays. Daytime is defined to be 07:00 – 19:00 on weekdays and 07:00 – 13:00 on Saturdays.

14.7.4 The NSR is defined as Category A if the ambient noise levels (rounded to the nearest 5 dB) are less than those stated for Category A. This is true for the Study Area and therefore the Proposed Development will be assessed to Category A thresholds.

14.7.5 The construction schedule of the Proposed Development is shown in **Table 14-6** which was supplied by the Principal Contractor, SBAM.

14.7.6 Cumulative construction noise has been considered for the following proposed Cumulative Projects:

- 400 kV Beauly-Denny (BD) OHL (dismantling and diversion)
- Black Bridge
- Western Isles Underground Cable (UGC)
- Spittal to Beauly 400 kV OHL
- Beauly to Peterhead 400 kV OHL

14.7.7 The construction schedule for the proposed Beauly Denny OHL diversion is presented in **Table 14-7** which was supplied by MES. A construction schedule is not available for Black Bridge, however a high-level assessment has been conducted to determine the potential impact. No information is currently available for the Western Isles UGC, and therefore has not been assessed cumulatively. The UGC project will be assessed as part of its own EA and assessed cumulatively with the projects listed within this report where relevant. Any construction activities associated with the Proposed Development that are concurrent with either Spittal to Beauly 400 kV OHL or Beauly to Peterhead 400 kV OHL must be controlled through a CNMP to manage noise emissions from traffic and static activities.

**Table 14-6: Indicative Construction Schedule of the Proposed Development**

| Contract Works | Start | End | Proposed Working Hours |
|---|---|---|---|
| Site Establishment | Month 1 | Month 6 | (January to December) Monday to Sunday: 07:00 to 19:00 |
| Earthworks AC | Month 3 | Month 21 | |
| Earthworks DC | Month 3 | Month 19 | |
| BAM Building Works | Month 12 | Month 22 | |
| Civils platform works | Month 15 | Month 30 | |
| M&E Installation and Commissioning | Month 23 | Month 56 | |
| Bunding, Landscaping and Removal of Temporary Laydown and Welfare | Unknown | Unknown | |

**Table 14-7: Daily Construction Schedule of OHL**

| Contract Works | Proposed Working Hours |
|---|---|
| Tree Felling | (January to December) Monday to Sunday: 07:00 to 19:00 |
| Foundations | |
| Tower Erection / Removal | |
| Downleads | |
| Stringing of Conductors | |
| Yard | |
| General | |

14.7.8 From the outlined construction schedule above, it is expected that the majority of construction works will occur during daytime but will extend into Saturday afternoons and Sundays. Construction work will be subject to the 55 dB Evening and Weekends limit. Excess over the 55 dB criteria will result in **Medium** impact magnitude. Excess of 5 dB over the 55 dB criteria will result in **High** impact magnitude. Below this limit will result in **Low** impact magnitude.

14.7.9 With a noise limit of 55 dB(A) identified from BS 5228-1, the following magnitude of impact at receptors can be determined from **Table 14-8**.

**Table 14-8: Construction Noise - Magnitude of Impact at Receptors**

| Magnitude of Impact | Construction Noise Level (dB(A)) |
|---|---|
| High | > 60 |
| Medium | 56 to 60 |
| Low | BGN to 55 |
| Negligible | < BGN |

14.7.10 Construction traffic for local haul roads and Site access are incorporated within the BS 5228-1 assessment, however additional criteria extend to construction traffic on highways. **Table 14-9** shows noise impact criteria for the assessment of changes to road traffic noise due to the addition of Proposed Development related construction traffic, with reference from **Table 3.17** of DMRB, LA 111 Noise and Vibration.

**Table 14-9: Construction Traffic - Magnitude of Impact at Receptors**

| Magnitude of Change | Traffic Noise Level Change, x |
|---|---|
| No Change | x < 0 |
| Negligible | 0.1= x < 0.9 |
| Low | 1.0 = x < 2.9 |
| Medium | 3 = x < 4.9 |
| High | x > 5 |

14.7.11 Construction traffic noise shall be defined as a significant effect where it is determined that a **High** or **Medium** magnitude of impact will occur for a duration exceeding:

- 10 or more days or nights in any 15 consecutive days or nights; and/or
- a total number of days exceeding 40 in any 6 consecutive months.

14.7.12 Criteria for construction vibration due to access tracks and foundation works are taken from **Table B.1** in BS 5228-2 and shown in **Table 14-10**. Vibration is measured as peak particle velocity (PPV) measured in millimetres per second ($mm \cdot s^{-1}$).

**Table 14-10: Construction Vibration Impact Assessment Criteria**

| Impact Magnitude | Vibration Level, Peak Particle Velocity (PPV) (mm.s$^{-1}$) | Effect |
|---|---|---|
| Negligible | 0.14 mm·s$^{-1}$ | Vibration might be just perceptible in the most sensitive situations for most vibration frequencies associated with construction. At lower frequencies, people are less sensitive to vibration. |
| Low | 0.3 mm·s$^{-1}$ | Vibration might be just perceptible in residential environments. |
| Medium | 1.0 mm·s$^{-1}$ | It is likely that vibration of this level in residential environments will cause complaints but can be tolerated if prior warning and explanation have been given to residents. |
| High | 10 mm·s$^{-1}$ | Vibration is likely to be intolerable for any more than a very brief exposure to this level in most building environments. |

14.7.13 Excess over the 10 mm·s$^{-1}$ criteria will result in **High** impact magnitude. Construction vibration between the 1 mm·s$^{-1}$ and 10 mm·s$^{-1}$ threshold will result in **Medium** impact magnitude. Below 1 mm·s$^{-1}$ will result in **Low** impact magnitude.

*Operational Noise*

14.7.14 Information from the rating level, the background sound level, and the stated impacts from a BS 4142 assessment have been converted into representative impact magnitudes, detailed in **Table 14-11**.

**Table 14-11: BS 4142 Impact Assessment Criteria**

| Impact Magnitude | Definition |
|---|---|
| Negligible | Impact to the receptor is immeasurable, undetectable or within the range of normal natural background variation. |
| Low | The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context. |

| Impact Magnitude | Definition |
|---|---|
| Medium | A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context. |
| High | A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context. |

14.7.15 The assessment within BS 4142 is context-based (i.e. informed by the baseline level of background noise during the relevant part of the day, as well as considering what equipment is less likely to be operational at various parts of the day), as is stated in the definitions of determining impact. There is no theoretical limit to how the context can or should influence the impact assessment, but any alteration of the conclusions of an assessment due to the context should be sufficiently explained and justified for the specific circumstances in question. Section 11 of BS 4142 states: *"Where background sound levels and rating levels are low, absolute levels might be as, or more, relevant than the margin by which the rating level exceeds the background. This is especially true at night."* The assessor will include additional consideration for internal noise levels during nighttime periods, where it is less likely that the external amenity is in use, and the preservation of internal conditions and the reduction of potential sleep disturbance is of more concern. For nighttime conditions, operational noise shall constitute a significant effect where:

- a **High** or **Medium** magnitude of impact is determined at the external amenity, and
- the internal noise limits of 30 dB(A) are exceeded as set out in BS 8233:2014, or the noise exceeds NR20 criteria.

14.7.16 This is due to the context of the assessment, during nighttime[4] conditions it is more appropriate to consider internal noise and the potential for sleep disturbance, rather than the external amenity which is likely not in use during these times.

*Significance of Effect*

14.7.17 After assessing the sensitivity of the NSR in its baseline state, and then the impact magnitude of the noise likely to affect the NSR, an estimate of the significance of effect can be derived by applying a calculation matrix (**Table 14-12**).

14.7.18 The measure of significance is the key output of the impact assessment process and drives the requirement for mitigation measures to be applied during operation to offset or reduce potential project generated effects.

14.7.19 The predicted significance of the effect was determined through the recommendations in TAN 2011 and based on professional judgement, considering both sensitivity and magnitude of change as detailed in **Table 14-12**.

4 BS 4142 defines 'nighttime' as the period between 23:00 and 07:00

**Table 14-12: Matrix for Determination of Significance of Effects**

| Significance | | Level of Significance Relative to Sensitivity of Receptor | | |
|---|---|---|---|---|
| | | Low | Medium | High |
| Impact Magnitude | **High** | Minor / Moderate | Moderate / Major | Major |
| | **Medium** | Minor | Moderate | Moderate / Major |
| | **Low** | Negligible / Minor | Minor | Minor / Moderate |
| | **Negligible** | Neutral / Minor | Neutral / Minor | Minor |
| | **No change** | Neutral | Neutral | Neutral |

14.7.20 The evaluation of effect significance shall be performed by following professional judgment, considering the context where necessary. A conservative approach to methodology has been applied, where worst-case results are reported. This is a robust approach and used to account for potential uncertainties that could affect the baseline data. Uncertainties include wind between 0 and 4 m/s affecting noise levels, temperature gradients near the ground which can affect the sound propagation, and traffic patterns throughout the day. Resulting effects of **Moderate** and **Major** impacts are considered significant.

## 14.8 Assessment Limitations and Assumptions

14.8.1 This assessment considers conservative assumptions with the aim to produce a worst-case assessment. This ensures that in practicality, noise levels would be expected to be lower than the assessment details, and uncertainty is reduced to as minimal as possible.

14.8.2 Estimated noise emissions from the construction of the Proposed Development have been based on the equipment information supplied by the Principal Contractor and Overhead Line Contractor (for the BD OHL diversion). There is always a degree of uncertainty when conducting assessments on developments prior to completion of detailed design. This assessment considers conservative assumptions to produce a worst-case assessment to account for those uncertainties and ensure that the assessment is robust.

14.8.3 Unless otherwise stated, all sound levels refer to free field levels i.e. sound levels without influence from any nearby reflective surfaces.

14.8.4 In accordance with ISO 9613, all assessment locations are modelled as downwind of all sound sources. Propagation calculations are based on a moderate ground-based temperature inversion, such as that commonly occuring at night.

14.8.5 Whilst some information gaps have been identified, 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 on noise.

## 14.9 Baseline Conditions

*Overview*

14.9.1 Background noise monitoring has been conducted in the vicinity of the Proposed Development to determine the existing noise environment for the purpose of the operational noise impact assessment. Free-field long term monitoring equipment was installed at five locations on 24 October 2023 and decommissioned on 9 November 2023. An additional long term monitoring survey was conducted at a sixth location from 29 March 2024 to 19

April 2024. This NSR (NSR 5) was added to provide comfort to the residents at that property who were concerned about noise impacts given their proximity to the Proposed Development. Baseline monitoring was extended at this location due to poor weather at the start of monitoring. A total of eight NSRs are identified, which consists of the six measurement locations and two additional NSRs in close proximity to two measurement locations. The additional NSRs will assume the same background noise level as those locations.

14.9.2 The construction noise impact assessment concerns a wider range of NSRs (including the same NSRs from the operational noise impact assessment) due to the noise created by vehicle movements on access tracks. These are listed in **Volume 4, Appendix 14.3 – Construction Noise Impact Assessment NSRS**.

