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Bramford to Twinstead Reinforcement

Volume 6: Environmental Information

Document 6.3.14.4: ES Appendix 14.4 – Grid Supply Point Substation Noise Assessment

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nationalgrid

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1. Introduction

1.1 Overview

1.1.1 National Grid Electricity Transmission plc (here on referred to as National Grid) is making an application for development consent to reinforce the transmission network between Bramford Substation in Suffolk, and Twinstead Tee in Essex. The Bramford to Twinstead Reinforcement ('the project') would be achieved by the construction and operation of a new electricity transmission line over a distance of approximately 29km (18 miles), the majority of which would follow the general alignment of the existing overhead line network.

1.1.2 This Environmental Statement (ES) appendix provides evidence to support scoping out operational noise from the proposed grid supply point (GSP) substation. The assessment includes consideration of sources of noise impacting upon nearby residential noise sensitive receptors (NSR) during the operation of the substation.

1.1.3 Operational noise from the GSP substation was scoped out the assessment at the scoping stage as National Grid committed to including a noise enclosure around the transformers at the substation (embedded measure EM-H01). The Planning Inspectorate confirmed in ID 4.9.2 of the Scoping Opinion (**application document 6.6**) that they agreed with scoping out operational noise on human receptors as there was unlikely to be a significant effect, based on the commitment to provide a noise enclosure (EM-H01) and the distance of the nearest NSR from the location of the GSP substation (circa 300m).

1.1.4 EM-H01 referenced in paragraphs 1.1.3 and 1.1.4 has also been embedded into the planning permission granted by Braintree District Council for the GSP substation.

1.2 Structure of this Report

1.2.1 The report presents the results of the survey undertaken to inform the baseline sound levels and the assessment of the operational noise levels. Chapter 2 describes the methodology used to undertake the assessment. Chapter 3 sets out the results of the baseline surveys. Chapter 4 sets out the results of the assessment and Chapter 5 presents the conclusions of the report.

1.2.2 This appendix is supported by the following Annexes:

- Annex A: Baseline Sound Level Survey;
- Annex B: Sound Propagation Modelling; and
- Annex C: Noise Impact Assessment of Atypical Scenarios.

2. Assessment Methodology

2.1 Introduction

2.1.1 This section describes the methodology for assessing operational noise from the proposed GSP substation at nearby NSR. NSR include residential dwellings, as well as some non-residential premises such as educational establishments, hospitals and religious buildings.

2.1.2 Effects are defined in terms of the following concepts:

- No Observed Effect Level (NOEL): This is the level below which no effect can be detected;
- Lowest Observed Adverse Effect Level (LOAEL): This is the level above which adverse effects on health and quality of life can be detected; and
- Significant Observed Adverse Effect Level (SOAEL): This is the level above which significant adverse effects on health and quality of life occur.

2.1.3 Relevant LOAEL and SOAEL have been identified for assessing noise impacts from the proposed GSP substation based on the following guidance documents, which are described further in Section 2.3:

- British Standard (BS) 4142:2014+A1:2019 (here on referenced as BS 4142) Methods for rating and assessing industrial and commercial sound; and
- BS 8223:2014 Guidance on sound insulation and noise reduction for buildings (here on referenced as BS 8223).

2.2 Baseline Sound Level Survey

2.2.1 A sound level survey has been conducted to obtain baseline data for use in the assessment of operational noise. The sound level measurements were conducted in general accordance with the methodology detailed in BS 7445-1:2003 (here on referenced as BS 7445) Description and measurement of environmental noise. Guide to quantities and procedures.

2.2.2 A desk study was undertaken to identify the nearest NSR. This found that there are relatively isolated NSR located in all directions from the proposed GSP substation site. The closest residential NSR to the site are:

- Approximately 325m to the southeast located off Whitelands Road;
- Approximately 420m to the northeast off Watery Lane;
- Approximately 460m to the southwest located off Old Road; and
- Approximately 550m to the northwest at Butlers Hall Farm.

2.2.3 A baseline sound level survey was conducted between Tuesday 6 July and Tuesday 13 July 2021 and comprised long duration unattended measurements at two locations. These sites were chosen as they were considered representative of nearby NSR. Location P1 was positioned approximately 930m to the west of the proposed GSP substation at Rectory Lane. Location P2 was positioned at Watery Lane, approximately

535m northeast of the site. The locations were selected as being representative of nearby NSR, being away from main noise sources such as the A131. Further details of the survey locations can be found in Annex A: Baseline Sound Level Survey.

2.2.4 The sound level meter recorded a range of parameters including the following:

- $L_{Aeq,T}$ – The A-weighted equivalent continuous sound pressure level over the measurement period T, representative of the 'average' sound pressure level over a given period, in this case 15 minutes;
- $L_{A10,T}$ – The L_{A10} is defined as the sound level that is exceeded for 10% of the measurement period, and is usually regarded as a descriptor of road traffic noise;
- $L_{A90,T}$ – The L_{A90} is defined as the sound level that is exceeded for 90% of the measurement period, and is usually regarded as a descriptor of the background sound level; and
- $L_{AFmax,T}$ – The L_{AFmax} is the maximum A-weighted sound level during the sample period, measured using a fast time weighting.

2.2.5 Broadband and 1/3 octave band values were also measured for the above parameters.

2.2.6 The sound level meters were installed at locations representative of nearby NSR and left unattended for a period of seven days to capture the fluctuation of ambient and background sound levels. Attended observations were undertaken during the installation and collection of equipment to capture qualitative information on the main noise sources and of the character of noise climate at the measurement locations and in the area.

2.2.7 The measurement locations were free-field, at least 3.5m from any reflective surfaces, other than the ground. Microphones were fitted with windshield and were tripod mounted between 1.3m – 1.5m from ground level. Weather conditions were monitored during the survey and data affected by periods of adverse weather were omitted from the subsequent analysis. Conditions were generally favourable, with low wind speeds and dry.

2.3 Operational Noise Assessment

2.3.1 The study area for operational noise impacts is within 1000m of the Order Limits, based on guidance from ISO 9613:1996 'Acoustics – Attenuation of sound during propagation outdoors – Part 2: General Method of calculation' (ISO 9613).

2.3.2 The assessment follows the methodology stated in BS 4142 and is based on the background sound level data gathered during the baseline surveys and plant sound level data based on similar projects. BS 4142 assesses the potential significance of effects by comparing the 'sound rating level' of an industrial source to the typically representative 'background sound level' at the location of nearby NSR.

2.3.3 Certain acoustic features can increase the potential for a sound to attract attention, and therefore increase its relative impact than that expected from a simple comparison between the specific sound level and the background sound level. In particular, BS 4142 identifies sounds that contain audible tonality, impulsivity and/or intermittency and recommends that a correction be added to the specific sound level. The specific sound level along with any applicable correction is referred to as the 'sound rating level'. It should be noted that the penalties can be additive i.e. if they have a combination of tonal, impulsive, and intermittent acoustic characters.

2.3.4 Where tonality is audible at an NSR, a penalty of between 0 and 6dB may be applied. Subjectively, a 2dB penalty may be applied where a tone is just perceptible, 4dB where it is clearly perceptible, and 6dB where it is highly perceptible.

2.3.5 Where impulsivity is audible at an NSR a penalty of between 0 and 9dB may be applied. Subjectively, a 3dB penalty may be applied where impulsivity is just perceptible, 6dB fs where it is clearly perceptible, and 9dB where it is highly perceptible.

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

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

2.3.8 The greater the difference between the rating level and the background sound level; the greater the likelihood of complaints. The assessment criteria given by BS 4142 are as follows:

- A difference of +10dB or more is likely to be an indication of a significant adverse impact, depending on the context;
- A difference of +5dB could be an indication of an adverse impact, depending on the context; and
- The lower the rating level is relative to the measured background sound level, the less likely it is that there would be an adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.

2.3.9 The assessment should also consider the context of the sound. Where the initial estimate of the impact needs to be modified due to the context, all pertinent factors should be considered, including:

- The absolute level of the sound;
- The character and level of the residual sound compared to the character and level of the specific sound; and
- The sensitivity of the NSR, including whether dwellings already incorporate design measures that secure good internal and/or outdoor conditions, such as: façade insulation treatment, ventilation and/or cooling that would reduce the need to have windows open to provide rapid or purge ventilation and acoustic screening.

2.3.10 The following effect levels apply for the assessment of operational noise:

- The LOAEL is equal to the background sound level, depending on context; and
- SOAEL is equal to 5dB above the background sound level, depending on context.

