Whittles, Whitehaven

Plant noise impact assessment

9724.4

8th May 2025

Revision A

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A	First issue	GV	8th May 25

Prepared for

Norr Consultants Limited
8th Floor, Percy House
Percy Street, Newcastle
NE1 4PW

Prepared by	Checked by
Geoff Venus BSc	Rich Hinton BSc MIOA

Apex Acoustics Limited Reg. in England no. 05656507
Design Works, William Street, Gateshead, NE10 0JP

T 0191 620 0750
E info@apexacoustics.co.uk
W www.apexacoustics.co.uk

Constructionline Gold Member

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1 Contents

2 Summary

2.1 This report has been prepared in support of Planning Application for the installation of mechanical plant at the former Whittles furniture store on Duke Street, Whitehaven.

2.2 All plant is assumed to operate continuously during the daytime 1-hour and night-time 15-minute assessment periods. While normal operation is expected to occur during the daytime only, assessment has been extended to include the night-time period as a precautionary measure. This accounts for the potential activation of frost protection mode during colder conditions, in line with a worst-case assessment approach.

2.3 Statistical analysis identified representative background sound levels ($L_{A90,15min}$) of 58 dB during the daytime and 31 dB during the night-time assessment period, as shown in Table 2. The measured night-time levels are notably low, which may make achieving a rated noise impact not exceeding background sound levels unfeasible. To address this, a night-time rating level of 35 dB(A), consistent with the WHO Night Noise Guidelines, is proposed to minimise adverse impacts while providing a pragmatic approach to compliance.

2.4 Road traffic on A5094 was observed to be the dominant noise source at all NSRs.

2.5 Plant details have been provided by the mechanical engineer. Where manufacturer noise data for specific elements (e.g. HRU intake and exhaust) was not available, sound power levels have been estimated using empirical methods within Caice software, based on the provided manufacturer specifications.

2.6 Noise emission from the proposed plant has been determined and noise propagation calculated modelled with proprietary software CadnaA.

2.7 The potential noise impact is calculated and rated in accordance with BS 4142.

2.8 Based on current proposals, the BS 4142 rated plant noise levels are calculated to be 7 dB above the background sound level during the daytime and 30 dB above during the night-time at the most exposed noise sensitive receptors.

2.9 It is calculated that the current proposals result in a significant adverse impact and do not satisfy the Local Authority requirements, and a scheme for the noise mitigation is required.

2.10 In order to result in a low impact, with rating noise levels not exceeding the background sound levels at the nearest noise sensitive receptors, the following mitigation options are proposed, as detailed in Section 9:

- **Installing a solid barrier with a height of ≥ 2.5 m at rooftop level,** fully enclosing all 3 no. REYQ42U units on all 3 sides, as shown Figure 3;
- Set the **3 no. REYQ42U condenser units to Low noise mode (Level 3)** during night-time operation (between 23:00-07:00hrs), as detailed in Figure 5.

2.11 To be effective in practice, the barrier should have no cracks or gaps, be continuous to the ground at roof level, and have a surface density of at least 10 kg/m^2, such as a timber fence with overlapping boards, solid concrete, or a brick wall.

2.12 BS 4142 notes that when background levels are very low, absolute rating levels may take precedence over the margin by which they exceed the background. This consideration is particularly relevant at night, where naturally reduced, environmental noise can lead to overly stringent requirements.

2.13 The proposed 35 dB noise impact criteria aligns with the WHO Night Noise Guidelines, which identify 40 dB $L_{night,\ outside}$ as the threshold for adverse health effects, offering a conservative 5 dB margin. Based on a 15 dB level difference through a partially open window, the highest internal noise level due to plant noise at night will be 20 dB(A), This is significantly lower than the BS 8233 guideline value of 30 dB $L_{Aeq,8hr}$ for internal noise levels in bedrooms at night.

2.14 Considering the predicted noise impact with the proposed mitigation measures it is calculated that the current proposals achieve the Local Authority requirements.

2.15 Considering the context of the existing acoustic environment, the BS 4142 assessment results indicate the likelihood of a low impact. This impact is considered to be a LOAEL in alignment with the NPSE aims.

4 Introduction

4.1 A renovation of the former Whittles furniture store on Duke Street, Whitehaven, is proposed to convert the building into a digital gaming hub for young people aged 9–14, with a variety of IT-based social and learning spaces. The site location is shown in Figure 1.

4.2 Apex Acoustics has been commissioned to undertake a noise survey and assessment of the noise from mechanical plant associated with the development in support of a Planning Application.

4.3 The scope of our instruction includes:

- Measurement of the existing noise environment over a 24-hour period at a location representative of the nearest noise-sensitive receptors.
- Determine representative background and residual sound levels at the nearest identified noise sensitive receptor based on measurement data.
- Analysis of proposed source noise levels, using manufacturers' data provided by the client.
- Calculate noise propagation using proprietary noise modelling software to the noise-sensitive receptor and assess the impact in accordance with BS 4142: 2014.
- Advise on a scheme for noise mitigation to satisfy Local Authority requirements.

4.4 This report presents the evaluation of the potential noise impact from plant associated with the proposed development on the identified nearest noise-sensitive receptors (NSRs), in support of a Planning Application.

4.5 The NSRs are identified as the residential properties located on all sides of the proposed site, along the A5094 (Duke Street), as shown as NSR 1-4 in Figure 1.

4.6 This assessment is based on the proposed plant details identified by the mechanical engineers.

4.7 The potential noise impact from the sources identified is calculated and rated according to the methodology described in BS 4142, Reference 1.