## 14.10 Instrumentation

14.10.1 Measurements were conducted using Class 1 sound level meters (SLMs). Four Rion NL-52 models were used and one 01 dB DUO SLM which were spot calibrated with a Rion NC-74 calibrator, before, and after the measurement campaign. These meters were housed in environmental cases and used to conduct long-term measurements.

- Rion NL-52 S/N 01265434
- Rion NL-52 S/N 01265412
- Rion NL-52 S/N 01265413
- Rion NL-52 S/N 00175536
- 01dB DUO S/N 10510

14.10.2 The sound level meters were externally calibrated by a third party to traceable standards within the preceding two years and the portable calibrators within the preceding 12 months. The sound level meters were spot calibrated both prior to and upon completion of the survey. No significant drift was noted to have occurred during the measurement campaign.

14.10.3 Instrument calibration certificates are shown in **Volume 4, Appendices 14.4** to **14.8**.

## 14.11 Measured Parameters

14.11.1 The following parameters were measured during the baseline noise survey and are in line with the requests in the Scoping Opinion (24/02655/SCOP) from the Highland Council:

- $L_{Aeq\ (15\ Minutes)}$
- $L_{Aeq}$ one-third octave band spectrum
- $L_{A90\ (15\ Minutes)}$
- $L_{A90}$ one-third octave band spectrum

## 14.12 Meteorological Conditions

14.12.1 As the survey is based on long-term unattended measurements, a meteorological station (Vantage Vue) was also set up in the area to monitor for appropriate weather conditions. Meteorological conditions such as wind and rain will affect background noise (BGN) conditions and have possible effects on noise propagation. Measurements were conducted every 15 minutes to coincide with the measured noise data.

## 14.13 Measurement Positions

14.13.1 AddressBase data, detailed maps and aerial photographs of the area surrounding the Proposed Development were examined and alongside review of previous noise assessments near noise sensitive receptors (NSRs)

were identified. **Table 14-13** contains a list of NSR locations measured with long term equipment during the survey. **Figure 14-1** shows an annotated map of the survey area.

14.13.2 The measurements were made within free-field conditions, i.e. at least 3.5 m from any acoustically reflective surfaces other than the ground. These measurement positions were deemed to represent the background noise conditions for external amenity for the surrounding NSRs in the closest proximity.

14.13.3 In addition to the measurement locations, which are already considered noise sensitive receptors, three additional residential properties are included in the study (NSRs 6, 7, 8). These properties will assume the same BGN level to measurement locations they are geographically closest to and share the same acoustic environment.

**Table 14-13: Measurement Locations and Noise Sensitive Receptors**

| Receptor BGN/NSR | Address | Easting | Northing | Measurement Period |
|---|---|---|---|---|
| BGN 1 – Upper Fanellan | Kiltarlity, Highland, Scotland, IV4 7JP, United Kingdom | 248600 | 842891 | 24/10/2023 to 09/11/2023 |
| BGN 2/NSR 1 – Fanellan Croft | Kiltarlity, Highland, Scotland, IV4 7JP, United Kingdom | 248979 | 843196 | |
| BGN 3/NSR 2 – Allordale | Kiltarlity, Highland, Scotland, IV4 7JP, United Kingdom | 248383 | 842188 | |
| BGN 4/NSR 3 – Forest Lodge | Kiltarlity, Highland, Scotland, IV4 7JP, United Kingdom | 247759 | 842019 | |
| BGN 5/NSR 4 – Teanassie | A831, Torgormack, Kilmorack, Highland, Scotland, IV4 7AE, United Kingdom | 247593 | 844065 | |
| BGN 6/NSR 5 – 3 Fanellan | Kiltarlity, Highland, Scotland, IV4 7JP, United Kingdom | 248032 | 842203 | 29/03/2024 to 25/04/2024 |
| NSR 6 – Fanellan Farm House | Kiltarlity, Highland, Scotland, IV4 7JP, United Kingdom | 248032 | 842203 | N/A |
| NSR 7 – Lower Fanellan | Kiltarlity, Highland, Scotland, IV4 7JP, United Kingdom | 248032 | 842203 | |
| NSR 8 – Dun Fionn | A831, Torgormack, Kilmorack, Highland, Scotland, IV4 7AE, United Kingdom | 247184 | 843257 | |

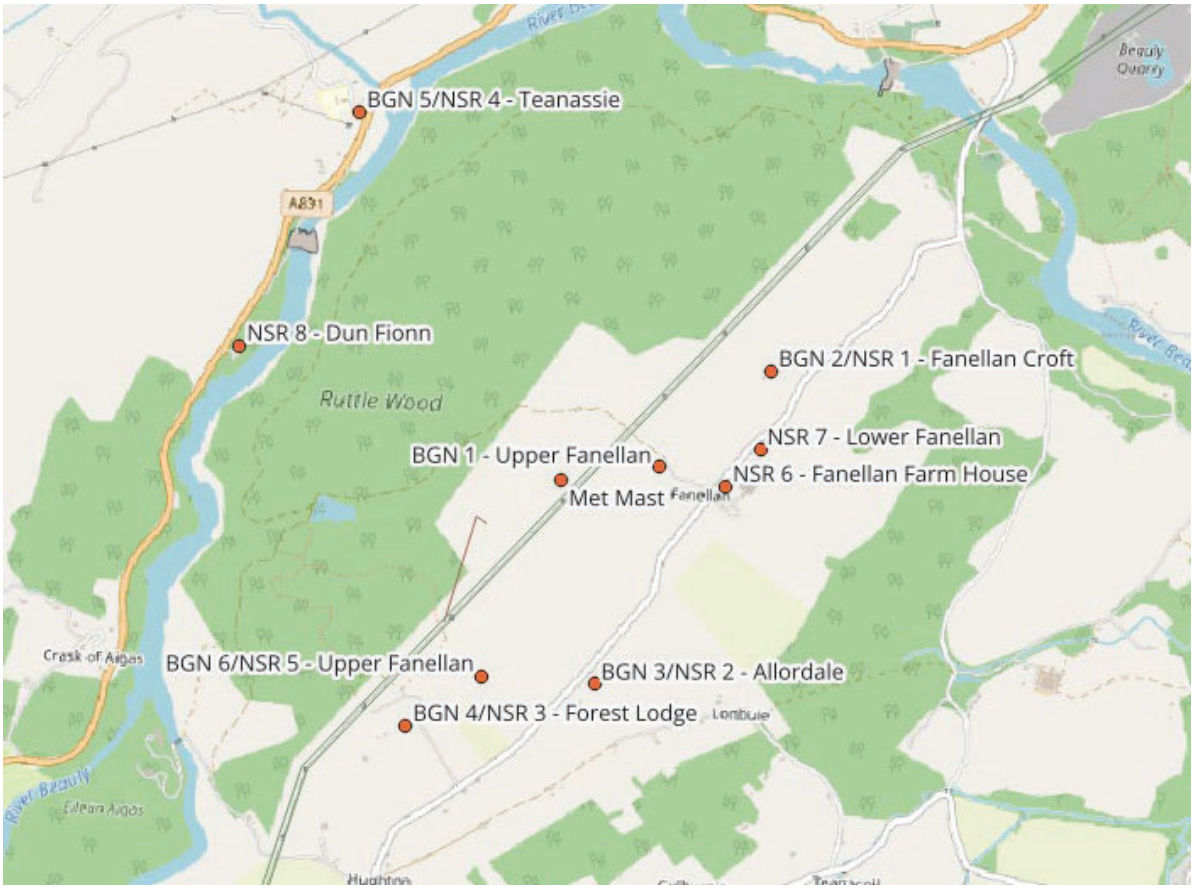


**Figure 14-1: Map of the Survey Area**

## 14.14 Baseline Conditions and Results

14.14.1 Noise measurements were filtered for daytime and nighttime conditions (nighttime defined as between 23:00 and 07:00) where noise is shown to be at its lowest.

14.14.2 Periods of rain or windspeeds of 5 m/s or above are removed from the analysis as per BS 4142. The impact of rain or high wind causes higher background noise levels to be measured, deeming the assessment no longer conservative. If data which included levels during wind and rain were to be used, the difference between modelled levels from the Proposed Development would appear to be lower than what a worst-case assessment would provide. Data is presented in **Volume 4, Appendix 14.9 – Meteorological Data.**

14.14.3 Statistical analysis of nighttime noise levels was conducted of the histogram distribution of $L_{A90}$ (15 minute) levels. The histograms for all five locations are presented in **Volume 4, Appendix 14.10 - Histograms of Measured Background Noise**.

14.14.4 The nighttime levels are right-skewed, indicating that the average noise level at night is higher than the most frequently recorded level. This means that the noise levels are concentrated at the lower end, but there were higher levels recorded, increasing the mean.

14.14.5 The levels presented show higher noise is exhibited during the day. The daytime histograms are mostly left-skewed, indicating that the average noise level is lower than the most frequently recorded level.

14.14.6 This statistical analysis was conducted for all six long-term measured NSRs to define a representative BGN level at each location.

14.14.7 In practice, there is no “single” background sound level as this is a fluctuating parameter. However, the background sound level used for the assessment should be representative of the period being assessed.

14.14.8 The modal value has been considered alongside the skew of the data set to select the appropriate representative level. **Table 14-14** provides the night-time and daytime representative $L_{A90}$ results of the baseline noise survey.

14.14.9 NSR 6 – Fanellan Farm House will assume the same background noise levels as BGN 1 – Upper Fanellan as it is the closest measurement location. Likewise, NSR 7 – Lower Fanellan will assume the same background noise levels as NSR 1 – Fanellan Croft. NSR 8 – Dun Fionn will assume the same background noise levels as NSR 4 – Teanassie.

**Table 14-14: Representative Background Noise Levels**

| Location | Easting | Northing | $L_{A90}$ (dB(A)) (Nighttime) | $L_{A90}$ (dB(A)) (Daytime) |
|---|---|---|---|---|
| BGN 1 – Upper Fanellan | 248600 | 842891 | 23 | 26 |
| BGN 2/NSR 1 – Fanellan Croft | 248979 | 843196 | 24 | 27 |
| BGN 3/NSR 2 – Allordale | 248383 | 842188 | 23 | 27 |
| BGN 4/NSR 3 – Forest Lodge | 247759 | 842019 | 25 | 26 |
| BGN 5/NSR 4 – Teanassie | 247593 | 844065 | 32 | 34 |
| BGN 6/NSR 5 – 3 Fanellan | 248032 | 842203 | 25 | 30 |
| NSR 6 – Fanellan Farm House | 248032 | 842203 | 23 | 26 |
| NSR 7 – Lower Fanellan | 248032 | 842203 | 24 | 27 |
| NSR 8 – Dun Fionn | 247184 | 843257 | 32 | 34 |

14.14.10 The representative LZ90 spectra for both daytime and night for each location are presented in **Volume 4, Appendix 14.11 - LZ90 Background Frequency spectra**.