2.3.11 When considering context, BS 4142 references BS 8223:2014 as providing context where background and rating levels are low. BS 8223:2014 recommends internal sound levels in bedroom spaces of ≤30dB $L_{Aeq,8h}$ during night-time periods and states that the attenuation of sound through a particularly open window for ventilation is 15dB. As such, suitable internal sound levels in bedroom spaces (≤30dB $L_{Aeq,8h}$) would be expected to be achieved where the sound rating level is below 45dB externally. The sound rating level

includes penalties for acoustic character and as such the absolute sound level would be lower. With closed windows, internal sound levels would be significantly lower.

2.3.12 Sound levels have been predicted via computer sound propagation modelling using SoundPlan software (version 8.2), based on the colocation methodology described in ISO 9613.

3. Survey Results

3.1.1 This section examines the NSR and the existing baseline acoustic environment in the study area. Annex B: Sound Propagation Modelling shows the site and NSR locations.

3.1.2 There are relatively isolated NSR located in all directions from the proposed GSP substation site. The closest residential NSR to the site are:

- Approximately 325m to the southeast located off Whitelands Road;
- Approximately 420m to the northeast off Watery Lane;
- Approximately 460m to the southwest located off Old Road; and
- Approximately 550m to the northwest at Butlers Hall Farm.

3.1.3 The noise climate in the vicinity of the proposed GSP substation site and at nearby NSR is typical of a rural area, being generally quiet with the exception of areas close to main roads. The main noise source in the area is road traffic on the A131, which is a moderately busy road running between Sudbury to the north and Halstead to the south. Other sources of noise include rustling foliage, birdsong, local road traffic, and general rural ambient sounds.

3.1.4 The results of the survey are summarised in Table 3.1 and the full results are provided in Annex A: Baseline Sound Level Survey. Values are presented in terms of the range of values experienced during the survey period, and typical values, based on either the logarithmic average or the mode, as appropriate to the measurement perimeter.

Table 3.1 – Summary of Measured Sound Levels

Location	Average Sound Levels, dB $L_{Aeq,15min}$	Maximum Sound Level, dB $L_{Amax,F,15min}$	Background Sound Level, $L_{A90,15min}$
Daytime (07:00 – 23:00):			
P1 Rectory Lane	24 – 55 Log average: 43	36 – 83 Mode: 59	21 – 44 Mode: 32
P2 Watery Lane	33 – 58 Log average: 46	45 – 79 Mode: 60	20 – 49 Mode: 33
Night-time (23:00 – 07:00):			
P1 Rectory Lane	20 – 54 Log average: 40	29 – 73 Mode: 57	19 – 38 Mode: 20
P2 Watery Lane	20 – 59 Log average: 43	38 – 81 Mode: 55	18 – 44 Mode: 19

Notes:

Log average = logarithmic average. Sound pressure levels are measured using a decibel (dB) scale, which is logarithmic. A logarithmic average therefore equates to the average sound pressure level experienced during the respective time period.

Mode = Modal average. With regards to statistical parameters, the mode represents the value (rounded to the nearest dB) that most often occurred during the measurement period and can therefore be regarded as 'typical' values.

3.1.5 The results show that sound levels at the two locations are broadly comparable. This is expected given that there is only one main noise source in the area, the A131. The measured background sound levels are therefore considered to be representative of other NSR in the study area.

3.1.6 The typical background sound level during daytime periods was 32 to 33dB $L_{A90,15min}$. For the purposes of this assessment, the lower value of 32dB $L_{A90,15min}$ was used for all NSR. During night-time periods the typical background sound level was 19 to 20dB $L_{A90,15min}$. Similarly, for the purposes of this assessment, the lower value of 19dB $L_{A90,15min}$ was used for all NSR.

4. Assessment

4.1 Operational Transformer Sound Level Data

4.1.1 The main source of noise from the proposed GSP substation during operation would be from the two super-grid transformers (SGT). The make and model of transformer has not yet been specified. As such, the assessment is based on National Grid's specification document TS2.03, which provides upper sound level limits for SGT, and therefore provides a worst-case assessment.

4.1.2 TS2.03 indicates that upper sound power limit for the proposed SGT specification is 95dBA L_W. This assumes it is being operated at 50% of load and 102.5% of excitation voltage. Each of the two SGT would typically operate at 50% maximum load such that there is capacity to operate only one SGT at 100% load during an outage without affecting supply.

4.1.3 National Grid has committed to installing the proposed transformers within enclosures (EM-H01). Standard enclosures used at National Grid substations provide a sound reduction of at least 20dB. This reduction is therefore assumed in the assessment.

4.2 Other Sources of GSP Substation Noise

4.2.1 Other sources of noise from the GSP substation would include cooling plant and an emergency backup generator. These would operate infrequently during certain atypical scenarios and their potential noise impacts are assessed in Section 4.5.

4.2.2 Switchgear noise is generated, in the main, by the operation of circuit breakers. Modern switchgear operates with a dull 'thud'. Switchgear operations would be very infrequent, likely less once every few years, and is therefore not considered significant and scoped out of further assessment. Other equipment which do not make significant noise include site auxiliary plant such as low voltage alternating current plant, battery rooms, and monitoring equipment.

4.3 BS 4142 Assessment

4.3.1 Resultant sound levels have been predicted via computer sound propagation modelling using SoundPlan software (version 8.2). Figures showing the model and the sound propagation plans are provided in Annex B: Sound Propagation Modelling. As a worst-case assumption, it is assumed that all acoustic energy is emitted at 100Hz within the sound propagation model. The highest sound level predicted at the nearby NSR has been considered (the plant noise level and impact at other NSR would therefore be lower).

4.3.2 The highest predicted specific sound level at nearby NSR is 8dB $L_{Aeq,T}$ at Ben Gramor Lodge, The Green, Twinstead, located approximately 325m to the south-east of the proposed GSP substation.

4.3.3 The results of the BS 4142 assessment of the operation of the proposed GSP substation during normal conditions are presented in Table 4.1. This assumes two SGT operating at 50% load. The rating sound level is taken from the worst-case affected residential NSR. Noise impacts at all other residential NSR would therefore be lower.

Table 4.1 – BS 4142 Assessment – Normal Operation

Parameter	Value		BS 4142 Clause	Commentary
	Daytime	Night-time		
Background sound level, dB L_{A90}	32	19	8.1	Typical background sound level at nearby NSR based on measured sound level data.
Specific sound level, dB $L_{Aeq,T}$	8	8	7.3	Calculated via sound propagation model based on worst-case plant specification data.
Acoustic feature correction, dB	6	6	9.2	Assumed potential tonal audibility at NSR as worst-case. In practice likely to be less.
Sound rating level, dB $L_{Ar,T}$	14	14	9	Sum of specific sound level and acoustic corrections.
Difference in sound rating level relative to background sound level, dB	-18	-5	11	The rating sound level is below the typical background sound level during both daytime and night-time periods at the worst-case NSR. Therefore, the impact of noise due to the normal operation of the proposed GSP substation is low during daytime and night-time periods at the worst-case residential NSR, depending on context. Noise impacts at all other residential NSR would be even lower. In context, the specific sound level is very low at NSR such that suitable conditions for sleeping can be achieved, even with open windows for ventilation. In context, the impact of noise from the proposed two SGT during normal operation remains low. **Outcome: Low impact**
Uncertainty	-	-	10	Uncertainty has been minimised through the use of long-term sound level survey data and worst-case plant specification data. In practice, impacts would be expected to be lower than reported. The outcome of the assessment is unlikely to be altered by uncertainty.

Notes: BS 4142 Clause refers to the corresponding clause in BS 4142 relating to that aspect of the assessment.

4.3.4 The results indicate that during normal operation of the proposed GSP substation the impact of noise at nearby NSR would be low during daytime and night-time periods, depending on context. In terms of context, the absolute sound level is very low and would be unlikely to adversely impact nearby NSR both internally and externally. The outcome of the assessment is therefore not affected by context and the outcome remains a low impact.

4.4 Non-Residential NSR

4.4.1 There are a number of non-residential NSR in the vicinity of the proposed GSP substation site. These include a scout campsite approximately 270m to the east, and Protected

Lanes approximately 310m to the south (Old Road), and approximately 440m to the north-east (Watery Lane). The sound rating level at these locations would also be below the background sound level during both daytime and night-time periods and as such the impact of noise from the normal operation of the proposed GSP substation would be low. The effects on ecological NSR are considered within ES Chapter 7: Biodiversity (**application document 6.2.7**).

4.5 Atypical Scenarios

4.5.1 Atypical scenarios include:

- When cooling is required; and
- Periods when the backup generator is required during emergency conditions or testing.

4.5.2 Operation of cooling plant is only likely to be required during periods of outages of an SGT, and therefore a single SGT would be required to run at 100% load.

4.5.3 The backup diesel generator would be installed for use during emergency conditions so that the proposed GSP substation's control systems remain operational, for example during an unforeseen failure of site electricity supplies. Backup generators are run briefly on a monthly basis to test their operation. This varies from manufacturer to manufacturer but is typically for around 5-10 mins approximately once a month during a daytime period.

