11 Noise

11. Noise

11.1. Introduction

11.1.1. The aim of this noise assessment is to assess the potential noise impact of the Proposed Development at nearby noise sensitive receptors, all of which have been identified as residential properties.

11.1.2. This noise assessment has been prepared by TNEI Services Ltd (TNEI) and the main steps that have been followed are:

- Identify the nearest Noise Sensitive Receptors (NSRs), in the vicinity of the Proposed Development;
- Undertake consultation with The Highland Council to agree a methodology;
- Establish the baseline noise levels;
- Identify the dominant sound sources associated with the operation of the Proposed Development and predict the likely levels of operational noise at the NSRs;
- Assess the potential noise impact due to the Proposed Development; and
- Indicate any requirements for noise mitigation measures, if required.

Proposed Development Description

11.1.3. The Proposed Development is for a Battery Energy Storage System (BESS) with a capacity of up to 36 MW , located north of Loch Luichart. The Site lies within rural land on Lochluichart Estate and comprises of grasslands, semi-natural woodland, and areas of both planted and commercial forestry.

11.1.4. For operational noise considerations, a BESS principally consists of three main elements: batteries, inverters, and Medium Voltage (MV) transformers. Groups of batteries are connected into an inverter, which converts between Direct Current (DC) and Alternating Current (AC). The inverter is then connected to a Medium Voltage (MV) transformer.

11.1.5. The Proposed Development will therefore be made up of several battery, inverter and MV Transformer units. Sometimes the inverter and MV transformers can be combined into a single unit. Collectively the inverter and MV transformer is referred to as a Power Conversion System (PCS).

11.1.6. The MV transformers will ultimately be connected to the grid network, typically through one or two High Voltage (HV) transformers, although these are not always located within the BESS site itself, sometimes utilising existing HV transformers located within a nearby substation. For the Proposed Development, HV transformers are not within the Site.

11.1.7. The sound level output of any auxiliary infrastructure included as part of the Proposed Development, for example, switch gear or auxiliary transformers, will be insignificant in comparison to the primary sound sources detailed above. Accordingly, no other items of plant have been considered within this assessment.

11.1.8. An indicative layout for the Proposed Development as considered for noise is included as **Figure 11.2**.

Study Area

11.1.9. Noise Sensitive Receptors (NSRs) are properties that are sensitive to noise and, therefore, require protection from nearby noise sources. The study area for the assessment of environmental noise is usually defined through the identification of the closest NSRs to the development.

11.1.10. The assessment of noise attributable to the Proposed Development considers the nearest and most sensitive NSRs only, on the assumption that if sound levels at these receptors are within the defined limits, then sound levels at NSRs at greater distances should also be within acceptable levels.

11.1.11. The nearest identified NSRs that have a high level of sensitivity, are existing residential properties located approximately 750 m to the south-east from the closest noise sources. Other nearby receptors are located east and south-west of the Proposed Development, approximately 1000 m and 875 m away respectively from the closest noise sources. **Table 11.1** details the locations of the nearest identified residential NSRs, which can also be seen on **Figure 11.1.**

Table 11.1 Nearest Identified Residential NSRs

Area Descriptor	Comment
Glenview	Single receptor to the south-east of the site
Corriemoillie Farm	Single receptor to the east of the site
Property North of Loch Luichart Lodge	Single receptor to the south-west of the site
Loch Luichart Lodge	Single receptor to the south-west of the site

11.2. Applicable policy and guidelines

11.2.1. At a national level, the relevant policy is PAN 1/2011 (PAN) *'Planning and Noise'*[1] and the associated Technical Advice Note (TAN) – *'Assessment of Noise'*[2]. With regards to the assessment of environmental noise, Appendix 1 of the TAN describes a number of standards and guidelines that may be referred to and details BS 4142:2014 *'Methods for Rating and Assessing Industrial and Commercial Sound'* [3] as appropriate standards to refer to for the assessment of industrial noise.