14.14.11 The BGN data is mostly composed of broadband noise, likely due to some traffic from Fanellan Road, but this is low. There is a notable peak in the 50 Hz third-octave bands at Teanassie, this is due to multiple nearby overhead towers and pole mounted transformers, which provide the characteristic low-frequency buzz of

electrical discharge. Generally, there is low background noise at the measurement locations closest to the proposed site.

14.14.12 The results of baseline noise survey show that NSRs in vicinity of the Proposed Development have a noise environment quantified between 23 – 25 dB LA90 during night periods. The noise environment is not dominated by any notable sources. Given the rural area, the acoustic environment is generally quiet.

## 14.15 Construction Noise

14.15.1 A desk-based construction noise impact assessment has been prepared for the effects of the construction works on any nearby residents. This assessment has been produced in line with British Standard 5228:2009 +A1:2014: Code of Practice for Noise and Vibration Control on Construction and Open Sites (BS 5228).

14.15.2 NSRs that fall within approximately 2 km of the centre of the Proposed Development and surrounding access tracks and links are considered. A total of seventy-three (73) NSRs are considered in this study and are detailed in **Volume 4, Appendix 14.3 – Construction Noise Impact Assessment NSRs**.

14.15.3 Potential significant noise effects that may result from the construction of the Proposed Development,

- effects of construction noise on the surrounding area and on NSRs. Including effects of static and quasi-static construction noise from construction plant, such as excavators, dump trucks and cranes.

14.15.4 The construction noise of the Proposed Development is assessed. In addition, other projects that are assessed cumulatively with the Proposed Development are:

- Beauly-Denny (BD) OHL (dismantling and diversion).
- Black Bridge Works.

14.15.5 Estimated construction schedules (**Table 14-16** and **Table 14-17**) and likely construction equipment have been supplied by SBAM (Civils, AC and DC works) and MES (BD OHL works) with source sound power level data identified in Annex C of BS 5228-1. The equipment and utilisation have been estimated by the Principal Contractors for the relevant phases, which are subject to change. SBAM has supplied equipment activity for Black Bridge works however the schedule is not known, therefore, to produce a worst-case assessment, the activities are assumed to take place during the noisiest phase of the Proposed Development (AC Earthworks). The activity is analysed to determine the percentage of the construction time each piece of equipment is being used and how many are in use. Using this information, a total equivalent noise level is calculated. The dispersion of this total noise level is then modelled, accounting for distance and ground absorption.

## 14.16 Results

*Stati and Quasi-Static*

14.16.1 At the time of writing, the total equipment expected to be used has been supplied.

14.16.2 **Volume 4, Appendices 14.12 to 14.28** show the plant activities, items, their quantities, utilisation and associated noise levels at 10 m from the source.

14.16.3 To calculate the potential construction noise levels from each construction phase, information about the proposed construction activities is needed. The Principal Contractor will be responsible for developing the detailed construction methodology and associated plant requirements. Noise due to vehicle movements is also considered in this calculation. By combining the items' noise levels ($L_{A,eq}$ at 10 m from the plant (dB)) with the amount of time each will be running (utilisation) and their quantity, the total equivalent noise can be calculated

for each activity. These are then logarithmically summed to give a total value for the construction noise at 10 m from the noise source. The total equivalent noise level at 10 m from the plant source for each activity can be used in a propagation calculation to find the specific noise at each receptor. To ensure a worst-case assessment, it has been assumed that all works within the phases will take place simultaneously.

14.16.4 This attenuation has been calculated over mixed hard and soft ground to the F.2.3.2 method in BS 5228. Given the dominance of soft ground in the area surrounding the Proposed Development, this is slightly conservative. The effects of barriers or topographical screening have not been considered.

14.16.5 The Construction Noise Assessment (results for the Proposed Development and relevant Cumulative Projects are shown in **Volume 4, Appendix 14.29 to 14.31**) predicts that construction noise has the potential to exceed the 55 dB noise limit at stages in the construction of the Proposed Development, the proposed 400 kV Beauly Denny (BD) OHL diversion and the Black Bridge replacement works. These are summarised in **Table 14-15** and **Table 14-16** below. With the information supplied for the Black Bridge site establishment, it is not anticipated that cumulative noise at any NSR will breach the 55 dB limit that has not already been breached by the worst-case construction (AC Earthworks for the Proposed Development). Tree felling will take place for both the Proposed Development and the BD OHL diversion. Most vegetation clearance areas are for the purposes of the BD OHL diversion, so results are included in **Table 14-16**.

**Table 14-15: Summary of Construction Noise Results per Phase - Proposed Development**

| Phase | NSRs in excess (above 55 dB Limit indicating Medium impacts) | NSRs in excess (above 60 dB indicating High Impacts) | NSRs above 65 dB (if assessed during Daytime and Saturdays) |
|---|---|---|---|
| Site Establishment | 34 | 6 | 0 |
| Earthworks AC | 42 | 14 | 1 |
| Earthworks DC | 37 | 11 | 0 |
| Building Works | 37 | 4 | 0 |
| Civils platform works | 31 | 11 | 0 |
| M&E Installation and Commissioning | 31 | 4 | 0 |
| Bunding, Landscaping and Removal of Temporary Laydown and Welfare | 31 | 4 | 0 |

**Table 14-16: Summary of Construction Noise Results per Phase – Associated Cumulative Development BD OHL**

| Phase | NSRs in excess (above 55 dB Limit indicating Medium impacts) | NSRs in excess (above 60 dB indicating High Impacts) | NSRs above 65 dB (if assessed during Daytime and Saturdays) |
|---|---|---|---|
| Tree Felling | 42 | 18 | 6 |
| Foundations | 36 | 19 | 2 |
| Tower Erection / Removal | 33 | 14 | 0 |
| Downleads | 36 | 7 | 0 |
| Stringing of Conductor | 36 | 12 | 0 |
| Fibre Diversion | 31 | 3 | 0 |
| Scaffold | 32 | 4 | 0 |
| Yard | 31 | 4 | 0 |

| | | | |
|---|---|---|---|
| General | 31 | 4 | 0 |

**Table 14-17: Summary of Construction Noise Results per Phase – Cumulative Development Black Bridge**

| Phase | NSRs in excess (above 55 dB Limit indicating Medium impacts) | NSRs in excess (above 60 dB indicating High Impacts) | NSRs above 65 dB (if assessed during Daytime and Saturdays) |
|---|---|---|---|
| Site Establishment | 34 | 9 | 0 |

14.16.6 Based on the results shown for the construction phases of the Proposed Development, construction noise is predicted to be above the 55 dB Evening and Weekends criteria at 42 NSRs. Noise at 14 NSRs is predicted to be above 60 dB, indicating **High** impacts. Therefore, prior to the mitigation measured outlined in **Section 14.17,** construction noise results in **High** impact magnitude, assessed as **Major,** and therefore **Significant** due to being at least 5 dB over the 55 dB limit.

14.16.7 With **High** sensitivity and **High** impact, the worst-case construction noise during the earthworks AC stages for the Proposed Development is assessed as **Major** and is therefore **Significant**. All other work stages exceed the 55 dB limit, however, if these works are prioritised and take place during Daytime and Saturday mornings (8 am to 1 pm), the resulting impact will be **Low** which is **Minor/Moderate**. However, given that the assessment uses peak (and simultaneous) activity levels, it is more likely in practice to be **Minor** and **Not Significant**. A detailed construction schedule must be developed by the Principal Contractor when further specific information is available and the assessment must be revisited.

14.16.8 Based on the results shown for the construction phases of the BD OHL diversion, construction noise at 36 NSRs is above the 55 dB Evening and Weekends criteria. The foundations phase is expected to cause a maximum of 71 dB at Fanellan Crofthouse. Therefore, prior to the mitigation measured outlined in Section **14.17**, construction noise results in **High** impact magnitude, assessed as **Major,** and therefore significant due to being at least 5 dB over the 55 dB limit.

14.16.9 Based on the results shown for the construction phases of the Black Bridge works, construction noise at 36 NSRs is above the 55 dB Evening and Weekends criteria. The site establishment phase is expected to cause a maximum of 63 dB at Millcroft. Therefore, prior to the mitigation measures outlined in **Section 14.17**, construction noise results in **High** impact magnitude, assessed as **Major,** and therefore significant due to being at least 5 dB over the 55 dB limit.

*Traffic*

14.16.10 The proposed construction routes reported in **Volume 2, Chapter 12: Traffic and Transport** have been used as the basis for the assessment of haul routes using information obtained in February 2025. Phase 1 is a route through Kiltarlity while Black Bridge is being replaced. Phase 2 avoids Kiltarlity and uses Black Bridge after replacement. It is stated that during Phase 2 there will be a maximum movement of 292 HGVs over a 11-hour delivery window, the traffic data is described as 'peak' traffic and therefore is conservative. Construction traffic noise calculations have followed guidance from BS 5228-1 Annex F.2.5 'Method for mobile plant using a regular well-defined route (e.g. haul roads) and noise levels incorporated into overall construction noise assessment.

14.16.11 Construction related traffic and transport impacts for main access routes have been assessed by calculating the relative increase in road traffic noise level adjacent to public roads used by construction traffic. The standard UK calculation method CRTN was used to calculate the noise level, at a nominal distance of 10 m from each

road, using baseline traffic flows and also accounting for the addition of construction traffic as reported in **Volume 2, Chapter 12: Traffic and Transport**.

14.16.12 The average daily traffic flows reported in **Volume 2, Chapter 12: Traffic and Transport** have been converted to 18-hour traffic flows for the purposes of the noise calculation as is required by CRTN. Noise levels for the baseline 2026 and baseline + construction traffic scenarios are presented in **Volume 4, Appendix 14.32 - Traffic Noise Assessment (CRTN)** for both cars and Heavy Goods Vehicles (HGVs).

14.16.13 Assuming the values above, and an average speed of 30 mph, the following L10 18-hour noise levels are obtained and are fully presented in **Volume 4, Appendix 14.32 - Traffic Noise Assessment (CRTN).**

14.16.14 Impacts on the majority of routes are predicted as either **Low** or **Negligible** and therefore **not significant**. **High** impacts are predicted at Links 5 for Phase 1, and Links 2 and 5 during Phase 2 (see **Chapter 10**: **Traffic and Transport** for description of links and phases). The highest change is 11.5 dB at Link 5 in Phase. This equates to **Major** impact with reference from **Table 3.17** of DMRB, LA 111 Noise and Vibration. With **High** sensitivity and **Major** impact, the worst-case construction traffic noise is assessed as **Major**. As the data suggests peak traffic levels which is a conservative assumption and results in a Major impact, it is more likely in practice to result in **Moderate** impacts and therefore remains **significant**. This will remain significant if the traffic noise continues for:

- 10 or more days or nights in any 15 consecutive days or nights; and/or
- a total number of days exceeding 40 in any 6 consecutive months.

