12 Construction and Operational Noise

12.1 Introduction

12.1.1 This chapter presents the assessment of the likely significant noise and vibration effects occurring as a result of the uprating and turn ins of the XL, ZCN, and ZCS OHL routes from 275 kV to 400 kV and Kincardine North Substation (Proposed Development). For the purposes of this Chapter, the term "Proposed Development" refers collectively to the Kincardine North Substation and the XL, ZCN, and ZCS overhead line routes and the SPD works. Where assessment findings relate specifically to either the substation or the OHL components, this is stated explicitly within the text to provide clarity. The methodology focuses on the assessment of effects on permanent noise sensitive receptors (NSRs) in the study area. Where likely significant effects are predicted, appropriate mitigation measures are proposed, and the significance of predicted residual effects are assessed. This Chapter (and its associated appendices) is not intended to be read as a standalone assessment and reference should be made to the introductory chapters of this Environmental Impact Assessment Report (EIAR), including Chapter 4: Project Description for full details of the Proposed Development;

12.1.2 The noise assessment of the XL, ZCN and ZCS routes was undertaken by Wood plc and concerns operational noise only with a qualitative construction noise from this element of the works by AECOM. The noise assessment of the Kincardine North substation was undertaken by AECOM and concerns both construction and operation. The Chapter sections will be subdivided where necessary.

12.1.3 The objectives of this Chapter are to:

- Describe the assessment methodology and significance criteria used in the assessment;
- Identify the residential NSRs in the vicinity of the proposed development;
- Describe and define the baseline noise environment;
- Identify the dominant sound sources associated with the operation of the proposed development;
- Predict the likely impacts and residual effects on NSRs; and
- Indicate any requirements for mitigation measures, if applicable, to provide sufficient levels of protection for all NSRs.

12.1.4 The construction and operation of the substation will not cause vibration-related effects as potential receptors are greater than 100m away so this has been scoped out of the assessment, based on professional judgement and experience.

12.1.5 As stated in Chapter 4, it is not envisaged that the Proposed Development would be decommissioned. Consent for the Proposed Development is being sought in perpetuity. As stated in Chapter 2, decommissioning effects have been scoped out of this assessment. It is generally the case that rather than decommissioning, assets within the substation would be refurbished or replaced in order to extend its operational life. In the event that the Proposed Development were to be decommissioned, given the nature of the Proposed Development and the effects associated with decommissioning being similar to those of construction,

decommissioning effects have not been assessed. In the event that the Proposed Development was no longer required and could be decommissioned then a Decommissioning Plan would be prepared and planning permission would be obtained, if required, in accordance with the relevant legislation in place at the time.

12.1.6 A summary of noise terminology relevant to this chapter is included in Volume 3, Appendix 12.1 'Noise Perception and Terminology'.

12.1.7 Noise is defined as unwanted sound. Human ears are able to respond to sound in the frequency range 20 Hz (hertz) (deep bass) to 20,000 Hz (high treble) and over the audible range of 0 dB (decibel) (the threshold of perception) to 140 dB (the threshold of pain). The ear does not respond equally to different frequencies of the same magnitude, but is more responsive to mid-frequencies than to lower or higher frequencies. To quantify noise in a manner that approximates the response of the human ear, a weighting mechanism is used. This reduces the importance of lower and higher frequencies, in a similar manner to the human ear.

12.1.8 Furthermore, the perception of noise may be determined by a number of other factors, which may not necessarily be acoustic. In general, the impact of noise depends upon its level, the margin by which it exceeds the background level, its character and its variation over a given period of time. In some cases, the time of day and other acoustic features such as tonality or impulsiveness can increase the potential for Adverse impacts on sensitive receptors. Any assessment of noise should give due consideration to all of these factors when assessing the significance of a noise source on an NSR.

12.1.9 The most widely used weighting mechanism that best corresponds to the response of the human ear is the 'A' weighting scale. This is widely used for environmental noise measurement, and the levels are denoted as dB(A) or LAeq, LA90 etc., according to the parameter being measured.

12.1.10 The decibel scale is logarithmic rather than linear, and hence a 3 dB increase in sound level represents a doubling of the sound energy present, however, this is generally regarded as the minimum difference needed for the human ear to perceive a change under normal listening conditions. Judgement of sound is subjective, but as a general guide a 10 dB(A) increase can be taken to represent a doubling of perceived loudness.

12.1.11 The Kincardine North Substation will be located near Kincardine, Fife at the site ('the Development Site') as described in Chapter 4 'Project Description' The proposed substation and nearest NSRs are shown in Figure 10.1 in Appendix 12.2. The substation will operate 24 hours a day with little variation in its sound emissions

12.1.12 An energised overhead line (OHL) can be the source of an audible phenomenon known as 'corona discharge'. This is a limited electrical breakdown of the air in the vicinity of the OHL conductors. While OHL conductors are designed and constructed to minimise corona discharge, surface irregularities such as damage, attached raindrops, insects and other types of contamination can increase local electric field strength beyond the inception level for local corona discharge at these sites. Such corona discharge can be the source of audible noise, a crackling sound accompanied sometimes by a low frequency hum.

12.1.13 The highest noise levels generated by an OHL usually occur during light rain when water droplets, collecting on the surface of the conductor, can initiate corona discharge. The number of droplets that collect, and hence the amount of noise, depends on the rate of rainfall. Mist or fog can also cause corona discharge from droplets condensing on and

attaching to the conductor surface. Sometimes, after a prolonged spell of dry weather, conductors can become contaminated with accumulated dust particles and other materials on which corona discharge can occur and audible noise can be generated. Later rain showers have the effect of washing the conductors clean of such debris.

12.1.14 The general principles of noise described above apply to both the substation and OHL assessments. Where specific acoustic phenomena relevant to individual components (e.g. corona discharge for OHLs) are discussed, these are addressed separately in the relevant sections to avoid duplication.

12.2 Legislation, Policy and Guidance

Legislation

Environmental Protection Act 1990

12.2.1 The Environmental Protection Act 1990 (Ref 12.1) identifies that noise (and vibration) emitted from premises (including land) can, at certain levels, be prejudicial to health or give rise to statutory nuisance. Local authorities are required to investigate any public complaints of noise and if they are satisfied that a statutory nuisance exists, or is likely to occur or recur, they must serve a noise abatement notice. A notice is served on the person responsible for the nuisance. It requires either the abatement of the nuisance; or works to abate the nuisance to be carried out; or it prohibits or restricts the activity. Contravention of a notice without reasonable excuse is an offence. A right of appeal to the Sheriff Court exists within 21 days of the service of a noise abatement notice.

12.2.2 No statutory noise limits exist for determining a nuisance; therefore, the Local Authority can take account of various guidance documents and existing case law when investigating complaints. Lower noise level limits are generally applied when considering the acceptability of a planning permission than those which would be used when considering whether an existing noise source amounts to a statutory nuisance. Demonstrating the use of Best Practicable Means (BPM) to minimise noise levels is an accepted defence against a noise abatement notice.

Control of Pollution Act 1974

12.2.3 The Control of Pollution Act 1974 (Ref 12.2) requires that BPM (as defined in Section 72) are adopted to control construction noise on any given site as far as reasonably practicable. Sections 60 and 61 provide the main legislation regarding enabling works and construction site noise and vibration. If noise complaints are received, a Section 60 notice may be issued by the Local Authority with instructions to cease work until specific conditions to reduce noise have been adopted.

12.2.4 Section 61 provides a means to apply for prior consent to carry out noise generating activities during construction. Once prior consent has been agreed under Section 61, a Section 60 notice cannot be served provided the agreed conditions are maintained onsite.

12.2.5 Whilst construction noise and vibration are factors which can be considered during the planning process, Local Authorities have alternative powers under Sections 60 and 61 of to regulate these issues if complaints arise.

Planning Policy

12.2.6 The following policies of relevance to the assessment have been considered.

12.2.7 The National Planning Framework (NPF4) states the following policy related to noise. Published in February 2023 (Ref 12.3), it sets out spatial principles, regional priorities, national developments, and national planning policy

- 11e i): In addition, project design and mitigation will demonstrate how the following impacts are addressed: i) impacts on communities and individual dwellings, including, residential amenity, visual impact, noise and shadow flicker;
- 14c: Development proposals that are poorly designed, detrimental to the amenity of the surrounding area or inconsistent with the six qualities of successful places, will not be supported.
- 23e: Development proposals that are likely to raise unacceptable noise issues will not be supported. The agent of change principle applies to noise sensitive development. A Noise Impact Assessment may be required where the nature of the proposal or its location suggests that significant effects are likely.

12.2.8 The Local Development Plan (LDP) for Clackmannanshire (2015) Policy EA11 – Environmental Quality (Ref 12.8) states:

- "Developments that have the potential to negatively impact the quality of the environment, either individually or in combination with other developments, such as through air, water, soil, noise or light pollution, will only be acceptable where the developer has demonstrated, to the satisfaction of the Council, that all reasonable measures to minimise any such impacts have been taken, and any unavoidable impacts will be appropriately mitigated."

12.2.9 Fife Council has published *Policy for Development and Noise* (2021) (Ref 12.6), the relevant part of which is set out below:

- "FIFEplan 2017, Policy 2.2: Housing and Policy 5: Employment Land and Property Policy 10: Amenity are relevant to the consideration of noise issues in planning applications. The selection of a site, the design of a development and the conditions which may be attached to a planning permission can all play a part in preventing, controlling and mitigating the effects of noise. Discussions with the planning authority prior to submitting an application will assist in deciding the level of detail required from an applicant in respect of noise. The specification of mitigation measures required should be balanced against the degree of risk to environmental quality, public health and amenity. More detailed assessments may be required for proposals that are likely to generate significant noise; for noise sensitive proposals which may affect existing noise sources and for proposals that may affect noise levels within or close to Noise Management Areas or Quiet."

12.2.10 Fife Council has also published *Fife Development Plan Scheme 2024, Fourteenth Edition* (2024) (Ref 12.7)

- This guidance aims to ensure that new development does not lead to detrimental impacts on existing businesses and future investment, or to impacts on the health and wellbeing of new or existing residents exposed to unacceptable levels of noise.

12.2.11 The Fife Planning Policy for Development and Noise has informed the scope and methodology of the noise assessment. The policy emphasises the need to avoid introducing or exacerbating conflicts between noise generating development and noise sensitive receptors, and places

particular importance on understanding existing baseline noise levels, likely changes arising from development, and the character and timing of any noise generated. In response, the assessment focuses on residential properties and other noise sensitive receptors, considers changes relative to the existing noise environment rather than absolute levels alone where necessary, and reaches a conclusion on the likely significant effects during both daytime and night time periods, with due regard to noise character and perceptibility.

- Policy 11: Low Carbon Fife: Development of low carbon energy schemes such as wind turbines, district heating, solar arrays, or energy from waste will be supported provided the proposals do not result in unacceptable significant adverse effects or impacts which cannot be satisfactorily mitigated, giving due regard to relevant environmental, community and cumulative impact considerations.

Guidance

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

Scottish Government Planning Advice Note (PAN) 1/2011: 'Planning and Noise' .

12.2.13 Current national guidance on noise is contained in Planning Advice Note (PAN) 1/2011 'Planning and Noise' (Ref 12.4). Paragraph 2 states that PAN 1/2011 promotes:

- "the principles of good acoustic design and a sensitive approach to the location of new development. It promotes the appropriate location of new potentially noisy development, and a pragmatic approach to the location of new development within the vicinity of existing noise generating uses, to ensure that quality of life is not unreasonably affected and that new development continues to support sustainable economic growth."

12.2.14 Paragraph 3 of PAN 1/2011 states that:

- "The Environmental Noise (Scotland) Regulations 2006 transposed the European Directive 2002/49/EC (the Environmental Noise Directive) into Scottish law... They require Scottish Ministers and airport authorities to manage noise through a process of strategic noise mapping and noise action plans. In the areas affected by the Regulations, planning authorities have a role in helping to prevent and limit the adverse effects of environmental noise."

12.2.15 PAN primarily provides planning principles rather than technical assessment methodology. These planning principles include:

- Avoidance of significant adverse noise impacts from new developments,
- Applying noise impact criteria reasonably,
- Use of mitigation measures to manage noise impacts,
- Protection of Quiet Areas, and
- Avoidance of development significantly adversely affecting Noise Management Areas.

12.2.16 There are no Environmental Noise Directive (END) 'noise action plans' in proximity to the Proposed Development.

12.2.17 A Technical Advice Note (TAN) (Ref 12.5) accompanies PAN 1/2011 and provides technical guidance on noise assessment to support the PAN. Paragraph 2.5 of the TAN states:

- "For a quantitative assessment of the noise impacts, the noise level change needs to be related to the sensitivity of the receptor so that the significance of the noise level change can be determined. Hence, the significance of the noise impact at a particular receptor can be determined from the magnitude of the noise change and the sensitivity of that receptor to the change in noise. The magnitude of the noise level change can be assessed relative to an absolute threshold level or relative to the pre-existing ambient noise level."

12.2.18 Paragraph 3.20 of the TAN also states:

- "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) 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)."

12.2.19 Neither PAN 1/2011 nor the associated TAN provides specific technical guidance on the assessment of noise, but the TAN includes an example assessment scenario for 'New noisy development (including commercial and recreation) affecting a noise sensitive building', which is based on British Standard (BS) 4142:1997: Method for rating industrial noise affecting mixed residential and industrial areas. This BS has been replaced with BS 4142:2014: Methods for rating and assessing industrial and commercial sound.

12.3 Consultation

Kincardine North Substation

12.3.1 Measurement positions and acoustic survey measurement metrics were confirmed with the Fife Environmental Health Officer (EHO) and a rating level of no more than +5dB over the background sound level was agreed for Kincardine North Substation. Further correspondence with the Local Authority was sought regarding internal noise levels and the following response was received on 17/02/2025.

12.3.2 "Unless otherwise agreed in writing with the LPA, noise emitted from the infrastructure of the site shall not exceed: NR 35 when measured in any amenity space of the houses nearby, or NR25 in any bedroom of the houses nearby. "

12.3.3 While the nearest NSRs to the substation are located in Fife, the Environmental Health Department at Clackmannanshire Council was also contacted in relation to establishing the assessment methodology and assessment criteria.

