12.

Noise and Vibration

12. Noise and Vibration

12.1 Introduction

12.1.1 This chapter presents an assessment of likely significant noise and vibration effects arising from the construction and operation of the Project. A full description of the Project is provided within Chapter 4. Information relating to construction traffic has been provided in Chapter 11.

12.1.2 This chapter is supported by the following appendices:

- Volume 3, Appendix 11.1: Transport Assessment;
- Volume 3, Appendix 12.1: Acoustic Glossary;
- Volume 3, Appendix 12.2: Baseline Noise for Overhead line;
- Volume 3, Appendix 12.3: Construction Noise for Overhead line Noise;
- Volume 3, Appendix 12.4: Operational Overhead line Noise;
- Volume 3, Appendix 12.5: Construction Noise Assessment for Bonnybridge Substation;
- Volume 3, Appendix 12.6: Operational Noise Impact Assessment for Bonnybridge Substation;
- Volume 3, Appendix 12.7: Construction Noise Assessment for Cumbernauld; and
- Volume 3, Appendix 12.8: Operational Noise Impact Assessment for Cumbernauld Substation.

12.1.3 The chapter details specific sections which consider the potential effects of the extension to Cumbernauld Substation associated with noise and vibration.

12.1.4 The Cumbernauld Substation Extension assessment includes the potential effects on noise sensitive receptors (NSRs) during both the construction and operation of the Project. The evaluation of the baseline has been made through a combination of desk-based study, field survey and consultation.

12.1.5 The specific objectives of the study are as follows:

- Identify the NSRs in the vicinity of the Project;
- Describe how consultation has informed the scope of the assessment;
- Describe the assessment methodology and significance criteria used in the assessment;
- Describe and define the baseline noise environment;
- Identify the dominant sound sources associated with the operation and construction of the Project;
- Calculate and assess the potential direct and indirect impacts on NSRs; and

- Indicate any requirements for mitigation measures, if applicable, to provide sufficient levels of protection for all NSRs.

12.2 Legislation, Policy and Guidance

12.2.1 Table 12.1 presents the legislation, policy and guidance relevant to this chapter.

Table 12-1 Relevant legislation, policy and guidance

Document	Summary
The Control of Pollution Act 1974	Sections 60 and 61 of the Control of Pollution Act 1974 give the local authority powers to control noise arising from construction and demolition works, regardless of whether a statutory nuisance has been caused or is likely to be caused. These powers may be exercised either before works start or after they have commenced. Best Practicable Means (BPM) are also defined within the Control of Pollution Act.
The Environmental Protection Act 1990	The Environmental Protection Act 1990 provides a local authority with powers to serve a noise Abatement Notice in the event that they believe that unnecessary and objectionable noise is being created. The Abatement Notice may require that the noise be stopped altogether or limited to certain times and level to avoid causing a nuisance in the future.
The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2017	The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2017 establish the process for determining whether the proposal constitutes Schedule 2 development, and therefore whether it is likely to give rise to significant environmental effects requiring an Environmental Impact Assessment (EIA). Substations are typically classified as electricity infrastructure under Schedule 2, meaning a screening opinion from the planning authority is required to confirm whether an EIA is necessary, taking into account factors such as the scale of the development, its proximity to sensitive receptors (including residential areas and designated sites), and the nature of potential impacts. Where an EIA is required, the Regulations set out the requirement to assess environmental effects across a range of topics, including noise, landscape and visual impact, ecology and traffic, and to inform decision-making through an Environmental Impact Assessment Report. Even where an EIA is not required, the principles of the Regulations guide the scope and proportionality of

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	supporting technical assessments submitted as part of the planning application.
National Planning Framework 4 (NPF4) 2023	NPF4 sets out the Scottish Government's spatial strategy and national planning policies, integrating planning with climate action and sustainable development objectives. Under Policy 11(e) i. states "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". Under Policy 23 (Health and Wellbeing), the framework emphasises the importance of creating environments that support physical and mental health. This includes the need to assess and manage noise impacts during the planning process, particularly where developments may affect residential amenity or sensitive uses such as schools and healthcare facilities. The policy promotes good acoustic design and encourages early engagement with Environmental Health Officers and acoustic consultants to ensure noise is appropriately considered and mitigated
Planning Advice Note (PAN) 1/2011	PAN 1/2011 provides guidance on the role of the planning system in managing noise in Scotland. It encourages good acoustic design and the careful siting of noise-sensitive developments. The document supports a pragmatic approach to development near existing noise sources and recommends early consultation with Environmental Health Officers. PAN 1/2011 does not prescribe fixed noise limits but advocates for context-sensitive noise assessments.
Technical Advice Note (TAN)	The TAN complements PAN 1/2011 by offering technical guidance on noise impact assessment methodologies. It introduces a framework for evaluating noise effects, including thresholds similar to LOAEL (Lowest Observed Adverse Effect Level) and SOAEL (Significant Observed Adverse Effect Level). The TAN allows local authorities to set their own criteria, recognising that noise sensitivity and acceptable levels may vary by location.
Falkirk Local Development Plan, 2020	The Falkirk Local Development Plan 2 (adopted 2020) sets out planning policy for development across the

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	Falkirk Council area. Under its Place and Environment policies, all development must safeguard environmental quality and public health, which includes managing noise impacts. Proposals that could generate significant noise, or those located near sensitive receptors such as housing, schools, or hospitals, are expected to provide noise impact assessments and demonstrate appropriate mitigation. PE01 Placemaking: "In support of climate change adaptation, infrastructure needs and their impacts should be identified and addressed by sustainable mitigation techniques, with particular regard to … noise".
North Lanarkshire Local Development Plan, 2022	The North Lanarkshire Local Development Plan (adopted July 2022) requires all development to manage noise impacts in accordance with Policy EDQ 2 (Specific Features for Consideration) and Policy EDQ 3 (Quality of Development). The Council's "Noise Guidance for New Developments" sets out specific criteria for construction and demolition noise, including recommended working hours (08:00-19:00 (Monday-Friday) and 08:00-13:00 (Saturdays), with no works on Sundays or bank holidays), BPM to minimise noise, and requirements for noise impact assessments where significant disturbance is likely. Early engagement with Environmental Health is encouraged, and mitigation measures such as restricted hours, use of quieter equipment, and site layout planning may be required. The guidance refers to relevant British Standards (e.g., BS 5228) and expects developers to follow best practice to protect residential amenity and public health, especially near sensitive receptors or within Noise Management Areas.
BS 4142:2014+A1:2019 'Methods for rating and assessing industrial and commercial sound'	BS 4142 provides a method for rating industrial and commercial sound and a method for assessing resulting impacts upon people. The method is applicable to fixed plant installations, sound from industrial and manufacturing process and other associated activities. The rating method takes into account specific source characteristics, such as tonality, impulsivity and intermittency. The impact assessment procedure described in BS 4142 is based on the comparison of the

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	rating sound level with the background sound level prevailing at the assessment locations.
IEC 60076-10-1: Power transformers - Part 10-1: Determination of sound levels, International Electrotechnical Commission (IEC), March 2016.	This standard describes how conformal surface measurements can be carried out around operational transformers to determine their sound power level. Measurements are performed in an approximately free-field environment while the transformers are operational. The measurements are conducted according to the point-by-point sound pressure level measurement procedure outlined in the standard.
BS 5228-1:2009+A1:2014 – 'Code of Practice for Noise and Vibration Control on Construction and Open Sites – Noise'	BS 5228-1 gives recommendations for basic methods of noise control relating to construction work. It also provides guidance concerning methods of predicting and measuring noise and assessing its impact on those exposed to it. The prediction method considers the noise emission level of the plant, the separation distance between the source and the receiver and the effect of the intervening topography and structures.
BS 5228-2:2009+A1:2014 – 'Code of Practice for Noise and Vibration Control on Construction and Open Sites – Vibration'	BS 5228-2 provides guidance on vibration levels that can be used to assess the likely impacts of construction activities. The standard gives guidance on the significance of vibration effects in terms of human response to vibration and the structural response from affected buildings.
BS 8233:2014 'Guidance on sound insulation and noise reduction for buildings'	BS 8233 provides guidance for the control of noise in and around buildings. It is applicable to the design of new buildings, or refurbished buildings undergoing a change of use.
BS EN IEC 60942:2018 'Electroacoustics – Sound calibrators'	BS EN IEC 60942 specifies the performance requirements for sound calibrators.
BS EN 61672-1:2013 'Electroacoustics – Sound level meters'	BS EN 61672-1 provides electroacoustic performance specifications for sound measuring instruments.
Calculation of Road Traffic Noise (CRTN), 1988	CRTN was published by the former Department of Transport and The Welsh Office and sets out standard procedures for calculating noise levels from road traffic in the UK.
Design Manual for Roads and Bridges, LA 111 Noise and Vibration (2020)	LA 111 'Noise and Vibration' provides guidance on the assessment of noise and vibration impacts due to road traffic. LA 111 includes impact magnitude criteria for

Document	Summary
	changes in road traffic noise occurring during construction and post-completion stages, which is applicable across a range of projects.
ISO 9613-2:2024 'Acoustics — Attenuation of sound during propagation outdoors. Part 2: Engineering method for the prediction of sound pressure levels outdoors'	Part two of ISO 9613 specifies an engineering method for calculating the attenuation of sound during propagation outdoors to enable the prediction of environmental noise at a distance from a variety of sources.
National Grid (2021) TGN(E)322 - Operational Audible Noise Assessment Process for Overhead lines.	TGN(E)322 provides a structured process for assessing audible noise from overhead transmission lines, including new builds, reconductoring, diversions, and uprating at 275kV and 400kV. The guidance outlines a three-tiered assessment approach, considering worst-case wet noise, combined wet/dry noise, and detailed site-specific analysis using BS 4142 principles. It details prediction and measurement methods, criteria for noise-sensitive receptors, and mitigation recommendations.

12.3 Methodology (excluding Bonnybridge and Cumbernauld Substations)

Consultation

12.3.2 A scoping report was written in June 2025 by AECOM (SP Energy Networks- Denny to Wishaw Network Upgrade- Scoping report) and submitted to the relevant local authorities.

12.3.3 In response, a scoping opinion dated 07 October 2025 was received on behalf of Scottish Ministers under the Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017. The response states:

"'The noise assessment should be carried out in line with relevant legislation and standards as detailed in Section 11 of the scoping report. The noise assessment report should be formatted as per Table 6.1 of the IOA "A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise'".

12.3.4 It is noted that although the IOA good practice guide relating to wind turbine noise mentioned above is not strictly relevant to the assessment of overhead lines or substations, Table 6.1 is similar in content to the reporting requirements set out in BS 4142 and hence by following this standard, this EIA report will naturally include the aspects requested by the scoping response.

12.3.5 Further confirmation is also given with regards to permitted construction works hours (limited to 08:00-19:00 (Monday-Friday) and 08:00-13:00 (Saturdays), with no works on

Sundays or bank holidays), as per North Lanarkshire Council's and Falkirk Council's published guidelines on noise producing construction activities.

Scope of Assessment

12.3.6 Based upon the considerations made in the initial scoping report, a number of factors have been 'scoped in' and 'scoped out' of the report as shown in Table 12.2.

Table 12-2 Effects to be scoped in and out of the assessment

Project Component	Phase	Potential Effects Scoped In/ Out of Assessment?	Rationale for Scoping Out
New Build Overhead Line	Construction	Noise and vibration scoped in	Construction activities are likely to involve large plant items with the potential for significant noise effects to occur.
	Construction traffic noise	Noise scoped in	During construction, there is potential for increase in HGV/vehicle movements that may cause significant effects.
	Operation	Noise scoped in Vibration scoped out	Noise from 'corona discharge' from the overhead line is anticipated to be produced from the new line. Overhead lines are not anticipated to produce any vibration at the nearest receptors but may cause increased noise levels due to the addition of the new line.
	Operation traffic noise	Noise scoped out	Operational traffic is not expected to meet the criteria where environmental assessment of traffic and movement is required.
Uprated overhead lines (ZG, XX, XR Routes)	Construction	Noise and vibration scoped in	Construction activities are likely to involve large plant items with the potential for significant noise effects to occur.
	Construction traffic noise	Noise scoped in	During construction, there is potential for increase in HGV/vehicle movements that may cause significant effects.
	Operation	Noise scoped in	Noise from 'corona discharge' from the overhead lines is anticipated to be greater with the uprated lines.

Project Component	Phase	Potential Effects Scoped In/ Out of Assessment?	Rationale for Scoping Out
		Vibration scoped out	Overhead lines are not anticipated to produce any vibration at the nearest receptors but may cause increased noise levels due to the uprating.
	Operation traffic noise	Noise scoped out	Operational traffic is not expected to meet the criteria where environmental assessment of traffic and movement is required.
CB Route removal	Construction	Noise and vibration scoped in	Construction activities are likely to involve large earthmoving/ lifting plant items with the potential for significant noise effects to occur.
	Construction traffic noise	Noise scoped in (but assessed as part of WB Route)	During construction, there is potential for increase in HGV/vehicle movements that may cause significant effects.
	Operation	Noise and vibration scoped out	With the removal of the line there will be no operational effects.
	Operation traffic noise	Noise scoped out	With the removal of the line there will be no operational traffic to cause effects.
AA Route Undergrounding	Construction	Noise and vibration scoped in	Construction activities are likely to involve large earthmoving/ lifting plant items with the potential for significant noise effects to occur.
	Construction traffic noise	Noise scoped in (but assessed as part of WB Route)	During construction, there is potential for increase in HGV/vehicle movements that may cause significant effects.
	Operation	Noise and vibration scoped out	With the undergrounding of the Route, noise levels are anticipated to be quieter than current levels and so no assessment is required.

Project Component	Phase	Potential Effects Scoped In/ Out of Assessment?	Rationale for Scoping Out
	Operation traffic noise	Noise scoped out	Operational traffic is not expected to meet the criteria where environmental assessment of traffic and movement is required.
Denny North Substation	Construction	Noise and vibration scoped in	Construction activities are likely to involve large earthmoving/ lifting plant items with the potential for significant noise effects to occur.
	Construction traffic noise	Noise scoped in	During construction, there is potential for increase in HGV/vehicle movements that may cause significant effects.
	Operation	Noise and vibration scoped out	No new noise or vibration generating equipment is anticipated to be included within the upgraded substation. Therefore noise and vibration have been scoped out.
	Operation traffic noise	Noise scoped out	Operational traffic is not expected to meet the criteria where environmental assessment of traffic and movement is required.
Wishaw Substation	Construction	Noise and vibration scoped in	Construction activities are likely to involve large earthmoving/ lifting plant items with the potential for significant noise effects to occur.
	Construction traffic noise	Noise scoped in	During construction, there is potential for increase in HGV/vehicle movements that may cause significant effects.
	Operation	Noise and vibration scoped out	No new noise or vibration generating equipment is anticipated to be included within the upgraded substation. Therefore noise and vibration have been scoped out.

Project Component	Phase	Potential Effects Scoped In/ Out of Assessment?	Rationale for Scoping Out
	Operation traffic noise	Noise scoped out	Operational traffic is not expected to meet the criteria where environmental assessment of traffic and movement is required.
Distribution Line Diversion Works	Construction	Noise and vibration scoped in	Construction activities are likely to involve large earthmoving/ lifting plant items with the potential for significant noise effects to occur.
	Construction traffic noise	Noise scoped out	Construction traffic is not expected to meet the criteria where environmental assessment of traffic and movement is required.
	Operation	Noise and vibration scoped out	Due to the lower voltage of the distribution lines, noise and vibration is not anticipated to be generated by the lines. Therefore noise and vibration have been scoped out.
	Operation traffic noise	Noise scoped out	Operational traffic is not expected to meet the criteria where environmental assessment of traffic and movement is required.

Study Area

12.3.7 The study area for construction will depend on the nature of works, the existing ambient noise level and the location of the nearest receptors. However, when considering the proposed works for this project, the potential for any significant effects is considered unlikely during the daytime beyond 300m from the construction works areas (including temporary construction compounds, working areas, access tracks and areas of construction or decommissioning activity), therefore a study area of 300m has been defined for construction noise (including construction traffic).

12.3.8 Operational noise from overhead lines is assessed in accordance with 'TGN(E)322 - Operational Audible Noise Assessment Process for Overhead lines'. As per this guidance, an initial study area of 500m has been defined which may be reduced depending on the outcome of the tiered assessments.

Receptor Identification

12.3.9 For impacts relating to individual substations (excluding Bonnybridge and Cumbernauld), generally the nearest noise sensitive receptors NSRs have been identified and discussed within the Baseline and Future Baseline Conditions section for each substation.

12.3.10 For impacts associated with the operation and construction of the new, uprated and removed/undergrounded overhead lines, receptors have been identified and assigned sensitivity using Address Base data. There are thousands of receptors within the study area and it is not practical to report every receptor individually. A tiered approach is used for assessing operational impacts, removing receptors from the study area if they pass the criteria for each stage (a detailed methodology of the assessment process is provided below). Therefore, for operational impacts, only the outcome of the Tier 3 assessments is included as other receptors not reported are deemed acceptable under a Tier 1 or Tier 2 assessment. For construction impacts relating to the overhead lines, the worst-affected receptors for each activity have been reported along with the number of receptors resulting in high or moderate impacts.

Assessment Methods

Sensitivity of Receptors

12.3.11 The sensitivity of receptors and magnitude of impact are defined based on the relevant guidance discussed above. Due to the type of noise being assessed there are variations in how receptor sensitivity is classed between assessment methodologies, which are outlined for each assessment type below.

12.3.12 For operational noise of the overhead line, the sensitivity of receptors and significance of effect is defined by TGN(E)322 and reproduced below in Table 12.3 and Table 12.4.

Table 12-3 Classification of receptor sensitivity for operational overhead line noise

Sensitivity	Receptor
High	Vulnerable subgroups including hospitals and preschools, care homes and hospices
Medium	Residential and schools
Low	Area used primarily for leisure activities, including PRoW, sites of historic or cultural importance.
Negligible	All other areas such as those used primarily for industrial or agricultural purposes.