*Blasting*

14.16.15 **Figure 14-2** shows where blasting may be required, although this is subject to confirmation through further Ground Investigation. The heat map shows that any colours in green will/light green will have a net fill above existing ground level, transitioning to the darker colours demonstrates a net cut from existing ground level. The cross section gives an indication of the rock level and associated finished platform level, this additionally shows rock around 4 m below existing ground, consistently across the site.

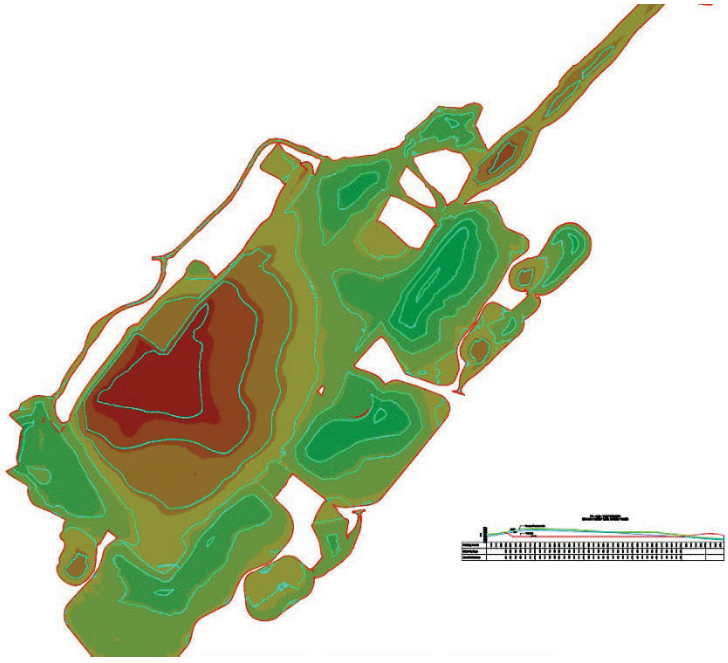

**Figure 14-2: Heat map of net fill (Green) or net cut (Red) for the ground level of the proposed site**

14.16.16 Blasting air overpressure is related to the levels shown in **Table 14-18**.

**Table 14-18: Comparison Between Wind Speed and Air Overpressure Equivalents**

| Wind Speed | Equivalent air overpressure |
|---|---|
| Constant wind of 5 m/s, Beaufort Scale 3, Gentle Breeze | 120 dB |
| Constant wind of 8 m/s, Beaufort Scale 4, Moderate Breeze | 130 dB |
| Constant wind of 20 m/s, Beaufort Scale 8, Gale | 140 dB |

14.16.17 No specific blasting assessment has been conducted at this stage of the project, as details of the activities are not available at this time. If blasting is to occur, good public relations have been shown to reassure the public of the fact that normal production blasting has not been found to damage property, and that even the most cosmetic of plaster cracking is extremely unlikely. In addition, contacting owners of sensitive properties to advise of imminent blasting can further help promote harmony with the public. It is good practice to publicise times when blasting will occur and to avoid blasting at other times whenever possible. Air overpressure from blasting comprises transient airborne pressure waves which can be heard and felt. Air overpressure can be influenced by meteorological conditions over which operators have no control. Although air overpressure can be affected by the total quantity of explosives deployed in a blast, there is a balance to be struck between a smaller number of large blasts and a larger number of small blasts. Public relations have an important role to play in determining the optimum balance between size and frequency of blasting.

14.16.18 A blasting assessment should be conducted by the Principal Contractor prior to works commencing. Significant impacts can be reduced in a Construction Noise Management Plan (CNMP). Practical measures, including good blast design, that have been found to reduce air overpressure are:

- ensuring appropriate burden to avoid over or under confinement of the charge;
- accurate setting out and drilling;
- appropriate charging;
- appropriate stemming with appropriate material such as sized gravel or stone chippings;
- using delay detonation to ensure smaller maximum instantaneous charges (MICs);
- using decked charges and in-hole delays;
- blast monitoring to enable adjustment of subsequent charges;
- avoiding the use of exposed detonating cord on the surface in order to minimise air overpressure.

## 14.17 Mitigation during Construction

14.17.1 All seven construction phases for the Proposed Development and all of the eight phases for the BD OHL diversion works are predicted to cause Moderate impact significance against the 55 dB limit.

14.17.2 As shown in **Volume 4, Appendix 14.13 - Fanellan Hub Worst Case Construction Activities and Associated Noise Levels for AC Earthworks**, the tracked semi-mobile crusher is a dominant source of noise during the earthworks of the Hub. Noise from the crushing activity has been calculated at various distances so that the total noise from construction meets a 65 dB limit if work is prioritised in the Daytime of weekdays and

Saturdays morning. Construction noise at NSR 6 - Fanellan Farm House may be able to meet the 65 dB limit if the distance to the crushing can be extended sufficiently but this would need to be explored by the Principal Contractor as to feasibility within the context of the space constraints on site and any relevant Health and Safety restrictions e.g. proximity to the OHL.

14.17.3 The potential piling works due to foundation construction for the BD OHL diversion works is the major contributor to noise limit breaches at nearby NSRs (NSR 1 and NSR 5). This work should also be prioritised during the day. The two piling rigs are currently predicted to operate 100 % of the working hours and to produce a sound power level of 123 dB and a sound pressure level of 115 dB at 10 metres. If the total sound power level of the two rigs can be reduced to 115 dB then noise limits could be met at the nearby NSRs. This could potentially be achieved by reducing the number of rigs in use, minimise the time that any rig is operational for, and procuring a lower noise piling rig where possible, but the Principal Contractor would need to explore the feasibility of this.

14.17.4 The felling of trees is also expected to produce high noise levels at the nearby NSRs. NSRs 1, 23, 48 are within 100 m of the vegetation clearance areas and result in high noise levels. Although felling is likely to be short-term, the noisiest equipment such as the chainsaws must be managed for the duration of total operational time.

14.17.5 Noise due to stringing of the temporary and permanent BD OHL diversions is largely dominated by the tractors, which must be managed for duration of total operational time.

14.17.6 It is best practice that construction noise should be controlled by a CNMP, in accordance with the guidance and procedures outlined in BS 5228-1. The CNMP is expected to be embedded within the Construction Environmental Management Plan (CEMP). Procedures will include:

- minimising the noise as much as is reasonably practicable at source;
- attenuation of noise propagation;
- carrying out identified high noise level activities at a time when they are least likely to cause a nuisance to residents; and
- providing advance notice of unavoidable periods of high noise levels to residents

14.17.7 In order to maintain low impact on the noise environment, consideration will be given to attenuation of construction noise at source by means of the following:

- giving due consideration to the effect of noise, in selection of construction methods;
- avoidance of vehicles waiting or queuing, particularly on public highways or in residential areas with their engines running;
- scheduling of deliveries to arrive during set hours to be agreed with THC that are likely to be in line with Monday to Friday 08:00 – 19:00 and Saturday 08:00 – 13:00. Care should be taken to minimise noise while unloading delivery vehicles. Delivery vehicles should follow routes that minimise use of residential roads;
- ensure plant and equipment are regularly and properly maintained. All plant should be situated to sufficiently minimise noise impact at nearby properties;
- fit and maintain silencers to plant, machinery, and vehicles where appropriate and necessary;
- operate plant and equipment in modes of operation that minimise noise, and power down plant when not in use;
- use electrically powered plant rather than diesel or petrol driven, where this is practicable;
- work typically not to take place outside of requested working hours (as set out in this EIA Report); and

- where feasible, procurement of low noise piling rigs, ideally at or below 115 dB sound power level.

14.17.8 Consideration will be given to the attenuation of construction noise in the transmission path by means of the following:

- locate plant and equipment liable to create noise as far from noise sensitive receptors as is reasonably practicable or use natural land topography to reduce line of sight noise transmission;
- noise screens, hoardings and barriers should be erected where appropriate and necessary to shield high-noise level activities; and
- provide lined acoustic enclosures for equipment such as static generators and when applicable portable generators, compressors and pumps.

## 14.18 Construction Vibration

*Stati and Quasi-Static*

14.18.1 A desk-based construction noise assessment has been prepared for the purpose of assessing the effects of the construction vibration works on any nearby residents. This appraisal has been produced in line with British Standard 5228:2009 +A1:2014: Code of Practice for Noise and Vibration Control on Construction and Open Sites (BS 5228).

14.18.2 BS 5228-2 provides recommended limits for vibration from construction sites. The construction vibration impact assessment (CVIA) has been carried out against the guidance on effects of vibration levels specified in **Table B.1** of BS 5228-2. The level of vibration ranging from 0.14 mm.s-1 to 10 mm.s-1 indicates where vibration may be perceptible however acceptable, or intolerable.

14.18.3 Construction activities that induce vibration are likely to be limited to potential piling activities where required at the foundations of tower platforms. As a worst-case assessment, all towers are assumed to require foundations works. The formulae for the prediction of groundborne vibration due to piling is taken from **Table E.1** in BS 5228-2.

14.18.4 Potential effects of heavy goods vehicle (HGV) vibration on receptors along haul roads will be predicted using the procedures in Transport and Road Research Laboratory (TRL) Research Report 246 – Traffic Induced Vibrations in Buildings.

14.18.5 There is the potential for construction vibration impacts from blasting activity. The highest levels of vibration on these sites are generally only associated with blasting activities, although at closer range vibrations can be experienced from material processing, transport and the operation of large earthmoving machinery. Measures to control vibration are generally necessary where sites are located in the vicinity of sensitive premises, for the benefit of both the public and the industry.

14.18.6 General formulae have been developed empirically in BS 5228 and can be used to predict vibration levels, but more site-specific testing should be done at time of construction.

## 14.19 Limitations and Assumptions

14.19.1 This assessment considers conservative assumptions with the aim to produce a worst-case assessment. This ensures that in practicality, noise levels would be expected to be lower than the assessment details, and uncertainty is reduced to as minimal as possible.

14.19.2 Whilst some information gaps have been identified, 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 on vibration.

## 14.20 Results

14.20.1 Construction activities resulting in vibration are largely unknown at time of writing, therefore, the worst-case parameters will be assumed for vibration. The vibration activities taking place at the Proposed Development and proposed Beauly Denny OHL diversion have been assessed for impact on the closest receptor. If the assessment passes at the closest receptor, it will pass at all others. The parameters that affect resultant vibration, $v_{res}$, are shown in **Table 14-19**. Airborne vibration is predicted to be negligible compared to groundborne vibration.

**Table 14-19: Groundborne Vibration Parameters from Mechanised Construction Works**

| Vibration Parameter | Range |
|---|---|
| Maximum amplitude of drum vibration, in millimetres (mm), | Between 0.4 and 1.72 mm |
| Pile toe depth, in metres (m), | Between 1 and 27 m |
| Vibrating roller drum width, in metres (m) | Between 0.75 and 2.2 m |
| Number of vibrating drums | 1 or 2 |
| Slope distance from the pile toe or tunnel crown, in metres (m) | Depends on distance between source and receiver and pile toe depth |
| Nominal hammer energy, in joules (J) | Between 1.5 and 85 kJ |
| Potential energy of a raised tamper, in joules (J) | Between 1 and 12 MJ |
| Distance measured along the ground surface, in metres (m) | 409 m for closest NSR for Proposed Development (Fanellan Farm House)<br>134 m for closest NSR to BD OHL (Fanellan Croft House) |

14.20.2 **Table 14-20** shows the worst-case results of the groundborne vibration. Vibratory compaction, percussive and vibratory piling, and dynamic compaction have been calculated in the case these activities will take place.