BS 4142 Standard

11.2.2. The BS 4142 form of assessment is based on the predicted or measured levels of an assessed sound source compared to the measured background sound levels without the specific sound source present and uses, *"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".*

11.2.3. In reference to the existing baseline conditions i.e. before any Proposed Development, BS 4142 uses the following terms:

- **Residual Sound Level**: The sound level of all noise sources in an area, except the sound source to be assessed, over a given time interval, t. Described using the metric LAeq(t).
- **Background Sound Level**: This is also the sound level of all noise sources in an area except the sound source to be assessed, however, it is quantified by determining the sound level that is exceeded for 90% of the given time interval. Described using the metric LA90(t).

11.2.4. The next two noise metrics (below) represent noise attributable to the proposed development only.

- **Specific Sound Level**: The equivalent continuous A-weighted sound pressure level (SPL) produced by the specific sound source at the assessment location over a given reference

[1] The Scottish Government. *PAN 1/2011 Planning and Noise*. Scotland : The Crown, 2011
[2] The Scottish Government. *Technical Advice Note (TAN) 'Assessment of Noise'*. Scotland : The Crown, 2011
[3] British Standards Institute. *Methods for Rating and Assessing Industrial and Commercial Sound*. UK : BSI, 2014. BS4142:2014 + A1:2019

time interval, i.e. the sound level of just the sound source to be assessed. Described using the metric LAeq(t).

- **Rating Level**: The Specific Sound Level adjusted for the characteristics of the sound. The Rating Level is calculated by adding a character correction(s), if required, to the Specific Sound Level when the sound source contains audible characteristics at the receptor location, such as tonal, impulsive or intermittent components. Described using the metric, LAeq(t).

11.2.5. The final noise metric represents the future noise level during the operational phase of a proposed development and can be thought of as the 'Total Sound' i.e. the existing baseline + the proposed development.

- **Ambient Sound Level**: Totally encompassing sound in a given situation at a given time, usually composed of sound from many sources, both near and far i.e. the sound level of all noise sources in an area, including the sound source to be assessed. Described using the metric, LAeq(t).

11.2.6. The BS4142 assessment is a two-stage process. Initially, Stage 1 is an estimate of the impact made by subtracting the measured Background Sound Level from the calculated or measured Rating Level. Stage 2 of the assessment is to then consider the context in which the sound occurs, which may modify the findings of the initial estimate. There is no definitive pass/fail element to the standard. Rather, the assessment outcome is an indication as to the likelihood for adverse impact.

11.2.7. For the Stage 1 initial estimate, the standard states:

"Obtain an initial estimate of the impact of the specific sound by subtracting the measured background sound level from the rating level, and consider the following…

a) Typically, the greater this difference, the greater the magnitude of the impact.

b) A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.

c) A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.

d) 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."

11.2.8. For the purpose of this assessment, the following grading have been used for the initial estimate:

- Significant Adverse : >=11 dB above background
- Adverse : 6-10 dB above background
- Minor : 1-5 dB above background
- Low : <= 0 dB below background (equal or less to background)

11.2.9. For Stage 2 there are many elements of context that can be considered to form a final noise assessment conclusion. The following list, which is not exhaustive, gives some examples that could be relevant to the assessment:

- the absolute level of sound;
- the character and level of the residual sound compared to the character and level of the specific sound;
- whether specific sound insulation and noise control measures have already been incorporated into a receptor (which would lower the sensitivity of the receptor);
- former uses, at or close to the site;
- the legitimacy of the industrial use, e.g. planning permissions or environmental permits;
- implementation of best practicable means for a given process or activity; and
- whether the Rating Level represents typical levels, realistic worst case, unlikely worst case etc.

11.2.10. Additional guidance on the BS 4142 assessment methodology is provided in the Association of Noise Consultants' (ANC) BS 4142: Technical Note, which has been authored by the ANC Good Practice Working Group (ANC, 2020) [4]. The guide is *"designed to assist readers with a reasonable interpretation and application of BS 4142 as a whole."*. The Technical Note states:

"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."

[4] The Association of Noise Consultants (ANC). *BS 4142:2014+A1:2019 – Technical Note*. s.l. : the Association of Noise Consultants (ANC), 2020.