Table 12-4 Residual significance of effect descriptor for operational overhead line noise

Significance of Effect	Sensitivity of Receptor			
Magnitude	**High**	**Medium**	**Low**	**Negligible**
High	Major	Major	Moderate	Minor
Medium	Major	Moderate	Minor	Negligible
Low	Moderate	Minor	Minor	Negligible
Negligible	Minor	Negligible	Negligible	Negligible
No Effect	Negligible	Negligible	Negligible	Negligible

12.3.13 For the other aspects of the project (construction noise and vibration, construction traffic and operation of substations), the sensitivity of receptors is defined in Table 12.5 below.

Table 12-5 Classification of receptor sensitivity for aspects other than operational overhead line noise

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

12.3.14 Table 12.6 below combines the magnitude of impact with sensitivity of receptor to result in overall significance of effect for construction noise and vibration, construction traffic and operation of substations.

Table 12-6 Resulting significance of effect descriptor for aspects other than operational overhead line noise

Significance of Effect	Sensitivity of Receptor			
Magnitude	**High**	**Medium**	**Low**	**Negligible**
High	Major	Moderate	Minor	Minor
Medium	Moderate	Minor	Negligible	Negligible
Low	Minor	Negligible	Negligible	Negligible
Negligible	Minor	Negligible	Negligible	Negligible

Construction Noise

12.3.15 Prediction and assessment of construction noise is based on the methodology contained within BS 5228-1:2009+A1:2014 'Code of Practice for Noise and Vibration Control on Construction and Open Sites – Noise'. The noise predictions determine whether the construction activities have the potential to result in significant adverse effects on the surrounding sensitive receptors. The prediction method considers the noise emission level of the proposed plant items, separation distance between the source and receptor, topographical features and intervening ground conditions.

12.3.16 Section E.3.2 details the 'ABC Method' of determining the likely significance of noise effects from construction. This method defines threshold noise levels for different time periods which are dictated by the pre-construction ambient noise levels. If the construction stage noise levels exceed the appropriate threshold value, then a likely significant effect is indicated. The threshold values are reproduced below in Table 12.7.

Table 12-7 Threshold of significant effect at dwellings (BS 5228 Table E.1)

Assessment category and threshold value period	Threshold value, $L_{Aeq,T}$ (dB)		
	Category A[A]	Category B[B]	Category C[C]
Night-time (23:00-07:00)	45	50	55
Evening and weekends [D]	55	60	65
Daytime (07:00-19:00) and Saturdays (07:00-13:00)	65	70	75

[A] Category A used when ambient noise levels (when rounded to the nearest 5dB(A)) are less than these values.
[B] Category B used when ambient noise levels (when rounded to the nearest 5dB) are the same as the category A values.
[C] Category C used when the ambient noise levels (when rounded to the nearest 5dB) are higher than category A values.
[D] 19.00 – 23.00 weekdays, 13.00-23.00 Saturdays and 07.00 – 23.00 Sundays.

Notes

[Note 1]
A significant effect has been deemed to occur if the L_{Aeq} noise level arising from the site exceeds the threshold level for the category appropriate to the ambient noise level.
[Note 2]
If the ambient noise level exceeds the threshold values given in the table (i.e. the ambient noise levels is higher than the above values), then a likely significant effect is indicated if the total $L_{Aeq,T}$ noise level for the period increases by more than 3dB due site noise.
[Note 3]
Applied to residential receptors only.

12.3.17 Based on the above guidance, the magnitude of impact for the construction assessment has been defined below in Table 12.8.

Table 12-8 Magnitude of impact for the construction assessment

Generic	Daytime (Category A receptors)	Weekend (Category A receptors)	Magnitude of Impact
> Threshold + 10dB	> 75dB	> 65dB	High
Threshold < x ≤ Threshold + 10dB	65dB < x ≤ 75dB	55dB < x ≤ 65dB	Medium
Threshold - 10dB < x ≤ Threshold	55dB < x ≤ 65dB	45dB < x ≤ 55dB	Low
≤ Threshold - 10dB	≤ 55dB	≤ 45dB	Negligible

12.3.18 Annex E also includes guidance and thresholds which apply for noise insulation and temporary rehousing if "all reasonable measures have been taken to reduce the noise levels but levels are still such that widespread community disturbance or interference with activities or sleep is likely to occur". These are set out in Table 12.9 below.

Table 12-9 Noise insulation and temporary rehousing criteria

Time	Relevant time period	Averaging time, T	Noise insulation trigger level dB $L_{Aeq,T}$ [A) B) C)]
Monday to Friday	07:00 – 08:00	1h	70
	08:00 – 18:00	10h	75
	18:00 – 19:00	1h	70
	19:00 – 22:00	3h	65
	22:00 – 07:00	1h	55
Saturday	07:00 – 08:00	1h	70
	08:00 – 13:00	5h	75
	13:00 – 14:00	1h	70
	14:00 – 22:00	3h	65

Time	Relevant time period	Averaging time, T	Noise insulation trigger level dB $L_{Aeq, T}$ A) B) C)
	22:00 – 07:00	1h	55
Sunday and Public Holidays	07:00 – 21:00	1h	65
	21:00 – 07:00	1h	55

A) All noise levels are predicted or measured at a point 1m in front of the most exposed of any windows and doors in any façade of any eligible dwelling.
B) Noise Insulation eligible for exceedance of the higher of:

- Noise insulation trigger levels.
- 5dB or more above existing pre-construction ambient noise level.

When the exceedance occurs for a period of 10 or more days of working in any 15 consecutive days or for a total number of days exceeding 40 in any 6 consecutive months.
C) Temporary rehousing is eligible for exceedance of the higher of:

- Noise level 10dB above noise insulation trigger levels.
- Noise level 10dB above pre-construction ambient noise level.

When exceedance occurs for a period of 10 or more days of working in any 15 consecutive days or for a total number of days exceeding 40 in any 6 consecutive months.

Construction Vibration

12.3.19 Certain construction works can produce ground-borne vibration, which has the potential to give rise to impacts at sensitive receptors including buildings and buried structures. The main source of vibration associated with the construction is expected to be attributable to compaction works (e.g. vibratory roller).

12.3.20 Annex B of BS 5228-2:2009+A1:2015 'Code of practice for noise and vibration control on construction and open sites. Vibration' gives guidance on the significance of vibration effects in terms of human response to vibration and structural response to vibration. The criteria are lower for human response and hence keeping within these criteria will naturally result in no structural damage. The criteria for human response are reproduced in Table 12.10 below.

Table 12-10 Guidance on effects of vibration levels perceptible to humans

Vibration level (PPV)	Descriptive Effect	Magnitude of Impact
0.14mm/s	Vibration might be just perceptible in the most sensitive situations for most vibration frequencies associated with construction. At lower frequencies, people are less sensitive to vibration	Negligible < 0.30mm/s

Vibration level (PPV)	Descriptive Effect	Magnitude of Impact
0.30mm/s	Vibration might be just perceptible in residential environments	0.30mm/s ≤ Low < 1.00mm/s
1.00mm/s	It is likely that vibration of this level in residential environments will cause complaint, but can be tolerated if prior warning and explanation has been given to residents	1.00mm/s ≤ Medium < 10.00mm/s
10.00mm/s	Vibration is likely to be intolerable for any more than a very brief exposure to this level	High ≥ 10.00mm/s

Construction Traffic

12.3.21 The assessment of construction traffic noise utilises the information set out in Chapter 4 alongside the traffic routing and future baseline traffic flows derived in Chapter 11. Annual average weekday traffic flows have been used to predict the change in noise level through different phases of the construction works. The guidance in DMRB LA 111 results in the magnitude of impact criteria outlined in Table 12.11 below.

Table 12-11 Magnitude of impact criteria for construction traffic noise

Increase in road traffic noise	Magnitude of Impact	Significance of effect for High sensitivity receptors
< 1dB	Negligible	Negligible
1dB ≤ x < 3dB	Low	Minor
3dB ≤ x < 5dB	Medium	Moderate
≥ 5dB	High	Major

Operational Noise for Overhead Lines

12.3.22 The operational assessment of overhead lines is undertaken using a tiered approach as per the guidance in TGN(E)322. If the predicted noise levels for each Tier result in "No Adverse Effect", the receptors can be scoped out from further assessment.

12.3.23 A Tier 1 assessment considers the predicted noise from the overhead line during wet weather ("wet noise") and compares against absolute criteria. Table 12.12 below identifies when receptors need further assessment as part of a Tier 1 when considering the predicted wet noise from the overhead line.

Table 12-12 Tier 1 Wet noise criteria and resulting significance of effect

Significance of Effect	Sensitivity of Receptor (dB)			
Magnitude	High	Medium	Low	Negligible

Significance of Effect	Sensitivity of Receptor (dB)			
High	>44	>44	>44	>44
Medium	39 – 44	39 – 44	39 – 44	39 – 44
Low	34 – 39	34 – 39	34 – 39	34 – 39
Negligible	29 – 34	29 – 34	29 – 34	29 – 34
No effect	<29	<29	<29	<29

12.3.24 A Tier 2 assessment considers the predicted noise from the overhead line in both wet and dry conditions. A percentage time correction is applied to the noise level for each condition and then combined to calculate an average level based on average rainfall in a year ("combined wet and dry noise". Table 12.13 below identifies when receptors need further assessment as part of Tier 2 when considering the combined wet and dry noise from the overhead line.

Table 12-13 Tier 2 Combined wet and dry noise criteria and resulting significance of effect

Significance of Effect	Sensitivity of Receptor			
Magnitude	**High**	**Medium**	**Low**	**Negligible**
High	>47	>47	>47	>47
Medium	42 – 47	42 – 47	42 – 47	42 – 47
Low	37 – 42	37 – 42	37 – 42	37 – 42
Negligible	32 – 37	32 – 37	32 – 37	32 – 37
No Effect	<32	<32	<32	<32

12.3.25 A Tier 3 assessment involves applying an appropriate "miller curve" to the measured background sound level to determine a "wet background sound level". This is then compared to the predicted wet noise. Table 12.14 below identifies the magnitude of impact and significance of effect for a Tier 3 assessment.

Table 12-14 Tier 3 Noise criteria and resulting significance of effect

Significance of Effect	Sensitivity of Receptor			
Magnitude	**High**	**Medium**	**Low**	**Negligible**
High	≥10dB	≥10dB	≥10dB	≥10dB
Medium	+ 5dB to + 9dB	+ 5dB to + 9dB	+ 5dB to + 9dB	+ 5dB to + 9dB
Low	+ 0dB to + 4dB	+ 0dB to + 4dB	+ 0dB to + 4dB	+ 0dB to + 4dB
Negligible	≤0dB	≤0dB	≤0dB	≤0dB

Significance of Effect	Sensitivity of Receptor			
Magnitude	**High**	**Medium**	**Low**	**Negligible**
No Effect	≤0dB	≤0dB	≤0dB	≤0dB

12.4 Methodology – Bonnybridge and Cumbernauld Substation Extensions

Sensitivity of Receptors

12.4.1 The sensitivity of the NSR is estimated in its current state by comparing its use to the NSR sensitivity definitions in TAN: Assessment of Noise (Scottish Government 2011). The definitions can be seen in Table 12.15 below.

Table 12-15 Level of Sensitivity Associated with Various Examples of NSRs

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

Identification of Sensitive Receptors

12.4.2 Potential NSRs were processed from Address Base data and cross-checked with satellite imagery. Seven NSRs were selected as an indicative 360-degree view of the closest properties to the Proposed Cumbernauld Substation Development. A further five NSRs

were selected as an indicative 360-degree view of the closest properties to the Proposed Bonnybridge Substation Development. All selected NSRs are treated as High sensitivity as they are considered residential in nature and therefore places where people could be particularly susceptible to noise.

12.4.3 The seven NSRs for Cumbernauld Substation are detailed in Table 12.16 and shown in Volume 2, Figure 12.3. The five NSRs for Bonnybridge Substation and detailed in Table 12.17 and shown in Volume 2, Figure 12.5.

Table 12-16 Cumbernauld NSRs

NSR	Easting	Northing	Address	Sensitivity
1	277533	674647	Laburnum Road	High
2	277654	674585	Consented not yet built	High
3	277690	674525	Consented not yet built	High
4	277703	674490	Consented not yet built	High
5	276649	673311	Greenside Cottage	High
6	276763	674449	204 Millcroft Road	High
7	277102	674800	19 Moss Kowe	High

Table 12-17 Bonnybridge NSRs

NSR	Easting	Northing	Address	Sensitivity
1	284739	681203	Bogton Farm	High
2	284659	680979	Wester Calmuirs Farm	High
3	283423	680717	133 Falkirk Road	High
4	283348	680746	101 Gateside Avenue	High
5	283291	680778	71 Gateside Avenue	High
6	283506	681723	Hills of Dunipace	High

Determining Magnitude of Impact

12.4.4 The impact magnitude has been assessed for both the construction noise and vibration in addition to the operational noise. These methods to determine impact magnitude of either major, moderate, minor, or negligible are described in the following sections.

Construction Noise

12.4.5 The noise criteria provided for the ABC method detailed in BS 5228-1 are shown in Table 12.7. NSRs are classified in categories A, B or C according to their measured or estimated background noise level. If the site noise level exceeds the threshold value of the appropriate category, then a likely significant effect is indicated.

12.4.6 The construction time periods according to BS 5228-1 are show in Table 12.18 below.

Table 12-18 Construction Noise Time Periods

Assessment Category	Definition
Night-time	23:00 to 07:00 everyday
Evenings and weekends	19:00 to 23:00 on weekdays 13:00 to 23:00 on Saturdays 07:00 to 23:00 on Sundays
Daytime	07:00 to 19:00 on weekdays 07:00 to 13:00 on Saturdays

12.4.7 To determine the threshold value and noise limit to which the construction noise is assessed against, the periods must be defined and categories identified.

12.4.8 Night-time is defined as between 23:00 and 07:00. This is also in line with the BS 4142 definition for night-time. Evenings and weekends are defined as 19:00 – 23:00 on weekdays, 13:00 – 23:00 on Saturdays and 07:00 – 23:00 on Sundays. Daytime is defined to be 07:00 – 19:00 on weekdays and 07:00 – 13:00 on Saturdays.

12.4.9 The NSR is defined as Category A if the ambient noise levels (rounded to the nearest 5dB) are less than those stated for Category A. This is true for the Study Area as shown by the background noise measurements presented in Table 12.44 and Table 12.62. Higher category thresholds are usually for more urbanised or industrial areas with high ambient noise levels.

12.4.10 From the outlined construction schedule, work is expected 6 days a week. It is expected that the construction works will occur 08:00-19:00 Monday-Friday and 08:00-13:00 Saturdays. The construction hours fall during daytime periods, as defined in BS 5228. It is not known what activities within each phase will take place at what times. Therefore, the 65dB(A) limit has been adopted for this assessment. If work occurs at other times, then the construction noise assessment should be updated to reflect the correct noise limit.

12.4.11 The following magnitude of impact at receptors can be determined from Table 12.8. Excess over the 65dB criteria will result in Medium impact magnitude. Excess of 5dB or more over the noise limit will result in High impact magnitude. As described in Table 12.6 these impact levels and High sensitivity receptors would result in Moderate and Major significances of effect respectively.

Operational Noise

12.4.12 The noise criteria for operational noise are taken from BS 4142 and are split into magnitudes of impact in line with TAN: Assessment of Noise (Scottish Government 2011). The criteria and magnitudes of impact are presented in Table 12.19 below.

Table 12-19 Operational Noise - Magnitude of Impact at Receptors

Magnitude of Impact	Operational Noise Excess Above background (dB)
High	> 10
Medium	5 to 10

Magnitude of Impact	Operational Noise Excess Above background (dB)
Low	0 to 5
Magnitude of Impact	Operational Noise Excess Above background (dB)

Determining the Significance of Impacts

12.4.13 The significance of impacts are defined by the magnitude of impact and the sensitivity of receptor. A matrix based on TAN: Assessment of Noise (Scottish Government 2011) is presented in Table 12.20 below.

Table 12-20 Significance of Impacts Matrix

Magnitude of Impact	Level of Significance Relative to Sensitivity of Receptor		
	Low	**Medium**	**High**
High	Slight/Moderate	Moderate/Large	Large/Very Large
Medium	Slight	Moderate	Moderate/Large
Low	Neutral/Slight	Slight	Slight/Moderate
Negligible	Neutral/Slight	Neutral/Slight	Slight

12.4.14 TAN also provides guidance as to the meaning of each level of significance, these are explained as follows:

- **Very Large:** These effects represent key factors in the decision-making process. They are generally, but not exclusively, associated with impacts where mitigation is not practical or would be ineffective;
- **Large:** These effects are likely to be important considerations but where mitigation may be effectively employed such that resultant adverse effects are likely to have a Moderate or Slight significance;
- **Moderate:** These effects, if adverse, while important, are not likely to be key decision making issues;
- **Slight:** These effects may be raised but are unlikely to be of importance in the decision making process; and
- **Neutral:** No effect, not significant, noise need not be considered as a determining factor in the decision making process.

12.5 Assessment of Effects, Mitigation and Residual Effects of the New Build Overhead Line

Introduction

12.5.2 The New Build Overhead line (the WB Route) will be a new double circuit overhead line consisting of approximately 19km of new overhead line running from Glenmavis to Bonnybridge Substation, with a connection to Cumbernauld Substation. This new

overhead line will have an operational capacity of 400kV, with the option for the circuits to operate at 400kV and 275kV.

12.5.3 The New Build Overhead line is set to consist of L8c towers, carrying twin GZTAR Matthew conductors, which have a standard design height of 63m, and minimum ground clearance of 7.6m. An approximate 'span length' between towers is set to be 300m, however this will vary upon obstacles and altitude, generally it is anticipated there will be 3-4 towers per kilometre.

