

Apex Plaza
Forbury Road
Reading
RG1 1AX

Plant Noise Impact Assessment
“End of Journey” Provision

On behalf of

Charles D. Smith & Associates Ltd

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1.0 Introduction

- 1.1. Noise Solutions Ltd (NSL) has been commissioned to provide a noise impact assessment of noise emissions from plant serving the “end of journey” provision at Apex Plaza, Reading.
- 1.2. An environmental sound survey has previously been undertaken to establish the prevailing background sound pressure levels at a location representative of the sound levels outside the nearest noise sensitive receptors to the site.
- 1.3. Plant noise levels, including attenuation, have been predicted at the nearest noise-sensitive windows and assessed against the local authority’s usual requirements and other recognised standards and guidance.
- 1.4. To assist with the understanding of this report a glossary of acoustic terms can be found in [Appendix A](#). An in-depth glossary of acoustic terms can be viewed online at www.acoustic-glossary.co.uk.

2.0 Details of development proposals

- 2.1. Showers, changing and a multi-functions space are proposed on the ground floor of Apex Plaza, to provide “end of journey” facilities to staff within the offices above.
- 2.2. Internal air handling plant above the showers will be ducted to intake and discharge louvres in the south elevation of the building. Plant is to comprise two air handling units.
- 2.3. The plant will operate only during the daytime, and not overnight.
- 2.4. Aerial views of the site and surrounding area and the noise monitoring location used in this assessment are presented in [Appendix B](#). The location of the facility, its internal arrangement and the ventilation plant and duct runs, are shown in [Appendix D](#).

3.0 Nearest noise-sensitive receptors

- 3.1. Apex Plaza is in a predominantly commercial area, to the east of Reading railway station and immediately to the south of the railway lines.
- 3.2. The closest windows to the louvres are on the first floor of Apex Plaza itself (Receptor R1).
- 3.3. The nearest windows of neighbouring buildings are to the south (Receptor R2), approximately 20m from the louvres.

- 3.4. The nearest residential property to the proposed plant is the staff accommodation above the Blagrove Arms public house on Blagrove Street (Receptor R3), approximately 55m to the southwest of the closest louvers.
- 3.5. The above are indicated in [Appendix B](#).

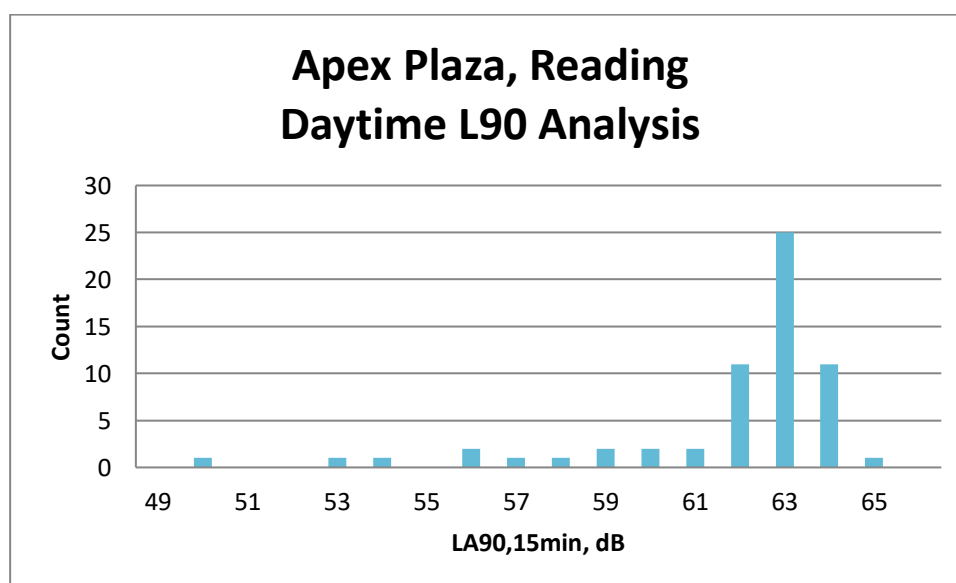
4.0 Existing noise climate

- 4.1. An environmental noise survey was undertaken to establish the typical background sound levels at a location representative of the noise climate outside the façades of the nearest noise sensitive receptors to the proposed plant area during the quietest times at which the plant will operate.
- 4.2. The results of the environmental sound survey are summarised in Table 1 below. The full set of measurement results and details of the survey methodology are presented in [Appendix C](#).

Table 1 Summary of survey results

Measurement period	Range of recorded sound pressure levels (dB)			
	L _{Aeq} (15mins)	L _{Amax} (15mins)	L _{A10} (15mins)	L _{A90} (15mins)
Daytime (07.00 – 23.00 hours)	64-74	75-98	67-73	50-65
Night-time (23.00 – 07.00 hours)	53-70	67-89	57-72	41-63