11.3. Methodology

Consultation

11.3.1. Prior to the assessment being undertaken a consultation process took place between TNEI and Environmental Health (EH) at The Highland Council (THC).

11.3.2. Upon review of the screening opinion and consideration of the nearby proposed Corriemoillie BESS, TNEI prepared a detailed consultation letter which was sent to THC on the 9th May 2025 to agree the methodology and main criteria for assessing the noise impact from the Proposed Development and cumulative impact with Corriemoillie BESS.

11.3.3. The letter included suggestions for representative background sound levels and relevant assessment criteria, all of which was agreed in a response from THC, dated 9th June 2025. Full details and correspondence are included as **Appendix 11.1,** and a summary of the agreed main criteria is included below.

Agreed Noise Criteria

11.3.4. The following was agreed at consultation:

- A list of four specific Noise Assessment Locations (i.e selected receptors) which needs to be assessed;
- The background sound levels that can be used for the noise assessment and confirmation that no new noise survey is required (i.e a previous nearby noise survey is applicable);
- Cumulative impact from operational noise with Corriemoillie BESS needs to be considered, based on the noise levels predicted from this development as per the planning application for that development;
- The operational noise assessment will need to be undertaken following the full process of BS 4142 to ensure the development includes sufficient noise mitigation to avoid an adverse impact, with consideration of the context. THC previously suggested (at screening) criteria of 'no increase beyond background levels' is aspirational only;
- the operational noise assessment must show predictions for at least the 100 Hz frequency band, and it should be confirmed that no tonality is expected using, for example, the BS 4142 Objective Tonal Assessment Method; and
- A Construction Environmental Management Plan (CEMP) would be prepared prior to the start of construction and include consideration of noise. It would identify the nearby receptors and outline best practice to be employed during construction to minimise noise. As such, no detailed construction noise assessment has been undertaken.

Noise Predictions Method

11.3.5. To predict the noise immission levels attributable to the Proposed Development, a noise propagation model was created using the propriety noise modelling software, CadnaA. Within the software, complex models can be produced to simulate the propagation of noise according to a range of international calculation standards.

11.3.6. For this assessment noise propagation was calculated in accordance with ISO9613-2:2024 *Acoustics — Attenuation of sound during propagation outdoors: Engineering method for the prediction of sound pressure levels outdoors*, using the following input parameters;

- Temperature is assumed to be 10°C and relative humidity as 70%;
- A ground attenuation factor of 1 (soft ground) has been used except for specific areas of developed ground (including the Proposed Development area) and bodies of water which is modelled with a ground attenuation factor of 0 (hard ground); and
- Receiver heights have been set to 4 m to represent the height of a first-floor bedroom window.

11.3.7. The noise propagation model is designed to give a good approximation of the specific sound level and the contribution of each individual sound source; however, it is expected that measured levels are unlikely to be matched exactly with modelled values. As such, the following limitations in the model should be considered:

- In accordance with ISO 9613, all assessment locations are modelled as downwind of all sound sources and propagation calculations are based on a moderate ground-based temperature inversion, such as commonly occurs at night. These conditions are favourable to noise propagation;
- The predicted barrier attenuation provided by local topography, embankments, walls, buildings and other structures in the intervening ground between source and receiver can only be approximated and not all barrier attenuation will have been accounted for; and
- The model assumes all sound sources are operating continuously and simultaneously at anticipated operating capacity.

11.3.8. With due regard to the above, noise level predictions are likely to be higher than what will occur during normal operation.

11.3.9. Note that the modelled sound sources represent candidate plant and an associated site layout. The location, operating conditions, number of, and noise output of individual items of plant may vary from what is presented in this report after final plant specification, which cannot be undertaken without a tendering process that would occur after planning consent has been granted.

Noise Assessment Locations

11.3.10. As agreed during consultation, noise immission levels have been calculated at four Noise Assessment Locations (NALs), which have been selected to represent the closest NSRs to the Proposed BESS. Each NAL has been set on the side of the property facing the Proposed BESS. The NALs are detailed in **Table 11.2** and also shown on **Figure 11.1**.