Baseline and Future Baseline Conditions

12.5.4 Due to the tiered nature of the operational assessment and the use of absolute noise criteria, baseline measurements are only required for undertaking a Tier 3 assessment. No receptors were required to have a Tier 3 assessment. In addition, the lowest category threshold for construction (Category A) has been assigned for all receptors along the WB Route and therefore no baseline monitoring is required.

12.5.5 The majority of the WB Route is located within a rural setting, typically comprising agricultural land use, and therefore there are not expected to be significant changes to the future baseline conditions along this Route.

12.5.6 However, where the WB Route is located close to transport infrastructure, such as roads and rail lines, there is potential for growth in the traffic flows in the future baseline scenario. In the absence of significant alterations to the wider road or rail network, the variation in traffic flows would be expected to be incremental and therefore unlikely to give rise to perceptible changes in the acoustic environment.

Embedded Mitigation Measures

12.5.7 All conductors which are to be operated at 275kV or 400kV should be surface treated to increase surface wettability and reduce magnitude of audible noise (although this does not always remove noise altogether). As a minimum this should involve blasting the conductor surface.

12.5.8 Where necessary to achieve "no adverse impact level", as an alternative to the twin GZTAR Matthew conductor, the triple GZTACSR 400mm2 (Upas sized) conductor has been proposed. Compared to the twin GZTAR Matthew conductor, the triple GZTACSR 400mm2 (Upas sized) conductor features a larger radius, a higher number of sub-conductors, and reduced bundle spacing. Through testing it is known that these design changes effectively lower the audible noise emitted by the overhead line, thereby reducing the offset distance required to meet noise limits at sensitive receptors.

Assessment of Effects

Construction Noise

12.5.9 Construction noise predictions have been undertaken for each of the construction activities along the proposed WB Route.

12.5.10 Plant lists and assumptions have been included in Volume 3, Appendix 12.3.

12.5.11 Table 12.21 shows for each construction activity taking place for WB Route the distance at which predicted construction noise levels would result in high, medium or low magnitudes of impact, and the number of high sensitivity receptors in each category. Receptors with

lower sensitivity categories will result in lower levels of significance of effects, and any mitigation included will also benefit these receptors.

Table 12-21 Predicted impact from construction noise from New Build Overhead Line

Construction Activity		Minimum distance (m) to achieve 75dB(A)	Number of receptors exceeding 75dB(A)	Minimum distance (m) to chieve 65dB(A)	Number of receptors between 65dB(A) and 75dB(A)	Minimum distance (m) to achieve 55dB(A)	Number of receptors between 55dB(A) and 65dB(A)
		High magnitude weekdays & weekends [1]		Medium magnitude weekdays, high magnitude weekends [1]		Low magnitude weekdays, medium magnitude weekends [1]	
1	Construction of Access Arrangements	44	9	110	52	275	362
2	Establishment of Construction Compounds	30	0	76	0	191	10
3a	Installation of tower foundation (raft/pad & column)	11	0	28	0	69	0
3b	Installation of tower foundations (micropile/ rock anchor)	13	0	33	0	83	0
4	Erection of Towers	12	0	30	0	76	0
5	Conductor Stringing and Wiring	30	0	76	0	191	4

Construction Activity		Minimum distance (m) to achieve 75dB(A)	Number of receptors exceeding 75dB(A)	Minimum distance (m) to chieve 65dB(A)	Number of receptors between 65dB(A) and 75dB(A)	Minimum distance (m) to achieve 55dB(A)	Number of receptors between 55dB(A) and 65dB(A)
		High magnitude weekdays & weekends [1]		Medium magnitude weekdays, high magnitude weekends [1]		Low magnitude weekdays, medium magnitude weekends [1]	
7	Removal and Reinstatement of Temporary Works	19	6	48	4	120	68
8	Bellmouth construction	30	1	76	31	191	158
9	Site clearance and de-vegetation	25	0	63	0	158	18
10	Site clearance and demobilisation	10	0	25	0	63	0

[1]
Weekday daytime is Monday to Friday 07:00 – 19:00 and Saturday 07:00 – 13:00.
Weekend daytime is Saturday 13:00 – 16:00 and Sunday 07:00 – 16:00.
No works are expected outside these times as per the project description.

Construction Vibration

12.5.12 he main source of vibration associated with the construction is expected to be attributable to compaction works (e.g. vibratory roller).

12.5.13 Table 12.22 shows the predicted impact from vibration for each construction activity using a vibratory roller for WB Route.

Table 12-22 Predicted impact from construction vibration from New Build Overhead Line

Construction Activity Minimum distance to achieve threshold		Number of receptors exceeding threshold Start-up / Steady state High 6m	Medium 44m / 35m	Low 114m / 80m
2	Establishment of Construction Compounds	0	0 / 0	0 / 0
3b	Installation of tower foundations (micropile/ rock anchor)	0	0 / 0	0 / 0
8	Bellmouth construction	0	9 / 0	57 / 34

12.5.14 The Bellmouth construction activity is predicting to result in a medium impact for the closest receptors during start-up of the vibratory roller. All other construction activities are anticipated to result in low and negligible impacts at the receptors.

Construction Traffic Noise

12.5.15 The construction traffic noise assessment is based on the information set out in Chapter 11 and the accompanying Volume 3, Appendix 11.1.

12.5.16 Table 12.23 summarises the potential impact of construction phase traffic noise from the New Build Overhead Line.

Table 12-23 Construction traffic road noise level change

Road name/link	Short term noise level change,dB $L_{A10, 18hr}$	Magnitude of impact
A883 Bonnybridge	0.1	Negligible
B9095 (M876 Junction 1)	0.3	Negligible
A883 (M876 Junction 1)	0.1	Negligible
A8004 Checkbar	0.2	Negligible
A803 Bonnybridge Substation	0.1	Negligible
A803 Falkirk Road	0.0	Negligible
B816 Bridge Street	0.0	Negligible

Road name/link	Short term noise level change,dB $L_{A10, 18hr}$	Magnitude of impact
Foundry Road	0.1	Negligible
A803 Glasgow Road	0.1	Negligible
Main Street Camelon	0.0	Negligible
B816 Glenfuir Road	0.1	Negligible
B816 Tamfourhill Road	0.2	Negligible
B816 Bonnyhill Road	0.5	Negligible
Beam Road	1.0	Low
Greenhill Road	0.2	Negligible
Glenyards Road	1.0	Low
B816 Seabegs Road	0.0	Negligible
Lochgreen Road	0.5	Negligible
Skipperton Burn road	1.4	Low
B816 Castlecary Road	0.0	Negligible
Forest Road Wardpark	0.1	Negligible
Forest Road Abronhill	0.1	Negligible
Arns Road	1.4	Low
Fannyside Road	0.3	Negligible
Forest Road Blackthorn Roundabout	0.1	Negligible
Forest Road Cumbernauld Substation	0.0	Negligible
B8054 Lenziemill Road East	0.0	Negligible
Palacerigg Road	0.2	Negligible
B8054 Lenziemill Road West	0.1	Negligible
A73 Greenfulds	0.0	Negligible
A73 Blairlinn	0.0	Negligible
Hulks Road	1.7	Low
B8039 Stirling Road Blackbog	0.0	Negligible
A73 Riggend	0.0	Negligible
Brackenhirst Road	0.4	Negligible
B803 Greengairs Road west	0.0	Negligible

Road name/link	Short term noise level change,dB $L_{A10, 18hr}$	Magnitude of impact
B803 Greengairs Road east	0.1	Negligible
A73 Stand Stirling Road	0.0	Negligible
B803 Raebog Road	0.0	Negligible
M876 Junction 1 - 2	0.0	Negligible
M876 Bankhead - Checkbar Junction	0.0	Negligible
M80 Bankhead - Old Inns Junction	0.0	Negligible
M80 Junction 4 - 6	0.0	Negligible

12.5.17 As shown in the above table, the increase in noise due to construction traffic is expected to result in low magnitude impacts or less for all road links. For high sensitivity receptors this equates to minor adverse effects (not significant).

Operational Noise

12.5.18 The receptors within the study area for operational noise are all residential and hence classified as medium sensitivity.

12.5.19 Wet and dry noise levels for WB Route have been predicted and reported by Bakerhicks in DWNO-MORG-CO-ZZZZOHL-RT-EL-0001 'WB Route: NOISE ASSESSMENT IN IDENTIFYING AREAS OF NOISE SENSITIVE RECEPTORS', along with minimum distances required to achieve Tier 2 criteria. These have been included in Volume 3, Appendix 12.4.

12.5.20 As identified in the above report, the Tier 1 criteria are exceeded at all the receptors within the study area for WB Route and therefore all receptors within the study area require further assessment.

12.5.21 However, to meet the Tier 2 criteria the triple conductor is required between span WB049 and WB054. Outwith this section, no receptors exceed the Tier 2 criteria using the twin conductor. No receptors require Tier 3 assessment.

Summary of Significant Effects

12.5.22 Table 12.24 summarises the predicted likely significant effects for the New Build Overhead Line aspect of the Project.

Table 12-24 Summary of significant effects for New Build Overhead Line

Project phase	Significant effects (without additional mitigation)
Construction noise	As summarised in Table 12.21, the below activities result in **short term major significant effects** at up to nine receptors on weekdays and up to 52 receptors on weekends: • Construction of Access Arrangements (weekdays and weekends).

Project phase	Significant effects (without additional mitigation)
	• Removal and Reinstatement of Temporary Works (weekdays and weekends). • Bellmouth construction (weekdays and weekends). The below activities result in **short term moderate significant effects** at up to 52 receptors on weekdays and 362 receptors on weekends: • Construction of Access Arrangements (weekdays and weekends). • Establishment of construction compounds (weekends only). • Conductor stringing and wiring (weekends only). • Removal and Reinstatement of Temporary Works (weekdays and weekends). • Bellmouth construction (weekdays and weekends). • Site clearance (weekends only). All other activities result in **short term minor or negligible effects.**
Construction vibration	As summarised in **Error! Reference source not found.**, the below activities result in **short term moderate significant effects** at nine receptors: • Bellmouth construction. All other activities result in **short term minor or negligible effects.**
Construction traffic noise	All road links result in **short term minor or negligible effects**
Operational noise	All receptors result in **long term negligible effects**

Proposed Additional Mitigation Measures

Construction noise and vibration

12.5.23 The following mitigation measures are proposed to be implemented as part of a Construction Environmental Management Plan (CEMP) to minimise the noise and vibration impacts at receptors in the vicinity of the construction works:

- All construction activities to be undertaken in accordance with BPM as set out in BS 5228-1;
- All equipment will be maintained in good working order and will be fitted with appropriate noise control at all times (for example, silencers, mufflers and acoustic hoods). Quieter options for equipment to be used where possible;
- All site employees to be advised of the noise sensitive nature of the area and be informed to adopt the quietest work practices, where appropriate;

- Site terrain, material stockpiles and suitable work locations will be used so as to screen work locations and maximise the distance between work activities and receptors;
- Additional temporary enclosures will be used to screen all static or semi-static plant from noise sensitive receptor locations; and
- A programme of community liaison will be carried out, including notification of works and details of the complaints process.

12.5.24 The magnitude of attenuation resulting from mitigation is not quantifiable at this stage. This is due to the high level nature of the proposed construction methodology. Therefore residual effects due to construction noise are not quantifiable. However, the residual levels should be confirmed through the use of a Construction Noise Management Plan (CNMP), construction programming and Section 61 applications where necessary. These are considered to be an industry standard approach to noise control from construction, allowing flexibility in construction technique, but ensuring impacts are controlled. The CNMP would be used to reduce the levels to a non-significant impact, or outline BPM to be implemented in order to control noise to lowest achievable levels.

Residual Effects

12.5.25 **Error! Reference source not found.** summarises the predicted likely residual effects for the New Built Overhead Line aspect of the Project.

Table 12-25 Summary of residual effects for New Build Overhead Line

Project phase	Significant effects (with additional mitigation)
Construction noise	Construction noise levels would be controlled through the use of a CNMP and would be reduced to levels of a **minor or negligible (non-significant) effect**.
Construction vibration	The below activities result in **short term moderate significant effects** at up to nine receptors: • Bellmouth construction. All other activities result in **short term minor or negligible effects.**
Construction traffic noise	All road links result in **short term minor or negligible effects**
Operational noise	All receptors result in **long term negligible effects**

Monitoring

12.5.26 Construction noise monitoring is unlikely to be required, as each construction task above is likely to only impact any individual receptor for a matter of weeks, even though the task for the project may last months. The construction programme can be finalised in order to ensure the exceedances do not occur for a period of 10 or more days of working in any 15 consecutive days or for a total number of days exceeding 40 in any 6 consecutive months.

12.5.27 As per the guidance provided in BS 5228-2, the magnitude of impact that is predicted from construction vibration is likely to cause complaint, however, with a programme of community liaison put in place (outlined in the mitigation measures) the levels "can be tolerated if prior warning and explanation has been given to residents" . Therefore, no construction vibration monitoring has been specifically recommended. No specific monitoring measures are considered to be required during operation of the New Build Overhead Line.

12.5.28 Should any noise-related complaints be received during either construction, operation or decommissioning, the Applicant could consider undertaking targeted monitoring.

12.6 Assessment of Effects, Mitigation and Residual Effects of the Uprated Overhead lines

Introduction

12.6.1 The ZG Route, XX Route and XR Route are proposed to be uprated from 275kV to 400kV and set to consist of L8c towers, carrying twin GZTAR Matthew conductors, triple GZTACSR 400mm2 (Upas sized) conductor where the outcome of the assessment identifies adverse effects. The section of XX Route between Easterhouse substation to XX0019B is proposed to remain at 275 kV.

Baseline and Future Baseline Conditions

12.6.2 Due to the tiered nature of the operational assessment and the use of absolute noise criteria, baseline measurements are only required for undertaking a Tier 3 assessment. No receptors were required to have a Tier 3 assessment along Route ZG and hence baseline monitoring has only been conducted along Routes XX and XR. For the construction assessment, the lowest category thresholds (Category A) have been assigned for all receptors along Routes ZG, XX and XR.

12.6.3 Baseline levels along Route XX and XR have been reported in 2063684-RSKA-RP-001-(01) 'Denny to Wishaw OHL Baseline Noise' and 2063684-RSKA-RP-002-(01) 'Denny to Wishaw OHL Baseline Noise' and have been included in Volume 3, Appendix 12.2.

12.6.4 The majority of the ZG, XX and XR Routes are located within a rural setting, typically comprising agricultural land use, and therefore there are not expected to be significant changes to the future baseline conditions along this Route.

12.6.5 However, where the ZG, XX and XR Routes are located close to transport infrastructure, such as roads and rail lines, there is potential for growth in the traffic flows in the future baseline scenario. In the absence of significant alterations to the wider road or rail network, the variation in traffic flows would be expected to be incremental and therefore unlikely to give rise to perceptible changes in the acoustic environment.

Embedded Mitigation Measures

12.6.6 All conductors which are to be operated at 275kV or 400kV should be surface treated to increase surface wettability and reduce audible noise (although this does not always remove noise altogether). As a minimum this should involve blasting the conductor surface.

12.6.7 For areas where necessary to achieve "no adverse impact level", as an alternative to the twin GZTAR Matthew conductor, the triple GZTACSR 400mm2 (Upas sized) conductor has been proposed. Compared to the twin GZTAR Matthew conductor, triple GZTACSR 400mm2 (Upas sized) conductor features a larger radius, a higher number of sub-conductors, and reduced bundle spacing. These design changes effectively lower the audible noise emitted by the overhead line, thereby reducing the offset distance required to meet noise limits at sensitive receptors.

12.6.8 The following sections of line are proposed to use the triple GZTACSR 400mm2 (Upas sized) conductor:

- XX0001B – XX002;
- XX002 – XX003;
- XX006 – XX010;
- XX010 – XX014;
- XX019B – Newarthill Substation (XX049); and
- Newarthill Substation (XR001) – Wishaw Substation (XR050).

Assessment of Effects

Construction Noise

12.6.9 Construction noise predictions have been undertaken for each of the construction activities being undertaken along the proposed updated ZG, XX and XR Routes.

12.6.10 Plant lists and assumptions have been included in Volume 3, Appendix 12.3.

12.6.11 Table 12.26 shows for each construction activity taking place for the ZG Route the distance at which predicted construction noise levels would result in high, medium or low magnitudes of impact, and the number of high sensitivity receptors in each category. Receptors with lower sensitivity categories will result in lower levels of significance of effects, and any mitigation included will also benefit these receptors.

12.6.12 Table 12.27 shows for each construction activity taking place for the XX Route the distance at which predicted construction noise levels would result in high, medium or low magnitudes of impact, and the number of high sensitivity receptors in each category. Receptors with lower sensitivity categories will result in lower levels of significance of effects, and any mitigation included will also benefit these receptors.

12.6.13 Table 12.28 shows for each construction activity taking place for the XR Route the distance at which predicted construction noise levels would result in high, medium or low magnitudes of impact, and the number of high sensitivity receptors in each category. Receptors with lower sensitivity categories will result in lower levels of significance of effects, and any mitigation included will also benefit these receptors.

Table 12-26 Predicted impact from construction noise from Uprated ZG Route

Construction Activity		Minimum distance (m) to achieve 75dB(A)	Number of receptors exceeding 75dB(A)	Minimum distance (m) to chieve 65dB(A)	Number of receptors between 65dB(A) and 75dB(A)	Minimum distance (m) to achieve 55dB(A)	Number of receptors between 55dB(A) and 65dB(A)
		High magnitude weekdays & weekends [1]		Medium magnitude weekdays, high magnitude weekends [1]		Low magnitude weekdays, medium magnitude weekends [1]	
1	Construction of Access Arrangements	44	1	110	4	275	4
2	Establishment of Construction Compounds	30	0	76	0	191	0
3a	Installation of tower foundation (raft/pad & column)	11	0	28	0	69	0
3b	Installation of tower foundations (micropile/ rock anchor)	13	0	33	0	83	0
4	Erection of Towers	12	0	30	0	76	0
5	Conductor Stringing and Wiring	30	0	76	0	191	0

Construction Activity		Minimum distance (m) to achieve 75dB(A)	Number of receptors exceeding 75dB(A)	Minimum distance (m) to chieve 65dB(A)	Number of receptors between 65dB(A) and 75dB(A)	Minimum distance (m) to achieve 55dB(A)	Number of receptors between 55dB(A) and 65dB(A)
		High magnitude weekdays & weekends [1]		Medium magnitude weekdays, high magnitude weekends [1]		Low magnitude weekdays, medium magnitude weekends [1]	
7	Removal and Reinstatement of Temporary Works	19	0	48	3	120	2
8	Bellmouth construction	30	0	76	0	191	5
9	Site clearance and de-vegetation	25	0	63	0	158	0
10	Site clearance and demobilisation	10	0	25	0	63	0

[1]
Weekday daytime is Monday to Friday 07:00 – 19:00 and Saturday 07:00 – 13:00.
Weekend daytime is Saturday 13:00 – 16:00 and Sunday 07:00 – 16:00.
No works are expected outside these times as per the project description.