Figure 1 Histogram of daytime L_{A90} background sound pressure levels



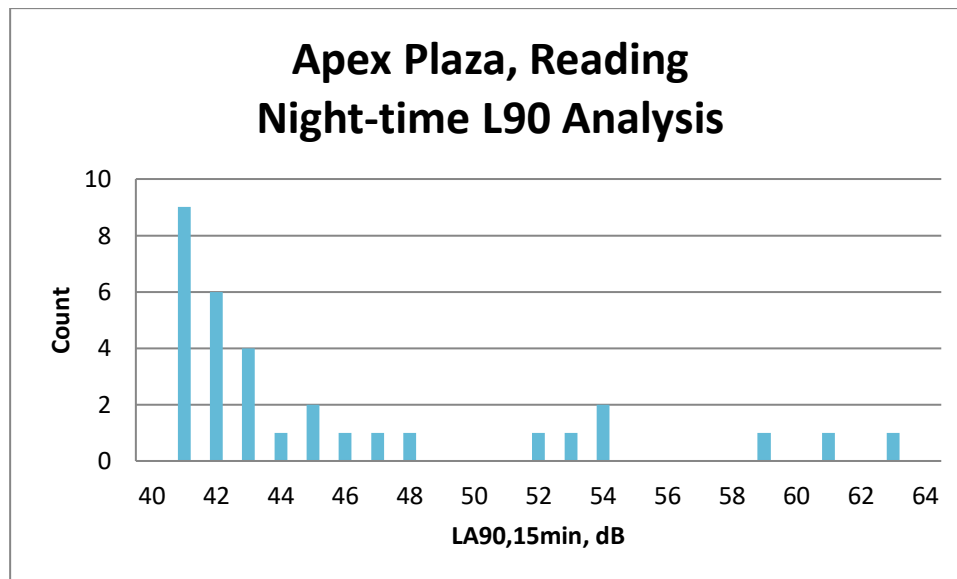
- 4.3. Further statistical analysis has been carried out on the data, and the mean and median values are shown in Table 2 below.

Table 2 Statistical analysis of $L_{A90,15min}$ levels during the daytime period

dB, L_{A90} daytime period	
mean	62
modal	63
median	63

- 4.4. From the histogram analysis, 56dB has been selected to be a robust representation of the background noise level during the daytime period.

Figure 2 Histogram of night-time L_{A90} background sound pressure levels



- 4.5. Further statistical analysis has been carried out on the data and the mean and median values are shown in Table 3 below.

Table 3 Statistical analysis of $L_{A90,15min}$ levels during the night-time period

dB, L_{A90} night-time period	
mean	46
modal	41
median	43

- 4.6. Again, from the histogram analysis, 41dB has been selected to be a robust representation of the background sound level during the night-time period.
- 4.7. Therefore, the following values are considered representative of the existing background sound pressure levels at nearby noise sensitive premises:
- 56dB L_{A90} during the daytime period; and
 - 41dB L_{A90} during the night-time period.

Covid-19

- 4.8. It should be noted that the environmental noise survey discussed in this report was undertaken in April 2021, at a time when the coronavirus pandemic was causing a disruption to typical working patterns and other activity. It is therefore likely that recorded sound levels are slightly lower than would otherwise be expected where dominated by road or air traffic. It is therefore likely to understate the more-usual background sound levels and therefore result in a robust assessment.

5.0 Plant noise design criteria

Reading Borough Council

- 5.1. For similar plant installations, including for other plant installed at Apex Plaza, Reading Borough Council usually seeks to impose the following Condition:

The rating level of the plant/equipment hereby approved, $L_{Ar,Tr}$ (specific sound level plus any adjustment for the characteristic features of the sound) as measured at a point 1 metre external to sensitive facades, shall be at least 10dB below the existing background sound level, $L_{A90,T}$ when all plant/equipment (or any part of it) is in operation.

- 5.2. Please note that in this context, the offices within Apex Plaza, and the nearby commercial premises, would not be considered “sensitive”, and alternative acoustic criteria would be appropriate.

BS 4142:2014 Methods for Rating and Measuring Industrial and Commercial Sound’

- 5.3. British Standard (BS) 4142:2014 describes a method for rating and assessing sound of an industrial or commercial nature, which includes sound from fixed installations which comprise mechanical and electrical plant and equipment.
- 5.4. The industrial or commercial sound is assessed outside a dwelling or premises used for residential purposes, upon which sound is incident.
- 5.5. The procedure contained in BS 4142 is to quantify the “specific sound level”, which is the measured or predicted level of sound from the source in question over a one-hour period for the daytime and a 15-minute period for the night-time. Daytime is defined in the standard as 07:00 to 23:00 hours, and night-time as 23:00 to 07:00 hours.
- 5.6. The specific sound level is converted to a rating level by adding penalties on a sliding scale to account for either potentially tonal or impulsive elements. The standard sets out objective

methods for determining the presence of tones or impulsive elements, but notes that it is acceptable to subjectively determine these effects.

- 5.7. The penalty for tonal elements is between 0dB and 6dB, and the standard notes: “Subjectively, this can be converted to a penalty of 2 dB for a tone which is just perceptible at the noise receptor, 4 dB where it is clearly perceptible, and 6 dB where it is highly perceptible.”
- 5.8. The penalty for impulsive elements is between 0dB and 9dB, and the standard notes: “Subjectively, this can be converted to a penalty of 3 dB for impulsivity which is just perceptible at the noise receptor, 6 dB where it is clearly perceptible, and 9 dB where it is highly perceptible.”
- 5.9. The background sound level should be established in terms of the L_{A90} noise index. The standard states that the background sound level should be measured over a period of sufficient length to obtain a representative value. This should not normally be less than 15-minute intervals. The standard states that: *“A representative level ought to account for the range of background sound levels and ought not automatically to be assumed to be either the minimum or modal value.”*
- 5.10. The assessment outcome results from a comparison of the rating level with the background sound level. The standard states:

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

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

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

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

Adverse impacts include, but are not limited to, annoyance and sleep disturbance. Not all adverse impacts will lead to complaints and not every complaint is proof of an adverse impact.”

- 5.11. The standard goes on to note that: “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.”

- 5.12. In addition to the margin by which the Rating Level of the specific sound source exceeds the Background Sound Level, the 2014 edition places emphasis upon an appreciation of the context, as follows:

“An effective assessment cannot be conducted without an understanding of the reason(s) for the assessment and the context in which the sound occurs/will occur. When making assessments and arriving at decisions, therefore, it is essential to place the sound in context.”