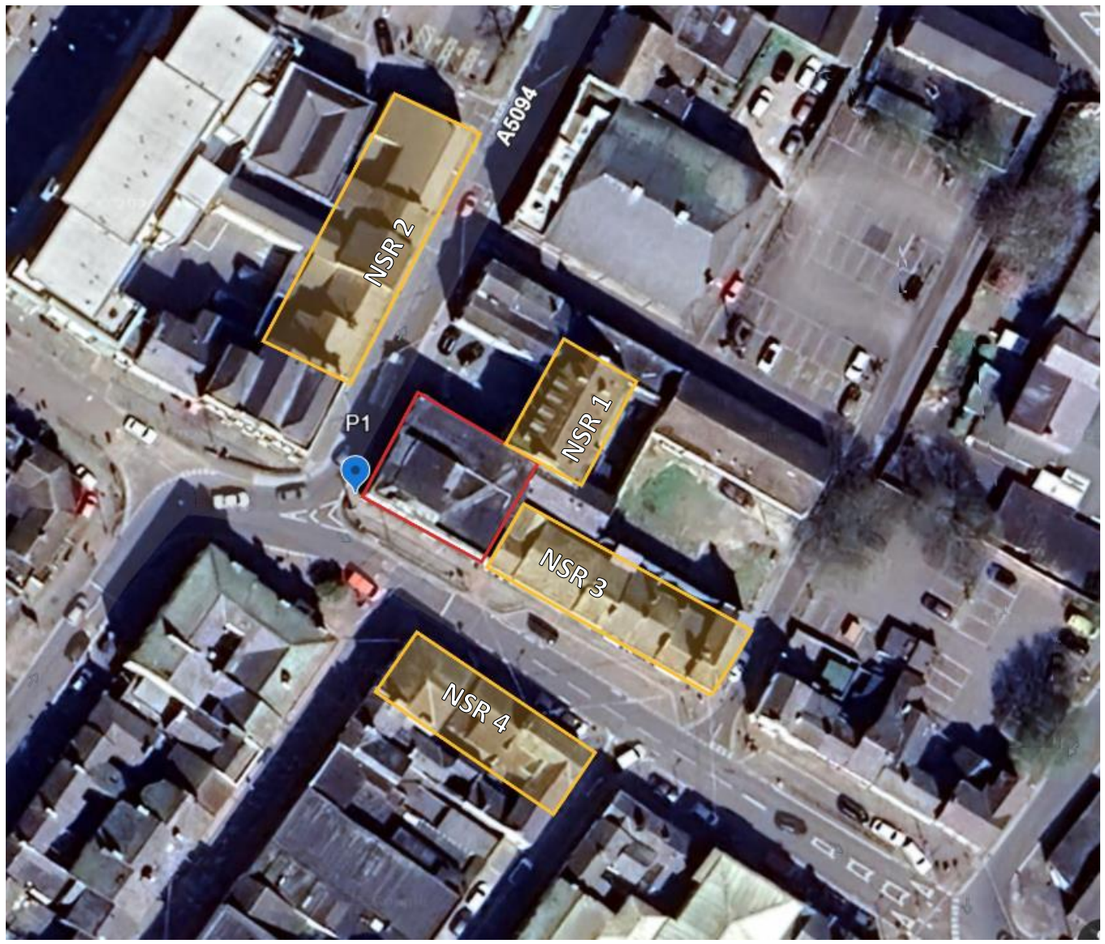


Figure 1: Site boundary (outlined in red), measurement location (P1) and identified NSRs (yellow).

5 Planning policy and noise criteria

5.1 National Planning Policy Framework (NPPF)

5.2 The National Planning Policy Framework (NPPF) Reference 2, sets out the Government's planning policies for England and how these should be applied. It provides a framework within which locally prepared plans for housing and other development can be produced. In respect of noise, Paragraph 187, 198 and 200 of the NPPF states the following:

5.3 Paragraph 187:

"e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability…"

5.4 Paragraph 198:

"Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:

a) mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life[65 [See Explanatory Note to the Noise Policy Statement for England];

b) identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason;

5.5 Paragraph 200:

"Planning policies and decisions should ensure that new development can be integrated effectively with existing businesses and community facilities (such as places of worship, pubs, music venues and sports clubs). Existing businesses and facilities should not have unreasonable restrictions placed on them as a result of development permitted after they were established. Where the operation of an existing business or community facility could have a significant adverse effect on new development (including changes of use) in its vicinity, the applicant (or 'agent of change') should be required to provide suitable mitigation before the development has been completed. "

5.6 Noise Policy Statement for England (NPSE)

5.7 The Noise Policy Statement for England, Reference 4, states three policy aims as follows:

"Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:

- avoid significant adverse impacts on health and quality of life;
- mitigate and minimise adverse impacts on health and quality of life; and
- where possible, contribute to the improvement of health and quality of life."

5.8 The NPSE defines adverse noise impact as follows:

- No Observed Effect Level (NOEL)
  This is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise.
- Lowest Observed Adverse Effect Level (LOAEL)
  This is the level above which adverse effects on health and quality of life can be detected.
- Significant Observed Adverse Effect Level (SOAEL)
  This is the level above which significant adverse effects on health and quality of life occur

5.9 The first two aims of the NPSE require that no significant adverse impact should occur and that, where a noise level which falls between a level which represents the lowest observable adverse effect and a level which represents a significant observed adverse effect, then according to the explanatory notes in the statement:

"… all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life whilst also taking into consideration the guiding principles of sustainable development. This does not mean that such effects cannot occur."

5.10 Planning Practice Guidance – Noise

5.11 Further Government guidance on how planning can manage potential noise impact in new development is outlined in Planning Practice Guidance (PPG-N) notes on the Government website: www.gov.uk/guidance/noise--2

5.12 BS 4142

5.13 BS 4142 defines an assessment method to quantify the potential level for adverse impact from commercial and / or industrial noise sources impacting upon sound sensitive receptors i.e. residential properties.

5.14 The method estimates the impact significance by comparing the Rated noise against the background sound levels, as summarised below:

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

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

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

d) The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound sources having a low impact, depending on the context.

5.15 The terminology used in BS 4142 to describe the various levels of potential adverse impact is respect to the PPG-N noise hierarchy, are summarised Appendix A.

6 Existing acoustic environment

6.1 The existing acoustic environment was measured over a 24-hour period from 14:39 hours on the 8th May 2024.

6.2 The measurement position is shown in Figure 1.

6.3 The microphone was located approx. 2.5 metres above ground level but at the building façade such that the measurements are considered façade incident levels.

6.4 The weather condition were dry and wind speeds were typically below 5 m/s.

6.5 Data was recorded in single-octave band frequencies at one-second intervals throughout the measurement period.

6.6 The most significant noise sources were passing vehicles on Duke St/A5094 and pedestrians passing the measurement position.

6.7 The equipment used is listed in Table 1.

Equipment	Model	Serial no.
Sound Level Meter	NTi XL2	A2A-05832-E0
Calibrator	Larson Davis CAL 200	9462

Table 1: Equipment used

6.8 Both meter and calibrator have current calibration certificates traceable to national standards. The sound level meter has been calibrated within the last two years and calibrator has been calibrated within the last year in accordance with the guidance of BS 4142; calibration certificates are available on request.

6.9 The equipment was field-calibrated before and after the measurements with no significant drift in sensitivity noted.

6.10 **Background sound level**

6.11 Statistical analysis is undertaken of the results of all the $L_{A90,\ 15\ min}$ data following the guidance of BS 4142, to determine a background sound level considered to be representative of the assessment period. Results of the analysis are shown in Figure 8 and Figure 9 in Appendix B.

6.12 Based on the statistical analysis results, the background sound level considered representative of the daytime and night-time assessment periods are shown in Table 2.

Assessment period	Range of residual $L_{Aeq,\ T}$ (dBA)	L_{A90} (dBA)
Daytime (07:00 – 23:00 hrs)	63 - 75	58
Night-time (23:00 – 07:00 hrs)	31 - 53	31

Table 2: Background sound levels representative of the assessment periods

6.13 BS 4142 states:

"Where background sound levels and rating levels are low, absolute levels might be as, or more, relevant than the margin by which the rating level exceeds the background. This is especially true at night."

6.14 It is proposed that the rating level does not exceed $L_{Ar,Tr}$ 35 dB(A) during the night-time, which is 5 dB lower than the WHO Night Noise Guidelines (NNG for Europe), Reference 3, target external noise level of 40 dB $L_{night,outside}$ considered as the threshold above which adverse health effects are observed. This approach will need to be agreed with Local Authority Environmental Health.

6.15 The proposed plant noise limits at the nearest residential noise sensitive receptors when assessed in accordance with BS 4142 assessment methodology are shown in Table 3.