Table 12-27 Predicted impact from construction noise from Uprated XX Route

Construction Activity		Minimum distance (m) to achieve 75dB(A)	Number of receptors exceeding 75dB(A)	Minimum distance (m) to chieve 65dB(A)	Number of receptors between 65dB(A) and 75dB(A)	Minimum distance (m) to achieve 55dB(A)	Number of receptors between 55dB(A) and 65dB(A)
		High magnitude weekdays & weekends [1]		Medium magnitude weekdays, high magnitude weekends [1]		Low magnitude weekdays, medium magnitude weekends [1]	
1	Construction of Access Arrangements	44	75	110	281	275	1572
2	Establishment of Construction Compounds	30	0	76	0	191	3
3a	Installation of tower foundation (raft/pad & column)	11	2	28	58	69	187
3b	Installation of tower foundations (micropile/ rock anchor)	13	4	33	69	83	257
4	Erection of Towers	12	4	30	62	76	210
5	Conductor Stringing and Wiring	30	0	76	0	191	63

Construction Activity		Minimum distance (m) to achieve 75dB(A)	Number of receptors exceeding 75dB(A)	Minimum distance (m) to chieve 65dB(A)	Number of receptors between 65dB(A) and 75dB(A)	Minimum distance (m) to achieve 55dB(A)	Number of receptors between 55dB(A) and 65dB(A)
		High magnitude weekdays & weekends [1]		Medium magnitude weekdays, high magnitude weekends [1]		Low magnitude weekdays, medium magnitude weekends [1]	
7	Removal and Reinstatement of Temporary Works	19	3	48	81	120	359
8	Bellmouth construction	30	20	76	71	191	609
9	Site clearance and de-vegetation	25	213	63	224	158	714
10	Site clearance and demobilisation	10	100	25	113	63	224

[1]
Weekday daytime is Monday to Friday 07:00 – 19:00 and Saturday 07:00 – 13:00.
Weekend daytime is Saturday 13:00 – 16:00 and Sunday 07:00 – 16:00.
No works are expected outside these times as per the project description.

Table 12-28 Predicted impact from construction noise from Uprated XR Route

Construction Activity		Minimum distance (m) to achieve 75dB(A)	Number of receptors exceeding 75dB(A)	Minimum distance (m) to chieve 65dB(A)	Number of receptors between 65dB(A) and 75dB(A)	Minimum distance (m) to achieve 55dB(A)	Number of receptors between 55dB(A) and 65dB(A)
		High magnitude weekdays & weekends [1]		Medium magnitude weekdays, high magnitude weekends [1]		Low magnitude weekdays, medium magnitude weekends [1]	
1	Construction of Access Arrangements	44	56	110	224	275	938
2	Establishment of Construction Compounds	30	0	76	32	191	145
3a	Installation of tower foundation (raft/pad & column)	11	0	28	3	69	48
3b	Installation of tower foundations (micropile/ rock anchor)	13	0	33	9	83	79
4	Erection of Towers	12	0	30	6	76	56
5	Conductor Stringing and Wiring	30	0	76	0	191	9

Construction Activity		Minimum distance (m) to achieve 75dB(A)	Number of receptors exceeding 75dB(A)	Minimum distance (m) to chieve 65dB(A)	Number of receptors between 65dB(A) and 75dB(A)	Minimum distance (m) to achieve 55dB(A)	Number of receptors between 55dB(A) and 65dB(A)
		High magnitude weekdays & weekends [1]		Medium magnitude weekdays, high magnitude weekends [1]		Low magnitude weekdays, medium magnitude weekends [1]	
7	Removal and Reinstatement of Temporary Works	19	2	48	59	120	263
8	Bellmouth construction	30	39	76	43	191	234
9	Site clearance and de-vegetation	25	69	63	96	158	354
10	Site clearance and demobilisation	10	30	25	39	63	96

[1]
Weekday daytime is Monday to Friday 07:00 – 19:00 and Saturday 07:00 – 13:00.
Weekend daytime is Saturday 13:00 – 16:00 and Sunday 07:00 – 16:00.
No works are expected outside these times as per the project description.

Construction Vibration

12.6.14 The main source of vibration associated with the construction is expected to be attributable to compaction works (e.g. vibratory roller).

12.6.15 Table 12.29, Table 12.30 and Table 12.31 show the predicted impact from vibration for each construction activity using a vibratory roller for ZG, XX and XR Routes.

Table 12-29 Predicted impact of construction vibration from Uprated ZG Route

Construction Activity Minimum distance to achieve threshold		Number of receptors exceeding threshold Start-up / Steady state High 6m	Medium 44m / 35m	Low 114m / 80m
2	Establishment of Construction Compounds	0	0 / 0	0 / 0
3b	Installation of tower foundations (micropile/ rock anchor)	0	0 / 0	0 / 0
8	Bellmouth construction	0	0 / 0	3 / 0

Table 12-30 Predicted impact of construction vibration from Uprated XX Route

Construction Activity Minimum distance to achieve threshold		Number of receptors exceeding threshold Start-up / Steady state High 6m	Medium 44m / 35m	Low 114m / 80m
2	Establishment of Construction Compounds	0	0 / 0	1 / 0
3b	Installation of tower foundations (micropile/ rock anchor)	0	107 / 78	451 / 235
8	Bellmouth construction	0	33 / 25	178 / 73

Table 12-31 Predicted impact of construction vibration from Uprated XR Route

Construction Activity Minimum distance to achieve threshold		Number of receptors exceeding threshold Start-up / Steady state High 6m	Medium 44m / 35m	Low 114m / 80m
2	Establishment of Construction Compounds	0	16 / 0	80 / 32

Construction Activity Minimum distance to achieve threshold		Number of receptors exceeding threshold Start-up / Steady state High 6m	Medium 44m / 35m	Low 114m / 80m
3b	Installation of tower foundations (micropile/ rock anchor)	0	20 / 11	172 / 66
8	Bellmouth construction	1	42 / 40	98 / 59

Construction Traffic Noise

12.6.16 The construction traffic noise assessment is based on the information set out in Chapter 11 and the accompanying Volume 3, Appendix 11.1.

12.6.17 Table 12.32 summarises the potential impact of construction phase traffic noise from the Uprated (ZG, XX and XR Routes) overhead lines.

Table 12-32 Construction traffic road noise level change

Road name/link	Short term noise level change,dB $L_{A10, 18hr}$	Magnitude of impact
A872 Denny	0.0	Negligible
Denny Substation road	0.5	Negligible
A9 Stirling Road Glenbervie	0.1	Negligible
A9 Stirling Road North Broomage	0.0	Negligible
B905 Denny Road	0.0	Negligible
A883 Bonnybridge	0.0	Negligible
B9095 (M876 Junction 1)	0.1	Negligible
A883 (M876 Junction 1)	0.1	Negligible
A8004 Checkbar	0.1	Negligible
A803 Bonnybridge Substation	0.0	Negligible
A73 Greenfulds	0.1	Negligible
A73 Blairlinn	0.0	Negligible
A73 Riggend	0.1	Negligible
Brackenhirst Road	0.4	Negligible
A73 Stand Stirling Road	0.1	Negligible
B802 Condorrat Road	0.0	Negligible
B803 Raebog Road	0.0	Negligible
Yetts Hole Road	1.9	Low

Road name/link	Short term noise level change,dB $L_{A10, 18hr}$	Magnitude of impact
Muirdyke Road	0.3	Negligible
Burnlip Road	1.5	Low
B804 Gartliston Road	0.1	Negligible
Gartgill Road	0.9	Negligible
Craignethan Drve	0.2	Negligible
A752 Lochend Road	0.3	Negligible
A752 Coatbridge Road	0.0	Negligible
A73 Stirling Road Dykehead	0.0	Negligible
Dykehead Road	0.1	Negligible
A73 Holehills	0.0	Negligible
Airdriehill Road	0.3	Negligible
Burnhead Road	0.1	Negligible
A73 Motherwell Street Rawyards	0.0	Negligible
A73 Motherwell Street Airdrie	0.0	Negligible
A89 Airdrie Road	0.0	Negligible
A89 Forrest Street	0.0	Negligible
A73 Carlisle Road Chapelhall	-0.4	Negligible
Burniebrae Road	0.1	Negligible
Craigens Road	0.7	Negligible
Roughrigg Road	0.1	Negligible
Lawmope Mill Road	0.8	Negligible
A73 Bellside Road Chapelhall	3.0	Medium
Lancaster Avenue	0.0	Negligible
A73 Bellside Road Newhouse	0.3	Negligible
A775 Edinburgh Road	0.0	Negligible
Glasgow and Edinburgh Road	0.0	Negligible
Legbrannock Road	0.0	Negligible
Kirk Road	0.0	Negligible
Rowantree Avenue eastbound	0.0	Negligible
Rowantree Avenue westbound	0.0	Negligible
Biggar Road	1.0	Low

Road name/link	Short term noise level change,dB $L_{A10, 18hr}$	Magnitude of impact
B7066 Motherwell Road	0.1	Negligible
A73 Carlisle Road Brownhill Farm	0.3	Negligible
Hareshaw Road	3.4	Medium
Greenhill Road North	3.7	Medium
A73 Cleland	0.2	Negligible
Greenhill Road South	4.8	Medium
Muiredge and Jersey Road north	2.6	Low
Muiredge and Jersey Road south	2.5	Low
Foulburn Road	1.1	Low
Allanton Road	0.3	Negligible
Mill Road Allanton	0.1	Negligible
A71 Crindledyke	0.1	Negligible
A71 Allanton	0.1	Negligible
Mill Road / Coltness Avenue	1.9	Low
Daviesdyke Road	0.6	Negligible
Morningside East road	2.5	Low
Mill Road Morningside	1.4	Low
Morningside Road	0.3	Negligible
A71 Newmains	0.1	Negligible
A73 Main Street Newmains	0.1	Negligible
A73 Westwood Road	0.2	Negligible
A722 Manse Road	0.1	Negligible
Woodhall Road	0.8	Negligible
A73 Bogside	0.0	Negligible
A71 Overtown Road north	0.1	Negligible
A71 Overtown Road south	0.7	Negligible
B754 Castlehill Road	0.0	Negligible
Allershaw Road	0.7	Negligible
M9 Glenbervie - Bannockburn	0.0	Negligible
M80 Bankhead - Bannockburn	0.0	Negligible
M876	0.0	Negligible

Road name/link	Short term noise level change,dB $L_{A10, 18hr}$	Magnitude of impact
M80 Junction 4 - 6	0.0	Negligible
M73 Junction 2A - 3	0.0	Negligible
M8 Junction 6 -8	0.0	Negligible
M8 Junction 8-10	0.1	Negligible

12.6.18 As shown in the above table, the increase in noise due to construction traffic is expected to result in medium level impacts for four road links (resulting in moderate significant adverse effects). For three of these road links the change in noise level is the result of low baseline traffic flows. Based on application of absolute noise levels from the construction traffic movements, the affected receptors are likely to result in levels below 65dB LAeq, T. Levels of this magnitude are not considered a significant adverse effect in line with the recommendations of DMRB LA 111 Noise and Vibration and those threshold levels as derived in BS 5228-1:2009+A1:2014 'Code of Practice for Noise and Vibration Control on Construction and Open Sites – Noise'.

12.6.19 The increase in noise due to construction traffic elsewhere is expected to result in minor (or lower) impacts.

Operational Noise

12.6.20 The majority of receptors within the study area for operational noise are residential and hence classified as medium sensitivity (according to the overhead line noise guidance). However, a small number of medical buildings (e.g. Wester Moffat Hospital, local GP and dentist surgeries) are present along Route XX and classified as high sensitivity as per the TGN(E)322 guidance.

ZG Route

12.6.21 Wet and dry noise levels for ZG Route have been predicted and reported by Bakerhicks in DWNO-MORG-CO-ZZZZOHL-RT-EL-0013 'ZG Route: NOISE ASSESSMENT IN IDENTIFYING AREAS OF NOISE SENSITIVE RECEPTORS', along with minimum distances required to achieve Tier 2 criteria. These have been included in Volume 3, Appendix 12.4.

12.6.22 As identified in the above report, the Tier 1 criteria are exceeded at all the receptors within the study area for ZG Route and therefore all receptors within the study area require further assessment.

12.6.23 However, the Tier 2 criteria are not exceeded at any of the receptors within the study area for ZG Route and therefore result in "No Adverse Effect" and do not require further assessment.

XX Route

12.6.24 Wet and dry noise levels for XX Route have been predicted and reported by Bakerhicks in DWNO-MORG-CO-ZZZZOHL-RT-EL-0014 'XX Route: NOISE ASSESSMENT IN IDENTIFYING AREAS OF NOISE SENSITIVE RECEPTORS', along with minimum distances required to achieve Tier 2 criteria. These have been included in Volume 3, Appendix 12.4.

12.6.25 As identified in the above report, the Tier 1 criteria are exceeded at all the receptors within the study area for XX Route and therefore require further assessment.

12.6.26 With the above embedded mitigation in place 14 receptors exceed Tier 2 criteria between spans XX042 and XX047. However, all of these receptors result in negligible effects under the Tier 3 assessment. Receptors that required a Tier 3 assessment were assigned baseline levels from the nearest monitoring position. Sufficient monitoring positions were employed in order to ensure the measured levels were suitably representative of the receptors being assessed.

12.6.27 The outcome of the Tier 3 assessment is detailed in Volume 3, Appendix 12.4 and shown on Volume 2, Figure 12.1 'XX Tier 3 Assessment'.

XR Route

12.6.28 Wet and dry noise levels for XR Route have been predicted and reported by Bakerhicks in DWNO-MORG-CO-ZZZZOHL-RT-EL-0011 'XR Route: NOISE ASSESSMENT IN IDENTIFYING AREAS OF NOISE SENSITIVE RECEPTORS' along with minimum distances required to achieve Tier 2 criteria. These have been included in Volume 3, Appendix 12.4.

12.6.29 As identified in the above report, the Tier 1 criteria are exceeded at all the receptors within the study area for XR Route and therefore require further assessment.

12.6.30 With the above embedded mitigation in place 4 receptors exceed Tier 2 criteria between spans XR043 and XR045. However, all of these receptors result in low effects under the Tier 3 assessment. Receptors that required a Tier 3 assessment were assigned baseline levels from the nearest monitoring position. Sufficient monitoring positions were employed in order to ensure the measured levels were suitably representative of the receptors being assessed. The outcome of the Tier 3 assessment is detailed in Volume 3, Appendix 12.4 and shown on Volume 2, Figure 12.2 'XR Tier 3 Assessment'.

Summary of Significant Effects

12.6.31 Table 12.33 below summarises the predicted likely significant effects for the Uprated (ZG, XX and XR Routes) overhead line aspects of the project.

Table 12-33 Summary of significant effects for Uprated ZG, XX and XR Routes

Project Phase	Significant Effects (without additional mitigation)
Construction noise	The below activities result in **short term major significant effects**: • Construction of Access Arrangements (ZG, XX, XR weekdays and weekends). • Establishment of construction compounds (XR weekends only). • Installation of tower foundations (both raft/pad & column and micropile/rock anchor) (XX weekdays and weekends, XR weekends only). • Erection of towers (XX weekdays and weekends, XR weekends only).

Project Phase	Significant Effects (without additional mitigation)
	• Removal and Reinstatement of Temporary Works (XX and XR weekdays and weekends, ZG weekends only). • Bellmouth construction (XX and XR weekdays and weekends). • Site vegetation and clearance (XX and XR weekdays and weekends). • Site clearance and demobilisation (XX and XR weekdays and weekends). The below activities result in **short term moderate significant effects**: • Construction of Access Arrangements. • Establishment of construction compounds (XX weekends only, XR weekdays and weekends). • Installation of tower foundations (both raft/pad & column and micropile/rock anchor) (XX and XR weekdays and weekends). • Erection of towers (XX and XR weekdays and weekends). • Conductor stringing and wiring (XX and XR weekends only). • Removal and Reinstatement of Temporary Works. • Bellmouth construction (XX and XR weekdays and weekends, ZG weekends only). • Site vegetation and clearance (XX and XR weekdays and weekends). • Site clearance and demobilisation (XX and XR weekdays and weekends). All other activities result in **short term minor or negligible effects**
Construction vibration	The below activities result in **short term major significant effects**: Bellmouth construction The below activities result in **short term moderate significant effects**: • Establishment of Construction Compounds. • Installation of tower foundations (micropile/ rock anchor). • Bellmouth construction. All other activities result in **short term minor or negligible effects**

Project Phase	Significant Effects (without additional mitigation)
Construction traffic noise	The below road links are predicted to result in **short term moderate significant effects:** • A73 Bellside Road Chapelhall. All other road links are predicted to result in **short term minor or negligible effects**
Operational noise	All receptors result in **long term minor or negligible effects**

Proposed Additional Mitigation Measures

Construction noise

12.6.32 The following mitigation measures are proposed to be implemented as part of a CEMP to minimise the noise and vibration impacts at receptors in the vicinity of the construction works:

- All construction activities to be undertaken in accordance with BPM as set out in BS 5228-1;
- All equipment will be maintained in good working order and will be fitted with appropriate noise control at all times (for example, silencers, mufflers and acoustic hoods). Quieter options for equipment to be used where possible;
- All site employees to be advised of the noise sensitive nature of the area and be informed to adopt the quietest work practices, where appropriate;
- Site terrain, material stockpiles and suitable work locations will be used so as to screen work locations and maximise the distance between work activities and receptors;
- Additional temporary enclosures will be used to screen all static or semi-static plant from noise sensitive receptor locations; and
- A programme of community liaison will be carried out, including notification of works and details of the complaints process.