- 5.13. BS 4142 requires uncertainties in the assessment to be considered, and where the uncertainty is likely to affect the outcome of the assessment, steps should be taken to reduce the uncertainty.

Noise to commercial premises

- 5.14. Offices and similar commercial premises are not as sensitive to noise as residential properties and, therefore, emissions criteria are generally relaxed at these locations.
- 5.15. However, it is considered appropriate to control plant noise levels within offices to meet the recommended internal noise levels provided in BS 8233:2014 ‘Guidance on sound insulation and noise reduction for buildings’. The standard states a range of noise levels for various spaces used for ‘study and work requiring concentration’ between 35 and 50 dB L_{Aeq} .
- 5.16. In addition, BS 8233 provides general guidance on the expected sound insulation performance of a given building façade, with details of how various elements can affect the overall performance. Concerning windows, it states that:

“If partially open windows were relied upon for background ventilation, the insulation would be reduced to approximately 15 dB.”

- 5.17. This implies that should windows on a noise affected façade be openable, a sound insulation value of 15 dB should be applied to the whole façade to an internal room being assessed. It should be noted that a sound insulation performance of much greater than 15 dB is expected for non-openable standard double-glazed windows. However, in order to assess the worst-case scenario, this report assumes that windows may be opened if desired.
- 5.18. Based on the above and assuming a worst-case internal criterion of 35dB L_{Aeq} , it is recommended that cumulative plant noise levels at the façade of the nearest office premises should not exceed 50dB L_{Aeq} .

Summary of criteria

- 5.19. From the local authority’s usual requirements and the above recommendations, the proposed plant limits are therefore as shown in Table 4.

Table 4 Proposed plant noise emissions level limits at nearest receptors

Period	Plant rating level	Plant specific sound level
	Residential dB L _{Ar,Tr}	Offices dB L _{Aeq}
Daytime (07.00 – 23.00 hours)	46	50
Night-time (23.00 – 07.00 hours)	31	50

- 5.20. Since the louvres are close to the public areas it is proposed to also control plant louvre noise to no higher than 45dBA at 5m from the louvres.

6.0 Plant noise impact assessment

- 6.1. The cumulative plant noise levels at the nearest noise sensitive receptors have been predicted. The assessment has considered attenuation, directivity, any screening between source and receivers and distance attenuation. The predictions have been based on the proposed plant all operating at full capacity during any part of the daytime.
- 6.2. Predictions are inclusive of the following atmospheric-side attenuators as shown in the tables below:

Table 5 Proposed atmosphere-side attenuators to ventilation systems

Attenuator	Insertion losses dB, at octave band centre frequencies (Hz)							
	63	125	250	500	1k	2k	4k	8k
Intake (each AHU)	4	5	8	15	21	20	17	14
Exhaust (each AHU)	4	5	8	15	21	20	17	14

For the residential receptor, R3, a feature correction of 3dB as described in BS 4142:2014 has been applied for the possible presence of “...characteristics that are neither tonal nor impulsive, though otherwise are readily distinctive against the residual acoustic environment...”.

- 6.2. Table 6 summarises the results of the assessment at the receptors identified previously. All other nearby receptors benefit from increased distance/screening to the plant. The full set of calculations can be found in [Error! Reference source not found.](#)

Table 6 Plant noise assessment

Receptor	Period		Plant noise level dB	Proposed criterion, dB	Excess, dB
R1 (Offices)	Daytime	Specific sound level	42	50	-8
R2 (Offices)	Daytime	Specific sound level	33	50	-17
R3 (Residential)	Daytime	Rating level	26	46	-20

- 6.3. The assessment shows that noise from the proposed plant will comply with criteria proposed in Table 4 and should therefore be acceptable to the local authority.
- 6.4. The sound pressure level at 5m from any louvre (Receptor R4) would not exceed 45dBA.