**Table 14-20: Groundborne Vibration Results at Nearest NSRs**

| Vibration Operation | Proposed Development | | BD | | BB | |
|---|---|---|---|---|---|---|
| | Resultant PPV ($mms^{-1}$) | Magnitude of Impact | Resultant PPV ($mms^{-1}$) | Magnitude of Impact | Resultant PPV ($mms^{-1}$) | Magnitude of Impact |
| Vibratory Compaction (Steady State) | 0.03 | Negligible | 0.15 | Low | 0.1 | Low |
| Vibratory Compaction (Start Up and Run Down) | 0.10 | Negligible | 0.41 | Low | 0.27 | Low |
| Percussive Piling | 0.02 | Negligible | 0.08 | Negligible | 0.05 | Negligible |
| Vibratory Piling | 0.01 | Negligible | 0.06 | Negligible | 0.04 | Negligible |
| Dynamic Compaction | 1.4 | Medium | 9.32 | Medium | 5.44 | Medium |

14.20.3 All impacts for potential vibration works, except dynamic compaction (**Medium),** have been assessed as **Negligible**. Otherwise, in the worst case, all operations are imperceptible, therefore, the effect for construction vibration is **Not Significant**.

*Traffic*

14.20.4 Vibration due to traffic on access routes has been assessed. Groundborne vibration arises primarily from the interaction of vehicle tires with irregularities in the road surface, such as potholes, cracks, or bumps. In this case, the road defect is assumed to be a 5 mm depression, which could amplify groundborne vibrations. However, it is important to consider the condition of the road surface, ground conditions and vehicle characteristics when evaluating the magnitude of impact.

14.20.5 In this case, with a HGV traveling at an assumed maximum 64 km/h over a 5 mm road defect, at a distance of 10 metres from an NSR, it is expected that the resultant PPV at NSR 1 is 0.4 $mm.s^{-1}$ would fall within the **Low** impact range. This would likely result in a **Minor/Moderate** effect**.** Vibration might be just perceptible in residential environments, however would not form any structural damage to the property. The assessment has assumed worst-case information, requiring a road defect to be directly outside of the property, therefore this effect is determined as **Minor** and therefore **Not Significant**.

*Blasting*

14.20.6 If blasting is to occur, then groundborne vibration as a result of the operations shall not exceed a peak particle velocity of 10 mm/sec and usually not below 6 mm/sec in 95 % of all blasts measured over any period of 6 months and no individual blast shall exceed a peak particle velocity of 12 mm/sec as measured at vibration sensitive buildings. The result will be the maximum of three measurements taken in a perpendicular direction to the ground surface.

## 14.21 Mitigation during Construction Vibration

14.21.1 If dynamic compaction is to occur the raised tamper energy must be reduced. The mitigation required to lower the impact to Low for this activity is shown in **Table 14-21**.

**Table 14-21: Groundborne Vibration Results from Dynamic Compaction at Nearest NSRs**

| Development | Maximum Energy of Raised Tamper for Low Impact (MJ) | Maximum Energy of Raised Tamper for Negligible Impact (kJ) |
|---|---|---|
| Proposed Development | 8.1 | 538.8 |
| BD | 0.9 | 57.8 |
| BB | 1.6 | 109 |

14.21.2 If blasting is to occur, good public relations have been shown to reassure the public of the fact that normal production blasting has not been found to damage property, and that even the most cosmetic of plaster cracking is extremely unlikely. In addition, contacting owners of sensitive properties to advise of imminent blasting can further help promote harmony with the public. It is good practice to publicise times when blasting will occur and to avoid blasting at other times whenever possible.

14.21.3 Practical measures, including good blast design, that have been found to reduce vibration are:

- taking particular care with the development of faces and with trial blasts as anomalous vibration levels might be produced when there is no free face to relieve the energy produced;
- ensuring appropriate burden to avoid over or under confinement of the charge;
- accurate setting out and drilling;
- appropriate charging
- appropriate stemming with appropriate material such as sized gravel or stone chippings;
- using delay detonation to ensure smaller maximum instantaneous charges (MICs);
- using decked charges and in-hole delays
- blast monitoring to enable adjustment of subsequent charges;
- designing each blast to maximise its efficiency and reduce the transmission of vibration;
- avoiding the use of exposed detonating cord on the surface in order to minimise air overpressure – if detonating cord is to be used in those cases where down-the-hole initiation techniques are not possible, it should be covered with a reasonable thickness of selected overburden.

## 14.22 Operational Noise – Proposed Development

14.22.1 A preliminary model of the site and surrounding area has been constructed in SoundPLAN 9, allowing for screening analysis of the impact of the site for NSRs and correlation with measured levels. All modelling assumptions are conservative and expected to result in slightly higher levels than those that would be measured once built.

## 14.23 Modelling Methodology

14.23.1 Elevation data at 50 m resolution have been used to create a digital ground model. Detailed plans for the site layout have been provided by the Client and used to model the Proposed Development. Satellite imagery and Ordnance Survey maps have been used to aid the construction of the surrounding area. Resolution of the digital ground model for the landscape forms surrounding the site is highly detailed, with elevation data provided by SSEN Transmission. Detailed plans for the Proposed Development layout have been provided by SSEN Transmission and used to construct a digital noise propagation model of the site

14.23.2 All modelling events are for worst-case scenarios, and therefore modelling results are considered conservative worst-case results. These conservative estimates come inherently with the model parameters and environmental conditions assumed, the use of non-acoustically optimised input data where specifics are not available at this stage of the project, and the use of maximum utilisation load levels for specific items such as cooling system (where in-situ these items would operate at higher loading levels and during higher ambient temperatures).

14.23.3 The landscape forms to the southeast of the site are modelled to be situated across and through the existing location of Upper Fanellan cottages. Therefore, this property is not considered in the assessment.

14.23.4 Propagation was modelled using ISO 9613-2[5], with the following parameters:

- ground absorption: 0.0 on paved surfaces, 0.6 elsewhere.
- receiver height: 1.5 m above ground / floor.
- temperature: 10 °C.
- relative humidity: 70 %.

## 14.24 Assumed Equipment Sound Power Levels

14.24.1 Data for the Proposed Development proposed equipment expected to produce operational noise have been based on design information and data from Hitachi. All noise from the units has been assumed to operate at a similar spectrum to equipment of the same type, according to Hitachi. The equipment information supplied by Hitachi is non-acoustically optimised, therefore, relatively conservative at this stage of the assessment. A slight deviation has been applied to noise from the valve coolers in the converter station to reflect the utilisation of similar coolers at the proposed Banniskirk (Spittal) HVDC Converter Station – which are also expected to operate under conditions of higher load and higher ambient temperature. Additionally, some air handling units, chillers, and climate systems have been housed internally rather than externally.

14.24.2 SSEN Transmission have advised that air handling units and chillers near the service buildings will be housed internally.

14.24.3 The sound power levels (SWLs) of noise-producing equipment are presented in **Volume 4, Appendix 14.33 – Source Noise Levels.**

14.24.4 In the modelling phase, the buildings that enclose the noise sources have been assumed to be treated for good acoustic reduction. The specific material sound reduction data sheet has been provided giving an overall sound reduction index (Rw) of 36 dB(A). Louvres and chimneys are included on the building facades and roofs as noise breakout areas. The chimneys are also assumed to be acoustically treated, providing a Rw of 14 dB(A).

5 ISO 9613-2:1996 Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation, ISO, 15 December 1996.

## 14.25 Assumptions

14.25.1 This assessment considers conservative assumptions with the aim to produce a worst-case assessment. This ensures that in practicality, noise levels would be expected to be lower than the assessment details, and uncertainty is reduced to as minimal as possible.

14.25.2 Modelled sound sources represent candidate plant only. The noise output of individual items of plant may vary from what is presented in this chapter after final plant specification. By way of illustration of this conservative approach to assessment, the assessment assumes all sound sources are operating continuously, simultaneously and at maximum noise output. In reality, not all sources will be operating at maximum noise level all of the time and operational noise levels may be lower than are presented in this chapter.

14.25.3 The sound level output of any auxiliary infrastructure such as insulators, bus bars, circuit breakers are considered insignificant in comparison to the primary sound sources detailed in this chapter. Accordingly, no other items of plant have been considered within the assessment.

14.25.4 Unless otherwise stated, all sound levels refer to free field levels i.e. sound levels without influence from any nearby reflective surfaces.

14.25.5 In accordance with ISO 9613, all assessment locations are modelled as downwind of all sound sources. Propagation calculations are based on a moderate ground-based temperature inversion, such as commonly occurs at night.

14.25.6 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 on noise and vibration.

## 14.26 Modelling Results – Proposed Site

14.26.1 The predicted noise levels received at the NSRs are detailed in **Table 14-22** for the sites' impact. Two scenarios have been modelled:

- Scenario 1 – Daytime with cooling
- Scenario 2 – Nighttime without cooling

14.26.2 Grid noise maps of the proposed site are provided in **Volume 4, Appendix 14.34 and 14.35.**

**Table 14-22: Proposed Site Modelled Noise Levels at NSRs**

| Receptors | Modelled Specific Noise (Scenario 1) (dB) | Modelled Specific Noise (Scenario 2) (dB) |
|---|---|---|
| NSR 1 – Fanellan Croft | 16.1 | 15.4 |
| NSR 2 – Allordale | 25 | 23.1 |
| NSR 3 – Forest Lodge | 22.9 | 21.2 |
| NSR 4 – Teanassie | 7.5 | 6.6 |
| NSR 5 – 3 Fanellan | 21.8 | 20 |
| NSR 6 – Fanellan Farm House | 22.8 | 22.5 |
| NSR 7 – Lower Fanellan | 20 | 19.7 |
| NSR 8 – Dun Fionn | -1.4 | -2 |

14.26.3 The highest contributing source equipment from the Proposed Development at nearby receptors are the external valve cooler banks, transformer coolers and the air handling units. The valve coolers are the highest noise-producing instruments on site, however, the height of the converter station relative to the valve coolers ensures noise is somewhat screened from Lower Fanellan and Fanellan Croft. Any lack of screening between the outdoor converter stations sources and NSRs have the potential for impact.

14.26.4 Equipment housed indoors has been sufficiently attenuated by the buildings. This is achieved by mitigation assumed in the design, by adding landscape forms, internalising the air handling units and noise sources such as transformers and reactors, specifying acoustically treated chimneys and louvres on the buildings with noise-producing equipment is necessary to ensure minimal noise impact.

14.26.5 The topography of the land and proximity of Ruttle Woods help reduce noise impact to receptors to the West (Dun Fionn and Teanassie).