Assessment period	Rated noise impact limit, $L_{Ar,Tr}$ (dB)
Daytime (07:00 – 23:00)	58
Night-time (23:00 - 07:00)	35

Table 3: Proposed noise limits for fixed mechanical plant associated with the development

6.16 To reduce the risk of an adverse impact, rated noise levels no greater than the proposed limits should be attained during all 1-hour periods during the daytime and all 15 minute periods throughout the night-time.

7 Noise sources

7.1 **Proposed plant and associated noise levels**

7.2 The mechanical plant is assessed based on plant details supplied by the client.

7.3 The location of the all the units have been taken from the client's drawings, Reference ???.

7.4 The proposed plant is understood to comprise of that summarised in Table 4.

Plant	Manufacturer	Model	No. proposed
Heat Recovery Unit (HRU)	Daikin	VAM2000J8	3
Condenser (OU)	Daikin	REYQ42U	3

Table 4: Proposed plant

7.5 Noise data for the condenser units (OU) and HRU duct breakout was provided by the mechanical engineer. However, specific noise emission data for the intake and exhaust of the HRU units was not available and has been estimated using empirical methods within Caice software, Reference 6, based on typical manufacturer data for the specified unit. This approach is considered to provide a reasonable, and likely conservative, estimate of the associated noise emissions

7.6 The corresponding noise levels are shown in Table 5.

Plant	Data type	dB(A)	Single-octave band centre frequency (Hz) Linear noise levels (dB)							
			63	125	250	500	1k	2k	4k	8k
OU *	L_w	89	-	-	-	-	-	-	-	-
HRU Intake (estimated)	L_w	63	66	65	66	61	56	51	46	46
HRU Exhaust (estimated)		63	66	65	66	61	56	51	46	46
HRU Duct Breakout		65	81	73	64	63	57	56	51	44

Table 5: Manufacturers noise levels

* *The client has confirmed that the condenser unit noise data (OU) corresponds to the combined operation of all three modules functioning together as one REYQ42U system.*

7.7 The mechanical engineer has confirmed the specification of the in-duct attenuator for the HRUs. However, no specific detail was provided regarding the duct casing construction. A sound reduction performance has therefore been assumed based on typical Fläkt Woods data for a 0.7 mm sheet steel with 50 kg/m³ insulation, Reference 7.

7.8 The insertion losses used in the calculations are shown in Table 6.

Attenuator ref.	Single-octave band centre frequency (Hz) In-duct attenuator insertion losses (dB)							
	63	125	250	500	1k	2k	4k	8k
Circular straight silencer	12	10	20	33	45	41	20	13
Duct Casing	10	10	19	29	31	28	32	33

Table 6: Proposed in-duct insertion loss

7.9 If plant emitting higher noise levels than those accounted for in this report is proposed, or additional plant also proposed, the impact should be reassessed to check compliance with the Planning Condition limits.

7.10 **Operation times**

7.11 All plant is assumed to operate continuously during the daytime 1-hour and night-time 15-minute assessment periods. While normal operation is expected to occur during the daytime only, assessment has been extended to include the night-time period as a precautionary measure. This accounts for the potential activation of frost protection mode during colder conditions, in line with a worst-case assessment approach.

7.12 **Noise transmission and propagation**

7.13 Noise transmission and propagation is modelled to the NSR based on the noise source data detailed, using proprietary software, CadnaA, Reference 8.

7.14 This models noise propagation outdoors according to ISO 9613, Reference 9.

7.15 The model parameters and assumptions are summarised in Appendix C.

8 Assessment results – based on mechanical engineers proposals

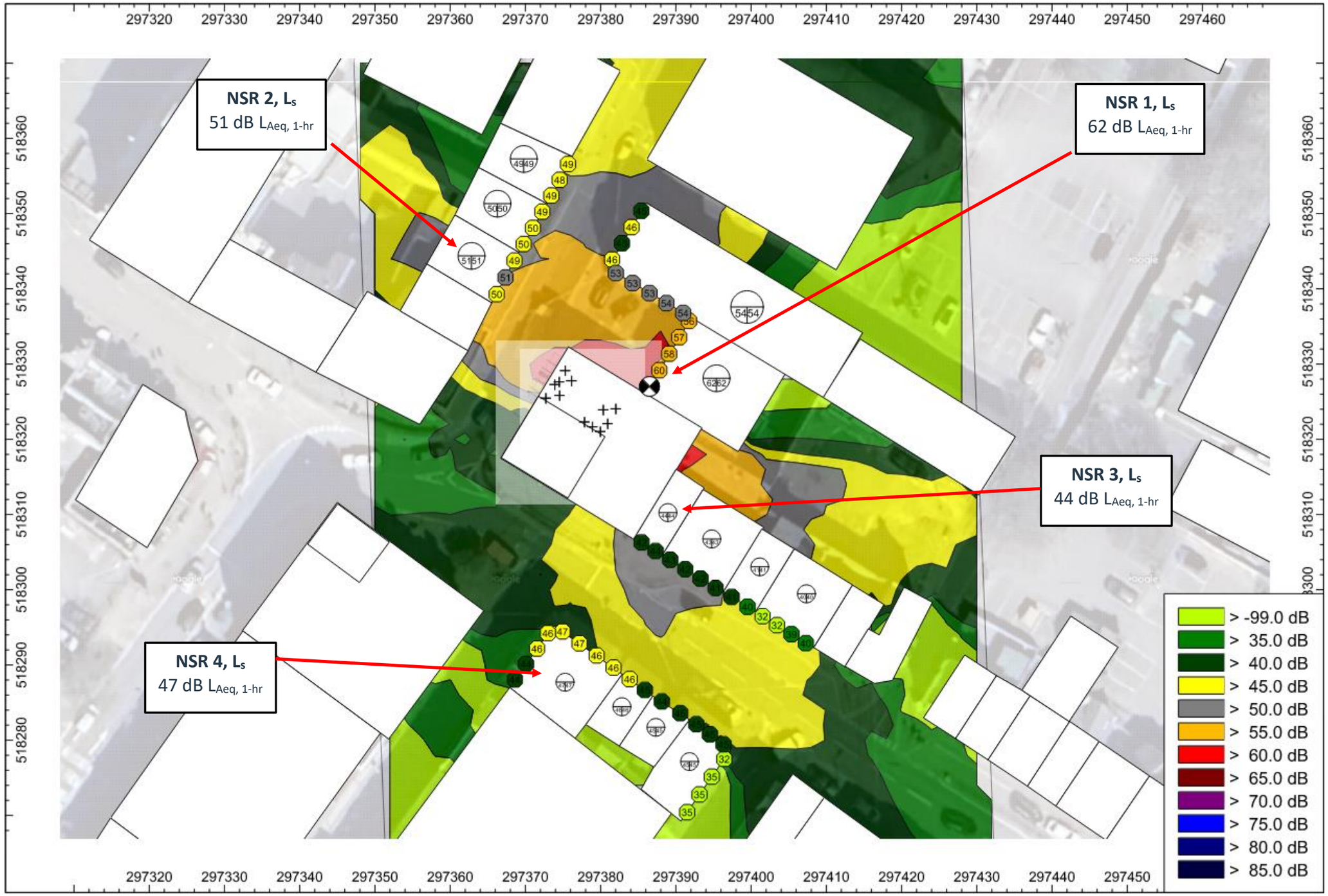


Figure 2: Sound contours at 12 m, showing the calculated specific sound level, $L_{Aeq\ 1\ hr}$ based on current proposals at the worst affected facades