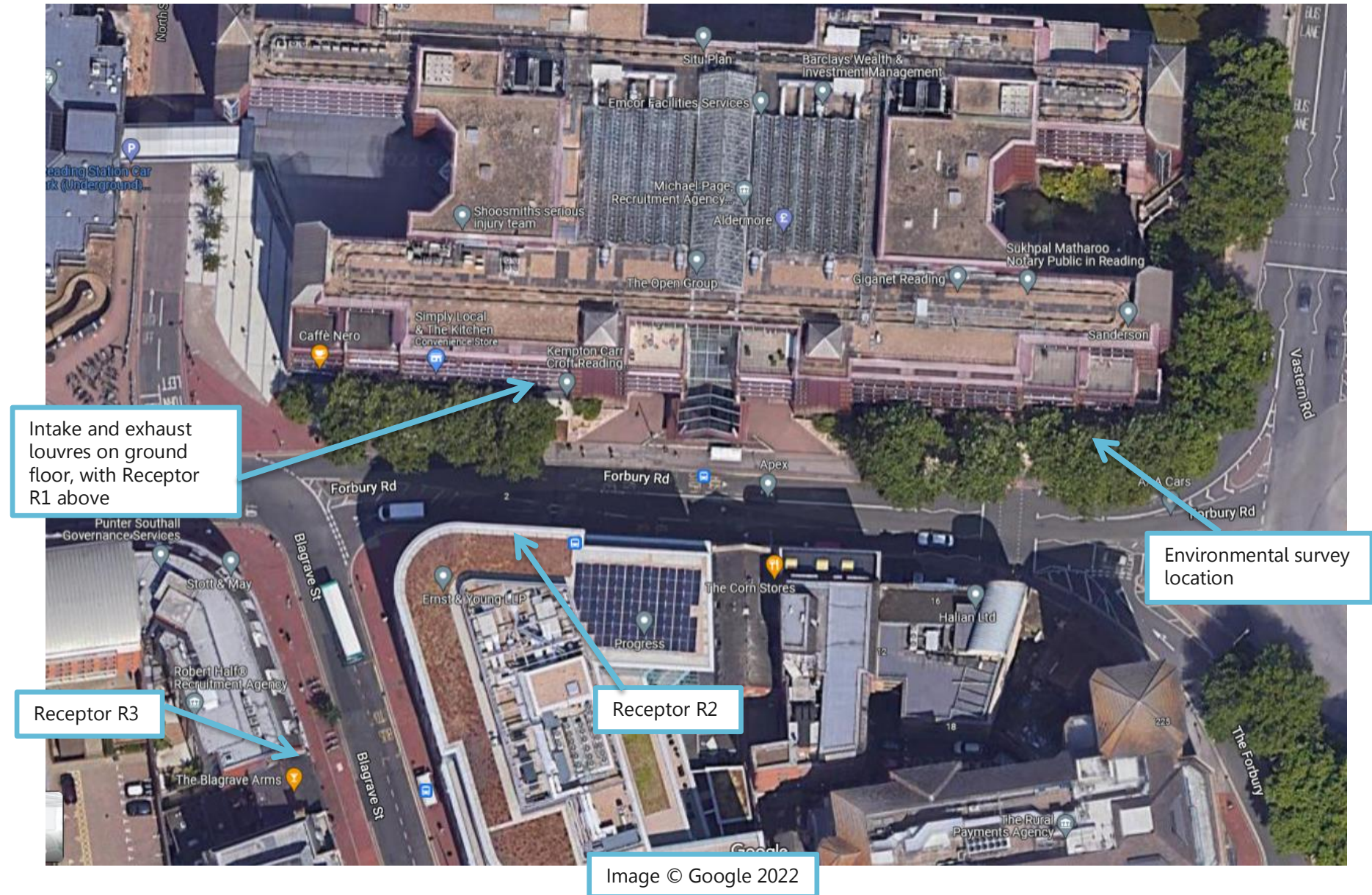
7.0 Summary

- 7.1. Noise Solutions Ltd has been commissioned to provide guidance on permissible noise emissions from louvres serving plant at the “end of journey” showers and amenities provision at Apex Plaza, Reading.
- 7.2. An environmental noise survey has been previously undertaken to establish the existing prevailing noise levels at a location representative of the noise climate outside the nearest noise sensitive receptors to the proposed site, and is used to inform the assessment.
- 7.3. When attenuated as described in this report, noise from the proposed AHUs will comply with the local authority’s usual requirements and other recognised standards and guidance.

Appendix A Acoustic terminology

Parameter	Description
Ambient Noise Level	The totally encompassing sound in a given situation at a given time, usually composed of a sound from many sources both distant and near ($L_{Aeq,T}$).
Decibel (dB)	A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds s_1 and s_2 is given by $20 \log_{10} (s_1/s_2)$. The decibel can also be used to measure absolute quantities by specifying a reference value that fixes one point on the scale. For sound pressure, the reference value is $20\mu\text{Pa}$. The threshold of normal hearing is in the region of 0 dB and 140 dB is the threshold of pain. A change of 1 dB is only perceptible under controlled conditions.
dB(A), L_{Ax}	Decibels measured on a sound level meter incorporating a frequency weighting (A weighting) which differentiates between sounds of different frequency (pitch) in a similar way to the human ear. Measurements in dB(A) broadly agree with people's assessment of loudness. A change of 3 dB(A) is the minimum perceptible under normal conditions, and a change of 10 dB(A) corresponds roughly to halving or doubling the loudness of a sound. The background noise in a living room may be about 30 dB(A); normal conversation about 60 dB(A) at 1 metre; heavy road traffic about 80 dB(A) at 10 metres; the level near a pneumatic drill about 100 dB(A).
Fast Time Weighting	Setting on sound level meter, denoted by a subscript F, that determines the speed at which the instrument responds to changes in the amplitude of any measured signal. The fast time weighting can lead to higher values than the slow time weighting when rapidly changing signals are measured. The average time constant for the fast response setting is 0.125 (1/8) seconds.
Free-field	Sound pressure level measured outside, far away from reflecting surfaces (except the ground), usually taken to mean at least 3.5 metres
Façade	Sound pressure level measured at a distance of 1 metre in front of a large sound reflecting object such as a building façade.
$L_{Aeq,T}$	A noise level index called the equivalent continuous noise level over the time period T. This is the level of a notional steady sound that would contain the same amount of sound energy as the actual, possibly fluctuating, sound that was recorded.
$L_{max,T}$	A noise level index defined as the maximum noise level recorded during a noise event with a period T. L_{max} is sometimes used for the assessment of occasional loud noises, which may have little effect on the overall L_{eq} noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.
$L_{10,T}$	A noise level index. The noise level exceeded for 10% of the time over the period T. L_{10} can be considered to be the "average maximum" noise level. Generally used to describe road traffic noise. $L_{A10,18h}$ is the A-weighted arithmetic average of the 18 hourly $L_{A10,1h}$ values from 06:00-24:00.
$L_{90,T}$	A noise level index. The noise level exceeded for 90% of the time over the period T. Generally used to describe background noise level.

Appendix B Photograph of site showing areas of interest



Appendix C Environmental sound survey

Details of environmental sound survey

- C.1 Measurements of the existing background sound levels were undertaken from 10.00 hours on Monday 19th April to 09.15 hours on Tuesday 20th April 2021.
- C.2 The sound level meter was programmed to record the A-weighted L_{eq} , L_{90} , L_{10} and L_{max} noise indices for consecutive fifteen-minute sample periods for the duration of the survey.