12.6.33 The magnitude of attenuation resulting from mitigation is not quantifiable at this stage. This is due to the high level nature of the proposed construction methodology. Therefore residual effects due to construction noise are not quantifiable. However, the residual levels should be confirmed through the use of a CNMP, construction programming and Section 61 applications where necessary. These are considered to be an industry standard approach to noise control from construction, allowing flexibility in construction technique, but ensuring impacts are controlled. The CNMP would be used to reduce the levels to a non-significant impact, or outline BPM to be implemented in order to control noise to lowest achievable levels.

Residual Effects

12.6.34 Table 12.34 below summarises the predicted likely residual effects for the Upated (ZG, XX and XR Routes) overhead line aspects of the project.

Table 12-34 Summary of residual effects for Uprated ZG, XX and XR Routes

Project Phase	Significant Effects (without additional mitigation)
Construction noise	Construction noise levels would be controlled through the use of a CNMP and would be reduced to levels of a **minor or negligible (non-significant) effect**.
Construction vibration	The below activities result in **short term major significant effects**: • Bellmouth construction. The below activities result in **short term moderate significant effects**: • Establishment of Construction Compounds. • Installation of tower foundations (micropile/ rock anchor). • Bellmouth construction. All other activities result in **short term minor or negligible effects**
Construction traffic noise	The below road links are predicted to result in **short term moderate significant effects:** • A73 Bellside Road Chapelhall. All other road links result in **long term minor or negligible effects**
Operational noise	All receptors result in **long term minor or negligible effects**

Monitoring

12.6.35 Construction noise monitoring is unlikely to be required, as each construction task above is likely to only impact any individual receptor for a matter of weeks, even though the task for the project may last months. The construction programme can be finalised in order to ensure the exceedances do not occur for a period of 10 or more days of working in any 15 consecutive days or for a total number of days exceeding 40 in any 6 consecutive months.

12.6.36 Construction vibration monitoring is likely to be required for Bellmouth construction which is predicted to be at a level that could be classed as “intolerable for any more than a very brief exposure to this level” . Installation of tower foundations are unlikely to require monitoring as although the magnitude of impact that is predicted is likely to cause complaint, with a programme of community liaison put in place (outlined in the mitigation measures) the levels “can be tolerated if prior warning and explanation has been given to residents”1.

12.6.37 No specific monitoring measures are considered to be required during operation of the Uprated (ZG, XX, XR Routes) overhead lines.

12.6.38 Should any noise-related complaints be received during either construction, operation or decommissioning, the Applicant could consider undertaking targeted monitoring.

12.7 Assessment of Effects, Mitigation and Residual Effects of the CB Route Removal

Introduction

12.7.1 The existing 132 kV CB Route is proposed to be removed as part of the Project, in order to provide a clear corridor for the new WB Route. The removal and dismantling involves the removal of conductors, removal of the earthwire and associated fittings, dismantling of existing towers, and removal of foundations to a depth of 1.5m.

12.7.2 Baseline and Future Baseline Conditions

12.7.3 For the construction assessment, the lowest category threshold (Category A) has been assigned for all receptors along the CB Route.

12.7.4 The majority of the CB Route is located within a rural setting, typically comprising agricultural land use, and therefore there are not expected to be significant changes to the future baseline conditions along this Route.

12.7.5 Embedded Mitigation Measures

12.7.6 No noise-specific embedded mitigation measures have been specified for this aspect of the project.

Assessment of Effects

Construction Noise

12.7.7 Construction noise predictions have been undertaken for each of the construction activities being undertaken along the CB Route.

12.7.8 Plant lists and assumptions have been included in Volume 3, Appendix 12.3.

12.7.9 Table 12.35 shows for each construction activity taking place for CB Route the distance at which predicted construction noise levels would result in high, medium or low magnitudes of impact, and the number of high sensitivity receptors in each category. Receptors with lower sensitivity categories will result in lower levels of significance of effects, and any mitigation included will also benefit these receptors.

Table 12-35 Predicted impact from construction noise for CB Route removal

Construction Activity		Minimum distance (m) to achieve 75dB(A)	Number of receptors exceeding 75dB(A)	Minimum distance (m) to chieve 65dB(A)	Number of receptors between 65dB(A) and 75dB(A)	Minimum distance (m) to achieve 55dB(A)	Number of receptors between 55dB(A) and 65dB(A)
		High magnitude weekdays & weekends [1]		Medium magnitude weekdays, high magnitude weekends [1]		Low magnitude weekdays, medium magnitude weekends [1]	
6	Dismantling of Existing Routes	36	0	91	2	229	19

[1]
Weekday daytime is Monday to Friday 07:00 – 19:00 and Saturday 07:00 – 13:00.
Weekend daytime is Saturday 13:00 – 16:00 and Sunday 07:00 – 16:00.

No works are expected outside these times as per the project description.

Construction Vibration

12.7.10 There are no sources of vibration associated with the construction activities for CB Route removal. Therefore the impact from construction vibration is negligible at all receptors.

12.7.11 Summary of Significant Effects

12.7.12 Table 12.36 below summarises the predicted likely significant effects for the CB removal aspect of the Project.

Table 12-36 Summary of significant effects for CB Route removal

Project Phase	Significant effects (without additional mitigation)
Construction noise	The below activities result in short term moderate to major significant effects: • Dismantling of Existing Routes (major weekends, moderate weekdays). All other activities result in **short term minor or negligible effects**
Construction vibration	All activities result in **short term minor or negligible effects**

Proposed Additional Mitigation Measures

Construction noise

12.7.13 The following mitigation measures are proposed to be implemented as part of a CEMP to minimise the noise and vibration impacts at receptors in the vicinity of the construction works:

- All construction activities to be undertaken in accordance with BPM as set out in BS 5228-1.
- All equipment will be maintained in good working order and will be fitted with appropriate noise control at all times (for example, silencers, mufflers and acoustic hoods). Quieter options for equipment to be used where possible.
- All site employees to be advised of the noise sensitive nature of the area and be informed to adopt the quietest work practices, where appropriate.
- Site terrain, material stockpiles and suitable work locations will be used so as to screen work locations and maximise the distance between work activities and receptors.
- Additional temporary enclosures will be used to screen all static or semi-static plant from noise sensitive receptor locations.
- A programme of community liaison will be carried out, including notification of works and details of the complaints process.

12.7.14 The magnitude of attenuation resulting from mitigation is not quantifiable at this stage. This is due to the high level nature of the proposed construction methodology. Therefore residual effects due to construction noise are not quantifiable. However, the residual levels should be confirmed through the use of a CNMP, construction programming and

Section 61 applications where necessary. These are considered to be an industry standard approach to noise control from construction, allowing flexibility in construction technique, but ensuring impacts are controlled. The CNMP would be used to reduce the levels to a non-significant impact, or outline BPM to be implemented in order to control noise to lowest achievable levels.

Residual Effects

12.7.15 Table 12.37 below summarises the predicted likely residual effects for the CB removal aspect of the Project.

Table 12-37 Summary of residual effects for CB Route removal

Project phase	Significant effects (with additional mitigation)
Construction noise	Construction noise levels would be controlled through the use of a CNMP and would be reduced to levels of a minor or negligible (non-significant) effect.
Construction vibration	All activities result in short term negligible effects

Monitoring

12.7.16 No specific monitoring measures are considered to be required during construction or operation of the CB removal. However, should any noise-related complaints be received during either construction, operation or decommissioning, the Applicant could consider undertaking targeted monitoring.

12.8 Assessment of Effects, Mitigation and Residual Effects of the AA Route Undergrounding

Introduction

12.8.1 The AA Route will be undergrounded in two sections where it would be crossed by the New Build Overhead line. The AA Route undergrounding works will take place between Bonnybridge Substation and existing AA towers of AA001 and in between existing towers AA006 and AA009. Operational noise from the AA Route will be quieter than current noise levels due to it being placed underground. Therefore only construction noise is considered for the AA Route.

Baseline and Future Baseline Conditions

12.8.2 For the construction assessment, the lowest category threshold (Category A) has been assigned for all receptors along the AA Route.

12.8.3 The majority of the AA Route is located within a rural setting, typically comprising agricultural land use, and therefore there are not expected to be significant changes to the future baseline conditions along this Route.

Embedded Mitigation Measures

12.8.4 No noise-specific embedded mitigation measures have been specified for this aspect of the Project.

Assessment of Effects

Construction Noise

12.8.5 Construction noise predictions have been undertaken for each of the construction activities being undertaken along the AA Route. Construction of access and compounds are shared with the WB Route and have not been included here to prevent duplication of impacts.

12.8.6 Plant lists and assumptions have been included in Volume 3, Appendix 12.3.

12.8.7 Table 12.38 shows for each construction activity taking place for AA Route the distance at which predicted construction noise levels would result in high, medium or low magnitudes of impact, and the number of high sensitivity receptors in each category. Receptors with lower sensitivity categories will result in lower levels of significance of effects, and any mitigation included will also benefit these receptors.

Table 12-38 Predicted impact from construction noise from AA Route undergrounding

Construction Activity		Minimum distance (m) to achieve 75dB(A)	Number of receptors exceeding 75dB(A)	Minimum distance (m) to chieve 65dB(A)	Number of receptors between 65dB(A) and 75dB(A)	Minimum distance (m) to achieve 55dB(A)	Number of receptors between 55dB(A) and 65dB(A)
		High magnitude weekdays & weekends [1]		Medium magnitude weekdays, high magnitude weekends [1]		Low magnitude weekdays, medium magnitude weekends [1]	
3a	Installation of tower foundation (raft/pad & column)	11	0	28	0	69	0
3b	Installation of tower foundations (micropile/ rock anchor)	13	0	33	0	83	0
4	Erection of Towers	12	0	30	0	76	0
5	Conductor Stringing and Wiring	30	2	76	5	191	2
6	Dismantling and Undergrounding of Existing Routes	36	2	91	0	229	0

[1]
Weekday daytime is Monday to Friday 07:00 – 19:00 and Saturday 07:00 – 13:00.
Weekend daytime is Saturday 13:00 – 16:00 and Sunday 07:00 – 16:00.

No works are expected outside these times as per the project description.

Construction Vibration

12.8.8 The main source of vibration associated with the construction is expected to be attributable to compaction works (e.g. vibratory roller).

12.8.9 Table 12.39 shows the predicted impact from vibration for each construction activity using a vibratory roller for AA Route.

Table 12-39 Predicted impact of construction vibration from AA Route undergrounding

Construction Activity Minimum distance to achieve threshold		Number of receptors exceeding threshold Start-up / Steady state High	Medium	Low
		6m	44m / 35m	114m / 80m
3b	Installation of tower foundations (micropile/ rock anchor)	0	2 / 1	0 / 1

12.8.10 The installation of tower foundations activity is predicted to result in a medium impact for the closest receptors. A minimum distance of 114m (start-up) or 80m (steady state) is required to result in a low or negligible impact.

Summary of Significant Effects

12.8.11 Table 12.40 below summarises the predicted likely significant effects for the AA undergrounding aspect of the Project.

Table 12-40 Summary of significant effects for AA Route undergrounding

Project phase	Significant effects (with additional mitigation)
Construction noise	The below activities result in **short term major significant effects**: • Conductor stringing and wiring (weekdays and weekends. • Dismantling and Undergrounding of Existing Routes (weekdays and weekends). The below activities result in **short term moderate significant effects**: • Conductor stringing and wiring (weekdays and weekends). All other activities result in **short term minor or negligible effects**
Construction vibration	The below activities result in **short term moderate significant effects**: • Installation of tower foundations (micropile/ rock anchor) All other activities result in **short term negligible effects**

Proposed Additional Mitigation Measures

Construction noise

12.8.12 The following mitigation measures are proposed to be implemented as part of a CEMP to minimise the noise and vibration impacts at receptors in the vicinity of the construction works:

- All construction activities to be undertaken in accordance with BPM as set out in BS 5228-1;
- All equipment will be maintained in good working order and will be fitted with appropriate noise control at all times (for example, silencers, mufflers and acoustic hoods). Quieter options for equipment to be used where possible;
- All site employees to be advised of the noise sensitive nature of the area and be informed to adopt the quietest work practices, where appropriate;
- Site terrain, material stockpiles and suitable work locations will be used so as to screen work locations and maximise the distance between work activities and receptors;
- Additional temporary enclosures will be used to screen all static or semi-static plant from noise sensitive receptor locations; and
- A programme of community liaison will be carried out, including notification of works and details of the complaints process.

12.8.13 The magnitude of attenuation resulting from mitigation is not quantifiable at this stage. This is due to the high level nature of the proposed construction methodology. Therefore residual effects due to construction noise are not quantifiable. However, the residual levels should be confirmed through the use of a CNMP, construction programming and Section 61 applications where necessary. These are considered to be an industry standard approach to noise control from construction, allowing flexibility in construction technique, but ensuring impacts are controlled. The CNMP would be used to reduce the levels to a non-significant impact, or outline BPM to be implemented in order to control noise to lowest achievable levels.

Residual Effects

12.8.14 Table 12.41 below summarises the predicted likely residual effects for the AA undergrounding aspect of the Project.

Table 12-41 Summary of residual effects for AA Route undergrounding

Project phase	Significant effects (with additional mitigation)
Construction noise	Construction noise levels would be controlled through the use of a CNMP and would be reduced to levels of a minor or negligible (non-significant) effect.
Construction vibration	The below activities result in short term moderate significant effects: • Installation of tower foundations (micropile/ rock anchor) All other activities result in short term negligible effects

Monitoring

12.8.15 Construction noise monitoring is unlikely to be required, as each construction task above is likely to only impact any individual receptor for a matter of weeks, even though the task for the project may last months. The construction programme can be finalised in order to ensure the exceedances do not occur for a period of 10 or more days of working in any 15 consecutive days or for a total number of days exceeding 40 in any 6 consecutive months.

12.8.16 As per the guidance provided in BS 5228-2, the magnitude of impact that is predicted is likely to cause complaint, however, with a programme of community liaison put in place (outlined in the mitigation measures) the levels "can be tolerated if prior warning and explanation has been given to residents".

12.8.17 Should any noise-related complaints be received during either construction, operation or decommissioning, the Applicant could consider undertaking targeted monitoring.

12.9 Assessment of Effects, Mitigation and Residual Effects of the Denny North Substation Works

Introduction

12.9.1 Works at Denny North Substation are required due to the uprating of the existing ZG Route. These comprise works at the northern side of the existing substation including the installation of a new bay containing air insulated switchgear and an overhead line gantry tower. No new noise generating equipment will be installed at the substation and hence only construction noise is considered for Denny North Substation.

Baseline and Future Baseline Conditions

12.9.2 Baseline measurements have not been conducted for Denny North Substation as there are no receptors within the 300m study area.

12.9.3 The Denny North Substation is located within a rural setting, typically comprising agricultural land use, and therefore there are not expected to be significant changes to the future baseline conditions.

Embedded Mitigation Measures

12.9.4 No noise-specific embedded mitigation measures have been specified for this aspect of the project.

Assessment of Effects

12.9.5 There are no receptors within the 300m construction noise study area for Denny North Substation and hence the associated works are anticipated to result in No Adverse Effects.

Construction traffic

12.9.6 The construction traffic noise assessment is based on the information set out in Chapter 11 and the accompanying Volume 3, Appendix 11.1.

12.9.7 Table 12.42 summarises the potential impact of construction phase traffic noise from the Denny North Substation Works.

Table 12-42 Construction traffic road noise level change

Road name/link	Short term noise level change,dB $L_{A10, 18hr}$	Magnitude of impact
A872 Denny	0.0	Negligible
Denny Substation Road	2.8	Low
M80 Bankhead - Bannockburn	0.0	Negligible
M80 Bankhead - Old Inns Junction	0.0	Negligible
M80 Junction 4 - 6	0.0	Negligible

12.9.8 As shown in the above table, the increase in noise due to construction traffic is expected to result in low and negligible impacts for all road links. For high sensitivity receptors this equates to minor adverse effects (not significant).

Summary of Significant Effects

12.9.9 The works for Denny North Substation are anticipated to result in no significant adverse effects at all receptors.

Proposed Additional Mitigation Measures

12.9.10 No additional mitigation measures are required due to no significant adverse effects being predicted for Denny North Substation.

Residual Effects

12.9.11 The works for Denny North Substation are anticipated to result in no significant adverse effects at all receptors.

Monitoring

12.9.12 No monitoring is deemed required due to no significant adverse effects being predicted for Denny North Substation. However, should any noise-related complaints be received during either construction, operation or decommissioning, the Applicant could consider undertaking targeted monitoring.

12.10 Assessment of Effects, Mitigation and Residual Effects of the Proposed Bonnybridge Substation Extension

Introduction

12.10.1 Works at Bonnybridge Substation are required due to the uprating of the existing ZG Route as well as the New Buiild Overhead line. These comprise the installation of 400kV equipment on five of the substation bays, installation of 33kV equipment on two of the substation bays, removal of existing electrical equipment including busbars, circuit breakers, inter-bus transformers and shunt reactors, and the construction of a new 400kV control building.

Baseline and Future Baseline Conditions

Existing Baseline Conditions

12.10.2 The Project is located within a predominantly suburban area, predominantly consisting of houses and apartment buildings with some forestry and agricultural land to the south.