Parameter	Daytime assessment Worst affected NSR (NSR1)	Night-time assessment Worst affected NSR (NSR1)	Relevant clause of BS 4142	Commentary
Measured residual sound level L_r,	63 dB $L_{Aeq, T}$	31 dB $L_{Aeq, T}$	7.3.6	This is lowest measured residual noise level and is used in the assessment as a worst-case scenario. The measured range of residual noise levels is between 63-75 $L_{Aeq, 1 hr}$ during the daytime and 31-53 $L_{Aeq, 15 min}$ during the night-time assessment period.
Background sound level	58 dB $L_{A90, T}$	35 dB $L_{A90, T}$ (proposed rating limit – see para. 6.14)	8.1.2 8.1.4	The background sound levels, determined through statistical analysis of $L_{A90,15min}$ data, as shown in Appendix B, are 58 dB during the daytime and 31 dB at night (Table 2). Due to very low night-time levels, a rating level of 35 dB(A) is proposed, consistent with WHO Night Noise Guidelines, to minimise the risk of adverse impacts.
Specific sound level L_s, due to all sources for the required assessment interval	62 dB $L_{Aeq, 1-hr}$	62 dB $L_{Aeq, 15-min}$	7.2 7.3.6	The predicted L_s contours across the site due to all sources during the assessment period are shown in Figure 2; the L_s assessed is the highest predicted level at the NSRs.
Acoustic feature correction	3 dB	3 dB	9.2	The sound power spectrum for the plant is fairly broadband, and as such a tonality penalty is not considered applicable, however, some of the plant is likely to be intermittent, particularly at night. Impulsivity or other feature corrections are not considered applicable. The following penalties are considered applicable by subjective assessment: Tonality – 0 dB; Impulsivity – 0 dB; Intermittency – 3 dB; Other – 0 dB;
Rating level, $L_{Ar,Tr}$	65 dB	65 dB		
Uncertainty of assessment	-	-	10	Background data was obtained over a 24-hour period, accounting for the changing acoustic environment.
Excess of $L_{Ar,Tr}$ over background sound level	+ 7 dB	+ 30 dB	11	The rated noise level exceeds the background sound level during the daytime and night-time when the plant is proposed to be operational, thereby exceeding Local Authority requirements, and **indicating the likelihood of a significant adverse impact.**

Table 7: BS 4142 assessment results, based on current proposals

9 Noise mitigation measures

9.1 Based on the current plant proposals, the results in Table 7 indicates the likelihood for a significant adverse impact and do not satisfy the requirements of the Local Authority.

9.2 This section details the proposed noise control measures required to mitigate and reduce to a minimum the adverse impacts, to satisfy the Local Authority requirements.

9.3 **Barrier**

9.4 A ≥ 2.5 m high solid barrier is proposed at roof level shown in blue in Figure 3 and Figure 4, fully enclosing all 3 no. REYQ42U condenser units on all 3 sides.

9.5 To be effective in practice, a barrier should have no cracks or gaps, be continuous to the ground, and have a surface density of at least 10 kg/m^2, such as a timber fence with overlapping boards or a brick wall.