Overhead Line Works (XL/ZCN/ZCS Uprating and Turn-ins)

12.3.4 Scoping was undertaken and a Gate Check 1 report shows that Kincardine Community Council raised concerns related to noise and these are addressed in this chapter. They have requested cumulative noise calculations are required in all weather conditions. According to the TGN(E)322 methodology, noise shall be calculated in both wet and dry conditions.

12.3.5 SEPA confirmed they had no concerns to raise about the current scope of the assessment.

12.4 Methods

Introduction

12.4.1 The assessment of noise effects has been undertaken using two established methodologies, reflecting the differing nature of the infrastructure assessed. For the Kincardine North Substation, significance has been defined using the EIA significance matrix set out in Chapter 2, where both Moderate and Major effects may be considered Significant. For the overhead line (OHL) assessment, significance has been defined in accordance with the TGN(E)322 methodology, where only Major effects are considered Significant in EIA terms. These approaches are consistent with accepted industry practice for the respective asset types and are applied independently within this Chapter. Where relevant, the outcomes are clearly identified to avoid ambiguity.

12.4.2 Where terminology differs between the assessment approaches (e.g. impact, effect, magnitude), these terms are applied in accordance with the relevant methodology but are used consistently within each assessment to ensure clarity. These terms are defined below.

- Impact: the change in an environmental receptor caused by a project action
- Magnitude: the degree or scale of change resulting from an impact
- Significance: the overall importance of an effect after considering both magnitude and sensitivity of the receptor

Study Area

Kincardine North Substation

12.4.3 The extent of the Study Area has been defined based on the closest NSRs in each direction from the Proposed Development for both the construction and operational phases as these are representative of the most sensitive receptors. Any additional NSRs are further away from the Proposed Development and therefore are less likely to be impacted by noise from the Proposed Development compared to the closest NSRs due to greater sound attenuation with distance.

Overhead Line Works (XL/ZCN/ZCS Uprating and Turn-ins)

12.4.4 The study area for the assessment of noise and vibration encompasses the area over which all desk-based and field data were gathered to inform the assessment presented in this Chapter. The study area comprises 104 nearby NSRs in proximity to the Proposed Development. NSRs were compiled from Address Base data (Ref 12.17), detailed maps, and aerial photographs of the area surrounding the Proposed Development. These NSRs are all within 500 m of the nearest point to the Proposed Development. 500 m was chosen based on established industry practice for operational overhead line noise assessments and the author's professional judgement, ensuring all potentially impacted NSRs were conservatively included. Beyond this distance, predicted operational effects fall below relevant screening thresholds outlined in each Tier of the TGN(E)322 assessment and effects are considered negligible.

Scope of Assessment

12.4.5 The scope of this assessment is as follows:

- Review of plans and mapping data to identify nearby noise sensitive receptors (NSRs);

- Consultation with Environmental Health Departments at Fife Council and Clackmannanshire Council regarding the proposed assessment method;
- Establish baseline sound levels in the locality;
- Qualitative assessment of construction noise impacts in accordance with the guidance in BS 5228:2009+A1 2014 'Code of practice for noise and vibration control from construction and open sites – Part 1: Noise' (Ref 12.9);
- Quantitative assessment of change in road traffic noise due to construction traffic on the public highway network used by construction traffic, potentially affecting NSRs in proximity to those routes.
- Quantitative assessment of impact of the change in substation sound emissions on NSRs in accordance with BS 4142:2014 + A1:2019 'Methods for rating and assessing industrial and commercial sound' (Ref 12.10);
- Quantitative assessment of the operational noise due to the uprating of the XL route and the ZCS and ZCN turn ins to the proposed Kincardine North Substation;
- Identification of acoustic requirements for mitigation measures if required; and
- Review of other proposed developments in the vicinity and assessment of likely cumulative effects.
- The assessment of operational traffic on local road network has been scoped out due to limited operational traffic movements.

12.4.6 Beyond about 100m vibration levels from typical sources are usually below the thresholds for human perception or building damage. As stated above, neither the construction nor operation of the Proposed Development are anticipated to generate significant levels of vibration at nearby NSRs due to distance, therefore, consideration of vibration impacts is excluded from the assessment scope.

Noise Sensitive Receptors

Kincardine North Substation

12.4.7 The NSRs closest to the substation element of the Proposed Development have been identified. NSR1KINN and NSR3KINN were selected for baseline monitoring NSR1 resides within Fife and is expected to have similar levels as NSR2KINN due to the primary noise source in the area being traffic and their similar distances from the A977. NSR3KINN which falls under Clackmannanshire was selected as the third closest receptor, the primary noise source for NSR3 is the A876 to the East. The identified NSRs are shown in Table 10-1 and provided below in Table 10 1. The ecological receptors are considered in Chapter 6.

Table 12-1 Nearest Sensitive Receptors

Receptor Number	Use	Approximate distance from site red line boundary (m)
NSR1KINN	Residential	300 – East
NSR2KINN	Residential	280 – East
NSR3KINN	Residential	950 - Northwest

Overhead Line Works (XL/ZCN/ZCS Uprating and Turn-ins)

12.4.8 Potential NSRs were processed from AddressBase data. All potential receptors from the AddressBase dataset that fall within 500 m of the centreline of the alignment are considered in the operational noise assessment. This resulted in the identification of 104 NSRs, shown in Appendix 12.7 OHL Noise Sensitive Receptors (NSRs).

12.4.9 The OHL consists of three conductor types. The conductor will be 400 kV Twin Matthew Gap from tower XL001A to XL031. Then, from XL031 to XL034 mid span, the conductor will be Triple Upas at 400 kV. A third conductor type (Triple Andrew) is being proposed to address likely significant effects on a specific noise receptor between XL12 to XL20, but this will no longer be required if impacts on the residential receptor are avoided, subject to conclusion of an option agreement relating to purchase of the affected property by SPT.

12.4.10 It was calculated that the wet noise from the Twin Matthew Gap conductor is predicted to produce 34 dB(A) of wet noise up to a distance of 315 m from the centreline of the OHL. Adding a buffer of 10 m, for variances in property size, meant that addresses up to 325 m from the XL route would be screened in at Tier 1 and progress to Tier 2. 20 of 47 NSRs falls within this category.

12.4.11 For Triple Upas, the distance is 262 m for a wet noise level of 34 dB(A) and thus progression for Tier 2. 5 of 53 NSRs falls within this category.

Guidance and Standards

BS 5228-1:2009+A1:2014 – 'Code of practice for noise and vibration control on construction and open sites- Part 1: Noise' (Ref 12.9)

12.4.12 Details of the proposed construction schedule and plant to be used are not available at this stage, therefore a quantitative construction noise and vibration assessment has not been possible. Instead, a qualitative assessment focussing on Best Practicable Means (BPM) has been completed. This considers the potential for significant effects to occur based on distance and timings of the proposed works but does not quantitatively assess the impact of the proposed works. This is considered appropriate for this stage of the Proposed Development, to identify likely significant effects, and where necessary recommend mitigation measures and best practice to achieve construction noise threshold.

12.4.13 BS 5228-1 provides practical information on construction noise and vibration reduction measures and promotes a BPM approach to control noise and vibration. The calculation method provided in BS 5228-1 is based on the number and types of equipment operating, their associated sound power level (Lw), and the distance to NSRs, together with the effects of any screening.

1. BS 5228-1 contains a methodology for the assessment of the significance of effect of construction noise in relation to the ambient noise levels, known as the "ABC method". The criteria for significance provided in BS 5228-1 are reproduced in Table 12-2.

Table 12-2 Construction noise threshold of potentially significant effect at dwellings

Assessment Category	Threshold Value (dB $L_{Aeq,T}$)		
	Category A (a)	Category B (b)	Category C (c)
Night-time (23:00 – 07:00)	45	50	55
Evenings and Weekends (d)	55	60	65
Daytime (07:00 – 19:00) and Saturdays (07:00 – 13:00)	65	70	75

NOTE 1: A potentially significant effect is indicated if the $L_{Aeq,T}$ noise level arising from the Proposed Development exceeds the threshold level for the category appropriate to the ambient noise level.

NOTE 2: If the ambient noise level exceeds the Category C threshold values given in the table (i.e. the ambient noise level is higher than the above values) then a potentially significant effect is indicated if the total $L_{Aeq,T}$ noise level for the period increases by more than 3 dB due to site noise.

NOTE 3: Applies to residential receptors only.

(a) **Category A: Threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are less than these values.**

(b) **Category B: Threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are the same as Category A values.**

(c) **Category C: Threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are higher than Category A values.**

(d) **19:00 – 23:00 weekdays, 13:00 – 23:00 Saturdays, 07:00 – 23:00 Sundays.**

12.4.14 For the appropriate period (day, evening/weekend, night), the ambient noise level is determined and rounded to the nearest 5 dB. The appropriate Threshold Value is then derived. The construction noise level is then compared with this Threshold Value. If the noise level from the works exceeds the Threshold Value, then there is the potential for a significant effect to occur. However, in line with best practice, this indicator of a potential significant effect is then further considered using professional judgement and accounting for a range of other factors, including:

- The duration of the impact. Based on the guidance in BS 5228-1, construction noise levels above the Threshold Value for less than 10-days (or 10-evenings/weekends or nights) in any 15 consecutive days, or 40-days or less (or 40 evenings/weekends or nights) in any 6-month consecutive period would not normally be considered significant.
- The timing of the impact, e.g. night-time impacts being more likely to be considered significant than daytime impacts.
- The location of the impact at the NSR, for example, an NSR may contain areas which are more or less sensitive than others, e.g. in a school, its office spaces or kitchens would be considered less sensitive than the classrooms.

- The nature, times of use and design of the NSR, e.g. an NSR which is not used at night would not be considered sensitive to night-time construction works.

12.4.15 The assessment of the Kincardine North Substation also used the following guidance documents:

- BS 7445-1:2003 – 'Description and Measurement of Environmental Noise' (Ref 12.11)
- Calculation of Road Traffic Noise' (CRTN) (Ref 12.14)
- Noise Advisory Council (NAC) A guide to measurement and prediction of the Equivalent Continuous Sound Level, L_{eq} (Ref 12.15)
- Design Manual for Road and Bridges (DMRB) LA 111 (Revision 2) 'Noise and Vibration' (Ref 12.16)

12.4.16 The Proposed Development has the potential to affect traffic flows on existing public highways in the area around the Site during construction refer to Chapter 11 Traffic and Transport. This preliminary assessment focuses on the impact at existing NSRs located alongside the existing local road network.

12.4.17 Construction traffic noise has been appraised by considering the increase in traffic flows during the construction works, following the guidance of CRTN, NAC guidance and DMRB, as appropriate.

12.4.18 24-hour Annual Average Daily Traffic (AADT) flow data have been provided for the 'with' and 'without' construction traffic scenarios for the following parameters for each road link in 2026.

- Annual Average Daily Traffic (AADT);
- Percentage HGV; and
- Vehicle speed (km/h).

12.4.19 These AADT flows, which include weekend traffic, have been taken as a proxy for the 18-hour (06:00 – 24:00) Annual Average Weekday Traffic (AAWT) data required by CRTN / NAC guidance. Where links are border line Significant Adverse this implication of this difference will be considered in further detail as appropriate.

12.4.20 Based upon the available traffic data, CRTN Basic Noise Level (BNL) calculations have been undertaken to predict the change in noise level between the 'with' and 'without' the construction traffic the Proposed Development, where flows are greater than 1000 vehicles AAWT, in order to determine if any existing roads are predicted to be subject to a potentially significant change in daily traffic flows.

12.4.21 The Noise Advisory Council (NAC) prediction method detailed in 'A Guide to Measurement and Prediction of the Equivalent Continuous Sound Level Leq' is applicable for prediction of noise levels from low traffic flows. i.e. less than 1000 vehicles AAWT, where CRTN is not valid. This has been used as necessary to supplement the CRTN calculations.

TGN(E)322 – Operational Audible Noise Assessment Process for Overhead Lines

12.4.22 National Grid Electricity Transmission (NGET) has derived a procedure which is followed by Transmission Network Operators, including SP Energy Networks, to assess the impact of OHL noise in both dry and rainy conditions – TGN (E) 322 – Operational Audible Noise Assessment

Process for Overhead Lines. The guidance of BS 4142: 2014 can also be used to assess the impact of the noise from a specific industrial source at NSRs.

12.4.23 The procedure requires that a series of assessments are conducted in tiers. Tier 3 requires that the background noise (BGN) at NSRs within a set distance from Proposed Development be measured during quiet night times and in dry conditions with little wind. The nature of the ground surface around the sensitive receptors is noted so that the contribution to background noise of the surface noise attributable to the rainfall can be derived from empirically derived curves (Miller curves). The logarithmic sum of the measured BGN and the empirically derived contribution for rainfall is adopted as the BGN level, in rainy conditions, against which to compare the predicted received noise from the OHL. Using the parameters provided in TGN(E)322 the likelihood of an Adverse impact can be assessed. At Tier 2, Adverse impacts translate to Low or Medium magnitudes of impact in EIA terms, for Medium sensitivity receptors. For Medium sensitivity receptors this results in Moderate or Minor effects. At Tier 2, if Significant Adverse impacts are realised, this translates to High magnitude of impacts in EIA terms, which are deemed a Significant effect. Any NSR deemed to experience adverse impact (but not Significant) or significant adverse impact shall be assessed in further detail at Tier 3. These terms are explained later in Table 1.5.