Measurement position

- C.3 The sound level meter was positioned on a lamppost on Forbury Road. The approximate location of the microphone is indicated on the plan in [Appendix B](#).
- C.4 In accordance with BS 7445-2:1991 ‘*Description and measurement of environmental noise – Part 2: Guide to the acquisition of data pertinent to land use*’, the measurements were undertaken under free-field conditions.

Equipment

- C.5 Details of the equipment used during the survey are provided in the table below. The sound level meter was calibrated before and after the survey; no significant change (+/-0.2 dB) in the calibration level was noted.

Environmental noise survey

Description	Model / serial no.	Calibration date	Calibration certificate no.
Class 1 Sound level meter	Svantek 977/ 81301	31/10/2019	14013747-01
Condenser microphone	ACO Pacific 7052E / 74660		
Preamplifier	Svantek SV12L / 86561		
Calibrator	Svantek SV 33B / 83850	23/10/2020	14016290

Weather conditions

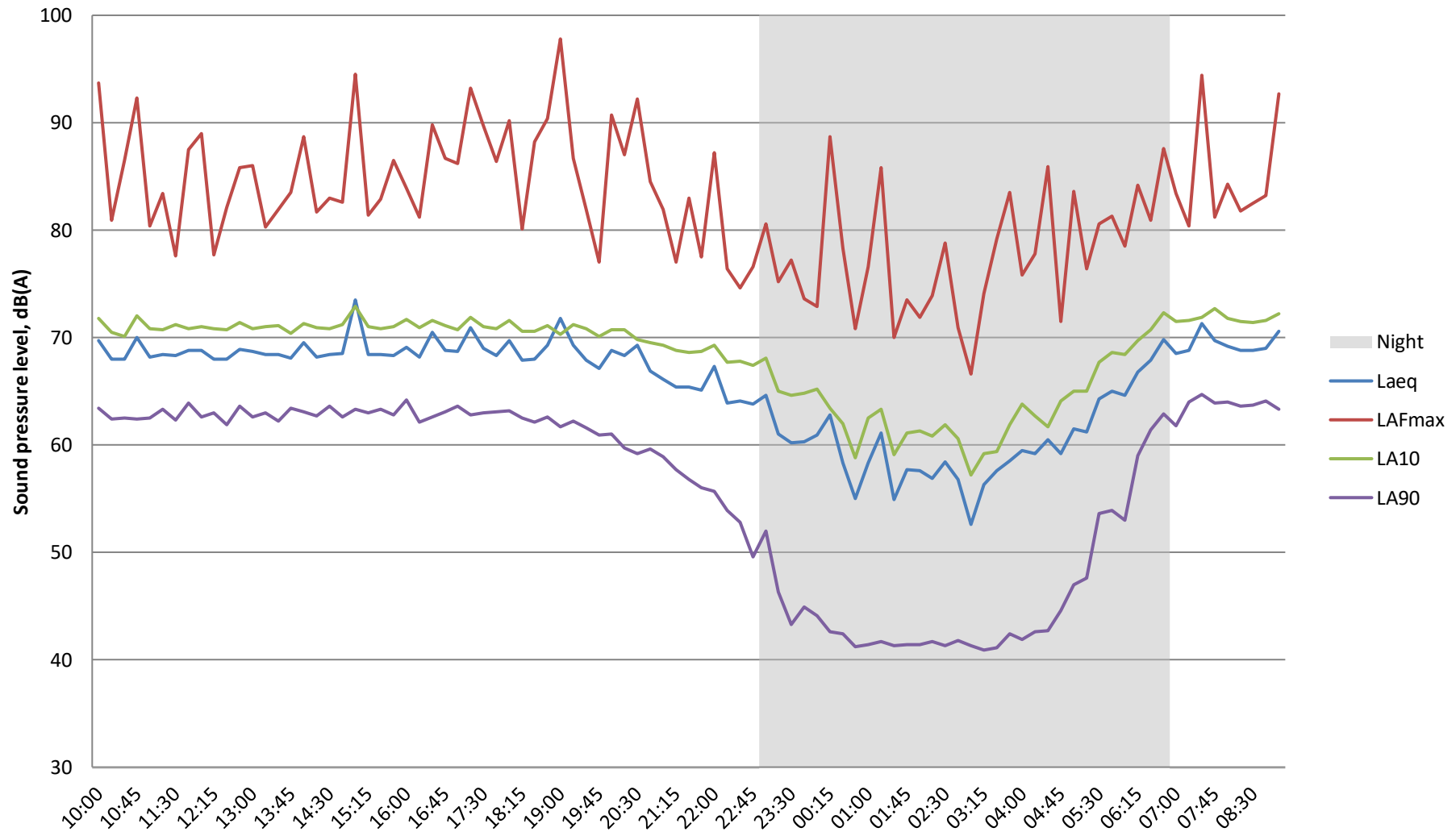
- C.6 Weather conditions were determined both at the start and on completion of the survey. It is considered that the meteorological conditions were appropriate for environmental noise measurements. The table below presents the weather conditions recorded on site at the beginning and end of the survey.