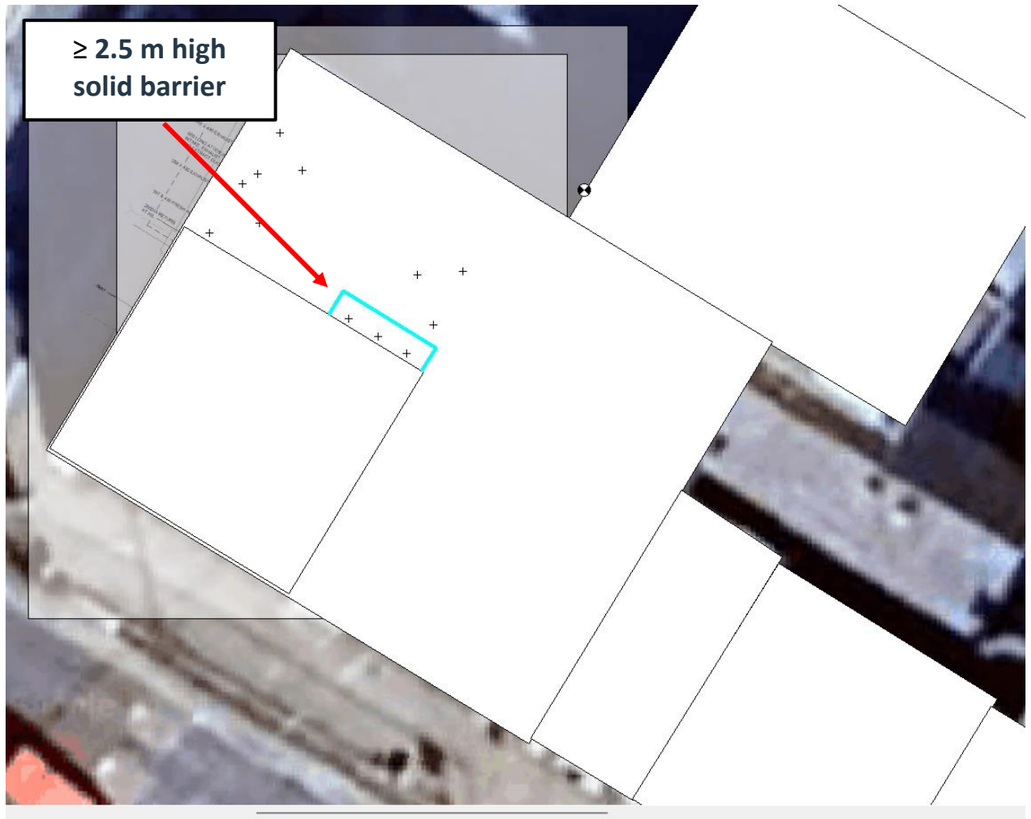


Figure 3: Proposed barrier location shown in blue

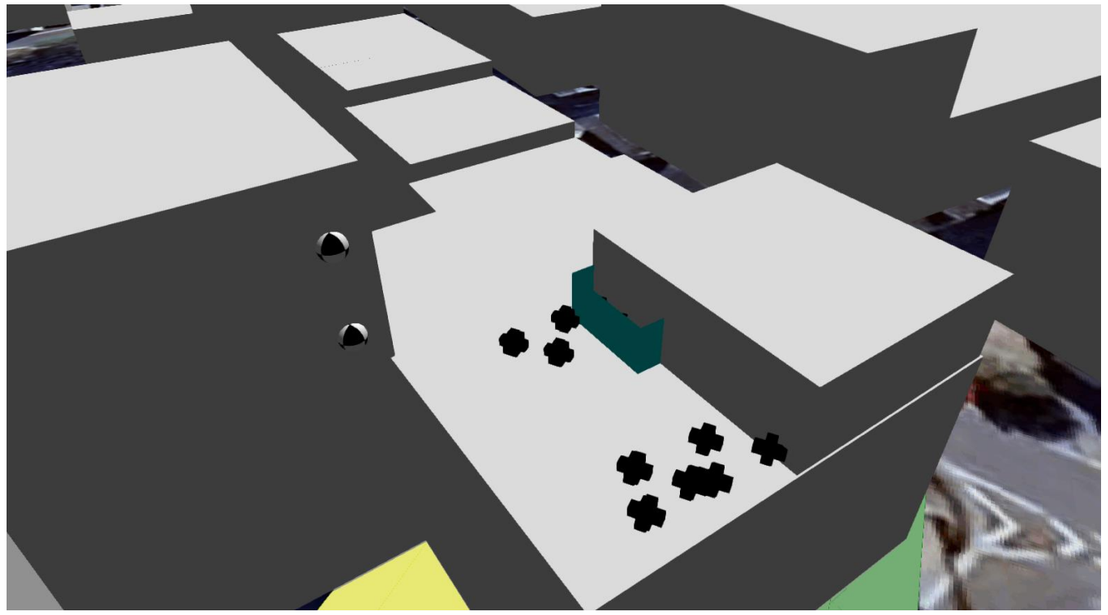


Figure 4: 3D view of the proposed barrier (in blue)

9.6 **Low noise mode operation at night (between 23:00 hrs and 07:00 hrs)**

9.7 Although the 3 no. REYQ42U condenser units are not expected to operate during the night-time period (23:00–07:00 hrs) under normal conditions, it is understood from the mechanical engineer that the system may occasionally activate defrost operations to prevent frost accumulation on the heat exchanger. This could result in intermittent night-time operation. To minimise any potential noise impact during such periods, it is proposed that all condenser modules operate in low noise mode (level 3 only), as shown in Figure 5.

Low noise mode data

			8HP	10HP	12HP	14HP	16HP	18HP	20HP
Standard	sound pressure	dBA	57	57	61	60	63	62	65
	Cooling Capacity/Heating Capacity (Norminal)	kW	22.4	28.0	33.5	40.0	45.0	50.0	56.0
	Heating Capacity (Max)	KW	25.0	31.5	37.5	45.0	50.0	56.0	63.0
Low noise level 1	Sound pressure	dBA	54	54	54	53	53	56	56
	Cooling Capacity	kW	20.6	28.0	29.5	35.2	36.9	45.0	47.6
	ratio	-	92%	100%	88%	88%	82%	90%	85%
	Heating Capacity	kW	21.3	28.4	28.9	34.2	35.0	45.9	47.3
	ratio (VS Max)	-	85%	90%	77%	76%	70%	82%	75%
Low noise level 2	Sound pressure issue value	dBA	52	52	52	48	48	52	52
	Cooling Capacity	kW	20.2	23.5	25.1	30.0	31.5	35.0	36.4
	ratio	-	90%	84%	75%	75%	70%	70%	65%
	Heating Capacity	kW	21.3	22.7	23.6	27.9	28.5	33.6	34.7
	ratio (VS Max)	-	85%	72%	63%	62%	57%	60%	55%
Low noise level 3	Sound pressure	dBA	50	50	50	46	46	45	45
	Cooling Capacity	kW	15.7	21.6	23.5	24.0	24.8	27.5	28.0
	ratio	-	70%	77%	70%	60%	55%	55%	50%
	Heating Capacity	kW	16.3	20.5	21.4	21.6	22.0	24.6	25.2
	ratio (VS Max)	-	65%	65%	57%	48%	44%	44%	40%

Figure 5: Low noise mode data used in the night time assessment

10 Assessment results – with proposed noise control measures

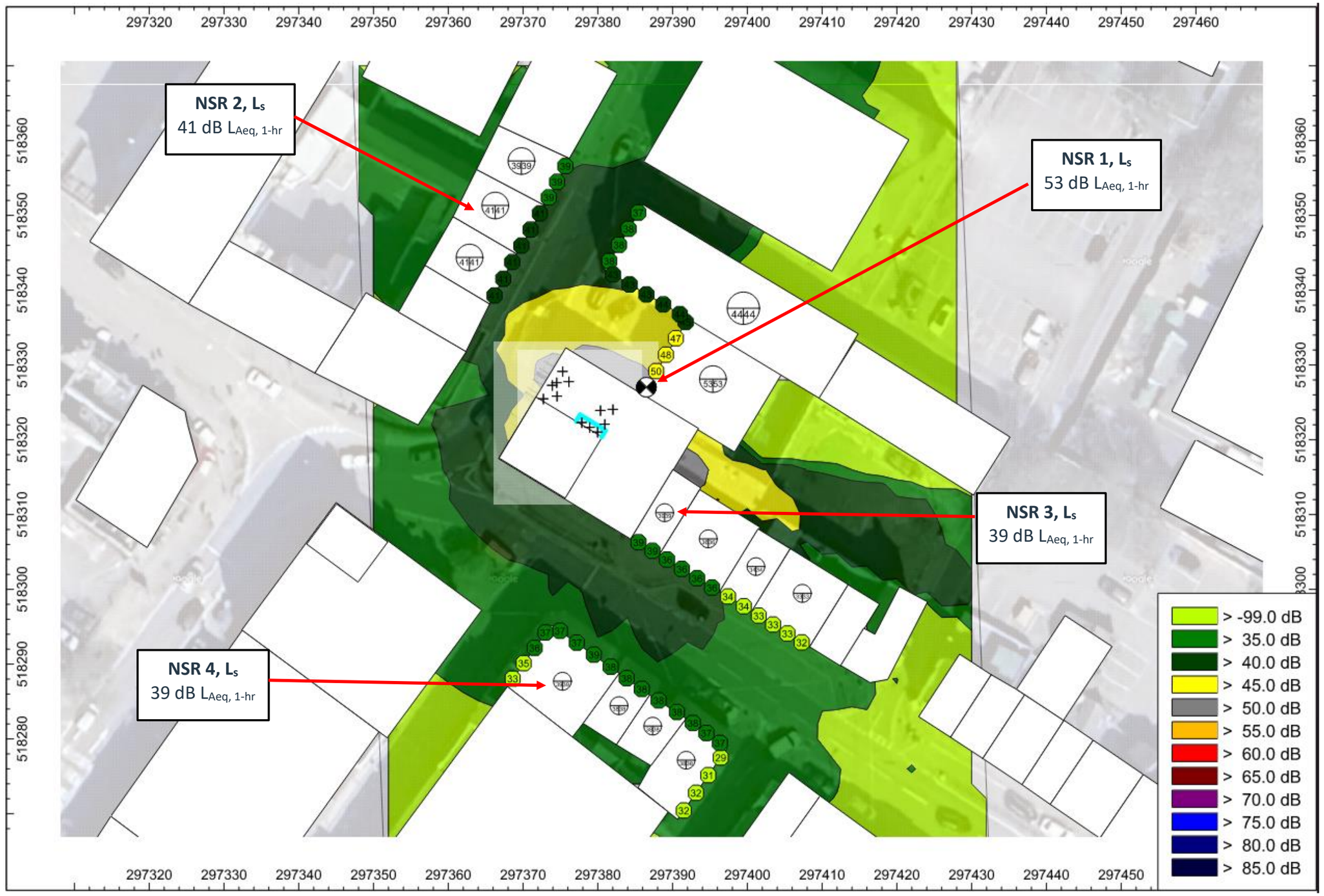


Figure 6: Daytime sound contours at 15 m, showing the calculated specific sound level, $L_{Aeq\ 1\ hr}$ based on proposed mitigation measures at the worst affected facades