4.5.4 An assessment of potential noise impacts from the operation of cooling plant and emergency backup generator is provided in Annex C: Noise Impact Assessment of Atypical Scenarios for information.

4.5.5 Sound levels due to the operation of the cooling plant would be below the background sound level during daytime periods and comparable to the background sound level during night-time periods. However, the absolute sound level from the cooling plant would be low and suitable internal sound levels in bedroom spaces of nearby residential NSR would still be achieved. In context, noise impacts from the cooling plant would be low at nearby residential NSR.

4.5.6 Sound levels from the emergency generator are expected to exceed background sound levels during both daytime and night-time periods. However, the absolute sound level from the emergency back-up generator would be low and would not cause unsuitable internal sound levels in bedroom spaces of nearby residential NSR. Furthermore, the use of the emergency backup generator would be infrequent, particularly at night. In context, noise impacts from the emergency backup generator would be low at nearby residential NSR.

5. Conclusion

5.1.1 This appendix sets out the assessment of potential noise impacts relevant to the operation of the proposed GSP substation. The assessment of potential noise impacts has been conducted in accordance with good practice guidance in line with current planning policy.

5.1.2 A baseline sound level survey has been conducted to inform the assessment. The results of the survey indicate that ambient and background sound levels in the vicinity of the proposed GSP substation and nearby NSR are generally low, particularly during night-time periods, and are typical of a rural area.

5.1.3 National Grid has committed to housing the proposed SGT within noise enclosures (EM-H01) and this reduction was therefore assumed in the assessment. The operational noise assessment indicates that a low impact is expected during normal operation, and during atypical situations, such as when the use of SGT cooling plant, or when back-up generators may be required during emergency conditions.

5.1.4 The impact of noise from the operation of the proposed GSP substation at NSR is expected to be low during normal operation, operation of the cooling plant, and during use of the backup generator and no further specific mitigation measures are required.

Annex A: Baseline Sound Level Survey

Table A1 – Equipment Details

Location	Equipment Type	Manufacturer	Type	Serial Number	Last Calibration Date
P1 Rectory Lane	Sound level meter	01dB	FUSION	12811	24/11/2020
	Microphone	GRAS	40CD	415859	24/11/2020
	External Preamplifier	01dB	Pre No22	1915119	24/11/2020
	Internal Preamplifier	01dB	FUSION	12811	24/11/2020
	Calibrator	01dB	CAL31	93744	24/11/2020
P2 Watery Lane	Sound level meter	01dB	FUSION	11200	11/2/2020
	Microphone	GRAS	40CE	226400	11/2/2020
	External Preamplifier	01dB	Pre No22	1605098	11/2/2020
	Internal Preamplifier	01dB	FUSION	11200	11/2/2020
	Calibrator	Brüel & Kjær	4231	2385276	11/3/2021

Table A2 – Survey Locations

Location	Eastings	Northings	Photograph
P1 Rectory Lane	583201	237066	

Location	Eastings	Northings	Photograph
P2 Watery Lane	585047	237560	

1.1 Weather Conditions

1.1.1 Weather conditions were monitored during the survey. Conditions were generally favourable, with low wind speeds and dry. Data is available on request.

1.2 Covid-19

1.2.1 The survey was conducted during the Covid-19 pandemic (July 2021) when certain restrictions were in place, limiting people's travel. This has the potential to affect sound levels, particularly from road traffic sources. Institute of Acoustics guidance is that sound level surveys should still be conducted but that the potential effects of the restrictions on sound levels should be considered.

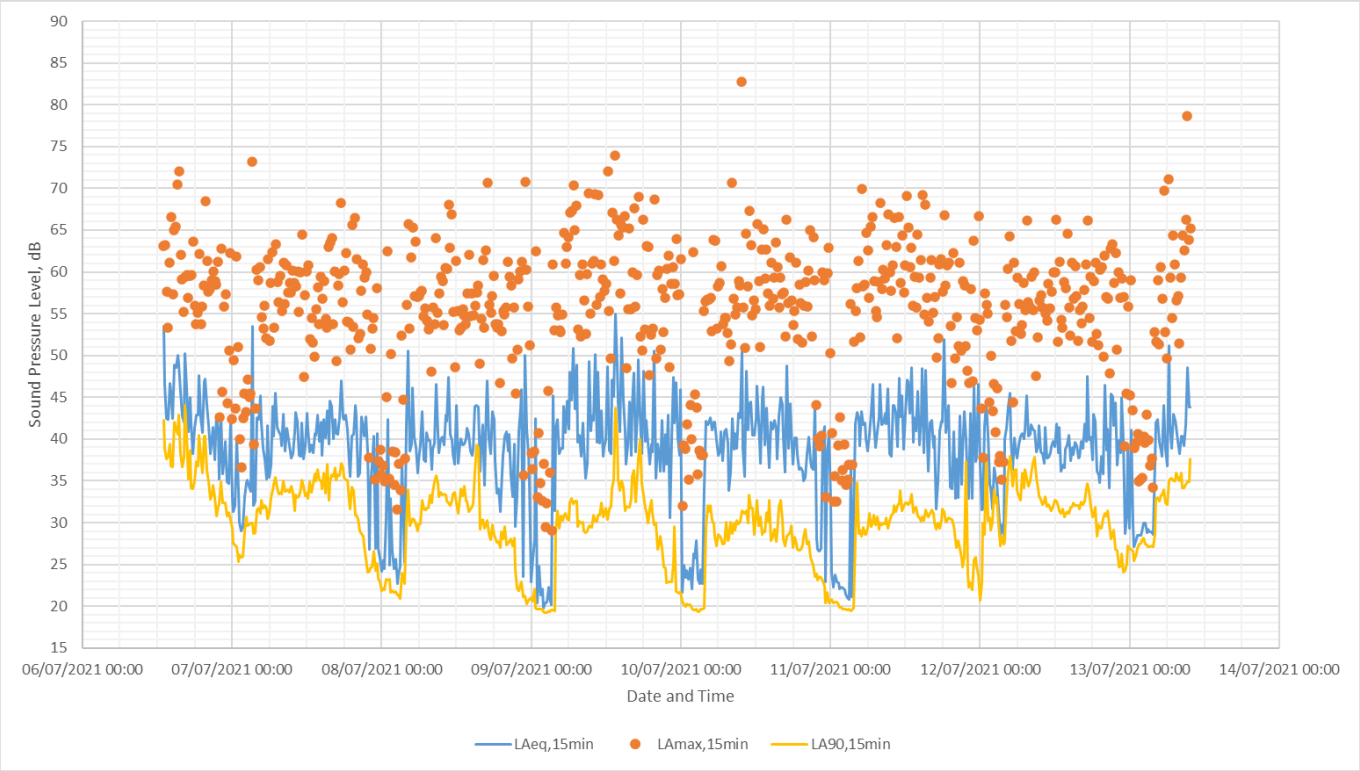
1.2.2 In this case, there is potential for reduced traffic on the A131 which is the main noise source in the area. The purpose of the survey was to obtain background sound levels for setting noise limits. As such, any potential effect associated with a reduction in road traffic is likely to lead to a conservative assessment. The results of the survey have also been compared to measurements in the area, conducted as part of a previous study in 2012. The measured sound levels are comparable, indicating that the effect of the Covid-19 restrictions on measured sound levels is likely to negligible for this survey.