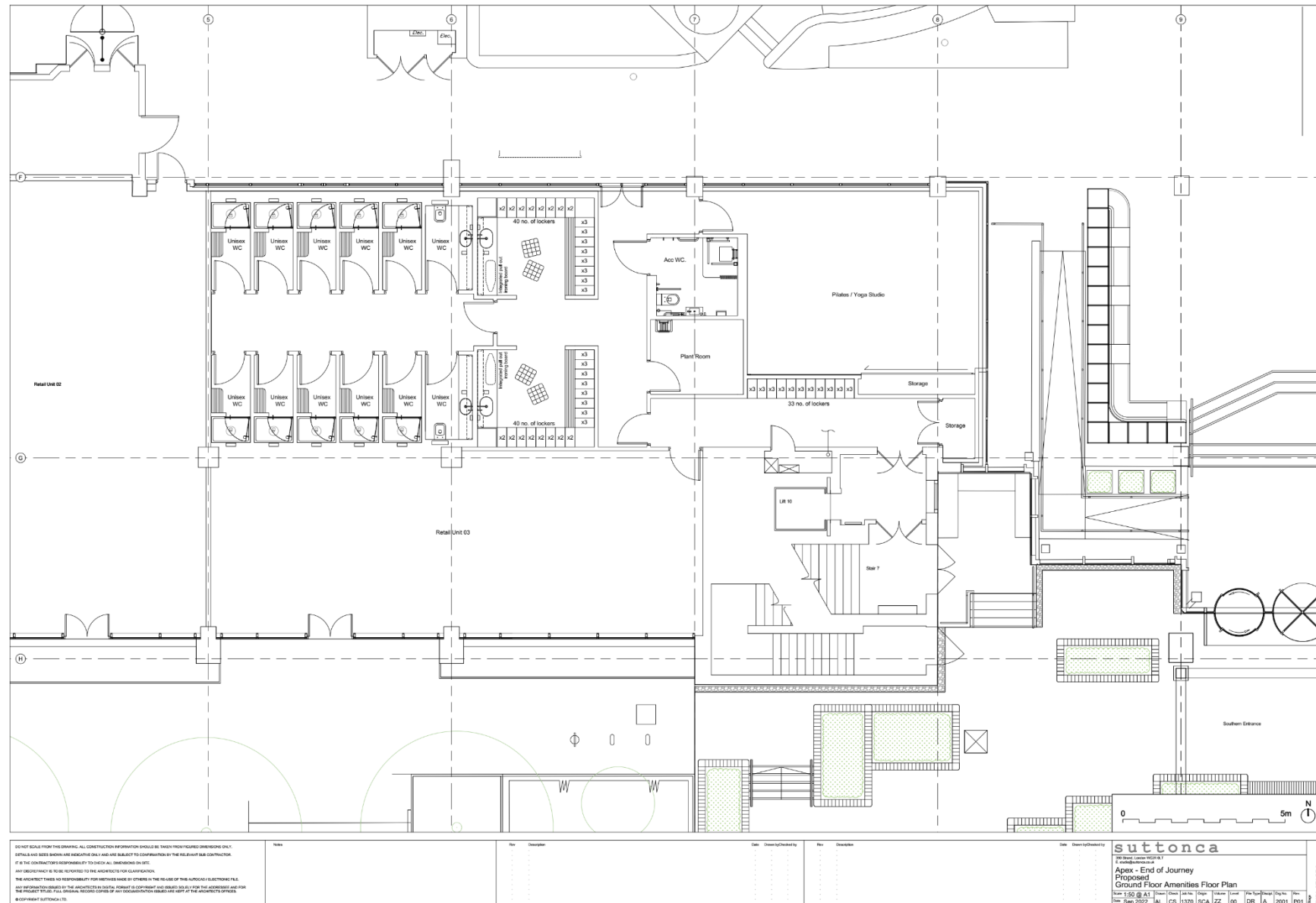
Weather Conditions				
Measurement Location	Date/Time	Description	Beginning of Survey	End of Survey
As indicated on Appendix B	10.00 19 Apr to 09.15 20 Apr 2021	Temperature (°C)	8	10
Cloud Cover Symbol Scale in oktas (eighths) 0 Sky completely clear 1 2 3 4 Sky half cloudy 5 6 7 8 Sky completely cloudy (9) Sky obstructed from view		Precipitation:	No	No
		Cloud cover (oktas - see guide)	1	0
		Presence of fog/snow/ice	No	No
		Presence of damp roads/wet ground	No	No
		Wind Speed (m/s)	<1	<1
		Wind Direction	No	No
		Conditions that may cause temperature inversion (i.e. calm nights with no cloud)	No	No

Results

- C.7 The results of the environmental survey are considered to be representative of the background sound pressure levels at the façades of the nearest noise sensitive receptors during the quietest times at which the plant will operate. The main noise source affecting the area was local road traffic. The results of the survey are presented in a time history graph overleaf.

Apex Plaza, Reading Monday 19 - Tuesday 20 Apr 2021







Appendix E Manufacturer’s plant noise data

Ref	Make / Model		Sound Power Level. dB @ octave band centre frequency, Hz							
			63	125	250	500	1k	2k	4k	8k
AHU1	ECE MVHR-6 Intake	In-duct intake	74	69	69	68	66	64	60	55
AHU1	ECE MVHR-6 Exhaust	In-duct exhaust	71	70	72	71	72	72	68	62
AHU2	ECE MVHR-6 Intake	In-duct intake	75	69	69	67	66	64	60	54
AHU2	ECE MVHR-6 Exhaust	In-duct exhaust	74	71	70	69	71	70	65	59

Appendix F

Plant noise calculations

	NSL Ref:	89905		Compiled by:		NAC		06/12/2022	
	Project	Apex Plaza - Showers							
	Plant Ref	AHU 1 Intake							
	Plant Description	ECE MVHR-6 Intake							

				Sound level (dB) at octave band centre frequencies (Hz)							
				63	125	250	500	1k	2k	4k	8k
Radius Bends		dim	No Off								
		400	2		0	0	0	0	2	4	6
Grille Face Area grille dimensions mm	1000	wide	250	high	9	5	1	0	0	0	0
SYSTEM LOSSES				9	5	1	0	2	4	6	6