Table 11.2: Noise Assessment Locations

NAL		Coordinates		Approximate distance to Proposed Development noise sources (m)
ID	Descriptor	Eastings	Northings	
NAL01	Glenview	235126	863598	750
NAL02	Corriemoillie Farm	235450	863844	1000
NAL03	North of Loch Luichart Lodge	233471	863584	875
NAL04	Loch Luichart Lodge	233518	863417	890

11.4. Existing Baseline

11.4.1. The approach to determining background sound levels was presented within the noise consultation letter and accepted by the THC. The approach utilises the noise survey which WSP undertook at Glenview and Corriemoillie Farm (NAL1 and NAL2) to inform the noise impact assessment of the now consented Corriemoillie BESS development. The survey was conducted from the 8th of May to the 15th of May 2024.

11.4.2. Although WSP did not conduct a noise survey near NALs 3-4, the measured sound levels at the quietest of NAL1 and NAL2 have been assumed to be representative of background noise at NAL3 and NAL4, which have similar set back distances from the A832. The overall agreed baseline sound levels are summarised in Table 11.3 below for the four NALs.

Table 11.1 Summary of Representative Baseline Sound Levels

NAL		Background Sound Level		Residual Sound Level	
ID	Descriptor	Day, dB LA90 (1hr)	Night, dB LA90 (15mins)	Day, dB LAeq (16hr)	Night, dB LAeq (8hr)
NAL01	Glenview	36	29	48	50

NAL		Background Sound Level		Residual Sound Level	
ID	Descriptor	Day, dB LA90 (1hr)	Night, dB LA90 (15mins)	Day, dB LAeq (16hr)	Night, dB LAeq (8hr)
NAL02	Corriemoillie Farm	34	28	57	40
NAL03	Property North of Loch Luichart Lodge	34	28	57	40
NAL04	Loch Luichart Lodge	34	28	57	40

11.5. Predicted Noise Levels

Scenarios Modelled

11.5.1. The candidate plant assumed in this report is based on a Canadian Storage E-Storage (CSES) solution, which uses a layout configuration consisting of battery containers, and combined inverters/MV transformers. Based on the candidate plant layout, the primary sound sources considered within this assessment are:

- CSES SolBank 3.0 Plus battery energy storage containers, number of 44, and
- CSES 5160-T690A-E PCS units, number of 11.

11.5.2. To illustrate the noise predictions over the various operating modes, results for three scenarios are presented in this assessment:

- Scenario 1: 100% fan speed (Battery and PCS)
- Scenario 2: 80% fan speed (Battery and PCS)
- Scenario 3: 60% fan speed (Battery and PCS)

11.5.3. All sound sources and are assumed to be operating concurrently, continually and with a constant sound level output. The below sections describes each individual sound source.

Sound Source: Battery Units

11.5.4. The candidate model used in the assessment is a CSES SolBank 3.0 Plus. This is a modern 20 ft ISO container sized solution with battery cells inside and a chiller located on one side (at end of container, small side).

Graphic 11.1 – Illustration of CSES SolBank 3.0 Plus Battery Unit

11.5.5. TNEI has been provided data from the client which includes sound pressure levels (SPL) at various positions surrounding the unit, and at different distances from the unit. The noise comes from the chiller unit. The model assumes one area source for the chiller where noise is emitted and whilst significantly less noise is emitted from the other sides, these were also modelled as area sources but at much lower levels based on the data available.

11.5.6. The noise data was provided for three conditions of operation 100%, 80% and 60% fan speeds. Table 11.4 presents the sound power levels assumed. The manufacturer indicated that 25°C ambient temperature would be expected to correspond to 60% fan speed, and 35°C ambient temperature would be expected to correspond to 80% fan speed. It should be noted that 1/3 octave data was also available and used in the noise model, with detailed 1/3 octave predictions shown in **Appendix 11.2** .