1.3 Results

P1 Rectory Lane

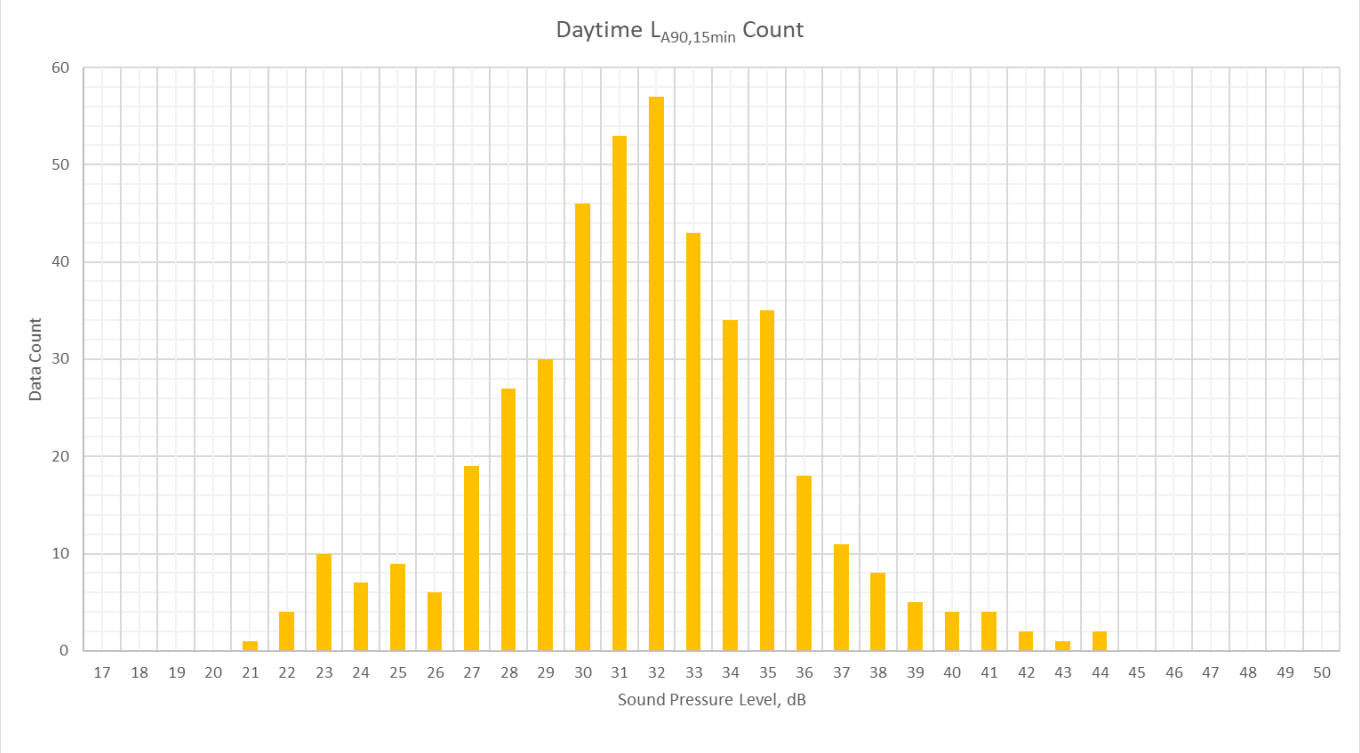
1.3.1 Figure A1 shows the temporal variation in sound levels at P1 Rectory Lane throughout the survey period.

Figure A1 – P1 Rectory Lane Temporal Variation



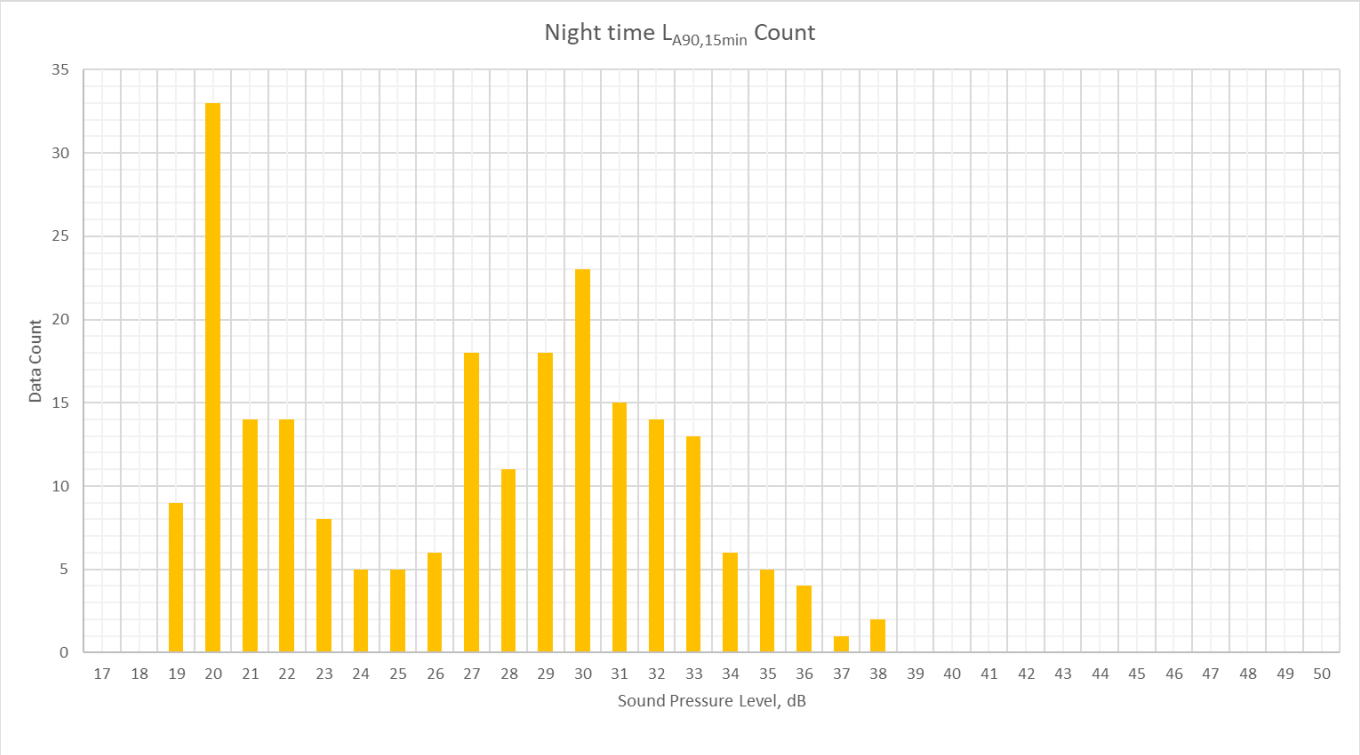
1.3.2 Figure A2 shows the statistical distribution of background ($L_{A90,15min}$) sound levels at P1 Rectory Lane throughout the survey period during daytime periods.

Figure A2 – P1 Rectory Lane Statistical Distribution of Background Sound Levels (Day)



1.3.3 Figure A3 shows the statistical distribution of background ($L_{A90,15min}$) sound levels at P1 Rectory Lane Hall throughout the survey period during night-time periods.

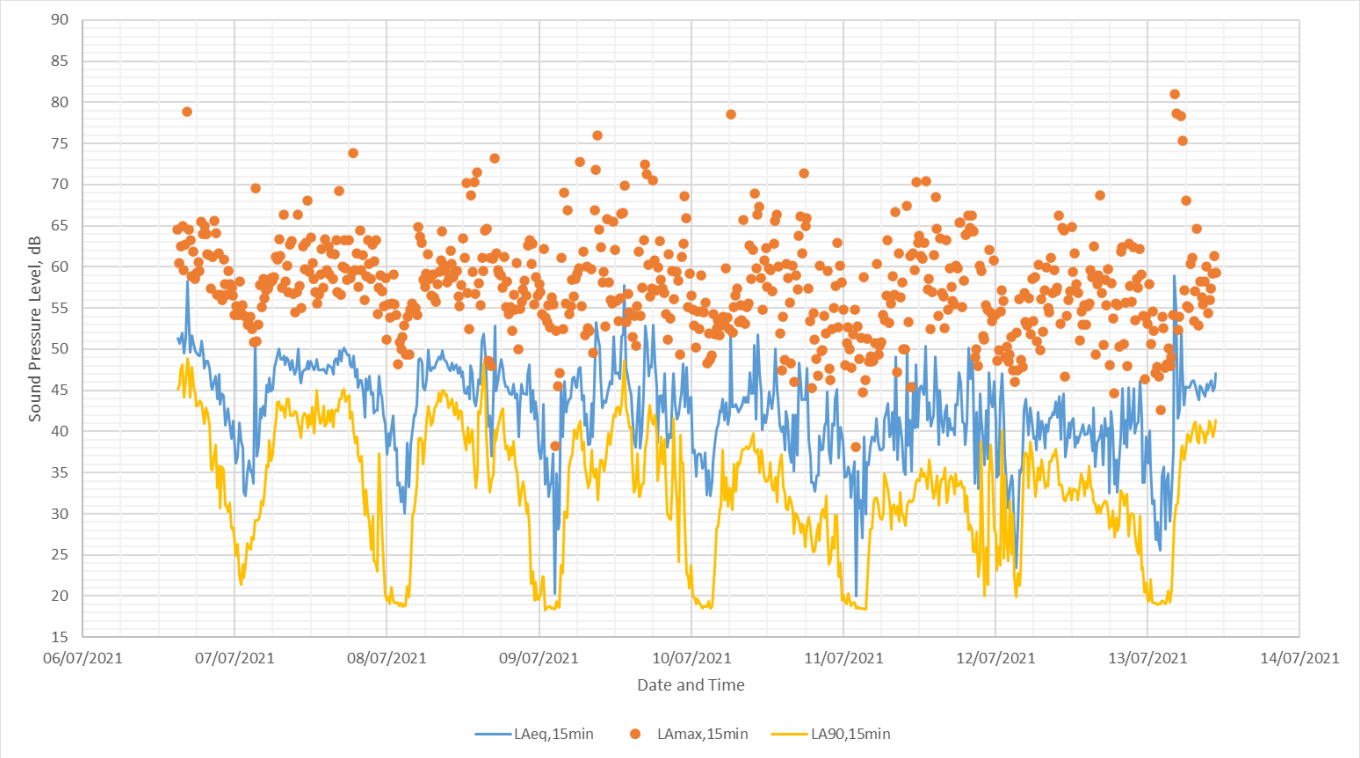
Figure A3 – P1 Rectory Lane Statistical Distribution of Background Sound Levels (Night)