Figure 7: Night-time sound contours at 15 m, showing the calculated specific sound level, $L_{Aeq\ 15\ min}$ based on proposed mitigation measures at the worst affected facades

Parameter	Daytime assessment Worst affected NSR (NSR1)	Night-time assessment Worst affected NSR (NSR1)	Relevant clause of BS 4142	Commentary
Measured residual sound level L_r,	63 dB $L_{Aeq, T}$	31 dB $L_{Aeq, T}$	7.3.6	This is lowest measured residual noise level and is used in the assessment as a worst-case scenario. The measured range of residual noise levels is between 63-75 $L_{Aeq, 1 hr}$ during the daytime and 31-53 $L_{Aeq, 15 min}$ during the night-time assessment period.
Background sound level	58 dB $L_{A90, T}$	35 dB $L_{A90, T}$ (proposed rating limit – see para. 6.14)	8.1.2 8.1.4	The background sound levels, determined through statistical analysis of $L_{A90,15min}$ data, as shown in Appendix B, are 58 dB during the daytime and 31 dB at night (Table 2). Due to very low night-time levels, a rating level of 35 dB(A) is proposed, consistent with WHO Night Noise Guidelines, to minimise the risk of adverse impacts.
Specific sound level L_s, due to all sources for the required assessment interval	53 dB $L_{Aeq, 1-hr}$	32 dB $L_{Aeq, 15-min}$	7.2 7.3.6	The predicted L_s contours across the site due to all sources during the assessment period are shown in Figure 2; the L_s assessed is the highest predicted level at the NSRs.
Acoustic feature correction	3 dB	3 dB	9.2	The sound power spectrum for the plant is fairly broadband, and as such a tonality penalty is not considered applicable, however, some of the plant is likely to be intermittent, particularly at night. Impulsivity or other feature corrections are not considered applicable. The following penalties are considered applicable by subjective assessment: Tonality – 0 dB; Impulsivity – 0 dB; Intermittency – 3 dB; Other – 0 dB;
Rating level, $L_{Ar,Tr}$	56 dB	35 dB		
Uncertainty of assessment	-	-	10	Background data was obtained over a 24-hour period, accounting for the changing acoustic environment.
Excess of $L_{Ar,Tr}$ over background sound level	- 2 dB	0 dB	11	The rated noise level does not exceed the representative background level during the daytime and night-time at the NSRs. Based on a 15 dB level difference through a partially open window, the highest internal noise level due to plant noise at night will be 20 dB(A), This is significantly lower than the BS 8233 guideline value of 30 dB $L_{Aeq,8hr}$ for internal noise levels in bedrooms at night. BS 4142 highlights that when background levels are very low, absolute rating levels may be more relevant than the margin by which they exceed the background. This is particularly applicable at night, where natural reductions in environmental noise can lead to disproportionately stringent requirements. The proposed 35 dB aligns with the WHO Night Noise Guidelines, which identify 40 dB $L_{night,outside}$ as the threshold for adverse health effects, providing a conservative 5 dB margin. With the calculated rating level at the worst-affected receptor being 4 dB greater than the representative background sound level, the assessment is 1 dB below the point at which BS 4142 indicates the likelihood of an adverse impact. This supports the conclusion of a low impact, consistent with BS 4142 guidance on minimising adverse effects. Considering the context of the existing acoustic environment the **assessment result indicates the likelihood of a low impact** once mitigation measures have been implemented.

Table 8: BS 4142 assessment results, with proposed mitigation measures

11 Conclusion

11.1 Based on the current development proposals it is calculated that the aims of the NPPF and NPSE have not been met.

11.2 Noise control measures are required to minimise the potential for adverse impacts, to satisfy the aims of the NPPF.

11.3 Based on the mitigation measures detailed in Section 9, the calculated BS 4142 rating level at the NSRs is 2 dB below the representative background levels during the daytime and does not exceed the proposed rating level limit during night-time assessment period, and therefore complies with the aims of the NPPF and NPSE.

11.4 Considering the context of the existing acoustic environment the assessment result indicates the likelihood of a low impact, on the basis of implementing the proposed noise control measures. This impact is considered to be a LOAEL in alignment with the NPPF and NPSE aims.

12 References

1 BS 4142 2014: A1+2019, Method for rating and assessing industrial and commercial sound.

2 National Planning Policy Framework, Ministry of Housing, Communities & Local Government, December 2024.

3 WHO Night Noise Guidelines for Europe, World Health Organization, 2009.

4 Noise Policy Statement for England, Department for Environment, Food and Rural Affairs, March 2010.

5 Plant location drawings: Condensers.png, HRUs.png

6 Caice Acoustic Software, version 2024, Caice Acoustic Air Movement, UK.

7 Fläkt Woods, Practical guide to noise control, Fifth Edition, published by Fläkt Woods Limited

8 CadnaA environmental noise modelling software, version 2024, Datakustik GmbH.

9 ISO 9613: Acoustics - Attenuation of sound during propagation outdoors.

10 Architects' drawings: DGHW-NOR-XX-ZZ-DR-A-00111_P01 PROPOSED GA ELEVATIONS, DGHW-NOR-XX-ZZ-DR-A-00023_P01 PROPOSED FLOOR AND ROOF PLANS