Table 11.4 SWL (dBA) of Battery Unit CSES SolBank 3.0

Metric	100% fan speed		80% fan speed		60% fan speed	
	Chiller side	Non-Chiller sides	Chiller side	Non-Chiller sides	Chiller side	Non-Chiller sides
Overall sound power level (dB LAeq)	84.6	68	79.2	65.2	73	63.6

Sound Source: PCS Unit

11.5.7. The noise model considers a CSES 5160-T690A-E PCS unit as a candidate. This is a relatively large unit with dimensions of 4 m long by 1.8 m wide and 2.4 m in height, combining inverters and MV transformers. On the layout, one such PCS unit is connected to two Battery units.

Graphic 11.2 – Illustration of CSES* 5160-T690A-E PCS *Unit

11.5.8. TNEI has been provided data from the client which includes sound pressure levels (SPL) at various positions surrounding the unit, and at different distances from the unit. The main noise is coming from the cooling units (with fans) found on both of the large 4 m sides. The noise data available indicates that levels are relatively similar all around the unit, so the model assumes that each PCS unit will be emitting noise from all facades with the same sound power level.

11.5.9. The noise data was provided for three conditions of operation 100%, 80% and 60% fan speeds. Table 11.5 presents the sound power levels assumed. The manufacturer indicated that 25°C ambient temperature would be expected to correspond to 60% fan speed and 35°C ambient temperature would be expected to correspond to 80% fan speed. It should be noted that 1/3 octave data was also available and used in the noise model, with detailed 1/3 octave predictions shown in **Appendix 11.2** .

Table 11.5 SWL (dBA) of PCS Unit CSES 5160-T690A-E

Metric	100% fan speed	80% fan speed	60% fan speed
	All sides	All sides	All sides
Overall sound power level (dB LAeq)	68.2	65.4	60.5

Calculated Immission Levels

11.5.10. The immission levels (Specific Sound Level) have been calculated assuming all plant is operating continuously and concurrently. The model assumes, as a worst case, that noise levels do not fluctuate and remain the same throughout the daytime and night-time assessment periods.

11.5.11. The noise immission levels are detailed in Table 11.6 and also illustrated as a noise contour plot shown in **Figure 11.2** for Scenario 1. Other Scenarios 2&3 have noise sources at identical locations with lower sound power levels and are only shown in the below table.

Table 11.6: Calculated Immission Levels, dB LAeq (t)

NAL		Immission Level		
ID	Descriptor	Scenario 1	Scenario 2	Scenario 3
NAL01	Glenview	29	24	18
NAL02	Corriemoillie Farm	28	23	17
NAL03	North of Loch Luichart Lodge	29	24	18
NAL04	Loch Luichart Lodge	28	23	17

11.6. Noise Impact Assessment (BS 4142)

BS4142 Rating Levels

11.6.1. To assess the immission levels in accordance with BS 4142, the Specific Sound Level must be converted into a Rating Level. The Rating Level allows for character corrections to be added to account for particular characteristics of the sound that may be perceived as more annoying. In particular, the Rating Level considers tonality, impulsivity and intermittency of the sound, as well other sound characteristics that are neither tonal, impulsive, or intermittent,

but are otherwise readily distinctive against the residual acoustic environment. Character corrections must consider the noise at the receiver location, not the source location.

Tonality

11.6.2. With regards to tonality, BS4142 states:

"For sound ranging from not tonal to prominently tonal the Joint Nordic Method gives a correction of between 0 dB and +6 dB for tonality. Subjectively, this can be converted to a penalty of 2 dB for a tone which is just perceptible at the noise receptor, 4 dB where it is clearly perceptible and 6 dB where it is highly perceptible."

11.6.3. Electrical plant such as power transformers are often tonal at source, typically in the 100 Hz frequency band, however, the BS 4142 corrections are only applied if noise characteristics are present at the receptor location, not at the source location. There are no indication of transformer or inverters tonal noise in the 1/3 octave data spectra of the candidate PCS unit.

11.6.4. The chiller of the battery unit has 1/3 octave source data indicating potential tones at the source. The PCS unit 1/3 octave data does not indicate any tones. Chiller units are generally not known to create significant tones that would attract penalties in comparison to transformers for example. An analysis of frequency data is shown in **Appendix 11.2** and a further discussion on tonality and 100 Hz predictions is included in section 11.6.31. As a result, no tonal character correction is judged to be applicable.