12.10.3 A campaign of field surveys was carried out to understand the baseline noise environment and to then inform the assessment. From the identified NSRs, three measurement locations were selected. An unattended noise survey was undertaken at BGN Location 1 Wester Carmuirs Farm between 04 December 2025 and 19 December 2025. The data was processed to LA90(15m inutes) as per BS 4142 and measurements during adverse weather conditions filtered out using data from a Vantage Vue weather station commissioned at BGN location 1. Short term attended measurements were undertaken at BGN 2 and 3 on a dry, quiet night between 02 and 03 December 2025 at locations on public property as seen in Volume 2, Figure 12.3: Bonnybridge NSR Locations. Two measurements were taken at each location on the same night to obtain a conservative baseline noise level to help understand the nature of the surrounding environment and supplement the long-term measured data. These measurements were also conducted and processed to BS 4142 standard.

12.10.4 Measurements were conducted on public land or on private land with prior permission from landowners. Locations and duration were confirmed with an Environmental Health Officer at Falkirk Council. A summary of the consultations and responses are presented in Table 12.43.

Table 12-43 Consultation and Responses

Consultee Date	Consultation Matter	Response and How Addressed
Energy Consents Unit **13 July 2025 - 07 October 2025**	The Scoping Report set out a methodology for identifying and assessing NSRs in proximity to the substation extensions, supported by representative baseline noise surveys agreed with Falkirk Council Environmental Health. The assessment framework includes construction noise evaluation in accordance with BS 5228 and operational noise assessment following BS 4142.	The ECU requested a comprehensive noise and vibration assessment, covering construction activities, operational noise from overhead lines and substations, and sensitive receptors. The assessment should follow relevant standards and identify mitigation where significant effects may occur, including best-practice construction controls, agreed working hours, and proactive community engagement with advance notice of noisy works. This report has

Consultee Date	Consultation Matter	Response and How Addressed
		been prepared in accordance with, and follows, this proposed methodology in relation to Bonnybridge Substation.
Falkirk Council Environmental Health **27 November 2025**	An amendment to the baseline noise monitoring methodology for the Bonnybridge Substation Extension was proposed. Due to difficulties in securing access to private land, only one long term unattended background noise monitoring location was agreed. To supplement this, attended short term night-time background noise measurements at additional representative locations on public land were proposed, in accordance with BS 4142.	Falkirk Council Environmental Health confirmed that they were satisfied with the proposed amended noise monitoring methodology. The noise assessment presented in this chapter adopts the agreed approach, comprising one long term unattended monitoring location supplemented by attended short term night-time measurements at additional representative locations, and is considered representative of background noise levels at the nearest noise sensitive receptors.

12.10.5 A summary of the results from the baseline noise monitoring campaign are presented in Table 12.44 and their locations are shown in Volume 2, Figure 12.3. A plot of the noise levels recorded at BGN 1 can be seen in Volume 2, Figure 1.3 of Volume 3, Appendix 12.6, the times and noise levels excluded due to high wind or rain are also presented.

Table 12-44 Summary of Background Noise Measurement Results

Location	L_{A90} (dB) (Nighttime)	L_{A90} (dB) (Daytime)
BGN 1	35	50
BGN 2	38	N/A
BGN 3	41	N/A

12.10.6 In general, the background data indicates low to moderate noise levels at night, with no dominant sources other than low level background traffic.

Future Baseline

12.10.7 In the absence of the Project, it is likely that the land will continue under the same land use and the character of the Site is therefore likely to continue as a substation surrounded by agricultural land. The landscape and visual amenity of the study area is likely to be influenced by a number of 'forces for change'. Forces for change are those factors affecting the evolution of the landscape and which may, consequently, affect the perception of the study area in the near or distant future. Although prediction of these is necessarily speculative, those of particular relevance are discussed below.

12.10.8 Settlements are likely to continue to locally change the nature of the area. The town of Bonnybridge has the potential for future expansion, especially with additional greenfield housing and industrial developments on the outskirts of the town.

12.10.9 Further reinforcement and extension of the electricity transmission and distribution networks is likely to occur within the study area, to meet energy demands for housing and industry, for example, additional overhead lines connecting to the existing Bonnybridge Substation.

12.10.10 Therefore, it is likely that a steady increase in background noise levels can be assumed due to the increase in development in the area. The assessment performed to existing baseline noise conditions is therefore an appropriate assessment and will result in a worst-case assessment. The increase in potential noise from other electrical infrastructure projects raises the importance of cumulative effects to be sufficiently assessed.

12.10.11 No changes to the baseline conditions are expected.

Embedded Mitigation Measures

12.10.12 No noise-specific embedded mitigation measures have been specified for this aspect of the project.

Assessment of Effects

Construction Noise

12.10.13 A desk-based construction noise appraisal has been prepared for the purpose of assessing the effects of the works on any nearby NSRs. This appraisal has been produced in line with BS 5228-1:2009 +A1:2014 (BS 5228), Code of Practice for Noise and Vibration Control on Construction and Open Sites.

12.10.14 Construction noise is assessed to a 65dB as works are only due to take place during daytime hours (defined as Daytime and Saturdays).

12.10.15 A list of construction phases, with plant items, quantities, and utilisation, provided by the Principal Contractor is included in Volume 3, Appendix 12.5.

12.10.16 Each activity is analysed to determine the percentage of the construction time each piece of equipment is being used and how many are in use. Using this information, a total equivalent noise level at 10m for each activity is calculated.

12.10.17 The dispersion of this total noise level is then modelled. The distance between source and receiver has been defined from the planning application boundary, which gives rise to an extremely conservative worst-case assessment. The attenuation of noise over distance has been calculated over mixed hard and soft ground to the method presented in BS 5228.

Given the dominance of soft ground in the area surrounding the Project, this is slightly conservative. The effects of barriers or topographical screening have not been considered as a conservative approach.

12.10.18 It is not currently known which phases of work could overlap; therefore a conservative scenario has been calculated where all phases of work occur concurrently, a summary of these results are presented in Table 12.45.

12.10.19 The full results are shown in Volume 3, Appendix 12.5.

Table 12-45 Summary of Construction Noise Results – Works at edge of site

Construction Phase	Medium Impacts (65dB Limit)	High Impacts (75dB Limit)
Simultaneous phases	0	0
Bulk earth works	0	0
Civil works	0	0
Transformer installation	0	0
Balance of plant work	0	0
Bunding, landscaping and removal of temporary laydown and welfare	0	0

12.10.20 In reality, construction works are very unlikely to always take place at the edge of the site, therefore impacts are likely to be even less.

12.10.21 The construction noise impact assessment shown in Table 12.45 predicts that construction noise is likely to result in Low impact magnitude, with a receptor sensitivity of High would result in Slight/Moderate effects. Given the conversative nature of the assessment this is likely to be Slight effects, which TAN identifies as unlikely to be of importance in the decision-making process. The assessment identifies that a robust CNMP is recommended to ensure BS 5228 criteria is met.

Construction Traffic Noise

12.10.22 Chapter 11 indicates that there are no roads carrying Bonnybridge Substation Extension traffic that require to be assessed for environmental effects. Construction traffic noise has therefore been scoped out of this report

Construction Vibration

12.10.23 The list of expected construction equipment provided by the Principal Contractor does not include any equipment which is likely to produce significant vibration. Therefore, construction vibration is scoped out of this assessment. If equipment is added at a later date that has the potential to produce significant vibration (such as equipment for piling, compaction or blasting), then it is recommended to conduct a construction vibration assessment.

Operational Noise

12.10.24 A detailed model of the Existing Site, the Project and the Study Area has been constructed using the sound propagation model, SoundPLAN 9, which takes into account geometric spreading, topography, screening, meteorological conditions and detailed information regarding the sources of noise, to predict noise levels at specific points (e.g. NSRs) allowing for analysis of the predicted impact of the Project for NSRs.

12.10.25 Elevation data to a resolution of 50m has been used to create a digital ground model, this is appropriate due to the distances from source to receiver.

12.10.26 Propagation was modelled using ISO 9613-2, with the following parameters:

- Ground absorption: 0.0 on paved surfaces, 1.0 in areas of vegetation, and 0.6 elsewhere;
- Receiver height: 1.5 m above ground/floor;
- Temperature: 10°C; and
- Relative humidity: 70%.

Existing Site

12.10.27 The equipment and associated noise levels used in the model were measured on site in accordance with IEC 60076-10-1 and are presented in Table 12.46 and in Volume 2, Figure 1.1: Equipment SPL Frequency Spectra and Volume 2, Figure 1.2: Equipment SWL Frequency Spectra within Volume 3, Appendix 12.6. Due to safety restrictions on site, not all noise producing equipment could be measured. Assumed sound power levels, based on team experience on similar projects, are presented in Table 12.47.

Table 12-46 Existing Equipment and Measured Input Noise Levels

Equipment	Quantity	Housing Arrangements	Sound Power Level (SWL) (dB(A))
Super Grid Transformer	1	External	100.3
Super Grid Transformer	1	External	99.3

Table 12-47 Existing Equipment and Assumed Input Noise Levels

Equipment	Quantity	Housing Arrangements	Sound Power Level (SWL) (dB(A))
Grid Transformer 132/32 kV	4	External	87
Grid Transformer 132/25 kV	3	External	87

Equipment	Quantity	Housing Arrangements	Sound Power Level (SWL) (dB(A))
33 kV 60 MVAr Air Core Shunt Reactor	2	External	89

12.10.28 Noise level predictions have been carried out to establish the specific noise levels at the nearest NSRs to the Existing Site. The model assumes all sound sources are operating continuously, simultaneously and at maximum noise output. The levels predicted by the model relate to the outdoor amenity of the NSR considered. Predicted received operational noise levels are presented in Table 12.48.

Table 12-48 Existing Site - Operational Noise Levels

Location	Modelled Specific Noise (dB(A))
NSR 1	31.5
NSR 2	33.7
NSR 3	35
NSR 4	34.6
NSR 5	35.7
NSR 6	32.2

12.10.29 A BS 4142 assessment has been conducted during daytime conditions. The results are presented in Table 12.49.

Table 12-49 Existing Site - BS 4142 Noise Impact Assessment

Location	Closest BGN Location	Modelled Specific Noise (dB(A))	Rating Level (dB(A))	BGN (dB(A))	Excess (dB(A))
NSR 1	BGN 1	31.5	38	35	3
NSR 2	BGN 1	33.7	40	35	5
NSR 3	BGN 2	35	41	38	3
NSR 4	BGN 2	34.6	41	38	3
NSR 5	BGN 2	35.7	42	38	4
NSR 6	BGN 3	32.2	38	41	-3

12.10.30 While the results indicate that the modelled specific noise from the Existing Site is in exceedance at NSRs 1, 2, 3, 4 and 5 - all modelled levels are below the measured background noise levels and exceedances are predicted in relation to the tonal penalty - which represents a worst-case scenario. These exceedance levels will be used for comparison with those of the Project.

Project

12.10.31 The equipment and associated noise levels used in the model have been taken from early manufactory information and are presented in Table 12.50 and have been modelled in addition to the equipment presented in Table 12.46 and Table 12.47.

Table 12-50 Proposed Equipment and Input Noise Levels

Equipment	Quantity	Housing Arrangements	Sound Power Level (SWL) (dB(A))
Super Grid Transformer (SGT) 400/132/33 kV	2	External	84
SGT Cooling	2	External	87

12.10.32 The model assumes all sound sources are operating continuously, simultaneously and at maximum noise output. In reality, not all sources will be operating at maximum noise level all of the time and operational noise levels are therefore likely to be lower than are presented in the assessment in this chapter.

12.10.33 Noise level predictions have been carried out to establish the specific noise levels at the nearest NSRs to the Project. The levels predicted by the model relate to the outdoor amenity of the NSR considered. Predicted received operational noise levels are presented in Table 12.51.

Table 12-51 Existing Site and Project - Predicted Operational Noise Levels

Location	Modelled Specific Noise (dB(A))
NSR 1	31.5
NSR 1	31.7
NSR 2	34 .0
NSR 3	35.3
NSR 4	35.1
NSR 5	36 .0

12.10.34 The modelled noise levels are presented in Volume 2, Figure 12.4: Bonnybridge Noise Contours. The predicted operational levels at NSRs due to the Project have been compared with background noise levels and assessed in accordance with BS 4142.

12.10.35 It is a requirement of BS 4142 that, when assessing the impact of noise with a tonal component, the noise emitted from the specific sound source is subject to a rating level penalty. Transformers and other electrical equipment associated with substation developments emit noise at frequencies of twice the normal operating current frequency due to magnetostriction of the transformer core. In the UK, the supply current frequency is 50Hz, which results in 100Hz and harmonics thereof being produced by the transformer. The nature of the noise generation mechanism results in tonal noise being emitted. The

noise is continuous and consistent depending on the electrical load of the equipment and therefore is not expected to have any impulsive characteristics.

12.10.36 Due to the lack of spectral noise data for the transformers (SGTs) and associated coolers, a tonal penalty of 6dB has been applied to ensure a conservative assessment. A 6dB tonal penalty is used as highly perceptible tones and is the highest recommended penalty. In reality, the tones likely to be less perceptible than this.

12.10.37 A BS 4142 assessment has been conducted during daytime conditions, using predicted noise with cooling systems active. The results are presented in Table 12.52.

Table 12-52 Existing Site and Project - BS 4142 Noise Impact Assessment

Location	Closest BGN Location	Modelled Specific Noise (dB(A))	Rating Level (dB(A))	BGN (dB(A))	Excess (dB(A))
NSR 1	BGN 1	31.7	38	35	3
NSR 2	BGN 1	34 .0	40	35	5
NSR 3	BGN 2	35.3	41	38	3
NSR 4	BGN 2	35.1	41	38	3
NSR 5	BGN 2	36 .0	42	38	4
NSR 6	BGN 3	32.4	38	41	-3

12.10.38 The assessment shows that, at all NSRs, the modelled specific noise levels remain below the representative background noise levels, consistent with the existing site conditions. Where positive excesses are predicted, these are attributable to the application of a tonal penalty and therefore represent a reasonable worst-case scenario.

12.10.39 The inclusion of the Project results in a predicted increase in specific noise levels of approximately 0.2 to 0.5dB(A) across the assessed NSRs. These changes do not raise the rating levels above background noise and do not result in any increase in excess above background. Changes of this magnitude are generally considered imperceptible to the human ear.

12.10.40 The proposed plant has also been assessed in isolation, with the results presented in Table 12.53.

Table 12-53 Project Only - BS 4142 Noise Impact Assessment

Location	Closest BGN Location	Modelled Specific Noise (dB(A))	Rating Level (dB(A))	BGN (dB(A))	Excess (dB(A))
NSR 1	BGN 1	18.4	24	35	-11
NSR 2	BGN 1	21.8	28	35	-7

Location	Closest BGN Location	Modelled Specific Noise (dB(A))	Rating Level (dB(A))	BGN (dB(A))	Excess (dB(A))
NSR 3	BGN 2	23.9	30	38	-8
NSR 4	BGN 2	25.2	31	38	-7
NSR 5	BGN 2	23.8	30	38	-8
NSR 6	BGN 3	19.7	26	41	-15

12.10.41 The results demonstrate that the proposed equipment, when assessed in isolation, does not generate any positive excess above background noise levels at any NSR. Rating levels are substantially below background and therefore the Project would not materially increase the cumulative noise impact when considered alongside the existing site.

Magnitude of Change

12.10.42 The predicted BS 4142 excesses for the existing site have been compared with those for the existing site plus the Project to determine the magnitude of change arising from the proposals. The results are presented in Table 12.54.

Table 12-54 Magnitude of Change

Location	Existing Site Excess (dB(A))	Existing Site and Project Excess (dB(A))	Magnitude of Change
NSR 1	3	3	0
NSR 2	5	5	0
NSR 3	3	3	0
NSR 4	3	3	0
NSR 5	4	4	0
NSR 6	-3	-3	0

12.10.43 The assessment confirms that there is no change in BS 4142 excess at any NSR following the completion of the Project. Accordingly, the magnitude of change is assessed as Negligible impact. As the receptor sensitivity is High, the magnitude of change results in an overall effect of Slight significance.

Summary of Significant Effects

12.10.44 Table 12.55 below summarises the predicted likely significant effects for the Bonnybridge Substation aspect of the Project.

Table 12-55 Summary of significant effects for Bonnybridge Substation

Project phase	Significant effects (without additional mitigation)
Construction noise	All receptors (high sensitivity) result in slight effects

Project phase	Significant effects (without additional mitigation)
Operational noise	All receptors (high sensitivity) result in slight effects

Proposed Additional Mitigation Measures

12.10.45 No mitigation is required for construction or operation.

Residual Effects

12.10.46 Table 12.56 summarises the predicted likely residual effects for the Bonnybridge Substation aspect of the Project.

Table 12-56 Summary of residual effects for Bonnybridge Substation

Project phase	Significant effects (with additional mitigation)
Construction noise	All receptors (high sensitivity) result in slight effects
Operational noise	All receptors (high sensitivity) result in slight effects

12.10.47 The assessment identifies that a robust CNMP is required to ensure BS 5228 criteria is met for the construction aspects of the project.

12.11 Assessment of Effects, Mitigation and Residual Effects of the Wishaw Substation Extension

Introduction

12.11.1 Works at Wishaw Substation are required due to the uprating of the existing XR Route. These include an extension of the existing substation platform and associated security fencing as well as installation of three new bays containing gas insulated switchgear and circuit breaker. No new noise generating equipment will be installed at the substation and hence only construction noise is considered for Wishaw Substation.

Baseline and Future Baseline Conditions

12.11.2 There are several receptors within the 300m study area for Wishaw Substation. For the construction assessment, the lowest category thresholds (Category A) have been assigned for all receptors.

12.11.3 The Wishaw Substation is located immediately south of the Argyle railway line running between Shieldmuir and Carluke and the local road network. Due to being located close to transport infrastructure, such as roads and rail lines, there is potential for growth in the traffic flows in the future baseline scenario. In the absence of significant alterations to the wider road or rail network, the variation in traffic flows would be expected to be incremental and therefore unlikely to give rise to perceptible changes in the acoustic environment.