P2 Watery Lane

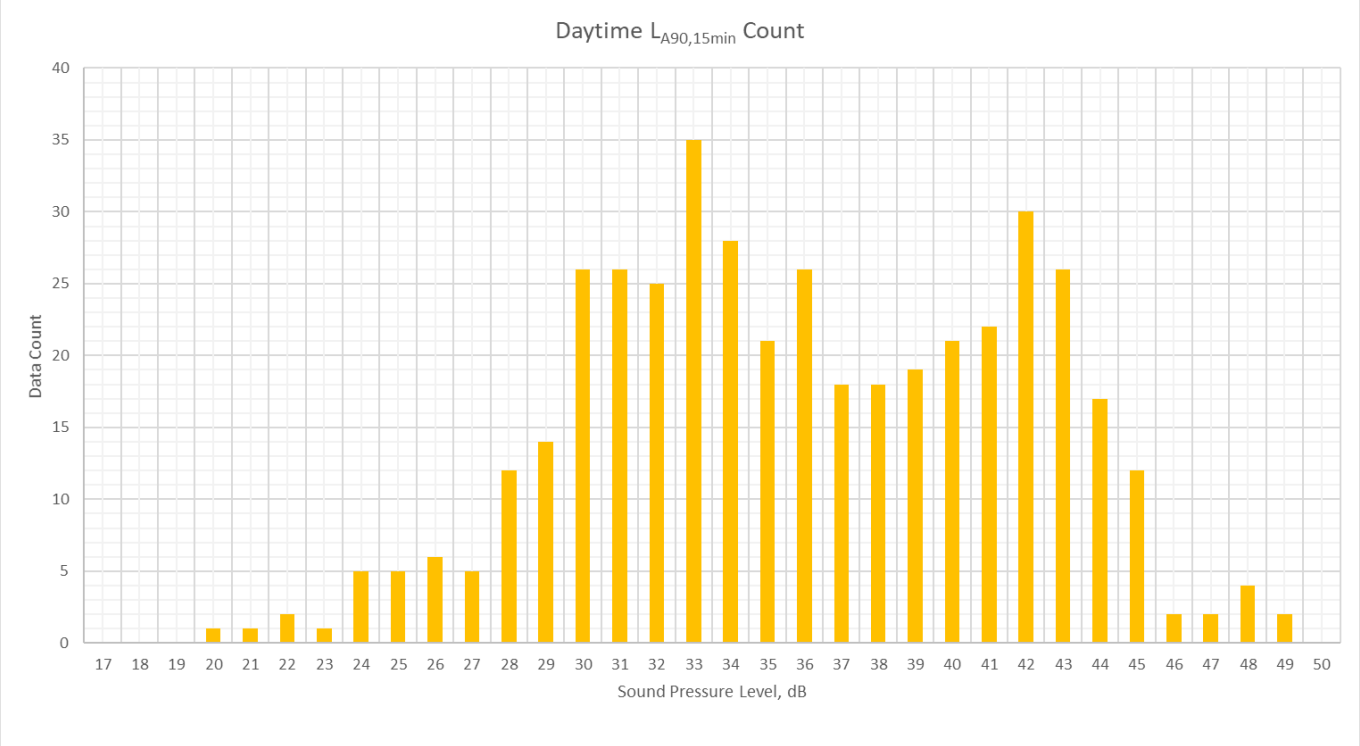
1.3.4 Figure A4 shows the temporal variation in sound levels at P2 Watery Lane throughout the survey period.

Figure A4 – P2 Watery Lane Temporal Variation



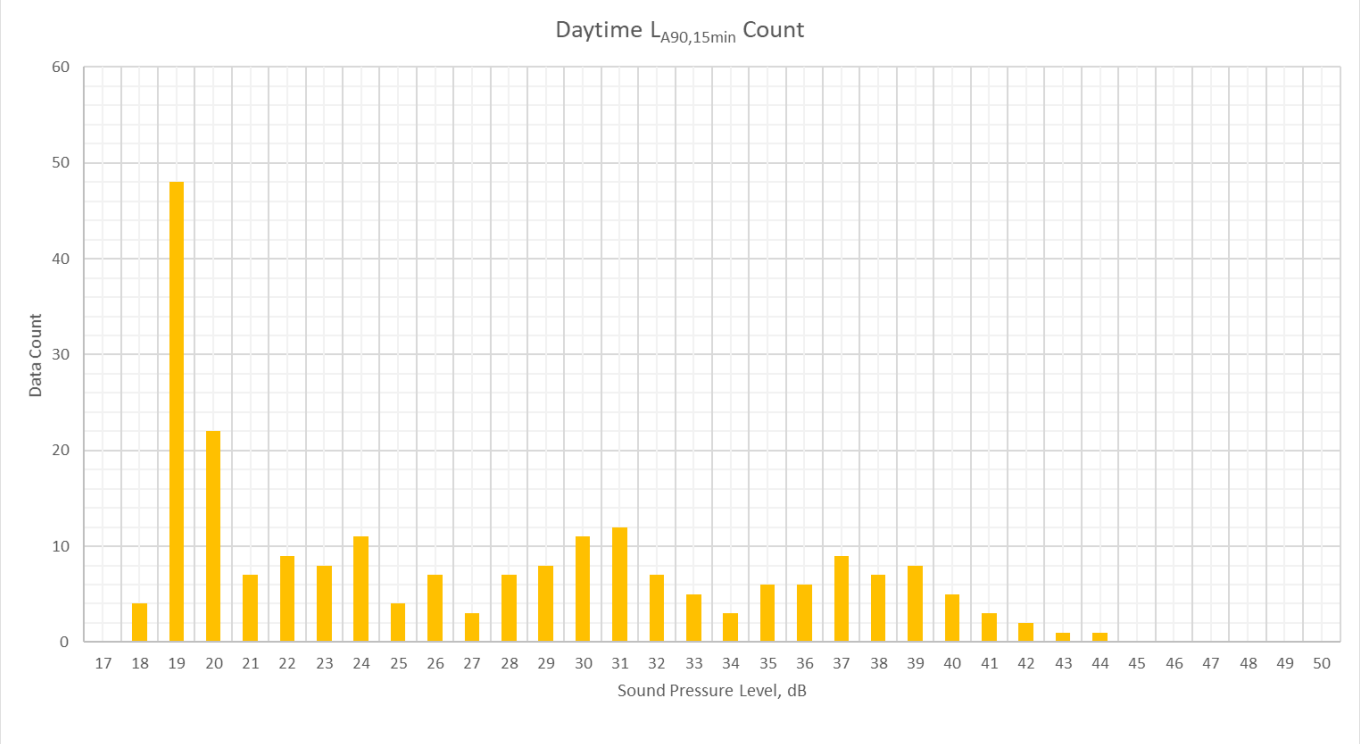
1.3.5 Figure A5 shows the statistical distribution of background ($L_{A90,15min}$) sound levels at P2 Watery Lane throughout the survey period during daytime periods.

Figure A5 – P2 Watery Lane Statistical Distribution of Background Sound Levels (Day)



1.3.6 Figure A6 shows the statistical distribution of background ($L_{A90,15min}$) sound levels at P2 Watery Lane throughout the survey period during night-time periods.