Impulsivity

11.6.5. With regards to impulsivity, BS 4142 states:

"A correction of up to +9dB can be applied for sound that is highly impulsive, considering both the rapidity of the change in sound level and the overall change in sound level. Subjectively this can be converted to a penalty of 3dB for impulsivity which is just perceptible at the noise receptor, 6dB where it is clearly perceptible, and 9dB where it is highly perceptible."

11.6.6. Impulsivity is not considered to be a relevant sound characteristic of a BESS when operational, the noise level will be predictable and consistent.

Intermittency

11.6.7. The intermittency of the sound source needs to be considered when it has identifiable on/off conditions. With regards to intermittency, BS4142 states:

"If the intermittency is readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied."

11.6.8. As with impulsivity, intermittency is not considered to be a relevant sound characteristic in this case. Once operational, noise levels may fluctuate by a small amount over long periods of time, but no regular step changes in noise level are anticipated.

Other Sound Characteristics

11.6.9. With regards to other sound characteristics, BS4142 states:

"Where the specific sound features characteristics that are neither tonal nor impulsive, nor intermittent, though otherwise are readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied."

11.6.10. Based on TNEI's understanding and experience of this type of plant, we do not anticipate any additional sound characteristics that would be considered readily distinctive against the residual acoustic environment.

Calculation of the Rating Level

11.6.11. With due regard to the above, no character corrections are required. Therefore, the Rating Levels are equal to the Specific Sound Levels shown in Table 11.6 above.

BS 4142 Stage 1 Assessment - Initial Estimate of Impact

11.6.12. Stage 1 of the assessment is the initial estimate which compares the Rating Level to the Background Sound Level, and this is detailed in Table 11.7 and Table 11.8.

Table 11.7: BS4142 Initial Estimate- Day

NAL ID	Background Sound (dB LA90)	Difference between Rating Levels and Background Sound Level, dB			BS4142 Initial Estimate, potential impact (low / minor / adverse / significant adverse), depending on the context		
		S1	S2	S3	S1	S2	S3
NAL01	36	-7	-12	-18	Low	Low	Low
NAL02	34	-6	-11	-17	Low	Low	Low
NAL03	34	-5	-10	-16	Low	Low	Low
NAL04	34	-6	-11	-17	Low	Low	Low

Table 11.8: BS4142 Initial Estimate- Night

NAL ID	Background Sound (dB LA90 (15mins))	Difference between Rating Levels and Background Sound Level, dB (+/-)			BS4142 Initial Estimate, potential impact (low / minor / adverse / significant adverse), depending on the context		
		S1	S2	S3	S1	S2	S3
NAL01	29	0	-5	-11	Low	Low	Low
NAL02	28	0	-5	-11	Low	Low	Low
NAL03	28	+1	-4	-10	Minor	Low	Low
NAL04	28	0	-5	-11	Low	Low	Low

11.6.13. The initial estimate shows that, depending on the context, a low impact is predicted during the day for all Scenarios S1-S3 at all NALs. And during the night, a minor impact (below adverse) is predicted for Scenario S1 (100% fan speed) at NAL3 and a low impact is predicted for Scenarios S2-S3 at all receptors.

11.6.14. As the initial estimate results are depending on the context, the context must be assessed before making a conclusion and this is detailed in the below paragraphs.

Stage 2 –Assessment of Context

11.6.15. Although there are other elements of context that may be relevant to the assessment, BS 4142 requires the following three contextual elements to be considered:

- the absolute level of the sound;
- the character and level of the residual sound compared to the character and the level of the specific sound;
- the sensitivity of the receptor; and
- any other pertinent factors.

11.6.16. Each of these is considered in turn below, alongside other contextual elements that are relevant for the Proposed Development.

Context: Absolute Level of Sound

11.6.17. BS 4142 suggests that in instances where the existing sound environment is considered either particularly low or particularly high then absolute levels may be more relevant than the initial estimate of impact. The standard 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."