Embedded Mitigation Measures

12.11.4 No noise-specific embedded mitigation measures have been specified for this aspect of the project.

Assessment of Effects

Construction Noise

12.11.5 The closest receptor in each direction from the substation (N, NE, W, SW) has been considered in the below assessment.

12.11.6 Plant lists and assumptions have been included in Volume 3, Appendix 12.3.

12.11.7 Table 12.57 shows the predicted impact from construction noise for each construction activity taking place at the substation.

Table 12-57 Predicted impact of construction noise from Wishaw Substation

Construction Activity		Minimum distance (m) to achieve 75dB(A)	Number of receptors exceeding 75dB(A)	Minimum distance (m) to chieve 65dB(A)	Number of receptors between 65dB(A) and 75dB(A)	Minimum distance (m) to achieve 55dB(A)	Number of receptors between 55dB(A) and 65dB(A)
		High magnitude weekdays & weekends [1]		Medium magnitude weekdays, high magnitude weekends [1]		Low magnitude weekdays, medium magnitude weekends [1]	
3a	Installation of Foundations (raft/pad & column)	11	0	28	0	69	1
3b	Installation of Foundations (micropile/ rock anchor)	13	0	33	0	83	18
7	Removal and Reinstatement of Temporary Works	4	0	10	0	25	0
9	Site clearance and de-vegetation	25	0	63	0	158	232
10	Site clearance and demobilisation	10	0	25	0	63	0

[1]
Weekday daytime is Monday to Friday 07:00 – 19:00 and Saturday 07:00 – 13:00.
Weekend daytime is Saturday 13:00 – 16:00 and Sunday 07:00 – 16:00.
No works are expected outside these times as per the project description.

Construction Vibration

12.11.8 The main source of vibration associated with the construction is expected to be attributable to compaction works (e.g. vibratory roller).

12.11.9 Table 12.58 shows the predicted impact from vibration for the construction activity 'installation of foundations' using a vibratory roller for Wishaw Substation.

Table 12-58 Predicted impact of construction vibration from Wishaw Substation

Construction Activity Minimum distance to achieve threshold		Number of receptors exceeding threshold Start-up / Steady state High 6m	Medium 44m / 35m	Low 114m / 80m
3b	Installation of foundations (micropile/ rock anchor)	0	0 /0	60 / 3

12.11.10 For the construction activity identified above, the vibration from works at Wishaw Substation are predicted to result in low and negligible impacts.

Construction Traffic Noise

12.11.11 The construction traffic noise assessment is based on the information set out in Chapter 11 and the accompanying Volume 3, Appendix 11.1.

12.11.12 Table 12.59 summarises the potential impact of construction phase traffic noise from the Wishaw Substation works.

Table 12-59 Construction traffic road noise level change

Road name/link	Short term noise level change,dB $L_{A10, 18hr}$	Magnitude of impact
A73 Bellside Road Newhouse	0.1	Negligible
A73 Carlisle Road Brownhill Farm	0.1	Negligible
A73 Cleland	0.1	Negligible
A73 Westwood Road	0.0	Negligible
A722 Manse Road	0.1	Negligible
Castlehill / Caledonian Road	0.1	Negligible
Allershaw Road	2.2	Low
M8 Junction 6 -8	0.0	Negligible
M8 Junction 8-10	0.1	Negligible

12.11.13 As shown in the above table, the increase in noise due to construction traffic is expected to result in low to negligible impacts for all road links. For high sensitivity receptors this equates to minor effects (not significant).

Summary of Significant Effects

12.11.14 Table 12.60 below summarises the predicted likely significant effects for the proposed Wishaw Substation works.

Table 12-60 Summary of significant effects for Wishaw Substation

Project phase	Significant effects (without additional mitigation)
Construction noise	All activities result in **short term minor or negligible effects**
Construction vibration	All activities result in **short term minor or negligible effects**
Construction traffic noise	Construction traffic results in **short term minor effects**

Proposed Additional Mitigation Measures

Construction noise

12.11.15 The following mitigation measures are proposed to be implemented as part of a CEMP to minimise the noise and vibration impacts at receptors in the vicinity of the construction works:

- All construction activities to be undertaken in accordance with BPM as set out in BS 5228-1.
- All equipment will be maintained in good working order and will be fitted with appropriate noise control at all times (for example, silencers, mufflers and acoustic hoods). Quieter options for equipment to be used where possible.
- All site employees to be advised of the noise sensitive nature of the area and be informed to adopt the quietest work practices, where appropriate.
- Site terrain, material stockpiles and suitable work locations will be used so as to screen work locations and maximise the distance between work activities and receptors.
- Additional temporary enclosures will be used to screen all static or semi-static plant from noise sensitive receptor locations.
- A programme of community liaison will be carried out, including notification of works and details of the complaints process.

Residual Effects

12.11.16 Table 12.61 below summarises the predicted likely residual effects for the proposed Wishaw Substation works.

Table 12-61 Summary of residual effects for Wishaw Substation

Project phase	Significant effects (with additional mitigation)
Construction noise	All activities result in short term minor or negligible effects

Project phase	Significant effects (with additional mitigation)
Construction vibration	All activities result in short term minor or negligible effects
Construction traffic noise	Construction traffic results in short term minor effects

Monitoring

12.11.17 No specific monitoring measures are considered to be required during construction of the proposed Wishaw Substation works. However, should any noise-related complaints be received during either construction, operation or decommissioning, the Applicant could consider undertaking targeted monitoring.

12.12 Assessment of Effects, Mitigation and Residual Effects of the Cumbernauld Substation Extension

Introduction

12.12.1 Works at Cumbernauld Substation are required due to the uprating of the existing ZG Route as well as the New Build Overhead line. These comprise the installation of 400kV equipment and the removal of existing electrical equipment.

Baseline and Future Baseline Conditions

Summary of Baseline

12.12.2 The Project is located within a predominantly suburban area, predominantly consisting of houses and apartment buildings with some forestry and agricultural land to the south.

12.12.3 A campaign of field surveys was carried out to understand the baseline noise environment and to inform the assessment. From the identified NSRs, three measurement locations were selected. An unattended noise survey at BGN 2 Greenside Cottage was undertaken between 13 November 2025 and 04 December 2025. The data was processed to LA90, 15minutes as per BS 4142 and measurements during adverse weather conditions filtered out. Short term attended measurements at BGN 1 and 3 were undertaken on a dry, quiet night between 02 and 03 December 2025 at locations on public property as seen in Volume 2, Figure 12.5: Cumbernauld NSR Locations. Two measurements were taken at each location on the same night to obtain a conservative baseline noise level to help understand the nature of the surrounding environment and supplement the long-term measured data. These measurements were also conducted and processed to BS 4142 standard.

12.12.4 Measurements were conducted on public land or on private land with prior permission from landowners. Locations and duration were confirmed with an Environmental Health Officer at North Lanarkshire Council.

12.12.5 A summary of the results from the baseline noise monitoring campaign are presented in Table 12.62 and their locations are shown in Volume 2, Figure 12.5: Cumbernauld NSR Locations. A plot of the noise levels recorded at BGN 1 can be seen in Volume 2, Figure 1.3 of Volume 3, Volume 3, Appendix 12.8, the times and noise levels excluded due to high wind or rain are also presented.

Table 12-62 Summary of Background Noise Measurement Results

Location	L_{A90} (dB) (Nighttime)	L_{A90} (dB) (Daytime)
BGN 1	38	N/A
BGN 2	41	48
BGN 3	38	N/A

12.12.6 In general, the background data indicates low to moderate noise levels at night, with no dominant sources other than low level background traffic.

Future Baseline in the Absence of the Project

12.12.7 In the absence of the Project, it is likely that the land will continue under the same land use and the character of the Site is therefore likely to continue as an 275kV substation surrounded by forested land. The landscape and visual amenity of the study area is likely to be influenced by a number of 'forces for change'. Forces for change are those factors affecting the evolution of the landscape and which may, consequently, affect the perception of the study area in the near or distant future. Although prediction of these is necessarily speculative, those of particular relevance are discussed below.

12.12.8 Settlements are likely to continue to locally change the nature of the area. The town of Cumbernauld has the potential for future expansion, especially with additional greenfield housing developments on the outskirts of the town.

12.12.9 Further reinforcement and extension of the electricity transmission and distribution networks is likely to occur within the study area, to meet energy demands for housing and industry, for example additional overhead lines connecting to the existing Cumbernauld Substation and housing development to the east of the Project.

12.12.10 Therefore, it is likely that a steady increase in background noise levels can be assumed due to the increase in development in the area. The assessment performed to existing baseline noise conditions is therefore an appropriate assessment and will result in a worst-case assessment. The increase in potential noise from other electrical infrastructure projects raises the importance of cumulative effects to be sufficiently assessed.

Future Baseline

12.12.11 No change to the baseline conditions is expected.

Embedded Mitigation Methods

12.12.12 No noise-specific embedded mitigation measures have been specified for this aspect of the project.

Assessment of Effects

Construction Noise

12.12.13 A desk-based construction noise appraisal has been prepared for the purpose of assessing the effects of the works on any nearby NSRs. This appraisal has been produced

in line with BS 5228-1:2009 +A1:2014 (BS 5228), Code of Practice for Noise and Vibration Control on Construction and Open Sites.

12.12.14 Construction noise is assessed to 65dB as works are only due to take place during daytime hours (defined as Daytime and Saturdays).

12.12.15 A list of construction phases, with plant items, quantities, and utilisation, provided by the Principal Contractor is included in Volume 3, Appendix 12.7.

12.12.16 Each activity is analysed to determine the percentage of the construction time each piece of equipment is being used and how many are in use. Using this information, a total equivalent noise level at 10m for each activity is calculated.

12.12.17 The dispersion of this total noise level is then modelled. The distance between source and receiver has been defined from the planning application boundary, which gives rise to an extremely conservative worst-case assessment. The attenuation of noise over distance has been calculated over mixed hard and soft ground to the method presented in BS 5228. Given the dominance of soft ground in the area surrounding the Project, this is slightly conservative. The effects of barriers or topographical screening have not been considered as a conservative approach.

12.12.18 It is not currently known which phases of work could overlap; therefore a conservative scenario has been calculated where all phases of work occur concurrently, a summary of these results is presented in Table 12.63. The full results are shown in Volume 3, Appendix 12.7.

Table 12-63 Summary of Construction Noise Results – Works at edge of site

Construction Phase	Medium Impacts (65dB Limit)	High Impacts (75dB Limit)
Simultaneous Phases	4	0
Bulk Earthworks	4	0
Civil Works	0	0
Transformer Installation	0	0
Balance of Plant Work	0	0
Bunding, Landscaping and Removal of Temporary Laydown and Welfare	0	0

12.12.19 In reality, construction works are very unlikely to always take place at the edge of the site, Table 12.64 provides a summary of a more average case where the distance to the centre of the site used. In this case it is predicted that construction noise is likely to result in Low impact magnitude, with a receptor sensitivity of High would result in a Minor / Moderate effect.

Table 12-64 Summary of Construction Noise Results – Works at centre of site

Construction Phase	Medium Impacts (65dB Limit)	High Impacts (75dB Limit)
Simultaneous phases	0	0
Bulk earth works	0	0
Civil works	0	0
Transformer installation	0	0
Balance of plant work	0	0
Bunding, landscaping and removal of temporary laydown and welfare	0	0

12.12.20 The construction noise impact assessment predicts that construction noise is likely to result in Medium impact magnitude, with a receptor sensitivity of High would result in Moderate / Large (significant) effects. Given the conversative nature of the assessment this is likely to be Moderate (significance) effects. The assessment identifies that a robust CNMP is required to ensure BS 5228 criteria is met.

Construction Traffic Noise

12.12.21 Construction traffic noise was scoped out for the Bonnybridge Substation; however, Forest Road was identified as requiring assessment as part of the Cumbernauld Substations study.

12.12.22 Construction-related traffic and transport impacts for the main access routes have been assessed by calculating the change in road traffic noise levels adjacent to public roads used by construction traffic. The standard UK calculation method, Calculation of Road Traffic Noise (CRTN), has been used to determine noise levels at a nominal distance of 10 m from each road. Calculations are based on baseline traffic flows and include the addition of construction traffic, as reported in Chapter 10: Traffic and Movement.

12.12.23 The 18-hour traffic flows reported in Table 11-13 of Chapter 10: Traffic and Movement have been used for the noise calculation as is required by CRTN. Vehicle numbers for the baseline 2028 traffic scenario are presented in Table 12.65 for both cars and Heavy Goods Vehicles (HGVs).

Table 12-65 2028 Predicted Peak Average 18-hr Traffic

Road Link	2028 Baseline		Project		% Increase	
	HGV	All Vehs	HGV	All Vehs	HGV	All Vehs
Forest Road Cumbernauld Substation	122	8,263	74	98	60%	1%

12.12.24 Assuming the traffic flows above and an average vehicle speed of 50 mph, the resulting L10 (18-hour) noise levels have been calculated and are presented in Table 12.66.

Table 12-66 Predicted Peak L10 18-hour noise level dB(A)

Road link	Noise Level Baseline	Baseline + Development	Increase	Magnitude of Impact
Forest Road Cumbernauld Substation	70.2	70.4	0.2	Negligible

12.12.25 Impacts on Forest Road are predicted as Negligible and therefore Not Significant.

Construction Vibration

12.12.26 The list of expected construction equipment provided by the Principal Contractor does not include any equipment which is likely to produce significant vibration. Therefore, construction vibration is scoped out of this assessment. If equipment is added at a later date that has the potential to produce significant vibration (such as equipment for piling, compaction or blasting), then it is recommended to undertake a construction vibration assessment.

Operational Noise

12.12.27 A detailed model of the Existing Site, the Project and the Study Area has been constructed using the sound propagation model, SoundPLAN 9, which takes into account geometric spreading, topography, screening, meteorological conditions and detailed information regarding the sources of noise, to predict noise levels at specific points (e.g. NSRs) allowing for analysis of the predicted impact of the Project for NSRs.

12.12.28 Elevation data to a resolution of 50m has been used to create a digital ground model, this is appropriate due to the distances from source to receiver.

12.12.29 Propagation was modelled using ISO 9613-2, with the following parameters:

- Ground absorption: 0.0 on paved surfaces, 1.0 in areas of vegetation, and 0.6 elsewhere;
- Receiver height: 1.5m above ground / floor;
- Temperature: 10°C; and
- Relative humidity: 70%.

Existing Site

12.12.30 The equipment and associated noise levels used in the model were measured on site in accordance with IEC 60076-10-1 and are presented in Table 12.67, as well as in Volume 2, Figure 1.1:Equipment SPL Frequency Spectra and Volume 2, Figure 1.2: Equipment SWL Frequency Spectra of Volume 3, Appendix 12.8.

Table 12-67 Measured Equipment and Input Noise Levels

Equipment	Quantity	Housing Arrangements	Sound Power Level (SWL) (dB(A))
Super Grid Transformer	2	External	90.6

12.12.31 Only a single transformer was in operation at the time of measurement but both transformers are modelled using the measured values in order to represent a worst-case scenario. The model assumes all sound sources are operating continuously, simultaneously and at maximum noise output.

12.12.32 Noise level predictions have been carried out to establish the specific noise levels at the nearest NSRs to the Existing Site. The levels predicted by the model relate to the outdoor amenity of the NSR considered. Predicted received operational noise levels are presented Table 12.68.

Table 12-68 Existing Site Operational Noise Levels

Location	Modelled Specific Noise (dB(A))
NSR 1	37.6
NSR 2	35.2
NSR 3	34.0
NSR 4	35.6
NSR 5	16.6
NSR 6	27.8
NSR 7	27.9

12.12.33 A BS 4142 assessment has been conducted during daytime conditions. The results are presented in Table 12.69.

Table 12-69 BS 4142 Noise Impact Assessment

Location	Closest BGN Location	Modelled Specific Noise (dB(A))	Rating Level (dB(A))	BGN (dB(A))	Excess (dB(A))
NSR 1	BGN 1	37.6	38	38	6
NSR 2	BGN 1	35.2	41	38	3
NSR 3	BGN 1	34 .0	40	38	2
NSR 4	BGN 1	35.6	42	38	4
NSR 5	BGN 2	16.6	23	41	-18
NSR 6	BGN 3	27.8	34	38	-4

Location	Closest BGN Location	Modelled Specific Noise (dB(A))	Rating Level (dB(A))	BGN (dB(A))	Excess (dB(A))
NSR 7	BGN 3	27.9	34	38	-4

12.12.34 The results indicate that the modelled specific noise from the Existing Site is in exceedance at NSRs 1, 2, 3 and 4. The operational noise BS 4142 assessment predicts a Moderate impact magnitude for the Existing Site at the worst effected receptor.

Project

12.12.35 The equipment and associated noise levels used in the model have been taken from early manufactory information and are presented in Table 12.70.

Table 12-70 Equipment and Input Noise Levels

Equipment	Quantity	Housing Arrangements	Sound Power Level (SWL) (dB(A))
Super Grid Transformer (SGT) 275/33kV	2	External	73

12.12.36 The model assumes all sound sources are operating continuously, simultaneously and at maximum noise output. In reality, not all sources will be operating at maximum noise level all of the time and operational noise levels are therefore likely to be lower than are presented in the assessment in this chapter.

12.12.37 Noise level predictions have been carried out to establish the specific noise levels at the nearest NSRs to the Project. The levels predicted by the model relate to the outdoor amenity of the NSR considered. Predicted received operational noise levels are presented in Table 12.71.

Table 12-71 Predicted Operational Noise Levels

Location	Modelled Specific Noise (dB[A])
NSR 1	26.5
NSR 2	26.2
NSR 3	26.7
NSR 4	27.2
NSR 5	9.5
NSR 6	19.3
NSR 7	21.1

12.12.38 The modelled noise levels are presented in Volume 2, Figure 12.6 Cumbernauld Noise Contours. The predicted operational levels at NSRs due to the Project have been compared with background noise levels and assessed in accordance with BS 4142.