Figure A6 – P2 Watery Lane Statistical Distribution of Background Sound Levels (Night)



Annex B: Sound Propagation Modelling

Figure B1 – SoundPlan Model and Plant Locations

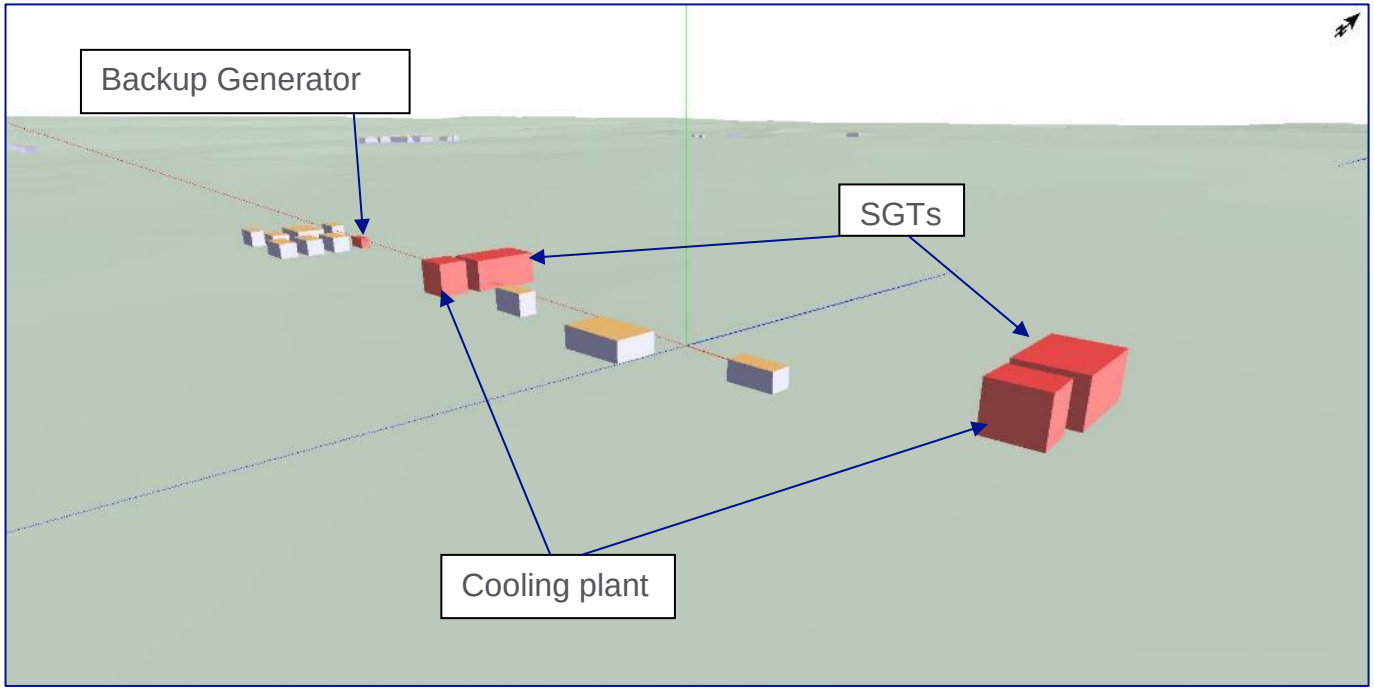


Figure B2 – SoundPlan Model Showing View to North-West

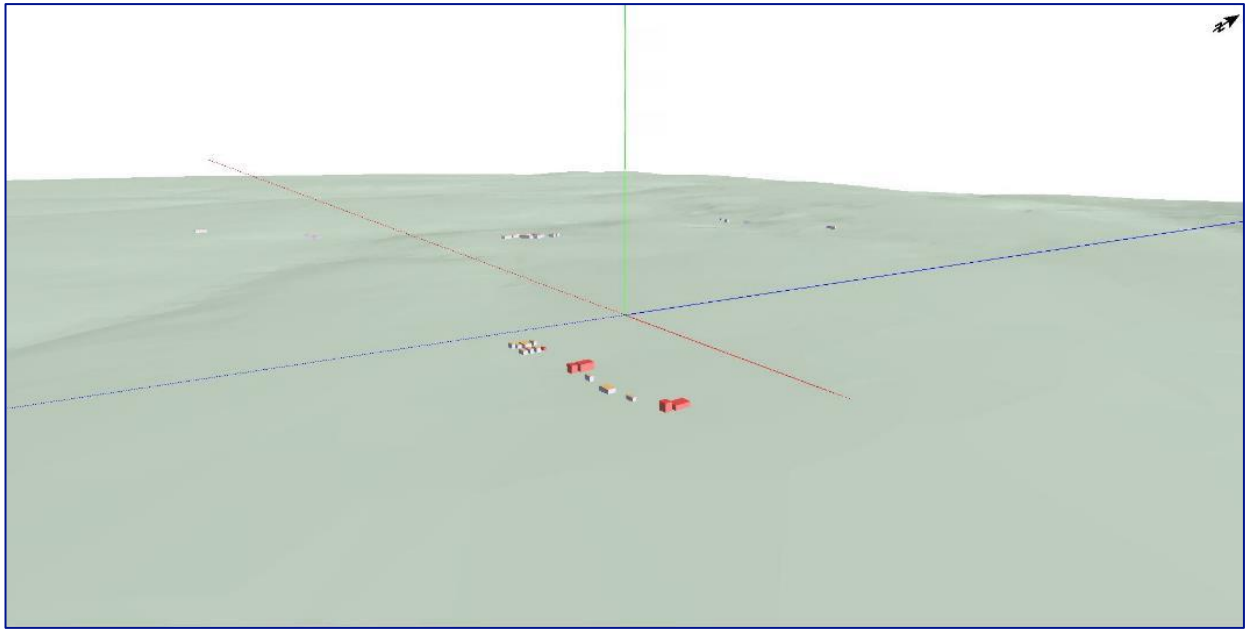