11 ISO 12913-1:2014 Acoustics, Soundscape, Part 1: Definition and conceptual framework

Appendix A Noise exposure hierarchy

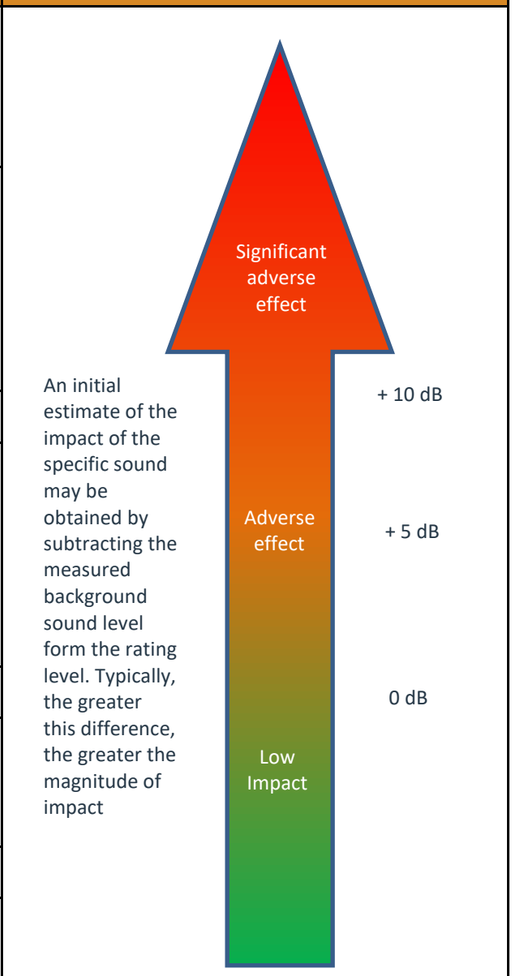
Planning Practice Guidance - Noise				BS 4142: Initial estimate of external noise risk significance
Noise	***Example of outcomes***	***Increasing effect level***	***Action***	
Present and very distributive	Extensive and regular changes in behaviour, attitude or other physiological response and/or an inability to mitigate effect of noise leading to psychological stress, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory	Unacceptable Adverse Effect	**Prevent**	
Present and distributive	The noise causes a material change in behaviour, attitude or other physiological response, e.g. avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area.	Significant Observed Adverse Effect	**Avoid**	
Significant Observed Adverse Effect Level (SOAEL)				
Present and intrusive	Noise can be heard and causes small changes in behaviour, attitude or other physiological response, e.g. turning up volume of television; speaking more loudly; where there is no alternative ventilation, having to close windows for some of the time because of the noise. Potential for some reported sleep disturbance. Affects the acoustic character of the area such that there is a small actual or perceived change in the quality of life.	Observed Adverse Effect	**Mitigate and reduce to a minimum**	
Lowest Observed Adverse Effect Level (LOAEL)				
Present and not intrusive	Noise can be heard, but does not cause any change in behaviour, attitude or other physiological response. Can slightly affect the acoustic character of the area but not such that there is a change in the quality of life.	No Observed Adverse Effect	**No specific measures required**	
No Observed Adverse Effect Level (NOAEL)				
Not present	No effect	No Observed Effect	**No specific measures required**	
No Observed Effect Level (NOEL)				

Table 9: PPG-N Noise Exposure Hierarchy and BS 4142 initial estimate of impact

Appendix B Residual and background sound levels

B.1 Analysis to determine the typical background sound level representative of the daytime and night-time period is undertaken following the guidance of BS 4142, with results shown in Figure 8 and Figure 9 respectively.

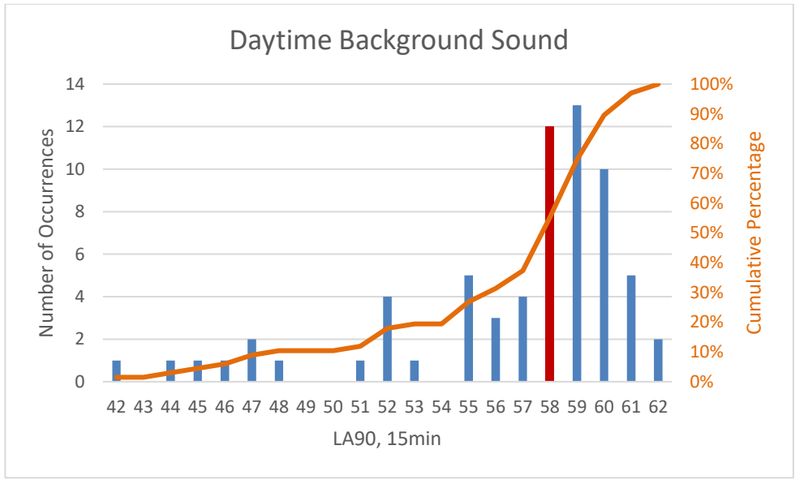


Figure 8: Analysis of daytime background levels, $L_{A90,\ 1hr}$

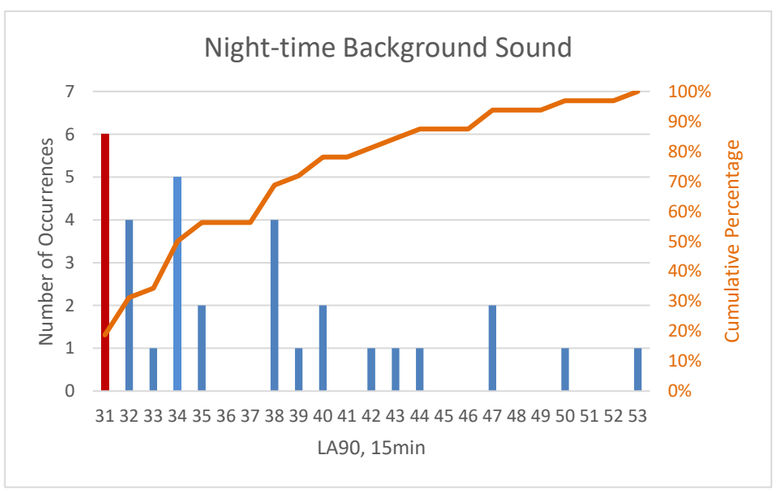


Figure 9: Analysis of night-time background levels, $L_{A90,\ 15min}$

Appendix C Noise transmission and propagation

C.1 Noise transmission and propagation is modelled using proprietary software, CadnaA. This models noise propagation outdoors according to ISO 9613. The parameters used, source of data and details are described in Table 10.

Parameter	Source	Details
Model dimensions	Google Earth	British Transverse Mercator coordinates
Site location and layout	Architects' drawings	Architects' drawings, Reference 10
Topography –within site	Site observations and Google Street view	Modelled with no changes in topography
Topography –Outside of site	Site observations and Google Street view	Modelled with no changes in topography
Building heights – proposed buildings	Drawings	Architects' drawings
Building heights – outside of site	Site observations and Google Street view	3 m per storey + 3 m roof (residential properties)
Receptor positions	Site observations and Google Street view	On the NSR façade closest to the source at a height of 12 m and 15 m to represent the second and third floor of the hotel. On the façades of the other NSRs at 4 m and 6.5 m to represent first and second floor window heights of the flats.
Building and barrier absorption coefficient	ISO 9613-2	0.21 to represent a reflection loss of 1 dB
G, Ground factor	ISO 9613-2	Hard ground, G = 0; Porous ground, G = 1 (locally on model)
Max. order of reflections	Apex Acoustics	Three

Table 10: Modelling parameters and assumptions

C.2 A plan view and a 3D perspective of the CadnaA model are shown in Figure 10 and Figure 11 respectively.

C.3 NSR receivers are positioned as shown by the black and white circles in Figure 10.