14.26.6 BS 4142 requires that, when assessing the impact of noise with a tonal component, the noise emitted from the specific sound source is subject to a rating level penalty. Tonal penalties have been determined using the objective 1/3 octave band method. A maximum 6 dB penalty is applicable if the level differences above both of the adjacent 1/3 octaves bands of the tonal element are:

- 15 dB in the low-frequency 1/3 octave bands (25 Hz to 125 Hz) or
- 8 dB in the middle frequency 1/3 octave bands (160 Hz to 400 Hz)

14.26.7 A 4 dB tonal penalty will be applied if the above criteria are not met, but due to the operation of electrical equipment tones may still be audible. This is deemed a worst-case assumption using the subjective method in BS 4142.

## 14.27 BS 4142 Assessment Results

14.27.1 The levels measured at NSRs during the baseline noise survey have been used to inform a BS 4142: 2014 (BS 4142) assessment.

14.27.2 BS 4142 states that the greater the excess at receptors, the greater the impact of the specific sound.

- an excess of around 10 dB or more is an indication of significant adverse impact.
- an excess of around 5 dB is an indication of adverse impact.
- the lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.

14.27.3 The Highland Council's Environmental Health team have recommended their allowable noise excess due to the Proposed Development to be 0 dB above background noise level as well as specifying the $L_{zeq,5min}$ of 100 to be limited to 30 dB at the external amenity of NSRs.

14.27.4 The assessments conducted are based on modelled results of the Proposed Development operating under standard yet conservative conditions. The conservative worst-case assumptions are that all cooling systems are active and at 100 % load during the day. Coolers generally operate only when there is high load and high ambient air temperatures, neither of which would typically occur during nighttime hours of 11 pm and 7 am, and therefore the conservative scenario of coolers active should only be assessed to daytime conditions.

14.27.5 BS 4142 requires that, when assessing the impact of noise with a tonal component, the noise emitted from the specific sound source is subject to a rating level penalty. The received 1/3 octave spectra at NSRs are presented in **Volume 4, Appendix 14.36 - Modelled Received 13 Octave Band Spectra**.

14.27.6 The received 1/3 octave spectra at NSRs indicate that there is a tonal component according to Annex C of BS 4142, however this tone (at 630 Hz) is at a relatively low level of 20 dB which is just audible in a very low noise environment. The 630 Hz tone at NSR 6 and 7 is contributed by the AC Capacitors in the HVDC Converter Station. When coolers associated with the HVDC Converter Station are on, they are the dominant noise source, which is mostly broadband in nature. There are items of equipment that have major tonal components but are housed indoors and have minimal contribution to the overall received level at NSRs. Based on this analysis the full tonal penalty of 6 dB has not been applied, however, a 4 dB penalty has been applied for all receptors representing a 'clearly perceptible tone' as a conservative assessment approach due to the potential tonal nature of electrical infrastructure sites. This potential tonal penalty is based on the subjective method described in Section 9.2 of BS 4142. The nature of the dominant noise predicted to emanate from the Proposed Development is less tonal in nature compared to nearby electrical infrastructure developments such as Beauly Substation. The auxiliary equipment and cooling systems provide the majority of broadband noise rather than the typical tonal buzzing and humming noise associated with transformers. A penalty has still been applied for conservatism but is not as strict as the maximum tonal penalty of 6 dB.

14.27.7 The excess noise above background at the NSRs will determine the significance of impact of the Proposed Development. The results of the BS 4142 assessment are shown in **Table 14-23** and **Table 14-24**.

**Table 14-23: Predicted Excess Above Dry Background at NSRs from Fanellan Proposed Development**

| Receptors | Daytime (Coolers on) Modelled Specific Noise (dB(A)) | Rating Level (including +4 dB tonal penalty) | Daytime Preliminary Background Noise Level, La90(dB) | Daytime Excess above Background Noise |
|---|---|---|---|---|
| NSR 1 – Fanellan Croft | 16.1 | 20 | 27 | -7 |
| NSR 2 – Allordale | 25 | 29 | 27 | 2 |
| NSR 3 – Forest Lodge | 22.9 | 27 | 26 | 1 |
| NSR 4 – Teanassie | 7.5 | 12 | 34 | -22 |
| NSR 5 – 3 Fanellan | 21.8 | 26 | 30 | -4 |
| NSR 6 – Fanellan Farm House | 22.8 | 27 | 26 | 1 |
| NSR 7 – Lower Fanellan | 20 | 24 | 27 | -3 |
| NSR 8 – Dun Fionn | -1.4 | 3 | 34 | -31 |

**Table 14-24: Predicted Excess Above Dry Background at NSRs from Fanellan Proposed Development**

| Receptors | Modelled Specific Noise (Scenario 2) (dB(A)) | Rating Level (including +4 dB tonal penalty) | Night time Preliminary Background Noise Level, La90(dB) | Nighttime Excess above Background Noise |
|---|---|---|---|---|
| NSR 1 – Fanellan Croft | 15.4 | 19 | 24 | -5 |
| NSR 2 – Allordale | 23.1 | 27 | 23 | 4 |
| NSR 3 – Forest Lodge | 21.2 | 25 | 25 | 0 |
| NSR 4 – Teanassie | 6.6 | 11 | 32 | -21 |
| NSR 5 – 3 Fanellan | 20 | 24 | 25 | -1 |
| NSR 6 – Fanellan Farm House | 22.5 | 27 | 23 | 4 |
| NSR 7 – Lower Fanellan | 19.7 | 24 | 24 | 0 |
| NSR 8 – Dun Fionn | -2 | 2 | 32 | -30 |

14.27.8 The preliminary BS 4142 assessment has shown to predict excess at three NSRs during the day and two at night. On completion of the Proposed Development, built as the layouts suggest with the landscape forms constructed across the location of Upper Fanellan Cottages, the new site is predicted to have a maximum daytime excess of 2 dB at NSR 3 - Allordale and a maximum night time excess of 4 dB at both NSR 3 – Allordale and NSR 6 - Fanellan Farm House during the night. This includes a 4 dB tonal penalty that is conservative, considering the majority of noise is emanating from the valve cooling banks, which is not as tonal as the typical transformer emission spectra and does not operate at full capacity all the time. (Note using no tonal penalty would result in no predicted excess at any of the NSRs). Including the 4 dB tonal penalty and reviewing the associated excesses noted above suggests a likelihood of **low impact** magnitude. Therefore, with a **high** receptor sensitivity, the potential risk for adverse noise effect is predicted as **Minor/Moderate**.

14.27.9 The preliminary BS 4142 assessment does not meet noise criteria proposed by The Highland Council being that excess must be below 0 dB. The operational noise is predicted to fall below the proposed limit of 30 dB in the 100 Hz third-octave band.

14.27.10 Measured background noise levels in the area at nighttime are low, and the specific noise level from the Proposed Development is predicted to be around background noise at multiple receptors, therefore it is necessary to consider the context of the noise, the absolute increase in noise, and how the impact affects the internal levels of the NSRs.

## 14.28 Further Context

14.28.1 To provide further context on the noise levels predicted and how they compare to background noise levels as well as existing nearby electrical infrastructure, this section aims to discuss details on the tonal penalties, noise characteristics and the wider noise impact and how that can be perceived in the study area.

14.28.2 The BS 4142 assessment has shown the maximum excess to be 4 dB at Fanellan Farm House and Allordale, meaning the modelled noise is expected to be equal to existing background noise level and the 4 dB tonal penalty contributes to all of the excess.

14.28.3 A tonal penalty of 4 dB has been applied as a conservative measure. The modelled spectra show the presence of a tone at 630 Hz, mostly due to the AC capacitors, which are modelled at a relatively high sound power level (85 dB(A)), which is expected to be reduced in the procurement phase.

14.28.4 Transformers and other electrical equipment associated with substation developments emit noise at frequencies of twice the normal operating current frequency due to magnetostriction of the transformer core. In the UK the supply current frequency is 50 Hz, which results in 100 Hz and harmonics thereof being produced by the transformer. The nature of the noise generation mechanism results in tonal noise being emitted.

14.28.5 The equipment associated with these 100 Hz and harmonic tones, which is subject to higher annoyance and often complaint, are the transformers and reactors. In the Proposed Development these are to be housed indoors, thus significantly reducing the tonal impact on NSRs.

14.28.6 The dominant noise sources modelled in the Proposed Development are associated with cooling which is broadband in character. The type of highly tonal noise usually associated with annoyance and subject to complaints from substation sites is not present in the Proposed Development, and therefore the effect of disturbance can be lessened. This factor, in addition to the housing of transformers and reactors within buildings, suggests that the maximum tonal penalty need not apply. The AC capacitors do provide tonal components, however the noise at which the tones are predicted at NSRs is generally low, and therefore not comparable to a highly tonal effect.

14.28.7 BS 4142 states for low noise conditions (which this proposed development applies):

- "For a given difference between the rating level and the background sound level, the magnitude of the overall impact might be greater for an acoustic environment where the residual sound level is high than for an acoustic environment where the residual sound level is low. Where background sound levels and rating levels are low, absolute levels might be as, or more relevant than the margin by which the rating level exceeds the background. This is especially true at night."

14.28.8 Absolute levels are the sum of the background noise level and the modelled specific noise level. Absolute levels do not contain any tonal penalties. 'Absolute' is used to convey the entire total noise if the development were to operate as modelled in the current acoustic environment. This is useful for understanding the total increase in noise compared to the existing acoustic environment.

14.28.9 Assessing the noise impact by the absolute levels is an appropriate method due to the low noise levels in the Study Area. The modelled specific noise levels for each scenario are below the measured background noise levels in all but one case (0.1 dB NSR 2 at night, which is a negligible difference). The total absolute noise of the modelled Proposed Development and the existing background is predicted to increase by no more than 3 dB. It is stated that a change of around 3 dB(A) is the minimum perceptible under normal conditions. The 3 dB level is not a strict technical requirement as it is subjective and depends greatly on the conditions, it serves as a guideline in industry and practice.

14.28.10 **Table 14-25** and **Table 14-26** show the absolute levels and increases for each scenario and NSR.