11.6.18. The ANC BS 4142 Technical Note provides additional guidance on this, providing indicative values that could be used to describe 'low' background sound levels and 'low' rating levels. Specifically, the Technical Note states:

"BS 4142 does not define 'low' in the context of background sound levels nor rating levels. The note to the Scope of the 1997 version of BS 4142 defined very low background sound levels as being less than about 30 dB LA90, and low rating levels as being less than about 35 dB LAr,Tr".

11.6.19. In this case the background sound levels are in the mid-30's (dB LA90(1hr)) during the daytime which are low to medium, however, during the night-time, background sound levels are below 30 dB, which could be described as very low. The Rating Levels are no more than 29 dB LAeq(t) so are low. At most a minor impact was found in Stage 1 during the night-time, and this may be reduced to a lower impact when considering this context, as absolute levels would be more relevant than the margin by which the rating level exceeds the background.

11.6.20. Consideration of the absolute level of sound suggests that the initial estimate of impact could be reduced, especially during the night-time.

Context: Character and Level of Residual Sound

11.6.21. The average residual sound level at all locations are shown in the Table 11.2. The lowest residual sound level are shown to be 48 dB (LAeq) during the daytime and 40 dB (LAeq) during the night-time, both of which are at least 10 dB higher than the Rating Levels of 29 dB. As such the development levels are predicted to be at much lower levels than the existing residual sound levels, to a point where it would not contribute to an increase in existing levels.

11.6.22. The predicted noise levels from the Proposed Development is not anticipated to have distinguishing character features and is considered a fairly continuous and relatively low-level sound source. Overall, it is not anticipated that the development will be readily distinctive against the residual acoustic environment.

11.6.23. Consideration of the character and residual sound level suggests that the initial estimate of impact would be equal or less.

Context: Sensitivity of Receptor

11.6.24. BS 4142 suggests that the sensitivity of the receptor may be lessened if design measures that secure good internal and/or outdoor acoustic conditions are already implemented within the receptor. An example of this could be where a residential building has been fitted with non-openable windows in an already high noise environment. This is not relevant to this assessment, where it is assumed that all nearby NSRs do not incorporate any specific noise control measures.

11.6.25. Consideration of the sensitivity of the receptor does not materially affect the initial estimate of impacts.

Context: Other Pertinent Factors

11.6.26. The assessment provides analysis of results from plant operating at various conditions. In reality, the plant will operate at less than 100% fan speed for the majority of the time, and noise levels would vary depending the load and ambient temperature. An operating mode of 60% fan speed, as in the Scenario S3 which is the quietest modelled, would be expected in ambient temperature of 25°C, which would be a very rare occurrence in the Highlands at night-time for example.

11.6.27. The noise model assumes all plant is operating concurrently; however not all cooling units will necessarily be required to operate at the same time and as such, overall noise levels are likely to be lower than predicted.

11.6.28. Consideration of other pertinent factors suggests that the initial estimate of impact could be reduced.

BS 4142 Assessment Conclusion

11.6.29. The Stage 1 Initial Estimate of Impact indicated that the specific sound source has a low / minor impact, depending on the context. Detailed consideration of the context concludes that there would be a low impact for all three scenarios (100%, 80%, 60% fan speed) during the daytime and night-time at all receptors, without any mitigation requirements.

11.6.30. It should be noted that 60% fan speed would typically represent an ambient temperature of around 25°C. As such, it is likely to be the most realistic of the three scenarios considered, as ambient temperatures over 25°C would be a rare occurrence for a site in the Highlands. Other candidate plant not considered in this report would also be suitable.

Further discussion about tonality and 100 Hz

11.6.31. The main noise is from the battery units, and comes from the chiller (i.e fan & pumps) at the end of the container unit. ⅓ octave data analysis indicates possible tones at 160 Hz when operating at 100% fan speed, 125 Hz when operating at 80% fan speed and 100 Hz when operating at 60% fan speed. However, at receptor locations the corresponding predicted

levels at these frequencies are very low, to a point where they would not be a distinguishable noise feature. A detailed analysis is show in **Appendix 11.2.** The numbers indicate predictions of 21 dB LAeq at 160 Hz (100% fan speed, and overall is 29 dB) and the overall existing residual noise at night are around 40 dB LAeq at least, which is nearly 20 dB lower. There is no expected tonality from the CSES chiller unit at receptor locations.