Figure B3 – SoundPlan Model Showing View to South-East

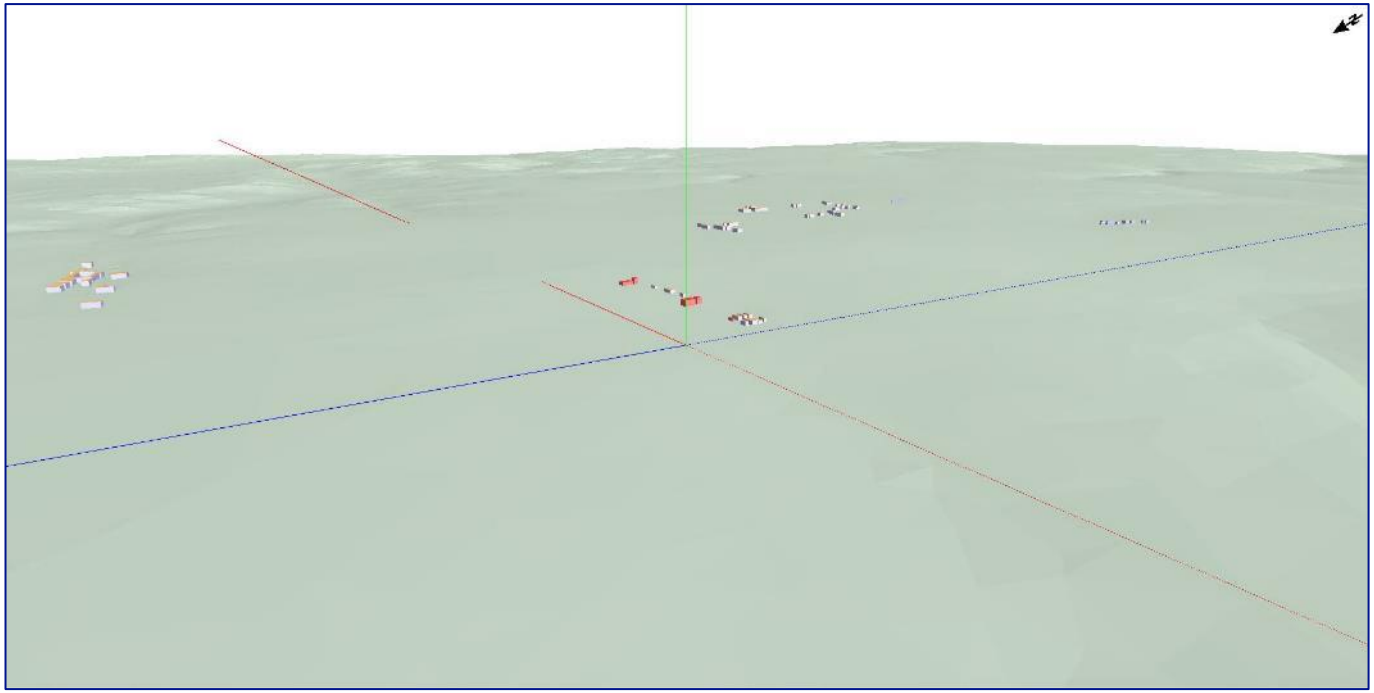


Figure B4 – SoundPlan Contour Plot – Normal Operation Scenario

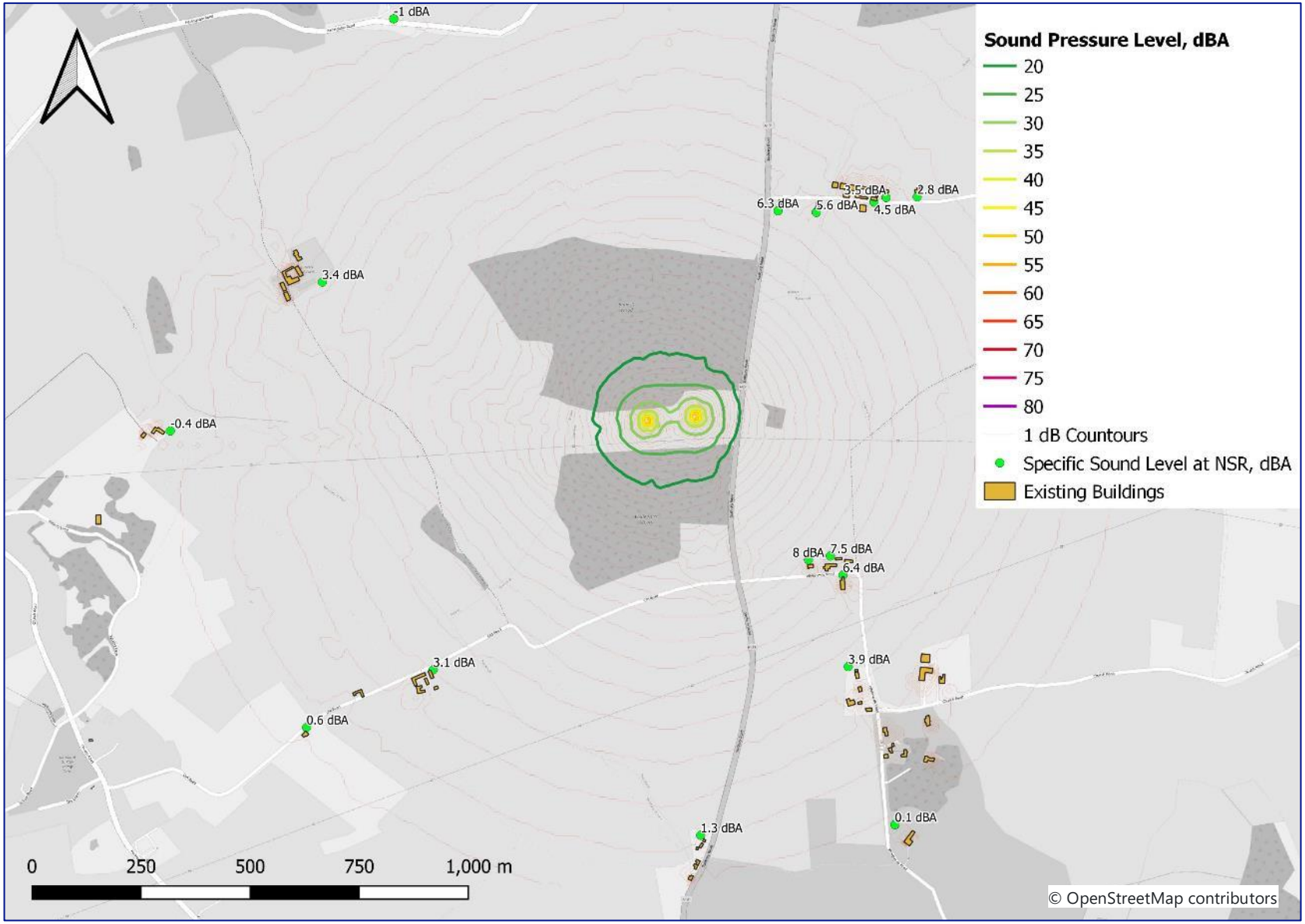


Figure B5 – SoundPlan Contour Plot – Cooling Scenario

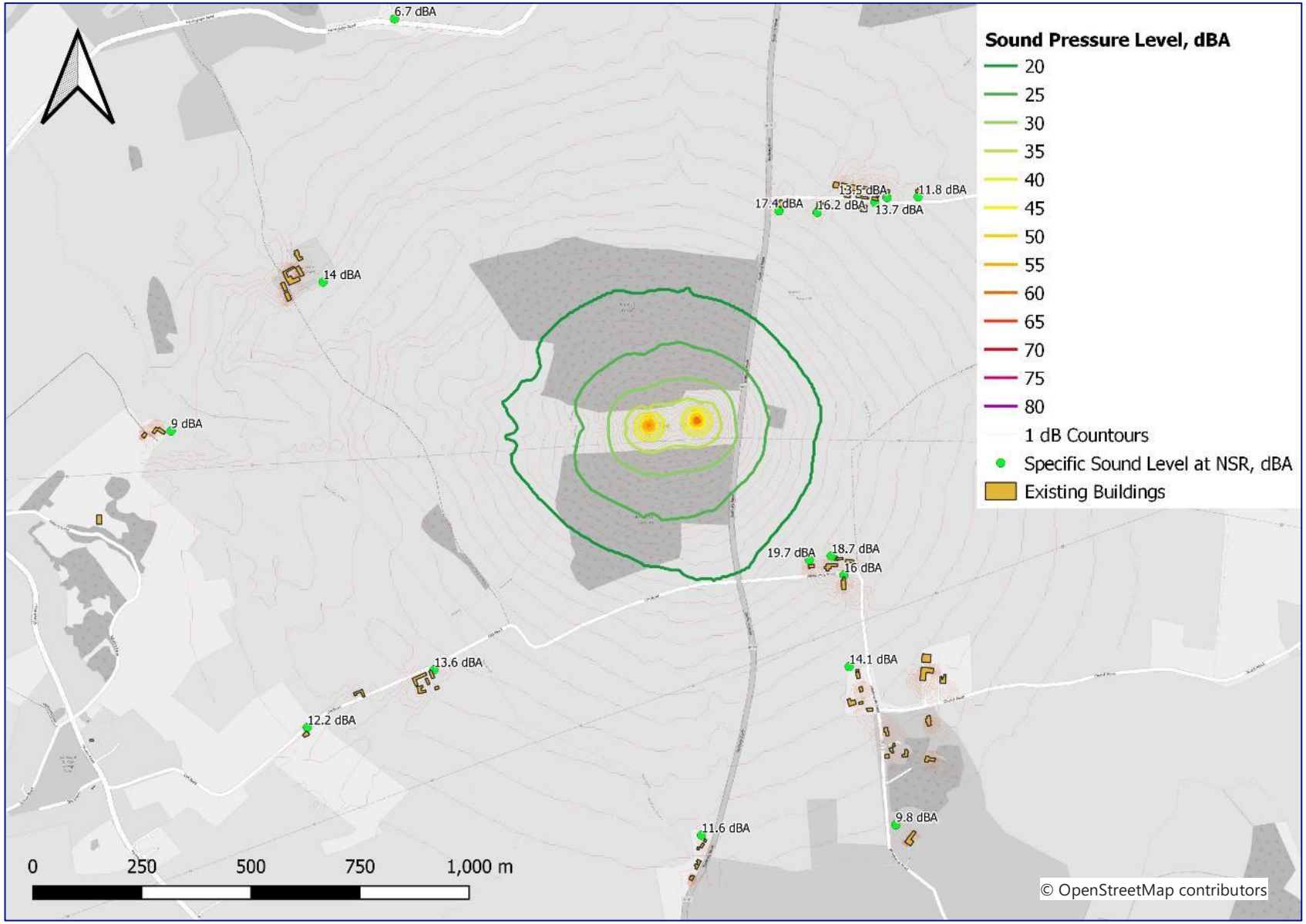
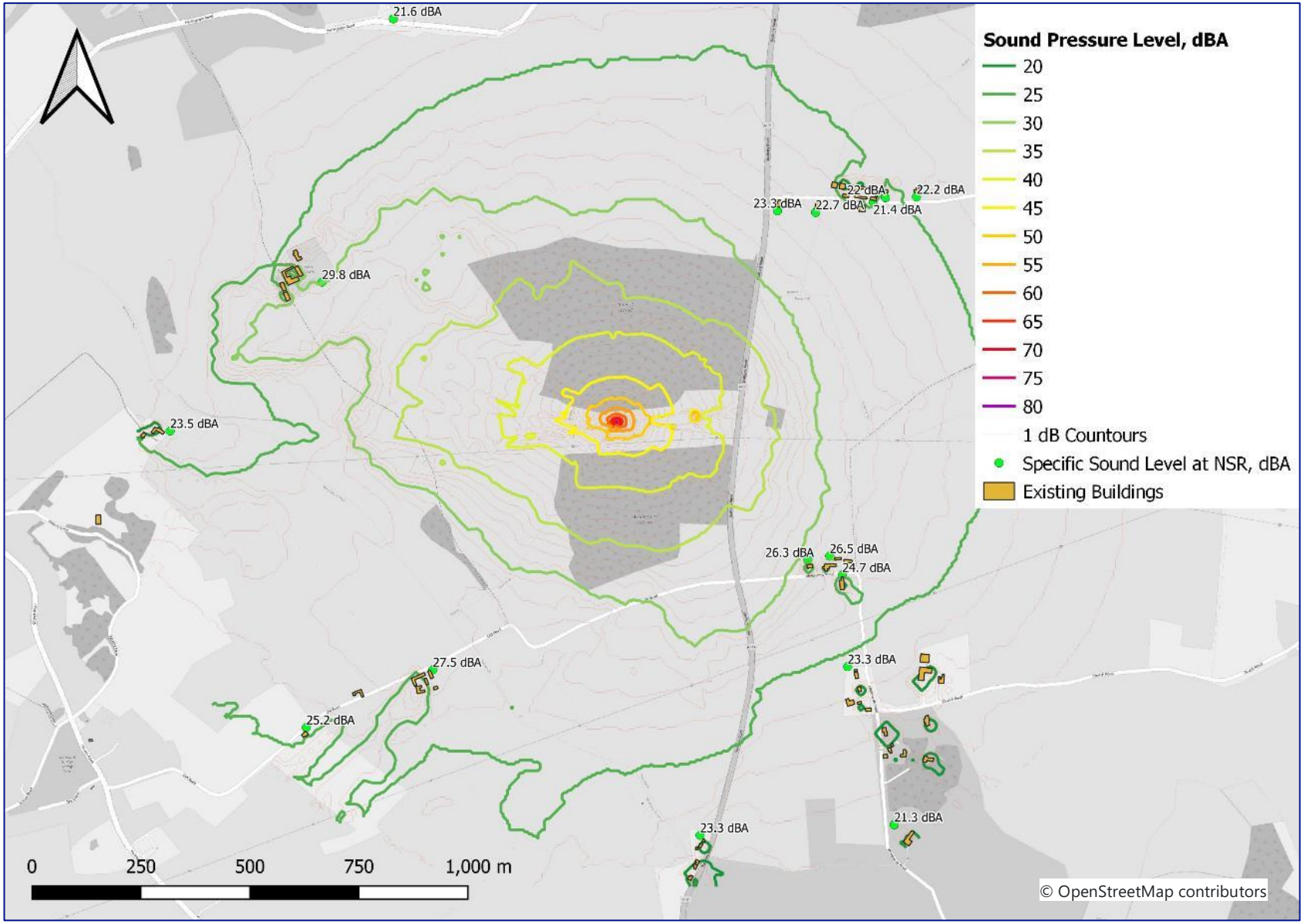