**Table 14-25: Daytime Predicted Absolute Levels**

| NSR | Name | Daytime BGN (dB(A)) | Specific Modelled Noise Level (dB(A)) | Rating | Excess (dB) | Absolute Level (dB) | Absolute Increase (Rounded to the Nearest Whole Number) |
|---|---|---|---|---|---|---|---|
| 1 | Fanellan Croft | 27 | 16.1 | 20 | -7 | 27.3 | 0 |
| 2 | Allordale | 27 | 25 | 29 | 2 | 28.5 | 2 |
| 3 | Forest Lodge | 26 | 22.9 | 27 | 1 | 27.2 | 1 |
| 4 | Teanassie | 34 | 7.5 | 12 | -22 | 34.0 | 0 |
| 5 | 3 Fanellan | 30 | 21.8 | 26 | -4 | 30.4 | 0 |
| 6 | Fanellan Farm House | 26 | 22.8 | 27 | 1 | 27.6 | 2 |
| 7 | Lower Fanellan | 27 | 20 | 24 | -3 | 27.7 | 1 |

| NSR | Name | Daytime BGN (dB(A)) | Specific Modelled Noise Level (dB(A)) | Rating | Excess (dB) | Absolute Level (dB) | Absolute Increase (Rounded to the Nearest Whole Number) |
|---|---|---|---|---|---|---|---|
| 8 | Dun Fion | 34 | -1.4 | 3 | -31 | 34.0 | 0 |

**Table 14-26: Night time Predicted Absolute Levels**

| NSR | Name | Daytime BGN (dB(A)) | Specific Modelled Noise Level (dB(A)) | Rating | Excess (dB) | Absolute Level (dB) | Absolute Increase (Rounded to the Nearest Whole Number) |
|---|---|---|---|---|---|---|---|
| 1 | Fanellan Croft | 24 | 15.4 | 19 | -5 | 24.6 | 0 |
| 2 | Allordale | 23 | 23.1 | 27 | 4 | 26.1 | 3 |
| 3 | Forest Lodge | 25 | 21.2 | 25 | 0 | 26.5 | 2 |
| 4 | Teanassie | 32 | 6.6 | 11 | -21 | 32.0 | 0 |
| 5 | 3 Fanellan | 25 | 20 | 24 | -1 | 26.2 | 1 |
| 6 | Fanellan Farm House | 23 | 22.5 | 27 | 4 | 25.8 | 3 |
| 7 | Lower Fanellan | 24 | 19.7 | 24 | 0 | 25.4 | 1 |
| 8 | Dun Fion | 32 | -2 | 2 | -30 | 32.0 | 0 |

14.28.11 The results show the following:

- Daytime – with coolers active (worst case) the excess is maximum 2 dB (including a conservative 4 dB penalty) and the absolute increase in noise level is below 3 dB.
- Nighttime - with coolers not active max excess of 4 dB (including a conservative 4 dB penalty) and the absolute increase in noise level is around 3 dB.

14.28.12 The maximum predicted increase in absolute level is around 3 dB, which as stated, is widely accepted in practice as the threshold of the minimum perceptible change in noise level, which considers conservative

assumptions in our model. This increase in noise is related to the background $L_{A90}$ level, in $L_{Aeq}$ terms this increase would be smaller. For this assessment, modelled levels are low and are only showing excess in a BS 4142 assessment due to tonal penalty, which is deemed conservative. During night-time conditions, residents are more likely to be indoors and noise limits should therefore be concerned with indoor noise and potential sleep disturbance rather than external amenity. The Proposed Development has been assessed to worst-case conditions (nighttime and low background noise level) and BS 4142 has initially detected some potential impacts. The context has been considered and when presenting the absolute levels this shows that the change is only just perceptible at night externally, and when further considering the indoor assessment that has been done (see **Section 14.29**), the noise levels can be shown to be low enough so as not to disturb sleep.

14.28.13 To further the context of what a 5 dB excess is, the following text is taken from the Scottish Government in the TAN:

- "3.20 In deciding if a significant impact occurs in regard to the assessment of industrial noise, or noise of an industrial nature, using the methodology of BS 4142 (where appropriate); the Scottish Government consider impacts are normally not significant (in a quantitative sense only) when the difference between the Rating and background noise levels is less than 5 dB(A), and that usually the threshold of minor significant impacts is when the difference between the Rating and background noise levels is at least 5 dB(A); and commonly do not become sufficiently significant to warrant mitigation until the difference between the Rating and background noise levels is more than 10 dB(A)."

14.28.14 Typically, the threshold of minor significant impacts is 5 dB or more. Below this threshold indicates less than minor effects.

14.28.15 The assessment of absolute levels has shown the maximum increase in noise is borderline perceptible. In line with the TAN excerpt above, the maximum excess is below the threshold of minor significance.

14.28.16 The 4 dB excesses at the external amenities of Allordale and Fanellan Farm House that were evaluated in the BS 4142 assessment are entirely contributed by the tonal penalty and do not imply a major increase in the absolute noise level.

14.28.17 Considering the context noted above, the impacts of the external amenity are assessed as **Minor** and **Not Significant**.

14.28.18 The internal noise assessment will provide further context on the extent of indoor noise impacts.

## 14.29 Internal Noise Assessment

14.29.1 According to **Table 4** of BS 8233, the indoor ambient noise levels in the night time should not exceed 30 dB $L_{Aeq,8hr}$. In addition, octave band levels should meet an NR20 rating.

14.29.2 The external noise levels and spectra have been considered at each receptor. An external to internal noise calculation has been performed on the basis of a partially open window. The small element parameter level difference (Dn,e) has been assumed from NANR116: Sound Insulation through Ventilated Domestic Windows. The level difference values are taken from a window opening of 200k $mm^2$ as shown in **Table 14-27**.

**Table 14-27: Level Difference Through a Partially Open Window NANR116**

| Opening Size | 63 Hz | 125 Hz | 250 Hz | 500 Hz | 1 kHz | 2 kHz | 4 kHz | Dn,e |
|---|---|---|---|---|---|---|---|---|
| 200k ($mm^2$) | 20 | 14 | 14 | 16 | 14 | 17 | 19 | 16 |

14.29.3 The results of the internal noise assessment for the existing site are presented in **Table 14-28**.

**Table 14-28: Predicted Internal Noise Levels**

| NSR | Level (dB(Z)) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 63 Hz | 125 Hz | 250 Hz | 500 Hz | 1 kHz | 2 kHz | 4 kHz | Total (dB(A)) |
| NSR 1 - Fanellan Croft | 10.7 | 7.9 | 2.9 | 0.5 | -6.2 | -15.5 | -32.5 | 1.0 |
| NSR 2 - Allordale | 12.4 | 12.3 | 10.7 | 9.3 | 5.1 | -4.0 | -28.3 | 9.9 |
| NSR 3 - Forest Lodge | 10.8 | 10.4 | 8.7 | 7.3 | 3.1 | -7.5 | -36.8 | 7.9 |
| NSR 4 - Teanassie | 3.9 | 0.1 | -5.3 | -8.2 | -16.3 | -29.6 | -59.8 | -7.7 |
| NSR 5 - 3 Fanellan | 11.5 | 11.0 | 8.7 | 6.3 | 1.1 | -9.7 | -37.3 | 6.8 |
| NSR 6 - Fanellan Farm House | 11.1 | 11.2 | 7.4 | 8.1 | 0.5 | -10.3 | -28.2 | 7.3 |
| NSR 7- Lower Fanellan | 10.8 | 9.1 | 5.1 | 5.1 | -2.6 | -14.2 | -31.7 | 4.4 |
| NSR 8 - Dun Fionn | -3.8 | -7.1 | -14.0 | -17.5 | -27.6 | -44.6 | -76.1 | -16.7 |

14.29.4 The results show that for the Proposed Development, the internal noise level at all NSRs comfortably meet the 30 dB NR20 limit. The maximum internal noise level is predicted to be 9.9 dB at NSR 3 - Allordale. The octave spectra also meet the NR20 rating level. These results are shown graphically in **Volume 4, Appendix 14.37 - Internal Noise Assessment.**

## 14.30 Mitigation during Operation

14.30.1 According to the TAN guidance, a **Low** impact is predicted externally and a **Negligible** impact predicted internally. However, the predicted noise rating is above background noise levels and, therefore, not in accordance with one of the criteria requested by The Highland Council in their Scoping Opinion. Therefore, where possible SSEN Transmission will work towards reducing operational noise impacts with appropriate engineering design or mitigation during the detailed design phase of the project. Further mitigation should be applied using the principle of 'as low as reasonably practicable' (ALARP).

14.30.2 A number of the highest noise producing items, such as the transformers and reactors, are housed indoors or in a total acoustic enclosure. This mitigates the potential noise issues these would cause, assuming the building materials and noise transmission areas offer sufficient acoustic attenuation. However, some input noise data provided at this stage of design has not been acoustically optimised, particularly the shunt reactors and external cooling equipment. The results indicate that the cause of any excess for the external BS 4142 assessment are the result of either the shunt reactors at the southwest part of the site near NSR 3 and 6 and the valve coolers operating at full load with their maximum defined SWL of 93.7 dB in an unmitigated state, also with contribution from some specific HVAC units and other cooling systems.

14.30.3 Housing the shunt reactors in acoustically optimised buildings will effectively reduce noise impact at NSRs 3, 4 6 but not to the point where levels fall below background noise.

14.30.4 Regarding the valve coolers, an acoustically optimised design will be progressed during the detailed design phase of the project. There are various engineering solutions and potential mitigation strategies that could be implemented to reduce noise levels from the valve cooler banks units. Options could include:

- specification of low noise units;
- use of an active fan system with variable speed drive;
- use of liquid to liquid cooling;
- housing the equipment indoors;
- a system with a larger number of fans operating at lower duty; and / or
- noise barriers to target propagation form specific noise sources.

14.30.5 With the options of mitigation available, and the project still going through detailed design phase, it is expected that SSEN Transmission can work towards reducing levels from the cooling systems.

14.30.6 In addition, it should be noted that the extent of the issue with the Valve Coolers is determined by the load and requirement for cooling. A prediction for assumed HVDC link loading profile has been provided by SSEN Transmission in **Volume 4, Appendix 14.38 - Assumed HVDC Loading Profile**. This shows that the Hub is unlikely to operate at its maximum load for a significant amount of time, and therefore it is unlikely that the Valve Cooling system will be required to run at its maximum capacity. While operating at lower loadings, it is less likely that the cooling systems are required to operate at maximum levels. Therefore, the extent of noise excess from the value coolers is likely to be limited to out with normal operation.

## 14.31 Cumulative operational Noise

*Associated Development - Beauly Denny OHL Diversion*

14.31.1 The corona-induced audible noise of both the temporary and permanent Beauly Denny (BD) OHL diversion in rainfall has been calculated using the EPRI method as recommended in TGN(E)322. Information of the Twin Araucaria conductor type has been supplied for this calculation. The external rain-induced noise levels will be assessed using the TGN(E)322 methodology developed by National Grid, which is recommended by the Department of Energy & Climate Change for the assessment of rain induced noise.

14.31.2 During wet conditions, the noise output from OHLs varies according to the number and size of rain droplets accumulated on the surface of the conductors. Therefore, there is a strong relationship between the rainfall rate and the noise output from an OHL. Background noise levels also increase with rainfall rate, such that during very heavy rain noise is generally inaudible. For these reasons, an alternative noise assessment method to deal with rain-induced noise is required.

14.31.3 In the TGN(E)322 method, the tiered system screens out receptors where wet noise is predicted to fall below 34 dB in Tier 1 and if necessary, assesses the combined wet and dry noise in Tier 2. If the combined wet and dry noise is predicted to be above 36.8 dB, Tier 3 is required. In Tier 3, the total noise is assessed at a worst-case rain rate of 1 mm/hr to provide the excess above the wet background noise.