12.4.24 The assessment procedure follows TGN(E)322, and has been conducted in the following stages:

- The outcome of the Tier 1 assessment determines whether the 'worst case' wet noise impact is predicted to be acceptable, or whether further assessment is required. The wet noise is assessed to a limit of 34 dB(A) for Medium sensitivity NSRs and 39 dB(A) for Low sensitivity NSRs;
- The outcome of the Tier 2 assessment determines whether the combined wet and dry noise impact is acceptable, or whether further assessment is required. Historical rain data in the region is used to calculate the mean annual wet hours and new criteria for a 'combined' wet and dry noise level. The mean annual wet hours are used to find the percentage of wet weather, which will determine how often wet noise occurs and conversely, the percentage of dry noise. Using the formula for combined wet and dry noise criteria in Appendix D of TGN(E)322, this results in a range for Adverse impacts of 36.6 dB(A) to 46.6 dB(A). Where the combined wet/dry noise falls below 36.6 dB(A), the NSR will be assessed to experience No Adverse impacts and OHL noise is deemed acceptable, and no further action is necessary. Where the combined wet/dry noise is within this range, the NSRs falls into the Adverse impacts category. TGN(E)322 suggests that NSRs in this category should be considered to proceed to Tier 3 given the scale and cost of noise mitigation associated with minimising the noise. If the combined wet/dry noise is above 46.7 dB(A), then the NSR falls into the Significant Adverse impact category and must proceed to Tier 3;
- The outcome of the Tier 3 assessment determines whether the noise impact is acceptable, whether the noise needs to be mitigated and minimised or whether the noise is unacceptable;
- The Tier 3 assessment takes account of existing background sound levels in the area and noise levels due to rainfall;

- At Tier 3, there must be a collection of night-time background noise levels at NSRs, or groups of such NSRs, deemed to have adverse impacts or worse, during suitable dry weather conditions;
- Allowance for the effects of rainfall on BGN (TGN(E)322 considers fog – an atypical condition – to produce lower noise levels than in rain but is still referred to as 'wet noise');
- In Tier 3, a 6 dB tonal penalty is added to the wet noise predicted in Tier 1 to determine a rating level. The excess wet figure is derived by comparing the total noise with penalty (rating) to the background noise level for the appropriate Miller Curve rating at each receptor at a rain rate of 1 mm/hr. Miller curve descriptions are provided in Table 1.1: Miller Curve Description. This rating level is then compared to the background noise level measured which must be adjusted for rainfall.
- A dry noise rating is also determined by adding a tonal penalty of 3 dB to the dry noise level. The excess dry figure is compared to a background noise level in dry conditions.

Table 12.3: 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.

12.4.25 While foggy conditions are associated with a low background noise level, the TGN(E)322 guidance defines noise in these conditions as 'wet noise'. If the Tier 1 or Tier 2 assessment screens out NSRs that are not affected by the wet noise and thus the effects are Negligible, then the NSR does not need an assessment at Tier 3 and the background noise level does not need to be considered. At these NSRs, noise during foggy conditions is also considered to be Negligible.

12.4.26 The excesses and magnitudes of impact are explained in the following section describing BS 4142.

BS 4142:2014+A1:2019: Methods for rating and assessing industrial and commercial sound (BS 4142)

12.4.27 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.

12.4.28 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.

12.4.29 The impact of the sound levels from the Proposed Development on nearby NSRs has been assessed using BS 4142. This standard is widely used for assessing the effect of noise of an industrial nature, including substation noise. BS 4142 describes methods for rating and assessing sound of an industrial and/or commercial nature. The method compares the *rating level* of the sound source under consideration with the *background sound level* in the vicinity of residential locations. The relevant parameters are as follows:

- Ambient sound level, L_a, $L_{Aeq,T}$ dB – defined in BS 4142 as the "equivalent continuous A-weighted sound pressure level of the totally encompassing sound in a given situation at a given time, usually composed of sound from many sources near and far, at the assessment location over a given time interval, T. The ambient sound comprises the residual sound and the specific sound when present";
- Residual sound level, Lr, LAeq,T dB – defined in BS 4142 as the "equivalent continuous A-weighted sound pressure level of the residual sound at the assessment location over a given time interval, T', where the residual sound is the 'ambient sound remaining at the assessment location when the specific sound source is suppressed to such a degree that it does not contribute to the ambient sound";
- Background sound level – LA90,T dB– defined in BS 4142 as the "A-weighted sound pressure level that is exceeded by the residual sound for 90% of a given time interval, T, measured using time weighting F and quoted to the nearest whole number of decibels";
- Specific sound level – Ls (LAeq,Tr) dB – defined in BS 4142 as the "equivalent continuous A-weighted sound pressure level produced by the specific sound source at the assessment location over a given reference time interval, Tr"; and
- Rating level – $L_{Ar,Tr}$ dB – defined in BS 4142 as the "specific sound level plus any adjustment made for the characteristic features of the sound", as follows:
  - Up to 6 dB for tonal characteristics, 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.

- Up to 9 dB 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 3 dB for impulsivity which is just perceptible at the noise receptor, 6 dB where it is clearly perceptible, and 9 dB where it is highly perceptible.
- If intermittency is readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied.
- 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."

12.4.30 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."

12.4.31 Importantly, as indicated above, BS 4142 requires that the rating level of the sound source under assessment be considered in the context of the environment when defining the overall significance of the impact. BS 4142 suggests that in assessing the context, all pertinent factors should be taken into consideration, including the following:

- "The absolute level of sound;
- The character and level of the residual sound compared to the character and level of the specific sound; and
- The sensitivity of the receptor and whether dwellings or other premises used for residential purposes will already incorporate design measures that secure good internal and/or outdoor acoustic conditions."

12.4.32 BS 4142:2014 states that an one hour assessment period is considered during the day and a 15-minute assessment period at night as required.

12.4.33 The guidance documents described above help inform the following assessments:

- TGN(E)322 has been used to assess potential effects of operational noise of the OHLs (see 12.4.22 for the approach)
- BS4142 has been used in Tier 3 assessment of TGN(E)322

BS 8233:2014 'Guidance on sound insulation and noise reduction for Buildings' (Ref 12.13)

12.4.34 BS 8233:2014 provides guidance for the control of noise in and around buildings. It provides design guidance for noise generated inside or outside the building including noise level criteria

and control measures, and a methodology for calculating internal noise levels depending on the performance of the building fabric.

12.4.35 Of relevance to this assessment, for "steady external noise sources" it provides guideline values for internal ambient noise levels within dwellings. These are reproduced in Table 12-4.

Table 12-4 Indoor Ambient Noise Levels for Dwellings

Activity	Location	07:00 to 23:00	23:00 to 07:00
Resting	Living room	35 dB $L_{Aeq,16hr}$	-
Dining	Dining Room	40 dB $L_{Aeq,16hr}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16hr}$	30 dB $L_{Aeq,8hr}$

12.4.36 BS 8233:2014 also provides information on noise rating (NR), which is a graphical method for assigning a single number rating to a noise spectrum, which can be used to specify the maximum acceptable level in each octave band of a frequency spectrum

Method of Baseline Sound Collation

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12.4.37 The monitoring procedure for the baseline survey was conducted at two locations as discussed with the EHO and was undertaken according to BS 7445:2003 'Description and Measurement of Environmental Noise' (Ref 12.11). Sound monitoring equipment was positioned at the measurement locations (MLs) shown in Figure 10.1 to gather a representative free field profile of baseline ambient sound levels at NSRs around the proposed substation over a minimum period of 5 days (including weekend and night) and accompanying weather monitoring.

12.4.38 Long-term measurements have been undertaken in 15 minute logging intervals for parameters LAeq, LA90 and LAmax as minimum over the relevant time period.

12.4.39 Any periods with windspeeds exceeding 5 m/s and periods of rainfall are excluded from the results based on observation while in the region and from public weather data sources.

12.4.40 Baseline conditions are discussed in the section below.

Overhead Line Works (XL/ZCN/ZCS Uprating and Turn-ins)

12.4.41 The field survey consisted of free-field attended spot measurements at the NSR using a class-1 sound level meter. This was necessary to determine the existing noise environment and to obtain BGN levels at the necessary location. This background noise level was used as a baseline for the operational noise impact assessment for dry and wet conditions in a Tier 3 TGN(E)322 Assessment.

12.4.42 Measurements were conducted using Rion NL-52 sound level meters (serial number 01265434) which was spot calibrated with a Rion NC-74 calibrator (serial number 34178103), before and after the measurement campaign. Where the acoustic environment was stable with no transient noise sources, a 10-minute measurement was conducted as this was representative of the location during this period. If transient noise sources (a sudden, short

burst of noise such as passing traffic or animals) were present the measurement was extended to 15-minutes as recommended by BS4142.

12.4.43 Measured parameters include the following:

- LAeq (10-minutes);
- LAeq (10-minutes) one-third octave band spectrum;
- LA90 (10-minutes); and
- LA90 (10-minutes) one-third octave band spectrum.

12.4.44 To determine the BGN a free-field attended spot measurement was conducted at the nearby NSR between 23:00 and 03:00 on the nights of 12 February 2025 and 23 September 2025.

Assessment Methodology

12.4.45 The assessment of operational noise differs between the substation and overhead line components due to the distinct characteristics of their noise emissions. Substation noise, which is analogous to industrial plant, has been assessed using BS 4142. In contrast, OHL noise is governed by corona discharge phenomena and has been assessed using the industry-specific TGN(E)322 methodology. These approaches are not directly comparable; however, both are recognised standards and are appropriate for assessing the respective noise sources. The results are therefore presented separately within this Chapter

Determining Magnitude of Impact

Kincardine North Substation

Construction Noise

12.4.46 The magnitude of the impact of the construction noise is based on the difference between the likely construction noise level at the receptor and the Threshold Value for potentially significant effects derived using the methodology in BS 5228-1:2009 in Table 12-2, as shown in Table 12-5.

Table 12-5 Construction Noise Magnitude of Impact for Residential Receptors

Construction and Demolition Sound Level above Threshold Value (dB)	Magnitude of Impact
Exceedance of ABC Threshold Value by ≥ +5 dB	High
Exceedance of ABC Threshold Value by up to +5 dB	Medium
Equal to or below the ABC Threshold Value by up to -5 dB	Low
Below the ABC Threshold Value by ≥ -5 dB	Very Low

Construction Noise – Daytime Construction Works Traffic on the Public Highways

12.4.47 The Proposed Development has the potential to affect traffic flows on existing roads in the area within and surrounding the Site during construction, as referred to in Volume 1, Chapter 11 Traffic and Transport. This assessment focuses on the impact at existing NSRs located alongside the existing local road network.

12.4.48 Construction traffic noise has been assessed by considering the increase in traffic flows during the construction works, following the guidance of CRTN13 and DMRB15. Where flows of less than 1000 are predicted for both the future baseline and future baseline with development construction traffic the method presented by the Noise Advisory Council (NAC) is used instead as CRTN is not considered appropriate.

12.4.49 18-hour (06:00 – 24:00) Annual Average Weekday Traffic (AAWT) data have been approximated using the 24-hour Annual Average Daily Traffic (AADT) obtained for the construction programme on a monthly basis 'with' and 'without' construction traffic. AADT includes weekends and in over a whereas AAWT does not. Where links are border line Significant Adverse this implication of this difference will be considered in further detail as appropriate.

12.4.50 The predicted level difference between 'with' and 'without' construction traffic scenarios determines if any existing roads are predicted to be subject to a potentially significant change in 18-hour traffic flows. Basic Noise Level (BNL) calculations have been undertaken to predict the change in noise level between the 'with' and 'without' scenarios. The criteria for the assessment of traffic noise changes arising from Proposed Development construction works have been taken from Table 3.17 of DMRB and are provided in Table 12-6.

Table 12-6 Construction Traffic Noise Criteria

Magnitude of Impact	Change in traffic noise level ($L_{A10,18hr}$ dB)
High	≥ 5
Medium	≥3 to <5
Low	≥1 to <3
Very Low	<1

12.4.51 An increase in road traffic flows of 25 % (where the traffic speed and composition remain consistent) equates to an approximate increase in road traffic noise of 1 dB L_A. A doubling of traffic flow would be required for an approximate increase in 3 dB L_A.

12.4.52 It is generally accepted that changes in noise levels of 1 dB L_A or less are imperceptible, and changes of 1 to 3 dB L_A are not widely perceptible. Consequently, at the selected road traffic noise receptors the magnitude of the predicted change in noise levels uses the scale shown in Table 12-6with respect to construction traffic.

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Operational Noise

12.4.53 Table 12-7 illustrates the adopted magnitude of impact scale used in this assessment based upon the numerical level difference. For BS 4142 assessment purposes, for a residential receptor, a significant adverse effect is set at a rating level above the background sound level of +10 dB, while the level at which adverse effect occurs is +5 dB, although the consideration of context (including the absolute level of the sound under consideration) can vary the overall classification of effects.

Table 12-7 Operational Noise Magnitude of Impact for Residential Receptors

Magnitude of Impact	BS 4142 Descriptor	Rating Level – Background Sound Level (dB)
High	No BS 4142 descriptor for this magnitude level	+14/> =15
Medium/High	No BS 4142 descriptor for this magnitude level	+12/+13
Medium	Indication of a significant adverse effect, depending upon context	+9/+10/+11
Low/Medium	No BS 4142 descriptor for this magnitude level	+7/+8
Low	Indication of an adverse effect, depending upon context	+4/+5/+6
Very Low / Low	No BS 4142 descriptor for this magnitude level	+2/+3
Very Low	Indication of low impact, depending upon context	≤ 0/+1

Overhead Line Works (XL/ZCN/ZCS Uprating and Turn-ins)

12.4.54 The magnitude of change has been assessed for operational noise of the OHL. These methods are described below.

12.4.55 The impact of operational noise is approached as a tiered assessment in TGN(E)322.

12.4.56 The outcome of the Tier 1 assessment will determine whether the 'worst case' wet noise impact is predicted to be acceptable, or whether further assessment is required. Predicted free field wet noise levels at the external façade of the NSR are compared against the Tier 1 noise criteria outlined in Table 1.2.

Table 12.8: Operational Noise – Tier 1

Sensitivity and Use	No Adverse Impact - Screened Out	Tier 2 Assessment Required
High - Vulnerable subgroups (such as care homes, pre-schools, hospices)	< 29 dB(A)	> 29 dB(A)

Sensitivity and Use	No Adverse Impact - Screened Out	Tier 2 Assessment Required
Medium – Residential and schools	< 34 dB(A)	> 34 dB(A)
Low – Leisure activity areas, sites of historical importance, industrial or agricultural areas	< 39 dB(A)	> 39 dB(A)

12.4.57 Where the predicted wet noise levels fall into the No Adverse impact category in Table 1.2, the noise from the OHL is not likely to give rise to significant effects in EIA terms. Receptors falling into this category are screened out of further assessment and no further action or assessment is necessary, impact can be considered Negligible and not significant in EIA terms.