Figure B6 – SoundPlan Contour Plot – Backup Generator Scenario



Annex C: Noise Impact Assessment of Atypical Scenarios

1.1 Introduction

1.1.1 Atypical scenarios include:

- When cooling is required are likely to be only during periods of outages of an SGT;
- Periods when the backup generator is required during emergency conditions or testing.

1.1.2 Resultant sound levels have been predicted via computer sound propagation modelling using SoundPlan software (version 8.2). Figures showing the model and the sound propagation plans are provided in Annex B: Sound Propagation Modelling. The highest sound level predicted at the nearby NSR has been considered (the plant noise level and impact at other NSR would therefore be lower).

1.2 Operational Plant Data – Cooling Plant and Backup Generator

1.2.1 Under normal SGT operating conditions (i.e. at 50% load), cooling plant would not be expected to operate. Exceptions to this would typically be during an outage (planned or otherwise) of one of the two SGT where the load on a single SGT would increase. The maximum sound power of the cooling plant, as stated in TS2.03, is 84dBA L_W.

1.2.2 A backup diesel generator would be installed for use during emergency conditions to ensure the proposed GSP substation system remains operational e.g. during an unforeseen outages. Additionally, backup generators are run briefly on a monthly basis to test their operation. This varies from manufacturer to manufacturer but is typically for around 5-10 mins approximately once a month.

1.2.3 Upper noise limits for standby diesel generators are contained in National Grid's specification document TS3.12. It is assumed that the generator would have a sound level not exceeding 75dBA at 1m. The equivalent sound power level of the generator would therefore vary depending on the size of the unit, but an adjustment of 21dB is a reasonable worst-case assumption (based on 10 times the logarithm of the measurement surface area at a distance of 1m, assuming 125m^2), leading to an equivalent sound power level of 96dBA L_W.

1.3 Assessments

BS 4142 Assessment - Cooling Scenario

1.3.1 The results of the BS 4142 assessment of the operation of the proposed GSP substation during conditions where cooling is required are presented in Table C1. There is no specific criteria for SGT operating at 100% load and as such it is assumed both SGT are running at 50% load with cooling plant operating for both units.

Table C1 – BS 4142 Assessment – Cooling Scenario

Parameter	Value		BS 4142 Clause	Commentary
	Daytime	Night-time		
Background sound level, dB L_{A90}	32	19	8.1	Typical background sound level at nearby NSR based on measured sound level data.
Specific sound level, dB $L_{Aeq,T}$	20	20	7.3	Calculated via sound propagation model based on worst-case plant specification data.
Acoustic feature correction, dB	0	0	9.2	Cooling plant not likely to be tonal, especially if dominant compared to SGT noise.
Sound rating level, dB $L_{Ar,T}$	20	20	9	Sum of specific sound level and acoustic corrections.
Difference in sound rating level relative to background sound level, dB	-12	+1	11	Low impact during daytime and night-time, depending on context. In context, the specific sound level is very at NSR low such that suitable conditions for sleeping can be achieved, even with open windows for ventilation. Additionally, the cooling plant would only operate rarely, primarily during outages of one SGT where the other SGT is required to take the increased load. In context, the impact of noise from the proposed cooling plant is low. **Outcome: Low impact**
Uncertainty			10	Uncertainty has been minimised through the use of long-term sound level survey data and worst-case plant specification data. In practice impacts would be expected to be lower than reported. The outcome of the assessment is unlikely to be altered by uncertainty.

Notes: BS 4142 Clause refers to the corresponding clause in BS 4142 relating to that aspect of the assessment.

1.3.2 The results indicate that on occasions where cooling may be required, this would cause a low impact during both daytime and night-time periods, depending on context. The specific sound level is comparable to the typical existing background sound level and below the existing average ambient sound level (approximately 40dB $L_{Aeq,8h}$) during night-time periods. Additionally, the specific sound level is low and suitable internal sound levels in bedroom and living spaces would still be achieved, even with open windows, when compared to the guidance sound levels stated in BS 8223:2014. Additionally, cooling is less likely to be required during night-time periods and as such would be an infrequent occurrence. In context, the impact of noise from the operation of cooling plant is low.

BS 4142 Assessment – Backup Generator Operation

1.3.3 The results of the BS 4142 assessment of the operation of the proposed GSP substation during the backup generator is required are presented in Table C2. It is assumed that both SGT are operating at 50% load with a backup generator operating.

Table C2 – BS 4142 Assessment – Backup Generator Scenario

Parameter	Value		BS 4142 Clause	Commentary
	Daytime	Night-time		
Background sound level, dB L_{A90}	32	19	8.1	Typical background sound level at nearby NSR based on measured sound level data.
Specific sound level, dB $L_{Aeq,T}$	30	30	7.3	Calculated via sound propagation model based on worst-case plant specification data.
Acoustic feature correction, dB	6	6	9.2	Assumed potential tonal audibility at NSR as worst-case. In practice likely to be less.
Sound rating level, dB $L_{Ar,T}$	36	36	9	Sum of specific sound level and acoustic corrections.
Difference in sound rating level relative to background sound level, dB	+4	+17	11	Potential indication of adverse impact during daytime significant adverse impact during night-time, depending on context. However, in context, the specific sound level is still very at NSR low such that suitable conditions for sleeping can be achieved, even with open windows for ventilation. Additionally, the plant would only operate rarely during outages. In context, the impact of noise from the proposed emergency backup generator is low. **Outcome: Low impact**
Uncertainty			10	Uncertainty has been minimised through the use of long-term sound levels survey data and worst-case plant specification data. In practice impacts would be expected to be lower than reported. The outcome of the assessment is unlikely to be altered by uncertainty.

Notes: BS 4142 Clause refers to the corresponding clause in BS 4142 relating to that aspect of the assessment.

1.3.4 Noise levels from the emergency generator are expected to exceed background sound levels during both daytime and night-time periods at nearby residential NSR. However, the absolute sound level from the emergency back-up generator would be low and would not cause unsuitable internal sound levels in bedroom spaces of nearby residential NSR would still be achieved. Furthermore, the use of the emergency backup generator would be infrequent, particularly at night.

1.3.5 The specific sound level is comparable to the existing typical background sound level during daytime periods and below the existing average ambient sound level during both daytime and night-time periods (approximately 43dB $L_{Aeq,16h}$ and 40dB $L_{Aeq,8h}$, respectively). Additionally, the specific sound level is low and suitable internal sound levels in bedroom and living spaces would still be readily achieved, even with open windows for ventilation, when compared to the guidance sound levels stated in BS 8223:2014. The use of the backup generator during night-time period would also be infrequent and typically only when required during emergency conditions. In context, the impact of noise from the operation of the backup generator is low.

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