12.12.39 It is a requirement of BS 4142 that, when assessing the impact of noise with a tonal component, the noise emitted from the specific sound source is subject to a rating level penalty. Transformers and other electrical equipment associated with substation developments emit noise at frequencies of twice the normal operating current frequency due to magnetostriction of the transformer core. In the UK the supply current frequency is 50 Hz, which results in 100 Hz and harmonics thereof being produced by the transformer. The nature of the noise generation mechanism results in tonal noise being emitted. The noise is continuous and consistent depending on the electrical load of the equipment and therefore is not expected to have any impulsive characteristics.

12.12.40 Due to the lack of spectral noise data for the transformers (SGTs) and associated coolers, a tonal penalty of 6 dB has been applied to ensure a conservative assessment. A 6dB tonal penalty is used as highly perceptible tones and is the highest recommended penalty. In reality, the tones likely to be less perceptible than this.

12.12.41 A BS 4142 assessment has been conducted during daytime conditions, using predicted noise with cooling systems active. The results are presented in Table 12.72.

Table 12-72 BS 4142 Noise Impact Assessment

Location	Closest BGN Location	Modelled Specific Noise (dB(A))	Rating Level (dB(A))	BGN (dB(A))	Excess (dB(A))
NSR 1	BGN 1	26.5	33	38	-5
NSR 2	BGN 1	26.2	32	38	-6
NSR 3	BGN 1	26.7	33	38	-5
NSR 4	BGN 1	27.2	33	38	-5
NSR 5	BGN 2	9.5	16	41	-25
NSR 6	BGN 3	19.3	25	38	-13
NSR 7	BGN 3	21.1	27	38	-11

12.12.42 The results indicate that the modelled specific noise from the Project at all NSRs is below background noise. The operational noise BS 4142 assessment predicts Negligible impact magnitude. This is an improvement over the Moderate impact magnitude calculated for the existing site. As the receptor sensitivity is High the overall effect is of Slight significance, and therefore unlikely to be of importance in the decision-making process.

Summary of Significant Effects

12.12.43 Table 12.73 below summarises the predicted likely significant effects for the Cumbernauld Substation aspect of the project.

Table 12-73 Summary of significant effects for Cumbernauld Substation

Project phase	Significant effects (without additional mitigation)
Construction noise	All receptors (high sensitivity) result in Large/Very Large effects

Project phase	Significant effects (without additional mitigation)
Operational noise	All receptors (high sensitivity) result in slight effects

Proposed Additional Mitigation Measures

Construction Noise

12.12.44 The implementation of a CNMP is required to reduce the effects from construction activities. Several control measures have been suggested that could reduce effects to slight.

12.12.45 An example strategy has been implemented to demonstrate the feasibility of control measures through the following action:

- Ensuring that Bulk Earth works do not overlap with any other phase of work;
- Minimise equipment and on-time during Bulk Earth works at the north-eastern edge of the site. Limiting equipment during Bulk Earth works to the following equipment would reduce noise levels;
- Two tracked excavator on 80% (no change);
- One tipper lorry on 50%;
- One breaker on 50%; and
- Two water pumps on 100% (no change).

12.12.46 Alternatively, if this is too restrictive, acoustic barriers could be used of a height at least 1.8m taller than the NSR and within 6m from the noise producing equipment.

12.12.47 It is indicated no further specific measures are required to meet the 65dB(A) limit using either of these two mitigation strategies.

12.12.48 The assessment has been performed assuming all plant and equipment is operating at the same time. With the implementation of a robust CNMP, it is predicted that construction noise is likely to result in Minor magnitude, with a receptor sensitivity of High would result in a Slight / Moderate effect. Due to the conservatism of the assessment methodology, an overall impact of Slight can be determined, which TAN identifies as unlikely to be of importance in the decision-making process.

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

- Minimising the noise as much as is reasonably practicable at source;
- Attenuation of noise propagation;
- Carrying out identified high noise level activities at a time when they are least likely to cause a nuisance to residents; and
- Providing advance notice of unavoidable periods of high noise levels to residents.

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

- Giving due consideration to the effect of noise, in selection of construction methods;
- Avoidance of vehicles waiting or queuing, particularly on public highways or in residential areas with their engines running;
- Scheduling of deliveries to arrive during daytime hours only. Care should be taken to minimise noise while unloading delivery vehicles. Delivery vehicles should follow Routes that minimise use of residential roads;
- Ensure plant and equipment are regularly and properly maintained. All plant should be situated to sufficiently minimise noise impact at nearby properties;
- Fit and maintain silencers to plant, machinery, and vehicles where appropriate and necessary;
- Operate plant and equipment in modes of operation that minimise noise, and power down plant when not in use;
- Use electrically powered plant rather than diesel or petrol driven, where this is practicable; and
- Work typically not to take place outside of hours defined in the construction schedule.

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

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

Operational Noise

12.12.52 No additional mitigation is required for operation.

Residual Effects

12.12.53 Table 12.74 below summarises the predicted likely residual effects for the Cumbernauld Substation aspect of the project.

Table 12-74 Summary of residual effects for Cumbernauld Substation

Project phase	Significant effects (with additional mitigation)
Construction noise	All receptors (high sensitivity) result in slight effects
Operational noise	All receptors (high sensitivity) result in slight effects

Monitoring

12.12.54 The assessment identifies that a robust CNMP is required to ensure BS 5228 criteria is met for the construction aspects of the project.

12.13 Assessment of Effects, Mitigation and Residual Effect of the Distribution Line Diversion Works

Introduction

12.13.1 Distribution line diversions will be required as part of the Project. These have been described in Chapter 4. The distribution lines will either be temporarily dipped (taken down and undergrounded) or in some locations permanently diverted. The process of temporarily dipping existing distribution lines consists of digging a track between the relevant existing poles, before laying the existing distribution line underground.

Baseline and Future Baseline Conditions

12.13.2 There are several receptors within the 300m study area for the distribution line diversion works. For the construction assessment, the lowest category threshold (Category A) has been assigned for all receptors.

12.13.3 The majority of the distribution line diversion works are located within a rural setting, typically comprising agricultural land use, and therefore there are not expected to be significant changes to the future baseline conditions.

Embedded Mitigation Measures

12.13.4 No noise-specific embedded mitigation measures have been specified for this aspect of the project.

Assessment of Effects

Construction Noise

12.13.5 Construction noise predictions have been undertaken for each of the construction activities being undertaken as part of the distribution line diversion works.

12.13.6 Plant lists and assumptions have been included in Volume 3, Appendix 12.3.

12.13.7 Table 12.75 shows for each construction activity taking place for distribution line diversion works the distance at which predicted construction noise levels would result in high, medium or low magnitudes of impact, and the number of high sensitivity receptors in each category. Receptors with lower sensitivity categories will result in lower levels of significance of effects, and any mitigation included will also benefit these receptors.

Table 12-75 Predicted impact of construction noise from distribution line diversion works

Construction Activity		Minimum distance (m) to achieve 75dB(A)	Number of receptors exceeding 75dB(A)	Minimum distance (m) to chieve 65dB(A)	Number of receptors between 65dB(A) and 75dB(A)	Minimum distance (m) to achieve 55dB(A)	Number of receptors between 55dB(A) and 65dB(A)
		High magnitude weekdays & weekends [1]		Medium magnitude weekdays, high magnitude weekends [1]		Low magnitude weekdays, medium magnitude weekends [1]	
6	Dismantling and Undergrounding of Existing Routes	36	4	91	20	229	199

[1]
Weekday daytime is Monday to Friday 07:00 – 19:00 and Saturday 07:00 – 13:00.
Weekend daytime is Saturday 13:00 – 16:00 and Sunday 07:00 – 16:00.

No works are expected outside these times as per the project description.

Construction Vibration

12.13.8 There are no sources of vibration associated with the construction activities for the distribution line diversion works. Therefore the impact from construction vibration is negligible at all receptors.

Summary of Significant Effects

12.13.9 Table 12.76 below summarises the predicted likely significant effects for the Distribution Line Diversion Works.

Table 12-76 Summary of significant effects for Distribution Line Diversion Works

Project phase	Significant effects (without additional mitigation)
Construction noise	As summarised in the above table the below activities result in **short term moderate to major significant effects**: • Dismantling of Existing Routes.
Construction vibration	All activities result in **short term negligible effects**

Proposed Additional Mitigation Measures

Construction noise

12.13.10 The following mitigation measures are proposed to be implemented as part of a CEMP to minimise the noise and vibration impacts at receptors in the vicinity of the construction works:

- All construction activities to be undertaken in accordance with BPM as set out in BS 5228-1;
- All equipment will be maintained in good working order and will be fitted with appropriate noise control at all times (for example, silencers, mufflers and acoustic hoods). Quieter options for equipment to be used where possible;
- All site employees to be advised of the noise sensitive nature of the area and be informed to adopt the quietest work practices, where appropriate;
- Site terrain, material stockpiles and suitable work locations will be used so as to screen work locations and maximise the distance between work activities and receptors;
- Additional temporary enclosures will be used to screen all static or semi-static plant from noise sensitive receptor locations; and
- A programme of community liaison will be carried out, including notification of works and details of the complaints process.

12.13.11 The magnitude of attenuation resulting from mitigation is not quantifiable at this stage. This is due to the high level nature of the proposed construction methodology. Therefore, residual effects due to construction noise are not quantifiable. However, the residual levels should be confirmed through the use of a CNMP, construction programming and Section 61 applications where necessary. These are considered to be an industry standard

approach to noise control from construction, allowing flexibility in construction technique, but ensuring impacts are controlled. The CNMP would be used to reduce the levels to a non-significant impact, or outline BPM to be implemented in order to control noise to lowest achievable levels.

Residual Effects

12.13.12 Table 12.77 below summarises the predicted likely residual effects for the Distribution Line Diversion Works.

Table 12-77 Summary of residual effects for Distribution Line Diversion Works

Project phase	Significant effects (with additional mitigation)
Construction noise	• Construction noise levels would be controlled through the use of a CNMP and would be reduced to levels of a minor or negligible (non-significant) effect.
Construction vibration	All activities result in **short term negligible effects**

Monitoring

12.13.13 Construction noise monitoring is unlikely to be required, as the construction task above is likely to only impact the nearest receptors for a matter of weeks, even though the overall task for the Project may last months. The construction programme can be finalised in order to ensure the exceedances do not occur for a period of 10 or more days of working in any 15 consecutive days or for a total number of days exceeding 40 in any six consecutive months.

12.13.14 Construction vibration monitoring is not required due to the negligible effects predicted.

12.13.15 Should any noise-related complaints be received during either construction, operation or decommissioning, the Applicant could consider undertaking targeted monitoring.

12.14 Project-wide Effects

Introduction

12.14.1 This chapter of the EIA Report presents details of the 'project-wide' effects of the project for noise and vibration. Project-wide (combined) effects are defined here as those effects that are considered separately in relation to various elements of Project which are reported in previous separate sections of this EIA Report chapter, but which have the potential to be of greater significance when considered in combination.

Identification of Shared Receptors

12.14.2 Table 12.78 presents a screening of the receptors identified as having the potential for project-wide effects for noise and vibration.

12.14.3 Effects that are moderate adverse and above are considered significant. However, intra-project cumulative effects has considered all residual effects over and including minor adverse. This approach has been undertaken because it is considered that multiple minor effects could result in a significant intra-project cumulative effect. Where only neutral or

negligible residual adverse effects are identified from technical assessments it is considered that there is no potential for significant intra-project cumulative effect. Where a receptor has been identified as only experiencing one effect or where only one factor has identified effects on that receptor, there is no potential for intra-project cumulative effect to occur.

Table 12-78 Screening of Project-wide receptors for noise and vibration

Receptor	Relevant Elements of the Project
Bonnyhill Farm	Construction noise and vibration from New Build Overhead Line, CB Removal and AA Undergrounding

Assessment of Potential Project-wide Effects

12.14.4 The receptors at Bonnyhill Farm result in a moderate significant adverse effect from construction activities from each of the New Build Overhead Line, CB Route removal and AA undergrounding. If all construction activities take place concurrently the receptor may result in major significant adverse effects even when considering mitigation. However, it is unlikely that all activities would take place concurrently due to needing certain activities to be in place before completing the next. It is still likely that the receptors would result in moderate significant adverse effects due to the cumulative effect of the combined elements of the project.

12.14.5 Where possible, the construction programme should be finalised in order to ensure exceedances do not occur for a period of 10 or more days of working in any 15 consecutive days or for a total number of days exceeding 40 in any six consecutive months.

12.14.6 Construction noise and vibration monitoring may be required at these receptors.

Summary of Potential Project-wide Effects

12.14.7 Table 12.79 shows a summary of potential project-wide effects for noise and vibration.

Table 12-79 Summary of Potential Project-wide effects for noise and vibration

Receptor	Summary of Potential Project-wide Effects of the Project for noise and vibration
Bonnyhill Farm	Moderate adverse significant effect due to construction noise and vibration from the project as a whole

Cumbernauld Project-wide Effects

12.14.8 The construction of Cumbernauld Substation extension has the potential to have a cumulative noise impact on nearby receptors during construction due to the equipment and increased traffic.

12.14.9 If the construction works of Cumbernauld Substation and the closest section of the DWNO overhead line are coincidental, a detailed CNMP must be updated to include working times, activities and a schedule. There is the potential for activities that are associated with the construction of the Cumbernauld Substation that take place concurrently to raise the noise above the 65dB daytime noise limit at the Project NSRs.

Therefore, it is possible for cumulative construction noise to result in Moderate / Large effect which is Significant.

12.14.10 Cumulative construction noise is required to be controlled through an updated assessment by the Principal Contractors, and a CNMP. Therefore, with the appropriate mitigation, in the form of reducing equivalent sound pressure level over the working day, residual effects are likely to be Slight / Moderate and Not Significant.

12.14.11 The New Build Overhead Line is expected to be a source of operational noise in the Study Area associated with Cumbernauld Substation. The Cumbernauld Substation is assessed for worst-case noise in dry conditions during which noise from the overhead line is negligible. The New Build Overhead Line overhead line is assessed in wet conditions, in these conditions, the background noise is raised due to rainfall, therefore, operational noise from Cumbernauld Substation will be less prominent. No increase in impacts is predicted due to the extension at Cumbernauld Substation.

12.14.12 Cumulative operational noise effects with Cumbernauld Substation have been assessed as being Slight. Therefore, cumulative noise in dry and wet conditions is Not Significant.

12.15 Summary and Conclusions

New Build Overhead Line/Uprating of existing overhead line

12.15.1 This chapter assesses the likely significant noise and vibration effects arising from the construction and operation of the Project, both in terms of individual components and the project as a whole.

12.15.2 A summary of relevant noise and vibration legislation, policy and guidance is included in this chapter. Consultation responses have been received from Falkirk Council and North Lanarkshire Council and this chapter takes into account those responses where appropriate.

12.15.3 Different types of conductors have been considered as part of the design and the triple GZTACSR 400mm2 (Upas sized) conductor used as part of the embedded mitigation to reduce noise levels to an acceptable level (no significant adverse effects) during operation of the Project. Elsewhere, the twin GZTAR Matthew conductor is proposed for new and uprated overhead lines.

12.15.4 Some construction activities for the New Build Overhead Line, uprated overhead lines, AA Route Undergrounding and distribution line diversion works are predicted to result in residual short term moderate significant effects for the project and monitoring has been advised where deemed necessary.

12.15.5 All Substation Works are predicted to result in minor or negligible (not significant effects).

Bonnybridge Substation Extension

12.15.6 This chapter has considered the potential noise effects that could arise due to the Project during the construction and operational phases at the closest NSRs. The assessment has taken account of applicable planning policy and current guidance.

12.15.7 A desk-based construction noise assessment, in line with BS 5228, has been prepared for the purpose of assessing the effects of the works on any nearby residents. For the

purposes of this assessment NSRs are classed as Category A, which is the most conservative, and assessed as High sensitivity. If construction takes place in during daytime working hours, noise is predicted to be below the 65dB limit at all the nearby NSRs and is therefore predicted to result in Low impacts on High sensitivity receptors resulting in Slight effect significance at those receptor locations.

12.15.8 The construction noise assessment is based on information provided by the Principal Contractor. A robust CNMP is recommended to be developed to ensure that construction noise remains as predicted. The CNMP will detail the schedule and duration of works, as well as "as low as reasonably practicable" (ALARP) methods such as avoiding idling plant and precuring low noise equipment where possible. The construction noise assessment should be updated if equipment or phases change.

12.15.9 Operational noise has been assessed to BS 4142 standard. The noise rating from the Project results in no change in exceedance level at any of the NSRs. The Project results in Negligible impacts on High sensitivity receptors, resulting in Slight effect significance. No mitigations are required for the Project.

Cumbernauld Substation Extension

12.15.10 This chapter has considered the potential noise effects that could arise due to the Project during the construction and operational phases at the closest NSRs. The assessment has taken account of applicable planning policy and current guidance.

12.15.11 A desk-based construction noise assessment, in line with BS 5228, has been prepared for the purpose of assessing the effects of the works on any nearby residents. For the purposes of this assessment NSRs are classed as Category A, which is the most conservative, and assessed as medium sensitivity. If construction takes place during daytime working hours, noise is predicted to be above the 65dB limit at 4 NSRs and is therefore predicted to result in Medium impacts on High sensitivity receptors resulting in Moderate/Large effect significance without mitigation at those receptor locations.

12.15.12 The construction noise assessment is based on information provided by the Principal Contractor. Mitigation methods are provided in On-Site Construction Noise section, methods include avoiding overlapping construction phases, and reducing on time of equipment or utilising noise barriers. The mitigation will help ensure residual construction noise of the Project will achieve a conclusion of Low impacts on nearby High sensitivity NSRs resulting in Slight effect significance. A robust CNMP should be developed to ensure that construction noise is reduced. The CNMP will detail the mitigation methods as well as the schedule and duration of works.

12.15.13 Operational noise has been assessed to BS 4142 standard. Specific noise from the Project at all NSR fall below background noise levels, resulting in Negligible impacts on High sensitivity receptors, resulting in Slight effect significance. Mitigation is not required due to the low noise levels.