12.4.58 A Tier 2 Assessment shall be carried out where predicted Wet Noise levels exceed the No Adverse impact Category. A tier 2 assessment considers the combined dry and wet noise contribution through logarithmic calculation to determine new noise criteria. The combined noise criteria are presented in Table 1.3.

Table 12.9: Operational Noise – Tier 2

Sensitivity and Use	No Adverse Impact	Adverse Impact	Significant Adverse Impact
High - Vulnerable subgroups (such as care homes, pre-schools, hospices)	< 31.6 dB(A)	31.6 - 41.6 dB(A)	> 41.6 dB(A)
Medium – Residential and schools	< 36.6 dB(A)	36.6 - 46.6 dB(A)	> 46.6 dB(A)
Low – Leisure activity areas, sites of histrocial importance, industrial or agricultural areas	< 41.6 dB(A)	41.6 - 51.6 dB(A)	> 51.6 dB(A)

12.4.59 Where the predicted combined wet/dry noise level falls into the No Adverse impact category in a Tier 2 assessment, impacts can be considered Negligible and not significant in EIA terms.

12.4.60 Where the predicted combined wet/dry noise level falls into the Significant Adverse Impact category in a Tier 2 assessment, TGN(E)322 states a Tier 3 assessment will be necessary. Where the predicted noise levels fall into the Adverse impact category at Tier 2, mitigation

should be considered or also considered to proceed to Tier 3. These may result in a Significant effect in EIA terms so to maintain a robust assessment, these NSRs are also taken forward to Tier 3.

12.4.61 The outcome of the Tier 3 assessment will determine whether the noise impact is acceptable and Not Significant in EIA terms, whether the noise needs to be mitigated and minimised or whether the noise is unacceptable (Significant in EIA terms). The Tier 3 assessment takes account of existing background sound levels in the area and noise levels due to rainfall. The Tier 3 Assessment requires the impact of Dry Noise and Wet Noise to be assessed separately using two different methods which are based on the principles of BS41425. The two methods differ in that the Dry Noise assessment requires the determination of the existing baseline sound level, whilst for the Wet Noise assessment, it is necessary to predict the increase in background sound levels due to rainfall.

12.4.62 The magnitude of a predicted noise 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 can be quantitative using standards such as BS 4142, which is determined by the outcome of a TGN(E)322 Tier 3 assessment. As reported in the table below, the impact magnitude is worked out on a case-by-case basis for each NSR and classified as Negligible, Low, Medium, or High.

12.4.63 Information from the rating level, the background sound level, and the stated impacts from a BS4142 assessment have been converted into representative impact magnitudes, detailed in Table 1.4.

Table 12.10: BS4142 Impact Magnitude in the Context of TGN(E)322

Impact Magnitude	Definition	Tier 1 Criteria for Magnitude of Impact	Tier 2 Criteria for Magnitude of Impact	TGN(E)322 Tier 3 Criteria for Magnitude of Impact (Difference between OHL Rating Noise Level and Background Sound Level)
Negligible	Impact to the receptor is immeasurable, undetectable or within the range of normal natural background variation.	<34 dBA wet noise	<36.6 dBA combined wet and dry noise	Low Impact ≤ 0 dB
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	>34 dBA, further assessment required at Tier 2	>36.6 dBA, further assessment required at Tier 3	Minor Impact 0 to 4 dB

Impact Magnitude	Definition	Tier 1 Criteria for Magnitude of Impact	Tier 2 Criteria for Magnitude of Impact	TGN(E)322 Tier 3 Criteria for Magnitude of Impact (Difference between OHL Rating Noise Level and Background Sound Level)
	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			
Medium	A difference of around +5 dB is likely to be an indication of an **Adverse** impact, depending on the context.			**Adverse** Impact 5 to 9 dB
High	A difference of around +10 dB or more is likely to be an indication of a **Significant Adverse** impact, depending on the context.			**Significant Adverse** impact ≥ 10 dB

Determining Sensitivity of Receptors and Significance of Effect

12.4.64 Receptor sensitivity has been defined separately for the substation and OHL assessments due to the use of different technical guidance documents. The substation assessment applies sensitivity criteria based on Technical Advice Note (TAN), while the OHL assessment adopts the sensitivity classifications defined within TGN(E)322. Whilst similar terminology is used (e.g. High, Medium, Low), the definitions are not directly equivalent. Sensitivity classifications are therefore applied and interpreted within the context of each assessment methodology.

12.4.65 Consideration of context forms an important part of both assessment approaches. For the substation, context is explicitly incorporated within the application of BS 4142 when determining the significance of effects. For OHL noise, context is inherently considered within the TGN(E)322 methodology, including factors such as weather conditions and background noise variation. These differences reflect the methodologies applied but do not affect the robustness of the assessment.

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12.4.66 The following subsections set out how the significance of effect is determined by combining magnitude of impact and receptor sensitivity.

12.4.67 Receptor sensitivity in this assessment has been assigned based on the example definitions provided in Technical Advice Note Table 2,1 (2011) (Ref 12.5) see Table 10-7 below.

Table 12-11 Sensitivity/Value of Receptors

Sensitivity / value of resource / receptor	Description	Examples of receptor usage
Very High	Receptors where noise or vibration will significantly affect the function of a receptor.	Auditoria/studios; Specialist medical/teaching centres, or laboratories with highly sensitive equipment.
High	Receptors where people or operations are particularly susceptible to noise or vibration. Sensitive ecological receptors known to be vulnerable to the effects of noise or vibration.	Residential; Quiet outdoor areas used for recreation; Conference facilities; Schools/educational facilities in the daytime; Hospitals/residential care homes; Libraries.
Medium	Receptors moderately sensitive to noise or vibration where it may cause some distraction or disturbance	Offices; Restaurants/retail; Sports grounds when spectator or noise is not a normal part of the event and where quiet conditions are necessary (e.g. tennis, golf).
Low	Receptors where distraction or disturbance of people from noise or vibration is minimal	Residences and other buildings not occupied during working hours; Factories and working environments with existing high noise levels; Sports grounds when spectator noise is a normal part of the event.

12.4.68 Non-residential receptors are not considered here as none were identified as being potentially affected by construction or operational phases of the Proposed Development.

- The following terminology has been used in the assessment to define noise effects:
- Adverse - detrimental or negative effects to an environmental resource or receptor;

- Neutral - effects to an environmental resource or receptor that are neither adverse nor beneficial; or
- Beneficial - advantageous or positive effect to an environmental resource or receptor.

12.4.69 The effect resulting from each individual potential impact type above has been classified according to the magnitude of the impact and the sensitivity or value of the affected receptor using the matrix presented in Table 10-8 but where necessary also considering the context of the acoustic environment.

Table 12-12 Classification of Effects

Sensitivity/ value of resource/ receptor	Magnitude of Impact			
	High	Medium	Low	Very Low
Very High	Major	Major	Moderate	Minor
High	Major	Moderate	Minor	Negligible
Medium	Moderate	Minor	Negligible	Negligible
Low	Minor	Negligible	Negligible	Negligible

12.4.70 Where adverse or beneficial effects have been identified, these have been assessed against the following significance scale, derived using the matrix presented in Table 10-8:

- Negligible – imperceptible effect of no significant consequence;
- Minor – slight, very short or highly localised effect of no significant consequence;
- Moderate – limited effect (by extent, duration or magnitude), which may be considered significant; or
- Major – considerable effect (by extent, duration or magnitude) of more than local significance or in breach of recognised acceptability, legislation, policy or standards.

12.4.71 For the purposes of this assessment, Negligible and Minor effects are considered to be Not Significant, whereas Moderate and Major effects are considered to be Significant.

Overhead Line Works (XL/ZCN/ZCS Uprating and Turn-ins)

12.4.72 For the purpose of this noise assessment, the free field wet noise level is predicted at the external façade of the NSRs. Locations from the AddressBase dataset are at the centre of buildings, this location is used to calculate distance to the Proposed Development, however 10 m is also subtracted to account for the size of the building. In the case of a borderline result from the noise assessment, the distance is manually reviewed to ensure the distance to the edge of the building is used. The method is conservative as does not consider the noise reduction (façade break-in) from passing through building walls and windows; this represents the case if an external amenity is used or if doors / windows are open. This chapter focuses primarily on the impacts to residential properties as all receptors are Medium with the exception of NSR 25 Tillicoultry Quarries which is of Low sensitivity as a commercial property. Receptors that are classed as Low sensitivity include non-residential properties such as

leisure activity areas, sites of historical importance, industrial or agricultural areas. The size of external amenity is not considered.

12.4.73 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 effect significance can be derived by applying a calculation matrix.

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

12.4.75 The predicted significance of the effect was determined through a standard method of assessment based on the TGN(E)322 methodology, considering both sensitivity and magnitude of change as detailed in Table 12.13 below. In a TGN(E)322 OHL assessment, **Major** effects only are considered **Significant**. This differs to the substation methodology as it is assessed separately in line with the relevant methodology. The Combined Effects assessment is qualitative.

Table 12.13: Matrix for Determination of Significance of Effects

		Sensitivity of NSR			
		High	Medium	Low	Negligible
Magnitude of Change	High	Major	Major	Moderate	Minor
	Medium	Major	Moderate	Minor	Negligible
	Low	Moderate	Minor	Minor	Negligible
	Negligible	Minor	Negligible	Negligible	Negligible

Limitations and Assumption

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12.4.76 The following sources of information that define the Proposed Development have been reviewed and form the basis of the assessment of likely significant noise and vibration effects:

- Baseline sound monitoring survey data
- Indicative construction plant and equipment (Chapter 4 Project Description)
- 24 hour AADT has been used to represent the 18 hour AAWT flows for calculating a BNL from each road link used by construction traffic on the public highway network. It is expected that this assumption will still provide a robust appraisal of potential effects;
- Indicative concept layout plans for the Proposed Development
- Items of plant including sound power level data for the Proposed Development. This has been supplemented with a representative transformer frequency spectrum data
- Ordnance Survey (OS) mapping of the Proposed Development and surrounding area; and
- Topographical data (Light Detection and Ranging (LIDAR) data) and aerial photography

12.4.77 To evaluate noise effects during the construction phases it is necessary to have knowledge of the variables listed above. Construction Contractors may use different working methods and plant to achieve the same ends. Therefore, a qualitative assessment has been undertaken based on available information.

12.4.78 In order to ensure a robust assessment of the likely significance of the environmental effects of the Proposed Development, the work has been undertaken adopting reasonable worst-case assumptions, where necessary.

12.4.79 The following assumptions have been made for the Proposed Development operational stage:

- The proposed substation site has been modelled as a hard standing with point sources representing the proposed transformers.
- The operational noise model has assumed that the Proposed Development will operate continuously at full load, 24 hours a day to present a worst-case assessment.
- It has been assumed that potential operational sound of a tonal, impulsive or intermittent nature will be designed out of the Proposed Development during the detailed design phase by the selection of appropriate plant, building cladding, louvres and silencers/attenuators as necessary. However, a +3 dB character correction for other distinctive sound has been included at NSRs where this potential exists above the background sound level.

12.4.80 The following limitations have been identified:

- Baseline sound surveys were carried out continuously over 5 days which is considered to be an adequate time span to obtain representative baseline data, although some variation can occur in both ambient activities and prevailing weather beyond this period, possibly due to atypical conditions. Weather conditions during the surveys were fair and suitable for environmental surveys. During periods of wind with speeds outside of the suitable range, or during precipitation, data have been excluded from the data used for the assessment. Therefore, environmental survey uncertainties raising the potential background sound level and informing the operational sound assessment have been reduced to a minimum or removed and are not considered significant.

Overhead Line Works (XL/ZCN/ZCS Uprating and Turn-ins)

12.4.81 The following assumptions have been made when undertaking the assessment of effects:

- There will be periods just after rainfall or during foggy conditions where there is some noise emission from the OHL, although these levels are less than those during rain according to TGN(E)322. Noise generated under these circumstances is referred to as ‘wet noise’. These post-precipitation periods where background noise is less than those during periods of rainfall are not accounted for in the assessment as there is no standardised methodology or procedure. The number of droplets, and hence the noise level, will depend primarily on the rate of rainfall. Historical studies determined that hum inception typically occurs at a rainfall rate of approximately 1 mm/hr. Hum inception is the point at which during rainfall the low-frequency humming component of corona discharge noise becomes noticeable. This hum induces a tonal component of the noise, which is represented by a 6 dB tonal penalty at Tier 3 of a TGN(E)322 assessment.
- Assumptions include a flat terrain between OHL centreline and NSR, an uncertainty distance of 10 m has been included when determining distance from source to receiver. In Tier 1 and 2 of the TGN(E)322 assessment, acoustic absorption due to the ground is included to ensure accurate propagation of noise in the environment. The calculation for OHL conductor noise uses the Electric Power Research Institute (EPRI) (Ref 12.18) method of calculation which assumes a moderately aged conductor, which is

appropriate for the assessment of the Proposed Development for the lifetime of its operation.

- The assessments are based on information available at the time of publication such as the tower locations, tower designs, alignment, and conductor choice. It is a worst-case scenario assessment.
- The perception and impact of noise is subjective. However, the standard methodologies aim to assess noise objectively. 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 from noise.
- Different tower types can produce varying noise levels. As a worst-case, the noisiest tower type has been assumed for the route, this is the L2 D60 M12. Any NSRs predicted to experience significant effects will be reassessed within this Chapter for the actual tower type is it closest to.
- Two scenarios are assessed in this Chapter. The first is where the noise is assessed as if the OHL routes are as designed. The second is where the noise is assessed as if the towers proposed are moved a maximum of 50 m from the existing location, representing the Limit of Deviation set out in Chapter 4. They are assessed as if they move 50 m closer to the NSR in question.