11.6.32. The 100 Hz predictions are shown in **Appendix 11.2** as requested by THC during the consultation. It should be noted that the predictions are outdoor noise levels at the NAL coordinates.

11.7. Cumulative Assessment

11.7.1. As the study area includes receptors near both the Proposed Development and the Corriemollie BESS development (at planning), it was agreed that cumulative noise with the Corriemollie BESS should be considered.

11.7.2. The cumulative effect of both developments can be assessed using a logarithmic addition of the respective predicted Rating Levels at the NALs. **Table 11.9** below presents the predicted cumulative Rating Levels at all NALs for Scenario S3 (more realistic), assessed against the background noise level reported from the Corriemoillie BESS noise assessment.

Table 11.9: Cumulative Margin Above/Below (+/-) Background Noise Level

NAL		Predicted Rating Level, dBA		
ID	Descriptor	Proposed Development with Scenario S3	Corriemoillie BESS with 5m barrier as proposed in noise assessment conclusion	Cumulative
NAL01	Glenview	18	29	29
NAL02	Corriemoillie Farm	17	23	24
NAL03	Property North of Loch Luichart Lodge	18	18*	21
NAL04	Loch Luichart Lodge	17	18*	21

** These receptors NAL3&4 are far from Corriemoillie BESS, levels approximately by TNEI based on WSP predictions at NAL1&NAL2.*

11.7.3. As can be seen, the cumulative predictions remain low with a maximum of 29 dB at one location, and therefore a low cumulative noise impact is predicted.

11.8. Noise Mitigation Measures

11.8.1. This assessment has shown that no noise mitigation measures are required for the Proposed Development based on a candidate plant.

11.9. Conclusion

11.9.1. An operational noise assessment has been undertaken following the BS 4142 standard and parameters agreed with an Environmental Health Officer (EHO) at the THC.

11.9.2. The baseline utilised a noise survey that had been undertaken for the nearby proposed Corriemoillie BESS in May 2024, and it was agreed with the EHO that this would represent the existing baseline sound levels of all relevant noise sensitive receptors (i.e. residential properties) surrounding the Proposed Development (as well as those surrounding the Corriemoillie BESS).

11.9.3. A noise propagation model has been produced to predict the noise immission levels at the nearest identified residential receptors. Noise modelling is based on candidate plant specified by the client and three scenarios are considered (100%, 80%, 60% fan speeds) to illustrate noise levels in various conditions (i.e. noise levels from BESS will be mostly depend on the load and ambient temperature, hence depend on cooling requirements). The noise model assumes that all plant will be operating continuously and concurrently, however, this is unlikely to occur for the majority of the time. Accordingly, the noise predictions are inherently conservative.

11.9.4. The BS 4142 assessment process concludes that there would be a low impact for all three scenarios (100%, 80%, 60% fan speed) during the daytime and night-time at all receptors, without any mitigation requirements. This demonstrates that the candidate plant would be suitable for this Proposed Development. Other candidate plant would also be suitable.

11.9.5. It should be noted that the scenario with the lowest noise predictions (60% fan speed) would typically represent an ambient temperature of around 25°C. As such, it is likely to be the most realistic of the three scenarios considered, as ambient temperatures over 25°C would be a rare occurrence for a site in the Highlands.

11.9.6. The cumulative noise assessment which considers the combined operation of both the Proposed Development and the nearby Corriemoillie BESS, also indicates that there would not be any significant cumulative noise impact.

11.9.7. Construction noise would be managed through the adoption of best practice measures incorporated within a Construction Environmental Management Plan (CEMP). A CEMP would be prepared prior to the start of construction and would identify the nearby receptors and outline best practice to be employed during construction to minimise noise.

11.9.8. As such, a low noise impact is predicted for both construction noise and operational noise, and no specific noise mitigation is anticipated to be required.