14.31.4 In a Tier 3 assessment, the excess wet figure is compared against BGN level calculated through the addition of dry BGN levels and predicted noise due to rainfall according to the Miller curve value for that specific NSR. Miller curve descriptions are provided in **Table 14-29**. To conduct a conservative assessment, all NSRs have been assigned the R-1 Miller Curve, which will provide the lowest background noise level in wet conditions.

**Table 14-29: Miller Curve Description**

| Miller Curve | Description |
|---|---|
| R-1 | Essentially bare, porous ground (that is ploughed field or snow-covered ground), no standing puddles or water. Relatively small-leafed ground cover vegetation, such as grass lawn, meadow, hayfield shortly after mowing, field of small-leaf plants. |
| R-2 | Non-porous, hard, bare ground or pavement, falling raindrops splash on thin layers of puddles of collected water; or in or beside wooded area of deciduous trees without leaves or with only small leaves; or in or beside wooded area of coniferous trees or evergreens having needles rather than leaves; or thin-leafed ground cover of crop, such as hay, clover, or grain. |
| R-3 | A few small, fully leafed deciduous trees 15 to 30 m or a few large, fully leafed trees 30 to 90 m distance. |
| R-4 | Large area of fully leafed trees or large-leafed crops or vegetation, such as corn starting 15 to 30 m distance. |
| R-5 | Large area of fully leafed trees or large-leafed crops or vegetation surrounding the area of interest. |

14.31.5 The permanent Beauly-Denny OHL diversion and the whole OHL will be operating at 400 kV on both circuits. The temporary diversion is assumed to be operating at 400 kV on both circuits as a worst-case assessment. Both diversion instances have been assessed according to the TGN(E)322 procedure.

14.31.6 All receptors in the OHL assessment are of **High** sensitivity. As shown in **Volume 4**, **Appendix 14.39 - Operational Noise Impact Assessment of BD OHL - Tier 1** for the Tier 1 assessment, the wet noise at each location is predicted to be between 15 and 39 dB. Also detailed is the distance from the NSRs to the nearest point on the relevant line. The temporary diversion contributes a higher noise level than the permanent diversion due to the proximity to nearest NSRs.

14.31.7 Audible noise from the wet Beauly-Denny temporary and permanently diverted overhead line falls below 34 dB for 5 of the 8 receptors. This results in **Negligible** magnitude of impact at these 5 NSRs and therefore **Not Significant**.

14.31.8 3 NSRs (Fanellan Croft, Forest Lodge, 3 Fanellan) are required to proceed to a Tier 2 assessment. This stage assesses the proportion of time the area is raining or is dry and calculates a ‘combined’ wet and dry noise. Dry noise is assumed to be 25 dB less than wet noise. **Table 2** and Appendix C of TGN(E)322 provide criteria on various rainfall. After evaluating historical rain data from June 2014 to December 2024 at the nearest weather station the Met Office has data for (Lentran Weather Station), the average annual wet hours rain is approximately 1278 hours, or rain is expected to fall 14.6 % of the annual hours. If combined noise is predicted to be above 36.8 dBA, NSRs will proceed to a Tier 3 assessment. The results of this assessment, assuming the worst-case levels of the permanent diversion, are shown in **Volume 4, Appendix 14.40 - Operational Noise Impact Assessment of BD OHL Temporary Diversion - Tier 2**. A summary is provided in **Table 14-30**.

**Table 14-30: Summary of BD OHL Operational Noise Results**

| Tier | Outcome |
|---|---|
| 1 | Wet noise is predicted to be above 34 dBA at NSRs 1, 3, 5, therefore proceed to Tier 2.<br>Wet noise is predicted to fall below 34 dBA at NSRs 2, 4, 6, 7, 8 |
| 2 | Combined wet and dry noise at NSRs 1, 3, 5 is predicted to fall below 36.8 dBA, therefore passing a Tier 2 assessment. |

14.31.9 The Tier 2 assessment for the remaining 3 NSRs indicates no excess above 36.8 dB for combined noise, therefore no NSRs proceed to Tier 3. The results of the assessment predict **Minor** impact, and **Not Significant**

## 14.32 Cumulative Noise from Wester Balblair Substation

14.32.1 Existing noise from Wester Balblair Substation will have no impact within the study area due to the distance between the source and surrounding NSRs associated with the Proposed Development. The Proposed Development will not exacerbate any current noise issues for noise sensitive receptors associated with Wester Balblair Substation for the same reason. Therefore, cumulative noise from Wester Balblair is scoped out of the assessment.

## 14.33 Cumulative OHL Assessment

14.33.1 Cumulative noise from three OHLs proposed to connect to the Proposed Development (400 kV Beauly-Denny OHL diversion and tie-ins [Associated Development], proposed 400 kV Beauly-Peterhead, and proposed 400 kV Spittal-Beauly) are considered in this study.

14.33.2 **Table 10.7** and **Table 10.8** of **Volume 4, Appendix 14.41 - Cumulative Noise Impact Assessment** show the noise contribution from each OHL span, summed with the predicted noise from the HVDC converter station. The proposed Beauly – Peterhead OHL and Spittal – Beauly OHL are both expected to use a triple Araucaria conductor array, which produces less noise compared to twin Araucaria. The temporary diversion of the BD OHL is predicted to produce a higher noise level at closest NSRs compared to the permanent diversion, therefore, the temporary case is assessed in the cumulative assessment. It should be noted that the total noise at NSR 1 and 3 is composed entirely of the wet noise of the BD OHL. At these locations, the other developments have a negligible contribution to total cumulative noise.

14.33.3 The predicted operational levels at NSRs due to the Fanellan Proposed Development and cumulative OHL noise can be compared with background noise levels in both wet and dry conditions in a BS 4142:2014 assessment for when the coolers are on in the day and when coolers are off at night (**Table 10.9** and **Table 10.10** of **Volume 4, Appendix 14.41 - Cumulative Noise Impact Assessment**).

14.33.4 A summary of the results in shown in **Table 14-31**.

**Table 14-31: Summary of Cumulative Operational Noise Results**

| Scenario | Outcome |
|---|---|
| Wet, with coolers on | Maximum noise level of 38.8 at NSR 1 and NSR 3. With a 6 dB tonal penalty applied for the nature of the wet noise from the OHLs, the maximum rating is 45 dB. (**Table 10.9**). |
| Wet, with coolers off | Wet background noise level is between 36.9 and 38.6 dB for all NSRs. (**Table 10.9** and **Table 10.10**).<br>The maximum excess is 8 dB at NSR 1 and NSR 3. (**Table 10.9** and **Table 10.10**). |

14.33.5 There are maximum excesses of 8 dB at the Fanellan Croft and Forest Lodge. This indicates **Medium** impact magnitude. However, the entire total noise is contributed by the wet noise of the BD OHL while the other developments have a negligible contribution. The noise impacts from the BD OHL were summarised in **Section 14.31.9** as being **Not Significant**. Therefore, cumulative noise is assessed as **Not Significant**. In wet conditions, the Proposed Development has little to no effect, even with coolers in operation.

## 14.34 Conclusions

14.34.1 Long-term measurements have been conducted at nearby noise sensitive receptors in relation to the Proposed Development to obtain background noise levels and define the acoustic environment of the project area.

14.34.2 The existing noise environment in the surrounding area is of a low level, with the nearby A950 road providing mild traffic noise.

14.34.3 The noise environment in the surrounding area is typically rural, with daytime noise consisting of road traffic noise from the A950. At night time there are no dominant noise sources and levels are relatively low.

14.34.4 The background noise levels at six measurement locations ranged from 23 to 32 dB $L_{A90}$ during nighttime and 26 to 34 dB $L_{A90}$ during daytime.

14.34.5 A desk-based construction noise assessment, in line with BS 5228, has been prepared for the purpose of assessing the effects of the works on any nearby residents. NSRs in the vicinity fall under Category A, and construction noise is predicted to be above the 55 dB Evening and Weekends limit during all stages of the Proposed Development work, and all stages of the BD OHL works, and therefore construction noise is assessed initially as **Major** significance. The implementation of a robust Construction Noise Management Plan (CNMP), prioritising particularly noisy work (such as crushing in earthworks) during daytime defined hours with a higher 65 dB limit, and careful consideration of the location of crushing activities will help construction noise of the Proposed Development to achieve a **Minor** (**Not Significant**) impact on nearby NSRs. OHL construction works such as felling and foundation work should also implement a detailed CNMP which considers the reduction of operational time for the noisiest equipment. If blasting is required, best practice is encouraged to minimise impact on residents. Careful management of the blasting process must take place through a Blasting Management Plan to minimise effects. Black Bridge site establishment works are not predicted to increase any noise at NSRs above the 65 dB limit. Implementing the above mitigation will lead to **Not Significant** residual effects.

14.34.6 Any updates to the construction schedule and plant will need to be revisited and assessed, to inform a more detailed management plan.

14.34.7 Operational noise has been assessed to BS 4142 and BS 8233 standards. The results of the external BS 4142 assessment predict **Minor** (**Not Significant**) effects with a maximum 2 dB excess above background at NSR 2 noise during daytime conditions. During nighttime the maximum excesses are predicted as 4 dB for NSRs 2 and 6. This assessment is conservative, while using inputs available for a non-acoustically optimised site, is assuming the cooling is fully active during the day (cooling is not likely to be fully active during the day in normal operating conditions) and has a 4 dB tonal penalty applied (which is conservative due to lower tones from capacitors and transformers are housed indoors). The maximum absolute level increase is 3 dB, which is widely accepted in industry as ‘just perceptible’.

14.34.8 Considering context, an internal noise assessment was conducted for the operational noise from the Proposed Development, according to BS 8233. The internal noise assessment indicates noise meets NR20 criteria, and therefore the effect is **Minor** (**Not Significant**).

14.34.9 Noise excess is limited to the operation of external cooling equipment. It has been identified that this issue will be limited to where the Proposed Development is operating at higher loadings and higher ambient temperatures and requirements for the cooling system are close to its maximum level. It has been shown that the maximum load in an exceptional circumstance and is not expected to occur for a significant amount of time.

14.34.10 During the detailed design phase, SSEN Transmission will work towards reducing noise levels using the principle of ALARP. Low-noise cooling fans are also recommended to be specified for any external HVAC units. AC equipment such as capacitors and filters are also recommended for a low noise specification.

14.34.11 An updated noise impact assessment should be conducted during detailed design, following further refinement of the assessment data and the implementation of mitigation.

14.34.12 No significant residual effects are predicted. In detailed design, any minor effects are likely to be reduced further.

14.34.13 Cumulative noise has been considered from the OHL works (proposed Beauly to Denny OHL diversion, proposed Beauly to Peterhead 400 kV OHL and proposed Spittal to Beauly 400 kV OHL). Effects are deemed to be **Not Significant** effect from cumulative SSEN Transmission Developments during the operational phase.

14.34.14 The assessment concludes that nearby NSRs have the potential for **Minor** effects from operational noise, which is **Not Significant**, however, it is expected that SSEN Transmission can work towards reducing operational noise impacts with appropriate engineering design or mitigation during detailed design.