12.5 Baseline

12.5.1 Baseline noise conditions have been established using different survey approaches for the substation and OHL assessments, reflecting the differing requirements of the applied methodologies. Long-term unattended measurements have been undertaken for the substation assessment to inform BS 4142 analysis, whereas attended short-term measurements have been undertaken for the OHL assessment in accordance with TGN(E)322 requirements. These approaches are considered appropriate for the respective assessments.

Kincardine North Substation

Baseline Sound Levels

12.5.2 The Proposed Development is located within the Fife Council area with a small part of the northwest located in Clackmannanshire. The Site is located approximately 1km north of Kincardine town centre. The Development Site is bordered to the east by the A977 and bordered to the west by the A876. These roads connect and border the Site to the north. The Site is additionally bordered by farmland.

12.5.3 The acoustic environment at the Measurement Locations (MLs) and NSRs is consistent with a rural area that is remote and generally free from continuous road traffic, commercial or industrial related sounds. The dominant sound source noted during measurements was birdsong but road noise, wind blowing through trees, and the nearby watercourse also contributed to the soundscape.

12.5.4 ML1 is adjacent to the A977, approximately 30m away and therefore experiences greater contribution from road traffic, but movements on this road are not continuous and at night would be infrequent and sporadic at most. ML1 is representative of NSR1KINN and NSR2KINN. ML2 is located approximately 380m from A977 and 140m from the A876, ML2

experiences distant road noise but the soundscape is predominantly made up of bird noise and wind blowing through trees. ML2 is representative of NSR3KINN.

12.5.5 Unattended baseline monitoring was undertaken at Measurement Locations representative of noise sensitive receptors over five days 1st to 5th August 2024 to establish the contributing sources and allow the ambient and *background sound levels* to be determined. Figure 10.1 shows the NSRs represented by the monitoring locations. The results are presented in detail in Appendix 12.4 and are summarised in Table 12-14 below.

Table 12-14 Summary of measured sound levels at monitoring locations

	Daytime				Evening				Night-time			
Monitoring Location	$L_{Aeq,T}$	L_{AFmax}	L_{A90} Mode	L_{A90} Mean	$L_{Aeq,T}$	L_{AFmax}	L_{A90} Mode	L_{A90} Mean	$L_{Aeq,T}$	L_{AFmax}	L_{A90} Mode	L_{A90} Mean
ML1 (NSR1KINN & NSR 2KINN))	51	85	45	44	46	75	38	40	44	78	32	33
ML2 (NSR3KINN)	49	84	46	45	44	70	41	39	41	73	34	33

Future Baseline

12.5.6 In considering the future baseline for the assessment area, no significant changes in road traffic flows are anticipated, and as such, road traffic noise levels are expected to remain broadly consistent with current conditions. However, it is recognised that there are other energy developments currently at the planning stage within the wider area. Should these schemes progress, they have the potential to influence the existing rural sound climate, both during construction and operation.

Overhead Line Works (XL/ZCN/ZCS Uprating and Turn-ins)

12.5.7 Only NSRs that proceed to Tier 3 are required for a baseline noise survey. The operational noise impact assessment in Section 1.7 and Technical Appendix 122.7 OHL Operational Noise Impact Assessment shows that measurements were required at eight NSRs of the 104 assessed.

12.5.8 In general, the BGN data is relatively low at night with slight noise from distant traffic. The results of baseline noise survey show that NSR 37 Starton House and NSR 57 Kennels Dollarbeg have a noise environment quantified around 31.0 dB(A) and 25.2 dB(A) LA90 respectively during night periods.

12.5.9 This background noise data has been used in the TGN(E)322 Tier 3 operational noise impact assessment Section 12.7.

Future Baseline in the Absence of the Proposed Development

12.5.10 It is not expected that there will be a significant change to future baseline noise levels than those measured in this study (in absence of the Proposed Development).

Issues Scoped Out of Further Assessment

12.5.11 The assessment of operational traffic on local road network has been scoped out due to limited operational traffic movements.

12.6 Embedded Mitigation

Kincardine North Substation

Construction

12.6.1 Measures to mitigate noise and vibration would be implemented during the Proposed Development construction phase to minimise impacts at NSRs such as local residential receptors and ecological receptors, particularly with respect to activities required outside of normal working hours.

12.6.2 Mitigation included in the construction environmental management plan (CEMP) includes the following noise mitigation measures to reduce construction noise impacts to as low as practicable. As a minimum the Contractor will follow best practice and guidance in BS 5228-1 with regard to mitigation of noise during construction.

- Proposed construction working hours, as stated in Chapter 4, should be adhered to i.e. 07:00-19:00 weekdays and 08:00-17:00 Saturdays with no working on Sundays or Bank Holidays (including site deliveries);
- Fixed and semi-fixed ancillary plant required during construction such as generators, compressors and pumps should be located away from the northern and eastern boundaries;
- All plant used on site should be regularly maintained, paying particular attention to the integrity of silencers and acoustic enclosures;
- All equipment should be shut down when not in use;
- The loading and unloading of materials should take place away from NSRs, ideally in locations which are acoustically screened from nearby NSRs;
- Materials should be handled with care and placed rather than dropped where possible. Drop heights of materials from lorries and other plant should be kept to a minimum;
- Modern plant should be selected which complies with the latest EC noise emission requirements. Electrical plant items (as opposed to diesel powered plant items) should be used wherever practicable. All major compressors should be low noise models fitted with properly lined and sealed acoustic covers. All ancillary pneumatic percussive tools would be fitted with mufflers or silencers of the type recommended by the manufacturers;
- Site operations and vehicle routes should be organised to minimise the need for reversing movements, and to take advantage of any natural acoustic screening present in the surrounding topography;
- Prior to any piling works being undertaken, an assessment of piling techniques would be undertaken to ensure the least disturbing techniques are used as far as possible and identify any additional noise mitigation requires. A piling method statement would be provided to Fife and Clackmannanshire Council prior to commencement of piling works. Any piling works would be restricted to day-time hours only.
- No employees, subcontractors and persons employed on the site should cause unnecessary noise from their activities e.g. excessive 'revving' of vehicle engines, music from radios, shouting and general behaviour etc. All staff inductions at the site should

include information on minimising noise and reminding them to be considerate of the nearby residents;

- As far as practicable, noisier activities should be planned to take place during periods of the day which are generally considered to be less noise sensitive i.e. not particularly early or late in the day; and
- Measures should be put in place to ensure that employees know that minimisation of noise will be important at the site.

12.6.3 A final CEMP would be prepared prior to works commencing once specialist sub-contractors have been appointed and detailed information on the proposed methods are known and the mitigation measures will be confirmed to ensure the construction noise thresholds are not exceeded.

12.6.4 Regular communication with the local community throughout the construction period would also serve to publicise the works schedule, giving notification to residents regarding periods when higher levels of noise may occur during specific operations e.g. piling operations, and providing lines of communication where complaints can be addressed. A communication plan would be included in the Final CEMP.

12.6.5 The appointed Principal Contractor should be a member of the 'Considerate Constructors Scheme' and as a minimum they will have to follow the above best practice and guidance in BS 5228-1 (Ref 12.9).

12.6.6 Based on the information provided in BS 5228-1 (Ref 12.9) Table B.1 it is likely that the embedded measures can provide up 5 to 10 dB of further reductions of construction noise levels at sensitive receptors.

Operation

- The substation is located at least ~300m from residential receptors which significantly reduces noise levels via distance attenuation. Power transformers and Shunt Reactors will be operated in accordance with the limits provided as follows:
- Power Transformers and cooling equipment will emit a maximum sound power level that shall not exceed 87 dB LWA measured in accordance with IEC 60076-10 at rated voltage.
- Earthing / Auxiliary Transformers will emit a maximum sound power level that shall not exceed 70 dB LWA measured in accordance with IEC 60076-10 at rated voltage.
- Shunt Reactors will emit a maximum sound power level that shall not exceed 83 dB LWA per three-phase set measured in accordance with IEC 60076-10 at rated voltage.

12.6.7 The sound associated with the maintenance of the substation will be lower than the operational sound, therefore have not been assessed further in this chapter.

Overhead Line Works (XL/ZCN/ZCS Uprating and Turn-ins)

12.6.8 Towers XL31 to XL34 plus mid-span of the XL Route is strung with Triple Upas conductor which is a continuation of the route in the neighbouring license boundary. This is a lower-noise conductor compared to the Twin Matthew Gap. This was selected at design phase to minimise noise at nearby receptors and continue with the conductor from the neighbouring license boundary at Blairingone.

12.6.9 Should reconductoring be required, SPT is committed to using low noise conductors between towers XL12 and XL20 to address likely significant effects from noise to the NSRs in the property immediately east of tower XL17 when operating at 400kV. The precise conductor to be used would be subject to SPT procurement. SPT is also discussing the option of property purchase with the owner, the successful conclusion of which would mean the use of Twin Matthew Gap conductor for these spans, consistent with the majority of the overhead line.

12.7 Assessment of Effects

Kincardine North Substation

Construction Phase

12.7.1 Construction work of any type that involves heavy plant activity will generate noise, which may result in complaints if appropriate scheduling and control of works is not exercised. Noise levels generated by construction activities and experienced by NSRs, depends upon a number of variables, the most significant of which are:

- The level of noise generated by plant or equipment used on-site, generally expressed as the sound power level;
- The periods of operation of the plant on the Site, known as its 'on-time';
- The distance between the noise source and the NSR; and,
- The attenuation of sound due to ground absorption, air absorption and barrier/screening effects.

12.7.2 Construction works will involve initial earthworks to level out the site, construction (including piling) of the new infrastructure (foundations, roads and drainage), installation of the new electrical plant and landscaping works.

12.7.3 The initial earthworks stage, which is expected to involve the use of excavators and dump trucks, is likely to generate the highest noise levels. Based on AECOM's experience of similar projects, the remainder of the works are expected to generate lower noise levels. Depending on the piling type adopted by the construction contractor, this activity may also generate relatively high noise levels.

12.7.4 For residential NSRs the 'ABC' method (detailed in BS 522801 Section E.3.2) sets construction noise thresholds for residential NSRs for different time periods (e.g. day, evening, night and weekends) based on the existing ambient sound levels as set out in Table 12-2. The predicted construction noise levels are then compared to these construction noise threshold values to indicate whether a potentially significant effect is likely to occur at residential NSRs.

12.7.5 The measured baseline ambient sound levels have been used to determine indicative BS 5228-1 'ABC' noise threshold categories. NSR1, NSR2 and NSR3 considered in this assessment fall within ABC Category A for all time periods. On this basis the applicable Threshold Values for the construction noise assessment at all receptors are:

- 65 dB L_{Aeq} 07:00 and 19:00 Monday to Friday and Saturdays 07:00 – 13:00;
- 55 dB L_{Aeq} 19:00 – 23:00 weekdays, 13:00 – 23:00 Saturdays and 07:00 – 23:00 Sundays; and
- 45 dB L_{Aeq} at all other times.

12.7.6 The closest properties (NSR1 and NSR2) to the proposed works are around 300 m from the Site boundary. At this distance it is considered likely that implementation of the standard construction mitigation measures outlined above would sufficiently control impacts such that the Threshold Values are unlikely to be exceeded for the vast majority of the works. If exceedances do occur, these are likely to be of short duration associated with specific activities during the working day (i.e. very unlikely to have continuous loud construction noise for the full working day) such that effects would not be significant. NSR3 is located further away, approximately 950m northwest of the Site boundary, therefore the construction noise levels at this receptor would be lower due to distance attenuation. As the piling methods have not yet been confirmed, initial predictions have been undertaken for a worst case scenario of impact piling (hammer-driven piling). At the closest NSR (approx. 280 m) the predicted levels are below the daytime construction threshold values.

12.7.7 As the construction threshold values would not be exceeded, except in isolated instances, with reference to Table 12-5, the magnitude of impact is Low which for a high sensitivity receptor is classed as Minor Adverse effect which is Not Significant in EIA terms.

Construction Traffic on the Public Network

12.7.8 The potential changes in road traffic noise during the construction phase of the Proposed Development have been considered.

12.7.9 In Table 10-9 the change in Basic Noise Level (BNL) is determined for the peak construction year (2026) as worst case.

Table 12-15 BS 4142 Predicted change in road traffic noise during construction

Road Link	2026 Baseline				2026 Baseline + Construction Traffic				Change in BNL, dB	Magnitude of impact
	AADT flow	% HGV	Speed (km/m)	Predicted BNL dB,	*AADT flow*	% HGV	Speed (km/m)	Predicted BNL dB,		
A977 north	7,434	10	97	71.8	7,662	11	97	72.2	0.4	Very Low
A907 west	15,334	5	64	**71.2**	15,562	6	64	71.5	0.3	Very Low
A907 east	2,440	8	97	66.5	2,668	13	97	67.7	1.2	Low
A977 Kilbagie Roundabout	22,958	9	97	76.5	23,186	9	97	76.6	0.1	Very Low
A977 Kilbagie	4,608	2	58	64.5	4,836	5	58	65.6	1.1	Low
A977 Feregait	4,730	2	57	64.6	4,730	2	57	64.6	0.0	No Change
Substation Access Road	347	2	44	51.7	575	29	44	55.1	3.4	Medium
C68 Hawkhill Road	270	2	43	51.4	498	33	43	54.6	3.2	Medium
A876	19,737	7	97	75.5	19,965	7	97	75.7	0.2	Very Low
Clackmannanshire Bridge	19,836	7	97	75.6	20,064	7	97	75.7	0.2	Very Low

Road Link	2026 Baseline				2026 Baseline + Construction Traffic				Change in BNL, dB	Magnitude of impact
	AADT flow	% HGV	Speed (km/m)	Predicted BNL dB,	*AADT flow*	% HGV	Speed (km/m)	Predicted BNL dB,		
A876 S Approach Road	32,306	6	113	78.8	32,534	6	113	78.9	0.1	Very Low
Kincardine Bridge	11,841	7	48	69.1	12,069	8	48	69.5	0.4	Very Low
A985 west	9,447	6	97	72.2	9,675	8	97	72.6	0.4	Very Low
A985 east	11,336	13	97	74.1	11,564	15	97	74.4	0.2	Very Low

12.7.10 The assessment of the predicted change in road traffic noise levels due the addition of construction traffic highlights a medium magnitude of impact, resulting in a Moderate adverse effect on Substation Access Road and C68 Hawkhill Road. All other roads in the vicinity of the site are predicted to experience a no change to Low magnitude of impact, resulting in Negligible to Minor adverse effects (Not Significant) at nearby NSRs.