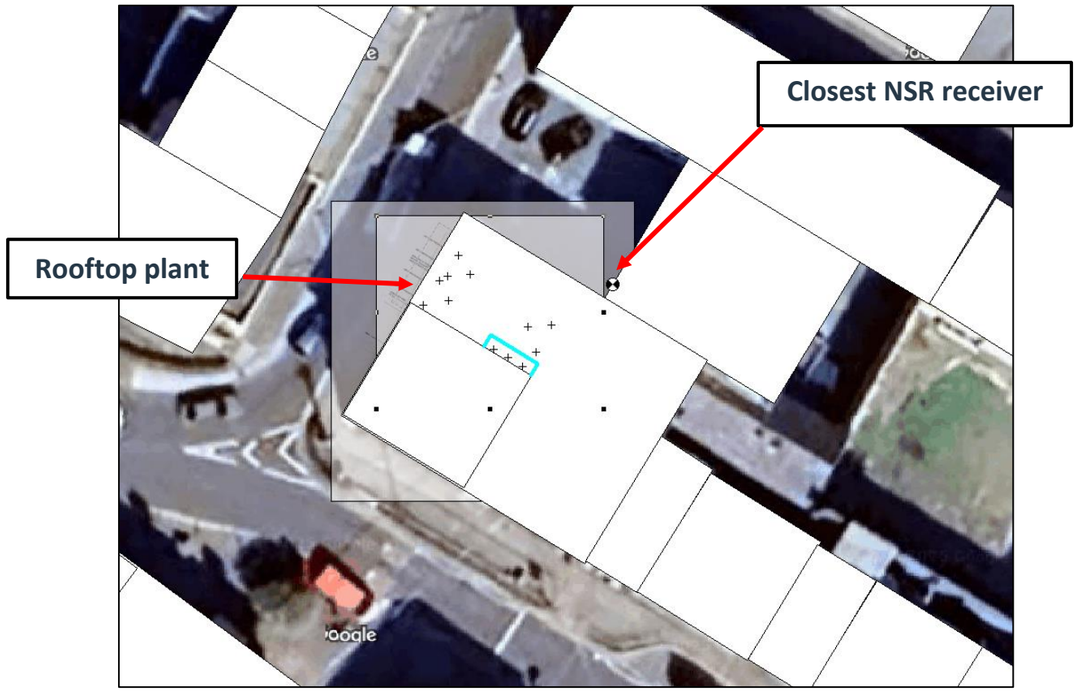


Figure 10: Plan view of the CadnaA model

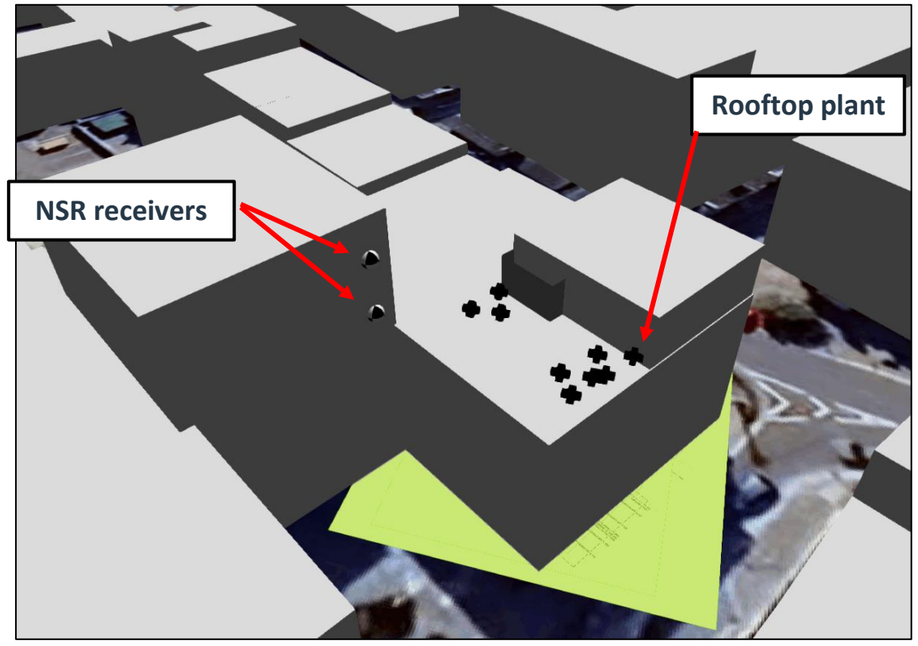


Figure 11: 3D view of the CadnaA model

Appendix D Context of acoustic environment

D.1 The context can be expressed in relation with the soundscape, as defined in BS ISO 12913-1, Reference 11.

D.2 ISO 12913-1 states that:

D.3 "The context may influence soundscape through the auditory sensation, the interpretation of auditory sensation and the responses to the acoustic environment."

D.4 The process of experiences that describe soundscape and illustrated in Figure 12.

D.5 The acoustic environment is defined as being:

D.6 "… the sound from all sound sources modified by the environment. Modification by the environment includes effects on sound propagation, resulting for example from meteorological conditions, absorption, diffraction, reverberation and reflection."

D.7 The auditory sensation is described as:

D.8 "… a function of neurological processes that begin when auditory stimuli reach the receptors of the ear. This is the first stage in detecting and representing the acoustic environment. Auditory sensation is influenced by masking, spectral contents, temporal patterns and spatial distribution of the sound sources."

D.9 The interpretation of auditory sensation refers to

D.10 "… unconscious and conscious processing of the auditory signal to create useful information, which may lead to awareness or understanding of the acoustic environment. Awareness of the acoustic environment, in context, represents an experience of the acoustic environment."

D.11 Responses describe the short-term reactions and emotions while the outcomes refer to the overall, long-term consequences facilitated or enabled by the acoustic environment.

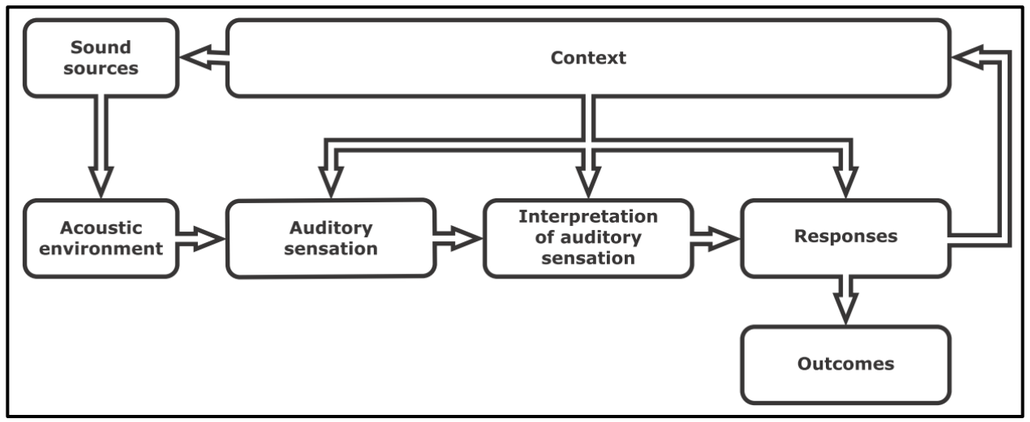


Figure 12: Elements in the perceptual construct of soundscape

D.12 The Planning Practice Guidance notes on noise state that the impact is categorised as SOAEL when "noticeable and disruptive". It details:

D.13 "The noise causes a material change in behaviour and/or attitude, e.g. avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise."

D.14 Such effect is typically defined as a difference between the BS 4142 rating level and the background level of +10 dB, depending on the context, and should be avoided on a regular basis.

Appendix E Professional qualifications and competence

E.1 All Apex Acoustics consultants work under the close supervision of a member who holds qualification in acoustics and is a member of the IOA.

E.2 This can be verified by searching the Institute of Acoustics' list of Members, available here, with the surname of the consultant.

http://www.ioa.org.uk/membership-check

E.3 Apex Acoustics is a member of the Association of Noise Consultants (ANC). The ANC is a trade organisation which seeks to raise the standards of acoustic consultancy and as such there are barriers to entry to ensure member's competency.

E.4 This report has been checked by an appropriately qualified and experienced acoustic consultant.