Description	Notes.	Sound level (dB) at octave band centre frequencies (Hz)								dBA
		63	125	250	500	1k	2k	4k	8k	
Source noise level (unattenuated)	In-duct Lw	74	69	69	68	66	64	60	55	71
System losses		-9	-5	-1	0	-2	-4	-6	-6	
Atmospheric side attenuator	I.L.	-4	-5	-8	-15	-21	-20	-17	-14	
Sound power level leaving terminal		61	59	60	53	43	40	37	35	55

Receptor R1	V angle	H angle		63	125	250	500	1k	2k	4k	8k	
Directivity correction	90	0	1000 x 250 (90,0)	0	0	-1	-5	-8	-7	-7	-7	
Distance correction	3	m	3 m	-18	-18	-18	-18	-18	-18	-18	-18	
Screening correction	Screened:		δ=	-3	0	0	0	0	0	0	0	
Surface corrections etc												
Resultant at Receptor R1			Lp	43	41	41	30	17	15	12	10	34

Receptor R2	V angle	H angle		63	125	250	500	1k	2k	4k	8k	
Directivity correction	0	0	1000 x 250 (0,0)	2	3	4	5	6	6	6	6	
Distance correction	20	m	20 m	-34	-34	-34	-34	-34	-34	-34	-34	
Screening correction	Screened:		δ=	-20	0	0	0	0	0	0	0	
Surface corrections etc												
Resultant at Receptor R2			Lp	29	28	30	24	15	12	9	7	25

Receptor R3	V angle	H angle		63	125	250	500	1k	2k	4k	8k	
Directivity correction	0	45	1000 x 250 (0,45)	1	2	3	3	4	4	4	4	
Distance correction	55	m	55 m	-43	-43	-43	-43	-43	-43	-43	-43	
Screening correction	Screened:		δ=	-55	0	0	0	0	0	0	0	
Surface corrections etc												
Resultant at Receptor R3			Lp	19	18	20	13	4	1	-2	-4	15

Receptor R4	V angle	H angle		63	125	250	500	1k	2k	4k	8k	
Directivity correction	0	0	1000 x 250 (0,0)	2	3	4	5	6	6	6	6	
Distance correction	5	m	5 m	-22	-22	-22	-22	-22	-22	-22	-22	
Screening correction	Screened:		δ=	-5	0	0	0	0	0	0	0	
Surface corrections etc												
Resultant at Receptor R4			Lp	41	40	42	36	27	24	21	19	37



NSL Ref: **89905**
Project **Apex Plaza - Showers**

Plant Ref **AHU 1 Discharge**
Plant Description **ECE MVHR-6 Exhaust**

Compiled by: **NAC** 06/12/2022

				Sound level (dB) at octave band centre frequencies (Hz)							
				63	125	250	500	1k	2k	4k	8k
Radius Bends		dim	No Off								
		400	2	0	0	0	0	2	4	6	6
Grille Face Area grille dimensions mm	1200	wide	250	high	8	3	1	0	0	0	0
SYSTEM LOSSES				8	3	1	0	2	4	6	6

Description	Notes.	Sound level (dB) at octave band centre frequencies (Hz)								dBA
		63	125	250	500	1k	2k	4k	8k	
Source noise level (unattenuated)	In-duct Lw	71	70	72	71	72	72	68	62	77
System losses		-8	-3	-1	0	-2	-4	-6	-6	
Atmospheric side attenuator	I.L.	-4	-5	-8	-15	-21	-20	-17	-14	
Sound power level leaving terminal		59	62	63	56	49	48	45	42	59

Receptor R1	V angle	H angle									
Directivity correction	90	0	1200 x 250 (90,0)	0	0	-1	-5	-8	-7	-7	-7
Distance correction	3	m	3 m	-18	-18	-18	-18	-18	-18	-18	-18
Screening correction	Screened:		δ= -3	0	0	0	0	0	0	0	0
Surface corrections etc											
Resultant at Receptor R1				Lp	41	44	44	33	23	23	20

Receptor R2	V angle	H angle									
Directivity correction	0	0	1200 x 250 (0,0)	2	3	4	5	6	6	6	6
Distance correction	20	m	20 m	-34	-34	-34	-34	-34	-34	-34	-34
Screening correction	Screened:		δ= -20	0	0	0	0	0	0	0	0
Surface corrections etc											
Resultant at Receptor R2				Lp	27	31	33	27	21	20	17

Receptor R3	V angle	H angle									
Directivity correction	0	45	1200 x 250 (0,45)	1	2	3	3	4	4	4	4
Distance correction	55	m	55 m	-43	-43	-43	-43	-43	-43	-43	-43
Screening correction	Screened:		δ= -55	0	0	0	0	0	0	0	0
Surface corrections etc											
Resultant at Receptor R3				Lp	17	21	23	16	10	9	6

Receptor R4	V angle	H angle									
Directivity correction	0	0	1200 x 250 (0,0)	2	3	4	5	6	6	6	6
Distance correction	5	m	5 m	-22	-22	-22	-22	-22	-22	-22	-22
Screening correction	Screened:		δ= -5	0	0	0	0	0	0	0	0
Surface corrections etc											
Resultant at Receptor R4				Lp	39	43	45	39	33	32	26



NSL Ref: **89905**
Project **Apex Plaza - Showers**

Plant Ref **AHU 2 Intake**
Plant Description **ECE MVHR-6 Intake**

Compiled by: **NAC** 06/12/2022

				Sound level (dB) at octave band centre frequencies (Hz)							
				63	125	250	500	1k	2k	4k	8k
Radius Bends		dim	No Off								
		300	2								
Grille Face Area grille dimensions mm	1200	wide	250	high	0	0	0	0	2	4	6
SYSTEM LOSSES					8	3	1	0	2	4	6