12.7.11 There is only one NSR along the Substation Access Road and C68 Hawkhill Road, Hawkhill Farm, which is owned by SPT. The property will be kept vacant during the construction works.

Operational Phase

12.7.12 The operational phase of the Proposed Development has the potential to produce audible sound beyond the site boundary.

12.7.13 The key noise generating items of substation plant that are assessed are:

- 2 x power transformer with cooler unit (adjacent fans and pumps)
- 2x earthing / auxiliary transformers
- 2x shunt reactors
- 1x standby diesel generator (emergency use only and automatic self-test at pre-determined times.)

12.7.14 Details of the model setup, sound power levels and spectrum used in the predictions are provided in Appendix 12.5.

BS 4142 Assessment

12.7.15 To undertake the BS 4142 assessment the specific sound levels, rating level and background sound level are required at each assessment location.

12.7.16 The assessment is based on the difference between the representative background sound level and the predicted rating level, $L_{Ar,Tr}$ dB (i.e. the specific sound level $L_{Aeq,Tr}$ plus any character correction) at the NSR. Positive differences indicate an excess of the rating level over the background sound level.

12.7.17 A model of the substation and surroundings has been developed in CadnaA MR1 2024 sound mapping software which calculates predictions in accordance with ISO 9613-2 (Ref 12.12). The model has been used to predict the Proposed Development's sound emissions from the substation at the NSRs identified in Table 12-1. Sound power/pressure levels have been provided by SP Transmission and these have been used to represent the plant. Further details on the source data and prediction methodology are provided in Appendix 12.3 and Appendix 12.5.

12.7.18 The substation sound is present 24 hours a day with little variation; hence no correction has been applied for on-time. As stated in the assumptions and limitations section, it has been assumed that potential operational sound of a tonal, impulsive or intermittent nature will be designed out of the Proposed Development during the detailed design phase by the selection of appropriate plant, building cladding, louvres and silencers/attenuators as necessary. The specific sound would likely be distinctively different to the background sound so a +3 dB correction has been included where the specific sound is greater than the background sound level. A comparison of specific sound level, rating level and maximum background sound level is provided in Table 12-16 and Table 12-17.

12.7.19 Results are provided for typical operation (without generator) and emergency (with generator) operation. The noise propagation model results showed that operational noise levels would be highest at NSR1 without the generator running and at NSR2 with the generator. These locations are provided in Table 10-11.

Table 12-16 BS 4142 Daytime BS 4142 Assessment Results

Receptor	*Specific sound level* $L_{Aeq,15min}$ (dB)	Rating Correction (dB)	*Rating level* $L_{Ar,15min}$ (dB)	Daytime *background sound level* $L_{A90.1hour}$ (dB)	Daytime exceedance	BS 4142:2014 Descriptor	Magnitude of Impact
NSR1KINN – Ground floor (typical operation)	17	0	17	43	-26	Indication of low impact, depending upon context	Very low
NSR1KINN – First floor (typical operation)	19	0	22	43	-24	Indication of low impact, depending upon context	Very low
NSR1KINN – Ground floor (emergency operation)	37	0	37	43	-6	Indication of low impact, depending upon context	Very low
NSR1KINN – First floor (emergency operation)	39	0	39	43	-4	Indication of low impact, depending upon context	Very low
NSR2KINN – Ground floor (typical operation)	17	0	17	43	-26	Indication of low impact, depending upon context	Very low
NSR2KINN – First floor (typical operation)	19	0	19	43	-24	Indication of low impact, depending upon context	Very low

Receptor	*Specific sound level* $L_{Aeq,15min}$ (dB)	Rating Correction (dB)	*Rating level* $L_{Ar,15min}$ (dB)	Daytime *background sound level* $L_{A90.1hour}$ (dB)	Daytime exceedance	BS 4142:2014 Descriptor	Magnitude of Impact
NSR2KINN – Ground floor (emergency operation)	37	0	37	43	-6	Indication of low impact, depending upon context	Very low
NSR2KINN – First floor (emergency operation)	40	0	40	43	-4	Indication of low impact, depending upon context	Very low
NSR3KINN – Ground floor (typical operation)	8	0	8	44	-36	Indication of low impact, depending upon context	Very low
NSR3KINN – First floor (typical operation)	11	0	11	44	-33	Indication of low impact, depending upon context	Very low
NSR3KINN – Ground floor (emergency operation)	31	0	31	44	-13	Indication of low impact, depending upon context	Very low
NSR3KINN – First floor (emergency operation)	34	0	34	44	-10	Indication of low impact, depending upon context	Very low

Table 12-17 BS 4142 Night-time BS 4142 Assessment Results

Receptor	*Specific sound level* $L_{Aeq,15min}$ (dB)	Rating Correction	*Rating level* $L_{Ar,15min}$ (dB)	Night-time *background sound level* $L_{A90.15min}$ (dB)	Night-time exceedance	BS 4142 Descriptor	Magnitude of Impact
NSR1 KINN – First floor (typical operation)	19	0	19	27	-8	Indication of low impact, depending upon context	Very low
NSR1 KINN – First floor (emergency operation)	39	3	42	27	+15	Indication of a significant adverse effect, depending upon context	High
NSR2 KINN – First floor (typical operation)	19	0	19	27	-8	Indication of low impact, depending upon context	Very low
NSR2 KINN – First floor (emergency operation)	40	3	43	27	+16	Indication of a significant adverse effect, depending upon context	High
NSR3 KINN – First floor (typical operation)	11	0	11	28	-17	Indication of low impact, depending upon context	Very low
NSR3 KINN – First floor (emergency operation)	34	3	37	28	+9	Indication of an adverse effect, depending upon context	Medium

12.7.20 The values presented in Table 10 11 and Table 10 12 produce a very low magnitude of impact at all NSRs assessed during both the daytime and night-time during typical operation. This would result in Negligible (Not Significant) effects.

12.7.21 However, exceedances of the criteria of a rating level that is no more than +5 dB over the background sound level, occur during emergency operation, due to the standby generator during the night-time period at NSRs 1KINN, 2KINN and 3KINN. The magnitude of impact at NSRs 1KINN and 2KINN at the first floor during the night-time period is High, this would result in Major (Significant) effects, subject to consideration of context. The magnitude of impact at NSR 3KINN at the first floor during the night-time period is Medium, this would result in Moderate (Significant) effects, subject to consideration of context.

Consideration of Context

12.7.22 Potential significant adverse effects are predicted when the standby generator is in use, however, there should only be exceedances during an emergency and an allowance may be made by the Local Authority for this context. For night-time noise sources BS 8233 recommends a night-time (23:00-07:00) 8-hour sound level of 30 dB LAeq inside bedrooms (for reasonably steady sound source) to avoid sleep disturbance (See Table 10.11). Assuming an open window provides 15 dB attenuation, the internal sound level of 30 dB inside bedrooms is achieved at NSRs 1, 2 and 3 when the emergency generator is in use.

12.7.23 Furthermore, with respect to the Local Authority's response regarding noise rating curve criteria in Section 10.3 Consultation Undertaken to Date, the predicted specific sound levels at NSRs in octave bands has been used to determine compliance with the stated NR 35 when measured in the amenity space of the houses nearby and NR 25 within the bedroom.

12.7.24 In the daytime, amenity space predicted levels are below the NR 35 curve in all octave bands for both the typical and emergency operation scenarios. In the night-time, predicted levels in the bedroom are below the NR 25 curve in all octave bands for both the typical and emergency operation scenarios. This is based on a partially opened window and a representative façade building envelope. Predicted internal NR values for typical and emergency operation scenarios are provided in Appendix 12.6.

12.7.25 Where possible, mitigation should be used to minimise the sound emissions from the standby generator (see Section 10.7 for further details).

12.7.26 Taking into account the context of the temporary occasional use of the standby generator and potential mitigation options, the operation of the Proposed Development with the standby generator is not likely to result in significant adverse effects at the nearest NSRs.

Overhead Line Works (XL/ZCN/ZCS Uprating and Turn-ins) and SPD Works

Construction Phase

12.7.27 As stated above for Kincardine North Substation, construction work of any type that involves heavy plant activity will generate noise, which may result in complaints if appropriate scheduling and control of works is not exercised.

12.7.28 Construction works for the overhead line works will involve the removal of existing overhead lines and associated wooden poles and replacement with an underground cabling. The majority of the underground cables will be installed by open cut trenching, however trenchless methods such as Horizontal Directional Drilling (HDD) will be used to cross an unmanned watercourse at the entrance to the KINN site.

12.7.29 The pole removal works will be short-term, using mobile crane and excavator. The main plant for the open cut trenching will be excavators, moving along the cable route.

12.7.30 The same construction noise thresholds for residential NSRs using the 'ABC' method (detailed in BS 522801 Section E.3.2) which are detailed above in paragraphs 12.7.4 and 12.7.5 apply for construction works associated with the overhead line works.

12.7.31 The closest properties (NSR1KINN and NSR2KINN) to the proposed works are over 500 m from the closest pole removal and trenching. At this distance it is considered likely that implementation of the standard construction mitigation measures outlined above would sufficiently control impacts such that the Threshold Values are unlikely to be exceeded for the works. If exceedances do occur, these are likely to be of short duration associated with specific activities during the working day (i.e. very unlikely to have continuous loud construction noise for the full working day) such that effects would not be significant. NSR3 is located further away, over 750m northwest of the closest pole removal and over 1km from the trenchless crossing, therefore the construction noise levels at this receptor would be lower due to distance attenuation.

12.7.32 Assuming that the Construction threshold values are not exceeded, with reference to Table 12-5 the magnitude of impact is Low which for a high sensitivity receptor is classed as Minor Adverse effect which is Not Significant in EIA terms.

Operational

12.7.33 The assessment of effects identified above is based on the project description as outlined in **Chapter 4: Project Description**.

12.7.34 There are differences in assessment methods for dry and wet conditions. Dry noise is assessed by indicating the excess of rating level over background. 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, OHL noise is generally inaudible. For these reasons, an alternative noise assessment method to deal with rain-induced noise is required. The external rain-induced noise levels are assessed using the methodology developed by National Grid and detailed in their Technical Guidance Note TGN(E)322.

12.7.35 The excess wet figure is derived by comparing the total noise to the background noise level for the appropriate Miller Curve rating at each receptor at a rain rate of 1 mm/hr.

12.7.36 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.

12.7.37 The corona-induced audible noise of the OHL in rainfall has been calculated using the EPRI[1] method as recommended in TGN(E)322. Noise emissions at distances up to 500 m of the conductors have been calculated. The external rain-induced noise levels have been assessed using the TGN(E)322 methodology developed by National Grid.

12.7.38 In the TGN(E)322 method, previously mentioned in Section 12.4.22, the tiered system screens out receptors of low enough wet noise in Tier 1. If the wet noise is above 34 dB(A), Tier 2 assesses the combined wet and dry noise. This stage assesses the proportion of time the area

[1]

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 of TGN(E)322 provides criteria on various rainfall. Historical rain data in the region has been used to calculate the mean annual wet hours from the period of 01 June 2014 to 01 December 2024. The Proposed Development is located between Salsburgh and Strathallan Airfield weather stations. Salsburgh was used as it showed higher mean annual wet hours. 13150 wet hours of rain were recorded over a period of 79,344 hours, resulting in a mean annual wet hours percentage of 16.6%. If combined noise is above 36.6 dBA, NSRs proceed to a Tier 3 assessment. If Tier 3 is required, the total noise is assessed at a worst-case rain rate of 1 mm/hr to provide the excess above the wet background noise.

Effects from XL, ZCN, and ZCS Route – Proposed Alignment

12.7.39 As shown in Table 1.1 of Appendix 12.8: OHL Operational Noise Impact Assessment, for the Tier 1 assessment, the wet noise at each location is predicted to be between 25.3 and 46.6 dB(A). Noise from the XL route dominates the NSRs in the study. The only NSRs that see an increase in noise due to ZCN and ZCS are NSRs 22-27 due to the turn in to the new KINN substation. The combination of Twin Araucaria and Quad Zebra conductors from ZCN and ZCN route add a maximum of 1.0 dB at these NSRs to the noise from the XL route. Also detailed is the distance from the NSRs to the nearest point on the existing line, also shown in Appendix 12.7: OHL Noise Sensitive Receptors (NSRs).

12.7.40 Table 1.2 of Appendix 12.8: OHL Operational Noise Impact Assessment shows the Tier 2 assessment.

12.7.41 Tables 1.3 and 1.4 of Appendix 12.8: OHL Operational Noise Impact Assessment show the Tier 3 wet and dry noise assessment.

12.7.42 Table 12.18 below summarises the operational noise impact assessment and the number of NSRs passing each tier.

Table 12.18: Summary of Operational Noise Impact Assessment

Tier of Assessment	Criteria to Pass tier and thus be acceptable	NSRs Below Criteria	NSRs Above Criteria	Action
1	Wet noise <34 dB(A) for Medium sensitivity Wet noise <39 dB(A) for Low sensitivity	74	30	30 proceed to Tier 2
2	Combined wet and dry noise <36.6 dB(A) for Medium sensitivity Combined wet and dry noise <46.6 dB(A) for Low sensitivity	28	2	1 NSR proceeds to Tier 3
3	Wet excess below 10 dB(A)	1	1	1 NSR requires

Tier of Assessment	Criteria to Pass tier and thus be acceptable	NSRs Below Criteria	NSRs Above Criteria	Action
				further assessment

12.7.43 Audible noise from the wet Proposed Development falls below 34 dB(A) for 74 of the 104 Medium sensitivity NSRs, and below 39 dB(A) at the one Low sensitivity NSR. This results in **Negligible** magnitude of impact at these NSRs and therefore effects are **Not Significant**. However, wet noise at the other 30 NSRs exceeds this level and therefore these receptors proceed to Tier 2 of the assessment.

12.7.44 At Tier 2, combined wet and dry noise falls below the 36.6 dBA criteria for 28 of the 30 remaining NSRs. This results in **Negligible** magnitude of impact at these NSRs and therefore effects are **Not Significant**. However, the combined wet and dry noise at NSR 37 Starton House and NSR 57 Kennels Cottage Dollarbeg exceeds this level and falls into the **Adverse** impact category of the assessment. The TGN(E)322 standard suggests that consideration should be given to mitigating and minimising noise from the OHL for this NSRs. Alternatively, a Tier 3 assessment may be conducted. To gain additional context for the impacts at these NSRs, a Tier 3 assessment has been conducted.

12.7.45 At Tier 3, audible noise from the wet Proposed Development was above wet background noise levels at NSR 57 with an excess of 7 dBA. This results in a **Moderate** magnitude of impact at this NSR.

12.7.46 TGN(E)322 states that only **Major** effects are deemed **Significant** in EIA terms. TGN(E)322 also states that it is important to consider the context in which the noise occurs. For further context, wet noise is predicted to occur 16.6% of the time, some of it will be during the daytime where background noise is elevated. The method tends to overestimate the impact during the daytime.

12.7.47 At NSR 37, audible noise from the wet Proposed Development was above wet background noise levels with an excess of 14 dBA. This results in a **Major** magnitude of impact at this NSR, effects are therefore Significant, and mitigation must be recommended.

12.7.48 For additional context, the assessment up to now has considered the worst-case tower in terms of noise. If the actual tower near to NSR 57 was used (L2 D STD type), the noise level is reduced, and would be screened out at Tier 2, and a Tier 3 assessment would not be necessary, deeming the effect **Minor**. For NSR 57, the actual tower (L2 D30 E24), also causes 14 dB of excess above background noise, effects are therefore still **Significant**. These results are shown in Table 1.5 to Table 1.7 of Appendix 12.8: OHL Operational Noise Impact Assessment.

Effects from XL, ZCN, and ZCS Route – Limit of Deviation

12.7.49 The scenario for the limit of deviation has also been considered for operational noise. The distance from NSR to the OHL was reduced by 50 m and the noise level was recalculated.

12.7.50 As shown in Table 1.8 of Appendix 12.8: OHL Operational Noise Impact Assessment, for the Tier 1 assessment, the wet noise at each location is predicted to be between 27.1 and 52.9 dB(A).

12.7.51 Table 1.9 of Appendix 12.8: OHL Operational Noise Impact Assessment shows the Tier 2 assessment.

12.7.52 Tables 1.10 and 1.11 of Appendix 12.8: OHL Operational Noise Impact Assessment show the Tier 3 wet and dry noise assessment.

12.7.53 Table 12.18 below summarises the operational noise impact assessment and the number of NSRs passing each tier.

Table 12.19: Summary of Operational Noise Impact Assessment

Tier of Assessment	Criteria to Pass tier and thus be acceptable	NSRs Below Criteria	NSRs Above Criteria	Action
1	Wet noise <34 dB(A) for Medium sensitivity Wet noise <39 dB(A) for Low sensitivity	70	34	34 proceed to Tier 2
2	Combined wet and dry noise <36.6 dB(A) for Medium sensitivity Combined wet and dry noise <46.6 dB(A) for Low sensitivity	25	9	9 NSRs proceed to Tier 3
3	Wet excess below 10 dB(A)	0	9	All 9 NSRs

12.7.54 Audible noise from the wet Proposed Development falls below 34 dB(A) for 70 of the 103 Medium sensitivity NSRs, and below 39 dB(A) at the one Low sensitivity NSR. This results in **Negligible** magnitude of impact at these NSRs and therefore effects are **Not Significant**. However, wet noise at the other 34 NSRs exceeds this level and therefore these receptors proceed to Tier 2 of the assessment.

12.7.55 At Tier 2, combined wet and dry noise falls below the 36.6 dB(A) criteria for 25 of the 34 remaining NSRs. This results in **Negligible** magnitude of impact at these NSRs and therefore effects are **Not Significant**. However, the combined wet and dry noise at 9 NSRs exceeds this level and falls into the **Adverse** impact category of the assessment. The TGN(E)322 standard suggests that consideration should be given to mitigating and minimising noise from the OHL for these 9 NSRs. Alternatively, a Tier 3 assessment may be conducted. To gain additional context for the impacts at these NSRs, a Tier 3 assessment has been conducted.

12.7.56 At Tier 3, audible noise from the wet Proposed Development was above wet background noise levels at all 9 NSRs with excesses ranging from 13 to 19 dB(A). This results in a **Major** magnitude of impact at all of these NSRs which is deemed **Significant** in EIA terms.

12.7.57 For further context, wet noise is predicted to occur 16.6% of the time, some of it will be during the daytime where background noise is elevated. The method tends to overestimate the impact during the daytime.

12.7.58 The assessment of the LoD scenario up to now has considered the worst-case tower in terms of noise. If the actual towers near to the NSRs were used the noise level is slightly reduced, then NSRs 53 and 54 would be deemed negligible after a Tier 2 assessment.

12.7.59 At the other six NSRS, the significance remains Major. These results are shown in Table 1.12 and Table 1.13 of Appendix 12.8: OHL Operational Noise Impact Assessment.

12.7.60 Therefore, operational effects are deemed **Significant**. The LoD must be limited at NSRs 24, 41, 43, 45, 46, and 57. These are highlighted in Table 1.14 of Appendix 12.8 OHL Operational Noise Impact Assessment. In the same table, the maximum distance the nearest tower can move towards each NSR is also shown.

12.7.61 Effects are permanent as decommissioning is not proposed.

12.8 Additional Mitigation

Kincardine North Substation

Construction

12.8.1 There is potential for adverse impacts if the construction noise thresholds are exceeded. Construction plant and methodologies should be reviewed at later stages when more detail is available and compared against these threshold values. If exceedances are predicted to occur further mitigation should be implemented such as temporary screening.

Operation

12.8.2 No exceedances are predicted to occur during typical operation however, exceedances are predicted to occur during emergency operation when the standby generator is in use.

12.8.3 Potential mitigation options to minimise emissions from the standby generator include:

- Specifying a quieter standby generator. It is understood that an urban diesel generator could be specified which has a sound pressure level at 1 m that is 10 dB quieter than the rural option considered in this assessment. This would reduce the rating sound level by 10 dB in emergency operation scenarios and result in a 1 dB exceedance of the background sound level at NSR2KINN First Floor, which would be an indication of low impact
- Locating the standby generator further away from the NSRs which are located to the east of the substation.
- Local screening or enclosure of the generator

12.8.4 If allowance cannot be made for exceedances during emergencies, mitigation should be implemented which could be expected to provide at least 5 – 10 dB mitigation. This should bring both daytime and night-time exceedances within the +5 dB criteria agreed by Fife Council and the significance of effects will be Not Significant.

12.8.5 It is understood that the standby generator will be tested once a month for 1 hour. Due to the predicted exceedances at nighttime, the test should be carried out during daytime periods only.

Overhead Line Works (XL/ZCN/ZCS Uprating and Turn-ins)

Conductor Selection

12.8.6 The conductor choice should be reviewed for the area immediately surrounding NSR 37 - Straton House. Triple Andrew has been used as a proxy due to its lower noise emissions. This will require restringing all conductors between the nearest tension towers (XL012 and XL020). Use of any of this these conductors will result in No Adverse impacts in a TGN(E)322 assessment and therefore no likely significant effects in EIA terms. The results of the assessment of Triple Andrew conductor are shown in Table 1.13 of Appendix 12.8.

Acquisition of the NSR

12.8.7 Alternatively, purchase of the NSR 37 – Starton House, would deem the property no longer a receptor and thus effects will be Not Significant.

Conductor Aging

12.8.8 The assessment assumes the conductor is moderately aged to capture the life cycle of the Proposed Development. New conductors are known to produce higher noise than aged conductor. The conductor will be either beadblasted prior to installation or AssetCool applied to artificially age the conductor and reduce the noise effects upon energisation.

LoD Restriction

12.8.9 Operational noise is predicted to exceed 10 dB above background noise at six NSRs where towers may move the maximum distance from the Proposed Alignment within the LOD. A change control process would be undertaken to ensure that there is no unacceptable increase in adverse impacts as a result of the change and could be secured by an appropriately worded condition.

12.8.10 Also included in Table 1.12 of Appendix 12.8: OHL Operational Noise Impact Assessment is the minimum distance the OHL must be for there to be no significant effects. The minimum distance ranges from 30 m at the NSRs close to Triple Upas to 113 m at the NSRs close to a Twin Matthew Gap conductor.

12.9 Residual Effects

Kincardine North Substation

Construction

12.9.1 At this stage it is predicted that final residual effects after good practice and additional mitigation (if required) are implemented would be minor adverse or less.

Operation

12.9.2 No exceedances are predicted to occur during typical operation however, exceedances are predicted to occur during emergency operation when the standby generator is in use.

Overhead Line Works (XL/ZCN/ZCS Uprating and Turn-ins)

12.9.3 Subject to the mitigation specified in Section, no likely significant residual operational effects are predicted.

12.10 Combined Effects

12.10.1 The potential for combined operational noise effects arising from the Kincardine North Substation and the XL, ZCN and ZCS overhead line (OHL) routes has been considered. The characteristics of these noise sources differ, with substation noise being relatively constant and independent of weather conditions, and OHL noise being dependent on meteorological conditions, particularly rainfall.

12.10.2 For typical operating conditions of the substation, predicted specific sound levels at NSR1KINN and NSR2KINN (equivalent to NSR 22 and NSR 23 in the OHL assessment) are approximately 19 dB(A). Under dry weather conditions, OHL noise is negligible, with predicted levels of 12 dB(A) and 15 dB(A) at NSR 22 and NSR 23 respectively. As such, the OHL does not contribute to any meaningful increase in noise levels at these receptors, and combined effects are effectively equivalent to those predicted for the substation alone.

12.10.3 During wet weather conditions, OHL noise increases due to rain-induced corona discharge and represents the dominant source of operational noise. Predicted wet noise levels at NSR 22 and NSR 23 are 36.1 dB(A) and 40.1 dB(A) respectively. When combined with substation noise (19 dB(A)), the increase in overall noise levels is negligible due to the relatively low contribution of the substation. Therefore, the outcome of the OHL assessment, as presented in Section 12.7, remains unchanged under combined conditions.

12.10.4 Higher noise levels have been predicted for the substation under emergency operating scenarios. However, such events are infrequent and of short duration, and it is highly unlikely that emergency generator operation would coincide with rainfall conditions sufficient to induce worst-case corona discharge. Taking this into account and considering the differing conditions under which peak noise levels arise for each source, there is limited potential for additive effects.

12.10.5 Overall, the worst-case noise conditions for the substation and OHL do not occur concurrently, and one source is typically dominant depending on weather conditions. On this basis, combined operational noise effects are not predicted to exceed those identified in the individual assessments. The significance of combined effects is therefore considered to be no greater than those assessed in isolation for each component and is not significant in EIA terms.

12.11 Cumulative Assessment

12.11.1 The cumulative assessment has been undertaken using approaches consistent with the methodologies applied to each component of the Proposed Development. For the substation, cumulative effects are considered qualitatively based on available information and distance to receptors. For the OHL, cumulative effects are considered quantitatively where appropriate, including the influence of meteorological conditions on noise propagation. The differing approaches reflect the nature of available data and established assessment practices.

Kincardine North Substation

12.11.2 The cumulative operation and construction of other developments has potential to give rise to background levels. A cumulative assessment was undertaken with reference to surrounding proposed developments. The majority comprise energy-related infrastructure, including consented Battery Energy Storage Systems (BESS), BESS schemes at the pre-application stage, modifications to the existing overhead lines (OHLs) and aggregate storage building and hardstanding.

12.11.3 The following developments have been considered but scoped out the cumulative assessment, this is due to the early stage of these developments and lack of noise information or low likelihood of them generating audible noise which could combine with the Proposed Development.

- Underground Cable from KINN to existing Kincardine Substation - 25/02494/SCR
- Temporary installation of transformers at Kincardine Substation - 25/02355/SCR and;
- Meadowend Battery Energy Storage System (BESS) - ECU00005178

12.11.4 It is considered that the above developments do not have associated operational noise impacts except for the Temporary installation of transformers at Kincardine Substation which is a permitted development pending construction and Meadowend Battery Energy Storage System (BESS). Without associated noise impact assessments these developments cannot be assessed for cumulative operational noise but have potential to contribute to operational cumulative noise. Kincardine substation is located approximately 900m south west of NSR1, given this distance, cumulative construction and operational impacts are unlikely.

12.11.5 Construction noise has also been considered and ruled out due to lack of information available.

12.11.6 The following developments with associated Noise Impact Assessments have been considered and assessed where necessary:

- Aggregate Storage Building and Associated hardstanding - 24/00979/FULL
- Kilbagie Battery Energy Storage System (BESS) - ECU00005240,

- Kincardine Battery Energy Storage System (BESS) - ECU00004987 and;
- Kincardine Grid Services Complex - ECU00003326.

12.11.7 Kincardine Grid Services Complex and Aggregate Storage building and associated hardstanding are located approximately 900 m south west of NSR 1 and Kincardine Battery Energy Storage System (BESS) is located approximately 600 m east of NSR 1. At these distances, cumulative construction and operational impacts are unlikely, assuming each development follows BPM during the construction phase and does not exceed operational sound limits. Kilbagie BESS is approximately 125 m south west of NSR 3.

Construction

12.11.8 No detailed quantitative construction has been provided for cumulative developments in the local area. If construction schedules overlap cumulatively and within close proximities, there is potential for short term impacts however with the implementation of BPM it is likely these effects will be reduced and would not be significant in EIA terms.

Operational

12.11.9 The Kincardine Battery Energy Storage System (BESS) proposed development is located approximately 900m to the south west of NSR 1 (closest NSR) and the assessment does not share any common receptors due to being further away. In addition, the BS4142 assessment for this development indicates that there would be no exceedances in operational levels during daytime and night-time at NSRs which are closer than NSR 1. Therefore, it is unlikely this proposed development would impact background levels from operational noise.