Description	Notes.	Sound level (dB) at octave band centre frequencies (Hz)								dBA
		63	125	250	500	1k	2k	4k	8k	
Source noise level (unattenuated)	In-duct Lw	75	69	69	67	66	64	60	54	71
System losses		-8	-3	-1	0	-2	-4	-6	-6	
Atmospheric side attenuator	I.L.	-4	-5	-8	-15	-21	-20	-17	-14	
Sound power level leaving terminal		63	61	60	52	43	40	37	34	55

Receptor R1	V angle	H angle									
Directivity correction	90	0	1200 x 250 (90,0)	0	0	-1	-5	-8	-7	-7	-7
Distance correction	3	m	3 m	-18	-18	-18	-18	-18	-18	-18	-18
Screening correction	Screened:		δ= -3	0	0	0	0	0	0	0	0
Surface corrections etc											
Resultant at Receptor R1			Lp	45	43	41	29	17	15	12	9

Receptor R2	V angle	H angle									
Directivity correction	0	0	1200 x 250 (0,0)	2	3	4	5	6	6	6	6
Distance correction	20	m	20 m	-34	-34	-34	-34	-34	-34	-34	-34
Screening correction	Screened:		δ= -20	0	0	0	0	0	0	0	0
Surface corrections etc											
Resultant at Receptor R2			Lp	31	30	30	23	15	12	9	6

Receptor R3	V angle	H angle									
Directivity correction	0	45	1200 x 250 (0,45)	1	2	3	3	4	4	4	4
Distance correction	55	m	55 m	-43	-43	-43	-43	-43	-43	-43	-43
Screening correction	Screened:		δ= -55	0	0	0	0	0	0	0	0
Surface corrections etc											
Resultant at Receptor R3			Lp	21	20	20	12	4	1	-2	-5

Receptor R4	V angle	H angle									
Directivity correction	0	0	1200 x 250 (0,0)	2	3	4	5	6	6	6	6
Distance correction	5	m	5 m	-22	-22	-22	-22	-22	-22	-22	-22
Screening correction	Screened:		δ= -5	0	0	0	0	0	0	0	0
Surface corrections etc											
Resultant at Receptor R4			Lp	43	42	42	35	27	24	21	18



NSL Ref: **89905**
Project **Apex Plaza - Showers**

Compiled by: **NAC** 06/12/2022

Plant Ref **AHU 2 Discharge**
Plant Description **ECE MVHR-6 Exhaust**

				Sound level (dB) at octave band centre frequencies (Hz)							
				63	125	250	500	1k	2k	4k	8k
Radius Bends		dim	No Off								
		300	2								
Grille Face Area grille dimensions mm	1200	wide	250	high	0	0	0	0	2	4	6
SYSTEM LOSSES					8	3	1	0	2	4	6

Description	Notes.	Sound level (dB) at octave band centre frequencies (Hz)								dBA
		63	125	250	500	1k	2k	4k	8k	
Source noise level (unattenuated)	In-duct Lw	74	71	70	69	71	70	65	59	76
System losses		-8	-3	-1	0	-2	-4	-6	-6	
Atmospheric side attenuator	I.L.	-4	-5	-8	-15	-21	-20	-17	-14	
Sound power level leaving terminal		62	63	61	54	48	46	42	39	57

Receptor R1	V angle	H angle									
Directivity correction	90	0	1200 x 250 (90,0)	0	0	-1	-5	-8	-7	-7	-7
Distance correction	3	m	3 m	-18	-18	-18	-18	-18	-18	-18	-18
Screening correction	Screened:		δ= -3	0	0	0	0	0	0	0	0
Surface corrections etc											
Resultant at Receptor R1			Lp	44	45	42	31	22	21	17	36

Receptor R2	V angle	H angle									
Directivity correction	0	0	1200 x 250 (0,0)	2	3	4	5	6	6	6	6
Distance correction	20	m	20 m	-34	-34	-34	-34	-34	-34	-34	-34
Screening correction	Screened:		δ= -20	0	0	0	0	0	0	0	0
Surface corrections etc											
Resultant at Receptor R2			Lp	30	32	31	25	20	18	14	28

Receptor R3	V angle	H angle									
Directivity correction	0	45	1200 x 250 (0,45)	1	2	3	3	4	4	4	4
Distance correction	55	m	55 m	-43	-43	-43	-43	-43	-43	-43	-43
Screening correction	Screened:		δ= -55	0	0	0	0	0	0	0	0
Surface corrections etc											
Resultant at Receptor R3			Lp	20	22	21	14	9	7	3	17

Receptor R4	V angle	H angle									
Directivity correction	0	0	1200 x 250 (0,0)	2	3	4	5	6	6	6	6
Distance correction	5	m	5 m	-22	-22	-22	-22	-22	-22	-22	-22
Screening correction	Screened:		δ= -5	0	0	0	0	0	0	0	0
Surface corrections etc											
Resultant at Receptor R4			Lp	42	44	43	37	32	30	26	40

Summary

Plant	Resultant at Receptor (dBA)			
	R1	R2	R3	R4
AHU 1 Intake	34	25	15	37
AHU 1 Discharge	38	29	19	41
AHU 2 Intake	34	25	15	37
AHU 2 Discharge	36	28	17	40
Combined sound pressure level	42	33	23	45
BS 4142:2014 feature correction	N/A	N/A	3	N/A
BS 4142:2014 rating level	N/A	N/A	26	N/A