12.11.10 The Kincardine Grid Services is located approximately 600 m west of NSR 1 (closest NSR). The Kincardine Grid Services Complex is subject to the same criteria as other proposed developments in the Fife area, with a specified rating level not exceeding +5 dB above background, together with compliance with NR 25 within bedrooms during night-time. The development is able to demonstrate compliance with the internal NR criteria at night and is predicted to operate at +2 dB relative to the external night-time limit at the closest NSR, indicating a negligible cumulative impact during typical operation of the Proposed Substation Development.

12.11.11 Kilbagie BESS is approximately 125 m south west of NSR 3. The Kilbagie BESS. demonstrates compliance with the NR25 internal criterion at the shared receptor NSR 3; however, the predicted external night-time specific sound level is 39 dB. The specific sound level of the Proposed Development during normal operation at NSR 3 is 11 dB, therefore cumulative operational sound will be due to Kilbagie BESS. During the scenario of the emergency generators operate at night, the cumulative specific sound would be a 1 dB higher which would be a negligible contribution in comparison with the Kilbagie development alone.

12.11.12 With regard to potential cumulative construction and operational noise arising from the committed developments in combination with activities within the Proposed Development red line boundary, the nature of the works, spatial separation, and/or programme phasing indicate that significant cumulative noise effects are not anticipated.

Overhead Line Works (XL/ZCN/ZCS Uprating and Turn-ins)

12.11.13 A 1 km search area from the centreline of the OHL was used to identify cumulative developments.

Development	Description	Status	Location	Result
Kincardine Battery Energy Storage System (BESS) **(ECU00004987)**	342 megawatt BESS and associated access, drainage and landscaping.	Approved (pending construction)	Located in Fife to the south/southwest of the Proposed Development south of Hawkhill Road.	Worst-case results from the proposed BESS site will occur in dry conditions, when background noise is a minimum, which is where the OHL noise is at a minimum. In wet conditions, the OHL noise is elevated. In these conditions, the background noise is increased due to the rainfall, which would make the effects of the cumulative developments such as the BESS development less likely to have an impact on the relevant receptors. The closest NSR (NSR 12 - Hawkhill Farm, Medium sensitivity) to the BESS site that is within the study area is 260m from the centreline of the Proposed Development. OHL noise (36.7 dB(A)) is negligible at this distance after a Tier 2 TGN(E)322 assessment. The noise from the BESS site was predicted to be 34 dB at this NSR. Cumulatively, this does not materially affect the impact. Therefore, cumulative impacts due to the BESS would be low and considered to have **Negligible** impact.

Development	Description	Status	Location	Result
Kincardine Grid Services Complex **(ECU00003326)**	Grid services facility comprising BESS and synchronous condenser as well as associated access, drainage and landscaping.	Approved (pending construction)	Located in Fife to the immediate west of the Proposed Development adjacent to the A876.	There are no NSRs that fall within 500m of both developments. Noise rating levels were found to be significantly below daytime background noise levels at nearest receptors. The noise level predicted at the closest NSR to both developments (NSR 12 Hawkhill Farm) was 34 dB(A). If summed with the Proposed Development predicted noise level of 36.7 dB(A), the total is 38.6 dB(A). This total noise level results in the NSR still being screened out at a Tier 2 assessment. Therefore, cumulative impacts due to the BESS are considered to have **Negligible** impact.
Aggregate Storage Building and associated hardstanding **(24/00979/FULL)**	Aggregate storage building unit including welfare, and hardstanding areas as well as loading areas.	Approved (pending construction)	Located in Fife south of Proposed Development south of Hawkhill Road at the disused railhead.	Any operational effects are predicted from the storage building would be intermittent. Cumulative effects are assessed as **Negligible**.
Underground Cable from KINN to existing Kincardine Substation **(25/02494/SCR)**	Installation of 275kV underground cable circuit between KINN and existing	Pre-application (screening)	Located in Fife within the Site and extending south to Hawkhill Road, crossing it into	No operational effects are predicted from the underground cable. Cumulative effects are assessed as **Negligible**.

Development	Description	Status	Location	Result
	Kincardine Substation approximately 1.9km long.		the existing Kincardine Substation.	
Temporary installation of transformers at Kincardine Substation **(25/02355/SCR)**	Temporary installation of two 400kV transformers within the existing Kincardine Substation site.	Permitted Development (pending construction)	Located in Fife within the footprint of the existing Kincardine Substation, approximately 1km south of the KINN substation platform.	Information is limited on the noise emissions; however a qualitative assessment can be made. Worst-case emissions from the proposed transformers will occur in dry meteorological conditions, when background sound levels are lowest. Under these conditions, the OHL noise is at a minimum as corona discharge (and consequent audible noise) is not significant. Conversely, in wet conditions, the OHL noise is elevated due to rain-induced corona effects. However, in these conditions, the background noise is increased due to the rainfall, acts to mask additional sources such as the transformers. As a result, the relative contribution and perceptibility of the transformer noise is reduced, which would make the effects of the cumulative developments such as the transformer development less likely to have an impact on the receptors within 500 m of the substation (NSRs 1 - 21 inclusive). The nearest NSR to the existing Kincardine Substation is NSR 12 at 231 m from the substation boundary.

Development	Description	Status	Location	Result
				Therefore, cumulative impacts due to the transformers would be low, temporary, and considered to have **Negligible** impact.
Kilbagie Battery Energy Storage System (BESS) **(ECU00005240)**	Up to 250MW BESS and associated infrastructure.	Application submitted (decision pending)	Located in Clackmannanshire approximately 50-100m north of the Proposed Development.	Worst-case noise emissions from the proposed BESS site will occur in dry meteorological conditions, when background sound levels are lowest. Under these conditions, OHL noise is at a minimum as corona discharge (and consequent audible noise) is not significant. Conversely, in wet weather conditions, the OHL noise is elevated due to rain-induced corona effects. However, in these conditions, the background noise is increased due to the rainfall, which acts to mask additional sources such as the BESS site. As a result, the relative contribution and perceptibility of the BESS noise is reduced, thus it would make the effects of the cumulative developments such as the BESS development less likely to have an impact on the relevant receptors. The closest NSR (NSR 24 – Ambleside Haven) to the BESS site that is within the study area is 122 m from the centreline of the Proposed Development. OHL noise is 43.5 dB(A) in wet weather, whereas noise from the BESS site was predicted to be 28 dB(A). Noise is dominated by the OHL, and the operational noise effects were deemed not significant in Section 1.7.

Development	Description	Status	Location	Result
				Therefore, cumulative impacts due to the BESS would be low and considered to have **Negligible** impact.
Meadowend Battery Energy Storage System (BESS) **(ECU00005178)**	Up to 500MW BESS and associated infrastructure.	Pre-application (screening)	Located in Clackmannanshire approximately 640m north of the Proposed Development.	Predicted noise levels are not currently available, however qualitative comments can be made on the noise impacts. Worst-case noise emissions from the proposed BESS site will occur in dry meteorological conditions, when background sound levels are lowest. Under these conditions, OHL noise is at a minimum as corona discharge (and consequent audible noise) is not significant. Conversely, in wet weather conditions, the OHL noise is elevated due to rain-induced corona effects. however, in these conditions, the background noise is increased due to the rainfall, which acts to mask additional sources such as the BESS site. As a result, the relative contribution and perceptibility of the BESS noise is reduced, thus it would make the effects of the cumulative developments such as the BESS development less likely to have an impact on the relevant receptors. The closest NSR (NSR 25 – R W M House) to the BESS site that is within the study area is 282m from the centreline of the Proposed Development. OHL noise is

Development	Description	Status	Location	Result
				negligible at this distance. Noise that will cause impacts is likely to be entirely due to the BESS. Therefore, cumulative impacts due to the BESS would be low and considered to have **Negligible** impact.
Meadowhill Opencast **(25/00057/FULL)**	Extension to current planning permission to remove overburden material	Approved	Approximately 3km south west of Blairingone. Adjacent to the Proposed Development	Worst-case emissions from the opencast site will occur in daytime and dry meteorological conditions, which is where the OHL noise and impact is at a minimum. In wet weather conditions, the OHL noise is elevated. In these conditions, the background noise is increased due to the rainfall, which would make the effects of the cumulative developments such as the opencast development less likely to have an impact on potential receptors within 500 m of both developments. NSR 42 Woodside Farm (39.6 dB(A) from the Proposed Development) is the closest to the Meadowhill Opencast site, at approximately 900 m away. According to the S42 Supporting Statement and the Decision Notice, a condition for the site is to minimise noise to as low as reasonably practicable. At 900 m the noise is not likely to increase above 39.6 dB(A) during the times of 1 mm/hr of rainfall. OHL noise is also maximised at night, when background noise is low, and the opencast is likely to not be operational.

Development	Description	Status	Location	Result
				Therefore, cumulative impacts due to the opencast would be low and considered to have **Negligible** impact.

12.12 Summary and Conclusions

Kincardine North Substation

12.12.1 AECOM have assessed the likely significant effects of the Kincardine North Substation element of the Proposed Development.

12.12.2 Sound measurements were undertaken to determine representative background noise levels.

12.12.3 A qualitative assessment of construction noise was completed, and an indicative scheme of best practice noise control measures has been provided.

12.12.4 The change in road traffic noise due to construction traffic on the public network has been assessed, there is potential for a moderate adverse effect at NSRs along the Substation Access Road and C68 Hawkhill Road, however there is only one NSR along these roads (Hawkhill Farm), which is owned by SPT. The property will be kept vacant during the construction works.

12.12.5 Operational sound predictions were made based on sound emissions data for the proposed transformers, shunt reactors, and standby generator provided by SPT and measurements made by AECOM.

12.12.6 During typical operation (without the standby diesel generator) the predicted rating levels are significantly below the background sound levels for both daytime and night-time. On this basis, it is concluded that the Proposed Development will have a negligible adverse effect, which is Not Significant.

12.12.7 During emergency operation (with the standby diesel generator) the rating levels of the proposed development are predicted to exceed the background sound levels by 9 - 16 dB. According to the guidance in BS 4142, this is an indication that a major significant adverse effect depending on the context is likely. However, when taking into context the occasional use of the standby generator in emergency situations, the short duration once a month for testing and potential mitigation options, the significance of effects will be Not Significant.

12.12.8 The NR criteria specified by Fife Council are also met for both typical and emergency operation scenarios.

12.12.9 The cumulative effects arising from committed developments in the vicinity have also been assessed, no significant cumulative effects are anticipated assuming each development follows BPM during construction phase and operational sound limits are not exceeded.

Overhead Line Works (XL/ZCN/ZCS Uprating and Turn-ins)

12.12.10 This chapter has assessed the likely significant noise effects that could arise due to the Proposed Development during the operational phase at appropriate NSRs. The assessment has taken account of applicable planning policy and current guidance.

12.12.11 Operational noise has been assessed to TGN(E)322 and BS4142 standards. Most NSRs are screened out at Tier 1 and 2 of the TGN(E)322 assessment, resulting in Negligible impacts which are Not Significant. However, two NSRs (37 and 57) are assessed to Tier 3, and this results in a Major and a Moderate significance of effect at these NSRs respectively when assessing with Twin Matthew Gap. Major effects only are Significant in EIA terms.

12.12.12 Avoiding the use of Twin Matthew Gap near NSR 37 by using a lower noise conductor is a potential mitigation option. Alternatively, purchasing the property so that it is no longer a receptor is another potential mitigation option.

12.12.13 Mitigation is recommended to ensure that there is no significant impact at NSRs 24, 41, 43, 45, 46, and 57. Restricting the LoD near these NSRs will result in Negligible impacts at all NSRs.

12.12.14 Cumulative noise has been considered for operational noise from nearby proposed developments. Due to the low predicted operational noise of the Proposed Development and the distance to receptors, cumulative operational noise has been assessed as Negligible

12.13 References

Ref 12.1 Environmental Protection Act 1990, c. 79. Available at https://www.legislation.gov.uk/ukpga/1990/43/contents (accessed 09/10/24)

Ref 12.2 Control of Pollution Act 1974, c. 60 and 61. Available at https://www.legislation.gov.uk/ukpga/1974/40/part/III/crossheading/construction-sites (accessed 09/10/24)

Ref 12.3 Scottish Government (2023). National Planning Framework 4 (NPF4)

Ref 12.4 The Scottish Government (2011). PAN 1/2011 Planning Advice Note, Planning and Noise.

Ref 12.5 The Scottish Government (2011). Technical Advice Note – Assessment of Noise.

Ref 12.6 https://www.fife.gov.uk/__data/assets/pdf_file/0026/255338/Planning-Policy-for-development-and-noise2.pdf (accessed 09/10/24)

Ref 12.7 https://www.fife.gov.uk/kb/docs/articles/planning-and-building2/planning/development-plan-and-planning-guidance/local-development-plan-fifeplan (accessed 09/10/24) Ref 12.8 https://www.clacks.gov.uk/document/6862.pdf (Accessed 09/09/25)

Ref 12.9 British Standards Institution (2014). BS 5228-1:2009+A1:2014 'Code of practice for noise and vibration control on construction and open sites – Part 1: Noise'

Ref 12.10 British Standards Institution (2019). BS 4142: 2014+A1:2019 'Methods for rating and assessing industrial and commercial sound'

Ref 12.11 BS 7445 'Description and Measurement of Environmental Noise', British Standards Institution, 2003.

Ref 12.12 International Standards Organisation (2024). ISO 9613-2 2024 'Acoustics -- Attenuation of sound during propagation outdoors -- Part 2: General method of calculation'

Ref 12.13 BS 8233:2014 *'Guidance on sound insulation and noise reduction for Buildings'*

Ref 12.14 Department of Transport/Welsh Office, 1988. Calculation of Road Traffic Noise (CRTN).

Ref 12.15 Noise Advisory Council, 1978. 'A Guide to Measurement and Prediction of the Equivalent Continuous Sound Level L_{eq}'.(NAC)

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Ref 12.17 Emapsite, n.d. UK Mapping and Data. [Online] Available at: https://www.emapsite.com/

Ref 12.18 Electrical Power Research Institute, 2005. *EPRI AC Transmission Line Reference Book – 200 kV and Above*, Third Edition, Final Report, 2005, Electrical Power Research Institute.